National Park Service,

U.S. Fish and Wildlife Service, and

The Nature Conservancy

Great Sand Dunes National Park and Preserve,

Baca National Wildlife Refuge, and

Medano- Zapata Ranch

## Colorado

# Greater Sand Dunes Interagency
# Fire Management Plan
# Environmental Assessment /Assessment of Effect

April 25, 2005

# Environmental Assessment
# Assessment of Effect

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# Greater Sand Dunes
# Interagency Fire Management Plan

**Great Sand Dunes National Park and Preserve**
**Baca National Wildlife Refuge**
**Medano- Zapata Ranch**

Colorado

## EXECUTIVE SUMMARY

The Greater Sand Dunes landscape, which is located in Alamosa and Saguache Counties in the San Luis Valley of Colorado, is a complex mixture of federal, state, and private lands. This landscape contains globally significant natural and cultural resources, a variety of vegetation types that harbor an abundance of natural resources, numerous recreational opportunities, and areas of wildland- urban interface. The goal of this project is to develop an integrated fire management plan for an approximately 275,000-acre site that includes the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and The Nature Conservancy's Medano- Zapata Ranch. The integrated fire management plan will provide guidance for fire management in a variety of ecological systems, meet specific management goals, protect human life, property, and other resources at risk, and conserve an irreplaceable landscape along the western flank of the Sangre de Cristo Mountains. To the extent practicable, the fire management plan will be compatible and integrated with existing land, resource, and fire management plans for neighboring properties. A Memorandum of Understanding was signed in summer 2003 by U.S. Fish and Wildlife Service, Bureau of Land Management, National Park Service, U.S. Forest Service, and The Nature Conservancy, which will provide a framework for cooperation and coordination among all entities in the achievement of mutual goals related to wildland fire management.

While many of the ecological systems within the project site are within their natural range of variability for fire, fire and fire management are still essential for the protection of human life and resources and properties at risk and for the long- term survival and maintenance of the plant communities and the plant and animal species that live within them. Three fire management alternatives are analyzed in this environmental assessment / assessment of effect. These include a no action/fire suppression alternative (Alternative 1), a fire suppression and fuels management alternative (Alternative 2), and a fire suppression, fuels management, and wildland fire use alternative (Alternative 3), which is the preferred alternative. Mitigation actions proposed in this document would reduce the likelihood of adverse impacts to cultural, natural, and human resources. Impact topics that were retained for analysis include:

- Air Quality
- Water Resources
- Soils
- Wetlands and Floodplains
- Vegetation Health and Ecological Integrity
- Threatened, Endangered, and Candidate Species
- Wildlife and Wildlife Habitat
- Non- native Invasive Species
- Wilderness
- Cultural Resources
- Socioeconomics
- Public Health and Safety
- Wildland- Urban Interface
- Recreational Opportunities and Visitation

It was found in this environmental assessment/assessment of effect that none of the three alternatives if implemented would have major adverse environmental consequences.

Under Alternative 1, all wildland fires would be suppressed and no fuels treatment activities would be allowed. Because Alternative 1 would not permit fuel treatments to be implemented within the planning area, cultural, natural, and human resources would be at greater risks of impacts caused by widespread and intense wildfires. Without fuel treatments, heavy fuel loads would remain and/or accumulate over time within some areas, thereby increasing the potential for damages to a variety of resources. If an uncontrollable wildfire were to occur, there would potentially be greater harm done to the resources present than would occur under Alternatives 2 or 3. Therefore, Alternative 1 was not chosen as the preferred alternative.

Fuel treatments, including mechanical and manual treatments and prescribed fire, as well as fire suppression would be permitted under Alternative 2. Fuels treatment projects would be implemented to reduce heavy fuel loads, especially around sensitive resources and structures, and within the wildland- urban interface, thereby reducing or eliminating potential damages to specific cultural, natural, and human resources caused by widespread and intense wildland fires. In addition, the fuels treatment projects would be utilized to meet specific resource management goals. Under Alternative 2, however, all unplanned wildfires would be suppressed. This would remove fire, a natural disturbance process, from the landscape, which may have a negative effect on many natural resources in the long- term. Therefore, Alternative 2 was not chosen as the preferred alternative.

The preferred alternative in this environmental assessment/assessment of effect is Alternative 3. Under this alternative, which is also identified in this document as the environmentally preferred alternative, the planning area would be divided into three fire management units (FMU), Mosca, Herard, and Baca- Dunes FMU's. Fire suppression and proposed fuels treatment activities would be authorized within all three FMU's. In addition, wildland fire use would be allowed under predetermined parameters within the Mosca and Herard FMU's, which each include portions of the Great Sand Dunes National Preserve. Before implementation of any fuels management project or wildland fire use, required implementation plans would be developed and approved by appropriate staff, including the Park superintendent or Refuge manager, as well as the appropriate regulatory agencies.

Alternative 3 would provide the most benefits to the resources found within the planning area and would allow the National Park Service, U.S. Fish and Wildlife Service, and The Nature Conservancy to fulfill their missions most efficiently and effectively, while still providing the necessary protection to cultural, natural, and human resources from widespread and intense wildland fires. Fuel treatment activities in each of the FMU's would provide protection to human health and safety, cultural resources, developments, and the wildland- urban interface. Wildland fire use would provide long- term benefits for many of the natural resources found within the Mosca and Herard FMU's by allowing fire to assume its natural role on the landscape. Because Alternative 3 meets the majority of fire management goals and would have the most beneficial effects, Alternative 3 was chosen as the preferred alternative, as well as the environmentally preferred alternative for fire management within the planning area.

# PUBLIC COMMENT PERIOD

We welcome your comments on this environmental assessment/assessment of effect. The public comment period on this environmental assessment / assessment of effect will be thirty (30) days. Your comments must be received in writing by close of business on May 24, 2005.

You can submit your comments by one of the following methods:

**By mail:** Jim Bowman, Chief Ranger
Great Sand Dunes National Park and Preserve
National Park Service
11500 Highway 150
Mosca, CO 81146- 9798

**By fax:** (719) 378- 6310

**By e- mail:** jim_bowman@nps.gov

**Hand deliver:** Jim Bowman, Chief Ranger
Great Sand Dunes National Park and Preserve
Park Headquarters
Mosca, Colorado

**You must include your name and mailing address with any comments you provide.** We will make comments including names and addresses of respondents available for public review during regular business hours. Also, we may be required to release your name and/or address if we receive a request for information that is covered by the Freedom of Information Act (5 U.S.C. 552, as amended). Individual respondents may request that we withhold their address from the record, which we will honor to the extent allowable by law. There also may be circumstances in which we would withhold from the record a respondent's identity, as allowable by law. **If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comments.** We will make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

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# CHAPTER 1: INTRODUCTION

This environmental assessment/assessment of effect (EA/AEF) is being prepared for the proposed interagency Greater Sand Dunes Fire Management Plan (FMP). The FMP will be prepared by and for Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and The Nature Conservancy's Medano-Zapata Ranch (Figures 1 and 2). The planning area is located in the San Luis Valley of Colorado within portions of Saguache and Alamosa Counties.

According to the National Environmental Policy Act (NEPA), federal actions that could have impacts on the human environment must be analyzed in a NEPA document. In the case of this planning effort, the federal action involves the development of an interagency fire management plan (FMP) that includes Great Sand Dunes National Park and Preserve and Baca National Wildlife Refuge. This EA/AEF has been developed to satisfy NEPA documentation requirements for the action taken by the federal agencies for these lands as well as lands owned by The Nature Conservancy, which will be transferred to the National Park Service and U.S. Fish and WIldife Service. In addition, interagency consultation associated with this EA/AEF is likewise tied to proposed activities on these federal lands. The FMP, however, will be broader in scope and will include the aforementioned federal lands along with land owned by The Nature Conservancy.

## NEED FOR FIRE MANAGEMENT PLAN

The approximately 275,000-acre Greater Sand Dunes landscape consists of a spectrum of ecological systems, including wet meadows, grasslands, shrublands, piñon-juniper woodlands, mixed conifer forests, and spruce-fir forests. In addition, the western flank of the Sangre de Cristo Mountains has globally significant biodiversity, which is maintained within these ecological systems (Appendix C, Neely et al. 2001, Pineda et al. 1999, Rondeau et al. 1998). Fire has undoubtedly played a role in the formation and maintenance of most, if not all, of the ecological systems present within the planning area (see "Fire Histories" section, Alington 1998, Romme 1996, USFS 1996).

Historical land management practices in portions of the Southern Rocky Mountain ecoregion, which includes the San Luis Valley and Sangre de Cristo Mountains, have altered natural processes, such as fire, and impacted a number of native plant and animal species and their habitats (Neely et al. 2001). In some instances, these past land management practices, especially fire suppression, have altered fire regimes to the extent that they have created hazardous fuel build-up. These hazardous fuel build-ups can, in turn, threaten human life and safety, important natural and cultural resources, and property values. These effects have been witnessed across the western United States in recent years.

**Figure 1: Greater Sand Dunes Interagency Fire Management Plan EA/AEF – Fire Management Planning Area**

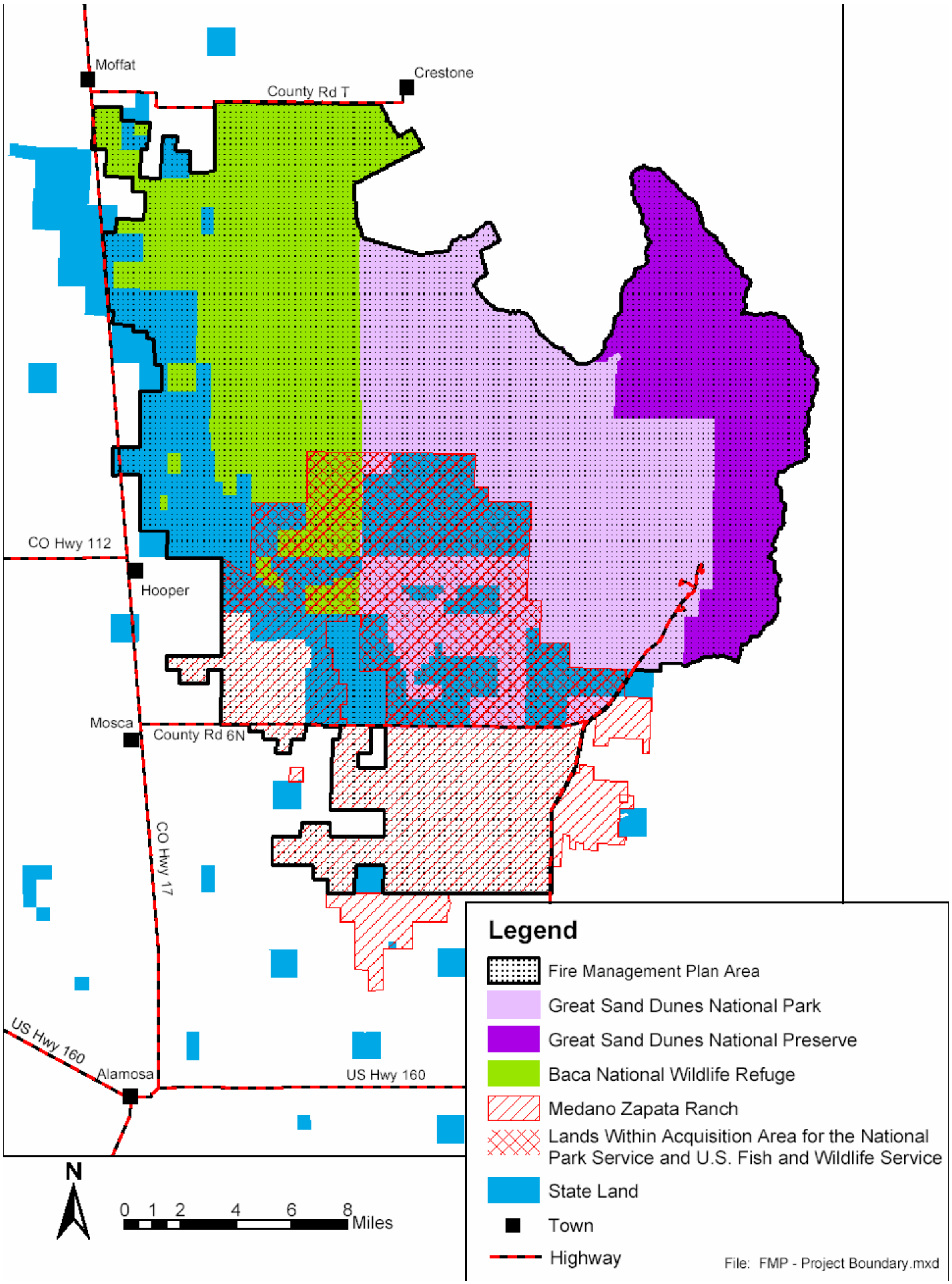
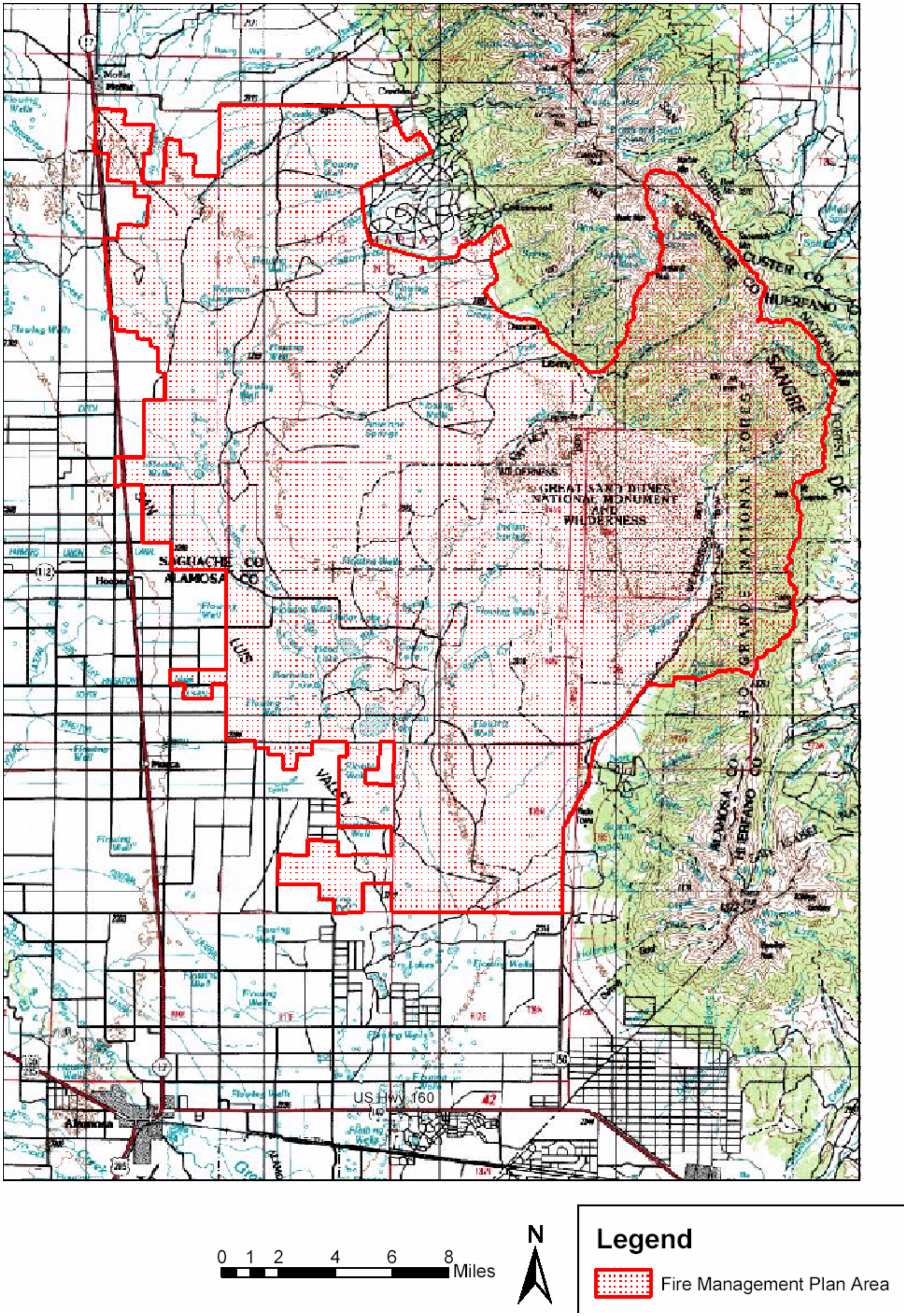


**Figure 2: Greater Sand Dunes Interagency Fire Management Plan EA/AEF – Planning Area Location**



Although other portions of the Southern Rocky Mountains ecoregion have altered fire regimes, the majority of ecological systems within the Greater Sand Dunes landscape are thought to be within or close to their natural range of variability for fire (i.e. fire suppression and other past land management activities have not severely altered the characteristics of fire across this landscape). While this may be the case for the majority of the Greater Sand Dunes landscape, fire and fire management are still essential for the protection of human life, natural and cultural resources, and other properties and resources at risk and for the long- term survival and maintenance of plant and animal communities. Fire and fuels management are important tools that can be used by land managers for maintenance of ecological systems and for habitat management on the landscape, as well as protecting human life, cultural resources, and property. As Brown (2000) states, "fire is a fundamental process of ecosystems that must be understood and managed to meet resource and ecosystem management goals."

Fire management, therefore, is vital to ensure that the ecological systems of the Greater Sand Dunes landscape are maintained within their natural range of variability for fire, while first and foremost, human life is protected. Fire management may also be utilized to meet specific resource management goals and objectives. In addition, the policies of the federal agencies (NPS's Director's Order No. 18 and FWS's Service Manual Part 621) and The Nature Conservancy (TNC's "Fire Management Manual") require that lands with burnable vegetation have a FMP in place. Therefore, this cooperative, interagency FMP is needed to provide the framework for fire management actions, which may be utilized to enhance, maintain, and protect wildlife habitat, biodiversity, and healthy ecosystems, while preventing uncharacteristically intense wildfires and protecting human health and safety, cultural resources, and structures.

This planning effort will also provide a collaborative model that will be useful for other landscapes within the San Luis Valley and beyond. For example, it has been congressionally mandated in Fire Program Analysis (FPA) that, at some future date, all federal agencies in the San Luis Valley will come together for Fire Management Planning. In the future, Colorado State, counties and other private interests such as TNC may join together with the federal agencies in formulating one master Fire Management Plan for the Valley. The Greater Sand Dunes FMP will address immediate needs for the current planning area, but will provide a model for these future fire planning efforts.

## PURPOSE OF FIRE MANAGEMENT PLAN

Human and ecological costs from altered historic fire regimes are critical issues for public and private land management entities across the western United States, including Colorado. Recent severe fires have demonstrated the magnitude of these costs (Graham et al. 2004, USFS et al. 2003, NAPA 2002, http://www.nifc.gov/stats/wildlandfirestats.html). Yet, it has been demonstrated that innovative groups can take positive actions to meet the needs of both the environment and the citizens of the United States, for the two are very much entwined. In fact, several established cooperative projects and partnerships dealing with wildland fire management already exist in the San Luis Valley and vicinity and are facilitating the integration of biodiversity and human values.

The Greater Sand Dunes landscape is a complex mixture of public (Federal and State) and private lands that includes globally significant biological and cultural resources, a variety of vegetation types, an abundance of natural resources, numerous recreational opportunities, and areas of wildland- urban interface. Federal and State agencies and The Nature Conservancy have formed a partnership, which allows them to cooperate in creating an integrated FMP for this landscape. The interagency FMP will provide guidance for fire management in a variety of fire- adapted ecological systems, meet specific management goals, protect human life, property, and other resources at risk, and conserve an irreplaceable landscape along the western flank of the Sangre de Cristo Mountains. A Memorandum of Understanding (MOU) was signed in summer 2003 by U.S. Fish and Wildlife Service, Bureau of Land Management, National Park Service, U.S. Forest Service, and The Nature Conservancy, which will provide a framework for cooperation and coordination among all entities in the achievement of mutual goals related to wildland fire management.

The purpose of this FMP is to develop a cross- boundary, interagency fire management program for the Greater Sand Dunes landscape that is compatible and integrated with the enabling legislation for each unit and departmental and agency policies, and to the extent practicable, fire management plans for neighboring properties. In addition, this FMP will implement fire management policies and help achieve resource management and fire management goals as defined in: (1) Federal Wildland Fire Management Policy and Review Program (USDA/USDI 1995 and 2001); (2) Managing Impacts of Wildfires on Communities and the Environment (USDA/USDI 2000) and Protecting People and Sustaining Resources in Fire Adapted Ecosystems – A Cohesive Strategy (USFS 2000); and (3) A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10- Year Comprehensive Strategy Implementation Plan (2001).

This FMP is a working reference for fire program implementation, which formally documents the fire management program elements, objectives, strategies, and resource considerations. The information within this FMP will guide fire management efforts throughout the entire planning area, while allowing each agency to meet their own protection and resource management objectives. In addition, specific details of the fire program that most efficiently meets fire management direction for the planning period, including organization, facilities, equipment, staffing needs, activities, timing, locations, and related costs, are also documented in this FMP. Annual updates will be made in the plan to reflect changes in the annual planning process. A plan revision, with National Environmental Policy Act (NEPA) review, will occur every five years.

# PLANNING AREA BACKGROUND INFORMATION

The planning area is located in Saguache and Alamosa Counties in the San Luis Valley of southern Colorado and includes lands currently or soon to be managed by the U.S. Fish and Wildlife Service (FWS), the National Park Service (NPS), The Nature Conservancy (TNC), and Colorado State Land Board, whose lands will eventually be transferred to FWS and NPS (Figures 1 and 2). These properties will include Great Sand Dunes National Park and Preserve (149,137 acres following expansion), Baca National Wildlife Refuge (92,623 acres), and TNC's Medano- Zapata Ranch (32,725 acres).

The San Luis Valley (Valley) is approximately 122 miles long and about 74 miles wide and has historically been dominated by ranching, farming, timber extraction, and mining (McConnell 1999). Farming, ranching, and logging still persist in the valley, but more lands are being removed from agricultural production and are being developed for rural recreational lands and residential home sites. Roughly the size of Connecticut, the Valley is one of Colorado's most biologically significant regions. The Greater Sand Dunes landscape provides habitat for more than 70 species of rare plants and animals (Pineda et al. 1999, Rondeau et al. 1998). Environmental factors including low precipitation, cold temperatures, a paucity of surface water, and isolation resulting from the surrounding high mountain ranges create harsh conditions in the area. Several species evolved under these environmental stresses and isolation, including at least five insect species found only in the Great Sand Dunes (Appendix C).

In the Greater Sand Dunes area, environmental forces of wind, precipitation and temperature have tremendous influences on the geography, vegetation, hydrology, and landforms. Weather conditions are strongly influenced by the adjacent mountains including the San Juan Mountain Range on the west side of the Valley and the Sangre de Cristo Mountains on the east side. Average annual precipitation ranges from under 7 inches on the Valley floor to over 40 inches in the high mountains, which occurs primarily as snow (Browne and Sanderson 2003). Most of the precipitation on the Valley floor falls during the short growing season, which averages around 60 frost- free days (Fryberger et al. 1990).

Consistent south and southwest winds occur from March through June. These winds commonly reach sustained velocities of 45 miles per hour. In summer the surface of the dune mass creates a "heat low" over the dunes, causing acceleration of surface winds. When storm fronts from the west collide with the eastern side of the Sangre de Cristo Mountains, heavy storm activity comes from the northeast, with wind gusts up to 80 miles per hour. These winds flow through three mountain passes, Music, Medano and Mosca. Accelerated by constriction, they rush down slope and then decrease after passing over the dune field. These "reversed" winds, rarely experienced on the valley floor, are part of the microclimate of the dunes (NPS 1997a).

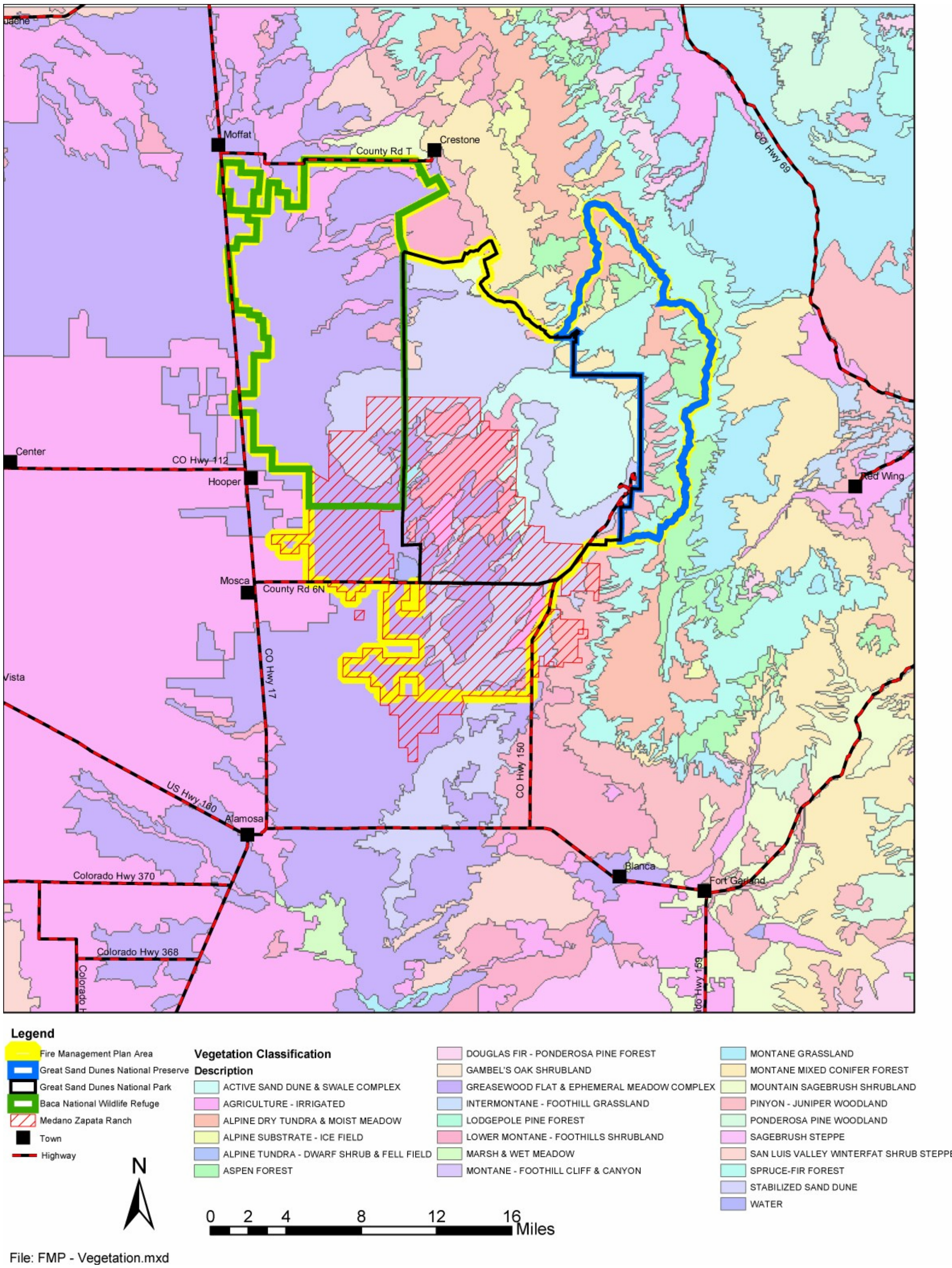
The approximately 275,000- acre Greater Sand Dunes Fire Management Plan planning area contains a variety of ecological systems (Figure 3). The planning area occurs within the Southern Rocky Mountains ecoregion extending from over 14,000 feet above mean sea level (msl) in the Sangre de Cristo Mountains to approximately 7500 feet msl along the floor of the San Luis Valley. The types of ecological systems vary throughout the site depending on a multitude of factors including the elevation, exposure, substrate, microclimate, fire history, past land uses, and hydrology of a given area. The planning area contains an alpine zone (above approximately 11,000 feet msl); a sub- alpine zone (9,200 feet to 11,500 feet msl); an upper montane zone (7,550 feet to 9,200 feet msl); and a lower montane- foothills zone (below 7,550 feet msl) (Neely et al. 2001). The vegetation within these ecological systems has adapted to a seasonally cold, semi- arid climate that is subject to changeable conditions as well as a number of natural disturbances. Each of these zones provides unique habitats that support a wide variety of wildlife species.

The sand at Great Sand Dunes and found throughout the planning area originated in the surrounding San Juan and Sangre de Cristo Mountains. These mountains have shed large quantities of cobble, gravel, and sand grains into the San Luis Valley over the centuries. Creeks in the northern half of the San Luis Valley flow into a depression known as a closed basin. These streams seasonally flood the closed basin with water and sediments forming a variety of wetlands. The resulting lakes and ponds are intermittent, and when dry, leave the sandy beach deposits exposed to winds sweeping across the area mostly from the southwest. The winds pick up and redeposit the sand, forming dunes that migrate toward the Sangre de Cristo Mountains. As the sand approaches the mountain front, wind patterns change. Mountain passes allow winds from the northeast and other directions to enter the valley. As a result, there is a zone several miles wide along the mountain front having abundant winds from multiple directions. This phenomenon causes the dunes, which are over 750 feet above the surrounding valley, to become vertical rather than migratory (NPS 1997b). Two expansive formations, the sand sheet and the sabkha, lie around the dune mass. The sand sheet, adjacent to the dune mass to the west, supports sparse vegetation, so its sand is more stable than the main dune mass. The sabkha is a sand deposit hardened by minerals precipitated out of the region's water, and is generally found further west (Browne and Sanderson 2003).

The Valley has two major aquifers, the shallow unconfined and the deep confined, which are recharged primarily by snowmelt. These aquifers consist mainly of unconsolidated clay, silt, sand, and gravel. The unconfined aquifer is separated from the confined aquifer by clay layers. Groundwater from the unconfined aquifer intercepts the ground surface in a number of low depressions throughout the Valley forming a variety of wetland habitats (Browne and Sanderson 2003, NPS 1997b).

The SLV has a long history of human use and occupation. Native American use has occurred for at least the past 10,000 years. Historic Euro- American use has been documented since the 15th century. Traditional uses by both American Indians and Euro- Americans are ongoing in the SLV.

**Figure 3: Greater Sand Dunes Interagency Fire Management Plan EA/AEF - Vegetation Map**



The Great Sand Dunes National Monument was established by Presidential Proclamation No. 1991 (17 Stat. 2506) on March 17, 1932 for “the preservation of the great sand dunes and additional features of scenic, scientific, and educational interest”. The proclamation was amended by congress on November 22, 2000 by "The Great Sand Dunes National Park and Preserve Act of 2000" (Act) "to provide for the establishment of the Great Sand Dunes National Park and Preserve" (Public Law 106- 530). Upon acquisition of the Baca Ranch property on September 13, 2004, the designation was officially changed from “National Monument” to “National Park”.

The creation of the Baca National Wildlife Refuge was authorized under Section 6 of “The Great Sand Dunes National Park and Preserve Act of 2000”. The U.S. Fish and Wildlife Service, along with others, have acquired the properties that will compose the Refuge. Currently, FWS has possession of the White Ranch.

In 1999, The Nature Conservancy acquired the approximately 100,000- acre Medano-Zapata Ranch located to the south and west of the Great Sand Dunes National Park, along with one of the largest bison herds in North America. The Conservancy manages the Medano- Zapata ranch to protect its globally significant natural values, including the herd of bison, while maintaining a portion of the ranch as a cattle operation.

# FIRE HISTORIES

Fire is a natural ecological process that has historically influenced the vegetation in the San Luis Valley. The Greater Sand Dunes Fire Management Plan planning area has a number of ecological systems each with different fire histories. Most of the upland systems in the region including shrublands, grasslands, piñon- juniper woodlands, mixed conifer and spruce- fir forests are thought to be dependent on periodic fire (Rondeau 2001, Loftin 1999).

Wildfires within the planning area are not well documented. Between 1983 and 1997, Great Sand Dunes National Monument (i.e. prior to expansion and addition of Preserve) averaged 1.3 recorded wildland fires per year (NPS 1997). One anthropogenically caused wildfire occurred within the planning area (Medano- Zapata Ranch and Great Sand Dunes National Monument) in 2000, which was fueled by high winds. This spring fire burned mainly in grassland and shrubland habitat, but also burned portions of the piñon- juniper woodland and riparian areas.

## Alpine

Fire does not play a large role within alpine systems due to the cool, moist conditions and low fuel levels that are found within this elevation zone. However, over long time scales, fire may move into the alpine zone from the adjacent spruce- fir forests. Fire return intervals within alpine systems, therefore, are potentially similar to or longer than (i.e. greater than 300 years) the adjacent forest type (Appendix A, USFS 1996).

## Spruce- Fir Forests

Spruce- fir forests are the primary forests in the subalpine zones of the Southern Rocky Mountains and occur between 9000 and 11,500 feet msl (Neely et al. 2001, USFS 1996). The topography within this system is moderately steep to very steep, and soils are relatively rocky. The canopy may be either closed (i.e. greater than 40% canopy cover) or open (i.e. less than 40% canopy cover) with very little herbaceous understory vegetation (Barbour and Billings 2000). In the Sangre de Cristo Mountains, Engelmann spruce (*Picea engelmannii*) and sub- alpine fir (*Abies lasiocarpa*) are co- dominant species. Quaking aspen (*Populus tremuloides*) occurs in areas that have been recently disturbed, especially by fire. Bristlecone pine (*Pinus aristata*) is also present within this forest type on dry ridges. The even- aged nature of most mature stands of bristlecone pine and the near absence of seedlings in these stands, together with abundant seedlings in recently burned stands, suggest that bristlecone pine regenerates primarily following fires (Baker 1992). Patches of montane grasslands are also found within this elevation zone where it is too dry for trees to grow. These grasslands are dominated by Arizona fescue (*Festuca arizonica*) and mountain muhly (*Muhlenbergia montana*) (Rondeau 2001). Spruce- fir forests grade into mixed conifer forests and piñon- juniper woodland at lower elevations.

Wildfires play a dominant role in the spruce- fir forest (Arno 2000, Alington 1998, USFS 1996) and are typically large- scale, stand replacing events (Rondeau 2001). Spruce- fir forests are typically characterized by moderately long to very long fire return intervals (100- 400 years) throughout its range with a combination of mixed severity fires and stand replacing fires (Barrett 2003 a, b, USFS 1996).

Ecological models were developed for spruce- fir forests within the planning area based on expert opinion and a literature review (Appendix A). Ecological modeling for the Greater Sand Dunes area has predicted replacement fire return intervals of approximately 330 years and non- replacement (mixed severity) fire return intervals of approximately 235 years. Overall, it is thought that spruce- fir forests within the planning area are within their natural range of variability for fire.

## Aspen Forests

Montane aspen forests are found in the Southern Rocky Mountains ecoregion between 8000- 10,000 feet msl and are dominated by quaking aspen (*Populus tremuloides*) (Neely et al. 2001, USFS 1996). These forests usually occur as a mosaic of many plant associations and may be surrounded by a diverse array of other systems, including grasslands and coniferous forests (Rondeau 2001). In the planning area, aspen is confined to relatively moist sites (16 to 40 plus inches annual precipitation) that have cold winters and a relatively long growing season.

Aspen may be found as a seral tree in the sub- alpine spruce- fir forests within the planning area. In many areas it may dominate the forest community for many decades following disturbance, such as fire, but will gradually decline as conifers become reestablished. At lower elevations aspen occurs as a temporarily dominant seral species in the mixed conifer forest type (Mueggler and Campbell 1986). Aspen is top killed by fire, but regenerates prolifically from its root system (i.e. sprouts) eventually forming an even- aged stand.

Aspen in the planning area occurs along riparian areas and intermingled with spruce- fir and mixed conifer forests. Broad stands of aspen are evident on the flanks of Cleveland Peak, Ptarmigan Peak, Mosca Canyon and Medano Canyon indicating that massive wildfires swept through the foothills and mountains before the 20th century. The cause of some of these fires may be attributable to sheepherders or ranchers (Agee and Cuenin 1924, DuBois 1903).

## Mixed Conifer Forests

Mixed conifer forests within the Greater Sand Dunes planning area occurs along the western flank of the Sangre de Cristo Mountains between 7500 and 10,500 feet msl within the upper montane zone (Neely et al. 2001, USFS 1996). The topography within this zone is steep to gentle along mountain slopes and valleys. The soils consist of rock outcrops, glacial moraines, and alluvial fans (USFS 1996). The canopy is typically closed (i.e. greater than 30% canopy cover) on the more mesic north facing slopes and open (i.e. less than 30% canopy cover) on more xeric south facing slopes. The dominant tree species within this forest type is Douglas fir (*Pseudotsuga menziesii*). Associate species include ponderosa pine (*Pinus ponderosa*), white fir (*Abies concolor*), aspen (*Populus tremuloides*), and Colorado blue spruce (*Picea pungens*). White fir occurs predominantly on the mesic north facing slopes, while Ponderosa pine occurs at lower elevations in more xeric conditions. Piñon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) occur at lower elevations, while Engelmann spruce (*Picea engelmannii*) and sub- alpine fir (*Abies lasiocarpa*) occur at higher elevations.

Fire plays a dominant role in the maintenance of mixed conifer forests (Arno 2000, Alington 1998, USFS 1996). Because each species within this forest type responds differently to fire, the fire regime influences the structure and composition of a given stand (Rondeau 2001). For example, in the absence of fire, the density of white fir increases (Rondeau 2001, Hopkins 1982). Aspen, on the other hand, will occupy a site following disturbance, particularly fire, and may form a relatively stable- state (Wolf 1995). Fires are typically surface or mixed severity fires in mixed conifer forests with stand- replacing events uncommon (Fulé et al. 1997, Dietrich 1983).

The exact nature of wildfires within mixed conifer forests, however, may potentially depend on factors such as location of the forest, microclimate, land uses, etc. Many southwest mixed conifer forests are characterized by a mean fire return interval that ranges from 1-35 years and includes frequent surface and mixed severity fires with occasional stand replacing fires (Pohl 2003, Alexander et al. 1984, Dieterich 1983). Other mixed conifer forests, however, experience longer fire return intervals, which tend to result in mixed-severity fires (Baker and Ehle 2001, Donnegan et al. 2001, Veblen et al. 2000, Kaufmann et al. 2000). In addition, land management activities such as heavy livestock grazing, logging, and fire suppression have had large effects on the ecology and fire regimes of many mixed conifer forests (Baisan and Swetnam 1997).

Because of the steep nature and dry conditions, fire occurs less frequently within the forests of the western Sangre de Cristo Mountains than in other similar forest types in the Southern Rocky Mountains (Alington 1998, Romme 1996). The mean fire return interval for the Greater Sand Dunes mixed conifer forests, therefore, is assumed to be slightly longer. Based on expert and local land manager knowledge of the Greater Sand Dunes area and a literature review (primarily Alington (1998) and Romme (1996)), ecological models were developed for mixed conifer forests within the planning area (Appendix A). These forests are assumed to have replacement fire return interval of 550 years and mixed severity fire return interval of approximately 90 years. Therefore, the mixed conifer forests within the planning area are thought to be within their natural range of variability for fire.

The ponderosa pine groves found within the planning area, particularly within portions of the Park, also appear to be quite different from other classic fire intervals in the southwest. Evidence of prehistoric fire is found throughout the various groves, but pre-1880 fire intervals were significantly longer than in most other ponderosa forests (Romme, 1996). Most of the culturally scarred ponderosa contain one or two (three at most) fire scars; burned branches (some as high as 15'-20' above ground) and no basal scarring. This is due in part to natural barriers to fire spread (the sand dunes, and steep rocky mountains to the north and east); and a discontinuous fuel bed (Romme, 1996). It appears that fire was an important process in the evolution of these groves and needs to be reintroduced, but at significantly longer intervals than elsewhere (Romme, 1996).

Besides wildfires, other natural disturbances also influence the mixed conifer forests within the planning area. Wind and weather stress and insect and pathogen-caused mortality are other disturbances within the mixed conifer forest that affect relatively small patches. Insect and pathogens within this forest type include Douglas fir beetle, spruce budworm, western pine beetle, blister rust, and Douglas fir dwarf mistletoe. These types of disturbance create patches of open canopy. In addition, avalanches may occur along certain steep drainages.

## Piñon-Juniper Woodlands

Piñon-juniper woodlands occur between 7600 and 9500 feet msl within the lower montane-foothill zone of the planning area (Neely et al. 2001, USFS 1996). The topography within this zone is steep to gentle, and soils are a combination of alluvium and rock. The canopy is typically open (i.e. less than 30% canopy cover), but the system also has patches with closed canopy (i.e. greater than 30% canopy cover). Piñon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) are the dominant species within this ecological system. Stand composition of these forests show approximately 85% of the cover to be piñon pine and about 10% to be Rocky Mountain juniper (Rowlands, 1997). The understory of piñon-juniper woodlands is composed of a variety of grasses, forbs, and shrubs including mountain mahogany and wax current (Rondeau 2001). The piñon-juniper woodlands within the planning area occur below mixed conifer and spruce-fir forests and above grassland and shrubland systems.

This forest type shows abundant evidence of historical wood harvesting of mature juniper trees (both live and down-dead) for fence posts and dead pinyon for firewood (Rowlands 1997). Not surprisingly, fire-scars were not evident in any pinyon or juniper cross sections taken during a study of stand structure of the pinyon-juniper forest, suggesting a long fire interval (up to 500 years) (Rowlands 1997). Comparison of aerial photographs taken in 1936 and 1990 (Great Sand Dunes National Monument was established in 1932) show expected results of vegetation changes (NPS 1997). The general outline of the boundary between piñon-juniper woodlands and grasslands in the foothills appears relatively unchanged, yet encroachment is occurring downward elevationally onto the grasslands. In addition, piñon density has increased since historical wood gathering (Rowlands, 1997).

As a dominant disturbance process, fire has received considerable amount of investigation within the piñon-juniper forests of the arid Southwest (Baker and Shinneman 2004, Schoennagel et al. 2004, Floyd et al. 2003, Romme et al. 2003, West 1999, Wright and Bailey 1982). A number of authors have suggested that historic heavy livestock grazing and fire suppression have pushed many piñon-juniper woodlands outside of their natural range of variability for fire (i.e. frequent, low-severity surface fires). Nelson et al. (2004), Brockway et al. (2002), Paysen et al. (2000), Wright and Bailey 1982), Wright et al. (1979), and West et al. (1979), among others, have suggested that these management practices have resulted in expansion of piñon and juniper into adjacent grasslands and shrublands and created unnaturally high tree densities. However, other authors have stated that some piñon-juniper forests may have been historically dominated by long-interval, high-severity fires, and therefore, denser canopies (Baker and Shinneman 2004, Floyd et al. 2003). Barbour and Billings (2000) point out that fires are typically infrequent in piñon-juniper systems because of low fuel levels. In addition, Romme et al. (2003) point out that not all piñon-juniper forests have the same natural fire regime and that fire management activities should be based on the actual ecology and fire history of the piñon-juniper stand in which a project is occurring. Other factors, besides the ecology of these systems, may also influence many of the management activities. Lanner (1981) states that many of the management tools to clear or thin piñon- juniper woodlands, such as chaining, may not be ecologically based, as many have suggested, but rather politically or economically based.

Historically, fire has played a role in influencing the structure, composition, and maintenance of piñon- juniper woodlands within the planning area (Arno 2000, Romme 1996, USFS 1996). Based on expert and local land manager knowledge of the Greater Sand Dunes area, ecological models were developed for piñon- juniper woodlands within the planning area (Appendix A). The mean fire return intervals for replacement fire were assumed to be 425 years and for mixed- severity fire was assumed to be 170 years. The estimate for replacement fire is consistent with a literature review, which found two studies of piñon- juniper woodlands that have estimated high severity fire return interval of 400 and 480 years, respectively (Baker and Shinneman 2004).

Piñon- juniper woodlands within the planning area have not been heavily altered by human activity with respect to fire regime. The woodlands are thought to be relatively close to their natural range of variation for fire (Romme 1996). In addition, it is thought that fire suppression efforts have not had as large of an impact on these forests or the surrounding plant communities (i.e. piñon- juniper expansion into shrublands and grasslands) as it has had in some other piñon- juniper systems within the Southwest (Romme 1996).

## Shrublands and Grasslands

Shrublands and grasslands within the Greater Sand Dunes planning area occur along the foothills of the Sangre de Cristo Mountains down to the floor of the San Luis Valley. These ecological systems are somewhat intermingled and include such species as blue grama (*Bouteloua gracilis*), Indian ricegrass (*Oryzopsis hymenoides*), needle- and- thread (*Hesperostipa comata*), western wheatgrass (*Pascopyrum smithii*), saltgrass (*Distichlis stricta*), black greasewood (*Sarcobatus vermiculatus*), four- wing saltbrush (*Atriplex canescens*), rubber rabbitbrush (*Chrysothamnus nauseosus*), and winterfat (*Kraschennikovia lanata*) (Rondeau 2001).

The Active Dune and Swale Complex is mostly composed of non- vegetated active sand dunes. Large star dunes tower up to 700 feet above the valley floor. The vegetated portions of the sand dune complex are scattered with small pockets of blowout grass (*Redfieldia flexuosa*) and scurfpea (*Psoralidium lanceolatum*) (Pineda et al. 1999). This rare plant community can also be found where blowouts are beginning within the stabilized sandsheet. Where the active dunes intersect the watertable, interdunal wetlands can be found. Scientific research has been conducted on important ecological processes such as dunes deposition, morphology, stratification, sand transport and the wind regime. Fire is a negligible process in the active dune and swale system as vegetation is sparse.

A vegetated sand sheet occupies the area of the stabilized sand dunes. Much of this region is covered by rabbitbrush (*Chrysothamnus nauseosus*), needle- and- thread grass (*Hesperostipa comata*), and Indian ricegrass (*Oryzopsis hymenoides*) (Pineda et al. 1999). Examination of the present vegetative cover shows a mosaic of grasslands and shrublands. Many of these grassy patches on relatively flat ground are thought to occur on areas that had previous wildland fires, where shrub densities were significantly reduced by fire. Exposure and moisture could also partially account for these patterns.

The ephemeral wetland and greasewood flats ecological system contains a connected system of shallow depressions or basins that support a variety of wetland types. Large patches of this system are restricted to the San Luis Valley on the sabkha (Rondeau 2001). The basins fill with snowmelt runoff and spring- fed flow and most are dry by late summer (Rondeau et al. 1998). Seasonally flooded basins support aquatic and emergent vegetation including spikerush (*Eleocharis palustris)*, and bulrushes (*Scirpus* spp.). More irregularly flooded basins contain saltgrass or are barren salt flats (Rondeau et al. 1998). Greasewood (*Sarcobatus vermiculatus*) and rabbitbrush shrublands form the dominant vegetation surrounding the basins with an understory of saltgrass (Pineda et al. 1999).

The planning area's shrublands and grasslands may have been altered substantially by a variety of factors over the past century or more, which makes determining the relative importance of fire difficult. For example, dense stands of rabbitbrush and winterfat in some portions of the planning area may indicate suppression of wildland fire, overgrazing, climatic change, or a combination of these factors (Romme 1996). In addition, soils, moisture, and other environmental factors help influence species composition and density within these ecological systems.

Sparsely vegetated salt flats, like those found within the greasewood and ephemeral wetland system have a fire regime that has been described as nonexistent (Paysen et al. 2000). In assessing the state of knowledge about fire in desert grasslands and shrublands, Paysen et al. (2000) reached the conclusion that most experts do not agree on the exact fire history of these systems. In fact, it has been noted that the fire history of the grasslands within the San Luis Valley prior to 1880 will probably never be known (Romme 1996).

At Great Sand Dunes National Park and Preserve, most fires in the recent past within grasslands and shrublands have been small and confined to a single woody plant and the ground within 1 acre or less around it (NPS 1996). Interviews with long time residents on and near the Medano- Zapata Ranch, confirm the small nature of natural fires in recent years, all of which did not require suppression efforts. Grassland fires may be rapidly extinguished by rains following a lightning ignition, or may spread quickly by the wind until rain comes, the wind dies down, or the fire reaches sandy areas with little fuel.

Based on a review of the literature, including the Fire Effects Information System (http://www.fs.fed.us/database/feis), most of the dominant, or common, species in the shrubland and grassland systems found within the planning area are at least moderately fire tolerant, indicating that past fires have not substantially changed the nature of the landscape (Ryan 2002). Many of the species that grow within the shrubland and grassland systems of the area have the ability to resprout after fire as long as adequate soil moisture is available. The predominance of sprouting species within an area has been interpreted by some to indicate the likelihood of a frequent, low- intensity fire regime, as opposed to a longer interval, higher- intensity regime, which would tend to favor obligate seeding plants (Keeley 1981). However, others have noted that either very short or very long fire intervals may favor sprouting species (Bond and van Wilgen 1996).

Many authors have described the fire regime in grassland and shrubland systems similar to those found within the planning area. Loftin (1999) argued that the majority of upland ecosystems in the Middle Rio Grande basin, including desert scrub, grassland, and piñon- juniper woodland, were historically dependent on periodic fire.

Few studies have been conducted regarding historic fire patterns in the saltbush-greasewood type (Paysen et al. 2000). It is thought that, typically, sparse understory vegetation and bare soil limited fire in this system. However, wet years potentially spur an increase in fine fuels, resulting in increased fire risk. West (1994) also observed that salt- desert shrub systems probably burned very rarely in the past, although occasional extreme wet periods may have produced sufficient fine fuels to support fire, especially in areas with more gravelly soils.

Within the Greater Sand Dunes area, grasslands and shrublands are intermixed with salt flats and blowouts, which lead to discontinuous fuels. Interviews with area residents and National Park Service staff indicate few fires that were more than 10 acres in the sandsheet region in the last 50 years. Based on this review, it could be concluded that, although the exact fire return intervals for the grassland and shrubland systems within the planning area are not known, small areas of these systems did occasionally burn, either by natural or anthropogenic causes. The extent, intensity, and severity of these burns would probably have been dependent on a multitude of factors including aspects of the weather (e.g. temperature, wind speed, and relative humidity) and the condition of the vegetation (e.g. species composition, density, fuel load, and moisture content) at the time of the burn.

## Wet Meadows

Wet meadows within the Greater Sand Dunes planning area primarily occur throughout the valley floor either at the terminus of streams or in areas where the groundwater is near or at the ground surface. This hydrology creates natural wet meadow areas which have been greatly enhanced through systems of irrigation canals and water spreading for much of the last century on the Baca and Medano- Zapata Ranches. The wet meadows are dominated by saltgrass (*Distichilis spicata*), alkali sacaton (*Sporobolus airoides*), Baltic rush (*Juncus balticus*) and sedges (*Carex* spp.). These communities have not been studied widely with regard to fire ecology, because wet meadows do not usually support fire (Paysen et al. 2000, West 1994). Keeley (1981), on the other hand, estimated that wet meadows in general have a mean fire return interval of 50- 100 years with individual fires occurring every 5 years or more. The wet meadows within the planning area are assumed to naturally burn infrequently, depending on a multitude of factors including aspects of the weather (e.g. temperature, wind speed, and relative humidity) and the condition of the vegetation (e.g. species composition, density, fuel load, and moisture content) at the time of the burn.

## Riparian

Little and Big Spring Creeks are the only low elevation perennial water courses in the area. These streams arise from interdunal wetlands within the active dune field. These streams have remarkably stable flow year round (Browne and Sanderson 2003).

The majority of the streams in the planning area become ephemeral as they move out of the flanks of the mountains and onto the valley floor. The ephemeral riparian areas are snow- melt dominated systems. Many of these creeks have seasonal flow and may not be available as a water source from mid- summer on. Thus, they are highly variable systems year to year and month to month. Sand Creek and Medano Creek are integral to the erosion, transport and deposition of sand to the dune field (Geary 1997). Sand Creek has several high quality globally rare plant communities found along its course. Other large streams in this system include Medano Creek and Deadman Creek. Running down the western slope of the Sangre de Cristo Mountains, these systems are home to a rich array of plants including cottonwoods (*Populus* sp.), alders (*Alnus* sp.), Rocky Mountain juniper (*Juniperus scopulorum*), coyote willow (*Salix exigua*), and other willows (*Salix* sp.).

The riparian systems within the planning area are assumed to naturally burn infrequently. This however depends on a multitude of factors including aspects of the weather at the time of the burn (e.g. temperature, wind speed, and relative humidity), the condition of the vegetation at the time of the burn (e.g. species composition, density, fuel load, and moisture content), and the surrounding upland vegetation type and fuels condition.

# FIRE MANAGEMENT GOALS AND OBJECTIVES

## Goals and Objectives

The overall goal for this planning effort is to develop and implement an interagency, comprehensive, ecologically- based Fire Management Plan for the Greater Sand Dunes planning area. This FMP will address the needs of the National Park Service, U.S. Fish and Wildlife Service, Colorado State Land Board, and The Nature Conservancy, while developing interagency cooperation across the greater landscape of the San Luis Valley. The FMP will create a fire management program that will protect human life and safety, facilities and properties, and natural and cultural resources and values. The plan will follow the Interagency Fire Management Plan Template and be supported by a rigorous environmental analysis.

The following are programmatic fire management goals and objectives for the entire planning area:

### Goal 1

Develop and implement an interagency Fire Management Plan that specifically addresses the individual fire management needs of the National Park Service, U.S. Fish and Wildlife Service, Colorado State Land Board, and The Nature Conservancy, while promoting interagency participation across the greater landscape of the San Luis Valley.

### Objectives

- Plan and manage for fire cooperatively with adjacent land management agencies and private landowners as outlined in the Memorandum of Understanding (MOU).
- Allow each Federal and State agency and The Nature Conservancy to meet their respective land management goals and objectives in a coordinated program as outlined in the MOU
- Provide direction for maintaining a level of preparedness commensurate with fire danger indices as outlined in the MOU.
- Cooperatively address funding and staffing requirements during each budget cycle to administer the total fire management program both adequately and professionally.
- Keep cooperative agreements current and continue to expand collaboration on joint fire- management projects.
- Update the interagency Fire Management Plan annually and revise the plan every 5 years.

### Goal 2

Provide for the protection of human health and safety during all phases of the interagency fire management program.

## Objectives

- Ensure the safety of fire fighting teams, agency personnel, and the public as the first priority for all fire management activities.
- Possess and maintain appropriate fire suppression equipment.
- Ensure that fire personnel are appropriately trained and qualified for the assignment they receive.
- Support professional development of agency staff as it relates to all fire management activities.

## Goal 3

Protect facilities, natural resources, and cultural resources from the unwanted effects of wildland fires.

## Objectives

- Suppress all unwanted wildland fires utilizing Appropriate Management Response (AMR) and the Wildland Fire Situation Analysis (WFSA) to reduce risk of adverse impacts of wildland fires to public and private property, cultural resources, and ecologically sensitive areas.
- Utilize mechanical/manual and prescribed burn fuel reduction projects to enhance the defense of fire sensitive cultural resources and facilities.
- Prevent unwanted human- caused wildland fires by developing a dynamic and pro-active interagency fire prevention program within 5 years.

## Goal 4

Apply fire management techniques in a coordinated manner to accomplish desired resource management objectives.

## Objectives

- Utilize fire management tools, such as prescribed fire and manual and mechanical treatments to restore and maintain fire- dependent systems, perpetuate native species, meet specific habitat management objectives, maintain scenic qualities, and reduce the threat of wildland fire to human assets and critical resource values.
- Develop and implement a viable Wildland Fire Use for Resource Benefits (WFURB) program, where appropriate, across agency boundaries within 5 years. Use the Wildland Fire Implementation Planning (WFIP) process to guide partners through the process as each incident occurs.
- Maintain high quality examples of healthy ecological systems including the natural processes that influence them. Restore degraded examples where possible.
- Coordinate fire management activities with other resource planning efforts.
- Prevent introduction, minimize spread, and support control efforts of invasive, non-native species through management practices. Develop an integrated, interagency plan for invasive, nonnative species within 5 years.

### Goal 5
Protect air and water quality- related values across all affected airsheds and watersheds in the area.

### Objectives
- Meet federal, state, and local air and water quality regulations.

### Goal 6
Base the interagency fire management program on sound data obtained through scientific investigation and monitoring.

### Objectives
- Determine and develop strategies to fill cultural and natural resources fire- related data needs.
- Establish an integrated, interagency fire- effects monitoring program for all areas within 2 years.
- Institute an adaptive management approach to fire management.

### Goal 7
Provide educational opportunities for the public regarding fire ecology, management and operations.

### Objectives
- Keep the public informed about fire operations, including fire suppression, prescribed fire, and wildland fire use, within the planning area during fire incidents by conducting public information meetings.
- Inform the public regarding the natural role of fire within ecological systems and the value of using fire to meet resource goals by conducting regular fire education programs.
- Institute a pro- active coordinated fire prevention program through regular public education programs.

## SCOPING

Scoping is a process to identify the resources that may be affected by a project proposal, and to explore possible alternative ways of achieving the goals of the project while minimizing adverse impacts. Staff from U.S. Fish and Wildlife Service, National Park Service, and The Nature Conservancy conducted internal scoping with an interdisciplinary team of resource specialists and external scoping with the public and interested/affected groups and agencies.

## Internal Scoping

Internal scoping was conducted by an interdisciplinary team of professionals from National Park Service, U.S. Fish and Wildlife Service, The Nature Conservancy, Colorado State Forest Service, Colorado Division of Wildlife, U.S. Bureau of Land Management, and U.S. Forest Service (see Appendix B for list of attendees). Interdisciplinary team members met on December 18, 2003, to discuss the purpose and need for the planning effort, the goals and objectives, various fire management alternatives, potential environmental impacts, project schedule and roles, and data needs and sources. Subsequent meetings by the Core Team (Appendix B) were conducted on January 9, February 12, March 4 and 5, June 1, and August 4, 2004 to revise the proposed planning effort's purpose and need, goals and objectives, list of impact topics, fire management alternatives, plan the public scoping process and meetings, coordinate pre- consultation with the State Historic Preservation Office (§106 consultation) and the U.S. Fish and Wildlife Service (§7 consultation), and strategize about and begin the preparation of this EA/AEF. In addition, e- mail and phone correspondence was conducted amongst Core Team members during this time.

During internal review of the draft EA/AEF, it was determined that the proposed alternatives descriptions within the draft document did not present enough specific information regarding the fuels treatment plans or the fire management units for the planning area. A meeting was subsequently held via conference call on October 14, 2004, to discuss these issues. It was determined at this meeting that specific fuels treatment plans needed to be incorporated into the final EA/AEF, and that the EA/AEF should not be released for public review until this was accomplished. Following the necessary approvals, the release of the EA/AEF and the FMP was postponed until fuels treatment options and fire management units were identified by the Core Team and added to the EA/AEF.

NPS staff met at the Great Sand Dunes Park and Preserve in October 2004 to discuss potential fuel treatment options and fire management units (FMU) for the Park and Preserve. On November 5, 2004, the Core Team met to discuss the FMU's and fuel treatment plans. With some minor changes, the team agreed to extend across the entire planning area the proposed FMU's that the NPS staff had developed for the Park and Preserve. Following the meeting, fuels treatment plans for the Baca National Wildlife Refuge, Great Sand Dunes National Park and Preserve, and the Medano- Zapata Ranch were developed and incorporated into the EA/AEF. Subsequent meetings were held by the Core Team to discuss the status of the EA/AEF.

## External Scoping

External, or public, scoping was conducted between March 15, 2004 and April 14, 2004. A newsletter (Appendix B) was mailed to approximately 310 individuals, organizations, and Native American groups. The purpose of the newsletter was to inform the public about the proposed fire management plan and the public scoping meetings and to seek comments regarding the proposed fire management alternatives and potential impacts of these alternatives.

Two public scoping meetings were conducted in an open-house format during the external scoping period. A news release (Appendix B) was submitted to the local newspapers to notify the public regarding these meetings. The first meeting was held on March 24, 2004, in Alamosa, Colorado, at Trinidad State Junior College's Student Center. The second public scoping meeting was held on March 25, 2004, at the Baca Grande Fire Department near Crestone, Colorado. The purpose of these meetings was to present the proposed purpose and need, goals and objectives, and fire management alternatives established by the interagency planning team and to solicit comments from the public regarding the alternatives and the potential impacts of these alternatives.

Thirteen public scoping comments were received (Appendix B). The primary concern (5 comments) was the proposed use of chemical treatments as part of the fire management plan. Six of the comments received were in favor of using natural fire regimes and/or wildland fire use in the management options. Appendix B provides a summary of the comments received during public scoping and the responses to those comments.

Following the public scoping period, the use of chemicals (i.e. herbicides) to treat non-native species before and after fire management activities was removed from the fire management alternatives. The use of herbicides to meet land management objectives may be covered in future Invasive Species Management Plans.

# RELATIONSHIP OF THE PROPOSED ACTION TO PREVIOUS PLANNING EFFORTS AND TO REGULATIONS, POLICIES, AND GUIDANCE DOCUMENTS

The following legislation, regulations, policies, guidance, and management documents relate directly to the completion of this EA/AEF and the proposed interagency FMP. The proposed fire management plan will be consistent with the goals and objectives for each site as stated in these documents.

## Enabling Legislation and Memorandum of Understanding

**NPS Organic Act of 1916**: Congress directed the U.S. Department of the Interior and NPS to manage units "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16

U.S.C. § 1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978 by stating that the NPS must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 U.S.C. § 1 a- 1).

**National Wildlife Refuge System Improvement Act of 1997**: This Act provides the first "organic" legislation for the management of the Refuge System. The Act amends the National Wildlife Refuge System Administration Act of 1966, and strengthens the mission of the Refuge System, clarifies the compatibility standard for public uses of refuges, and requires the completion of comprehensive plans for every refuge. The mission, as stated in the Act is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans"

**Presidential Proclamation No. 1994** (1932): Great Sand Dunes National Monument was established in 1932 by presidential proclamation number 1994. The purpose of the monument was to preserve Federal land containing spectacular and unique sand dunes and additional features of scenic, scientific, and educational interest for the benefit and enjoyment of future generations

**Great Sand Dunes National Park and Preserve Act of 2000** (Public Law 106- 530): The Great Sand Dunes National Park and Preserve Act of 2000 established the Great Sand Dunes National Park and Preserve following the expansion of Great Sand Dunes National Monument and Preserve and authorized the creation of the Baca National Wildlife Refuge.

**Memorandum of Understanding 2003 Amongst Great Sand Dunes National Park and Preserve, Alamosa, Monte Vista, & Baca National Wildlife Refuges, Bureau of Land Management, Rio Grande National Forest, and The Nature Conservancy of Colorado:** The MOU provides a framework for cooperation and coordination among all entities in the achievement of mutual goals related to wildland fire management. Cooperation and coordination may involve conducting assessments, inventory, research, monitoring, protection, restoration and other management activities necessary to implement a comprehensive wildland fire management program.

## National Environmental Policy Act Guidance

**National Environmental Policy Act (NEPA)**: The National Environmental Policy Act (NEPA) was passed by Congress in 1969 and took effect on January 1, 1970. This landmark legislation established the United States of America's environmental policies, including the goal of achieving productive harmony between human beings and the physical environment for present and future generations. It provided the tools to carry out these goals by mandating that every federal agency prepare an in- depth study of the impacts of "major federal actions having a significant effect on the environment" and alternatives to those actions, and requiring that each agency make that information an integral part of its decisions. NEPA also requires that agencies make a diligent effort to involve the interested and affected public before they make decisions affecting the environment.

**Department of Interior Departmental Manual, Part 516 (USDI 2004)**: Part 516 of the Departmental Manual establishes the Department of Interior's policies for complying with Title I of NEPA, as amended (42 U.S.C. 4321- 4347); Section 2 of Executive Order 11514, Protection and Enhancement of Environmental Quality, as amended by Executive Order 11991; Executive Order 12114, Environmental Effects Abroad of Major Federal Actions; and the regulations of the Council on Environmental Quality (CEQ) implementing the procedural provisions of NEPA (40 CFR 1500- 1508).

**NPS Director's Order- 12 (DO- 12)**: DO- 12 is the NPS guidance for conservation planning, environmental impact analysis, and decision making. DO- 12 provides guidelines for implementing NEPA according to NPS regulations and meets the Council on Environmental Quality (CEQ) regulations for implementing NEPA.

## Fire Management Policies and Guidance Documents

**Federal Wildland Fire Management Policy (**USDA/USDI **2001):** The "Review and Update of the 1995 Federal Wildland Fire Management Policy" is the current update of the 1995 Federal Wildland Fire Management Policy. The Federal Wildland Fire Management Policy directs federal agencies to achieve a balance between suppression to protect life, property, and resources and fire use to regulate fuels and maintain healthy ecosystems. In addition, it directs agencies to utilize the appropriate management response for all wildland fires regardless of the ignition source. The "Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy" (WFLC 2003) provides clarification to the fire management policy and presents direction for consistent interagency implementation of the policy at the operational level.

The 2001 Federal Wildland Fire Management Policy provides nine guiding principles that are fundamental to the success of the Federal wildland fire management program:

- Firefighter and public safety is the first priority in every fire management activity.
- The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.

- Fire Management Plans, programs, and activities support land and resource management plans and their implementation.
- Sound risk management is a foundation for all fire management activities.
- Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.
- Fire Management Plans and activities are based upon the best available science.
- Fire Management Plans and activities incorporate public health and environmental quality considerations.
- Federal, State, tribal, local, interagency, and international coordination and cooperation are essential.
- Standardization of policies and procedures among federal agencies is an ongoing objective.

In addition, the following policies provide guidance for wildland fire management including authorization to utilize wildland fire use for resource benefit:

**Safety**
Firefighter and public safety is the first priority. All Fire Management Plans and activities must reflect this commitment.

**Fire Management and Ecosystem Sustainability**
The full range of fire management activities will be used to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social components.

**Response to Wildland Fire**
Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries. Response to wildland fire is based on ecological, social, and legal consequences of the fire. The circumstances under which a fire occurs, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected, will dictate the appropriate management response to the fire.

**Use of Wildland Fire**
Wildland fire will be used to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in its natural ecological role. Use of fire will be based on approved Fire Management Plans and will follow specific prescriptions contained in operational plans.

**Rehabilitation and Restoration**

Rehabilitation and restoration efforts will be undertaken to protect and sustain ecosystems, public health, and safety, and to help communities protect infrastructure.

**Protection Priorities**

The protection of human life is the single, overriding priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be based on the values to be protected, human health and safety, and the costs of protection. Once people have been committed to an incident, these human resources become the highest value to be protected.

**Wildland Urban Interface**

The operational roles of federal agencies as partners in the Wildland Urban Interface are wildland firefighting, hazardous fuels reduction, cooperative prevention and education, and technical assistance. Structural fire suppression is the responsibility of tribal, State, or local governments. Federal agencies may assist with exterior structural protection activities under formal Fire Protection Agreements that specify the mutual responsibilities of the partners, including funding. (Some federal agencies have full structural protection authority for their facilities on lands they administer, and may also enter into formal agreements to assist State and local governments with full structural protection.)

**Planning**

Every area with burnable vegetation must have an approved Fire Management Plan. Fire Management Plans are strategic plans that define a program to manage wildland and prescribed fires based on the area's approved land management plan. Fire Management Plans must provide for firefighter and public safety; include fire management strategies, tactics, and alternatives; address values to be protected and public health issues; and be consistent with resource management objective, activities of the area, and environmental laws and regulations.

**Science**

Fire Management Plans and programs will be based on a foundation of sound science. Research will support ongoing efforts to increase our scientific knowledge of biological, physical, and sociological factors. Information needed to support fire management will be developed through an integrated interagency fire science program. Scientific results must be made available to managers in a timely manner and must be used in the development of land management plans, Fire Management Plans, and implementation plans.

**Preparedness**
Agencies will ensure their capability to provide safe, cost- effective fire management programs in support of land and resource management plans through appropriate planning, staffing, training, equipment, and management oversight.

**Suppression**
Fires are suppressed at minimum cost, considering firefighter and public safety, benefits, and values to be protected, consistent with resource objectives.

**Prevention**
Agencies will work together and with their partners and other affected groups and individuals to prevent unauthorized ignition of wildland fires.

**Standardization**
Agencies will use compatible planning processes, funding mechanisms, training and qualification requirements, operational procedures, value- to- be- protected methodologies, and public education programs for all fire management activities.

**Interagency Cooperation and Coordination**
Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners.

**Communication and Education**
Agencies will enhance knowledge and understanding of wildland fire management policies and practices through internal and external communication and education programs. These programs will be continuously improved through the timely and effective exchange of information among all affected agencies and organizations.

**Agency Administrators and Employee Roles**
Agency administrators will ensure that their employees are trained, certified, and made available to participate in the wildland fire program locally, regionally, and nationally as the situation demands. Employees with operational, administrative, or other skills will support the wildland fire program as necessary. Agency administrators are responsible and will be held accountable for making employees available.

**Evaluation**
Agencies will develop and implement a systematic method of evaluation to determine effectiveness of projects through implementation of the 2001 Federal

Fire Policy. The evaluation will assure accountability, facilitate resolution of areas of conflict, and identify resource shortages and agency priorities.

**National Fire Plan (2000):** The National Fire Plan (NFP) was developed in August 2000, following a landmark wildland fire season, with the intent of actively responding to severe wildland fires and their impacts to communities while ensuring sufficient firefighting capacity for the future. The NFP addresses five key points: Firefighting, Rehabilitation, Hazardous Fuels Reduction, Community Assistance, and Accountability.

**Interagency Standards for Fire and Aviation Operations (NIFC 2004):** The "Interagency Standards for Fire and Fire Aviation Operations" (Redbook) states, references, and supplements the fire and fire aviation program management policies of the Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, and National Park Service. The Redbook provides standards for all agencies which are designed to ensure safe and efficient wildland fire, fuels, and fire aviation operations. The purpose of Redbook is to provide a reference for current operational policies, procedures, and guidelines for managing wildland fire and fire aviation operations.

**U.S. Department of Interior Departmental Manual, Part 620, Wildland Fire Management (USDI 1998)**: U.S. Department of Interior Departmental Manual Part 620 (DM 620) provides departmental policies and procedures for wildland fire management including responsibilities for fire management and operations, wildland fire policies and objectives, and wildland fire management strategies. As a policy, DM 620 requires the incorporation of fire management into planning documents and allows the use of fire to meet management objectives. The following policies regarding fire management planning are stated in DM 620:

A. Firefighter and public safety is always the first priority. All Fire Management Plans and activities must reflect this commitment.

B. Every area with burnable vegetation must have an approved Fire Management Plan. Fire management plans must be consistent with firefighter and public safety, values to be protected, and land, natural, and cultural resource management plans and must address public health issues. Fire management plans must also address all potential wildland fire occurrences and include the full range of wildland fire management actions. Bureau fire management plans must be coordinated, reviewed, and approved by responsible agency administrators, to insure consistency with approved land management plans.

C. Fire, as a critical natural process, will be integrated into land, natural, and cultural management plans and activities on a landscape scale, across bureau boundaries, and will be based upon best available science. All use of fire for natural and cultural resource management requires an approved plan which contains a formal prescription.

D. Wildland fire will be used to protect, maintain, and enhance natural and cultural resources and, as nearly as possible, be allowed to function in its natural ecological role.

E. Bureaus will ensure their capability to provide safe, cost- effective fire management programs in support of land, natural, and cultural resource management plans through appropriate planning, staffing, training, and equipment.

F. Management actions taken on wildland fires must be cost effective, consider firefighter and public safety, benefits, and values to be protected, and be consistent with natural and cultural resource objectives.

G. Bureaus will work together and with other affected groups and individuals to prevent unauthorized ignition of wildland fires.

H. Protection priorities are (1) human life and (2) property and natural/cultural resources. If it becomes necessary to prioritize between property and natural/cultural resources, this is done based on relative values to be protected, commensurate with fire management costs. Once people have been committed to an incident, these human resources become the highest value to be protected.

I. Fire management planning, preparedness, wildland fire and prescribed fire operations, monitoring, and research will be conducted on an interagency basis with the involvement of all partners.

J. Bureaus will use compatible planning processes, funding mechanisms, training and qualification requirements, operational procedures, values- to- be- protected methodologies, and public education programs for all fire management activities.

K. Fire management programs and activities will be based on economic analyses that incorporate commodity, non- commodity, and social values.

L. The operational role of the bureaus as a partner in the wildland/urban interface is wildland firefighting, hazard fuels reduction, cooperative prevention and education, and technical assistance. Structural fire protection is the responsibility of Tribal, State, and local governments. Federal agencies may assist with exterior structural protection activities under formal Fire Protection Agreements that specify the mutual responsibilities of the partners, including funding. (Some Federal agencies have full structural protection authority for their facilities on lands they administer and may also enter into formal agreements to assist Tribes, State and local governments with full structural protection.)

M. Employees who are trained and certified will participate in the wildland fire program as the situation demands; noncertified employees with operational, administrative, or other skills will support the wildland fire program as needed. Agency Administrators will be responsible, and will be held accountable, to make employees available to participate in the wildland fire program.

**NPS Director's Order-18 (NPS 2002)**: National Park Service's Director's Order Number 18 (DO-18) is the NPS guidance for Wildland Fire Management, which states that "every NPS unit with burnable vegetation must have an approved Fire Management Plan." DO-18 defines what an approved FMP must include, stressing that "firefighter and public safety is the first priority" and promoting "an interagency approach to managing fires on an ecosystem basis across agency boundaries." Procedures for completion, review, approval, and required contents for FMP's are provided in Reference Manual-18 (RM-18). Until an FMP is approved, NPS units must take an aggressive suppression action on all wildland fires.

**FWS Service Manual, Part 621, Fire Management (USFWS 2004a)**: U.S. Fish and Wildlife Service policy requires that an approved FMP be in place for all FWS lands with burnable vegetation. The Fish and Wildlife Service Manual has regulatory force and effect within the Service. It implements the Service's authorities and the Director's policies, and steps down the Service's compliance with other requirements, such as statutes, Executive Orders, Departmental directives, and regulations of other agencies. Part 621 describes policies, objectives, definitions, and responsibilities for fire management; the fire planning required in the fire management program; and the basic policy guidance for FWS's prescribed fire program.

**FWS, Fire Management Handbook (USFWS 2004b):** The U.S. Fish and Wildlife Service's "Fire Management Handbook" is a supplement to the "Interagency Standards for Fire and Fire Aviation Operations" (NIFC 2004). It provides additional guidance to FWS regarding fire management and operations.

## Management Plans

**Great Sand Dunes National Park and Preserve General Management Plan**: A revised "General Management Plan" (GMP) is currently being prepared for Great Sand Dunes National Park and Preserve, but is not expected to be completed until July 2007. The new GMP will provide management direction for resource stewardship, visitor understanding and appreciation, partnerships, facilities, and operations for the next 15-20 years for lands within the Great Sand Dunes National Park and Preserve.

A draft mission statement was presented in the General Management Plan Newsletter #2, (November 2003). This mission statement states:

"*Majestic and austere, the Great Sand Dunes rise from a high mountain valley flanked by some of the tallest peaks in the Rocky Mountains. Great Sand Dunes National Monument and Preserve celebrates the entire natural system of the Great Sand Dunes as well as a rich and living connection with ancient and modern peoples. Our mission is to offer visitors opportunities for learning, solitude, and a growing sense of stewardship in an accessible and undeniably enticing natural setting. The National Park Service works with park partners, neighbors, and the American public to protect this treasure forever*."

A draft purpose statement for the Great Sand Dunes National Park and Preserve was presented in the General Management Plan Newsletter #2, (November 2003). It states that the purpose is to:

- *"preserve spectacular and unique sand dunes and their high elevation watersheds, and to perpetuate the entire system for the benefit and enjoyment of present and future generations*
- *provide long- term protection of the geological, hydrological, ecological, scenic, scientific, cultural, wilderness, educational, wildlife, and recreational resources of the area, including the sand deposits associated with the dune mass and the groundwater system on which the sand dune and wetland systems depend, and the remarkable biodiversity evident in the landscape from the valley floor to the mountain crest*
- *provide opportunities for visitors to experience, understand, enjoy, and gain a sense of stewardship of the park's natural and cultural resources*
- *facilitate research to support park management and to promote scientific knowledge and education"*

**Great Sand Dunes National Monument Fire Management Plan (NPS 1997a)**: The proposed interagency fire management plan will replace the Great Sand Dunes National Monument's previous fire plan (NPS 1997a). The 1997 FMP covered only the Great Sand Dunes National Monument and permitted fire suppression, fuels management, and wildland fire use within various fire management units within the Monument, but did not include the Preserve or other areas that were included in the Park expansion.

**Baca National Wildlife Refuge Draft Conceptual Management Plan** (FWS 2004c): The Baca National Wildlife Refuge currently does not have a "Comprehensive Conservation Plan" (CCP) or FMP, but a "Conceptual Management Plan" (CMP) is currently being prepared for the site.

The purpose of the CMP is to provide local landowners, neighboring governmental agencies, and the interested public with a general understanding of the anticipated management approaches for the Baca National Wildlife Refuge while the acquisition planning process continues. The CMP will provide a broad overview of the FWS's proposed management approach to wildlife and their relative habitats, public uses, facilities, interagency coordination, and other operational needs.

The CMP is not intended to provide substantive detail regarding issues such as where new facilities (if any) would be developed or how approved public uses would be implemented, for instance. These details will be discussed and planned for in a CCP planning process. The CCP planning process will include significant input from the public and others, as required by FWS policy and the National Environmental Policy Act. The CCP will provide guidance on how the Refuge will be managed for the longer term (15 years).

Although a final purpose statement has not been developed for the Baca National Wildlife Refuge, the draft CMP (FWS 2004c) contains a proposed purpose statement, which states:

> *"Baca National Wildlife Refuge will provide habitat for wildlife, plants and fish native to the San Luis Valley. Restoration, enhancement and maintenance of wetland, upland and riparian habitat that benefit migratory birds will be priorities of refuge operations integrated with other wildlife management issues and opportunities. Refuge management will compliment wildlife management of broader landscapes including but not limited to the San Luis Valley, state of Colorado, Central and Pacific Flyways lending itself to local, state, national, and international partnerships."*

## The Nature Conservancy - Medano- Zapata Ranch

The Nature Conservancy's mission is "to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive". This is accomplished through strategic, science- based planning and taking action in an adaptive management framework.

The Nature Conservancy, along with many state and federal partners, conducted an ecoregional assessment of the Southern Rocky Mountains (Neely et al. 2001). This assessment identified areas of importance for conserving the biodiversity of the Southern Rocky Mountains, including the Greater Sand Dunes landscape. Collectively, the planning area is called the Great Sand Dunes Conservation Area, an irreplaceable site with species found nowhere else on earth. A management plan was written in 2001 for the Medano- Zapata Ranch that defines broad goals and objectives. The Medano-Zapata Ranch Management Plan is an account of how The Nature Conservancy will protect the ecological values of the ranch, while educating others about the importance of the Great Sand Dunes' biodiversity. The Nature Conservancy is committed to the conservation of the diversity of life found on the Medano- Zapata Ranch and surrounding areas.

**The Nature Conservancy's Fire Management Manual (TNC 2004):** The Nature Conservancy's "Fire Management Manual" is part of the organization's standard operating procedures and requires all preserves with burnable vegetation to have a FMP in place. This manual also provides guidance on conducting fire management activities on TNC lands. The Ranch currently does not have a FMP.

## Other Relevant Plans and Planning Efforts

**Rio Grande National Forest Land and Resource Management Plan (USFS 1996):** The Land and Resource Management Plan provides guidance for all resource management activities on the Rio Grande National Forest, which occurs throughout the Sangre de Cristo Mountains adjacent to the Greater Sand Dunes planning area.

**Fire Management Plan for the Rio Grande National Forest (USFS 2003):** The Rio Grande National Forest FMP provides specific details and guidance for the fire management program of the national forest. This plan allows for fire suppression, wildland fire use, and fuels management. In general, wildland fire use and prescribed fires will be allowed in the wilderness areas located adjacent to the Greater Sand Dunes planning area.

**Draft Accelerated Watershed/Vegetation Restoration Plan (USFS 2004):** The accelerated watershed/vegetation restoration plan will provide strategies on management of wildland fire, hazardous fuels, and ecosystem restoration on the Rio Grande National Forest and surrounding lands. However, no fuels management projects are currently schedule near the Greater Sand Dunes planning area.

**Fire Program Analysis Preparedness Module:** Fire Program Analysis (FPA) is an interagency process for fire management planning and budgeting, which will be used to assess alternative fire management strategies as they relate to land management goals and objectives. The San Luis Valley is the planning unit for this region. The first portion of FPA will determine preparedness funding and fire management units.

**San Luis Valley Bureau of Land Management Field Office Five-Year Fuels Reduction Plan:** The fuels reduction plan calls for mechanical fuels reduction and prescribed fire in a number of sites throughout the Valley as a means to reduce the threat of wildfires. Mechanical thinning occurred adjacent to the planning area at Zapata Falls and near Crestone in winter 2004.

**Draft Bureau of Land Management Fire Management Plan Interim Guidance (BLM 2004):** The BLM FMP will provide details and guidance on fire management activities within the San Luis Valley and includes fire suppression, wildland fire use, prescribed fire, and mechanical, chemical, hand, and biological methods for vegetation treatments.

A number of sites included in this plan are adjacent to the Greater Sand Dunes planning area.

**Zapata Subdivision Wildland Fire Assessment & Mitigation Plan / Baca Grande Wildfire Assessment & Mitigation Plan (Forest Stewardship Concepts, Ltd. 2002 a, b):** The Baca Grande and Zapata Subdivisions have FMP's, which identify wildfire mitigation measures including fuel breaks and defensible space.

# IMPACT TOPICS

Impact topics for this planning effort have been identified on the basis of federal laws, regulations, and orders; National Park Service's 2001 *Management Policies*; U.S. Fish and Wildlife Service's 2004 *Service Manual*; and knowledge of the resources within the planning area from a variety of sources, including resource specialist within the Interdisciplinary Team and the general public. Impact topics are the resources of concern that could be affected by the range of alternatives. Table 1 lists the impact topics that were either retained or dismissed for the Greater Sand Dunes Interagency FMP EA/AEF and the relevant regulations or policies that relate to these issues.

**Table 1: Impact Topics for the Greater Sand Dunes Interagency Fire Management Plan Environmental Assessment/Assessment of Effect**

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| Impact Topic | Retain or Dismiss | Relevant Regulations or Policies |
|---|---|---|
| **Biological and Physical Resources** | | |
| Air Quality | Retain | Federal Clean Air Act, as amended; NPS *Management Policies*; FWS *Service Manual*; Colorado Air Pollution Prevention and Control Act |
| Water Resources | Retain | Clean Water Act; Executive Order 12088; NPS *Management Policies;* FWS *Service Manual* |
| Soils | Retain | NPS *Management* Policies; FWS *Service Manual* |
| Wetlands and Floodplains | Retain | Executive Order 11988; Executive Order 11990; Rivers and Harbors Act; Clean Water Act; NPS *Management Policies*; FWS *Service Manual* |
| Vegetation Health and Ecological Integrity | Retain | NPS *Management* Policies; FWS *Service Manual* |
| Threatened, Endangered, and Candidate Species | Retain | Federal Endangered Species Act; Nongame and Endangered Species Conservation, Colorado Statutes, Title 33, Article 2; NPS *Management* Policies; FWS *Service Manual* |

**Table 1: Impact Topics for the Greater Sand Dunes Interagency Fire Management Plan Environmental Assessment/Assessment of Effect**

| Impact Topic | Retain or Dismiss | Relevant Regulations or Policies |
|---|---|---|
| Wildlife and Wildlife Habitat | Retain | NPS *Management Policies*; FWS *Service Manual* |
| Non- native, Invasive Species | Retain | Executive Order 13112; NPS *Management Policies*; FWS *Service Manual* |
| Wilderness | Retain | Wilderness Act of 1964,; Director's Order 41; NPS *Management Policies* |
| Prime and Unique Farmlands | Dismiss | Council on Environmental Quality 1980 memorandum on prime and unique farmlands |
| **Cultural Resources** | | |
| Archeological Resources | Retain | National Historic Preservation Act, as amended; Archeological and Historic Preservation Act of 1974, as amended; Archeological Resources Protection Act of 1979, as amended; The Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation*; The National Environmental Policy Act; NPS Director's Order 12; NPS Director's Order 28; NPS Management Policies; FWS *Service Manual*; Executive Order 11593 |
| Historic Structures | Retain | National Historic Preservation Act, As amended; Archeological and Historic Preservation Act of 1974, as amended; The Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation*; The National Environmental Policy Act; NPS Director's Order 12; NPS Director's Order 28; NPS Management Policies; FWS *Service Manual*; Executive Order 11593 |
| Ethnographic Resources | Retain | National Historic Preservation Act, as amended; Native American Grave Protection and Repatriation Act (NAGPRA 1990); American Indian Religious Freedom Act (1978), The National Environmental Policy Act; NPS Director's Order 12; NPS Director's Order 28; NPS Management Policies; FWS *Service Manual* |
| Cultural Landscapes | Retain | NPS Director's Order 28; NPS Management Policies; FWS *Service Manual* |
| Museum Objects | Dismiss | NPS Director's Order 28; NPS Management Policies; FWS *Service Manual* |
| **Human Resources** | | |
| Socioeconomics | Retain | 40 CFR 1500 Regulations for Implementing NEPA |
| Environmental Justice | Dismiss | Executive Order 12898 |
| Indian Trust Resources | Dismiss | Department of the Interior Secretarial Order No. 3206; Secretarial Order No. 3175 |
| Public Health and Safety | Retain | NPS *Management Policies*; FWS *Service Manual* |

**Table 1: Impact Topics for the Greater Sand Dunes Interagency Fire Management Plan Environmental Assessment/Assessment of Effect**

| Impact Topic | Retain or Dismiss | Relevant Regulations or Policies |
|---|---|---|
| Wildland- Urban Interface | Retain | National Fire Plan; Federal Wildland Fire Management Policy |
| Recreational Opportunities and Visitation | Retain | NPS *Management Policies*; FWS *Service Manual* |

## Impact Topics Retained for Further Analysis

**Air Quality:** The purpose of the Clean Air Act, as amended, is to prevent and control air pollution, and prevent major deterioration of areas where air is cleaner than National Ambient Air Quality Standards. Because activities addressed under the three proposed alternatives have the potential to impact air quality and air quality related values in and in the vicinity of the planning area, air quality is addressed as an impact topic.

**Water Resources:** The Clean Water Act and Executive Order 12088 provide protection for water resources. In addition, water is an important resource within the planning area and throughout the region. Because activities addressed under the three proposed alternatives have the potential to impact water resources in the planning area, water resources are addressed as an impact topic.

**Soils:** Excessive erosion, loss of fertility, and/or contamination of soils can have long-term negative effects on a variety of resources. Because activities addressed under the three proposed alternatives have the potential to impact soils in the planning area, soils is addressed as an impact topic.

**Wetlands and Floodplains:** Executive Orders 11990 and 11988 provide for protection of wetlands and floodplains, respectively. Because activities addressed under the three proposed alternatives have the potential to impact both wetlands and floodplains in the planning area, wetlands and floodplains are addressed as an impact topic.

**Vegetation Health and Ecological Integrity:** Management actions, whether active or passive, can have tremendous effects on plant communities and the health and integrity of ecological systems. Because activities addressed under the three proposed alternatives have the potential to impact vegetation health and ecological integrity in the planning area, vegetation health and ecological integrity are addressed as an impact topic.

**Threatened, Endangered, and Candidate Species:** The Endangered Species Act, under Section 7, requires federal agencies to consult with the U.S. Fish and Wildlife Service regarding activities that may impact listed species. Because activities addressed under the three proposed alternatives have the potential to impact federal and state-listed species that may occur in the planning area, threatened, endangered, and candidate species are addressed as an impact topic.

**Wildlife and Wildlife Habitat:** Wildlife can respond in a variety of positive and negative ways to management actions. Because activities addressed under the three proposed alternatives have the potential to impact wildlife and wildlife habitat in and in the vicinity of the planning area, wildlife and wildlife habitat are addressed as an impact topic.

**Non-Native Invasive Species:** Non-native invasive species have the potential to significantly alter ecological systems. In addition, Executive Order 13112 requires federal agencies to prevent the spread of and control non-native invasive species. Because activities addressed under the three proposed alternatives have the potential to impact the introduction and spread of non-native invasive species in and in the vicinity of the planning area, non-native invasive species are addressed as an impact topic.

**Wilderness:** National Park Service Management Policies state "Fire management activities conducted in wilderness area will conform to the basic purposes of wilderness" (NPS 2001, Section 6.3.9). Because activities addressed under the three proposed alternatives have the potential to impact wilderness and wilderness values in the planning area, wilderness is addressed as an impact topic.

**Cultural Resources (archeological resources, historic structures, ethnographic resources, and cultural landscapes)**: The National Historic Preservation Act, as amended, NEPA, and NPS and FWS policy and guidance require consideration of impacts to cultural resources including sites and districts listed on or determined eligible for inclusion to the National Register of Historic Places. Activities addressed under the three proposed alternatives have the potential to impact cultural resources in the planning area. Therefore, cultural resources, including archeological resources, historic structures, ethnographic resources, and cultural landscapes are addressed in this document as an impact topic.

**Socioeconomics:** The Park, Refuge, and Ranch have and/or will have an effect on the socioeconomics of the region. Because activities addressed under the three proposed alternatives have the potential to impact socioeconomics in the vicinity of the planning area and within the region, socioeconomics is addressed as an impact topic.

**Public Health and Safety:** Wildfires pose a significant risk to the health and safety of firefighters, personnel, and the general public. Because activities addressed under the three proposed alternatives have the potential to impact public health and safety in and in the vicinity of the planning area, public health and safety is addressed as an impact topic.

**Wildland- Urban Interface:** Protection of the wildland- urban interface is a priority for each agency and is a primary component of the National Fire Plan. Because activities addressed under the three proposed alternatives have the potential to impact the wildland- urban interface in and surrounding the planning area, the wildland- urban interface is addressed as an impact topic.

**Recreational Opportunities and Visitation:** Wildfires and fire management activities may influence recreational opportunities and visitation to the Park, Refuge, and Ranch. Because activities addressed under the three proposed alternatives have the potential to impact recreational opportunities and visitation in the planning area, recreational opportunities and visitation is addressed as an impact topic.

## Impact Topics Dismissed from Further Consideration

**Environmental Justice:** According to the guidance issued by the Council on Environmental Quality, environmental justice is the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. Presidential Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low Income Populations", requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low- income populations and communities. The proposed action would not have disproportionate health or environmental effects on minorities or low- income populations or communities as defined in the Environmental Protection Agency's Environmental Justice Guidance (1998). Therefore, environmental justice was dismissed as an impact topic in this document.

**Cultural Resources - Museum objects**: The proposed projects under all alternatives lack the potential to affect curated museum objects housed within the project area. Therefore, the topic, cultural resources - museum objects, was dismissed as an impact topic in this document.

**Prime and Unique Farmland:** In August, 1980, the Council on Environmental Quality (CEQ) directed that federal agencies must assess the effects of their actions on farmland soils classified by the U.S. Department of Agriculture's Natural Resource Conservation Service as prime or unique. Prime or unique farmland is defined as soil which particularly produces general crops such as common foods, forage, fiber, and oil seed;

unique farmland produces specialty crops such as fruits, vegetables, and nuts. Because the fire management plan will not be converting prime and unique farmland to non-agricultural uses, the topic of prime and unique farmlands has been dismissed as a possible impact topic in this document.

**Indian Trust Resources:** Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by the Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes.

There are no Indian trust resources at Great Sand Dunes National Park and Preserve or Baca National Wildlife Refuge. The lands comprising the Park and Refuge are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. Therefore, projects implemented as part of the Fire Management Plan would have no effect on Indian trust resources, and this topic was dismissed as an impact topic.

# CHAPTER 2: ALTERNATIVES CONSIDERED

Federal wildland fire policy states that every management response to wildland fire must be specified in an approved Fire Management Plan, be based on site-specific management goals and objectives, and have sound rationale that clearly demonstrates the validity of that response (IWG 2001, NIFC 1998). To this end, three fire management alternatives were developed through internal and public scoping including a no action alternative, which is required under NEPA. These fire management alternatives are consistent with the purpose and intent of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and the Medano-Zapata Ranch and reflect the purpose and need for action and the fire management goals and objectives that are outlined in this EA/AEF. The three fire management alternatives chosen to be analyzed in this document are described below.

## STRATEGIES COMMON TO ALL ALTERNATIVES

### Fire Suppression

**Appropriate Management Response.** Under Alternatives 1, 2, and 3, all wildland fires, whether naturally ignited or human caused, would be managed with an Appropriate Management Response (AMR). The AMR is any specific action taken in response to a wildland fire to meet protection and/or fire use objectives. It is based on the specific, pre-defined fire management goals and objectives for a site, the ability to accomplish those goals and objectives, the current environmental and fuel conditions, any overriding constraints, and safety concerns. In addition, the AMR would seek to minimize costs, considering firefighter and public safety, benefits, and values to be protected.

Depending on the characteristics and location of the wildfire, suppression activities may include construction of firelines; utilization of fire engines, tankers, and aircraft; helicopter water drops; and/or use of retardant where life, property, and other values are immediately threatened. Camps, staging areas, helispots, security checkpoints, and any other temporary facilities would occur, where deemed necessary. All wildland fires occurring within the planning area would be monitored daily or more frequently by the appropriate staff in accordance with the Wildland Fire Situation Analysis. The Park and Refuge would provide regular updates on fire location, size, behavior, smoke dispersal, safety conditions, and effects. If necessary, a wildfire may go into extended attack under this alternative. Following a wildfire, mop-up, rehabilitation, and other postfire activities would occur as necessary.

# ALTERNATIVE 1: NO- ACTION ALTERNATIVE

The no action alternative (Alternative 1) includes preparing a Fire Management Plan that would direct each agency to suppress all wildland fires regardless of ignition source throughout the entire planning area. This alternative would not permit any active fuels management projects, including prescribed fire or manual and mechanical treatments, or wildland fire use for the protection and benefit of resources. The goal of this alternative would be to safely and efficiently suppress all wildland fires throughout the planning area in conformance with existing policies and procedures.

## Fire Management Strategies

**Fire Suppression.** Because the primary goal under Alternative 1 would be to suppress all wildland fires throughout the entire planning area regardless of ignition source, the AMR under Alternative 1 would be an aggressive initial attack on any and all wildland fires. This strategy would include all actions necessary to quickly and safely suppress a wildland fire. In addition, Minimum Impact Suppression Tactics (MIST) will be employed whenever possible.

# ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

The Fire Suppression Plus Fuels Management Alternative (Alternative 2) would be based on the "natural fire regimes" and/or "desired future conditions" of ecological systems within the planning area, as well as local collaborative processes for ensuring community protection needs and firefighter and public safety. This alternative would allow for fuels management activities, including manual and mechanical treatments and prescribed fires, to occur within appropriate limits of the planning area. Wildland fire use for resource benefits (WFURB), however, would not be allowed under this alternative. All wildland fires would be suppressed regardless of ignition source and location of the wildland fire. To the extent possible, fire management goals, objectives, and strategies across shared boundaries would correspond under this alternative. Where boundaries are shared, similar fire management goals and objectives would be met through joint operations and shared positions, wherever possible.

## Fire Management Units

A Fire Management Unit (FMU) is any land management area defined by common fire management goals and objectives and fire management strategies, which are distinct from those goals, objectives, and strategies of adjacent units. The fire management goals, objectives, and strategies for each FMU are pre- selected and outlined in a Fire Management Plan.

FMU's for the entire planning area are described in detail for the preferred alternative, Alternative 3 (please refer to pages 38- 41). The FMU's for Alternative 2 would be the same as those defined for Alternative 3 except that WFURB would not be allowed in any FMU. Within each FMU, the fuels treatment activities (that is, prescribed fire and manual/mechanical fuels treatment projects) for Alternatives 2 and 3 would be the same; this proposed schedule of fuels treatment activities follows the discussion of fire management strategies for Alternative 3 (please refer to pages 44- 48).

## Fire Management Strategies

**Fire Suppression.** Because one of the primary goals under Alternative 2 would be to suppress all unplanned wildland fires throughout the entire planning area regardless of ignition source or location, the AMR would be an aggressive initial attack on any and all wildland fires. This strategy would include all actions necessary to quickly and safely suppress a wildland fire. In addition, Minimum Impact Suppression Tactics (MIST) will be employed whenever possible.

**Manual and Mechanical Fuels Treatments.** Under Alternative 2, manual and mechanical fuels treatments would be permitted. The primary goal of the manual and mechanical fuels treatments would be to reduce fuel loads in areas with resources at risk that have heavy fuel accumulations and to protect the wildland urban interface. These treatment sites would include areas of high visitor use, around structures and developments, along the perimeters and jurisdictional boundaries, around cultural resources, and in other areas with values that could be adversely affected by prescribed fire and/or wildland fires.

A range of actions may occur under this treatment depending upon the requirements set forth in the prescription for individual projects. The following guidelines would be utilized when developing fuel treatment plans:

- Firewise guidelines and standards (www.firewise.org) would be adhered to for all fuels treatment activities around structures and developments.
- The "Minimum Requirement Analysis" would be utilized for fuels management activities within designated or proposed wilderness areas.
- Fuel treatment activities around each resource to be protected, which includes cultural resources and structures and developments found within the planning area, would be limited to a maximum 328- foot (100 meter) buffer.
- Intergovernmental coordination would take place for fuels treatment activities along the perimeters of the planning area and jurisdictional boundaries.

In addition, the amount of fuel reduction would be determined based on such factors as:

- impact to aesthetics, cultural resources, and natural resources;
- level of protection required for resource at risk;
- type, age, amount, diversity, volatility, fire history, and size of the vegetation around the area of concern;
- proximity to wildland- urban interface;
- general weather patterns;
- construction, design, materials, and value of structures at risk;
- risk of human caused fire, human density, and ease of evacuation;
- access routes;
- topography; and
- jurisdiction.

The range of actions for manual and mechanical treatments under Alternative 2 may include selective thinning of brush and smaller trees, limbing trees to a certain height above the ground surface, removing all trees within a certain range of diameters, or selectively removing trees or other vegetation of any size class to achieve desired crown spacing or clearance zones. Thinning projects would primarily involve using chainsaws or, in wilderness areas, hand saws. Grass and smaller diameter brush and trees may be trimmed or removed using a variety of tools including hand tools up to and including gasoline powered grass trimmers and brush cutters in non- wilderness areas. Vegetation would be disposed of in select areas by chipping with a mechanical chipper, scattering of smaller brush and trees on- site away from sensitive resources, pile burning of slash, and/or hauling from the site for disposal outside the planning area.

Project specific consultation with U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act and/or with the State Historic Preservation Office under Section 106 of the National Historic Preservation Act would be required for manual and mechanical fuel treatment activities that may affect threatened/endangered species and/or cultural resources.

**Prescribed Fire.** The goals of a prescribed burn program under Alternative 2 would be to 1) mimic the natural fire regime to the extent possible, 2) achieve a reduction in the fuel load, 3) create a fuel break or buffer to reduce the risks associated with a wildland fire, and/or 4) alter the composition and structure of a plant community to achieve a desired future condition, which may include reducing the amount of non- native species or altering the composition and structure of the vegetation for wildlife habitat.

Under Alternative 2, a prescribed burn could be conducted in any plant community throughout the planning area to meet predefined management goals and objectives set forth in a land or natural resource management plan. A prescribed burn would be utilized if and when it is determined that prescribed burning is the best method for achieving those goals and objectives. An approved, site- specific Prescribed Burn Plan would be required for all prescribed burns occurring within the planning area.

Under Regulation Number 9 of the Colorado Air Quality Control Act, a permit must be obtained from the Air Pollution Control Division of the Colorado Department of Public Health and Environment, or from a designated local agency, for any open burning, including prescribed burns, that occurs within the state of Colorado. Project specific consultation with U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act and/or with the State Historic Preservation Office under Section 106 of the National Historic Preservation Act would be required for prescribed burn activities that may affect threatened/endangered species and/or cultural resources.

## ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

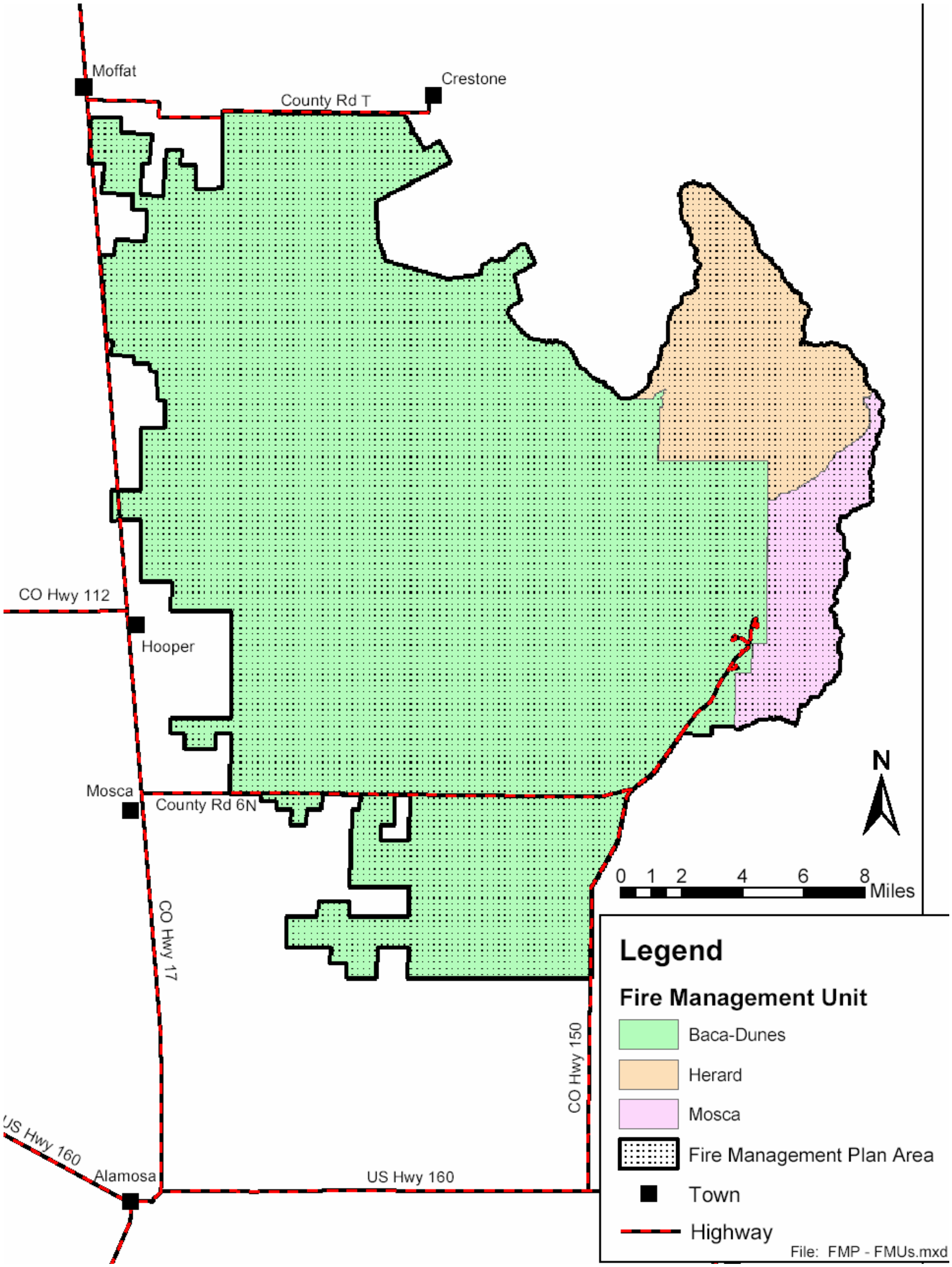
The Fire Suppression and Fuels Management Plus Wildland Fire Use Alternative (Alternative 3) is the preferred alternative for fire management within the planning area. Alternative 3 would be based on the "natural fire regimes" and/or "desired future conditions" of ecological systems, as well as local collaborative processes for ensuring community protection needs and firefighter and public safety. This alternative would allow for fuels management activities, including manual and mechanical treatments and prescribed fires, and fire suppression. The primary difference between Alternatives 2 and 3 is that under Alternative 3 WFURB would be allowed within portions of the planning area. Under Alternative 3, fire management goals, objectives, and strategies across shared boundaries would also correspond to the extent possible, and where boundaries are shared, similar fire management goals and objectives would be met through joint operations and shared positions, wherever possible.

### Fire Management Units

Under Alternative 3, the planning area would be divided into three FMU's, which would include the Herard FMU, the Mosca FMU, and the Baca- Dunes FMU (Figure 4). These FMU's were developed by the planning team based on the following factors:

- land management goals and objectives for each location;
- values to be protected including cultural resources, structures, and developments;
- safety concerns;
- wildland- urban interface;
- access for fire management activities;
- land features;

**Figure 4. Greater Sand Dunes Interagency Fire Management Plan EA/AEF – Fire Management Units.**



political boundaries and jurisdictions;

- fuel types;
- natural fire regimes and the mean fire return intervals for each vegetation type; and
- special management areas (e.g. wilderness).

The three FMU's proposed under Alternative 3 are described below. The specific fire management strategies are described in the "Fire Management Strategies" section following the descriptions of the FMU's.

**Herard FMU**

The Herard FMU would include the portion of the Great Sand Dunes National Preserve that is located north of Medano Pass Road. The entire FMU is located within designated wilderness. Based on the fire histories presented in this EA/AEF, this portion of the planning area is within its natural range of variability for fire, and therefore, fuels treatment activities are not necessary to return the site to its natural condition. The primary goals of fuels treatments within the Herard FMU would be to perpetuate fire as a natural ecological process, achieve ecosystem sustainability, protect the unit perimeters and jurisdictional boundaries, and protect visitors and cultural resources.

To meet the stated goals, the Herard FMU would have a broad parameter wildland fire use prescription with an AMR along the unit boundaries. Limited manual fuel treatment and prescribed fires along the unit's perimeters and along jurisdictional boundaries and around specific sites would be utilized for cultural resource and visitor protection. A five year fuels treatment plan is discussed below.

**Mosca FMU**

The Mosca FMU would include lands south of and on either side of Medano Pass Road within the Great Sand Dunes National Preserve. The majority of the FMU is located within designated wilderness except for the Mosca Pass Road. Based on the fire histories presented in this EA/AEF, this portion of the planning area is within its natural range of variability for fire, and therefore, fuels treatment activities are not necessary to return the site to its natural condition. However, because this unit has a number of sensitive resources and is closer to the wildland- urban interface, limited wildland fire use would be applied. The primary goals for the Mosca FMU would be to perpetuate fire as a natural ecological process, achieve ecosystem sustainability, protect the unit's perimeters and jurisdictional boundaries, and protect visitors, cultural resources, and improvements.

The Mosca FMU would have a limited parameter WFURB prescription. An AMR would be utilized along the unit and jurisdictional boundaries. Fuels treatments would include manual hazardous fuels reduction and prescribed fire for cultural resource, visitor, and wildland- urban interface protection. Fuels work within the Mosca FMU would occur along unit perimeters and jurisdiction boundaries, around cultural resources, in areas designated as necessary for visitor protection, along access roads including the Medano Pass Road corridor, and around improvements including the on-site communication towers. A five year fuels treatment plan is discussed below.

**Baca- Dunes FMU**

The Baca- Dunes FMU would include all lands within Great Sand Dunes National Park, Baca National Wildlife Refuge, and Medano- Zapata Ranch. This FMU would not include the Preserve, which would be included in the Herard and Mosca FMU's. The Baca- Dunes FMU includes designated and proposed wilderness areas as well as non-wilderness areas. Because this FMU has a number of cultural resources, occurs closer to the wildland- urban interface, and poses a number of safety concerns, wildland fire use for resource benefit would not be allowed within this unit.

All wildfires would be controlled with an AMR throughout the Baca- Dunes FMU to protect cultural resources, visitors, and property. To the extent possible, indirect suppression activities using existing roads and natural barriers would be employed. Fuels treatments within the Baca- Dunes FMU would include manual and mechanical fuels treatments and prescribed fire. The goals of the fuels treatments within the Baca-Dunes FMU would be to protect cultural resources, visitors, and the wildland- urban interface, protect the unit's perimeters and jurisdictional boundaries, and manage habitat to meet specific wildlife management objectives. A five year fuels treatment plan is discussed below.

## Fire Management Strategies

**Fire Suppression.** Under Alternative 3, all unplanned wildland fires throughout the entire planning area would be managed using the AMR, which may include an aggressive initial attack, or if the fire is within the Mosca or Herard FMU's, WFURB. To the extent possible and where appropriate, indirect means of wildfire suppression (i.e. using roads, waterways, etc. as natural fire breaks) would be utilized within all three FMU's. This method of fire suppression would likely reduce the level of impacts to cultural and natural resources during suppression efforts. This strategy would include all actions necessary to quickly and safely manage a wildland fire. In addition, Minimum Impact Suppression Tactics (MIST) will be employed whenever possible.

**Manual and Mechanical Fuels Treatments.** Like Alternative 2, manual and mechanical fuels treatments would be permitted under Alternative 3. The primary goal of the manual and mechanical fuels treatments would be to reduce fuel loads in areas with resources at risk that have heavy fuel accumulations and to protect the wildland urban interface. These treatment sites would include areas of high visitor use, around structures and developments, along the perimeters and jurisdictional boundaries, around cultural resources, and in other areas with values that could be adversely affected by prescribed fire and/or wildland fires.

A range of actions may occur under this treatment depending upon the requirements set forth in the prescription for individual projects. The following guidelines would be utilized when developing fuel treatment plans:

- Firewise guidelines and standards (www.firewise.org) would be adhered to for all fuels treatment activities around structures and developments.
- The "Minimum Requirement Analysis" would be utilized for fuels management activities within designated or proposed wilderness areas.
- Fuel treatment activities around each resource to be protected, which would include cultural resources and structures and developments found within the planning area, would be limited to a maximum 328- foot (100 meter) buffer.
- Intergovernmental coordination would take place for fuels treatment activities along the perimeters of the planning area and jurisdictional boundaries.

In addition, the amount of fuel reduction would be determined based on such factors as:

- impact to aesthetics, cultural resources, and natural resources;
- level of protection required for resource at risk;
- type, age, amount, diversity, volatility, fire history, and size of the vegetation around the area of concern;
- proximity to wildland- urban interface;
- general weather patterns;
- construction, design, materials, and value of structures at risk;
- risk of human caused fire, human density, and ease of evacuation;
- access routes;
- topography; and
- jurisdiction.

The range of actions for manual and mechanical treatments under Alternative 3 may include selective thinning of brush and smaller trees, limbing trees to a certain height above the ground surface, removing all trees within a certain range of diameters, or selectively removing trees or other vegetation of any size class to achieve desired crown spacing or clearance zones. Thinning projects would primarily involve using chainsaws or, in wilderness areas, hand saws. Grass and smaller diameter brush and trees may be trimmed or removed using a variety of tools including hand tools up to and including gasoline powered grass trimmers and brush cutters in non- wilderness areas. Vegetation would be disposed of in select areas by chipping with a mechanical chipper, scattering of smaller brush and trees on- site away from sensitive resources, pile burning of slash, and/or hauling from the site for disposal outside the planning area.

Project specific consultation with U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act and/or with the State Historic Preservation Office under Section 106 of the National Historic Preservation Act would be required for any manual and mechanical fuel treatment activities that may affect threatened/endangered species and/or cultural resources.

**Prescribed Fire.** The goals of a prescribed burn program under Alternative 3 would be to 1) mimic the natural fire regime to the extent possible, 2) achieve a reduction in the fuel load, 3) create a fuel break or buffer to reduce the risks associated with a wildland fire, and/or 4) alter the composition and structure of a plant community to achieve a desired future condition, which may include reducing the amount of non- native species or altering the composition and structure of the vegetation for wildlife habitat.

Under Alternative 3, a prescribed burn could be conducted in any plant community throughout the planning area to meet predefined management objectives set forth in a land or natural resource management plan. A prescribed burn would be utilized if and when it is determined that prescribed burning is the best method for achieving those objectives. An approved, site- specific Prescribed Burn Plan would be required for all prescribed burns occurring within the planning area.

Under Regulation Number 9 of the Colorado Air Quality Control Act, a permit must be obtained from the Air Pollution Control Division of the Colorado Department of Public Health and Environment, or from a designated local agency, for any open burning, including prescribed burns, that occurs within the state of Colorado. Project specific consultation with U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act and/or with the State Historic Preservation Office under Section 106 of the National Historic Preservation Act would also be required for all prescribed burn activities that may affect threatened/endangered species and/or cultural resources.

**Wildland Fire Use for Resource Benefit.** Under Alternative 3, WFURB would be allowed within the Herard and Mosca FMU's. WFURB is defined as the management of naturally- ignited wildland fires to accomplish specific, pre- stated resource management objectives, which are set for in predefined geographic areas and have been outlined in an approved Fire Management Plan (NIFC 1998). Resource benefits may include habitat improvement, reduction of hazardous fuels, restoration and maintenance of natural fire regimes, and preservation of natural processes and disturbances across the landscape as defined by land management planning documents. Overall, the management of wildland fires for the purpose of meeting resource management objectives requires stricter planning and documentation than other fire management activities. In addition, all wildland fires managed for resource benefits would adhere to national fire management policy.

A “Go/No- Go” decision making process would be utilized for all unplanned fire events to determine the appropriate management response (NIFC 1998). The decision to either suppress a wildland fire or let it burn to meet resource management objectives would be based on the pre- determined goals and objectives for the FMU in which the wildland fire is burning, the relative risk of the wildland fire to firefighters, staff, visitors, and cultural and natural resources, external constraints such as air quality concerns and public health and safety, and the overall ability to defend the boundaries of the fire. The determination of the relative risk of a wildland fire is based on such factors as the time within the fire season in which the wildland fire is burning (i.e. early, mid, late), the size of the fire, the potential complexity of the wildland fire, the current and near- term weather conditions, and the fire danger indicator (i.e. low, high, extreme). Wildland fire use, like all fire management operations, would be managed with firefighter and public safety as the primary goal.

Regulation Number 3 of the Colorado Air Quality Control Act requires an unplanned fire ignition permit for any fire under wildland fire use. This permit must be obtained prior to the start of any wildland fire use fire, and if granted, provides a set of conditions and mitigation measures. A Wildland Fire Implementation Plan (WFIP) is also required before any wildland fire use fire is allowed. WFIPs are one or more documents that are developed for each wildland fire managed under the National Wildfire Coordinating Group’s 1998 Implementation Plan Guide (Guide). Conformance to the Guide is required on all wildland fire use fires on land managed by the U.S. Forest Service, National Park Service, Bureau of Land Management, and other land management agencies. The Guide is available at: www.fs.fed.us/fire/fireuse/wildland_fire_use/ref_guide/index.html

Although WFURB is only currently proposed for a portion of the planning area, a long-term goal for the Greater Sand Dunes planning area is to maximize the extent to which WFURB is allowable. Currently, a number of safety and resource protection issues, as well as insufficient information regarding the natural fire regime, fuels, and fire behavior within portions of the planning area, limit the area to which WFURB may be permitted across the planning area. However, in future planning efforts, WFURB would be reevaluated to determine whether it may be included as a fire management strategy in additional portions of the site. This determination would be directly related to the adaptive management program (see below) and would be based on land and resource management objectives for each site. In addition, continuing consultation with U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act and/or with the State Historic Preservation Office under Section 106 of the National Historic Preservation Act would also be required during WFURB planning and implementation.

## Fuels Treatment Projects

Under both Alternatives 2 and 3, fuels treatment projects would be included for all lands within the planning area including Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, Medano- Zapata Ranch, and all State Land Board properties within the planning area. Table 2 provides the proposed five-year fuels treatment projects for Great Sand Dunes National Park and Preserve and Baca National Wildlife Refuge. The overall goal of each of the proposed wildland urban interface and hazardous fuels reduction projects presented below for each jurisdiction is the protection of resources at risk, particularly cultural resources, structures, and developments, the safety of firefighters, neighbors, staff, visitors, and the general public, and the wildland-urban interface. Each agency, as well as The Nature Conservancy, would be responsible for implementing these activities within each of their own jurisdictions. However, wherever possible, joint and cross-boundary projects will be pursued.

Resource specialists from the National Park Service, U.S. Fish and Wildlife Service, and The Nature Conservancy will annually review the proposed projects prior to implementation. This review will include an assessment of any changes in conditions within the treatment areas, an assessment of any changes in land management or fire management policy, and an assessment of any potential impacts to sensitive resources such as threatened and endangered species or cultural resources. Following the review, any necessary revisions to each of the proposed projects would be made before implementation.

**Great Sand Dunes National Park and Preserve**

The five-year fuels treatment plan for the Great Sand Dunes National Park and Preserve is presented in Table 2a. The goals of these projects are to protect resources at risk within the treatment areas, protect human health and safety, and create a defensible space along the wildland-urban interface. Fuel treatment activities within each treatment area would occur within the immediate vicinity of the resource elements to be protected. The maximum buffer of fuels treatment around each identified resource element would be 328 feet (100 meters). Fuels treatment work along the perimeter of the Park and Preserve would extend to a maximum of 1640 feet (500 meters) away from the boundary with neighboring properties. Little to no fuels treatment activities would occur in potential Canada lynx (*Lynx Canadensis*) habitat, which includes high elevation spruce-fir forests with dense tree canopies and large woody debris on the forest floor, which is used for den sites. Many of treatment areas have not yet been surveyed for the specific resource elements to be protected, and therefore, an initial assessment of each treatment area would be required prior to implementation of each treatment to identify the appropriate locations for treatments. All treatments would adhere to the goal of protection from wildland fires.

The proposed fuels treatment plan calls for projects (approximately 325 acres total) within each of the three FMU's. Treatment areas would include the Medano Pass Road corridor, residential areas, the wildland-urban interface, and along the northwest boundary of the property. In addition, a natural resource protection project and a

**Table 2. Proposed five-year fuel treatment projects for a. Great Sand Dunes National Park and Preserve and b. Baca National Wildlife Refuge.**

**a Fuels Treatments for Great Sand Dunes National Park and Preserve**

| Fiscal Year | Treatment Name | WUI or HFR[1] | Treatment Type | Target Acres |
|---|---|---|---|---|
| FY06 | Medano Pass Road Corridor | WUI | Mechanical | 20 |
| FY06 | Residential Area | WUI | Mechanical | 10 |
| FY07 | Medano Pass Road Corridor | WUI | Mechanical | 20 |
| FY07 | Natural Resource Protection | WUI | Mechanical | 20 |
| FY07 | Assessment - Interface | WUI | Other | 0 |
| FY08 | Cultural Resource Protection | WUI | Mechanical | 25 |
| FY08 | Medano Pass Road Corridor | WUI | Mechanical | 25 |
| FY08 | NW Boundary | WUI | Mechanical | 20 |
| FY09 | Medano Pass Road Corridor | WUI | Mechanical | 25 |
| FY09 | NW Boundary | WUI | Fire | 35 |
| FY10 | Medano Pass Road Corridor | WUI | Mechanical | 30 |
| FY10 | NW Boundary | WUI | Mechanical | 30 |
| FY10 | NW Boundary | WUI | Fire | 65 |

**b. Fuel Treatments for Baca National Wildlife Refuge**

| Fiscal Year | Treatment Name | WUI or HFR[1] | Treatment Type | Target Acres |
|---|---|---|---|---|
| Unknown | Baca- WUI- 01 | WUI | Mechanical | 27.3 |
| Unknown | Baca- WUI- 02 | WUI | Prescribed Fire, Mechanical | 78 |
| Unknown | Baca- WUI/HFR- 03 | WUI/HFR | Other: Fuel Monitoring | 2,019 / 16,527 |
| Unknown | Baca- WUI- 04 | N/A | Other: Information and Education | N/A |
| Unknown | Baca- WUI/HFR- 05 | WUI/HFR | Other: Infrastructure Inventory | 22,893 / 121,281 |

1 WUI = Wildland Urban Interface, HFR = Hazardous Fuels Reduction

cultural resource protection project are proposed. Treatment options would include manual and mechanical operations and prescribed fire.

**Baca National Wildlife Refuge**

The five-year fuels treatment plan developed for the Baca National Wildlife Refuge (Greystone Environmental Consultants, Inc. 2004) is presented in Table 2b. The overall goals of these projects are to protect resources at risk within the treatment areas, protect human health and safety, and create a defensible space along the wildland-urban interface. All projects would occur within the Baca-Dunes FMU since the entire Refuge occurs within this FMU. This plan proposes the following wildland-urban interface and hazardous fuels reduction projects:

**Baca-WUI-01**. The Baca-WUI-01 fuels treatment project is located in the northeast corner of the Refuge from North Crestone Creek south to Cottonwood Creek along the boundary with the communities of Baca Grande and Crestone. The goal of the project would be to create a fuel break, which would reduce the risk of a wildland fire crossing between the Refuge and the communities. The project site would be approximately 7.5 miles in length and 30 feet wide (approximately 27 acres) and would include mechanical clearing of shrubs and mowing grasses where appropriate to create a defensible fuel break. Long-term maintenance and monitoring to ensure that the fuel break remained in a defensible state would be required.

**Baca-WUI-02.** The Baca-WUI-02 fuels treatment project would occur within the cottonwood stands along Crestone and South Crestone Creeks in the northeast corner of the Refuge (approximately 78 acres). The goals of this project would be to protect the cottonwood stands in the riparian areas as well as other key vegetation by reducing ground fuels and minimizing expected fire behavior through these stands in the event of a wildfire. This fuels reduction will assist in providing protection to firefighters, the public, and structures in the communities of Baca Grande and Crestone. The implementation phase of this project would involve removing large down and dead woody material within the stands by manual and/or mechanical means. Some flammable brush species within a 15 foot radius around live cottonwoods may be removed as well. This would also be completed by manual and/or mechanical means. Woody material collected from these stands would be piled and burned in adjacent open areas.

**Baca-WUI/HFR-03**. The Baca-WUI/HFR-03 project proposes to monitor fuels within wet meadow areas that may change in the near future with changes in the type of management, such as the cessation of grazing and haying within these areas. Goals of this monitoring would be to track changes in the vegetation and to determine whether prescribed fire or other hazardous fuels treatments would be required in the future for protection of resources at risk in these areas.

**Baca-WUI-04.** The Baca-WUI-04 project calls for the development of an information and education program, which FWS would use to educate and inform local residents and landowners about wildfire risks and wildfire risk reduction. This would partially be accomplished through the creation of a brochure about reducing fuels and creating defensible space around structures and highlighting what hazardous fuels reduction actions have been taken or are planned for the Refuge. In addition, public meetings would be conducted to disseminate information regarding hazardous fuels reduction projects and management.

**Baca-WUI/HFR-05.** The Baca-WUI/HFR-05 project would entail inventorying and mapping all existing infrastructure within the Refuge including access roads, potential safety zones, and water sources. The purpose of these activities would be to improve fire suppression capabilities on the Refuge and to increase protection of the Refuge's resources as well as improve firefighter safety.

### Medano-Zapata Ranch and State Land Board Jurisdictions

Hazardous fuels assessments will occur within five years around all historic and currently utilized structures and developments at the Medano-Zapata Ranch and Colorado State Land Board's jurisdiction (approximately 100 acres total for both). The goal of these assessments would be to ensure that all structures and developments are protected, to the extent possible, from wildland fire dangers. The hazardous fuels assessments, as well as subsequent hazardous fuels reduction implementation plans, would be based on firewise guidelines and standards (www.firewise.org) and take into account such site characteristics as slope, vegetation type, and roofing and structural materials.

All projects within the boundaries of the Ranch and State lands would be within the Baca-Dunes FMU. The locations of the site-specific assessments would include, but would not be limited to, the Zapata headquarters, the bison corrals, Medano headquarters, Medano homestead, the historic Trujillo cabin, and all ranch residences. Because of its historic and biological significance, fuels would also be assessed and treated around individual ponderosa pine (*Pinus ponderosa*) found on the properties. The fuels treatments would likely include the reduction of hazardous woody materials and the removal of windblown herbaceous vegetation (e.g. Russian thistle and kochia), which accumulates along ditches, buildings, fences, wood piles, etc. Fuel treatment activities within each treatment area would occur within the immediate vicinity of identified resource elements to be protected. The maximum buffer of fuel treatments around each resource element would be 328 feet (100 meters). Fuels treatment work within the wildland-urban interface would extend to a maximum of 1640 feet (500 meters) away from the boundary with neighboring properties. Fuel reduction methods would be accomplished by manual and mechanical means (e.g. chainsaws, loppers, mowers, etc.), or potentially, prescribed fire depending on the location and characteristics of the fuels (i.e. the hazard level).

In addition to hazardous fuels assessments and fuels reduction projects, a limited number of research burns within wet meadow habitat on the Medano- Zapata Ranch are also proposed. The purpose of these research burns would be to monitor the effects of fire within these ecological systems. This might include monitoring the response of vegetation and wildlife following fires conducted at different times of the year and/or under different climatic conditions. All research burns would be set up with clear objectives, incorporate a scientifically sound monitoring program, and adhere to all federal, state, and local policies and regulations, as well as the policies of The Nature Conservancy.

## Adaptive Management

An adaptive management approach to all fire management activities would be applied to the selected fire management plan. This approach would account for unanticipated changes in environmental conditions, inaccurate predictions, and/or subsequent information that might affect the original environmental predictions. This approach is critical to meeting the desired outcomes.

The basic steps of the adaptive management process include:

1. Plan – Develop plan of action based on current management goals and objectives.
2. Predict – Predict the outcome of the action based on current information and understanding.
3. Mitigate – Mitigate for any anticipated impacts.
4. Implement – Implement plan of action.
5. Monitor – Monitor the resources prior to, during, and following the action.
6. Adapt – Revise plans based on new information and understanding and monitoring results and begin adaptive management process again.

This NEPA planning effort will lead to a decision on a fire management plan for the Greater Sand Dunes area; thus accomplishing steps 1- 3 in the adaptive management process. Following the NEPA process, fire management activities would be implemented, as described in steps 4 and 5. Fire management plans will be evaluated on an annual basis (step 6) and fire management activities may be revised or changed based on monitoring information. If such revisions or changes to the fire management activities are outside the original scope of the fire management plan and NEPA documentation, then additional NEPA analysis would be required.

# MITIGATION INCLUDED IN THE ALTERNATIVES CARRIED FORWARD

The purpose of mitigation is to minimize the degree or severity of potential adverse effects to a resource caused by an action or an activity. The Code of Federal Regulation (40 CFR 1508.20) states that "mitigation" includes:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.
(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
(e) Compensating for the impact by replacing or providing substitute resources or environments.

For all fire management activities, appropriate mitigation and monitoring measures would be implemented with the intent of avoiding, minimizing, reducing, or eliminating impacts to resources and documenting the results of the mitigation actions. The following sections describe the mitigation and monitoring measures that will be implemented to reduce potential impacts to key resources. For each fire management project, a resource specialist, in coordination with the Refuge Manager, Park Superintendent, or Ranch Manager, will determine prior to the start of any fire management action which of the mitigation measures listed below are necessary.

## Mitigation Measures

### Air Quality

The following mitigation measures will be taken to minimize adverse impacts to air quality:

- Coordinate with the Air Pollution Control Division of the Colorado Department of Public Health and Environment for all prescribed fires and wildland fire use activities and receive all required permits prior to the start of an activity.
- Follow smoke management reporting and implementation procedures for burning in Colorado for all prescribed fire and wildland fire use operations as mandated under the Colorado Air Pollution Prevention and Control Act and required by the Colorado Department of Public Health and Environment.

- Monitor air quality adjacent to the project area and in nearby developed areas by monitoring and documenting smoke dispersal, column mixing height, and documenting smoke complaints by visitors and neighbors.
- When conducting slash pile and prescribed burns, attempt to utilize wind directions that carry smoke away from structures and neighbors.
- Keep burn piles free from dirt, as dry as possible, and small enough so smoke impacts can be managed.
- Reevaluate meteorological conditions on the day of the burn to ensure that conditions are favorable for smoke dispersion and air quality standards would not be threatened. If unfavorable conditions are indicated, postpone the burn.
- Keep mechanized equipment in good operating condition so that exhaust emissions are kept to a minimum.
- Notify public of all prescribed fire and wildland fire use activities.

**Water Resources**

The following mitigation measures will be taken to minimize adverse impacts to water resources:

- Do not apply fire retardant within a 300- foot buffer around any waterway.
- Utilize best management practices to reduce the risk of increased sedimentation in streams.
- Utilize refueling stations with ground protection for refueling and maintaining chainsaws, vehicles, or other equipment to minimize chances of gasoline or oil spills
- Employ "Minimum Impact Suppression Tactics" whenever possible.

**Soils**

The following mitigation measures will be taken to minimize adverse impacts to soils:

- Utilize natural barriers and wetlines, where feasible, to minimize or prevent erosion of disturbed soil during and after all fire management activities.
- Rehabilitate exposed soils where necessary during fire management activities, including such measures as installing erosion- control devices on steep slopes or covering bare soil to prevent soil movement.
- Specific mitigation measures would be identified during an on- site evaluation, usually by a Burned Area Emergency Rehabilitation (BAER) team.
- Employ "Minimum Impact Suppression Tactics" whenever possible.

### Wetlands and Floodplains

The following mitigation measures will be taken to minimize adverse impacts to wetlands and floodplains:

- Identify wetlands and floodplains during project planning and limit impacts to these resources to the extent possible by adjusting proposed project boundaries or total avoidance.
- Do not conduct equipment maintenance or fueling in wetlands or riparian areas.
- Do not move slash from upland sites to wetland or riparian areas or place slash in open water without approval of resource specialist.
- Avoid using retardant and foam in or near wetlands or riparian areas to the extent possible.
- Employ “Minimum Impact Suppression Tactics” whenever possible.

### Vegetation Health and Ecological Integrity

The following mitigation measures will be taken to minimize adverse impacts to vegetation health and ecological integrity:

- Consult with natural resource specialists on proposed locations of camps, staging areas, helispots, or other management actions that may remove or disturb native vegetation and/or sensitive species.
- Utilize natural barriers (e.g. rock outcroppings, surface water, open meadows, sand dunes, etc.) and/or human- made features (e.g. roads, trails, right of ways, etc.) as control lines to the extent possible.
- Utilize natural disturbance regimes and revegetation to the extent possible to restore native vegetation.
- Utilize fire retardant and low- level aircraft only with approval by the Refuge Manager or Park Superintendent for each respective site.
- Keep fire lines to a minimum width necessary to allow backfiring or creation of a safe blackline.
- Whenever possible, utilize natural barriers to avoid unnecessary fire line construction.
- Transport crews and equipment on established roads, whenever possible.
- Wherever possible, ensure that fire crews park vehicles in specified areas and access project areas within the Refuge, Park, and Ranch on foot to avoid resource damage.
- If adequate water and pumps are available, use wet lines in lieu of hand line construction.
- Rehabilitate all fire lines, camps, and other disturbances created during fire management activities including stabilizing slopes, and if necessary, re- seed disturbed sites with native vegetation.

- Employ "Minimum Impact Suppression Tactics" whenever possible.

**Threatened, Endangered, and Candidate Species**

The following mitigation measures will be taken to minimize adverse impacts to threatened, endangered, and candidate species:

- Where suitable habitat for any State or Federal- listed threatened, endangered, or candidate species is present, the TNC, FWS, or NPS biologist would be consulted as to the need for surveys to determine species presence. If species are found, steps would be taken to reduce or avoid impacts, including not conducting activities. U.S. Fish and Wildlife Service Ecological Services would be contacted pursuant to Section 7 of the Endangered Species Act to ensure that appropriate and effective mitigation is implemented for all federally listed species.
- As a conservation measure, the spatial occurrence and the timing of all fuels treatment activities (i.e. manual and mechanical treatments and prescribed fire) will be planned to avoid potential habitat for State and Federal threatened, endangered, and candidate species.

**Wildlife and Wildlife Habitat**

The following mitigation measures will be taken to minimize adverse impacts to wildlife and wildlife habitat:

- Consult with FWS or NPS wildlife biologist on proposed locations of camps, staging areas, helispots, or other management actions that may impact wildlife or important wildlife habitat.
- Conduct all necessary wildlife surveys as determined by FWS or NPS wildlife biologist prior to commencing fuel reduction activities or a prescribed burn in order to identify important wildlife resources that may need to be protected.
- To the extent possible, implement any fuels management programs outside the breeding and nesting season of most wildlife species.
- Avoid nests to the extent possible during fuels treatment activities.
- Preserve snags and dead fallen trees that can be retained without compromising wildland fire safety.
- Mark and avoid to the extent possible living or dead trees during fuels treatment activities that show signs of active wildlife use (e.g. nests or occupied cavities).
- Do not to the extent possible disturb pinecone caches used by squirrels and other small mammals during fuels treatment activities.

**Non- native, Invasive Species**

The following mitigation measures will be taken to minimize the introduction and spread of non- native invasive species:

- Monitor for non- native, invasive plants within fire management areas prior to and following treatment.
- Incorporate measures that reduce the likelihood of non- native invasive introduction and spread in all fire management planning efforts such as washing equipment prior to entering project site and limiting the area of disturbance.
- Control or eradicate non- native, invasive species that invade following fire management activities.
- Utilize certified weed seed free straw during rehabilitation.

**Cultural Resources**

Mitigation measures would be agreed upon by NPS, FWS, and/or TNC personnel and the Colorado SHPO office, on a project- specific basis. Mitigation measures will be included in all treatment plans, Wildland Fire Implementation Plans (WFIP), and Incident Management Plans for suppression actions. The following mitigation measures may be taken to minimize adverse impacts to cultural resources in the Greater Sand Dunes Fire Management area; additional mitigation measures may be developed and implemented in coordination with the SHPO:

- Conduct project- specific section 106 review and consultation with SHPO
- Inventory and reporting will be completed by person(s) meeting the Secretary of the Interior Standards
- A Resource Advisor (READ) who meets the Secretary of the Interior Standards will be assigned to wildland fire use actions, prescribed burns, manual/mechanical fuel reduction projects, wildland fire suppression actions, and Burned Area Emergency Rehabilitation (BAER) as needed
- Utilize protective tactics in areas identified by NPS and FWS cultural resource specialists and/or ranch manager/personnel, as having cultural significance, including archeological, historic, ethnographic, or landscape. Tactics may include foaming or wetting the resource, wrapping with fire- shelter fabric, installing a temporary sprinkler system, and black- lining around the resource
- Locate and isolate historic properties that are vulnerable to fire, suppression, or manual/mechanical activities for protection during project implementation
- Identify and protect/restore contributing elements of cultural landscapes prior to implementation of project work
- Identify and protect ethnographic resources in coordination with Native American tribes, and work crews

- Brief work crews about the need to protect any cultural resources encountered, and instruct them regarding the illegality of collecting artifacts on federal and private land; a notification process should be set up for crews to alert cultural resource specialist about new resources encountered
- Where appropriate, remove heavy fuels which cause long- duration heating on and around cultural resources
- Confine vehicle traffic to existing roadways
- Avoid aerial application of water or retardant to structures and structural remains
- Dispose of slash away from cultural resources
- Route fire control lines around cultural resources during suppression actions

**Wilderness**

The following mitigation measures will be taken to minimize adverse impacts to wilderness resources:

- Apply the "minimum requirement" concept and "minimum tool" and "primitive tool" procedures, as specified in the Wilderness Act (1964), NPS Management Policies (NPS 2001), NPS Reference Manual #41, and "Minimum Requirement Decision Guide" (ACNWTC 2004), for all fire management activities within designated and recommended wilderness areas.
- Conduct initial attack actions within designated or recommended wilderness areas using "minimum impact suppression tactics" (MIST).
- Do not utilize heavy equipment, pumps, chainsaws, or off- road vehicles within wilderness areas without the approval of the Park Superintendent.

**Socioeconomics, Public Health and Safety, and Recreational Opportunities and Visitation**

The following mitigation measures will be taken to minimize adverse impacts to socioeconomics, public health and safety, and recreational opportunities and visitation:

- Consider safety of the public, personnel, and fire crews as the highest priority for all fire management activities.
- Consider impacts to socioeconomics and recreational opportunities and visitation of all fire management activities including the impacts to local and regional businesses and economy.
- Ensure all fire personnel have had the proper training prior to being assigned to a fire management project.
- Do not initiate fire management operations until all personnel involved receive a safety briefing describing known hazards and mitigation actions (e.g. lookout, communications, escape routes, and safety zones), current fire season conditions, and current and predicted fire weather and behavior.

- Equip fire personnel with appropriate personal protection equipment for their incident assignment.
- Notify Park, Refuge, and Ranch neighbors and visitors and local residents and businesses of all planned and unplanned fire management activities that have the potential to impact them. Notify the public about treatment activities through procedures identified in project- specific work plans. These methods could include press releases, Park and Refuge entrance postings, local radio broadcasts, and direct mailings.
- Develop an interpretation and education plan to be implemented by FWS, NPS, and TNC for all fire management activities.
- Limit the removal of vegetation within prominent viewsheds to the extent possible.

**Wildland Urban Interface**

The following mitigation measures will be taken to minimize adverse impacts to the wildland urban interface:

- Work with neighboring land owners to minimize risks within the wildland urban interface.
- Apply fire wise standards (www.firewise.org) within the wildland urban interface.
- Notify Park, Refuge, and Ranch neighbors of all planned and unplanned fire management activities that have the potential to impact them.

## ENVIRONMENTALLY PREFERRED ALTERNATIVE

The Council on Environmental Quality defines the environmentally preferred alternative as "...the alternative that will promote the national environmental policy as expressed in the National Environmental Policy Act's §101." Section 101 of the National Environmental Policy Act states that "...it is the continuing responsibility of the Federal Government to...

(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

(2) assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;

(3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

(4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;

(5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

Environmentally preferable is defined as "the alternative that will promote the national environmental policy as expressed in the National Environmental Policy Act's §101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (CEQ 1978).

Alternative 1 represents the no action or current fire management direction for the three properties. Currently, the only property that has a FMP is Great Sand Dunes National Monument, which does allow for some fuels management (NPS 1997a). However, the other properties that will be included in the interagency FMP, including portions of the Park and Preserve that are not included in the previous FMP, do not have a FMP. Therefore, this alternative would set a policy of suppression of all wildfires with no fuels management on all properties covered in the interagency FMP. Because Alternative 1 does not provide for protection against uncharacteristically intense wildfire, the protection and preservation of fire-adapted ecological systems, or the protection of cultural resources, provisions 1, 2, 3, 4, or 6 of the national environmental policy goals would not be fully realized. Although Alternative 1 would provide a large degree of protection to cultural and natural resources in the short-term, this alternative would not result in the same continued level of protection over time.

Alternative 2 includes suppression of wildfires and the management of fuel loads with manual and mechanical treatments and prescribed fire. This alternative realizes the full range of national environmental policy goals as stated in §101 of the National Environmental Policy Act for a majority of the site. However, it does not allow for wildland fire use, and therefore, falls short of helping to preserve the natural resources within the planning area (provisions 1, 3, 4, and 6). Wildland fire use would fulfill these provisions, particularly in areas where fuels management activities may not occur (e.g. in remote areas). Some areas might become degraded over time through continued fire suppression. In addition, some areas with sensitive resources might be at greater risk from uncharacteristically intense wildfire. The end result, therefore, would be that protection of cultural, human, and natural resources in the long-term may not be realized.

The environmentally preferable alternative is Alternative 3 because it surpasses Alternatives 1 and 2 in realizing the full range of national environmental policy goals as stated in §101 of the National Environmental Policy Act. Alternative 3 (a) provides a high level of protection to natural and cultural resources for the long- term; (b) maintains an environment that supports diversity and variety of individual choice; and (c) integrates resource protection with an appropriate range of visitor uses. It fulfills the responsibility of each generation to protect the environment for future generations (provision 1) and the actions included in Alternative 3 help to better assure safe and productive surroundings (provision 2) and the quality of renewable resources (provision 6).

## COMPARISON OF ALTERNATIVES

The following tables provide comparisons of the three alternatives. Table 3 provides a comparison of the three alternatives by showing which fire management actions (i.e. fire suppression, manual and mechanical treatments, prescribed fire, and wildland fire use) are allowed under each. A determination of whether each alternative meets the goals established for the fire management plan is found in Table 4. This comparison shows that Alternative 3, the preferred alternative, meets the project's goals to the greatest extent. Table 5 provides a summary of the potential impacts to each resource caused by the three alternatives.

Table 3. Comparison of Alternatives

| Component | Alternative 1: No Action | Alternative 2: Suppression Plus Fuels Management | Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative) |
|---|---|---|---|
| **Fire Suppression** | All wildland fires within planning area must be suppressed. | All unplanned wildland fires must be suppressed in Mosca, Herard, and Baca-Dunes FMU's. | Unplanned wildland fires will be suppressed, unless wildland fire use is permitted within FMU. |
| **Manual and Mechanical Treatment** | Not permitted. | Permitted in limited situations in all FMU's to reduce fuel loads and to protect sensitive cultural resources, structures, and wildland- urban interface. | Permitted in limited situations in Mosca, Herard, and Baca- Dunes FMU's to reduce fuel loads and to protect sensitive cultural resources, structures, and wildland- urban interface. |
| **Prescribed Fire** | Not permitted. | Permitted in all FMU's for fuel reduction and to meet specific management objectives, following the approval of a prescribed burn plan. | Permitted in all FMU's for fuel reduction and to meet specific management objectives, following the approval of a prescribed burn plan. |
| **Wildland Fire Use for Resource Benefit** | Not permitted. | Not permitted. | Permitted in limited situations in the Mosca and Herard FMU's with an approved Wildland Fire Implementation Plan |

**Table 4. Fire Management Goals and the Ability of the Alternatives to Meet Them**

| Table 4. Fire Management Goals and the Ability of the Alternatives to Meet Them | | | |
|---|---|---|---|
| **Fire Management Goal** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Develop and implement an interagency Fire Management Plan that specifically addresses the individual fire management needs of each agency, while promoting interagency participation across the greater landscape of the San Luis Valley.** | Does not meet goal of developing and implementing interagency plan and promoting interagency participation, or addressing needs of each agency. | Meets goal of developing and implementing interagency plan and promoting interagency participation, while addressing needs of each agency. | Meets goal of developing and implementing interagency plan and promoting interagency participation, while addressing needs of each agency. |
| **Provide for the protection of human health and safety during all phases of the interagency fire management program.** | Meets goal in short- term, but does not provide protection from widespread and intense wildfires, particularly in areas of high human use. | Meets goal by providing protection from widespread and intense wildfires in areas of high human use. | Meets goal by providing protection from widespread and intense wildfire in high human use areas. |

| Table 4. Fire Management Goals and the Ability of the Alternatives to Meet Them | | | |
|---|---|---|---|
| **Fire Management Goal** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Protect facilities, natural resources, and cultural resources from unplanned wildland fires.** | Meets goal in short- term, but does not reduce the possibility of damage to facilities, natural resources, and cultural resources in the future due to intense wildfire. | Meets goal by reducing the possibility of damage to facilities, natural resources, and cultural resources due to intense wildfire in both the short- and long- term. | Meets goal by reducing the possibility of intense wildfire near facilities and cultural resources by allowing for fuels management and wildland fire use. Also, allows for fuels management and wildland fire use, which in the long- term will protect natural resources. |
| **Apply fire management techniques in a coordinated manner to accomplish desired resource management objectives.** | Does not meet goal. | Meets goal by allowing for coordinated efforts across agency boundaries. | Meets goal by allowing for coordinated efforts across agency boundaries. |

| Table 4. Fire Management Goals and the Ability of the Alternatives to Meet Them | | | |
|---|---|---|---|
| **Fire Management Goal** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Protect air and water quality- related values across all affected airsheds and watersheds in the area.** | Meets goal in short- term, but does not reduce the possibility of impacts to air and water quality in the future due to widespread and intense wildfire. | Meets goal by reducing the possibility of impacts to air and water quality due to widespread and intense wildfire by allowing fuels management. | Meets goal by reducing the possibility of impacts to air and water quality due to widespread and intense wildfire by allowing for fuels management and wildland fire use. |
| **Base the interagency fire management program on sound data obtained through scientific investigation and monitoring.** | Does not meet goal. Majority of scientific data supports the idea that, not only did most ecological systems within planning area burn in the past prior to current suppression activities, fire is needed for ecosystem maintenance. | Meets goal by allowing for fuels management and monitoring of results. Provides for adaptive management. | Meets goal by allowing for fuels management and wildland fire use and monitoring of results. Provides for adaptive management. |

| Table 4. Fire Management Goals and the Ability of the Alternatives to Meet Them | | | |
|---|---|---|---|
| **Fire Management Goal** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Provide educational opportunities for the public regarding fire management and operations.** | Does not meet goal. | Meets goal by providing opportunities to educate the public about fire and fuels management activities. | Meets goal by providing opportunities to educate the public about fire and fuels management activities. |

Table 5. Comparison of Impacts of Alternatives

| Table 5. Comparison of Impacts of Alternatives | | | |
|---|---|---|---|
| **Impact Topic** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Air Quality** | Potential adverse impacts to air quality under Alternative 1 are minor to moderate with short-term effects depending upon the nature and intensity of any ensuing wildland fire and other activities in the planning area. | Under Alternative 2, adverse impacts caused by fire suppression and fuels management activities would be minor to moderate and short-term in nature. Fuels management activities would be planned and coordinated in such a way as to reduce adverse impacts to air quality. | Adverse impacts caused by implementation of Alternative 3 would be minor to moderate and short- term in nature. Fuels management activities would be planned and coordinated in such a way as to reduce adverse impacts to air quality. Wildland fire use would also be restricted to reduce adverse impacts to air quality. |
| **Water Resources** | Under Alternative 1, short- term negligible to minor adverse impacts to water resources (i.e. quality and quantity) would occur because of fire suppression activities. However, short- to long- term minor to moderate adverse impacts to water resources would result if a wildland fire occurred under this alternative. | Effects of Alternative 2 would result in negligible to minor short- term impacts to water resources as a result of either fire suppression or fuels management. However, short- to long- term minor to moderate adverse impacts to water resources would result if a wildland fire occurred under this alternative. | Short- term negligible to minor impacts would occur under Alternative 3 including the effects of wildland fire use. However, short- to long- term minor to moderate adverse impacts to water resources would result if a wildland fire occurred under this alternative. |

**Table 5. Comparison of Impacts of Alternatives**

| Impact Topic | Alternative 1: No Action | Alternative 2: Suppression Plus Fuels Management | Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative) |
|---|---|---|---|
| **Soils** | Potential adverse impacts to soils under Alternative 1 are minor to moderate with short- to long-term effects depending upon the nature and intensity of any ensuing wildland fire and other activities in the planning area. | Under Alternative 2, adverse impacts to soils caused by fire suppression and fuels management activities would be minor to moderate and short- to long- term in nature. Prescribed fire, however, could be beneficial to soil nutrient cycling. | Adverse impacts caused by implementation of Alternative 3 would be minor to moderate and short- to long- term in nature. Prescribed fire and wildland fire use, however, could be beneficial to soil nutrient cycling. |
| **Wetlands and Floodplains** | Impacts to wetlands and floodplains under Alternative 1 would likely be negligible because of the low natural fire frequencies in these habitat types. If it is deemed necessary to suppress a wildfire within a floodplain or wetlands, impacts may be minor and short- term. | Under Alternative 2, impacts to wetlands and floodplains due to fuels management treatments would be minor and short- term and often beneficial. Fire suppression activities within wetlands and floodplains would cause minor, short- term impacts. | Implementation of Alternative 3 would result in minor and short- term impacts and potentially beneficial due to fire suppression activities, fuels management, and wildland fire use. |

| Table 5. Comparison of Impacts of Alternatives | | | |
|---|---|---|---|
| **Impact Topic** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Vegetation Health and Ecological System Integrity** | The ecological systems within the Greater Sand Dunes planning area are thought to have relatively long fire return intervals, and therefore, are within their natural range of variability for fire. Fire suppression under Alternative 1 would, therefore, have a minor, short- term impact on these systems. | Implementation of Alternative 2 would have a minor, short- term impact on the ecological systems of the Greater Sand Dunes area. Fuels management activities that mimic natural process while reducing the risks to people, cultural resources, and property would be beneficial. | Because the majority of ecological systems within the planning area are fire-adapted, impacts from implementation of Alternative 3, including those due to wildland fire use, would be minor and short-term, and potentially beneficial over the long-term. |
| **Threatened and Endangered Species** | Alternative 1 would result in negligible to minor adverse short-term impacts to state and federal-listed species, should all fires be suppressed. Continued suppression may degrade habitats that are historically known to have frequent fire cycles. Widespread and intense wildfires could have the potential to degrade habitat for certain species. | Impacts from implementation of Alternative 2 would be negligible to minor, short- term impacts to state or federal listed species. Impacts would be reduced if the spatial occurrence of fuels management operations and the timing is planned carefully. | Implementation of Alternative 3 would result in negligible to minor and short- term adverse impacts to state or federal listed species, if the spatial occurrence of operations and the timing are planned carefully. |

| Table 5. Comparison of Impacts of Alternatives | | | |
|---|---|---|---|
| **Impact Topic** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Wildlife and Wildlife Habitat** | Impacts to wildlife and wildlife habitat under Alternative 1 would be negligible to minor and short-term. Continued suppression may degrade habitats that are historically known to have frequent fire cycles. | Under Alternative 2, impacts to wildlife and wildlife habitat would be negligible to minor and short-term and potentially beneficial because of fuels management activities. | Impacts of Alternative 3 to wildlife and wildlife habitat would be negligible to minor and short- term and potentially beneficial because of fuels management activities and wildland fire use. |
| **Non- native, Invasive Species** | Implementation of Alternative 1 is expected to have a negligible to minor effect on non- native, invasive species with potential short- term effects. Suppression activities as well as other non- fire related activities may introduce non- native species to the site. | Under Alternative 2, negligible to minor effect on non- native, invasive species with potential short- term effects would occur. Suppression activities as well as other non- fire related activities may introduce non- native species to the site. Fuels management activities may reduce or eliminate some non- native species. | Alternative 3 would result in negligible to moderate impacts for non- native, invasive species with short- to long- term effects depending on the severity of the infestation. Suppression activities and wildland fire use may introduce non- native species to the site. Fuels management activities may reduce or eliminate some non- native species. |

| Table 5. Comparison of Impacts of Alternatives | | | |
|---|---|---|---|
| **Impact Topic** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Wilderness** | Effects to wilderness under Alternative 1 would be minor to moderate due to the changes in wilderness character that can occur during suppression and rehabilitation activities with effects being mainly short- term | Implementation of Alternative 2 would result in minor to moderate and short- term adverse effects during and immediately after suppression and/or fuels management actions. However, moderate and long- term cumulative effects could occur as a result of not allowing fire to have its natural and historic role in the wilderness landscape. | Under Alternative 3, minor to moderate and short- term adverse effects would result from wildland fire use fires, fuels management actions, and/or suppression. Beneficial long- term impacts would result by allowing fire to maintain wilderness character and the role of natural fire in the landscape. This alternative would be consistent with fire management in the Sangre de Cristo Wilderness Area. |

| Table 5. Comparison of Impacts of Alternatives | | | |
|---|---|---|---|
| **Impact Topic** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Cultural Resources: Archeological Resources, Historic Structures, and Cultural Landscapes** | Implementation of Alternative 1 could result in negligible to minor adverse impacts to archeological resources, historic structures, and cultural landscapes. Impacts would be the direct result of artificially high temperatures and resident heat time in areas with artificially high fuel loads. Adverse impacts could also be sustained during fire suppression operations while constructing fire containment lines (hand tools and heavy equipment), and on staging areas, and during rehabilitation following wildland fire. | Implementation of Alternative 2 could result in negligible to minor adverse impacts to archeological resources, historic structures, and cultural landscapes; impacts would be the same as Alternative 1, with a decrease in direct adverse impacts from heat as fuels are reduced. Impacts from suppression and rehabilitation would be the same as Alternative 1. Implementation of Alternative 2 would result in a minor to moderate beneficial impact to archeological resources, historic structures, and cultural landscapes, as fuel loads on and near sites are reduced. Reduced fuel loads would result in lower temperatures on site, and shorter resident heat time. | Implementation of Alternative 3 could result in negligible to minor adverse impacts to archeological resources, historic structures, and cultural landscapes. Impacts from suppression and fuels management would be the same as Alternative 2. Potential adverse impacts from wildland fire use would be the direct impacts from fire, including consumption, smoke damage, heat damage/alteration, and the indirect impact from removal of vegetation and increase in erosion. Except where fuel loads are artificially high, cultural resources have probably been subjected to fires similar or greater in intensity than those proposed as wildland fire use fires under this alternative. Implementation of Alternative 3 would result in minor to moderate beneficial impacts to archeological resources, historic structures, and cultural landscapes, as fuel loads on and near sites are reduced. Reduced fuel loads would result in lower temperatures on site and shorter resident heat time. Beneficial effects would also occur as a result of Wildland Fire Use reducing fuel loads. |

| Table 5. Comparison of Impacts of Alternatives | | | |
|---|---|---|---|
| **Impact Topic** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Cultural Resources: Ethnographic Resources** | Implementation of Alternative 1 could result in minor effect on ethnographic resources. The potential adverse impacts could increase with time if Alternative 1 is implemented, due to the increase risk of high intensity wildland fire from total suppression and lack of fuel reduction. | Implementation of Alternative 2 could result in minor effect on ethnographic resources, as described in Alternative 1, although potential impacts would not increase over time due to fuel reduction projects. Implementation of Alternative 2 could result in minor beneficial effects on ethnographic resources by maintaining access to areas through fuel reduction projects. | Implementation of Alternative 3 could result in minor effects to ethnographic resources. Resources would be impacted directly by wildland fire use fires. Implementation of Alternative 3 could result in minor to moderate beneficial effects to ethnographic resources as well. Fuel reduction projects and wildland fire use may stimulate the growth of important plants, open viewsheds, or otherwise enhance important qualities of the resource. |

| Table 5. Comparison of Impacts of Alternatives | | | |
|---|---|---|---|
| **Impact Topic** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Socioeconomics** | Implementation of Alternative 1 would create short to long- term, minor to moderate impacts to socioeconomics. The nature and extent of adverse impacts would depend upon the extent and duration of a wildfire or successive fires. Some beneficial impacts could result from revenue generated due to fire suppression efforts. | Alternative 2 would reduce the chances for extreme fire events, primarily in the main visitor use areas, so that potential adverse economic impacts are more likely to be minimized that may otherwise result during extreme fires. Overall, impacts would be minor and short- term. | Alternative 3 would result in negligible to minor, short- term, indirect adverse impacts during the periods of some fuels reduction activities. However, long- term beneficial impacts would result from the decreased potential of extreme fire events including the direct costs of fire suppression efforts and indirect costs to the local economy from reduced tourism and recreation revenues. Short- term beneficial impacts would result from expenditures during fuel reduction and wildland fire use monitoring projects. |

| Table 5. Comparison of Impacts of Alternatives | | | |
|---|---|---|---|
| **Impact Topic** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Public Health and Safety** | Under Alternative 1, minor to moderate and short- term to long- term impacts to public health and safety would result. | Implementation of Alternative 2 would create negligible to minor and short- term, and potentially beneficial, impacts to public health and safety. | Adverse impacts under Alternative 3 would be negligible to minor and short term while beneficial impacts would be long- term. |
| **Wildland Urban Interface** | Potential adverse impacts under Alternative 1 are moderate with short to long- term duration due to risks associated with hazardous fuel accumulations. | Under Alternative 2, adverse impacts would be negligible to minor, short- term in nature, and associated with fuels management activities. | Under Alternative 3, impacts would be negligible to minor, short- term in nature, and associated with fuels management activities. Wildland fire use fires, in most instances, would not be allowed to burn in the wildland urban interface due to potential risk. |

| Table 5. Comparison of Impacts of Alternatives | | | |
|---|---|---|---|
| **Impact Topic** | **Alternative 1: No Action** | **Alternative 2: Suppression Plus Fuels Management** | **Alternative 3: Suppression and Fuels Management Plus Wildland Fire Use (Preferred Alternative)** |
| **Recreational Opportunities and Visitation** | Implementation of Alternative 1 would result in negligible to minor impacts to recreational opportunities and visitation unless and until wildland fires occurred in which case minor and short-term to moderate and long- term impacts could result depending upon the nature and extent of the fire. | Implementation of Alternative 2 would result in negligible and short- term adverse effects on recreational opportunities and visitation directly associated with ongoing prescribed fire and manual and mechanical treatment projects. Minor to moderate and long- term effects are likely to be beneficial and with a generally positive public opinion. | Under Alternative 3, negligible and short- term adverse effects on recreational opportunities and visitation directly associated with ongoing prescribed fire, wildland fire use fires, manual and mechanical treatment projects would occur. Minor to moderate and long- term effects are likely to be beneficial and with a generally positive public opinion. |

# CHAPTER 3: ENVIRONMENTAL CONSEQUENCES

## METHODOLOGY

This section describes the environmental consequences, or potential impacts, on the natural, cultural, and human environment within the planning area from implementation of the three fire management alternatives considered in this EA/AEF. Potential impacts for each alternative are described in terms of type (i.e. beneficial or adverse), context (i.e. site- specific, local, or regional), duration (i.e. short- term or long-term), timing (i.e. season), and intensity (i.e. negligible, minor, moderate, or major). Because the definitions of intensity and duration vary by impact topic, intensity and duration definitions are provided separately for each impact topic analyzed in this EA/AEF (Table 6). Impacts were assessed based on the definitions and criteria presented in this document, as well as a review of relevant scientific literature, pertinent references, and the best professional judgment of the resource specialists who provided input into this EA/AEF.

### Cumulative Impact Scenario

The Council on Environmental Quality (CEQ) regulations, which implement the National Environmental Policy Act of 1969 (42 USC 4321 *et seq*.), require assessment of cumulative impacts in the decision making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non- federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for the No Action alternative and the two proposed action alternatives.

Cumulative impacts were determined by combining the impacts of the alternatives with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at the Great Sand Dunes National Park and Preserve and Baca National Wildlife Refuge, and if applicable, the surrounding region. Other actions with the potential to have a cumulative effect in conjunction with this planning effort and subsequent projects include the following:

- Recreational activities
- Water management projects
- Grazing
- Non- native, invasive species management
- Roads and vehicles
- Ground disturbance for utility lines and other civil engineering activities

- Rio Grande National Forest's and Bureau of Land Management's land management policies
- Zapata Subdivision and Baca Grande Subdivision land management policies

## Impairment Analysis

The National Park Service's Management Policies (NPS 2001) require analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the NPS, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values. However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given NPS the management discretion to allow certain impacts within a park, that discretion is limited by the statutory requirement that NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;

- key to the natural or cultural integrity of the park; or

- identified as a goal in the park's general management plan or other relevant NPS planning documents.

A determination on impairment is included in the conclusion of each impact analysis section for all impact topics relating to park resources and values, as well as those of the refuge and ranch.

## Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | **Impact Threshold Definitions** | | | | **Impact Duration Definitions** |
| **Impact Topic** | **Negligible** | **Minor** | **Moderate** | **Major** | |
| **Air Quality** | No changes would occur or changes in air quality or air quality related values would be below or at the level of detection. If detected, effects would be considered slight with no perceptible consequences to health and visibility. | Changes in air quality and air quality related values would be measurable. The changes would be small and the effects on health and/or visibility would be localized. No air quality mitigation measures would be necessary. | Changes in air quality and air quality related values would be readily apparent and measurable and would have consequences to health and/or visibility. Air quality mitigation measures would be necessary and would likely be successful. | Changes in air quality and air quality related values would be obvious and measurable, have substantial consequences to health and/or visibility, and be noticed regionally. Air quality mitigation measures would be necessary, though the success of the measures could not be guaranteed. | Short- term: Following management action, recovers in 7 days or less. Long- term: Takes more than 7 days to recover following management action. |
| **Water Resources** | Water resources (i.e. quantity and/or quality) would not be affected, or changes would be either non-detectable or if detected, would have effects that would be considered slight and local. | Changes in water resources (i.e. quantity and/or quality) would be measurable, although the changes would be small and the effects would be localized. No mitigation measures would be necessary. | Changes in water resources (i.e. quantity and/or quality) would be measurable, but would be relatively local. Mitigation measures would be necessary and would likely succeed. | Changes in water resources (i.e. quantity and/or quality) would be readily measurable, would have substantial consequences, and would be noticed on a regional scale. Mitigation measures would be necessary, though the success of the measures could not be guaranteed. | Short- term: Following management action, recovery will take less than six months. Long- term: Following management action, recovery will take longer than six months. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | **Impact Threshold Definitions** | | | | **Impact Duration Definitions** |
| **Impact Topic** | **Negligible** | **Minor** | **Moderate** | **Major** | |
| **Soils** | Soils would not be affected or the effects would be below or at the lower levels of detection. Soil erosion rates would not increase. Any effects to soil productivity, fertility, stability, or infiltration capacity would be slight. | The effects to soils would be detectable. Soil erosion rates would increase slightly. Effects to soil productivity, fertility, stability, or infiltration capacity would be small, as would the area affected. If mitigation was needed to offset adverse effects, it would be relatively simple to implement and would likely be successful. | Soil erosion rates would increase substantially and would be noticeable and measurable. The effect on soil productivity, fertility, stability, or infiltration capacity or other geological resources would be readily apparent and result in a change to the soil character over a relatively wide area. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful. | Soil erosion rates would increase substantially and would be noticeable and measurable. The effect on soil productivity or fertility or to other geological resources would be readily apparent and substantially change the character of the soils or other geological resources over a large area. Mitigation measures to offset adverse effects would be needed and potentially extensive, though their success could not be guaranteed. | Short- term: Recovers in less than 3 years following management action. Long- term: Takes more than 3 years to recover following management action. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | Impact Threshold Definitions | | | | Impact Duration Definitions |
| Impact Topic | Negligible | Minor | Moderate | Major | |
| **Wetlands and Floodplains** | Wetlands or floodplains would not be affected, or the effects would be below or at the lower levels of detection. | The effect to wetlands and floodplains would be detectable and relatively small in terms of area and the nature of the change. | The effects to wetlands or floodplains would be readily apparent. Changes to wetland or floodplain functions and values may occur. Mitigation measures would be required and would likely be successful. | Effects to wetlands or floodplains would be observable over a large area. The character of the wetland or floodplain would be changed so that the functions and values typically provided would be altered. Mitigation measures would be required and extensive, though the success could not be guaranteed. | <u>Short- term</u>: Recovers in less than 1 year following management action. <u>Long- term</u>: Takes more than 1 year to recover following management action. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | Impact Threshold Definitions | | | | Impact Duration Definitions |
| Impact Topic | Negligible | Minor | Moderate | Major | |
| **Vegetation Health and Ecological System Integrity** | Native plant populations or communities or ecological processes that regulate native vegetation would not be affected, though some individual native plants could be affected as a result of the alternative. The effects would occur over a small scale and within the natural range of variability. No species of special concern would be affected. | Individual native plants or a relatively minor portion of that species' population would be affected. Native plant communities and/or the ecological processes that regulate native vegetation may also be affected. Overall, the effects would be small, localized, and within the natural range of variability. Mitigation to offset adverse effects, including special measures to avoid affecting species of special concern, could be required and would be effective. | Individual native plants or a sizeable segment of that species' population would be affected. Native plant communities and/or the ecological processes that regulate native vegetation may also be affected. The change(s) would occur over a relatively large area, and may push an ecological system outside of its natural range of variability. Mitigation to offset adverse effects could be extensive, but would likely be successful. | Regional scale effects on native plant populations, native plant communities, and/or the ecological processes that regulate native vegetation would occur. An ecological system would be left outside of its natural range of variability. Species of special concern could also be adversely affected. Mitigation measures to offset the adverse effects would be required, extensive, and success of the mitigation measures would not be guaranteed. | Short- term: Recovers in less than 3 years following management action. Long- term: Takes more than 3 years to recover following management action. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | Impact Threshold Definitions | | | | Impact Duration Definitions |
| **Impact Topic** | **Negligible** | **Minor** | **Moderate** | **Major** | |
| **Threatened, Endangered, and Candidate Species** | No federal or state listed species or its critical habitat would be affected, or the alternative would affect an individual of a listed species or its critical habitat, but the change would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population. | An individual(s) of a federal or state listed species or its critical habitat may be affected, but the change would be small and would not adversely affect the continued existence of the species or cause the death of any individual of the species. | An individual or population of a federal or state listed species, or its critical habitat would be noticeably affected. The effect would have some consequence to the individual, population, or habitat and would be difficult to mitigate. | An individual or population of a federal or state listed species, or its critical habitat, would be noticeably affected with vital consequence to the individual, population, or habitat. Appropriate mitigation would be required and may be difficult to implement successfully. | Short- term: Recovers in 3 - 5 years following management action. Long- term: Takes more than 5 years to recover following management action. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | **Impact Threshold Definitions** | | | | **Impact Duration Definitions** |
| **Impact Topic** | **Negligible** | **Minor** | **Moderate** | **Major** | |
| **Wildlife and Wildlife Habitat** | Native fish or wildlife, their habitat, or the natural processes sustaining them would not be affected, or the effects would be at or below the level of detection. The changes would be so slight that they would not be of any measurable or perceptible consequence to the wildlife species' population. Impacts would be well within the range of natural fluctuations. | Effects to native fish and wildlife, their habitat, or the natural processes sustaining them would be detectable, although the effects would likely be localized and would be small and of little consequence to the species' population. The changes would not be expected to be outside of the range of natural variability. Species viability and genetic variability would remain stable. Occasional responses to disturbance by some individuals would not interfere with feeding, reproduction, or population dynamics. Mitigation measures, if needed to offset adverse effects, would be simple and successful. | Effects to native fish and wildlife, their habitat, or the natural processes sustaining them would be detectable, with consequences at the population level. Changes may be outside the natural range of variability. However, species viability and genetic variability would remain stable. Frequent responses to disturbance by some individuals could be expected, with some interference with feeding, reproduction, or population dynamics. Breeding animals of concern are considered present. Mortality or interference with activities necessary for survival can be expected on an occasional basis without threatening the continued existence of the species within the region. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful. | Effects to native fish and wildlife, their habitat, or the natural processes sustaining them would be obvious and would have substantial, regional consequences. Changes would be outside the natural range of variability. Species viability and genetic variability could have impacts affecting population dynamics. Frequent responses to disturbance by some individuals would be expected, with adverse impacts on feeding, reproduction, or population levels. Breeding animals of concern are considered present and may move out of the area. Mortality or interference with activities necessary for survival is expected. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed. | <u>Short- term</u>: Recovers in 3 - 5 years following management action. <u>Long- term</u>: Takes more than 5 years to recover following management action. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | Impact Threshold Definitions | | | | Impact Duration Definitions |
| **Impact Topic** | **Negligible** | **Minor** | **Moderate** | **Major** | |
| **Non- native and Invasive Species** | The populations of non- native and invasive species would not be affected, or changes in the occurrence of non- native and invasive species would be either non- detectable or if detectable, would have effects that would be considered slight and local. | Changes in the populations of non- native and invasive species would be measurable, although the changes would be small and the effects would be localized. No mitigation measures would be necessary. | Changes in non- native and invasive species' populations would be measurable but would be relatively local. Negative effects to native flora and fauna and/or ecological processes may occur. Mitigation measures to control the spread of non- native, invasive species would be necessary and would likely succeed. | Changes in non- native and invasive species' populations would be readily apparent and measurable, would have substantial negative consequences to the native flora and fauna and/or ecological processes, and would be noticed on a regional scale. Mitigation measures would be necessary, though the success of the measures could not be guaranteed. | Short- term: Recovers in less than 1 year following management action. Long- term: Takes more than 1 year to recover following management action. |
| **Wilderness** | A change in the wilderness character of a potential or designated wilderness area may occur, but it would be so small that it would not be of any measurable or perceptible consequence. | A change in the wilderness character and associated values of a potential or designated wilderness area would be small and, if measurable, would be highly localized. | A change in the wilderness character and associated values of a potential or designated wilderness area would occur. It would be measurable, but localized. | A noticeable change in the wilderness character and associated values of a potential or designated wilderness area would occur. It would be measurable, and would have a substantial consequence. | Short- term: Recovers in less than 1 year after management action. Long- term: Takes more than 1 year to recover after management action. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | Impact Threshold Definitions | | | | Impact Duration Definitions |
| **Impact Topic** | **Negligible** | **Minor** | **Moderate** | **Major** | |
| **Cultural Resources: Archeological Resources, Historic Structures, and Cultural Landscapes** | Impact is at the lowest level of detection – barely measurable with no perceptible consequences, either adverse or beneficial, to archeological resources and/or historic structures. For the purpose of Section 106, the determination of effect would be *no adverse effect.* | Disturbance of a resource(s) results in little, if any, loss of significance or integrity and the National Register eligibility of the resource(s) is unaffected. For Purposes of Section 106, the determination of effect would be *no adverse effect.* Beneficial impacts may include maintenance and preservation of the resource(s). | Disturbance of a resource(s) does not diminish the significance or integrity of the resource(s) to the extent that its National Register eligibility is jeopardized. For purposes of Section 106, the determination of effect would be *adverse effect.* Beneficial impacts may include stabilization of a resource(s). | Disturbance of a resource(s) diminishes the significance and integrity of the resource(s) to the extent that it is no longer eligible to be listed on the National Register. For purposes of Section 106, the determination of effect would be *adverse effect.* Beneficial impacts may include active intervention to preserve and/or restore resources. | <u>Short- term</u>: Management activity effects on the vegetative elements of a resource may be restored in 5 years (e.g. native vegetation is re-established, or plantings are established). <u>Long- term</u>: Most cultural resources are non- renewable resources. Therefore, any effects to archeological and historic material would be long-term. Effects to some ethnographic and landscape elements may be long- term (<5 years) as well. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | Impact Threshold Definitions | | | | Impact Duration Definitions |
| Impact Topic | Negligible | Minor | Moderate | Major | |
| **Cultural Resources: Ethnographic Resources** | Impacts would be barely perceptible and would neither alter resource conditions, such as traditional access or site preservation, nor alter the relationship between the resource and the affiliated group's body of practices and beliefs. For purposes of Section 106, the determination of effect would be *no adverse effect*. | Impacts would be slight, and noticeable, but would neither appreciably alter resource conditions, such as traditional access or site preservation, nor alter the relationship between the resource and the affiliated group's body of practices and beliefs. For purposes of Section 106, the determination of effect would be *no adverse effect*. Beneficial effects may include allowing access to and/or accommodating a group's traditional practices or beliefs. | Impacts would be apparent and would alter resource conditions. Something would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive. For purposes of Section 106, the determination of effect would be *adverse effect*. Beneficial effects may include facilitating and/or accommodating a group's practices or beliefs. | Impacts would alter resourced conditions. Something would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of the group's practices and/or beliefs would be jeopardized. For purposes of Section 106, the determination of effect would be *adverse effect*. Beneficial effects may include encouraging traditional access and/or accommodating the group's practices or beliefs. | <u>Short- term</u>: adverse effects of management activity could be corrected within 3 years. This refers primarily to access and vegetation components of the resource. <u>Long- term</u>: adverse effects of management activity would take more than 3 years to correct, and in some cases, would not be correct- able due to the non-renewable nature of some ethnographic resources. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | Impact Threshold Definitions | | | | Impact Duration Definitions |
| **Impact Topic** | **Negligible** | **Minor** | **Moderate** | **Major** | |
| **Socioeconomics** | No effects would occur or the effects to socioeconomic conditions would be below or at the level of detection. The effect would be slight. | The effects to socioeconomic conditions would be detectable, although small with consequences that cause no disruption to local community socioeconomics. If mitigation is needed to offset potential adverse effects, it would be simple and successful. | The effects to socioeconomic conditions would be readily apparent and with sufficient consequences to cause disruption to local community socioeconomics. If mitigation is needed to offset potential adverse effects, it could be extensive, but would likely be successful. | The effects to socioeconomic conditions would be readily apparent and would cause substantial changes to socioeconomic conditions both locally and in the region. Mitigation measures to offset potential adverse effects would be extensive and their success could not be guaranteed. | Short- term: Occurs only during the management action. Long- term: Occurs after the management action. |
| **Public Health and Safety** | Impacts would not have an appreciable effect on public health and safety, with no injuries or loss of life. | The impact would be detectable, but would not have an appreciable effect on public health and safety, with few or minor injuries and no loss of life. | The impacts would be readily apparent and would result in substantial, noticeable effects to public health and safety on a local scale, with possible serious injuries, but no loss of life. | The impacts would be readily apparent and would result in substantial, noticeable effects to public health and safety on a regional scale, or with the possibility of extremely serious injuries and/or loss of life. | Short- term: Effects lasting for the duration of the management action. Long- term: Effects lasting longer than the duration of the management action. |

| Table 6. Impact Threshold Definitions for Greater Sand Dunes Interagency Fire Management Plan EA/AEF | | | | | |
|---|---|---|---|---|---|
| | Impact Threshold Definitions | | | | Impact Duration Definitions |
| **Impact Topic** | **Negligible** | **Minor** | **Moderate** | **Major** | |
| **Wildland- Urban Interface** | The wildland urban interface would not be affected, or changes within the wildland urban interface would be at or below the level of detection. | Impacts to the wildland urban interface would be detectable, but would be small and localized. | Effects to the wildland urban interface would be readily apparent and long term. Mitigation would be possible, and potentially successful. | Effects to the wildland urban interface would be readily apparent, long term, and cause substantial changes. Mitigation measures would be extensive, though their success would not be guaranteed. | Short- term: Occurs only during the management action. Long- term: Occurs after the management action. |
| **Recreational Opportunities and Visitor Use** | Visitors would not be affected or changes in visitor use, opportunities, experience, and/or public access would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative. | Changes in visitor use, opportunities, experience, and/or public access would be detectable, although the changes would be slight. The visitor would be aware of the effects associated with the alternative. | Changes in visitor use, opportunities, experience, and/or public access would be readily apparent. The visitor would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes. Mitigation would be possible, and potentially successful. | Changes in visitor use, opportunities, experience, and/or public access would be readily apparent. The visitor would be aware of the effects and would likely express a strong opinion about the changes. Mitigation would not be possible or very successful. | Short- term: Occurs only during the management action. Long- term: Occurs after the management action. |

# IMPACT ANALYSIS

## AIR QUALITY

### Affected Environment

Federal regulation of air quality was established in the Clean Air Act, as amended (CAA). The purpose of CAA is to prevent and control air pollution; to initiate and accelerate research and development; and to provide technical and financial assistance to state and local governments in connection with the development and execution of air pollution programs. The CAA recognizes the need to protect visibility and air quality in national parks and national wildlife refuges, as well as on other public and private lands. To this end, it establishes requirements for areas failing to attain National Ambient Air Quality Standards (NAAQS) and provides for prevention of significant deterioration of areas where air is cleaner than NAAQS. In addition, the CAA provides that federal land managers have an affirmative responsibility to protect air quality related values, including visibility, plants, animals, soils, water quality, cultural resources, and visitor health, from adverse pollution impacts. Section 118 of the CAA requires federal agencies to comply with all applicable federal, state, and local air pollution control requirements.

In addition to the federal CAA, air quality within the planning area is also regulated under the Colorado Air Pollution Prevention and Control Act (APPCA). The Air Pollution Control Division (APCD) of the Colorado Department of Public Health and Environment regulates air quality within the state of Colorado. Under Regulation Number 9 of the APPCA, a permit must be attained from the APCD or from a designated local agency for any open burning, including prescribed burns, that occurs within the state of Colorado.

Regulation Number 3 of the APPCA also requires an unplanned fire ignition permit for any wildland fire use fire. This permit must be obtained prior to the start of any wildland fire use fire, and if granted, provides a set of conditions and mitigation measures. A Wildland Fire Implementation Plan (WFIP) is also required before any wildland fire use fire is allowed. WFIPs are one or more documents that are developed for each wildland fire managed under the National Wildfire Coordinating Group's 1998 Implementation Plan Guide (Guide). Conformance to the Guide is required on all wildland fire use fires on land managed by the U.S. Forest Service, National Park Service, Bureau of Land Management, and other land management agencies. The Guide is available at www.fs.fed.us/fire/fireuse/wildland_fire_use/ref_guide/index.html.

The planning area has two sets of air quality standards. The Great Sand Dunes National Park and Preserve is categorized as a Class I air quality area under the CAA, as amended (CAA, Sec. 162. (a)). Class I areas are provided the highest air quality protection with air quality standards that are higher than the NAAQS. These standards provide little allowance for air quality deterioration. The Baca National Wildlife Refuge and the Medano- Zapata Ranch are categorized as Class II areas. Class II areas have less stringent air quality standards than Class I airsheds and may be allowed slight increases in the concentrations of certain air pollutants over baseline conditions. Regulation 3 of the AQCA provides information regarding the air quality standards in each of these classes.

Sources of air pollution within the planning area and in the San Luis Valley include automobiles, space and water heating equipment, fuel storage tanks, camp fires, wildfires, wood burning stoves, and agriculture. In 2001, estimates of air pollution emissions at Great Sand Dunes National Monument and Preserve were tabulated for many of these sources (EA Engineering, Science, and Technology 2003). Table 7 provides annual estimates for particulate matter ($PM_{10}$ and $PM_{2.5}$), sulfur dioxide ($SO_2$), nitrogen oxide (NOx), carbon monoxide (CO), carbon dioxide ($CO_2$), and volatile organic compounds (VOCs). Based on these estimates, Great Sand Dunes National Monument and Preserve has attained the state and federal ambient air quality standards (EA Engineering, Science, and Technology 2003). It is possible, however, that with the expansion of the Park and the creation of the Refuge slight increases in air pollution emissions may occur due to increased visitation and additional sources of pollution (e.g. increased number of non- road vehicles and equipment).

Air quality within the planning area has historically been excellent. On most days, visibility of 60 to 80 miles is possible for 180 degrees. Air quality within the Rio Grande National Forest was rated as good for all air pollutants and was described as having among the best air quality in the country (USFS 1996). However, the San Luis Valley does have current issues regarding air quality, namely blowing dust that can potentially affect public health (M. McMillan, Air Quality Planner/Environmental Health Scientist, Colorado Dept. of Public Health and Environment, pers. com. July 27, 2004).

An air quality plan has been developed for the City of Alamosa in partnership with State and local resources (City of Alamosa et al. 2002). This plan is in compliance with the Environmental Protection Agency's Natural Events Policy (NEP), which was issued on May 30, 1996. The NEP sets forth procedures through the development of a Natural Events Action Plan (NEAP) for protecting public health in areas where the PM10 standard may be violated due to uncontrollable natural events such as wind and wildfire. The City of Alamosa has exceeded limits for PM10 on several occasions because of high winds in the Valley (City of Alamosa et al. 2002).

**Table 7. Estimates of Air Pollutant Emissions Within Great Sand Dunes National Monument and Preserve for 2001 (EA Engineering, Science, and Technology 2003)**

| | Pollutants (lbs. /yr.) | | | | | | |
|---|---|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | NOx | CO | $CO_2$ | VOC |
| Stationary Sources[1] | 7 | na | 0 | 252 | 36 | 224,588 | 29 |
| Woodstoves[2] | 304 | na | 4 | 23 | 2,217 | na | 2,009 |
| Camp Fires[3] | 1,962 | na | 23 | 147 | 14,322 | na | 12,984 |
| Prescribed Burning[4] | 5,880 | 4,980 | na | na | 63,360 | 449,520 | 2,940 |
| Highway Vehicles[5] | 13,686 | na | na | 2639 | 36,735 | na | 1,840 |
| Nonroad Vehicles and Equipment[6] | 39 | na | na | 20 | 44 | na | 42 |
| Total | 21,878 | 4,980 | 27 | 3,081 | 116,714 | 674,108 | 19,844 |

1 Estimates for 2001 based on heating equipment (17,967 gal/yr of propane) and one underground gasoline storage tanks
2 Estimates for 2001 based on two woodstoves
3 Estimates for 2001 based on estimated 7,560 campfires per year and 75 tons of wood per year
4 Estimates for 2001 based on 30- acre prescribed burn within ponderosa pine and shrub dominated habitat
5 Estimates for 2001 based on 83,000 visitor vehicles with 829,130 vehicle miles traveled within park unit (VMT) and 25 NPS vehicles with 104,870 VMT
6 Estimates for 2001 based on 2 non- road vehicles operating for 110 hours

## Methodology

The impact threshold definitions for air quality shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

## IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

## Impact Analysis

Under Alternative 1, all wildland fires would be suppressed and no fuels management activities would occur. Fire suppression would have short- term negligible to minor and short- term impacts to air quality. If a widespread and intense wildfire occurred, emissions of air pollutants, including particulate matter and smoke, would result in short- term, minor to moderate indirect adverse impacts to public health and visibility on an intermittent basis and would result in the short- term and minor to moderate direct adverse impact on air quality due to localized exceedences of some air quality standards (e.g. particulate matter). On a regional basis, effects to air quality would generally include minor to moderate short- term adverse impacts, as large quantities of pollutants, primarily particulate matter, are released to the atmosphere and travel past the planning area boundaries.

## Cumulative Effects

In addition to wildfires within the planning area, dust blowing across the San Luis Valley, vehicular and campfire emissions, and other wildfires in the region may also impact air quality within the planning area boundaries and surrounding area. Cumulative effects to air quality under this alternative would be minor to moderate with short- term impacts.

## Conclusion

Potential adverse impacts to air quality under Alternative 1 are minor to moderate with short- term effects depending upon the nature and intensity of any ensuing wildland fire and other activities in the planning area.

Alternative 1 would not produce any major adverse impacts on air quality whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of air quality as a result of implementation of Alternative 1.

# IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

## Impact Analysis

Under Alternative 2, fire suppression and fuel management activities would be allowed. All wildfires regardless of cause of ignition would have to be suppressed under this alternative. Impacts are expected to be similar to those described under Alternative 1 for fire suppression and wildfires. Air quality may be adversely impacted by prescribed burns and other fuels treatment operations under Alternative 2. Impacts from prescribed burns may be minor to moderate and short- term, while impacts from manual and mechanical fuels treatments would be negligible to minor. Prescribed burns would be conducted under pre- determined weather conditions, which would be outlined in an approved Prescribed Burn Plan. Therefore, fuels management activities would be planned and coordinated in such a way as to reduce the adverse impacts to air quality.

## Cumulative Effects

Cumulative effects associated Alternative 2 would be similar to those described under Alternative 1.

## Conclusion

Under Alternative 2, adverse impacts caused by fire suppression and fuels management activities would be minor to moderate and short- term in nature. Fuels management activities would be planned and coordinated in such a way as to reduce adverse impacts to air quality.

Alternative 2 would not produce any major adverse impacts on air quality whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of air quality as a result of implementation of Alternative 2.

# IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

## Impact Analysis

A full range of management actions would be allowed under Alternative 3, the preferred alternative, including wildland fire use within the Mosca and Herard FMU's, which would be allowed under pre- defined conditions as outlined in a Wildland Fire Implementation Plan. Adverse impacts would be similar to those described under Alternative 2 above. Wildland fire use would have minor to moderate, short- term impacts on air quality, but would not be allowed until an approved wildland fire use plan is in place. This plan would state the weather and other conditions under which wildland fire use would be allowed, and therefore, help to minimize impacts to air quality.

## Cumulative Effects

The cumulative effects under Alternative 3 would be similar to those described under Alternative 1.

## Conclusion

Adverse impacts caused by implementation of Alternative 3 would be minor to moderate and short- term in nature. Fuels management activities and wildland fire use would be planned and coordinated in such a way as to reduce adverse impacts to air quality.

Alternative 3 would not produce any major adverse impacts on air quality whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of air quality as a result of implementation of Alternative 3.

# WATER RESOURCES

## Affected Environment

Water resources (i.e. water quality and quantity) are very important resources within the Greater Sand Dunes planning area. National Park Service and Fish and Wildlife Service policies require protection of water quality consistent with the Clean Water Act as amended (CWA). The CWA is a national law to restore and maintain the chemical, physical, and biological integrity of the nation's waters and to prevent, control, and abate water pollution. In addition, Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process; discharge of dredged or fill material into waters of the United States.

Great Sand Dunes National Monument prepared a water resources management plan in 1997, which provides a reference to the water resources found within the monument portion of the site and a program to address certain issues regarding the water resources (NPS 1997b). This report includes information regarding wetlands, water quality, groundwater, and water rights. The Nature Conservancy has a report on the water resources of the Medano- Zapata Ranch, which provides a framework to understand the ecological impacts of water management practices within this site and the vicinity (Browne and Sanderson 2003).

The Greater Sand Dunes area is underlain by two relatively distinct aquifers, the unconfined and the confined aquifers, which are separated by a clay layer and occur throughout the San Luis Valley. Water enters the unconfined aquifer by way of precipitation and surface water infiltration occurring across the planning area and via upward movement of water from the confined aquifer at occasional fractures in the clay layer (Browne and Sanderson 2003, NPS 1997b). Water from the unconfined aquifer reaches the surface at numerous locations throughout the planning area including areas of seeps, wet meadows, and interdunal wetlands. Within the Greater Sand Dunes site, the confined aquifer is primarily recharged through infiltration of water from streams near the foot of the Sangre de Cristo Mountain range where the aquifer- dividing clay layer is absent.

The Greater Sand Dunes are located within a topographic basin referred to as the "closed basin". Water enters the closed basin through precipitation and snowmelt, but there are no natural outlets for water from the basin other than by evapotranspiration. The Closed Basin Canal, which is maintained and operated by the U.S. Bureau of Reclamation, runs through the site and is supplied with water that is pumped from the unconfined aquifer. Many of these wells and associated infrastructure are located within the Greater Sand Dunes site. The canal was built to transfer water from the closed basin to the Rio Grande River to the south in order to meet water requirements outlined in the Rio Grande Compact. This compact mandates the amount of water the state of Colorado must leave within the river to be delivered downstream to New Mexico, Texas, and Mexico.

Precipitation across the site ranges from approximately 7 inches within the western portion of the site to over 30 inches per year at the higher elevations within the Sangre de Cristo Mountains. The majority of the water within the planning area originates from the Sangre de Cristo Mountain range as snow melt. This water flows across the site primarily in southwest direction via a number of streams. Beginning in the north and heading south, the major streams occurring on- site include Crestone Creek, Willow Creek, Spanish Creek, Cottonwood Creek, Deadman Creek, Sand Creek, San Luis Creek, Big Spring Creek, Little Spring Creek, Medano Creek, and Zapata Creek. In addition, a number of tributaries and unnamed drainages and ditches occur throughout the site. The streams tend to be fast moving along the steep slopes of the mountains with reduced velocities as the water flows onto the valley floor. Of the streams located within the planning area, only a small number, including Big Spring and Little Spring Creeks and some of the higher elevation portions of various creeks such as Medano Creek, are perennial, while the remaining streams are ephemeral. The streams that are perennial tend to be spring- fed. All of the streams eventually infiltrate into the ground or end up in terminal ponds and wetlands and are not connected to any major stream or river.

A number of other water features, which include lakes, wetlands, springs, ditches and wells, are also found throughout the planning area. A group of relative small lakes occurs within the planning area on Colorado State lands and the Medano Ranch and includes San Luis Lake, Bachelor Lake, Head Lake, Dollar Lake, and Cotton Lake. Weisman Lake occurs within the Baca National Wildlife Refuge. Numerous interdunal wetlands and springs, including Antelope Springs and Indian Springs, are found within the planning area within the dune fields.

In accordance with the Clean Water Act, the State of Colorado through the Colorado Department of Health – Water Quality Control Commission, has established surface water quality standards and designated use classifications for all surface waters. Water within Medano and Sand Creeks were found to be of excellent quality (NPS 1997b). Because of the lack of point sources of pollution, it is assumed that water quality in other portions of the site is of similar quality. Potential impacts on water quality include livestock grazing in portions of the site, pumping of the unconfined and confined aquifers, roads, trails, and visitor use.

## Methodology

The impact threshold definitions for water resources shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

## IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

## Impact Analysis

Under this alternative all fires would be suppressed and no fuels management activities would occur. Fire suppression would have negligible to minor and short- term impacts to water resources. Construction of fire lines and other suppression activities could cause slight changes in water quality because of the potential for erosion, particularly along the steeper mountain slopes. In addition, water would be used to fight the fires, which, in an extreme case, may reduce the supply of water within any waterbody used for pumping depending on the location and size of the fire and the overall water needs.

Although the majority of wildland fires would be suppressed, the potential for widespread and intense wildfires would persist. These wildfire events could significantly alter the hydrologic cycle by burning the overstory and understory vegetation. Rain and snowmelt would not be absorbed but instead run- off quickly and erosion could occur especially along steep slopes. The short term effect of this alternative would be a deterioration of the water quality (clarity, pH, DO, etc) in the areas where the burn occurs. These impacts would be minor to moderate with short- to long- term effects.

## Cumulative Effects

Cumulative effects under this alternative would be minor to moderate with short- to long- term impacts. Other activities such as erosion from hiking trails, runoff from roads, and the effects of water management projects may impact the quality and quantity of water within the planning and surrounding areas.

## Conclusion

Under this alternative, potential adverse impacts are minor to moderate with short- to long- term effects depending upon the nature and intensity of any ensuing wildland fire and other activities in the planning area.

Alternative 1 would not produce any major adverse impacts on water resources or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano-Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of water resources or values as a result of implementation of Alternative 1.

# IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

## Impact Analysis

Under Alternative 2, fire suppression and fuel management activities would be allowed. All wildfires regardless of cause of ignition would have to be suppressed under this alternative, which would have similar impacts as those described under Alternative 1. Fuels management under Alternative 2 would result in lessened potential for widespread and intense wildfires within treatment areas followed by a lessened potential for disruption or change of the hydrologic regime and watershed character. Impacts associated with fuels management activities would be expected to be negligible to minor and short- term. Fuels management activities would be planned and coordinated in such a way as to not adversely impact water resources.

## Cumulative Effects

Cumulative effects associated with this alternative would be minor and short- term and primarily beneficial in the long- term because of fuel reduction accomplishments resulting in reduced risk of extreme wildfires. With the reduced risk of the chance of widespread and intense wildfires, the risk of watershed altering events is also lowered. The fuel reduction activities would have to be carefully executed in order to prevent minor alterations to the watershed. Other activities such as erosion from hiking trails, runoff from roads, and the effects of water management projects may impact the quality and quantity of water within the planning and surrounding areas and would need to be considered in any fuels management activity.

### Conclusion

Under Alternative 2, adverse impacts caused by fire suppression and fuels management activities would be minor to moderate and short- to long-term in nature. Cumulative effects would be beneficial because fuel buildups would be reduced resulting in a long-term reduction in the risk of intense fires within treatment areas. Fuel management activities would need to be planned and coordinated in such a way as to not adversely affect water resources.

Alternative 2 would not produce any major adverse impacts on water resources or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano-Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of water resources or values as a result of implementation of Alternative 2.

## IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

### Impact Analysis

Under Alternative 3, the preferred alternative, a full range of management actions would be allowed including wildland fire use within the Mosca and Herard FMU's under certain pre-determined conditions that would be outlined in a Wildland Fire Implementation Plan. Adverse impacts would be similar to those described under Alternative 2 above (i.e. negligible to moderate and short- to long-term). Adverse impacts associated with the addition of allowing for wildland fire use would normally be expected to be minor and short-term (duration of the fire) because most such fires are expected to be relatively isolated and occur at relatively long fire return intervals (100's of years). In addition, wildland fire use would be planned and coordinated in such a way as to not adversely impact water resources.

## Cumulative Effects

The cumulative effects under Alternative 3 would be similar to those described under Alternative 2.

## Conclusion

Under Alternative 3, adverse impacts caused by fire suppression and fuels management activities would be minor to moderate and short- to long- term in nature. Cumulative effects would be beneficial because fuel buildups would be reduced resulting in a long-term reduction in the risk of intense fires within treatment areas. Fuel management activities as well as wildland fire use would need to be planned and coordinated in such a way as to not adversely affect water resources.

Alternative 3 would not produce any major adverse impacts on water resources or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of water resources or values as a result of implementation of Alternative 3.

# SOILS

## Affected Environment

The landforms throughout the Greater Sand Dunes site consist of the Sangre de Cristo Mountain Range along the eastern border, alluvial fans along the western flank of the Sangre de Cristo Mountains, the active dune field, stabilized sand sheets, and the sabkha. The parent material is composed of eolian and alluvial deposits from the San Juan Mountains and the Sangre de Cristo Mountains. The prevailing wind, which blows from the southwest, has deposited large amounts of sand from the San Juan Mountains throughout the site. In addition, streams flowing down the western flank of the steep Sangre de Cristo Mountains and from Poncha Pass to the north, as well as occasional winds blowing from the northeast, have also deposited sand and soil throughout the area. The sand dunes cover approximately 39 square miles and reach heights of over 700 feet, making them the tallest sand dunes in North America. The dunes dominate the park scene and beautifully represent the interplay of physical forces and geologic processes. A variety of vegetation types throughout the planning area influence and are influenced by sand movement and characteristics of the soil and the geologic resources.

Soils within the planning area are varied and include those that are coarse textured with low water holding capacity and rapid permeability and some that are poorly drained and subject to flooding. Sand is prevalent particularly at the base of the Sangre de Cristo Mountains, while soils in the mountains tend to have high rock content and those in the west portion of the site tend to have a higher percent clay content. The following soil associations occur within the planning boundaries (Figure 5, SCS 1973, 1981):

- Mirror – Teewinot – Bross Association: Well to moderately drained, somewhat deep, moderately sloping to very steep (1 to 70% slope) soils formed in very stony colluvial material weathered from igneous rocks, slope wash or alluvial fan sediments from mixed crystalline rocks, or are composed of shallow to hard bedrock. Located on alpine ridges and mountain sides.

- Leadville – Granile – Lakehelen Association: Well drained, somewhat to very deep, moderately sloping to very steep (1 to 70% slopes) soils formed in thick colluvium, alluvium, or glacial debris derived from gneiss, schist, and sedimentary rocks and material weathered in place from granite or hard sandstone. Found on mountain slopes, alluvial fans, and terraces.

- Uracca - Comodore – Blackhall - Rock Outcrop Association: Well drained, deep or shallow, coarse textured (very stony and cobbly) to loamy with rock outcrops, sloping to very steep (15 to 65% slopes) soils on mountainsides and fans. Slopes include many deeply incised streams.

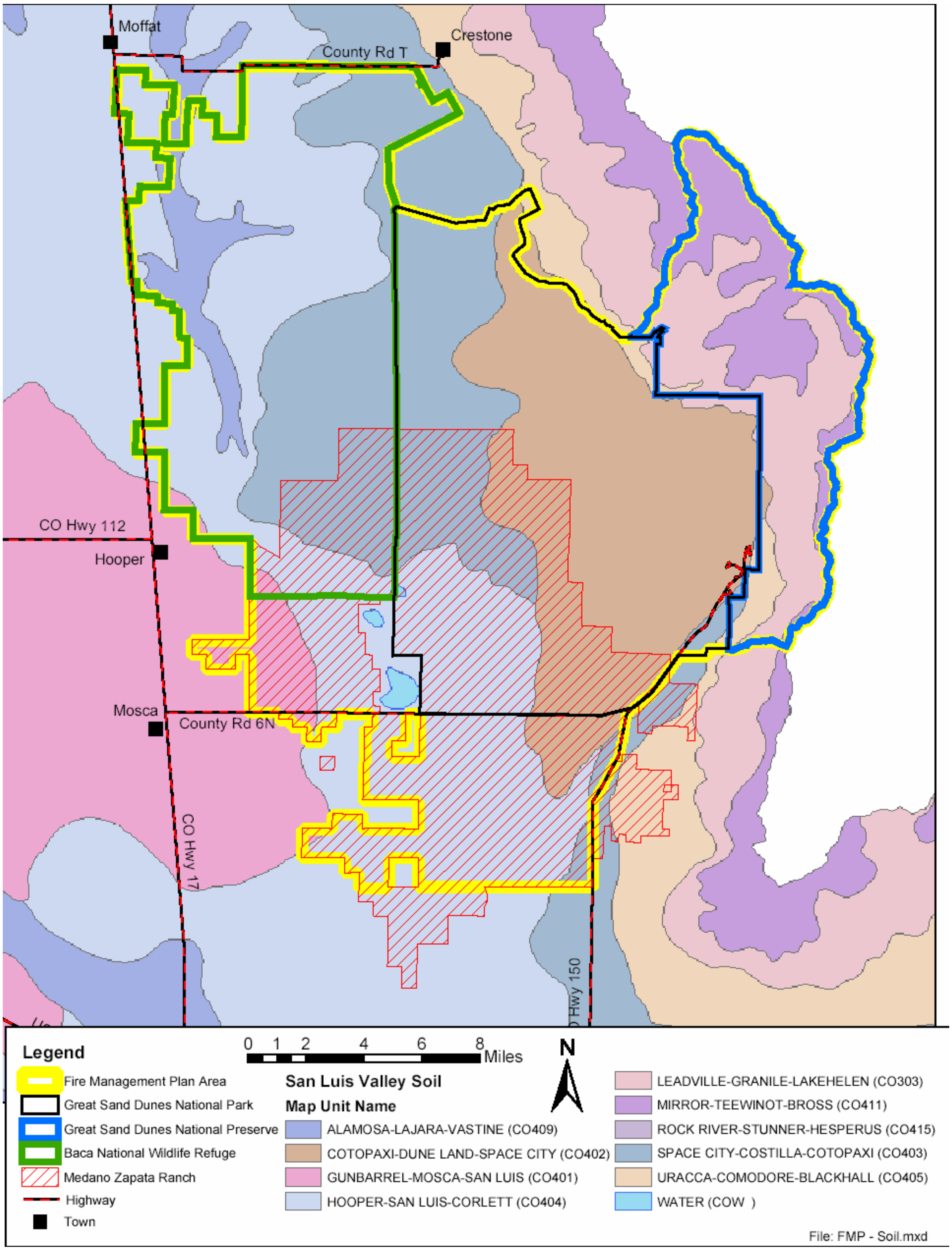
- Cotopaxi - Dune Land – Space City Association: Excessively drained, deep, coarse textured, rolling to hilly soils on dune and dune- like hills and ridges on alluvial valley floors. The active sand dune is composed of shifting sands and reaches heights of greater than 600 feet. These soils naturally have the potential for severe wind erosion.

- Space City – Costilla - Cotopaxi Association: Somewhat excessively drained, deep, coarse- textured, level to moderately sloping (0 to 15% slope) soil typically on alluvial fans and floodplains. These soils have the potential for severe wind erosion if the vegetation is removed.

- Hooper – San Luis - Corlett Association: Well drained to somewhat excessively drained, alkaline, deep, moderately fine textured to coarse textured, level, undulating, or hilly soils found within floodplains and low dunes. These soils have the potential for moderate to severe wind erosion if the vegetation is removed.

- Alamosa – Lajara – Vastine Association: Poorly to somewhat poorly drained, flat to gently sloping, deep, soils formed in moderately fine- textured mixed alluvium. Found on alluvial flood plains, old lake basins or alluvial fans.

**Figure 5: Greater Sand Dunes Interagency Fire Management Plan EA/AEF - Soils Map**



- Gunbarrel – Mosca – San Luis Association: Somewhat poorly to poorly drained, flat to gently sloping, deep soils formed in wind reworked alluvium from volcanic rocks and mixed alluvium. Found on valley floors, flood plains, terraces, and alluvial fans.

## Methodology

The impact threshold definitions for soils shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

# IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

## Impact Analysis

Under Alternative 1, all wildland fires would be suppressed and no fuels management activities would occur. Fire suppression would have short- term, negligible to minor impacts caused by potential erosion or compaction along fire lines or along paths used by fire trucks and other fire equipment. If a widespread and intense wildfire took place, large- scale erosion could potentially occur in the footprint of the burn, especially on steeper slopes. Erosion resulting from decreased vegetative cover after an intense wildfire, particularly on those lands with steep slopes, or following intense rainfall events, would result in both short- term and long- term, minor to moderate direct adverse impacts to soil stability. Fires of high intensity and severity may eliminate organic cover, decrease soil nutrients, kill soil microorganisms that are critical to soil fertility, increase pH, and alter soil structure. Intense fire can also create hydrophobic soils, which repel water and result in decreased infiltration that can alter soil hydrology and promote erosion. These direct impacts are generally short- term and localized, but accelerated erosion and increase sedimentation may impact the area over the long-term, depending on soil types and fire severity. An approved rehabilitation plan would be required and implemented following most wildfires to reduce the impacts to soil.

## Cumulative Effects

Cumulative effects under Alternative 1 could include other soil disturbing activities such as trails and roads. Cumulative effects to soil under this alternative would be minor to moderate with short- term impacts.

## Conclusion

Potential adverse impacts to soils under Alternative 1 are minor to moderate with short- to long- term effects depending upon the nature and intensity of any ensuing wildland fire and other activities in the planning area.

Alternative 1 would not produce any major adverse impacts on soil whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of soil as a result of implementation of Alternative 1.

# IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

## Impact Analysis

Fire suppression and fuel management activities would be allowed under Alternative 2. Impacts of fire suppression and wildfires are expected to be similar to those described under Alternative 1. Soils may be adversely impacted by fuels treatments under Alternative 2, particularly during prescribed burns and manual/mechanical treatments. Impacts from fuels treatments may be minor and short- term. Trucks and other equipment used during fuels treatments may cause compaction or erosion. Prescribed fire could be beneficial to soil nutrient cycling. Prescribed burning can enhance the cycling of nutrients by converting surface mulch and plant litter to ash and by making many nutrients soluble and available for plant growth. Through this process, fire encourages new growth of many plant species. Overall, fuels management activities would be planned and coordinated in such a way as to reduce the adverse impacts to soils.

## Cumulative Effects

Cumulative effects associated Alternative 2 would be similar to those described under Alternative 1. Fuels reduction projects, however, could in the long- term reduce the severity and intensity of wildland fire in treatment areas, which could reduce the impact to soils.

## Conclusion

Under Alternative 2, adverse impacts to soils caused by fire suppression and fuels management activities would be minor to moderate and short- to long- term in nature. Fuels management activities would be planned and coordinated in such a way as to reduce adverse impacts to soils.

Alternative 2 would not produce any major adverse impacts on soils whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of soils as a result of implementation of Alternative 2.

# IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

## Impact Analysis

Under Alternative 3, the preferred alternative, fire suppression, fuels management, and wildland fire use would be allowed in various portions of the planning area. Adverse impacts would be similar to those described under Alternative 2 above for fire suppression and fuels management. Impacts caused by wildland fire use would be similar to those described under Alternative 1 for wildland fires (i.e. minor to moderate and short to long- term). The degree of adverse effects would depend on the intensity, severity, and location of the burn, the effects of the burn to vegetation, and the weather conditions (i.e. amount of precipitation) following the burn. An approved rehabilitation plan would be required and implemented following most wildfires to reduce the impacts to soil. Prescribed fire and wildland fire use, however, could be beneficial to soil nutrient cycling, making many nutrients soluble and available for plant growth.

## Cumulative Effects

The cumulative effects under Alternative 3 would be similar to those described under Alternative 1. Fuels reduction projects, however, could in the long- term reduce the severity and intensity of wildland fire in treatment areas, which could reduce the impact to soils.

## Conclusion

Adverse impacts caused by implementation of Alternative 3 would be minor to moderate and short- to long- term in nature. Prescribed fire and wildland fire use, however, could be beneficial to soil nutrient cycling, making many nutrients soluble and available for plant growth. Fuels management activities and wildland fire use would be planned and coordinated in such a way as to reduce adverse impacts to soils.

Alternative 3 would not produce any major adverse impacts on soils whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of soils as a result of implementation of Alternative 3.

# WETLANDS AND FLOODPLAINS

## Affected Environment

Executive Order 11990, Protection of Wetlands, requires federal agencies to avoid, to the extent possible, the long- and short- term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. In addition, Section 404 of the Clean Water Act directs the U.S. Army Corps of Engineers to issue permits for activities that result in the discharge of dredged or fill material into waters of the United States, including wetlands. Proposed actions that have the potential to adversely impact wetlands must be addressed in a Statement of Findings (SOF). The SOF must include a map and a detailed description of the affected wetlands in addition to the anticipated impacts to the wetland. In addition, it must describe the reasons why the preferred alternative must affect a wetland and any mitigation measures that are included in the proposal.

Executive Order 11988, Floodplain Management, requires all federal agencies to avoid, to the extent possible, the long- and short- term adverse impacts associated with the occupancy and modifications of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. It directs all federal agencies to avoid, if possible, development and other activities in the 100- year (or base) floodplain. If a proposed action is in or will affect the applicable regulatory floodplain and relocating the action to a non- floodplain site is not a viable alternative, then a SOF is required as a basis for management decision making. The SOF will describe the rationale for selection of a site in or affecting a floodplain, disclose the amount of risk associated with the chosen site, and explain flood mitigation plans.

The Greater Sand Dunes site is located within an area known as the "closed basin". Although water enters the closed basin through precipitation and snowmelt, there are no natural outlets for water from the basin other than by evapotranspiration. However, water is currently diverted out of the unconfined aquifer of the closed basin via the Closed Basin Canal, which runs through the planning area and is operated by the Bureau of Reclamation.

A diversity of wetland types are found throughout the Greater Sand Dunes site. The National Wetland Inventory (NWI) identifies a large number of wetland and riverine areas that occur throughout the planning area (USFWS 2004d). The majority of these wetlands is found west of the sand dunes and is classified as palustrine systems. Palustrine systems are non- tidal wetlands that are less than 8 hectares, lacking wave-formed or bedrock shoreline features, less than 2 meters deep, and non- saline (Cowardin et al. (1979). The wetlands further are broken down into a number of classes, which include "emergent," "aquatic bed," "unconsolidated shore," and "scrub- shrub". These wetlands are further recognized as being either temporarily, seasonally, semi-permanently, permanently, or intermittently flooded. Major ephemeral riverine systems include Medano and Sand Creeks. NWI classifies Medano Creek as an intermittent, temporarily flooded, streambed and Sand Creek as lower perennial, upper perennial, and intermittent system with "unconsolidated shore" and "streambed" (FWS 2004d).

In general, these wetlands can be broadly categorized as either wet meadows or ephemeral wetlands and greasewood flats. Wet meadows are primarily found at the terminus of the stream systems. As the gradient lowers, the watertable comes close to the surface. This creates natural wet meadow areas which have been greatly enhanced through systems of irrigation canals and water spreading for much of the last century. The wet meadows are dominated by Baltic rush (*Juncus balticus*), sedges (*Carex* sp.), and alkali sacaton (*Sporobolus airoides*) (Rondeau et al. 1998).

Ephemeral wetlands and greasewood flats are composed of a connected system of shallow depressions or basins that support a variety of wetland communities. The basins fill with snowmelt runoff and spring- fed flow, and most are dry by late summer (Rondeau et al. 1998). Seasonally flooded basins support aquatic and emergent vegetation including spikerush (*Eleocharis palustris)* and bulrushes (*Scirpus* spp.). Bulrush is usually associated with more permanent type wetlands as are cattails, but bulrush can be found in seasonally flooded "basins" if they hold water for a good portion of the growing season. Irregularly flooded basins contain saltgrass (*Distichilis spicata*) or are barren salt flats (Rondeau et al. 1998). Greasewood (*Sarcobatus vermiculatus*) and rabbitbrush shrublands form the dominant vegetation surrounding the basins.

A group of relatively small lakes occurs within the planning area including San Luis Lake, Bachelor Lake, Head Lake, Dollar Lake, Cotton Lake, and Wellsman Lake. The majority of these lakes occur at the terminus of streams, and many could be considered larger ephemeral wetlands. In addition, some of these lakes, including San Luis Lake, are manipulated for various purposes.

A series of interdunal wetlands occur on the active dune portion of the site. The area that these wetlands encompass has been found to fluctuate over time, primarily due to changes in annual precipitation levels (Hammond 1998).

Several streams cross the Greater Sand Dunes area. Beginning at the north end of the site and heading south, the major streams include Crestone Creek, Willow Creek, Spanish Creek, Cottonwood Creek, Deadman Creek, Sand Creek, San Luis Creek, Big Spring Creek, Little Spring Creek, Medano Creek, and Zapata Creek. In addition, a number of smaller tributaries, unnamed drainages, and ditches occur throughout the site. Of these, Little and Big Spring Creek are the only perennial streams, while the others are ephemeral. The ephemeral riparian areas are primarily snow- melt dominated systems. The 100- year floodplains of these streams have not been mapped for the planning area.

## Methodology

The impact threshold definitions for wetlands and floodplains shown in Table 6 were used to assess the effects of each fire management alternative on these resources. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

# IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

## Impact Analysis

Under Alternative 1, all wildland fires would be suppressed and no fuel management activities would occur. Impacts to wetlands and floodplains would likely be negligible because of the low natural fire frequencies in these habitat types. If it is deemed necessary to suppress a wildfire within a floodplain or wetlands, impacts may be minor and short- term. These impacts would be caused by such activities as construction of fire lines through these systems. However, wetlands and floodplains should be avoided to the extent possible during suppression activities to avoid adverse impacts.

Wildfires that do occur in wetlands and floodplains would result in complete vegetation replacement due to the type of fuels present in each (i.e. light, herbaceous species in wetlands and non- fire adapted species such as cottonwood (*Populus* sp.) and willow (*Salix* sp.) in floodplains). However, wildfires normally produce a mosaic of vegetation structure that may increase the diversity of breeding, feeding, and loafing opportunities for migratory birds and other wildlife species that inhabit these ecological systems.

## Cumulative Effects

Wetlands and floodplains naturally have long fire return intervals, and therefore, are not expected to burn often. The hydrology, and in particular, flooding are expected to have more influence over this vegetation type than fire in both the short- and long- term. In addition, it is not expected that other activities such as recreational use and other land management, with the possible exception of water management activities, will have a large adverse cumulative effect on wetlands and floodplains. Water management projects do have the potential to draw down the water table, which can alter the hydrology and species composition, and therefore, the fire regimes of wetlands and floodplains. Cumulative effects of fire suppression overall though are expected to be negligible to minor.

## Conclusion

Implementation of Alternative 1 would result in negligible to minor impacts to wetlands and floodplains. To the extent possible, wetlands and floodplains should be avoided during any suppression activity.

Alternative 1 would not produce any major adverse impacts on wetland or floodplain resources or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of wetland or floodplain resources or values as a result of implementation of Alternative 1.

## IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

## Impact Analysis

Under Alternative 2, fire suppression and fuel treatment would be allowed throughout the planning area. Fire suppression impacts would be similar to those described under Alternative 1. Impacts of fuel treatments would be negligible to minor and short- term and often beneficial because projects would be planned and executed in certain defined and prescribed locations, often during the non- growing season. In addition, any slash removed during manual/mechanical treatments would not be discarded within any wetland or floodplain without the prior approval of a resource manager.

## Cumulative Effects

Cumulative effects to wetlands and floodplains under Alternative 2 are likely to be beneficial and long- term because of the diminished possibility of widespread and intense wildfire from the use of active habitat management. Properly executed fuels reduction and wildlife habitat management projects, whether completed by prescribed fire or mechanical and manual means, would result in minor, short- term impacts with no long- term or adverse cumulative effects. Cumulative impacts of other activities would be similar to those described under Alternative 1.

## Conclusion

Implementation of Alternative 2 would result in negligible to minor, short- term adverse effects on wetlands and floodplains directly associated with ongoing prescribed fire or manual and mechanical fuel treatment projects. However, effects of fuels treatments within wetlands and floodplains would likely be beneficial in the long- term. In addition, any slash removed during mechanical treatments would not be discarded within any wetland or floodplain without the prior approval of a resource manager.

Alternative 2 would not produce any major adverse impacts on wetland or floodplain resources or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of wetland or floodplain resources or values as a result of implementation of Alternative 2.

# IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

## Impact Analysis

Under Alternative 3, the preferred alternative, fire suppression, fuels treatment, and wildland fire use would be permitted based on the three FMU's. Impacts to wetlands and floodplains under this alternative are likely to be similar to those described under Alternative 2 above for fire suppression and fuels treatment activities. Wildland fire use within the Mosca and Herard FMU's would be allowed only under certain pre- defined situations as outlined in a Wildland Fire Implementation Plan and would have negligible to minor, short- term impacts on wetlands and floodplains primarily because of the effects on vegetation within these systems (i.e. stand replacing fires). However, a wildland fire may not be able to carry itself through these systems a majority of the time because of the moisture content of the vegetation and therefore, would have negligible effects. In addition, if a fire does burn through these systems, the vegetation typically will resprout quickly following the fire.

## Cumulative Effects

Cumulative effects to wetlands and floodplains under Alternative 3 would be expected to be similar to those described in Alternative 2 above.

## Conclusion

Implementation of Alternative 3 would result in negligible to minor, short- term adverse effects on wetlands and floodplains directly associated with ongoing prescribed fire or manual and mechanical fuel treatment projects and wildland fire use. However, effects of fuels treatments and wildland fire use within wetlands and floodplains would likely be beneficial in the long- term. In addition, any slash removed during mechanical treatments would not be discarded within any wetland or floodplain without the prior approval of a resource manager.

Alternative 3 would not produce any major adverse impacts on wetland or floodplain resources or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of wetland or floodplain resources or values as a result of implementation of Alternative 3.

# VEGETATION HEALTH AND ECOLOGICAL INTEGRITY

## Affected Environment

The Greater Sand Dunes planning area contains an array of ecological systems, which reflect different combinations of elevation, topography, hydrology, soils, micro-climates, fire history, and human land uses within the area (Figure 3). The variety of ecological conditions that characterize the planning area allows for a diverse range of species throughout the area. Historic land use has altered some ecosystems within the planning area. Across the San Luis Valley, intense grazing occurred from the 1870's to about 1940 (McConnell Simmons 1999). This grazing pressure probably impacted portions of the grasslands and shrublands within the Greater Sand Dunes. Some areas of the montane forests, especially near communities were logged from the late 19th century until the 1950's. The resistance and resilience of many of these ecological systems as well as their isolation and relatively intact nature has allowed them to continue in their relatively natural states.

Ecological systems within the planning area include dry alpine tundra, moist to wet alpine meadow, cold alpine streams, and small cirque lakes within the alpine zone (above 11,000 feet msl); bristlecone pine woodland, spruce- fir forest, wet meadow, subalpine- montane riparian shrubland, and high gradient streams within the sub-alpine zone (9,200 feet to 11,500 feet msl); aspen forest, mixed conifer forests, montane grasslands, montane riparian woodland and shrubland, and high montane lakes and streams of high to moderate gradient within the upper montane zone (7,550 feet to 9,200 feet msl); and ponderosa pine woodland, piñon- juniper woodland, intermontane-foothills grassland, active and stabilized sand dunes, greasewood flats and ephemeral wetlands, foothill riparian woodland and shrubland, wet meadow, and streams of varying size and gradient within the lower montane- foothills zone (below 7,550 feet msl) (Neely et al. 2001). Overall, the majority of vegetation has adapted to dry, cool, and variable climatic conditions. Figure 3 shows the ecological systems present within the planning area and adjacent areas.

The following sections describe the major ecological systems that occur within the planning area and provide information regarding their current health and ecological integrity.

## Vegetation of the Greater Sand Dunes Area

**Alpine.** Alpine ecological systems occupy the high mountain summits, slopes and ridges above the upper elevational limits of tree species (Barbour and Billings 2000). Alpine areas at the crest of the Sangre de Cristo Mountains are dominated by alpine tundra dry meadows with small patches of wet meadows, and rock and ice fields. Alpine systems occur between 10,000 and 14,000 feet msl. Vegetation in these alpine areas is controlled by snow retention, wind desiccation, permafrost, and a short growing season (Rondeau 2001). Much of the alpine in the Greater Sand Dunes area is of high quality, because of the rugged and inaccessible nature of the landscape. Very few trails with relatively little use are found crossing the alpine.

Alpine dry meadows are found on gentle to moderate slopes, flat ridges, valleys, and basins, where soils are relatively stable and water supplies are more or less constant. The dry meadows are commonly a mosaic of sedges, grasses, and forbs. Dominant species include boreal sagebrush (*Artemisia arctica)*, blackroot sedge (*Carex elynoides*), rock sedge *(C. rupestris)*, tufted hairgrass (*Deschampsia cespitosa)*, short- leaved fescue (*Festuca brachyphylla)*, Ross' aven (*Geum rossii)*, Pacific kobresia (*Kobresia myosuroides)*, and whiproot clover (*Trifolium dasyphyllum*) (Barbour and Billings 2000, Rondeau 2001).

Alpine and subalpine wet meadows are confined to portions of the alpine with water levels at or near the surface for much (or all) of the growing season. While these wet meadows may have surface water for part of the year, depths rarely exceed a few centimeters. This system often occurs as a mosaic of sedges, grasses and forbs. Dominant species include slimstem small reedgrass (*Calamagrostis stricta),* slender sepal marsh marigold (*Caltha leptosepala),* small head sedge (*Carex illota),* small- wing sedge (*C. microptera),* Rocky Mountain sedge *(C. scopulorum)*, *tufted* hairgrass *(Deschampsia cespitosa)*, few flower spikerush (*Eleocharis quinqueflora)*, yellowcress *(Rorippa alpina)* and Parry's clover (*Trifolium parryi)* (Barbour and Billings 2000, Rondeau 2001).

Fire does not play a large role within alpine systems due to the cool, moist conditions and low fuel levels that are found within this elevation zone. However, over long time scales, fire may move into the alpine zone from the adjacent spruce- fir forests with fire return intervals that are similar or longer than this forest type (USFS 1996).

**Spruce- Fir Forests.** Spruce- fir forests are the primary forests in the montane and subalpine zones of the Southern Rocky Mountains (Neely et al. 2001). These forests occur between 9000 and 11,500 feet msl within the sub- alpine zone (Neely et al. 2001, USFS 1996). The topography is generally moderately steep to steep, and soils are relatively rocky. The canopy of this forest type is typically closed (i.e. greater than 40% canopy cover) with very little understory herbaceous vegetation (Barbour and Billings 2000). In the Sangre de Cristo Mountains, Engelmann spruce (*Picea engelmannii*) and sub- alpine fir (*Abies lasiocarpa*) are co- dominant species although fir is largely absent in the upper 300 m of the forest (Barbour and Billings 2000). Quaking aspen (*Populus tremuloides*) occurs within this elevation zone in areas that have been recently disturbed, while bristlecone pine (*Pinus aristata*) is present on dry ridges. Bristlecone pine is the oldest living tree species in the Rocky Mountains (Ranne 1995). The even- aged nature of most mature stands and the near absence of seedlings in these stands, together with abundant seedlings in recently burned stands, suggest that bristlecone pine regenerates primarily following fires (Baker 1992). Patches of montane grasslands are also found within this elevation zone where climatic and edaphic factors favor grasses over trees. These grasslands are dominated by Arizona fescue (*Festuca arizonica*) and mountain muhly (*Muhlenbergia montana*) (Rondeau 2001). Spruce- fir forests grade into mixed conifer forests at lower elevations.

Fire, insects, windthrow, and avalanches are important disturbances within spruce- fir forests. Fire, in particular, plays a dominant role in this forest type (Arno 2000, Alington 1998, USFS 1996). Spruce- fir forests are characterized by a fire regime which includes moderately long to very long fire return intervals with a combination of mixed severity fires and stand replacing fires (Barrett 2003 a, b). Fire return intervals of 100- 400 years for stand- replacing fires in spruce- fire forests have been noted in the literature (USFS 1996). Ecological modeling for the Great Sand Dunes area has predicted replacement fire return intervals of approximately 330 years and non- replacement (mixed severity) fire mean return intervals of approximately 235 years. See Appendix A for more details on this modeling effort. The most common insects within spruce- fir forests that may cause mortality to trees are spruce beetle and western spruce budworm.

Overall, spruce- fir forests within the Greater Sand Dunes area have not been heavily altered by human activity, and therefore, are within their natural range of variation for fire. Fire suppression efforts have not had as large an impact on these forests as they may have had in other forest ecosystems of the Southern Rocky Mountains (Alington 1998). These assumptions are based on the rugged nature and inaccessibility of much of this vegetation type within the Greater Sand Dunes area.

**Aspen Forests.** Montane aspen forest ecological system is found in the Southern Rocky Mountains ecoregion between 8,000- 10,000 feet msl (Neely et al. 2001). These forests usually occur as a mosaic of many plant associations and may be surrounded by a diverse array of other systems, including grasslands and coniferous forests (Rondeau 2001). In the planning area, aspen is confined to relatively moist sites (16 to 40 plus inches annual precipitation) that have cold winters and a reasonably long growing season.

Aspen is usually a seral tree in the sub- alpine spruce- fir forest. In such situations it may dominate the forest community for many decades following disturbance, such as fire, but will gradually decline as conifers become reestablished. At lower elevations aspen can occur as a temporarily dominant seral species in the mixed conifer forest type (Mueggler and Campbell 1986).

**Mixed Conifer Forests.** The Greater Sand Dunes mixed conifer forest occurs along the western flank of the Sangre de Cristo Mountains between 7500 and 10,500 feet msl within the upper montane zone (Neely et al. 2001, USFS 1996). The topography within the mixed conifer system is steep to gentle along mountain slopes and valleys. Soils consist of rock outcrops, glacial moraines, and alluvial fans (USFS 1996). The canopy is typically closed (i.e. greater than 30% canopy cover) on the more mesic north facing slopes and typically open (i.e. less than 30% canopy cover) on more xeric south facing slopes. The dominant tree species within this forest type is Douglas fir (*Pseudotsuga menziesii*). Associated species include ponderosa pine (*Pinus ponderosa*), white fir (*Abies concolor*), aspen (*Populus tremuloides*), and Colorado blue spruce (*Picea pungens*). White fir occurs predominantly on the mesic north facing slopes, while Ponderosa pine occurs at lower elevations in more xeric conditions.

Fire, insects, and avalanches are important disturbances within mixed conifer forests. Fires are typically surface or mixed severity fires with stand- replacing events uncommon (Dietrich 1983). Different conifer species react differently in the presence of fire and therefore, fire regime is a controlling influence on the forest structure (Rondeau 2001). In the absence of fire, the density of white fir increases (Rondeau 2001, Hopkins 1982). Aspen will occupy a site following disturbance, particularly fire, and may form a relatively stable- state (Wolf 1995). Wind and weather stress and insect and pathogen-caused mortality are other disturbances within the mixed conifer forest that affect relatively small patches. Insect and pathogens within this forest type include Douglas fir beetle, spruce budworm, western pine beetle, blister rust, and Douglas fir dwarf mistletoe. These types of disturbance create patches of open canopy. In addition, avalanches may occur along certain steep drainages.

Fire plays a dominant role in the maintenance of mixed conifer forest systems (Arno 2000, Alington 1998, USFS 1996). Fires are typically surface or mixed severity fires with stand- replacing events uncommon (Fulé et al. 1997, Dietrich 1983). Many southwest mixed conifer forests are characterized by a mean fire return interval that ranges from 1-35 years and includes frequent surface and mixed severity fires with occasional stand replacing fires (Alexander et al. 1984, Dieterich 1983; Pohl 2003). However, there is uncertainty about the exact fire regime of these systems with some areas potentially experiencing longer fire return intervals of mixed- severity fires (Baker and Ehle 2001, Donnegan et al. 2001, Veblen et al. 2000, Kaufmann et al. 2000). In addition, land management activities such as heavy livestock grazing, logging, and fire suppression have had large effects on many mixed conifer forests (Baisan and Swetnam 1997).

Because of the steep nature and dry conditions, fire occurs less frequently within the forests of the western Sangre de Cristo Mountains than in other similar forest types in the Southern Rocky Mountains (Alington 1998, Romme 1996). The mean fire return interval for the Greater Sand Dunes mixed conifer forests was assumed to be slightly higher. Replacement fire mean return intervals are assumed to be 550 years and non-replacement fire mean return intervals are assumed to be approximately 90 years. These mean fire return intervals were determined based on ecological models based on input from local experts and from Alington (1998) and Romme (1996) (See Appendix A for more details).

The Greater Sand Dunes mixed conifer forests have not been heavily altered by human activity. Overall, this forest type is thought to be within its natural range of variation for fire (Alington 1998), and not largely impacted by fire suppression efforts. These assumptions are based on the rugged nature and inaccessibility of much of this vegetation type.

The ponderosa pine groves found within the planning area, particularly within portions of the Park, also appear to be quite different from other classic fire intervals in the southwest. Evidence of prehistoric fire is found throughout the various groves, but pre- 1880 fire intervals were significantly longer than in most other ponderosa forests (Romme, 1996). Most of the culturally scarred ponderosa contain one or two (three at most) fire scars; burned branches (some as high as 15'- 20' above ground) and no basal scarring. This is due in part to natural barriers to fire spread (the sand dunes, and steep rocky mountains to the north and east); and a discontinuous fuel bed (Romme, 1996). It appears that fire was an important process in the evolution of these groves and needs to be reintroduced, but at significantly longer intervals than elsewhere (Romme, 1996).

**Piñon-Juniper Woodlands.** Piñon-juniper woodlands occur between 7600 and 9500 feet msl within the lower montane-foothill zone (Neely et al. 2001, USFS 1996). The topography is steep to gentle, and soils are a combination of alluvium and rock. The canopy is typically open (i.e. less than 30% canopy cover), but the system also has patches with more closed canopy. Piñon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) are the dominant species within this ecological system. The understory is composed of a diversity of grasses, forbs, and shrubs (Rondeau 2001). Piñon-juniper woodlands form a transition zone between the shrublands of the valley floor and the mixed conifer forests of the Sangre de Cristo Mountains.

As a dominant disturbance process, fire has received considerable amount of investigation within the piñon-juniper forests of the arid Southwest (Baker and Shinneman 2004, Floyd et al. 2003, Romme et al. 2003, Schoennagel et al. 2004, West 1999, Wright and Bailey 1982). A number of authors have suggested that historic heavy livestock grazing and fire suppression have pushed many piñon-juniper woodlands outside of their natural range of variability for fire (i.e. frequent, low-severity surface fires). Nelson et al. (2004), Brockway et al. (2002), Paysen et al. (2000), Wright and Bailey 1982), Wright et al. (1979), and West et al. (1979), among others, suggest that these management practices have resulted in expansion of piñon and juniper into adjacent grasslands and shrublands and unnaturally high tree densities. However, other authors have stated that some piñon-juniper forests may have been historically dominated by long-interval, high-severity fires (Baker and Shinneman 2004, Floyd et al. 2003). Barbour and Billings (2000) point out that fires are typically infrequent because of low fuel levels in piñon-juniper systems. Other factors, besides the ecology of these systems, may influence many of the management activities. Lanner (1981) states that many of the management tools to clear or thin piñon-juniper woodlands, such as chaining, may not be ecologically based, as many have suggested, but rather politically or economically based. In addition, Romme et al. (2003) point out that not all piñon-juniper forests have the same fire regime and that fire management activities should be based on the actual ecology and fire history of the piñon-juniper stand in which a project is occurring.

Fire and insect outbreaks are dominant disturbance processes of piñon-juniper woodlands (West 1999). Some insects present within the planning area in low frequency and on a scattered basis include mountain pine beetle (*Dendroctonus ponderosae*, among other *Dendroctonus* species) and piñon ips (*Ips pini*). Fire historically has played a role in influencing the structure, composition, and maintenance of piñon-juniper woodlands at the Greater Sand Dunes (Arno 2000, Romme 1996, USFS 1996). Fires are typically infrequent because of low fuel levels (Barbour and Billings 2000). The mean fire return interval for replacement fire and mixed-severity fire mean return intervals were assumed to be approximately 425 years and 170 years, respectively. The estimate for replacement fires is consistent with a literature review which found only two studies of piñon- juniper woodlands have estimated high severity fire return interval, 400 and 480 years (Baker and Shinneman 2004).

Piñon- juniper woodlands within the planning area have not been heavily altered by human activity with respect to fire regime. The woodlands are thought to be relatively close to their natural range of variation for fire (Romme 1996). In addition, it is thought that fire suppression efforts have not had as large of an impact on these forests or the surrounding plant communities (i.e. piñon- juniper expansion into shrublands and grasslands) as it has had in some other piñon- juniper woodlands within the Southwest (Romme 1996).

**Shrublands and Grasslands.** Shrublands and grasslands within the Greater Sand Dunes planning area occur along the foothills of the Sangre de Cristo Mountains down to the floor of the San Luis Valley. These ecological systems are somewhat intermingled and include such species as blue grama (*Bouteloua gracilis*), Indian ricegrass (*Oryzopsis hymenoides*), needle- and- thread (*Hesperostipa comata*), western wheatgrass (*Pascopyrum smithii*), saltgrass (*Distichlis stricta*), black greasewood (*Sarcobatus vermiculatus*), four- wing saltbrush (*Atriplex canescens*), rubber rabbitbrush (*Chrysothamnus nauseosus*), and winterfat (*Kraschennikovia lanata*) (Rondeau 2001, Pineda et al. 1999). In assessing the state of knowledge about fire in desert grasslands and shrublands, Paysen et al. (2000) reached the conclusion that most experts do not agree on the exact fire history of these systems. In fact, it has been noted that the fire history of the grasslands within the San Luis Valley prior to 1880 will probably never be known (Romme 1996).

Based on a review of the literature, including the Fire Effects Information System (http://www.fs.fed.us/database/feis), most of the dominant, or common, species in the shrubland and grassland systems found within the planning area are at least moderately fire tolerant, indicating the potential for past frequent fires without substantially changing the nature of the system (Ryan 2002). Providing adequate soil moisture is available, many of the species that grow within the shrubland and grassland systems of the area have the ability to resprout after fire. The predominance of sprouting species has been interpreted by some to indicate a likelihood of a frequent, low- intensity fire regime, as opposed to a longer interval, higher- intensity regime, which would tend to favor obligate seeding plants (Keeley 1981). However, others have noted that either very short or very long fire intervals may favor sprouting species (Bond and van Wilgen 1996).

Many authors have described the fire regime in grassland and shrubland systems similar to those found throughout the planning area. Loftin (1999) argued that the majority of upland ecosystems in the Middle Rio Grande basin, including desert scrub, grassland, and piñon- juniper woodland, were historically dependent on periodic fire.

Although the exact fire return intervals for the grassland and shrubland systems within the planning area are not known, small areas of these systems did occasionally burn, either by natural or anthropogenic causes. The extent, intensity, and severity of these burns would probably have been dependent on a multitude of factors including the weather (e.g. temperature, wind speed, and relative humidity) and the condition of the vegetation (e.g. species composition, density, fuel load, and moisture content) at the time of the burn. Within the Great Sand Dunes area, grasslands and shrublands are intermixed with salt flats and blowouts which lead to discontinuous fuels. Interviews with area residents indicate few fires that were more than 10 acres in the sandsheet region in the last 50 years.

The Active Dune and Swale Complex is mostly composed of non- vegetated active sand dunes. Large star dunes tower up to 700 feet (210 m) above the valley floor. The vegetated portions of the sand dune complex are scattered with small pockets of blowout grass (*Redfieldia flexuosa*) and scurfpea (*Psoralidium lanceolatum*) (Pineda et al. 1999). This rare plant community can also be found where blowouts are beginning within the stabilized sandsheet (Pineda et al. 1999). Many of the endemic insects live in the vegetated portions of the active dunes or at the junction of this region and the stabilized sand sheet. Where the active dunes intersect the watertable, interdunal wetlands can be found. Scientific research has been conducted on important ecological processes in the active dune and swale system, such as dunes deposition, morphology, stratification, sand transport and the wind regime. Fire, however, is a negligible process in the active dune and swale system as vegetation is sparse.

A vegetated sand sheet occupies the area of the stabilized sand dunes. Much of this region is covered by rabbitbrush (*Chrysothamnus nauseosus*), needle- and- thread grass (*Hesperostipa comata*), and Indian ricegrass (*Oryzopsis hymenoides*) (Pineda et al. 1999). Examination of the present vegetative cover shows a mosaic of grasslands and shrublands. Many of the grassy patches on relatively flat ground are thought to occur on areas that had previous wildland fires, where shrub densities were significantly reduced by fire. Exposure and moisture could also partially account for these patterns.

The ephemeral wetland and greasewood flats ecological system contains a connected system of shallow depressions or basins that support a variety of wetland types. Large patches of this system are restricted to the San Luis Valley on the sabkha (Rondeau 2001). The basins fill with snowmelt runoff and spring- fed flow and most are dry by late summer (Rondeau et al. 1998). Seasonally flooded basins support aquatic and emergent vegetation including spikerush (*Eleocharis palustris)*, and bulrushes (*Scirpus* spp.). More irregularly flooded basins contain saltgrass or are barren salt flats (Rondeau et al. 1998). Greasewood (*Sarcobatus vermiculatus*) and rabbitbrush shrublands form the dominant vegetation surrounding the basins with an understory of saltgrass (Pineda et al. 1999).

**Wet Meadows.** In the Greater Sand Dunes planning area, wet meadows are found at the terminus of the riparian areas. As the gradient lowers, the watertable comes close to the surface. This hydrology creates natural wet meadow areas which have been greatly enhanced through systems of irrigation canals and water spreading for much of the last century on the Baca and Medano- Zapata Ranches. The wet meadows are dominated by saltgrass (*Distichilis spicata*), alkali sacaton (*Sporobolus airoides*), Baltic rush (*Juncus balticus*) and sedges (*Carex* spp.). The wet meadows also harbor the largest populations of slender spiderflower (*Cleome multicaulis*) found in a relatively natural setting. This rare plant is restricted to moist alkaline soils (Pineda et al. 1999). These communities have not been studied widely with regard to fire ecology, presumably because wet meadows do not usually support fire (Paysen et al. 2000, West 1994). The wet meadows within the planning area are assumed to naturally burn infrequently, depending on a multitude of factors including aspects of the weather (e.g. temperature, wind speed, and relative humidity) and the condition of the vegetation (e.g. species composition, density, fuel load, and moisture content) at the time of the burn.

**Riparian.** Little and Big Spring Creeks are the only low elevation perennial water courses in the area. These streams arise from interdunal wetlands within the active dune field. These streams have remarkably stable flow year round (Browne and Sanderson 2003).

The majority of the streams in the planning area become ephemeral as they move out of the flanks of the mountains and onto the valley floor. The ephemeral riparian areas are snow- melt dominated systems. Many of these creeks have seasonal flow and may not be available as a water source from mid- summer on. Thus, they are highly variable systems year to year and month to month. Sand Creek and Medano Creek are integral to the erosion, transport and deposition of sand to the dune field (Geary 1997). Sand Creek has several high quality globally rare plant communities found along its course. Other large streams in this system include Medano Creek and Deadman Creek. Running down the western slope of the Sangre de Cristo Mountains, these systems are home to a rich array of plants including cottonwoods (*Populus* sp.), alders (*Alnus* sp.), Rocky Mountain juniper (*Juniperus scopulorum*), coyote willow (*Salix exigua*), and other willows (*Salix* sp.).

In the Sangre de Cristo Mountains, several streams contain high quality rare plant communities. Deadman Creek, for example, supports the largest known occurrence of a globally rare narrowleaf cottonwood- Rocky Mountain juniper riparian community (*Populus angustifolia- Juniperus scopulorum*) (Rondeau et al. 1998).

## Methodology

The impact threshold definitions for vegetation health and ecological integrity shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

## IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

### Impact Analysis

Under this alternative, all fires would be suppressed and no fuels management activities would occur. Depending on the area (ecosystem) of suppression, wildland fire and suppression activities would pose varying impacts. Widespread fire has not occurred over the area recently, although an anthropogenically- caused wildfire did spread over the lower elevations (piñon- juniper communities and grassland communities) of the Great Sand Dunes National Monument and to the south of the monument in 2001.

**Alpine.** Fire does not play a large role within alpine systems due to the cool, moist conditions that are found within this elevation zone. Therefore, fire suppression would have a negligible impact on this system. However, fire suppression activities may have a minor impact if fire lines were placed in sensitive areas or equipment and people were to bring non- native, invasive species into the system.

**Spruce- Fir Forests.** Spruce- fir forests are the primary forests in the montane and subalpine zones of the planning area. Ecological modeling for the Great Sand Dunes area has predicted replacement fire return intervals of approximately 330 years and mixed severity fire mean return intervals of approximately 235 years. In addition, the spruce- fir forests are relatively free of non- native, invasive species. These forests are extensive and fire suppression activities would probably impact a very small portion of the site. However, there is the potential during fire suppression operations to introduce via equipment or people non- native, invasive species to this forest type. Overall, because of the long fire return intervals and rugged nature of the landscape, fire suppression efforts would have a minor, short- term impact on spruce- fir forests.

**Aspen Forests.** Because aspen is a seral species that requires intermittent disturbances such as fire to regenerate, implementation of Alternative 1 would likely reduce the area of aspen forests throughout the landscape in the long- term. However, because of the long fire return intervals of adjacent forest types (i.e. spruce- fir and mixed conifer) and the rugged nature of the landscape, fire suppression efforts would have a minor, short-term impact on aspen forests.

**Mixed Conifer Forests.** Mixed conifer forest within the Greater Sand Dunes planning area occurs along the western flank of the Sangre de Cristo Mountains within the upper montane zone. Because of the steep nature and dry conditions, fire occurs less frequently within the forests of the western Sangre de Cristo Mountains than other similar forest types in the Southern Rocky Mountains (Alington 1998, Romme 1996).

Based on expert and local land manager knowledge of the Greater Sand Dunes area, ecological models were developed for mixed conifer forests within the planning area. The mean fire return interval for the Greater Sand Dunes mixed conifer forests is assumed to be 550 years for replacement fire and 90 years for mixed severity fire. In addition, the mixed conifer forests are relatively free of non- native, invasive species. These forests are extensive and fire suppression activities would probably impact a very small portion of the site. However, there is the potential during fire suppression operations to introduce via equipment or people non- native, invasive species to this forest type. Overall, because of the long fire return intervals and rugged nature of the landscape, fire suppression efforts would have a minor, short- term impact on mixed conifer forests.

**Piñon- Juniper Woodlands.** Piñon- juniper woodlands occur within the lower montane- foothill zone of the planning area. Based on expert and local land manager knowledge of the Greater Sand Dunes area, ecological models were developed for piñon- juniper woodlands within the planning area. The mean fire return interval for replacement fire was assumed to be approximately 425 years and mixed- severity fire mean return intervals were assumed to be approximately 170 years. In addition, the piñon- juniper woodlands are relatively free of non- native, invasive species. However, there is the potential during fire suppression operations to introduce (e.g. on equipment or people) non- native, invasive species to this forest type. Overall, fire suppression efforts would have a minor, short- term impact on piñon- juniper woodlands.

**Shrublands and Grasslands.** Shrublands and grasslands within the Greater Sand Dunes planning area occur along the foothills of the Sangre de Cristo Mountains down to the floor of the San Luis Valley. Although the exact fire return intervals for the grassland and shrubland systems within the planning area are not known, small areas of these systems did occasionally burn, either by natural or anthropogenic causes. Therefore, fire suppression would have a negligible impact on these systems. Fire suppression activities could have minor impacts if fire lines were placed in sensitive areas or if equipment and people should introduce non- native, invasive species into the system.

**Wet Meadows.** The wet meadows within the planning area are assumed to naturally burn infrequently depending on such factors as fuels and weather. Wildland fires generally burn slowly with low intensities through these areas when vegetation is green and the ground surface is moist, which is common during peak lightning season. Therefore, fire suppression would have a negligible impact on these systems. However, if wildland fires do start, fire suppression activities could have minor, short- term impacts if fire lines were placed in sensitive areas or if equipment and people should introduce non- native, invasive species into the system.

**Riparian**. The riparian systems within the planning area are assumed to naturally burn infrequently depending on such factors as fuels, weather, and characteristics of the surrounding upland vegetation. Wildland fires generally burn slowly with low to moderate intensities through riparian areas when vegetation is green and the ground surface is moist, which is common during peak lightning season. It is anticipated that fire suppression would have a negligible impact on riparian systems, but fire suppression activities could have minor, short- term impacts if fire lines were placed through a riparian system or if equipment and people should introduce non- native, invasive species into the system.

## Cumulative Effects

The forested areas of the planning area have fire return intervals from 90 to 500 years. With such long fire return intervals, it would take several hundred years of successful fire suppression to have a major impact on stand structure. Even then, the types of fires that might occur (i.e. high intensity, stand replacing) are similar to the type of fire expected without fire suppression. Vegetation within other plant communities found within the planning area also are not likely to be effected by fire suppression because of the stand replacing nature of fires within these systems. Other activities within and surrounding the planning area such as fire management on adjacent lands, recreational use, and grazing may also influence the vegetation within the planning area. Overall, the cumulative effects of this alternative would be negligible to minor.

## Conclusion

The ecological systems within the Greater Sand Dunes planning area are thought to have relatively long fire return intervals, and therefore, are within their natural range of variability for fire. Fire suppression would, therefore, have a negligible to minor, short-term impact on these systems. Suppression activities such as construction of fire lines and any non- native, invasive species introductions could have a minor impact depending upon the location of the fire line and the nature of the non- native, invasive species that was introduced.

Alternative 1 would not produce any major adverse impacts on vegetation health and ecological integrity whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of vegetation health and ecological integrity as a result of implementation of Alternative 1.

## IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

### Impact Analysis

Under Alternative 2, fuels management activities, in addition to fire suppression, would be allowed which would have the effect of reducing risks associated with hazardous fuel accumulations where public safety and protection of structures, facilities, cultural resources, and wildland-urban interface warrant such actions. In addition, this alternative would allow prescribed burning for habitat improvement and weed management.

**Alpine.** Fire does not play a large role within alpine systems due to the cool, moist conditions that are found within this elevation zone. Therefore, fire suppression would have a negligible impact on this system. However, fire suppression activities might have a minor impact if fire lines were placed in sensitive areas or equipment and people were to bring non-native, invasive species into the system. Because of the rugged nature of the landscape and the high elevation of the alpine, very little if any mechanical treatment or prescribed fire is anticipated within the planning area.

**Spruce-Fir Forests.** Fire suppression under Alternative 2 would have the same effects on spruce-fir forest as those described under Alternative 1. Because of the rugged nature of the landscape and the high elevation of the spruce fir forests, very little mechanical treatment or prescribed fire is anticipated within the planning area.

**Aspen Forests.** Fire suppression under Alternative 2 would have the same effects on aspen forest as those described under Alternative 1. Because of the rugged nature of the landscape and the high elevation of the aspen forests, very little if any mechanical treatment or prescribed fire is anticipated within this forest type, and therefore, fuels treatments would have a negligible impact.

**Mixed Conifer Forests.** Fire suppression under Alternative 2 would have the same effects on mixed conifer forest as those described under Alternative 1. Under Alternative 2, fuels management activities would be allowed around structures and cultural resources and within the wildland urban interface, which would have the effect of reducing risks associated with fuel accumulations. Mitigation efforts would be ongoing and may successfully reduce or eliminate the chances of a wildland fire crossing planning area boundaries and entering into neighboring developments or communities. These activities will further open up the canopy, but can be planned and carried out in such a way as to have minor, short-term impacts on the mixed conifer ecological system. Also important, timing of operations should carefully consider periods when the activities of native, but destructive forest pest insects are high. Examples of these would be mountain pine beetle (*Dendroctonus ponderosae*, among other *Dendroctonus* species), and other species that are often attracted by the chemistries (i.e. terpenes) of mechanically- injured trees and fire- damaged trees. Because these insects are most active between June and August for breeding and in late October for overwintering, activities which damage trees during these periods should be avoided. Because of potential for insects and safety concerns, prescribed fire may be the only way to have fire within portions of these mixed conifer woodlands.

**Piñon- Juniper Woodlands.** Fire suppression under Alternative 2 would have the same effects on piñon- juniper woodlands as those described under Alternative 1. Under Alternative 2, fuels management activities would be allowed around structures and cultural resources and within the wildland urban interface, which would have the effect of reducing risks associated with fuel accumulations. Mitigation efforts would be ongoing and may successfully reduce or eliminate the chances of a wildland fire crossing planning area boundaries and entering into neighboring developments or communities. These activities will further open up the canopy, but can be planned and carried out in such a way as to have minor, short- term impacts on the piñon- juniper ecological system. Also important, timing of operations should carefully consider periods when the activities of native, but destructive forest pest insects are high. Examples of these would be mountain pine beetle (*Dendroctonus ponderosae*, among other *Dendroctonus* species), piñon ips (*Ips pini*), and other species that are often attracted by the chemistries (i.e. terpenes) of mechanically- injured trees and fire- damaged trees. Because these insects are most active between June and August for breeding and in late October for overwintering, activities which damage trees during these periods should be avoided. Because of potential for insects and safety concerns, prescribed fire may be the only way to have fire within portions of these piñon juniper woodlands.

**Shrublands and Grasslands.** Shrublands and grasslands within the Greater Sand Dunes planning area occur along the foothills of the Sangre de Cristo Mountains down to the floor of the San Luis Valley. Although the exact fire return intervals for the grassland and shrubland systems within the planning area are not known, small areas of these systems did occasionally burn, either by natural or anthropogenic causes. Therefore, fire suppression would have a negligible impact on these systems. Fire suppression activities could have minor impacts if fire lines were placed in sensitive areas or if equipment and people should introduce non- native, invasive species into the system. Within the grasslands and shrublands, prescribed burning may be desired to meet habitat management objectives or within an integrated weed management framework. These activities would only be conducted with clear outcomes and monitoring in place to ensure that goals are met. Prescribed fires therefore would have negligible to minor and short- term impacts.

**Wet Meadows.** The wet meadows within the planning area were assumed to naturally burn infrequently. Therefore, fire suppression would have a negligible impact on these systems. Fire suppression activities could have minor impacts if fire lines were placed in sensitive areas or if equipment and people should introduce non- native, invasive species into the system. Within the wet meadows, prescribed burning may be desired to meet habitat management objectives or within an integrated weed management framework. Prescribed fire in wet meadow habitats would have a negligible to minor impact with short-term effects, and overall, would be very beneficial. Management ignited prescribed fire, along with other available management tools, when applicable, will prevent and/or reduce residual growth accumulation in wet meadows to maintain quality nesting cover for waterfowl and other ground nesting migratory birds. Prescribed fire can also be utilized to modify the grass to forb ratio to a desired proportion (Wright and Bailey 1982). These activities would only be conducted with clear outcomes and monitoring in place to ensure that goals are met.

**Riparian**. Impacts to riparian caused by suppression activities would be similar to those described under Alternative 1. Fuels treatment as proposed under Alternative 2 would have negligible to minor impacts to riparian areas because most fuels treatments would not occur within these systems.

## Cumulative Effects

The cumulative effects of fire suppression under Alternative 2 would be the same as those under Alternative 1. Because most of the area is thought to be within the natural range of variability for fire, management treatments would be conducted for habitat improvement, non-native, invasive species management and fuel reductions around structures, sensitive resources and within the wildland urban interface. The fuel reduction treatments would benefit these resources in the long-term, while having negligible impacts on the plant communities.

## Conclusion

The ecological systems within the Greater Sand Dunes planning area are thought to be within their natural range of variability for fire and most have relatively long fire return intervals. Fire suppression would, therefore, have a minor impact on these systems. Suppression activities such as construction of fire lines and any non-native, invasive species introductions could have a minor impact depending upon the location of the fire line and the nature of the weed that was introduced.

Fuels treatments under Alternative 2 would have a negligible to minor impact on the ecological systems of the Greater Sand Dunes area. Fuels management activities that mimic to the extent possible natural process while reducing the risks to people, cultural resources, and property would be beneficial.

Alternative 2 would not produce any major adverse impacts on vegetation health and ecological integrity whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National

Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of vegetation health and ecological integrity as a result of implementation of Alternative 2.

## IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

### Impact Analysis

Under Alternative 3, the preferred alternative, the impacts of fuels management activities and fire suppression would be similar for each ecological system as those described under Alternative 2 above. In addition, Alternative 3 allows for wildland fire use within the Mosca and Herard FMU's. The majority of ecological systems within these FMU's is fire- adapted and has long fire return intervals. In addition, wildland fire is a natural process that creates mosaics of plant communities across the landscape and helps to preserve biodiversity. Wildland fire use, therefore, would be beneficial to the ecological systems in the Greater Sand Dunes area and are expected to have only minor, short- term impacts.

### Cumulative Effects

The cumulative effects of fire suppression and fuels management under Alternative 3 would be the same as those under Alternative 2. Wildland fire use under Alternative 3 would allow the natural fire regime to continue in the ecological systems found within the planning area. This would be beneficial for the long- term health and maintenance of these systems and is in line with the goals of the land management agencies and organizations in the area. Therefore, the cumulative effects of this alternative are negligible.

### Conclusion

The ecological systems within the Greater Sand Dunes planning area are thought to be within their natural range of variability for fire and most have relatively long fire return intervals. Fire suppression would, therefore, have a minor impact on these systems. Suppression activities such as construction of fire lines and any non- native, invasive species introductions could have a minor impact depending upon the location of the fire line and the nature of the weed that was introduced.

Impacts of fuels treatment operations under Alternative 3 would be similar to those under Alternative 2 and will have a minor impact on the ecological systems of the Great Sand Dunes area. In addition, under Alternative 3, wildland fire use would be utilized within the Mosca and Herard FMU's, which would provide as natural a fire regime as is possible.

Alternative 3 would not produce any major adverse impacts on vegetation health and ecological integrity whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of vegetation health and ecological integrity as a result of implementation of Alternative 3.

## THREATENED, ENDANGERED, AND CANDIDATE SPECIES
**Including Biological Assessment Analyses Pursuant to Section 7 of the ESA**

## Affected Environment

The Endangered Species Act (1973) requires an examination of impacts on all federally-listed threatened, endangered, and candidate species. Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats. Colorado State statute also provides protection for state listed threatened and endangered species (Colorado Statutes Title 33, Article 2, Nongame and Endangered Species Conservation). Furthermore, National Park Service and U.S. Fish and Wildlife Service policies require examination of the impacts on federal candidate species, as well as state- listed threatened, endangered, candidate, rare, declining, and sensitive species. For the purpose of this analysis, the U.S. Fish and Wildlife Service and the Colorado Division of Wildlife were contacted to determine if any federal- or state- listed and candidate species may occur within or near the planning area. A letter from U.S. Fish and Wildlife Service, dated March 16, 2004, provided a list of candidate, threatened, and endangered species occurring within the vicinity of the planning area (i.e. Saguache and Alamosa Counties, Colorado). Collectively, the following analyses serve as the Biological Assessment for the federally listed species that occur or may occur on those federal lands that are within the planning area.

Table 8 lists federal and state- listed threatened, endangered, and candidate species that were identified as potentially occurring within Saguache and Alamosa Counties by the U.S. Fish and Wildlife Service and Colorado Division of Wildlife (K. Navo, Wildlife Biologist, Colorado Division of Wildlife, pers. com., June 7, 2004). "Colorado Listing of

**Table 8. Federal- and State- endangered, threatened, and candidate species potentially found in Saguache and Alamosa Counties, Colorado; Occurrence in Planning Area; and Impacts Under Alternatives 1, 2, and 3.**

**Table 8. Federal- and State- endangered, threatened, and candidate species potentially found in Saguache and Alamosa Counties, Colorado; Occurrence in Planning Area; and Impacts Under Alternatives 1, 2, and 3.**

| Species | Common Name | Federal Status | State Status | Occurrence in Planning Area | Impacts Under Alternative 1 | Impacts Under Alternative 2 | Impacts Under Alternative 3 |
|---|---|---|---|---|---|---|---|
| *Empidonax traillii extimus* | Southwestern Willow Flycatcher | endangered | endangered | Within range of species; Suitable migrating and nesting habitat present within planning area | Negligible - Minor, Short- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |
| *Haliaeetus leucocephalus* | Bald Eagle | threatened | threatened | Known to migrate through planning area | Negligible - Minor, Short- term | Negligible; Short- term | Negligible; Short- term |
| *Lynx canadensis* | Canada Lynx | threatened | endangered | Not known to occur within planning area, however potential habitat exists | Negligible- Minor, Short- term | Negligible- Minor, Short- term | Negligible- Minor, Short- term |
| *Strix occidentalis lucida* | Mexican Spotted Owl | threatened | threatened | Not known to occur within planning area, however potential habitat exists | Negligible - Minor, Short- term | Negligible; Short- term | Negligible; Short- term |

| Table 8. Federal- and State- endangered, threatened, and candidate species potentially found in Saguache and Alamosa Counties, Colorado; Occurrence in Planning Area; and Impacts Under Alternatives 1, 2, and 3. | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Species** | **Common Name** | **Federal Status** | **State Status** | **Occurrence in Planning Area** | **Impacts Under Alternative 1** | **Impacts Under Alternative 2** | **Impacts Under Alternative 3** |
| *Bufo boreas boreas* | Boreal Toad | candidate* | endangered | Not known to occur within planning area | No Impact | No Impact | No Impact |
| *Centrocercus minimus* | Gunnison Sage- Grouse | candidate | candidate | Not known to occur within planning area | No Impact | No Impact | No Impact |
| *Coccyzus americanus* | Yellow- billed Cuckoo | candidate | candidate | Within range of species; Suitable habitat present within planning area | Negligible - Minor, Short- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |
| *Catostomus plebeius* | Rio Grande Sucker | none | endangered | Present in Medano Creek | Negligible - Moderate; Short- term - Long- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |
| *Gulo gulo* | Wolverine | none | endangered | Not known to occur within planning area | No Impact | No Impact | No Impact |

| Table 8. Federal- and State- endangered, threatened, and candidate species potentially found in Saguache and Alamosa Counties, Colorado; Occurrence in Planning Area; and Impacts Under Alternatives 1, 2, and 3. | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Species** | **Common Name** | **Federal Status** | **State Status** | **Occurrence in Planning Area** | **Impacts Under Alternative 1** | **Impacts Under Alternative 2** | **Impacts Under Alternative 3** |
| *Athene cuniculave* | Burrowing Owl | none | endangered | Within range of species; Suitable habitat present within planning area | Negligible - Minor, Short- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |
| *Oncorhynchus clarki virginalis* | Rio Grande Cutthroat Trout | none | candidate | Reintroduced into Medano Creek | Negligible - Moderate; Short- term - Long- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |
| *Crotalus viridis concolor* | Midget Faded Rattlesnake | none | candidate | Not known to occur within planning area | No Impact | No Impact | No Impact |
| *Rana pipiens* | Northern Leopard Frog | none | candidate | Known to occur within planning area at Weisman Lake | Negligible; Short- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |
| *Buteo regalis* | Ferruginous Hawk | none | candidate | Present within planning area | Negligible; Short- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |

| Table 8. Federal- and State- endangered, threatened, and candidate species potentially found in Saguache and Alamosa Counties, Colorado; Occurrence in Planning Area; and Impacts Under Alternatives 1, 2, and 3. | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Species** | **Common Name** | **Federal Status** | **State Status** | **Occurrence in Planning Area** | **Impacts Under Alternative 1** | **Impacts Under Alternative 2** | **Impacts Under Alternative 3** |
| *Falco peregrinus anatum* | American Peregrine Falcon | none | candidate | Present within planning area; Not common | Negligible; Short- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |
| *Charadrius alexandrinus nivosus* | Western Snowy Plover | none | candidate | Within range of species; Suitable habitat present within planning area | Negligible; Short- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |
| *Charadrius montanus* | Mountain Plover | none | candidate | Present within planning area; Not common | Minor; Short- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |
| *Numenius americanus* | Long Billed Curlew | none | candidate | Within range of species; Suitable habitat present within planning area | Negligible; Short- term | Negligible - Minor, Short- term | Negligible - Minor, Short- term |

* Not listed in letter from U.S. Fish and Wildlife Service (March 16, 2004)

Endangered, Threatened and Wildlife Species of Special Concern" (CDOW 2004) and the Natural Diversity Information Source (NDIS 2004) were also consulted, and a number of state listed species that may occur within Saguache and Alamosa Counties were found.

## Fish

**Rio Grande sucker (*Catostomus plebeius*):** The Rio Grande sucker is a state- listed endangered species. The species inhabits small to moderate sized streams with clear water, pools, and riffles and spawns over gravel patches. Threats to this species include hybridization and predation by introduced fish species and sedimentation and siltation within streams. The Rio Grande sucker has been reintroduced into Medano Creek by the Colorado Division of Wildlife. Additional information about this species can be found at http://www.natureserve.org/ and at http://wildlife.state.co.us/species_cons/WildlifeInDanger/riograndesucker.pdf. Rio Grande sucker occurs within the planning area in Medano Creek.

**Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*):** The Rio Grande cutthroat trout is a state candidate species that are found in small headwater streams and spawn over clean gravels. Threats to this species have included reduced streambank cover due to overgrazing by livestock and timber harvest, and hybridization and competition with introduced fish species. Additional information regarding the Rio Grande cutthroat trout can be found at http://www.natureserve.org/. The Rio Grande cutthroat trout has been reintroduced within the planning area into Medano Creek by the Colorado Division of Wildlife.

## Birds

**Southwestern Willow Flycatcher (*Empidonax traillii extimus*):** The southwestern willow flycatcher is a federally- and state- listed endangered species. The subspecies is known to breed in dense, multistoried riparian habitats in the arid southwestern United States and potentially northwestern Mexico and to migrate during the winter to southern Mexico, Central America, and northern South America. The riparian habitats in which this species breeds consists of trees and shrubs (e.g. willow (*Salix* sp.) and cottonwood (*Populus* sp.)) occurring along rivers and wetlands. Its breeding range encompasses portions of southwestern Colorado, including sites within the San Luis Valley (see FWS 2002 for discussion). The primary cause of the decline of southwestern willow flycatcher populations has been the loss and modification of breeding habitat. Additional information regarding southwestern willow flycatcher can be found in the final rule determining endangered status for the southwestern willow flycatcher (60 Fed. Reg. 10694- 10715 (February 27, 1995)), the species' recovery plan (FWS 2002), and http://www.natureserve.org/. This species breeds and migrates in willow and cottonwood areas in the San Luis Valley. The planning area, therefore, is within the range of southwestern willow flycatcher and portions of it may support suitable migrating and nesting habitat (USFWS 2002-2004). Although there may be some question as to which subspecies of willow flycatcher inhabits the planning area, until further notice, any willow flycatchers within the planning area should be considered southwestern willow flycatchers (*Empidonax traillii extimus*).

**Bald Eagle (*Haliaeetus leucocephalus*):** The bald eagle is a federally- and state-listed threatened species, which occurs throughout North America and is associated with aquatic ecosystems such as large lakes and major rivers. Bald eagles typically nest in tall, sturdy trees along shorelines in relatively secluded areas. Within the Valley, wintering and migrating bald eagles roost in large, mature cottonwood (*Populus* sp.) trees and snags and primarily forage on waterfowl and carrion. Major threats to this species include the destruction and degradation of its habitat and environmental contaminants. Additional information regarding the bald eagle can be found in the final rule for the bald eagle reclassification (60 Fed. Reg. 36000-36010 (July 12, 1995)), in Snyder (1993), and at http://www.natureserve.org/. The planning area is near appropriate wintering habitat for bald eagle (i.e. the Closed Basin Canal), but for most of the migration and winter seasons, it does not have the appropriate combination of roosting and foraging areas used by bald eagles. Bald eagles are known to migrate through the planning area (P. Bovin, biologist, Great Sand Dunes National Park and Preserve, unpublished data, 2004).

**Mexican Spotted Owl (*Strix occidentalis lucida*):** The Mexican spotted owl is a federally- and state-listed threatened species that inhabits cliffs and canyons. The species occurs in a variety of multi-layered forest types with high canopy closure and high stand density, but is frequently found in uneven-aged, old-growth mixed conifer forests. These forests are composed of such species as white fir (*Abies concolor*), Douglas fir (*Pseudotsuga menziesii*), and ponderosa pine (*Pinus ponderosa*). In addition, Mexican spotted owls are found in piñon-juniper (*Pinus edulis* - *Juniperus* spp.) forests below mixed conifer forests. The primary factors that have impacted Mexican spotted owl habitat include human alterations to the habitat, including logging and recreation, and natural causes such as fire. Additional information regarding the Mexican spotted owl can be found in the final rule to list the species as threatened (58 Fed. Reg. 14,248-14,271 (March 16, 1993)) and http://www.natureserve.org/. Surveys for Mexican Spotted Owl were conducted in the 1990's by the U.S. Forest Service within portions of what is now part of Great Sand Dunes National Preserve, but no Mexican Spotted Owls were found (F. Bunch, Resource Specialist, Great Sand Dunes National Park and Preserve, pers. com. 2005). At present, Mexican Spotted Owls are not known to occur within the planning area, but suitable habitat does exist.

**Burrowing Owl (*Athene cuniculave*):** The Burrowing Owl is a state listed endangered species occurring in well-drained grasslands, steppes, deserts, prairies and agricultural lands. They can also be found in or near golf courses, abandoned lots, and road allowances. Since they nest in underground burrows, they are usually found in occurrence with the presence of burrowing mammals such as prairie dogs. They are opportunistic feeders primarily foraging upon arthropods, small mammals and birds, and insects. Foraging habitat is usually within short- grass habitats and often in mowed or over grazed pastures. Within the San Luis Valley, the number of Burrowing Owls has varied depending on the availability of prairie dog towns and the vegetation height of prairies and pastures. However, every year there are breeding Burrowing Owls in the San Luis Valley, although usually not in large numbers. Albeit there is no known documentation of Burrowing Owls within the planning area, there have been observations of breeding burrowing owls just to the south near the Blanca Wetlands. The probability of this species breeding within the planning area is good, but dependent on the availability of short- grass areas occupied by burrowing mammals. The planning area with its various grassland and desert habitats, offers a potentially good opportunity to support Burrowing Owls.

**Gunnison Sage Grouse (*Centrocercus minimus*):** The Gunnison Sage Grouse is a federal and state candidate species that occurs within the southwestern portion of Colorado and southeastern Utah. The habitat of Gunnison Sage Grouse is composed of large expanses of sage (*Artemisia* spp.), grasslands, and riparian areas. A variety of factors have reduced the numbers of Gunnison Sage Grouse including direct habitat loss, fragmentation, and degradation, fire suppression, overgrazing, drought, and pollution, among other factors. Additional information can be found in the annual review of candidate species (69 Fed. Reg. 24881 (May 4, 2004)), in McWilliams (2002), and at http://www.natureserve.org/. Gunnison Sage Grouse do not occur within the planning area. However, this species is found in the northern portion of the Valley near Poncha Pass, approximately 20 miles north/northwest of the planning area, where sagebrush is prominent.

**Yellow- billed Cuckoo (*Coccyzus americanus*):** The Yellow- billed Cuckoo is a federal and state candidate species. This species occurs in riparian habitats (i.e. *Populus* sp. and *Salix* sp.) adjacent to streams throughout the western United States. The primary causes of the decline of this species include conversion to agriculture, grazing, competition from non- native plants, river management practices, and flood control practices. Additional information about this species can be found in the annual review of candidate species (69 Fed. Reg. 24887 (May 4, 2004)) and at http://www.natureserve.org/. In the San Luis Valley, the Yellow- billed Cuckoo has only been documented in thick tall cottonwood forests along one portion of the Conejos River (BLM, 2003- 2004). Limited surveys for Yellow- billed Cuckoo have been conducted throughout the majority of the planning area. Although Yellow- billed Cuckoos are not known to occur within the planning area at this time, the planning area is within the range of this species, and therefore, potential effects to this species should be considered during fire management planning. Future surveys will help determine whether this species is present or not.

**Ferruginous Hawk (*Buteo regalis*):** The Ferruginous Hawk is a state listed candidate species, which is found in grassland and riparian areas. Loss of habitat and extermination of prey species are the primary reasons for decline. Additional information can be found in Tesky (1994). The Ferruginous Hawk is known to occur within the planning area.

**American Peregrine Falcon (*Falco peregrinus anatum*):** The American Peregrine falcon is a state listed candidate species that occur in a wide variety of habitat types throughout North America and nest in high cliffs and river gorges. The pesticide, DDT, is the primary cause of the decline of this species, though successful efforts have been made to reintroduce the American Peregrine Falcon throughout the state and country. More information about this species can be found in Snyder (1991a). The American Peregrine Falcon is not common within the vicinity of the planning area, but isolated sightings have been made.

**Western Snowy Plover (*Charadrius alexandrinus nivosus*):** The Western Snowy Plover is a state listed candidate species. Habitat loss and degradation are the primary causes for decline. Western Snowy Plovers migrate and breed on vegetation-free alkaline beaches, flats, and playas. For nesting, the species requires barren wetland areas with a high saline content. These narrow habitat requirements restrict it to a very few locations within the San Luis Valley, primarily the BLM Blanca Wetlands, south of the planning area. Depending on hydrology and other factors, the planning area may at times, have appropriate breeding and migrating habitat for this rare species. Although Western Snowy Plover has not been documented in the recent past, this species may be present within the planning area.

**Mountain Plover (*Charadrius montanus*):** The Mountain Plover is a state listed candidate species that typically lives in shortgrass prairie habitat found on the Great Plains. However, this species may occasionally occur in mountain habitats with appropriate vegetation types (i.e. short vegetation). The major threat to this species is loss of prairie habitat due to cultivation as well as other causes. The Mountain Plover is not common within the vicinity of the planning area, but isolated sightings have been made. Therefore, Mountain Plovers may be present within the planning area in sites with appropriate habitat.

**Long-billed Curlew (*Numenius americanus*):** The Long-billed Curlew is a state listed candidate species that inhabits grasslands and meadows near water. This species nests in uplands areas with a fairly sparse cover of short-structured grasses. Its migrating habitat needs are similar. This species nests and migrates in grasslands and wetlands along the Valley floor of the planning area. The primary cause of decline for Long-billed Curlew has been destruction or degradation, primarily due to cultivation. The Long-billed Curlew is known to occur in the vicinity of the planning area and is likely to be found within the planning area.

## Mammals

**Canada Lynx (*Lynx canadensis*):** The Canada lynx is a federally- listed threatened species and a state- listed endangered species, which occurs in high elevation, boreal forest types (i.e. subalpine fir (*Abies lasiocarpa*) and spruce (*Picea* spp.) forests), as well as within mixed conifer forests at lower elevations, within the Southern Rocky Mountains, among other locations throughout the United States and Canada (Ruediger et al. 2000). Canada lynx occurs where forest cover is dense and use large woody debris on the forest floor as den sites. Factors that have altered Canada lynx habitat have included timber harvest, fire suppression, and conversion of forest land to agriculture. In addition, population levels of Canada lynx tend to fluctuate and are closely tied to the population levels of its prey, particularly the snowshoe hare (*Lepus americanus*). The Colorado Division of Wildlife (CDOW) began reintroducing Canada lynx from Alaska and Canada into portions of southwest Colorado in spring 1999 in an effort to reestablish a viable population within the state. The reintroduced lynx are currently being monitored by CDOW. More information regarding the Canada lynx can be found in the final rule for the determination of threatened status for this species (65 Fed. Reg. 16,052- 16,086 (March 24, 2000)), at http://www.natureserve.org/, and in Snyder (1991b). Currently, Canada lynx are not known to occur within the planning area. However, potential habitat does occur in the higher elevation forests (i.e. mixed conifer and spruce- fir forests).

**Wolverine (*Gulo gulo*):** The wolverine is a state- listed endangered species that occurs in high elevation forests and tundra. Poisoning has been cited as a potential reason for the decline of this species. Wolverines are not known to occur within the planning area.

## Amphibians and Reptiles

**Boreal Toad (*Bufo boreas boreas*):** The Boreal toad is a federal candidate species and a state- listed endangered species that occurs between 7,500 and 12,000 feet above mean sea level within lodgepole pine and spruce- fir forests, and alpine meadows with suitable breeding habitat (Loeffler 2001). Potential causes of decline of this species may include habitat modifying activities such as recreation or logging, water management activities, pesticide use, and pathogens, such as chytrid fungus. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the U.S. Geological Survey in 2001 and 2002 did not record this species from the high elevation areas of the Sangre de Cristo Mountains. The boreal toad, therefore, is not known to occur within the planning area.

**Midget Faded Rattlesnake (*Crotalus viridis concolor*):** The midget faded rattlesnake is a state listed candidate species which is found in arid, rocky habitats. The San Luis Valley is considered a zone of intergradations between the front- range subspecies (*Crotalus viridis viridis*) and the Midget Faded Rattlesnake (*Crotalus viridis concolor*)

(Hammerson 1999). Individuals within the planning area should be referred to by their binomial name *Crotalus viridis* (Western rattlesnake). Habitat alterations and collection have been the primary causes of decline. The midget faded rattlesnake is not known to occur within the planning area. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the US Geological Survey in 2001 and 2002 did not record this species from this area.

**Northern Leopard Frog (*Rana pipiens*):** The northern leopard frog is a state listed candidate species that is found in or near streams, ponds, wet meadows, and other aquatic habitats as well as adjacent upland habitats. The major threats to this species include habitat loss and degradation, overexploitation, and potential competition with non- native species. Historically, northern leopard frogs were more common through much of the wetland portions of the Valley. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the US Geological Survey in 2001 and 2002 did not record this species in areas of what was known as its former range. Reports have surfaced that this species has been encountered in the Blanca Wetlands area, a report that warrants formal verification and documentation. In addition, the species is known to occur at Weisman Lakes.

## Plants

**Smith Whitlow- grass (*Draba smithii*):** Smith whit- low grass is a Forest Service sensitive species that is known to occur in at least three areas within the planning area. This is a species endemic to Colorado, occurring in the Sangre de Cristo and San Juan Mountain ranges (Alamosa, Custer, Las Animas, Mineral and Saguache Counties). This species is found on talus slopes or rocky and exposed cliff faces in crevices, and between rocks in shaded, dry, and protected sites. Usually, Smith whitlow- grass is found on southern exposures and is found in an elevation range from 8,000 to 11,000 feet msl. Little is known about its biology.

## Methodology

The impact threshold definitions for threatened, endangered, and candidate species shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

Analysis of the effects using the language of both NEPA and ESA has been provided for all federally listed species under the preferred alternative, Alternative 3. The definition of cumulative effects under Section 7 of the ESA is "those effects of future State or private activities, not involving Federal activities, which are reasonably certain to occur within the action area of the Federal action subject to consultation." However, because the action area for this analysis and decision is limited to the Federal acreage of the Baca National Wildlife Refuge and Great Sand Dunes National Park and Preserve, there are no cumulative effects under the ESA definition. Therefore, the cumulative impacts analysis at the end of this section refers solely to the NEPA definition of cumulative impacts. Under ESA, effects to listed species are quantified by "take" of an individual or habitat. The definition of "take" is "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct."

Consultation with the U.S. Fish and Wildlife Service produced a list of all potentially occurring federally- listed species for Saguache and Alamosa Counties, Colorado. Also, consultation with the Colorado Division of Wildlife and the Colorado Natural Heritage Program produced a list of state- listed, sensitive, or rare species that are known or potentially known to occur within the area of analysis.

## IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

### Impact Analysis

Under this alternative, all fires would be suppressed and no fuels management activities would occur. Depending on the area (ecosystem) of suppression, wildland fire suppression activities might pose a threat to local populations or individuals of rare species. Widespread fire has not occurred over the area recently, although an anthropogenically- caused wildfire did spread over the lower elevations (piñon- juniper communities and grassland communities) of the Great Sand Dunes National Monument and to the south of the monument in 2001.

**Fish.** Two species of fish, the Rio Grande cutthroat trout and the Rio Grande sucker are two native fish known to occur in the study area. The Rio Grande cutthroat trout is a species considered a candidate for listing in the state of Colorado. The Rio Grande sucker has a state status of endangered in Colorado. One other fish, the Rio Grande chub (*Gila pandora*), is known as a Colorado state species of special concern and is found at Weisman Lake, soon to be part of the Baca National Wildlife Refuge.

Both the Rio Grande cutthroat trout and the Rio Grande sucker were reintroduced to the areas of Medano Creek above the main sand dune mass, which was not affected by the 2001 fire. Should fire occur here, negligible impacts to these species would be expected if the fire is limited or suppressed quickly. Should fire occur and become widespread and severe, the water quality and characteristics that are favored by the fish would be impacted. Water quality impacts might include a post- fire alteration in the pH of Medano Creek because of the presence of ash in the creek (making it more basic and reducing water clarity), which decreases the habitability of the creek for fish. Also, post- fire rain/snow runoff in the absence of stabilizing vegetation, could impact the sedimentation rate in the creek, as well as change the substrate suitable for spawning and foraging. An increased sedimentation rate in the creek could impact the ecology of the area for benthic macroinvertebrate organisms which are used extensively as forage by the fish. The increase in sedimentation could also alter the texture of the substrate, making it unsuitable for spawning. Further, a streambed that is no longer protected by vegetative cover may be subjected to an increase in temperature. Temperatures above 15 degree C (59 degree F) are unsuitable for breeding/spawning, and temperatures above 20 degree C (70 degree F) are unsuitable for general activity. Overall, these impacts would be minor to moderate and short- term to long- term.

**Birds**. The Bald Eagle (federal and state threatened) migrates and winters in the hundreds in the Valley, but based on limited surveys within the planning area it is assumed they occur only occasionally. Within the Valley, wintering and migrating bald eagles roost in large, mature cottonwood (*Populus* sp.) trees and snags and primarily forage on waterfowl and carrion. Therefore, bald eagles use large rivers and canals, wetlands, and reservoirs that may contain stretches of ice- free water. The planning area is near appropriate wintering bald eagle habitat (the Closed Basin Canal) but for most of the migration and winter seasons, it does not have the combination of appropriate roosting and foraging areas used by bald eagles. If a fire would occur under Alternative 1, it would probably not negatively affect the quality of foraging sites during winter or migration, and therefore, would have negligible to minor and short- term impacts on this species.

The Yellow- billed Cuckoo is a federal and state candidate for listing. This species breeds in mature cottonwood (*Populus* sp.) and willow (*Salix* sp.) riparian sites where it forages on tent caterpillars, cicadas, and sometimes frogs associated with these habitats. In the San Luis Valley, this species has only been documented in thick tall cottonwood forests along one portion of the Conejos River (BLM, 2003- 2004) and is not known to occur within the planning area. Under Alternative 1, if all fires were suppressed, there likely would be negligible to minor and short- term impacts on the habitat for this species. If under Alternative 1 a widespread and intense wildfire occurred and removed the woody vegetation used for nesting and the herbaceous vegetation which supports the prey base, suitable habitat for this species would be negatively affected for a few years until the vegetation recovers.

Another riparian- obligate, the Southwestern Willow Flycatcher is a federal and state endangered species, no survey efforts have been made in the planning area so it is unknown if it occurs. However, it does breed and migrate in willow and cottonwood areas throughout the San Luis Valley below ~8,000 feet (USFWS 2002- 2004). There is a high probability that dense willow areas along rivers and streams within the planning area at lower elevations support breeding and migrating southwestern willow flycatchers. Under Alternative 1, if all fires were suppressed, there likely would be negligible to minor and short- term impacts on the habitat for this species. Should a widespread and intense wildlife take place under Alternative 1, the brushy, thick woody vegetation that the bird nests and feeds within would be removed and thus negatively affected for a few years until the woody vegetation recovered.

The Mexican Spotted Owl is listed as both a federal and state threatened species. Although not known to occur within the planning area, several areas do exist as potential habitat for this species. These habitats include piñon- juniper habitats (*Pinus edulis- Juniperus* sp.) and mixed conifer forests with ponderosa pine (*Pinus ponderosa*), white fir (*Abies concolor*) and Douglas fir (*Pseudotsuga menziesii*). Under Alternative 1, if all fires were suppressed, there likely would be negligible to minor impacts on the habitat for this species in the short- term. In habitats that have a longer fire return interval, fire suppression would likely not alter the habitat over the long- term. However, should a widespread and intense wildfire occur under Alternative 1, the suitable habitat for this species would be negatively affected.

The Burrowing Owl is a state listed endangered species that may occur within the planning area in well- drained grasslands and disturbed areas such as along roads or agriculture fields where burrowing mammals also occur. Because this species occurs in habitat with short herbaceous vegetation, which is less likely to carry a fire, impacts to burrowing owls under Alternative 1 are expected to be negligible. However, impacts to active burrows from vehicles (i.e. crushing burrows) during fire suppression activities may have a minor, short- term impact on this species.

The Gunnison Sage Grouse is both a federal and state candidate listed species. This species is not known from the planning area, as suitable habitat does not occur in this area. It is unlikely that any consequence of Alternative 1 would affect this species or its habitat.

The Ferruginous Hawk is a state endangered species and is a possible year- round resident of dry, open country, such as that found on the floor of the San Luis Valley, where it forages and breeds. This hawk species is known to occur within the planning area, although it is indefinite as to whether it actually breeds within the area, although this is likely. Under Alternative 1, if all fires were suppressed, there likely would be negligible impacts on the habitat for this species along the short- term. However, should a widespread and intense wildfire take place under Alternative 1, the suitable habitat for this species would be negatively affected. Depending on the size and intensity of the wildfire, however, it would be likely that this species would occupy similar and suitable habitat in adjacent and nearby areas.

The Peregrine Falcon is a state candidate species that typically nests in cliff areas near open wetlands, and is known as a summer (breeding) resident in the planning area. Although its preference for nesting occurs mostly in fairly inaccessible cliff and rocky habitat, foraging will take place near the open wetlands and grasslands within the planning area. Under Alternative 1, if all fires were suppressed, there likely would be negligible impacts on the habitat for this species along the short- term. However, should a widespread and intense wildfire take place under Alternative 1, the suitable foraging areas for this species would be negatively affected.

The Western Snowy Plover, a plover subspecies, is a state candidate species. Snowy plovers migrate and breed on vegetation- free alkaline beaches, flats, and playas. For nesting, the species requires barren wetland areas with a high saline content. These narrow habitat requirements restrict it to a very few locations within the San Luis Valley, primarily the BLM Blanca Wetlands, south of the planning area. Depending on hydrology and other factors, the planning area may at times, have appropriate breeding and migrating habitat for this rare species. This species has been known to historically occur as a breeding resident within the planning area and may still be present within portions of the planning area. Under Alternative 1, if all fires were suppressed, there would be negligible impacts on the habitat for this species along the short- term, given the barren and sparsely vegetation nature of its preferred habitat.

The Mountain Plover is a state candidate species that migrates and breeds in prairie and grassland habitats containing short- structured grasses (from grazing, burning, drought or use by prairie dogs) and with minimal to no shrubs within the prairie and mountain states. In eastern Colorado, mountain plovers also nest in agriculture fields prior to planting. There have not been Valley- wide surveys for Mountain Plover within agricultural fields; however, there have been incidental observations of juvenile Mountain Plover in grazed pastures on BLM and private lands in several locations within the Valley. This species does migrate and nest in short- grass prairies, grasslands and pastures within the Valley but has not been documented to date in the planning area. However, if all wildland fires were suppressed, suitable habitat for the Mountain Plover may be negatively altered by the encroachment of shrubs. The impacts would potentially be minor and short- term.

The Long- billed Curlew is a state candidate species that migrates and breeds near wetlands associated with grasslands. This species nests in uplands areas with a fairly sparse cover of short- structured grasses. Its migrating habitat needs are similar. This species nests and migrates in grasslands and wetlands along the Valley floor of the planning area. Under Alternative 1, if all fires were suppressed, there likely would be negligible impacts on the habitat for this species along the short- term, given the barren and sparsely vegetation natures of its preferred habitat. However, negative impacts under Alternative 1 may occur if shrubs became established within Long- billed Curlew habitat.

**Mammals**. The Canada lynx (state endangered, federal threatened) occurs primarily in high elevation, boreal forest types with dense cover and containing spruce (e.g. *Picea pungens*) and subalpine fir (*Abies lasiocarpa*) within the United States, Canada, and locally, within the Southern Rocky Mountains. Canada lynx prefer a forested habitat with large amounts of woody debris on the forest floor, which are used as den sites. Currently, Canada lynx are not known to occur within the planning area, but potential habitat is present. Under Alternative 1, if all fires were suppressed, there likely would be negligible to minor impacts on the habitat for this species because the forest types in which it occurs have long fire return intervals and construction of firelines and other fire suppression tactics would be limited because the habitat occurs in designated wilderness areas. Therefore, fire suppression would likely not alter the habitat over the long- term. On the other hand, the suitable habitat for this species would be negatively affected should a widespread and intense wildfire occur across a large portion of the lynx habitat under Alternative 1. These effects may include reducing forest canopy cover and removal of den sites. However, fire may also increase herbaceous cover in some areas, which would benefit the lynx's main prey, snowshoe hare.

The wolverine is a state endangered and federal candidate species that inhabits densely forested systems in higher elevations of Colorado. However, on- going mammalian surveys by Ernest Valdez of the US Geological Survey (Albuquerque, New Mexico office) have not recorded any occurrences of this species in the planning area. Furthermore, it is unlikely that the wolverine would be found in the target area (E. Valdez, pers. com.). Therefore, it is unlikely that any consequence of Alternative 1 would affect this species' viability.

**Herpetiles.** The boreal toad is a federal candidate and state endangered species that occupies high elevation marshes, wet meadows, and along the edges of beaver ponds, streams, and subalpine lakes in Colorado (Hammerson 1986). However, Hammerson (1986) states that this species is apparently absent from the Wet Mountains, Sangre de Cristo Range, and the Pikes Peak region. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the US Geological Survey in 2001 and 2002 did not record this species from the high elevation areas of the Sangre de Cristo Mountains. Therefore, it is unlikely that any consequence of Alternative 1 would affect this species' viability.

The northern leopard frog is a state candidate species that inhabits shallow portions of both permanent and temporary water sources including marshes, ponds lakes, reservoirs, beaver ponds, streamsides, and sub- irrigated meadows (Hammerson 1986). It may inhabit suitable habitats up to an elevation of 11,000 feet in southern Colorado (Hammerson 1986). Although this species was formerly known to inhabit the interdunal ponds and wetlands of the western edges of the sandsheet at Great Sand Dunes, no individuals have been reported or encountered since the late 1960s. There are a number of hypotheses to explain its decline in this area, including exposure to the deadly chytrid fungus (E. Muths, pers.comm), as well as a discontinuity and decline in suitable pond habitats due to the disappearance of wetlands throughout the area. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the US Geological Survey in 2001 and 2002 did not record this species in areas of what was known as its former range. Reports have surfaced that this species has been encountered in the Blanca Wetlands area, a report that warrants formal verification and documentation. In addition, the species is known to occur at Weisman Lakes. Because this species occurs in aquatic habitats, impacts of Alternative 1 would be negligible and short- term.

The midget faded rattlesnake, which is a subspecies of the western rattlesnake (*Crotalus viridis*), is a state candidate species (Hammerson 1986). This species is known to occupy suitable habitat in western Colorado, and is therefore unlikely to be encountered in the target area. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the US Geological Survey in 2001 and 2002 did not record this species from this area. Therefore, it is unlikely that any consequence of Alternative 1 would affect this species' viability.

**Plants.** Smith whitlow- grass is a Forest Service sensitive species that is known to occur in at least three areas within the planning area. This is a species endemic to Colorado, occurring in the Sangre de Cristo and San Juan Mountain ranges (Alamosa, Custer, Las Animas, Mineral and Saguache Counties). This species is found on talus slopes or rocky and exposed cliff faces in crevices, and between rocks in shaded, dry, and protected sites. Usually, Smith whitlow- grass is found on southern exposures and is found in an elevation range from 8,000 to 11,000 feet msl. Little is known about its biology. If all fires were suppressed, it is unlikely that the species would be affected. However, should a widespread and intense wildfire occur under Alternative 1, the population could be locally degraded and potentially extirpated, though this is unlikely because of the nature of the locations (i.e. rocky and exposed cliffs, between rocks, etc.) where this species is found.

## Cumulative Effects

Alternative 1 includes the incremental impacts of past management practices, including fire suppression actions, added to existing and potential future fire management activities throughout the planning area and on adjacent and nearby lands, as well as other planned projects. Cumulative impacts to the species treated above derive from trail maintenance, other short- term maintenance projects, and recreational activities and from other area fires. Under Alternative 1, if all fires were successfully suppressed, short- term cumulative impacts to potential habitats and habitats of species confirmed present in the area would be negligible. For habitats that are subject to long cycles in fire frequency, the impacts would also likely be negligible. Should a widespread and intense wildfire occur in the area, however, the overall effect would be a degradation or elimination of portions of suitable habitat for the species discussed above.

## Conclusion

Alternative 1 would result in negligible to minor, short- term impacts to the habitat and species listed above, should all fires be suppressed. Continued suppression may degrade habitats that are historically known to have frequent fire cycles, and therefore, negatively impact the wildlife species dependent upon these habitats. Widespread and intense wildfire could have the potential to degrade habitat for certain species such as rare plants and fish. Impacts could be minor to moderate and short- term to long- term for the Rio Grande sucker and Rio Grande cutthroat trout if a widespread and intense wildfire occurred.

Alternative 1 would not produce any major adverse impacts on threatened, endangered, or candidate species or their designated critical habitat whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of threatened, endangered, or candidate species or their designated critical habitat as a result of implementation of Alternative 1.

## IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

### Impact Analysis

Under Alternative 2, fuels management activities would be allowed which would have the effect of reducing risks associated with hazardous fuel accumulations. Mitigation efforts would be ongoing and may successfully reduce or eliminate the chances of an uncharacteristically intense wildland fire.

**Fish.** Impacts to the two species known to occur in the area (i.e. Rio Grande cutthroat trout, state candidate and the Rio Grande sucker, state endangered) would be minimized under Alternative 2 by conducting thinning and carefully planned prescribed burns within the Medano Creek watershed outside of the spawning seasons. The reduction activities would take place outside of periods known for heavy run- off, likely during March- April and late- July through early- September. Further, the reduction activities should be spatially planned so that large, widespread areas of treatment do not occur within the watershed over any time or close lapse in time. The riparian communities of willow, cottonwood, and river birch along Medano Creek would not be targeted for mechanical thinning or prescribed fire operations. Slash would not be concentrated in the creeks, tributaries, and ephemeral creeks. Impacts to the fish under Alternative 2 would be localized, negligible to minor, and short- term, with benefits expected over the long- term.

**Birds.** While there has been very little monitoring effort of Bald Eagle (federal and state threatened) in most of the planning area, the species is not known to nest on the Valley floor nor in the planning area. Most of the wintering Bald Eagles in the San Luis Valley, including those near the planning area, concentrate in locations where there is appropriate roosting habitat, such as in tall mature cottonwoods along ice-free water which support concentrations of wintering waterfowl, or in areas where carrion is likely to be found. Most of the waterways in the planning area are frozen or dry in the winter, and therefore, are not appropriate foraging sites for this species. Bald Eagle would likely be unaffected under Alternative 2 because they are not common in most of the planning area and the proposed actions will not likely negatively impact the habitat features this species utilizes (i.e. large, mature cottonwood (*Populus* sp.) trees and snags). Should fuels reduction activities occur during the migration and wintering period (late-fall, early-mid winter), the impacts to the Bald Eagle's roosting habitat would be negligible and short-term since the efforts are geared towards the reduction and removal of down and dead vegetation. No mature and standing cottonwoods or snags would be removed.

Neither Southwestern Willow Flycatcher (federal and state endangered species) nor Yellow-billed Cuckoo (federal and state candidate species) have been surveyed for in the majority of the planning area, and therefore, it is unknown if they occur. However, suitable habitat for the willow flycatcher exists and may exist for the cuckoo within the planning area. Based on survey results from other portions of the San Luis Valley where they do nest and migrate, Southwestern Willow Flycatchers likely migrate and nest in the willow and other woody vegetation along rivers, streams and possibly irrigation canals in areas below ~8,000 feet in the planning area. Suitable Southwestern Willow Flycatcher habitat includes fairly contiguous patches of thick, dense woody vegetation with flowing or standing water and an understory of herbaceous vegetation to provide for the insect prey base. Yellow-billed Cuckoos require similar habitat features along with multi-layers of woody vegetation including an overstory of tall, mature cottonwoods or large willows. It is possible, but not too likely, that Yellow-billed Cuckoos occur in the planning area, perhaps on the upper (eastern) portions of the major streams primarily on USFS and NPS lands. Yellow-billed Cuckoos have only been documented in Colorado in one location and that was in 2003 and 2004 on a mature riparian forest on the Conejos River in the San Luis Valley and it is unknown if the planning area has habitat similar to that of the area being used.

Any actions within riparian habitats that promote the long-term health of vegetation, such as generation of new plants and maintaining the composition of native species would in the long-term benefit Southwestern Willow Flycatchers and Yellow-billed Cuckoos. Southwestern Willow Flycatchers depend upon fairly early successional stages of riparian habitat and will move between patches of appropriate habitat, while Yellow-billed Cuckoos also require mature overstory trees. Therefore providing a mosaic of riparian habitats with willows and cottonwoods in various growth forms will benefit both of these species in the long-term. Under Alternative 3, fuels management activities including manual and mechanical treatments and prescribed fire may occur in suitable habitat for Southwest Willow Flycatcher and Yellow-billed Cuckoo. However, these activities will not remove or degrade the primary habitat for these species, and will likely improve the habitat over the long- term if properly planned. As a conservation measure, surveys for both species will occur prior to implementation of any fuels management project. Also, all fuels treatment work within suitable habitat for these species would be timed outside of the breeding season.

The Mexican Spotted Owl (federal and state threatened species) is not known from the project area, although areas of suitable habitat do exist. The species occurs in a variety of multi- layered forest types with high canopy closure and high stand density, but is frequently found in uneven- aged, old- growth mixed conifer forests and piñon- juniper forests. Limited fuels treatments would occur in Mexican Spotted Owl habitat. Fuel treatment activities would occur within the immediate vicinity of resource elements to be protected (e.g. developments and cultural resources). The maximum buffer of fuels treatment around each identified resource element would be 328 feet (100 meters). Fuels treatment work along the perimeter of the planning area within Mexican Spotted Owl habitat would extend to a maximum of 1640 feet (500 meters) away from the boundary with neighboring properties. Because of the presence of potential habitat, any implementation plan will consider limiting removal to smaller trees, maintaining an overall multi- age class forest, and by avoiding the complete removal of litter, downed logs, and snags. However, because this species is not known from the area, it is unlikely that the short- term presence of work- crews and machinery performing these operations would have any impact on the species. Therefore, impacts would be negligible and short- term.

The Burrowing Owl is a state listed endangered species that may occur within the planning area in well- drained grasslands and disturbed areas such as along roads or agriculture fields where burrowing mammals also occur. Because this species occurs in habitat with short herbaceous vegetation, which is less likely to carry a fire except under extreme weather conditions, impacts to burrowing owls under Alternative 2 are expected to be negligible. In addition, limited fuels treatment activities would occur within Burrowing owl habitat because of the fuel type present. However, impacts to active burrows from vehicles (i.e. crushing burrows) during fire suppression and fuels treatment activities may have a minor, short- term impact on this species.

The Gunnison Sage Grouse is both a federal and state candidate listed species. This species is not known from the planning area, as its suitable habitat for this species does not occur in this area. It is unlikely that any consequence of Alternative 2 would affect this species or its habitat.

The Ferruginous Hawk (state candidate species) is known to occur within the planning area, although it is indefinite as to whether it actually breeds within the area, although this is likely. Impacts under Alternative 3 would be negligible to minor with short term effects. In areas of suitable habitat, burning and/or thinning operations should be timed when possible to avoid breeding seasons including any nesting areas that have been located prior to project implementation. Areas of suitable habitat should also be patchily treated over a number of years to avoid temporarily impacting large areas of habitat in a given timeframe.

The Peregrine Falcon (state candidate species) is known as a summer (breeding) resident within the planning area. Although its preference for nesting mostly occurs in fairly inaccessible cliff and rocky habitat, foraging will take place near the open wetlands and grasslands within the planning area. Impacts under Alternative 2 would be negligible to minor with short term effects. In areas of suitable habitat, burning/thinning operations should be timed to avoid breeding seasons and known nesting areas. Areas of suitable habitat should also be patchily treated over a number of years to avoid temporarily damaging large swaths of foraging habitat in a given timeframe.

The Western Snowy Plover (state candidate species) is known to occur as a breeding resident within the planning area, but is restricted to the playa lake system occurring along the valley floor. Impacts under Alternative 2 would be negligible to minor with short term effects. In areas of suitable habitat, burning/thinning operations should be timed to avoid breeding seasons and known nesting areas. Areas of suitable habitat should also be patchily treated over a number of years to avoid temporarily damaging foraging habitat in a given timeframe. Alternatively, activities under Alternative 2 may positively affect this species if shrubs and other woody species are reduced.

The Mountain Plover (state candidate species) is a plover known to breed in plains and shortgrass prairie habitats with minimal shrubby vegetation. This species does migrate and nest in short- grass prairies, grasslands and pastures within the Valley, but has not been documented in the planning area to date. Activities under Alternative 2 may positively affect this species if shrubs and other woody species are reduced. Impacts are anticipated to be negligible to minor and short- term.

The Long- billed Curlew (state candidate species) occurs within the planning area, inhabiting the grasslands and wetlands along the valley floor. Impacts under Alternative 2 would be negligible to minor with short term effects. In areas of suitable habitat, burning/thinning operations should be timed to avoid breeding seasons and known nesting areas. Areas of suitable habitat should also be patchily treated over a number of years to avoid temporarily damaging large swaths of foraging habitat in a given timeframe. Activities under Alternative 2 may positively affect this species if shrubs and other woody species are reduced.

**Mammals**. The Canada lynx (federal threatened species and state endangered species) occurs primarily in high elevation, boreal forest types containing spruce (*Picea pungens*) and subalpine fir (*Abies lasiocarpa*) within the United States, Canada, and locally, within the Southern Rocky Mountains. Canada lynx prefer a forested habitat with dense forest canopy and large amounts of woody debris on the forest floor, which are used as den sites. Impacts to Canada lynx under Alternative 2 would likely be negligible to minor and short-term because little to no fuels treatments would occur in potential lynx habitat.

The wolverine (state endangered species) is a mammalian species of densely forested habitats in higher elevations of Colorado. However, on-going mammalian surveys by Ernest Valdez of the US Geological Survey (Albuquerque, New Mexico office) have not recorded any occurrences of this species in the planning area. Furthermore, it is unlikely that the wolverine would be found in the target area (E. Valdez, pers. com.). Therefore, it is unlikely that any consequence of Alternative 2 would affect this species' viability.

**Herpetiles.** The boreal toad (federal candidate species and state endangered species) occupies high elevation marshes, wet meadows, and along the edges of beaver ponds, streams, and subalpine lakes in Colorado (Hammerson 1986). However, Hammerson (1986) states that this species is apparently absent from the Wet Mountains, Sangre de Cristo Range, and the Pikes Peak region. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the US Geological Survey in 2001 and 2002 at Great Sand Dunes did not record this species from the high elevation areas of the Sangre de Cristos. Therefore, it is unlikely that any consequence of Alternative 2 would affect this species' viability.

The northern leopard frog (state candidate species) inhabits shallow portions of both permanent and temporary water sources including marshes, ponds lakes, reservoirs, beaver ponds, streamsides, and sub-irrigated meadows (Hammerson 1986). Although this species was formerly known to inhabit that interdunal ponds and wetlands of the western edges of the sandsheet at Great Sand Dunes, no individuals have been reported or encountered since the late 1960s. However, this species has been reported to occur at Weisman Lake. Impacts would likely be negligible to minor and short-term for this species under Alternative 2.

The midget faded rattlesnake (state candidate species) is a midget rattlesnake subspecies of the western rattlesnake (*Crotalus viridis*) (Hammerson 1986). This species is known to occupy suitable habit in western Colorado, but is not known to be present within the planning area. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the US Geological Survey in 2001 and 2002 at Great Sand Dunes did not record this species from this area. Therefore, it is unlikely that any consequence of Alternative 2 would affect this species' viability.

**Plants.** Smith whitlow-grass is a Forest Service sensitive species that is known to occur in at least three areas within the planning area. Because this species is narrowly restricted to small areas of suitable habitat, areas of occurrence of this species should be well-known prior to any thinning operations or prescribed burns. However, because this species is found in locations where little to no fuels treatments would occur (i.e. cliffs and canyons, talus slopes, crevices, and between rocks in shaded, protected sites in upper montane and lower subalpine areas), fuels treatment activities should have no to negligible effects on this species. Nevertheless, mechanical thinning operations, crews and equipment should avoid known areas of occurrence. For prescribed fire operations, crews should be advised of species locations to avoid utilizing equipment that could disturb the soil in these areas.

## Cumulative Impacts

Cumulative impacts under Alternative 2 include the incremental impacts of past management practices, including fire suppression actions, added to existing and potential future fire management activities throughout the planning area and on adjacent and nearby lands, as well as other planned projects. Cumulative impacts resulting from incremental past, present, and reasonably foreseeable future fire management activities, combined with other administrative and maintenance actions in the planning area would result in short- term, minor, adverse impacts to species of management concern, assuming mitigation is used and fuel treatment activities occur in appropriate seasons to minimize impacts on breeding animals. Implementation of Alternative 2 would result in beneficial impacts to wildlife, especially as habitat improves with fire and non- fire treatments. Human activity in wildlife habitat, such as hiking or horseback- riding, would result in short- term disturbance of certain species. Long-term cumulative impacts include potential habitat fragmentation and development and inappropriate water management on lands surrounding the planning area.

Also important, timing of operations should carefully consider periods when the activities of native, but destructive forest pest insects are high. Examples of these would be mountain pine beetle (*Dendroctonus ponderosae*, among other *Dendroctonus* species), piñon ips (*Ips pini*), and other species that are often attracted by the chemistries of mechanically- injured trees and fire- damaged trees (terpenes). Because these insects are most active during June- August for breeding and in late- October for overwintering, activities which damage trees during these periods should be avoided.

## Conclusion

Overall, impacts of Alternative 2 would result in negligible to minor adverse impacts with short- term effects to the species listed above. As a conservation measure, the spatial occurrence and the timing of fuels treatment operations will be planned carefully to limit the extent of impacts.

Alternative 2 would not produce any major adverse impacts on threatened, endangered, or candidate species or their designated critical habitat whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of threatened, endangered, or candidate species or their designated critical habitat as a result of implementation of Alternative 2.

## IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

### Impact Analysis

Under Alternative 3 (the preferred alternative), fuels management activities would be similar to those described under Alternative 2. Impacts created by wildland fire use for resource benefit (WFURB) would be similar to prescribed burn impacts mentioned above, which would be minimal to species identified. The decision to utilize WFURB would involve assessing impacts to threatened, endangered, and candidate species, and therefore, impacts would be minimized.

**Fish.** Impacts to the two species known to occur in the area (i.e. Rio Grande cutthroat trout, state candidate and the Rio Grande sucker, state endangered) would be minimized under Alternative 3 by conducting thinning and carefully planned prescribed burns within the Medano Creek watershed outside of the spawning seasons. The reduction activities would take place outside of periods known for heavy run- off, likely during March- April and late- July through early- September. Further, the reduction activities should be spatially planned so that large, widespread areas of treatment do not occur within the watershed over any time or close lapse in time. The riparian communities of willow, cottonwood, and river birch along Medano Creek would not be targeted for mechanical thinning or prescribed fire operations. Slash would not be concentrated in the creeks, tributaries, and ephemeral creeks. Impacts from WFURB would be negligible to minor and short- term if efforts were made to rehabilitate any undesirable impacts near Medano Creek as soon as possible following a wildfire. Impacts to the fish under Alternative 3 would be localized, negligible to minor, and short- term, with benefits expected over the long- term.

**Birds.** While there has been very little monitoring effort of Bald Eagle (federal and state threatened) in most of the planning area, the species is not known to nest on the Valley floor nor in the planning area. Most of the wintering Bald Eagles in the San Luis Valley, including those near the planning area, concentrate in locations where there is appropriate roosting habitat, such as in tall mature cottonwoods along ice- free water which support concentrations of wintering waterfowl, or in areas where carrion is likely to be found. Most of the waterways in the planning area are frozen or dry in the winter, and therefore, are not appropriate foraging sites for this species. Bald Eagle would likely be unaffected under Alternative 3 because they are not common in most of the planning area and the proposed actions will not likely negatively impact the habitat features this species utilizes (i.e. large, mature cottonwood (*Populus* sp.) trees and snags). Should fuels reduction activities occur during the migration and wintering period (late fall and early- mid winter), the impacts to the Bald Eagle's roosting habitat would be negligible and short- term since the efforts are geared towards the reduction and removal of down and dead vegetation. No mature and standing cottonwoods or snags would be removed. If WFURB occurred during Bald Eagle migration, impacts would be negligible to minor and short- term because WFURB would only be allowed in the Mosca and Herard FMU's. These FMU's provide little to no habitat for Bald Eagles.

In Section 7 terms, it is anticipated that actions under Alternative 3 "may affect", but "is not likely to adversely affect" Bald Eagles or their habitat. Limited fuels management will occur in Bald Eagle habitat (i.e. riparian areas), and no mature, standing cottonwoods or snags would be removed. As a conservation measure under the Endangered Species Act (ESA), surveys will be conducted for Bald Eagle prior to implementation of any fuels treatment project with the possibility of redesigning or abandoning the project if Bald Eagles are present. In addition, the intent of fire management activities under Alternative 3 would be to improve Bald Eagle habitat, while meeting other fire management objectives such as protection of natural, cultural, and human resources.

Neither Southwestern Willow Flycatcher (federal and state endangered species) nor Yellow- billed Cuckoo (federal and state candidate species) have been surveyed for in the majority of the planning area, and therefore, it is unknown if they occur. However, suitable habitat for the willow flycatcher exists and may exist for the cuckoo within the planning area. Based on survey results from other portions of the San Luis Valley where they do nest and migrate, Southwestern Willow Flycatchers likely migrate and nest in the willow and other woody vegetation along rivers, streams and possibly irrigation canals in areas below ~8,000 feet in the planning area. Suitable Southwestern Willow Flycatcher habitat includes fairly contiguous patches of thick, dense woody vegetation with flowing or standing water and an understory of herbaceous vegetation to provide for the insect prey base. Yellow- billed Cuckoos require similar habitat features along with multi- layers of woody vegetation including an overstory of tall, mature cottonwoods or large willows. It is possible, but not too likely, that Yellow- billed Cuckoos occur in the planning area, perhaps on the upper (eastern) portions of the major streams primarily on USFS and NPS lands. Yellow- billed Cuckoos have only been documented in Colorado in one location and that was in 2003 and 2004 on a mature riparian forest on the Conejos River in the San Luis Valley and it is unknown if the planning area has habitat similar to that of the area being used.

Any actions within riparian habitats that promote the long- term health of vegetation, such as generation of new plants and maintaining the composition of native species would in the long- term benefit Southwestern Willow Flycatchers and Yellow- billed Cuckoos. Southwestern Willow Flycatchers depend upon fairly early successional stages of riparian habitat and will move between patches of appropriate habitat, while Yellow-billed Cuckoos also require mature overstory trees. Therefore providing a mosaic of riparian habitats with willows and cottonwoods in various growth forms will benefit both of these species in the long- term. Under Alternative 3, fuels management activities including manual and mechanical treatments and prescribed fire may occur in suitable habitat for Southwest Willow Flycatcher and Yellow- billed Cuckoo. However, these activities will not remove or degrade the primary habitat for these species, and will likely improve the habitat over the long- term if properly planned. As a conservation measure, surveys for both species will occur prior to implementation of any fuels management project. Also, all fuels treatment work within suitable habitat for these species would be timed outside of the breeding season. Therefore, any impacts to Southwest Willow Flycatcher and Yellow- billed Cuckoo under Alternative 3 would be negligible to minor and short- term. Impacts from WFURB would be negligible to minor and short- term because WFURB would only be allowed in the Mosca and Herard FMU's. These FMU's provide little to no habitat for Southwestern Willow Flycatcher and Yellow-billed Cuckoo.

In Section 7 terms, it is anticipated that actions under Alternative 3 "may affect", but "is not likely to adversely affect" Southwestern Willow Flycatcher or Yellow- billed Cuckoo or their habitat in the short- term and is likely to benefit these species in the long- term. The determination of short- term "not likely to adversely affect" is based on the conservation measure of surveys prior to implementation of fuels treatment work in suitable habitat and the small amount of fuels management to occur in the habitat of both species (i.e. riparian areas). Thus, the fire management plan impacts to Southwestern Willow Flycatcher and Yellow- billed Cuckoo are negligible or discountable. Overall, the intent of any fuels management activity will be to improve habitat, to the extent possible under the fire management program, for these two species by ensuring the appropriate species composition and vegetation structure, as well as rejuvenating the habitat in some instances with prescribed fires.

The Mexican Spotted Owl (federal and state threatened species) is not known from the project area, although areas of suitable habitat do exist. The species occurs in a variety of multi- layered forest types with high canopy closure and high stand density, but is frequently found in uneven- aged, old- growth mixed conifer forests and piñon- juniper forests. Limited fuels treatments would occur in Mexican Spotted Owl habitat. Fuel treatment activities would occur within the immediate vicinity of resource elements to be protected (e.g. developments and cultural resources). The maximum buffer of fuels treatment around each identified resource element would be 328 feet (100 meters). Fuels treatment work along the perimeter of the planning area within Mexican Spotted Owl habitat would extend to a maximum of 1640 feet (500 meters) away from the boundary with neighboring properties. Because of the presence of potential habitat, any implementation plan will consider limiting removal to smaller trees, maintaining an overall multi- age class forest, and by avoiding the complete removal of litter, downed logs, and snags. However, because this species is not known from the area, it is unlikely that the short- term presence of work- crews and machinery performing fuels reduction operations would have any impact on the species. In addition, wildland fire use for resource benefit (WFURB) will help to maintain the uneven aged, old- growth characteristics of the forests. Therefore, impacts under Alternative 3 would be negligible and short- term.

In Section 7 terms, it is anticipated that actions under Alternative 3 "may affect", but "is not likely to adversely affect" Mexican Spotted Owl or its habitat. Mexican Spotted Owls are not currently known to exist within the planning area, but suitable habitat is present. However, limited fuels management will occur in Mexican Spotted Owl habitat (i.e. multi- age class forest). As a conservation measure under ESA, surveys will be conducted for Mexican Spotted Owl prior to the implementation of any fuels treatment projects with the possibility of redesigning or abandoning the project if Mexican Spotted Owls are present. In addition, the intent of activities under Alternative 3 is to improve Mexican Spotted Owl habitat to the extent possible under the fire management program, while meeting other fire management objectives such as protection of natural, cultural, and human resources.

The Burrowing Owl is a state listed endangered species that may occur within the planning area in well- drained grasslands and disturbed areas such as along roads or agriculture fields where burrowing mammals also occur. Because this species occurs in habitat with short herbaceous vegetation, which is less likely to carry a fire except under extreme weather conditions, impacts to burrowing owls under Alternative 3 are expected to be negligible. In addition, limited fuels treatment activities would occur within Burrowing owl habitat because of the fuel type present. However, impacts to active burrows from vehicles (i.e. crushing burrows) during fire suppression and fuels treatment activities may have a minor, short- term impact on this species. Impacts from WFURB would be negligible because habitat for this species does not occur in the Mosca or Herard FMU's.

The Gunnison Sage Grouse is both a federal and state candidate listed species. This species is not known from the planning area, as its suitable habitat for this species does not occur in this area. The nearest population is found in the northern portion of the Valley near Poncha Pass, approximately 20 miles north/northwest of the planning area, where sagebrush is prominent. It is unlikely that any consequence of Alternative 3 would affect this species or its habitat. Because this species is not present within the planning area, there will be "no effect" to this species or its habitat in Section 7 terms.

The Ferruginous Hawk (state candidate species) is known to occur within the planning area, although it is indefinite as to whether it actually breeds within the area, although this is likely. Impacts under Alternative 3 would be negligible to minor with short term effects. In areas of suitable habitat, burning and/or thinning operations should be timed when possible to avoid breeding seasons including any nesting areas that have been located prior to project implementation. Areas of suitable habitat should also be patchily treated over a number of years to avoid temporarily impacting large areas of habitat in a given timeframe.

The Peregrine Falcon (state candidate species) is known as a summer (breeding) resident within the planning area. Although its preference for nesting mostly occurs in fairly inaccessible cliff and rocky habitat, foraging will take place near the open wetlands and grasslands within the planning area. Impacts under Alternative 3 would be negligible to minor with short term effects. In areas of suitable habitat, burning/thinning operations should be timed to avoid breeding seasons and known nesting areas. Areas of suitable habitat should also be patchily treated over a number of years to avoid temporarily damaging large swaths of foraging habitat in a given timeframe.

The Western Snowy Plover (state candidate species) is known to occur as a breeding resident within the planning area, but is restricted to the playa lake system occurring along the valley floor. Impacts under Alternative 3 would be negligible to minor with short term effects. In areas of suitable habitat, burning/thinning operations should be timed to avoid breeding seasons and known nesting areas. Areas of suitable habitat should also be patchily treated over a number of years to avoid temporarily damaging foraging habitat in a given timeframe. Alternatively, activities under Alternative 3 may positively affect this species if shrubs and other woody species are reduced.

The Mountain Plover (state candidate species) is a plover known to breed in plains and shortgrass prairie habitats with minimal shrubby vegetation. This species does migrate and nest in short- grass prairies, grasslands and pastures within the Valley, but has not been documented in the planning area to date. Activities under Alternative 3 may positively affect this species if shrubs and other woody species are reduced. Impacts are anticipated to be negligible to minor and short- term.

The Long- billed Curlew (state candidate species) occurs within the planning area, inhabiting the grasslands and wetlands along the valley floor. Impacts under Alternative 3 would be negligible to minor with short term effects. In areas of suitable habitat, burning/thinning operations should be timed to avoid breeding seasons and known nesting areas. Areas of suitable habitat should also be patchily treated over a number of years to avoid temporarily damaging large swaths of foraging habitat in a given timeframe. Activities under Alternative 2 may positively affect this species if shrubs and other woody species are reduced.

**Mammals**. The Canada lynx (federal threatened species and state endangered species) occurs primarily in high elevation, boreal forest types containing spruce (*Picea pungens*) and subalpine fir (*Abies lasiocarpa*) within the United States, Canada, and locally, within the Southern Rocky Mountains. Canada lynx prefer a forested habitat with dense forest canopy and large amounts of woody debris on the forest floor, which are used as den sites. Impacts to Canada lynx under Alternative 3 would likely be negligible to minor and short- term because little to no fuels treatments would occur in potential lynx habitat under this alternative. Wildland fire use for resource benefit (WFURB) may occur within potential Canada lynx habitat under Alternative 3. Impacts caused by WFURB would likely be negligible to minor and short- term. Effects caused by WFURB may include reducing forest canopy cover and removal of den sites. However, fire may also increase herbaceous cover in some areas, which would benefit the lynx's main prey, snowshoe hare. In addition, because of the long fire return interval (100's of years) within spruce- fir forests and the patchy nature of this forest type caused by climatic and edaphic factors, any impacts caused by WFURB are likely to be limited in extent both spatially and temporally.

In Section 7 terms, it is anticipated that actions under Alternative 3 "may affect", but "is not likely to adversely affect" Canada lynx or their habitat. Little to no fuels treatments will occur in Canada lynx habitat (i.e. spruce- fir forest). As a conservation measure under ESA, surveys will be conducted for Canada lynx prior to the implementation of any fuels treatment projects within or adjacent to Canada lynx habitat. Impacts caused by WFURB would be minimized through consultation with U.S. Fish and Wildlife Service, Ecological Services, and by considering Canada lynx habitat when determining the appropriate management response (AMR) during a wildfire. Overall, efforts will be made to improve Canada lynx habitat to the extent possible under the fire management program. This will be done by allowing natural wildfires to occur under appropriate conditions within lynx habitat, which will provide suitable habitat for snowshoe hare, the lynx main prey.

The wolverine (state endangered species) is a mammalian species of densely forested habitats in higher elevations of Colorado. However, on- going mammalian surveys by Ernest Valdez of the US Geological Survey (Albuquerque, New Mexico office) have not recorded any occurrences of this species in the planning area. Furthermore, it is unlikely that the wolverine would be found in the target area (E. Valdez, pers. com.). Therefore, it is unlikely that any consequence of Alternative 3 would affect this species' viability.

**Herpetiles.** The boreal toad (federal candidate species and state endangered species) occupies high elevation marshes, wet meadows, and along the edges of beaver ponds, streams, and subalpine lakes in Colorado (Hammerson 1986). However, Hammerson (1986) states that this species is apparently absent from the Wet Mountains, Sangre de Cristo Range, and the Pikes Peak region. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the US Geological Survey in 2001 and 2002 at Great Sand Dunes did not record this species from the high elevation areas of the Sangre de Cristos. Therefore, it is unlikely that any consequence of Alternative 3 would affect this species' viability. Because this species is not present within the planning area, there will be "no effect" to this species or its habitat in Section 7 terms.

The northern leopard frog (state candidate species) inhabits shallow portions of both permanent and temporary water sources including marshes, ponds lakes, reservoirs, beaver ponds, streamsides, and sub- irrigated meadows (Hammerson 1986). Although this species was formerly known to inhabit that interdunal ponds and wetlands of the western edges of the sandsheet at Great Sand Dunes, no individuals have been reported or encountered since the late 1960s. However, this species has been reported to occur at Weisman Lake. Impacts would likely be negligible to minor and short- term for this species under Alternative 3.

The midget faded rattlesnake (state candidate species) is a midget rattlesnake subspecies of the western rattlesnake (*Crotalus viridis*) (Hammerson 1986). This species is known to occupy suitable habit in western Colorado, but is not known to be present within the planning area. Inventories at Great Sand Dunes National Monument and Preserve undertaken by Muths and Street (2002) of the US Geological Survey in 2001 and 2002 at Great Sand Dunes did not record this species from this area. Therefore, it is unlikely that any consequence of Alternative 3 would affect this species' viability.

**Plants.** Smith whitlow- grass is a Forest Service sensitive species that is known to occur in at least three areas within the planning area. Because this species is narrowly restricted to small areas of suitable habitat, areas of occurrence of this species should be well- known prior to any thinning operations or prescribed burns. However, because this species is found in locations where little to no fuels treatments would occur (i.e. cliffs and canyons, talus slopes, crevices, and between rocks in shaded, protected sites in upper montane and lower subalpine areas), fuels treatment activities should have no to negligible effects on this species. Nevertheless, mechanical thinning operations, crews and equipment should avoid known areas of occurrence. For prescribed fire operations, crews should be advised of species locations to avoid utilizing equipment that could disturb the soil in these areas.

## Cumulative Impacts

Cumulative impacts under Alternative 3 include the incremental impacts of past management practices, including fire suppression actions, added to existing and potential future fire management activities throughout the planning area and on adjacent and nearby lands, as well as other planned projects. Cumulative impacts resulting from incremental past, present, and reasonably foreseeable future fire management activities, combined with other administrative and maintenance actions in the planning area would result in short- term, minor, adverse impacts to species of management concern, assuming mitigation is used and fuel treatment activities occur in appropriate seasons to minimize impacts on breeding animals. Implementation of Alternative 3 would result in beneficial impacts to wildlife, especially as habitat improves with fire and non- fire treatments. Human activity in wildlife habitat, such as hiking or horseback- riding, would result in short- term disturbance of certain species. Long-term cumulative impacts include potential habitat fragmentation and development and inappropriate water management on lands surrounding the planning area.

Also important, timing of operations should carefully consider periods when the activities of native, but destructive forest pest insects are high. Examples of these would be mountain pine beetle (*Dendroctonus ponderosae*, among other *Dendroctonus* species), piñon ips (*Ips pini*), and other species that are often attracted by the chemistries of mechanically-injured trees and fire-damaged trees (terpenes). Because these insects are most active during June-August for breeding, and in late-October for overwintering, activities, especially mechanical treatments which damage trees, should be avoided during these periods.

## Conclusion

Overall, impacts of Alternative 3 would result in negligible to minor and short-term adverse impacts to the species listed above, if the spatial occurrence of operations and the timing are planned carefully.

Alternative 3 would not produce any major adverse impacts on threatened, endangered, or candidate species or their designated critical habitat whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano-Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of threatened, endangered, or candidate species or their designated critical habitat as a result of implementation of Alternative 3.

# WILDLIFE AND WILDLIFE HABITAT

## Affected Environment

A wide variety of wildlife species utilize the various habitats available throughout the planning area. Species lists of fauna within the planning area are primarily limited to checklists, inventories, and descriptive studies that have been completed in accessible areas found within the Great Sand Dunes National Park and Preserve and supplemented by information from The Nature Conservancy's Medano-Zapata Ranch. Approximately 61 native species of mammals, 168 species of birds, 6 species of fish, 13 species of reptiles and amphibians, and 986 species of insects are known or thought to inhabit Great Sand Dunes National Park and Preserve. These species presumably occur within other portions of the planning area that have similar habitat types including sections of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and

Medano- Zapata Ranch. Additional species may also occur in areas that have not yet been surveyed and within the surrounding landscape.

Large mammal population, density, and carrying capacity studies are currently being conducted in the planning area. A checklist of mammals within the Great Sand Dunes National Monument and Preserve and the surrounding area has been prepared and provides background information about each species (Armstrong 2002). Limited population and distribution observations of deer, elk, pronghorn, and bighorn sheep on habitat surrounding the Park are performed annually by the Colorado Division of Wildlife. Small mammal surveys in Great Sand Dunes National Monument and Preserve have also been conducted (Valdez 2003). A species list of mammals found or potentially found within the planning area is in Appendix C.

Historically, wild bison (*Bos bison bison*) occurred in the San Luis Valley, at least seasonally. The Nature Conservancy currently manages a herd of bison on the Medano (north) portion of their property. In fall 2003, the herd consisted of at least 946 females and 585 males for a total of 1531 individuals (T. Bragg, ranch manager, pers. com. June 21, 2004). The goal of The Nature Conservancy is to manage the herd to the extent possible as a natural herd. Some characteristics of a natural herd include the ability to roam freely, a relatively equal ratio of males and females, and a natural age distribution. The herd is rounded up annually for counts, vaccinations, and harvest of surplus animals.

More than 200 species of songbirds, raptors, waterfowl, shorebirds, and other waterbirds use the planning area to meet migrating, breeding, foraging, and wintering needs (Appendix C). This array of species has a variety of specific habitat requirements, which are provided in the planning area. For several species, the planning area is one of the only places in the Valley where their habitat requirements are met. The Valley in general is important to many bird populations, and the planning area specifically supports avian species and populations that have been identified as important on local, state, and national levels. These include long- billed curlews, dabbling ducks, mountain plovers, riparian- obligate songbirds, and white- faced ibis. Additionally many avian species require wetland and upland habitats that are primarily located within the planning area. A number of bird species occurring within the planning area are protected under the Migratory Bird Treaty Act, as amended (MBTA). MBTA prohibits the collection, possession, transfer, or take of any migratory bird.

An extensive survey of insect fauna was conducted in the 1970's, consisting primarily of inventories, but not distribution. Six endemic insects are known from the Greater Sand Dunes area. Many of the endemic insects live in the vegetated portions of the active dunes or at the junction of this region and the stabilized sand sheet. Pineda (2002) conducted a more recent survey of the insects within the Monument. This species list is found in Appendix C.

The planning area contains habitats that support a wide variety of reptile and amphibian species (Appendix C). These species are an important contribution to the Valley, which in general is arid. As a large block of land with various wetland habitats and various hydrologic and vegetation conditions, the planning area will be a key area for the support of many amphibian and reptile species, and perhaps the recovery of the rare, but endemic, Northern leopard frog (*Rana pipiens*).

A number of fish species occur within the planning area. These include a variety of native species, a number of which have been reintroduced within the planning area. The reintroduced species are the Rio Grande chub (*Gila pandora*), Rio Grande sucker (*Catostomus plebeius*), and Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*). Additionally, Sand Creek contains non- native species, including brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and rainbow trout (*Oncorhynchus mykiss*).

## Methodology

The impact threshold definitions for wildlife and wildlife habitat shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

## IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

## Impact Analysis

Under Alternative 1, all wildland fires would be suppressed and no fuels management activities would occur. Impacts to wildlife and wildlife habitat would depend on a variety of variables, including vegetation type, condition of the habitat, and climatic conditions where suppression activities occur. Many of the ecological systems as well as the wildlife in the planning area are fire adapted. Fire suppression will not change the nature of fire within the majority of the ecological systems of the planning area, and therefore, will have negligible to minor impacts on wildlife.

However, fire suppression and associated activities could have minor impacts on wildlife habitat if fire lines were placed in sensitive areas or equipment and people were to bring non- native, invasive species into the area. Non- native, invasive species, if left unchecked, can have an impact on wildlife habitat quality. In addition, noise from fire suppression activities may also impact wildlife.

## Cumulative Effects

The forested areas of the planning area have fire return intervals from 90 to 500 years, while many of the unforested areas such as the wet meadows may also have long fire return intervals. With such long fire return intervals it would take several hundred years of successful fire suppression to have a major impact on stand structure. Even then, the types of fires that might occur (i.e. high intensity, stand replacing) are similar to the type of fire expected without fire suppression. Vegetation within other plant communities found within the planning area (i.e. grasslands and shrublands) also are not likely to be effected by fire suppression because of the stand replacing nature of fires within these systems. Cumulative effects to wildlife and wildlife habitats from fire suppression would primarily result from impacts to sensitive habitats and the introduction of non-native, invasive species. Other activities within and surrounding the planning area such as fire management on adjacent lands, recreational use, water management projects, and grazing may also influence the vegetation within the planning area, and therefore influence the type of wildlife present. Overall, cumulative effects would be negligible to minor and short- term depending upon the location, intensity, and extent of any suppression efforts.

## Conclusion

The ecological systems within the Greater Sand Dunes planning area are thought to be within their range of natural variability for fire because most have relatively long fire return intervals. Fire suppression would have a negligible to minor impact on these systems and therefore, the wildlife that inhabit them. Suppression activities such as construction of fire lines within sensitive habitats and any non- native, invasive species introductions could have a minor impact depending upon the location of the fire line and the nature of the non- native, invasive species that was introduced. Noise from fire suppression activities may also impact wildlife. Implementation of Alternative 1 would result in negligible to minor and short- term impacts to wildlife and wildlife habitat.

Alternative 1 would not produce any major adverse impacts on wildlife or wildlife habitat whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of wildlife or wildlife habitat as a result of implementation of Alternative 1.

## IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

### Impact Analysis

Under Alternative 2, fuels management activities within select locations within the Mosca, Herard, and Baca- Dune FMU's would be allowed which would have the effect of reducing risks associated with hazardous fuel accumulations. In addition, this alternative would allow prescribed burning for habitat management. The impacts described under Alternative 1 for suppression activities would also apply for this alternative.

Impacts to wildlife and wildlife habitat caused by fuels management activities would depend on a variety of variables, including vegetation type, condition of the habitat, and climatic conditions. These activities would only be conducted with clear outcomes and monitoring in place to ensure that goals are met. Overall, the impacts of fuel management activities would be negligible to minor and short- term.

Mechanical and manual fuel treatments would have the effect of removing certain plant species or parts of plants (i.e. limbs), while reducing the potential for intense wildfires and opening up habitat for other species. Fuels management activities would be utilized with care within sensitive habitats and during breeding seasons to limit impacts to wildlife species. These treatments, however, would be used on a limited basis throughout the planning area, and therefore, are not expected to have a large effect on wildlife species.

Prescribed burning operations would have an immediate effect on wildlife and wildlife habitats by removing plant material, exposing the soil, stimulating growth of some plants, and killing or reducing the vigor of some plants. Some direct mortality of some sedentary animal species could occur during prescribed fires. However, prescribed burning can also enhance the cycling of nutrients by converting surface mulch and plant litter to ash and by making many nutrients soluble and available for plant growth. Fire encourages new growth of many plant species, such as grasses and forbs, which, in time, provides nesting sites for ground nesting sparrows and other wildlife species. Fire can also be used to alter plant species composition. Burning can be used to clear the landscape of excess plant residual and, when used in conjunction with other management tools, to negatively impact noxious weeds or plant species that dominate certain habitats to the extent that habitat quality is compromised. The ability to alter plant species composition and abundance can provide a variety of habitat conditions which better meets the resource needs of wildlife species. These impacts would mostly be minor, short term, and beneficial. Impacts may include short term wildlife displacement to other adjacent habitats. Active habitat management with prescribed fire activities will also improve wildlife habitat, populations, and species diversity.

## Cumulative Effects

Cumulative effects from fire suppression and associated activities would be similar to those described under Alternative 1. Cumulative effects to wildlife and wildlife habitats from fuels management activities associated with Alternative 2 are likely to be minor and short- term and potentially beneficial. There is always the possibility that prescribed fires could escape and result in significant immediate habitat loss. However, well planned and conducted fuel reduction, habitat management or restoration activities, whether completed by prescribed fire or manual and mechanical means, will result only in short- term impacts with no long- term and adverse cumulative effects.

## Conclusion

Implementation of Alternative 2 would result in negligible to minor and short- term adverse effects on wildlife and wildlife habitats directly associated with fire suppression and ongoing prescribed fire or manual and mechanical fuel treatment projects.

Alternative 2 would not produce any major adverse impacts on wildlife or wildlife habitat whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of wildlife or wildlife habitat as a result of implementation of Alternative 2.

# IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

## Impact Analysis

In addition to fire suppression and fuels management activities, Alternative 3, the preferred alternative, allows for wildland fire use within the Mosca and Herard FMU's. Under Alternative 3, fuels management activities and fire suppression would be similar to those of Alternative 2. Wildland fire use impacts would be beneficial overall to the ecological systems in the Greater Sand Dunes area, and therefore, is expected to be beneficial to the majority of wildlife species in the long- term. Impacts to wildlife and wildlife habitats caused by wildland fire use are likely to minor and short- term.

## Cumulative Effects

Cumulative effects to wildlife and wildlife habitats would be expected to be similar to those described in Alternative 2 above.

## Conclusion

Implementation of Alternative 3 would result in negligible to minor and short- term adverse effects on wildlife and wildlife habitats directly associated with fire suppression, prescribed fire or manual and mechanical fuels treatments, and wildland fire use.

Alternative 3 would not produce any major adverse impacts on wildlife or wildlife habitat whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of wildlife or wildlife habitat as a result of implementation of Alternative 3.

# NON- NATIVE, INVASIVE SPECIES

## Affected Environment

Non- native, invasive species are plant and animal species, which may be found in the planning area, but are not native to a particular area (i.e. species that have spread to areas formally uninhabited by that species). These species have a competitive advantage for nutrients, water, and/or sunlight when compared to native species. Non- native, invasive species threaten biodiversity and the stability of ecological systems (Lodge and Shrader- Frechette 2003, Van Driesche and Van Driesche 2000, U.S. Congress 1993). Many of these species can alter ecological processes such as the fire regime. In addition, fire can be used as a tool to control certain non- native species and can be an important part of integrated pest management.

A number of non- native, invasive plant species occur within the planning areas in various habitats, elevations, and with varying degrees of infestation. As of 2004, a noxious weed survey was underway by staff from Montana State University to map the occurrence and extent of such species within the boundaries of Great Sand Dunes National Monument and Preserve. In addition, TNC annually surveys and maps non-native species throughout the Medano- Zapata Ranch (TNC 2002, 2000). The most prevalent species occurring at the present time are Canada thistle *(Cirsium arvense)*, leafy spurge (*Euphorbia esula*), hoary cress (*Cardaria draba*), perennial pepperweed (*Lepidium latifolium*), Russian knapweed (*Centaurea repens*), Russian thistle (*Salsola* spp.) and cheatgrass (*Bromus tectorum*) (Shana Wood, Montana State University, pers. com). Although some areas of infestation are somewhat large (~ 40 acres), current management activities are somewhat successful in controlling the spread of the species, although not all activities are successfully reducing the area of the species.

Each of the non- native plant species found on the site has a unique response to fire. Canada thistle has an extensive perennial root system that allows it to survive even intense fires, resprouting from below- ground structures. In addition, Canada thistle is known to spread rapidly by seed into recently burned areas. Populations of Canada thistle frequently increase, but may also decrease after fire, depending on a range of factors, including the prefire plant community, site conditions such as topography and soil moisture, the season of burn, and the frequency and severity of fires on the site (Zouhar 2001a).

Leafy spurge is typically top- killed by fire, but can resprout from roots, rhizomes, and root crown (Simonin 2000). In addition, this species contains oils in its leaves, which increase the amount of heat released when burned. Fire may increase the density of leafy spurge by stimulating otherwise dormant buds.

Perennial pepperweed also has the potential to survive fire by resprouting, or to invade burned areas through seed. The effects of fire on perennial pepperweed can also vary (Esser 1994). Hoary cress is thought to resprout from its roots after fire, as well as establishing from buried seed and newly arrived seed after fire. Hoary cress is believed to benefit from fire, just as it benefits from other disturbances that reduce competition from native species (Esser 1994).

The response of Russian knapweed to fire is essentially unknown, although it also has the ability to sprout from its perennial root system, and thus is likely to survive at least low intensity fires (Zouhar 2001b).

Russian- thistle is probably killed by fire, but it colonizes or recolonizes burned areas quickly through seed carried from nearby populations by abscised, tumbling plants (Howard 1992). Since Russian- thistle thrives in disturbed areas, it can dominate newly burned areas for several years after a fire. Russian- thistle can aid in spreading fire in several ways. The arrangement of stems and leaves on the plant makes it highly flammable, and dead, dry plants tend to retain their shape, increasing fuel loading. Also, tumbling plants blowing from a fire across unburned areas can spread the fire over great distances quickly (Howard 1992).

Cheatgrass is a disturbance prone species that is adapted to frequent fires and may invade recently burned site (Zouhar 2003). In fact, the presence of cheatgrass typically increases the likelihood of fire, while the increased fire frequency may give cheatgrass a competitive advantage over other native species (Zouhar 2003). Once established, this species develops a large seed bank, which then can germinate following a fire.

Currently, neither NPS nor FWS has specific species control plans or integrated pest management (IPM) plans for their respective properties. However, NPS does currently use mechanical, cultural, chemical, and biological means to control weeds, depending on a number of factors such as species biology, the site, and the weather (P. Bovin pers. com.). To determine the species biology and specific control measures, the Park will reference such sources as "Biology and Management of Noxious Rangeland Weeds" (Sheley and Petroff 1999) or other NPS resource managers. TNC uses an integrated pest management plan to control non- native species throughout the Medano- Zapata Ranch (TNC 2002, 2000).

To use certain methods of control, such as chemical or biological, the Park and Refuge must have a "pesticide- use proposal" approved by their respective agencies. In addition, each agency must record and report methods, amounts of chemical or biological control utilized, and location of use. The Department of Interior's *Department Manual*, Section 517, Environmental Quality, Chapter 1, prescribes the Department's policies for the use of pesticides on the lands and waters under its jurisdiction and for compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended.

The Nature Conservancy has standard operating procedures for the removal of plants and animals, including non- native species, and the use of non- indigenous biocontrols on their preserves (TNC 2004).

As fire management actions are planned, a revegetation and rehabilitation plan will be developed. This will help prevent the invasion and spread of non- native, invasive species. As a first step, a seed bank of native seed should be collected for the area. This seed bank should emphasize native early- seral species that would normally colonize disturbed areas, as well as native perennial grasses and forbs. The seed bank would require cooperation with the various agencies to establish such a seed bank. In the event that an agency can only use species native to the area (e.g. National Park Service), a cooperative project needs to be undertaken by multiple agencies to produce viable seed or propagules for revegetation purposes using vegetative material from the site. Further, as fire management activities are carried out, it is essential that all equipment entering the area be thoroughly cleaned of mud, soils, etc., to reduce the possibility of non-native, invasive species seeds being carried incidentally into the planning area.

## Methodology

The impact threshold definitions for non- native, invasive species shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

# IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

## Impact Analysis

Under Alternative 1, all fires would be suppressed and no fuels management activities would occur. If all fires are successfully suppressed, the number and size of non- native, invasive species would not be expected to increase greatly for most species. One species, however, may continue to spread without intensive management actions. The biology of leafy spurge is such that it can successfully invade areas that are not obviously disturbed, although it does favor sites that are disturbed during periods of initial establishment, i.e., ground disturbance. In addition, in the event of a major wildland fire, the result could be increased areas of infestation by noxious weeds, such as Russian knapweed, cheatgrass, and Canada thistle, as was seen following the 2001 fire that swept through the monument.

Suppression activities by mechanical and other means (i.e. use of motorized or manual equipment) may have the potential to increase the routes through which non- native species can spread, such as ground disturbance, fire lines, carriage of seeds on boots, tires and other equipment. The wildland- urban interface also has a higher potential for invasive species, which are either accidentally or purposefully introduced to the planning area by anthropogenic means, but would not be controlled under Alternative 1. Further, post- fire remediation activities often include the introduction of stabilizing vegetation that is not necessarily native to the area.

The majority of the non- native invasive species found on the site are not expected to spread uncontrollably should all fires be successfully suppressed, although the seeds of such species are probably established throughout the area within the seed bank. Therefore, in the event of a large and intense wildfire, the result would be large areas of infestation by noxious weeds, such as Russian knapweed, cheatgrass, and Canada thistle, as is evidenced by the fire that swept through the monument in 2001. Overall, Alternative 1 is expected to have a negligible to minor effect on non- native, invasive species with potential short- term effects.

## Cumulative Effects

Cumulative effects of the impact of noxious invasive weeds is compounded by the impacts of recreational activities, vehicular activities, ground disturbance for utility lines and other civil engineering activities. The cumulative effects of fire suppression on invasive weed species should be minimal since suppression activities generally occur in different areas over time. The exception to this might be travel corridors, such as the entry road into the Great Sand Dunes National Park. The potential for weeds to be transported can be minimized by requiring vehicles and other equipment to be cleaned before entering into the planning area.

## Conclusion

Under Alternative 1, should all fires be successfully suppressed, it is not expected that the intensity of infestation for most non- native, invasive species would be altered and would only have a negligible to minor effect. Suppression activities, especially those that disturb the soil, have the potential to provide entry points for weed invasions. This potential can be minimized by requiring equipment to be cleaned before entering the planning area.

# IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

## Impact Analysis

Under Alternative 2, fuels management activities would be allowed throughout the planning area, which would have the effect of reducing risks associated with hazardous fuel accumulations and provide a means to manage for desired vegetation types including controlling non- native, invasive species. Management actions would be ongoing and may successfully reduce or eliminate the chances of an uncharacteristically intense wildland fire and/or the spread of non- native, invasive species. Fire suppression activities under Alternative 2 would have the same effects as those reported under Alternative 1.

Under Alternative 2, thinning activities and prescribed fire activities would both directly and indirectly affect the degree of invasion by non- native, invasive species. A potential direct impact would be the removal of native vegetation that in its present state (i.e. the ground has not been disturbed or cleared by fire) suppresses the growth of undesirable non- native, invasive species either by competition for water and nutrients or by providing overstory that shades sun- loving non- native vegetation. In these instances, the non- native species may gain a competitive advantage, at least in the short- term, if the native vegetation is removed. Indirect impacts would be the potential for non-native, invasive species to become established because of the activities of crews and machinery in an area (e.g. carriage of invasive weed seeds on equipment or footwear) or by disturbing the ground where equipment is mobilized for fuel management activities. These direct and indirect effects, however, could be offset by any fuel management activity (e.g. prescribed burn) that is utilized to reduce or eliminate a non- native species. Prescribed burning and other fuels treatment are expected to be an important part of an integrated weed management program across the planning area. Some infestations of non- native, invasive species can be reduced through prescribed burning and mechanical treatments. Overall, Alternative 2 would have minor to moderate effects that may be either short- term or long- term in duration depending on the intensity of infestation.

## Cumulative Effects

Besides the cumulative effects of recreational and other anthropogenic activities and of continual fire suppression mentioned under Alternative 1, the cumulative effects of non- native, invasive species would likely increase slightly under Alternative 2. These effects include recurring impacts that may occur due to fuel management activities such as removal of native vegetation, which serves to suppress the non- native, invasive species in the area, or carriage of non- native, invasive species seeds into a site via boots, crews, and/or mechanical equipment, as well as continuous ground disturbances of mobilizing equipment. Overall, these impacts would be minor to moderate with short- to long- term effects possible.

## Conclusion

Alternative 2 would have minor to moderate impacts that potentially could have short-term or long- term effects. These effects would primarily be caused by various fuels management activities. However, beneficial effects could also be experienced under Alternative 2 if fuel management activities are used to reduce or eliminate non- native, invasive species.

As thinning activities and prescribed fires are planned, it is crucial that a revegetation and rehabilitation plan that minimizes the spread of non- native, invasive species be put into place before such activities are carried out. As a first step, a seed bank of native seed (i.e. weed free) should be collected for the area. This seed bank should emphasize native early- seral species that would normally colonize disturbed areas, as well as native perennial grasses and forbs. The seed bank would require cooperation with the various agencies to establish such a seed bank. In the event that an agency can only use species native to the area (e.g. National Park Service), a cooperative project needs to be undertaken by multiple agencies to produce viable seed or propagules for revegetation purposes using vegetative material from the site. Further, as thinning activities and prescribed fire activities are undertaken, it is essential that all equipment entering the area be thoroughly cleaned of mud, soils, etc., to reduce the possibility of non- native, invasive species seeds being carried incidentally into the planning area. In addition, prescribed burning and mechanical and manual fuel treatments should be an important part of an integrated weed management program across the planning area.

## IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

### Impact Analysis

Under Alternative 3, the preferred alternative, fuels management activities would be similar to and have similar effects as Alternative 2. Wildland fire use would also be allowed under certain predetermine guidelines within the Mosca and Herard FMU's. Wildland fire use fires would have similar effects as prescribed fire in that the potential for certain non- native, invasive species to increase and/or invade a site is possible. These effects would be negligible to moderate and either short- term or long- term depending on the location of the fire, the severity and intensity of the fire, and whether the seeds or propagules of non- native, invasive species are within the seed bank or in the vicinity of the fire.

### Cumulative Effects

The cumulative effects of non- native, invasive species impacts under Alternative 3 would be similar to those under Alternative 2. Numerous wildland fire use fires through time or across the landscape may increase the potential for invasion of non- native, invasive species. The overall cumulative effect would be minor to moderate and short- to long- term in duration.

### Conclusion

Alternative 3 would result in negligible to moderate impacts for non- native, invasive species with short- to long- term effects depending on the severity of the infestation. Wildland fire use fires may increase the spread of non- native, invasive species depending on the severity and intensity of the fire and the nearest seed source of invasive species.

As thinning activities and prescribed fires are planned, it is crucial that a revegetation and rehabilitation plan that minimizes the spread of weeds be put into place before such activities are carried out. As a first step, a seed bank of native seed (i.e. weed free) should be collected for the area. This seed bank should emphasize native early- seral species that would normally colonize disturbed areas, as well as native perennial grasses and forbs. The seed bank would require cooperation with the various agencies to establish such a seed bank. In the event that an agency can only use species native to the area (e.g. National Park Service), a cooperative project needs to be undertaken by multiple agencies to produce viable seed or propagules for revegetation purposes using vegetative material from the site. Further, as thinning activities, prescribed fire, and wildland fire use activities are undertaken, it is essential that all equipment entering the area be thoroughly cleaned of mud, soils, etc., to reduce the possibility of non- native, invasive species seeds being carried incidentally into the planning area. In addition, prescribed burning and mechanical and manual fuel treatments should be an important part of an integrated weed management program across the planning area.

## WILDERNESS

## Affected Environment

With the signing of the Wilderness Act of 1964, the National Wilderness Preservation System was established to "...secure for the American people of present and future generations the benefits of an enduring resource of wilderness." The Wilderness Act states that "In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness." Although there is great similarity between the NPS Organic Act and the Wilderness Act, Congress applied the Wilderness Act to NPS to strengthen its protective capabilities. The NPS *2001 Management Policies*, §6 states, "The National Park Service will evaluate all lands it administers for their suitability for inclusion within the national wilderness preservation system. For those lands that possess wilderness characteristics, no action that would diminish their wilderness suitability will be taken until after Congress and the President have taken final action. The superintendent of each park containing wilderness will develop and maintain a wilderness management plan to guide the preservation, management, and use of the park's wilderness area, and ensure that wilderness is unimpaired for future use and enjoyment as wilderness." Therefore, all wilderness categories, including suitable, study, proposed, recommended, and designated shall be treated as wilderness.

The "minimum requirement" concept and "minimum tool" and "primitive tool" procedures, as specified in the Wilderness Act (1964), NPS Management Policies (NPS 2001), NPS Reference Manual #41, and "Minimum Requirement Decision Guide" (ACNWTC 2004), will be applied for all fire management activities within designated and recommended wilderness areas. In addition, fire management actions, including prescribed fire, wildland fire use, and wildland fire suppression, will conform to the basic purposes of wilderness. All wildland fires within designated and recommended wilderness boundaries, whether suppression actions or fire use actions, will be effectively managed considering resource values while providing for public and fire personnel safety using the full range of strategic and tactical options. Initial attack actions within designated or recommended wilderness areas would be conducted using minimum impact suppression tactics. Strategies and tactics will be selected commensurate with potential fire behavior and values to be protected, as well as to minimize long- term environmental impacts.

The Great Sand Dunes National Park and Preserve currently has 32,643 acres of designated wilderness area within the former monument boundaries. Within the preserve, the Sangre de Cristo Wilderness accounts for another 40,512 acres. Therefore, the total area of designated wilderness within the monument and preserve is 73,155 acres. Areas that are currently classified as potential wilderness include 2,363 acres, which include various parcels including areas along Sand Creek. These areas of potential wilderness, however, will be administratively converted to designated wilderness soon after the closing of the Baca property (J. Bowman, chief ranger, NPS, pers. com., May 17, 2004). Currently, the National Park Service does not have a final figure for the acreage that will be declared suitable for wilderness in the new expansion area. In addition, neither the Baca National Wildlife Refuge nor the Medano- Zapata Ranch contains wilderness areas. Currently, there are no plans to designate any part of the Refuge as wilderness (B. DeVries, refuge operations specialist FWS, pers. com. June 23, 2004).

In addition, NPS 2000 *Management Policies* (2001) direct parks to preserve and protect, to the greatest extent possible, the natural soundscapes and to restore degraded soundscapes to the natural condition wherever possible. Using appropriate management planning, superintendents are to identify what levels of human- caused sound can be accepted within the management purposes of parks. The frequency, magnitude, and duration of human- caused sound considered acceptable will vary throughout the park, being generally greater in developed areas and generally lesser in undeveloped areas. In and adjacent to parks, the NPS staff are to monitor human activities that generate noise that adversely affects park soundscapes, including noise caused by mechanical or electronic devices. The National Park Service is to take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored.

Due to the planning area's relative isolation from major urban centers and major roads and highways, human- caused sounds within the majority of the site are nonexistent or relatively minor. However, near roads and other developed areas, the level of human-caused sounds increases.

## Methodology

The impact threshold definitions for wilderness shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

## IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

### Impact Analysis

Under Alternative 1, all wildland fires must be suppressed including those in wilderness areas. Suppression actions taken under this alternative may vary from active and aggressive suppression to confine and contain strategies if it is determined that the risks associated with active suppression are too great considering resource values at risk. Even under confine and contain strategies, monitoring costs would be high because more intensive monitoring practices must be employed within wilderness.

Direct and indirect impacts caused by suppression activities would include damage to wilderness characteristics as put forward in the Wilderness Act of 1964 (e.g. vegetation, wildlife, and natural quiet). These impacts would be caused by such activities as construction of fire lines and in certain circumstances, approved use of machinery or other mechanical devices such as aircraft and chainsaws may be used to complete suppression actions. Suppression of fires also affects wilderness characteristics by purposely removing a natural process from the landscape, which has created and maintains many of the wilderness characteristics.

Rehabilitation actions taken after a fire has been suppressed may also have the direct or indirect effect of altering the character of the wilderness by increasing noise levels during rehabilitation work and change the character of the site with some rehabilitation measures. Fire suppression within wilderness also poses a higher risk to the safety of firefighters engaged in suppression because of potential limitations on the kinds of suppression techniques used, the hazardous terrain within these areas, and all other risks personnel may be exposed to during a wildfire. Overall, direct and indirect effects under Alternative 1 would be minor to moderate due to the changes in wilderness character that can occur during suppression and rehabilitation activities with effects being mainly short- term.

### Cumulative Effects

Cumulative effects of Alternative 1 within wilderness areas may cause minor to moderate effects to the wilderness resource that are short- to long- term in nature due to the additive effects of suppressing fires (i.e. alteration of the wilderness characteristics of a site). Fire suppression over the long- term eliminates the natural and historic role of fire within the ecological systems in which wilderness has been designated, and thus removes the normal processes that have created and maintain the wilderness characteristics. Some of the basic purposes of wilderness in this context may not be achieved. Other activities such as recreational use may also impact wilderness.

## Conclusion

Implementation of Alternative 1 would result in minor to moderate and generally short-term adverse effects during and immediately after suppression actions. Moderate and short- to long-term cumulative effects could occur as a result of not allowing fire to have its natural and historic role in the wilderness landscape.

Alternative 1 would not produce any major adverse impacts on wilderness resource or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano-Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of wilderness resources or values as a result of implementation of Alternative 1.

# IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

## Impact Analysis

Under Alternative 2, fuel management activities, as well as fire suppression, would be allowed. Fuel management activities would include prescribed fire and manual fuel treatments. Only non-motorized tools for thinning projects would be allowed in wilderness areas. Such activities, however, may not be feasible within a large portion of the wilderness area given the remote and rugged nature of much of the site.

Under this alternative, fuel management would help to confine large wildfires and lessen the potential for disruption or change of wilderness character associated with suppression actions. Impacts associated with fuel management activities would be expected to be minor and short-term and changes to wilderness character would be small and, if measurable, highly localized. Such impacts may include increased noise levels and visual distractions associated with fuel management activities within wilderness areas. However, under this alternative, all unplanned wildfires, regardless of cause of ignition, would have to be suppressed. In this case, adverse effects would be similar to those described under Alternative 1.

## Cumulative Effects

Long- term cumulative effects as described under Alternative 1 would be lessened under Alternative 2 due to fuels management activities, especially prescribed burning. Fuel management activities would seek to reduce fuel loads throughout the area, and therefore, reduce the risk associated with large, intense wildfires. Cumulative effects under Alternative 2 would be minor to moderate because some changes in wilderness character may occur during management activities and suppression actions with short to long- term effects possible depending on rehabilitation actions completed.

Of more importance is the fact that under Alternative 2 the natural and historic role of wildfire in the wilderness will not continue at an appropriate scale and natural processes will be interfered with because all naturally occurring fires will be suppressed. Thus, some of the basic purposes of wilderness in this context would not be achieved.

## Conclusion

Implementation of Alternative 2 would result in minor to moderate and generally short-term adverse effects during and immediately after suppression and/or fuels management actions. With fuel management activities, the cumulative effect to wilderness areas would be minor to moderate, with short- term to long- term effects possible. However, moderate and long- term cumulative effects could occur as a result of not allowing fire to have its natural and historic role in the wilderness landscape. Prescribed burning may minimize some of these impacts.

Alternative 2 would not produce any major adverse impacts on wilderness resource or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of wilderness resources or values as a result of implementation of Alternative 2.

# IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

## Impact Analysis

Under Alternative 3, the preferred alternative, a full range of management actions would be allowed including the addition of allowing for wildland fire use under certain predetermined conditions within the Mosca and Herard FMU's, which are both part of the wilderness of the planning area. Impacts to wilderness would be similar to those described under Alternative 2 above for both fuel management activities and fire suppression activities. Adverse impacts of wildland fire use would be expected to be negligible to minor and short- term (i.e. duration of the fire). In addition, allowing wildland fires to burn within wilderness areas would enhance and maintain many of the wilderness characteristics. Overall, fewer fires would need to be suppressed resulting in fewer direct impacts associated with suppression actions. Monitoring of wildland fire use fires would be less intensive and less expensive than expected under confine and contain suppression strategies.

### Cumulative Effects

Beneficial long- term impacts would result, particularly along the lines of maintaining and enhancing wilderness characteristics. Because fire in most instances would be allowed to have its natural and historic role within wilderness areas, the wilderness landscapes would be maintained. This alternative would also provide consistency with the Rio Grande and San Isabel National Forests regarding fire management in the adjacent Sangre De Cristo Wilderness Area.

### Conclusion

Implementation of Alternative 3 would result in minor to moderate and generally short-term adverse effects during and immediately after wildland fire use, fuels management actions, and/or suppression. Beneficial long- term impacts would result by allowing for wildland fire use to maintain wilderness character and the role of natural fire in the wilderness landscape. This alternative would also be consistent with adjacent Forest Service fire management in their portions of the Sangre De Cristo Wilderness Area.

Alternative 3 would not produce any major adverse impacts on wilderness resource or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, or Medano- Zapata Ranch, (2) key to the natural and cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of wilderness resources or values as a result of implementation of Alternative 3.

## CULTURAL RESOURCES

In this environmental assessment/assessment of effect, impacts to cultural resources are described in terms of type, context, duration, and intensity, which is consistent with the regulations of the Council on Environmental Quality (CEQ) that implement the

National Environmental Policy Act (NEPA). These impact analyses are intended, however, to comply with the requirements of both NEPA and §106 of the National Historic Preservation Act (NHPA). In accordance with the Advisory Council on Historic Preservation's regulations implementing §106 of the NHPA (36 CFR Part 800, Protection of Historic Properties), impacts to cultural resources were identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that were either listed in or eligible to be listed in the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources either listed in or eligible to be listed in the National Register; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the Advisory Council's regulations a determination of either adverse effect or no adverse effect must also be made for affected National Register eligible cultural resources. An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualify it for inclusion in the National Register (e.g. diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the preferred alternative that would occur later in time, be farther removed in distance or be cumulative (36 CFR Part 800.5, Assessment of Adverse Effects). A determination of no adverse effects means there is an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion in the National Register.

CEQ regulations and the National Park Service's *Conservation Planning, Environmental Impact Analysis and Decision- Making* (Director's Order #12) also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g. reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by §106 is similarly reduced.

A §106 summary is included in the impact analysis sections under the preferred alternative. The §106 summary is intended to meet the requirements of §106 and is an assessment of effect of the undertaking (implementation of the alternative) on cultural resources, based upon the criterion of effect and criteria of adverse effect found in the Advisory Council's regulations.

## Affected Environment

The project area for the currently proposed Greater Sand Dunes Interagency Fire Management Plan includes a diverse array of cultural resources which represent human use of the area for at least the past 10,000 years. Representative sites from the Paleoindian, Archaic, Late Prehistoric/Ceramic, Protohistoric, Historic American Indian, and Historic Euro- American periods have been recorded within the project area. For an overview of the cultural resources of the San Luis Valley, and a comprehensive culture history of the area, please refer to *Historical Context (Overview) of the Medano Ranch and Trujillo Homestead Sites, The Nature Conservancy, San Luis Valley Program, Colorado* (RMC Consultants 2004).

The proposed project area has been subjected to 18 cultural resource surveys for past projects. Approximately 32,320 acres have been surveyed for past projects; survey levels varied by project (Jones 2003; Mabry, Phillips, and Clark 1997; Perlman and Torres 1996; Phillips 1995; Foothills Engineering Consultants, Inc. 1993; Hass and Scheherazade 1981, 1982; Johnson 1984; Kyle 1981; Lewis 1996; Lutz et al 1977; Martorano 1994; Martorano et al 2003; Mehls 1988; Williams 1986, 1987, 1988; Zalucha 1976).

More than 747 sites within and adjacent to the proposed project area have been identified and recorded by past cultural resource surveys. Site types include open camps, artifact scatters (flaked lithics, ceramics, ground stone, fire cracked rock), hearths, burials, kill/jump sites, prehistoric and historic quarries, proto- historic and historic structures (wickiups, homesteads), historic features (mine adits/tailings, water conveyance systems, mill sites, landing strip, rock art, roads, railroad grades), and historic artifact scatters (glass, metal, wood, crockery, bricks, leather).

In order for a cultural resource to be eligible for the National Register of Historic Places it must meet one or more of the following criteria of significance: A) associated with events that have made a significant contribution to the broad pattern of our history; B) associated with the lives of persons significant in our past; C) embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction; D) have yielded, or may be likely to yield, information important in prehistory or history. In addition, the cultural resource must possess integrity of location, design, setting, material, workmanship, feeling, and/or association (*National Register Bulletin, Guidelines for Evaluation and Registering Archeological Properties)*.

Forty- eight sites within the project area are listed on or have been determined eligible for listing on the National Register of Historic Places. Eligible site types include kill sites with several time periods represented (paleoindian, archaic, late prehistoric), open camps, flaked lithic scatters, water conveyance systems, historic- era ranch complexes, quarry sites, culturally scarred trees, historic dumps, roads, and historic- era structures. Two- hundred and fifty- seven sites have been determined not eligible for inclusion on the National Register of Historic Places. The remaining sites have not been evaluated for National Register eligibility, but will be treated as eligible until evaluated otherwise.

**Archeological Resources.** The majority of archeological sites recorded within the project area are classified as open camp sites. Most of the open camp sites contain flaked lithic material (debitage, tools), and some combination of ground stone (manos, metates, hammerstones, shaft abrader), fire cracked rock, ceramics (Rio Grande, redware, plainware, greyware, cordmarked greyware), hearths, or animal bone/teeth. Flaked lithic material within the proposed project area includes Trout Creek chert, unclassified chert, jasper, flint, chalcedony, red flint, quartzite, basalt, rhyolite, siltstone, white agate, agate, Jemez obsidian, and unsourced obsidian. Groundstone material found within the proposed project area includes andesite, granite, sandstone, schist, and unclassified igneous and volcanic material.

Other aboriginal archeological site types within the proposed project area include burials, jump/kill site, prehistoric quarry sites, stone circles, rock cairns, wickiups, and culturally scarred trees. Material types found on these sites include bone, flaked stone tools and debitage, unmodified rocks, dead wood, and living and dead trees.

Euro-American archeological sites include ruined buildings, trash piles, mine adits/tailings, water conveyance systems, mill sites, landing strip, rock art, roads, and railroad grades. Material types found on these sites include wood, stone, clay, concrete, earth, glass, metal cans, bullet cartridges, bolts and nails, sheet metal, wire, bricks, buttons, leather, mule/horse shoes, coins, a Colorado license plate, iron pipe, and a natural rock face.

**Historic Structures.** The majority of historic structures are elements of historic-era homesteads. Building types include homes, bunkhouses, cook houses, barns, corrals, sheds, and miscellaneous structures. Material types found on these sites include, wood, brick, earth, sheet metal, concrete and stone. Most of the historic structures have some sort of trash pile or discard pile associated with them; trash piles can contain wood, metal, glass, crockery, brick, and leather.

**Cultural Landscapes**. Although no cultural landscapes have been inventoried within the proposed project area, several potential cultural landscapes are apparent. These include the stand of culturally modified trees in Great Sand Dunes National Park, the Medano, Trujillo, and Zapata Ranch complexes on The Nature Conservancy Land, and various viewsheds on National Park Service, U.S. Fish and Wildlife Service, and The Nature Conservancy lands.

The potential landscapes fall into the categories of vernacular, ethnographic, and historic, according to the NPS Cultural Landscapes Program (12/2002).

**Ethnographic Resources.** Both the Great Sand Dunes National Park and the U.S. Fish and Wildlife Service have documented ethnographic use of federal lands in the San Luis Valley. Examples of ethnographic resources and uses include but are not limited to culturally peeled ponderosa pine trees, collection of sand from the sand dunes for ceremonial uses, and viewsheds of surrounding mountains. To date, The Nature Conservancy has not documented ethnographic use on their property.

Consultation with local Native American tribes has been initiated by delivery of scoping information for this document to area tribes (see Chapter 4 for a list of tribes contacted) and interested groups. Subsequent consultation activities will include delivery of this EA/AEF to the same parties, and the analysis and discussion of comments received during public scoping for this EA/AEF.

## Methodology

The impact threshold definitions for cultural resources shown in Table 6 were used to assess the effects of each fire management alternative on these resources. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

Direct impacts to cultural resources from fire, suppression, and fuel reduction activities can be considered in two categories: effects from fire, and effects from suppression, rehabilitation, and fuel reduction.

Direct effects from fire include consumption, smoke damage, and heat damage. Some cultural materials are not prone to consumption (lithic material, ceramics, metal, glass) but may be damaged by smoke or heat, while other materials are readily consumed by fire (wood, paper/cardboard, linoleum, petroleum product). Some cultural resources, such as rock art, are particularly vulnerable to smoke damage. Table 9 is a general reference guide to temperatures at which certain classes of materials are affected by fire and/or heat.

Direct effects from suppression, rehabilitation, and fuel reduction activities include damage from heavy equipment and hand tools used to build fire containment line, and used in manual or mechanical fuel reduction projects. Indirect effects to cultural resources include increased resource visibility making the resource vulnerable to vandalism and/or more easily inventoried, and removal of vegetation resulting in increased erosion potential.

## IMPACTS OF ALTERNATIVE 1: NO ACTION ALTERNATIVE

## Impact Analysis

Under Alternative 1, all fires would be suppressed and no fuels management activities would occur.

**Archeological Resources and Historic Structures**. Wildfires could threaten and potentially destroy archeological resources and historic structures, particularly those

**Table 9. Summary Tables of Fire Effects to Cultural Resources including a. Direct Effects to Features and Artifacts and 2. Fire Effects to Cultural Landscapes, Traditional Cultural Properties; Fire Effects to Dating Techniques and Other Sources of Information Important for Study of Artifacts and Features (Oster 2002)**

**1. Direct Effects to Features and Artifacts**

| Material/Feature Type | Temperature Thresholds | Types of Changes |
|---|---|---|
| Stone (architectural, grinding) | 300°C | Discoloration, cracking, spalling, disintegration of stone. When fire- affected stone is part of a structure, feature walls may weaken/topple. |
| Stone (flaked) | 100°C for jasper<br>400- 500°C for chert<br>500°obsidian for (lower for OH) | As water "cooks out", stone becomes brittle, discolored, patinated, fractured, and may take on characteristics of intentional heat treatment. Stone artifacts may be smoke blackened. Obsidian may "puff", so that it looks like styrofoam. |
| Ceramics | 350°C—carbon paint burnout<br>500°C—oxidization, other color changes<br>600°C—destabilizes material | Effects include smoke- blackening, oxidization, fracturing. Firing signatures may be lost, reducing potential for some kinds of technological studies. Discoloration and blackening may reduce /eliminate possibility that the ceramics can be "typed". |
| Wood (and other organic materials: pollen, bone, antler, seeds) | Variable; depends heavily on factors such as species type for plants, and moisture content. | Partial or complete consumption of materials; smoke- blackening, charring. |
| Plaster/Mortar | Variable; depends on moisture content and material type, nature of exposure. | Blackening, discoloration, flaking, spalling, complete consumption. |
| Rock Art | Variable; depends on rock type, nature of exposure. | Blackening, spalling. In worst- case scenarios, entire worked panels can flake off. |
| Metal | 232°C for tin<br>327°C for lead<br>300- 400°C for pot metal | Various kinds of metals that may be found in historic artifacts are altered, distorted, melted. |
| Glass | 593- 1427°C | Various kinds of glass, such as found in bottles and windowpanes are altered, distorted, melted. |

## 2. Fire Effects to Cultural Landscapes, Traditional Cultural Properties; Fire Effects to Dating Techniques and Other Sources of Information Important for Study of Artifacts and Features

| Affected Resource | Types of Changes |
|---|---|
| Traditional Cultural Properties, Cultural Landscapes | —Structures and offerings may be consumed, destabilized.<br>—Vegetation collected for medicinal/other traditional purposes destroyed/altered. In addition to consumption (direct effect), growth patterns may be altered (not necessarily a negative effect).<br>—Erosion; alteration of drainage patterns.<br>—Increased exposure to vandals, looters. |
| Dating Techniques and Other Information Potential | **Obsidian Hydration (OH),350- 430°C:** May destroy hydration rinds.<br>**Thermoluminescence, 400°C:** Clock "reset", dating potential destroyed.<br>**Archaeomagnetism, 750°C:** Clock "reset", dating potential destroyed.<br>**Dendrochronology:** Datable wood consumed.<br>**Radiocarbon ($^{14}C$):** Datable organics consumed (wood, bone, plaster, blood, etc.); modern charcoal can be mixed with ancient charcoal (destroys dating potential).<br>**Ceramic Cross- dating:** If discoloration/blackening is sufficient, items cannot be typed, thus cannot be used to determine dates for sites/features.<br>**Architectural Studies:** Partial/complete consumption of structural components negates study of materials that allow for determination of function, chronology, occupational history of buildings. |

### Relevant Temperature Information

**Centigrade temperatures:** 100°C is the boiling point of water (212°F), while 0°C is the temperature at which water freezes. To convert a temperature value in degrees Centigrade to degrees Fahrenheit, multiply the temperature in degrees Centigrade by 1.8, then add "32".
**BTU, or British Thermal Unit:** The amount of heat required to raise the temperature of one pound of water at 39.2° F one degree Fahrenheit (= .252 kg. calorie).
**Note,** under extreme conditions, 25 cm of duff consumption over coarse, dry soil may result in soil temperatures of 500°C to depth of 2cm, 200°C at 10cm. *Stumps and roots may carry fire effects to much deeper levels.*

with wood components, and those susceptible to smoke damage. Suppression activities could damage these resources during use of heavy equipment and hand tools to construct fire containment lines, development of fire camp, and placement of staging areas for fire fighting equipment. Additional damage may be sustained during mop- up activities which include turning over dirt and ash to smother the fire, and from post- fire rehabilitation efforts. Much of the project area has not been surveyed for cultural resources, so locations of archeological resources and historic structures are not all known.

Mitigation measures could include assigning a Resource Advisor who meets the Secretary of Interior standards to the fire to identify resources to be avoided; protecting known and newly discovered resources through avoidance, foam application, wrapping in fire retardant material, or installation of a temporary sprinkler system; and prompt consultation with the Colorado SHPO, and tribes with cultural ties to the area.

With mitigation, effects to archeological resources and historic structures under Alternative 1 would be short and long term, adverse, direct and indirect, and negligible to minor.

**Cultural Landscapes**. Wildfires could threatened and potentially destroy cultural landscapes, particularly vegetation that is not fire adapted, or vegetation that is subjected to unnaturally intense fire as a result of heavy fuel accumulations produced by a policy of total suppression. Suppression activities could also damage cultural landscapes during use of heavy equipment and hand tools to construct fire containment lines, development of fire camp, and placement of staging areas for fire fighting equipment. Additional damage may be sustained during mop- up activities which include turning over dirt and ash to smother the fire, and from post- fire rehabilitation efforts. Although no cultural landscapes have been inventoried within the project area, they are certainly present at suspected and unknown locations.

Mitigation measures could include assigning a Resource Advisor who meets the Secretary of Interior standards to the fire to identify resources to be avoided; protecting suspected and newly discovered cultural landscapes through avoidance, or foam/ water application; and prompt consultation with the Colorado SHPO, and groups with cultural ties to the area.

With mitigation, effects to cultural landscapes under Alternative 1 would be short and possibly long term, adverse, direct, and negligible to minor.

**Ethnographic Resources**. Wildfires can threaten and potentially destroy ethnographic resources, particularly those resources that can be consumed by fire, or damaged by smoke or heat. The growth of ethnographically important native vegetation may be stimulated by fire under certain conditions. Suppression activities could also damage ethnographic resources during use of heavy equipment and hand tools to construct fire containment lines, development of fire camp, and placement of staging areas for fire fighting equipment. Additional damage may be sustained during mop-up activities which include turning over dirt and ash to smother the fire, and from post-fire rehabilitation efforts.

Mitigation measures could include assigning a Resource Advisor who meets the Secretary of Interior standards to the fire to identify resources to be avoided; protecting suspected and identified ethnographic resources through avoidance, foam/ water application, or wrapping with fire retardant material; and prompt consultation with the Colorado SHPO, and groups with cultural ties to the area.

With Mitigation, effects to ethnographic resources under Alternative 1 would be short and possibly long term, adverse, direct and indirect and minor.

## Cumulative Effects

Cumulative effects describe the additive effects of the proposed project to any ongoing or reasonably foreseeable impacts to cultural resources. Other actions that are currently impacting cultural resources include visitor use (hiking, camping), agricultural practices (hay production, livestock grazing), and the current drought in the intermountain portion of the western United States. All of these actions have adverse effects on cultural resources. Impacts from Alternative 1 plus other actions would be short and long term adverse, and negligible to minor.

## Conclusion

Under Alternative 1, potential adverse impact to cultural resources are negligible to minor, with short and long term duration depending on the nature and intensity of any ensuing wildland fire and the subsequent fire suppression and rehabilitation activities.

Alternative 1 would not produce any major adverse impacts to cultural resources or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, the Baca National Wildlife Refuge, or the Medano-Zapata Ranch, (2) key to the natural or cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of cultural resources or values as a result of implementation of Alternative 1.

## IMPACTS OF ALTERNATIVE 2: FIRE SUPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

### Impact Analysis

Under Alternative 2, all fires would be actively suppressed and manual/mechanical fuel reduction work and prescribed fires would be implemented.

**Archeological Resources and Historic Structures**. In addition to potential impacts and mitigations described in Alternative 1, archeological resources and historic structures may be impacted by the use of heavy equipment and hand tools to reduce fuel loads within the project area. Damage from heavy equipment or hand tools would be direct, while erosion could be an indirect adverse effect. Beneficial effects include fuel reduction around archeological resources and historic structures, creating defensible space for protection from wildland fire.

Mitigation measures include those identified in Alternative 1, plus consultation with the Colorado SHPO to develop a survey strategy to identify and avoid archeological resources and historic structures during fuel reduction projects.

With mitigation, adverse effects to archeological resources and historic structures under Alternative 1 would be short and long term, adverse, and negligible to minor. Beneficial effects would be short and long term, direct, and minor to moderate.

**Cultural Landscapes**. In addition to potential impacts and mitigations described in Alternative 1, cultural landscapes may be impacted by the use of heavy equipment and hand tools to reduce fuel loads within the project area. Damage from heavy equipment or hand tools would be a direct adverse effect. Beneficial effects include fuel reduction around archeological resources and historic structures, creating defensible space for protection from wildland fire.

Mitigation measures include those identified in Alternative 1, plus avoidance and fuel reduction around any potential cultural landscapes.

With mitigation, effects to cultural landscapes under Alternative 2 would be short and possibly long term, adverse, direct, and negligible to minor. Beneficial effects to cultural landscapes would be short and long term, direct, and minor to moderate.

**Ethnographic Resources**. In addition to potential impacts and mitigations described in Alternative 1, ethnographic resources may be impacted by the use of heavy equipment and hand tools to reduce fuel loads within the project area. Damage from heavy equipment or hand tools would be direct, and could damage a cultural group’s ability to continue religious or ceremonial practices through damage to geographic features or vegetation. Beneficial effects include fuel reduction around ethnographic resources, creating defensible space for protection from wildland fire, possibly stimulating growth of important vegetation through clearing overstory vegetation, and/or maintaining or restoring important viewsheds.

Mitigation measures include those identified in Alternative 1, plus consultation with ethnographically affiliated groups and the Colorado SHPO to develop a survey strategy to identify and avoid ethnographic resources during fuel reduction projects.

With mitigation, effects to ethnographic resources under Alternative 2 would be short and long term, adverse, direct, and minor. Beneficial effects to ethnographic resources would be short and long term, direct and minor.

## Cumulative Effects

Cumulative effects describe the additive effects of the proposed project to any ongoing or reasonably foreseeable impacts to cultural resources. Other actions that are currently impacting cultural resources include visitor use (hiking, camping), agricultural practices (hay production, livestock grazing), and the current drought in the intermountain portion of the western United States. All of these actions have adverse effects on cultural resources. Impacts from Alternative 2 plus other actions would be short and long term adverse, and negligible to minor. Cumulative beneficial effects would be short and long term, and minor.

## Conclusion

Under Alternative 2, potential adverse impacts to cultural resources are negligible to minor, with short and long term duration depending on the nature and intensity of any ensuing wildland fire and the subsequent fire suppression and rehabilitation activities. Under Alternative 2, potential beneficial impacts to cultural resources are minor to moderate, with short and long term duration.

Alternative 2 would not produce any major adverse impacts to cultural resources or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, the Baca National Wildlife Refuge, or the Medano-Zapata Ranch, (2) key to the natural or cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of cultural resources or values as a result of implementation of Alternative 2.

## IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FULES MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

### Impact Analysis

Alternative 3, the preferred alternative, would allow for fire suppression, and manual and mechanical fuel reduction projects as described in Alternative 2. Additionally, wildland fire use for resource benefit would be allowed under certain conditions, and in certain units of the project area.

**Archeological Resources**. In addition to impacts and mitigations described in Alternative 2, archeological resources and historic structures could be impacted by wildland fire use actions. Damage from wildland fire use would be direct, and could include consumption, smoke damage, and/or heat damage to archeological resources and historic structures. Indirect adverse effects could include increased resource visibility making the resource vulnerable to vandalism and/or more easily inventoried, and removal of vegetation resulting in increased erosion potential. Beneficial effects to archeological resources and historic structures include reducing fuel levels on a broader scale than manual/mechanical fuel reduction projects that would result in lower temperatures on and around resources, and shorter resident heat time in the event of a wildland fire.

Mitigation measures include those identified in Alternative 2, plus measures agreed upon by an assigned Resource Advisor who meets the Secretary of the Interior Standards and the Colorado SHPO during consultation at the start of a wildland fire use action.

With mitigation, effects to archeological resources and historic structures under Alternative 3 would be short and long term, direct and indirect, adverse, and negligible to minor. Beneficial impacts would be short and long term, direct and indirect, and minor to moderate.

**Cultural Landscapes**. In addition to impacts and mitigations described in Alternative 2, cultural landscapes could be impacted by wildland fire use actions. Damage from wildland fire use would be direct, and could include consumption of landscape elements such as vegetation or fences. Beneficial effects to cultural landscapes include reducing fuel levels on a broader scale than manual/mechanical fuel reduction projects that would result in lower temperatures and less damage to fire- adapted vegetation that might be part of a cultural landscape. Wildland fire use may also maintain/restore viewshed elements.

Mitigation measures include those identified in Alternative 2, plus measures agreed upon by an assigned Resource Advisor who meets the Secretary of the Interior Standards and the Colorado SHPO during consultation at the start of a wildland fire use action.

With mitigation, effects to cultural landscapes under Alternative 3 would be short and long term, direct, adverse, and negligible to minor. Beneficial impacts would be short and long term, direct, and minor to moderate.

**Ethnographic Resources**. In addition to impacts and mitigations described in Alternative 2, ethnographic resources could be impacted by wildland fire use actions. Damage from wildland fire use would be direct, and could include consumption of vegetation and other elements of the resource. Smoke and/or heat may also affect elements of the resource. Beneficial effects to ethnographic resources include reducing fuel levels on a broader scale than manual/mechanical fuel reduction projects that would result in lower temperatures and less damage to fire- adapted vegetation that might be part of a cultural landscape. Wildland fire use may also maintain/restore viewsheds that are important to the ethnographic resource.

Mitigation measures include those identified in Alternative 2, plus measures agreed upon by an assigned Resource Advisor who meets the Secretary of the Interior Standards and the ethnographically affiliated groups and the Colorado SHPO during consultation at the start of a wildland fire use action.

With mitigation, effects to ethnographic resources under Alternative 3 would be short and long term, direct, adverse, and minor. Beneficial impacts would be short and long term, direct, and minor to moderate.

## Section 106 Summary

Planned fire management activities within the proposed project area will always be managed for a determination of "no adverse effect" to historic properties (referred to as "cultural resources" in the affected environment and environmental analysis sections, above). Project- specific consultation with the Colorado SHPO will be completed prior to implementation of any planned fire management activities.

Historic properties likely to occur within the project area were determined by reviewing past survey work and previously recorded sites, and in consultation with affected Indian tribes. Pursuant to 36CFR800.5, implementing regulations of the National Historic Preservation Act, addressing the criteria of effect and adverse effect, the National Park Service, U.S. Fish and Wildlife Service, and The Nature Conservancy find that the implementation of Alternative 3 would result in no adverse effects to archeological resources, historic structures, cultural landscapes, or ethnographic resources that are unevaluated, eligible for, or listed on the National Register of Historic Places.

Whenever possible, the park, refuge, and ranch staff would continue to educate visitors regarding archeological site etiquette to provide long term protection for surface artifacts and architectural features. Then park, refuge, and ranch would also continue to work with affiliated tribes to preserve and protect ethnographic resources on public lands.

## Cumulative Effects

Cumulative effects describe the additive effects of the proposed project to any ongoing or reasonably foreseeable impacts to cultural resources. Other actions that are currently impacting cultural resources include visitor use (hiking, camping), agricultural practices (hay production, livestock grazing), and the current drought in the intermountain portion of the western United States. All of these actions have adverse effects on cultural resources. Impacts from Alternative 3 plus other actions would be short and long term adverse, and negligible to moderate. Cumulative beneficial effects would be short and long term, and minor.

## Conclusion

Under Alternative 3, potential adverse impact to cultural resources are negligible to minor, with short and long term duration depending on the nature and intensity of any ensuing wildland fire and the subsequent fire suppression and rehabilitation activities. Under Alternative 3, potential beneficial impacts to cultural resources are minor to moderate, with short and long term duration.

Alternative 3 would not produce any major adverse impacts to cultural resources or values whose conservation is (1) necessary to the purpose of the establishment of the Great Sand Dunes National Park and Preserve, the Baca National Wildlife Refuge, or the Medano-Zapata Ranch, (2) key to the natural or cultural integrity of the park, refuge, or ranch or opportunities for enjoyment of these sites, or (3) identified as a goal in each site's general management plan or other site planning documents. Consequently, there would be no impairment of cultural resources or values as a result of implementation of Alternative 3.

# SOCIOECONOMICS

## Affected Environment

The planning area is located within the east-central portion of the San Luis Valley (population 46,190) in south-central Colorado (Population data from Census Bureau 2000). The northern portion of the planning area is located within Saguache County (pop. 5,917) and the southern portion of the site is located in Alamosa County (pop.

14,966). The towns of Alamosa and Saguache are the county seats for Alamosa and Saguache Counties, respectively. Alamosa, which is approximately 15 miles southwest of the planning area, is the largest town in the vicinity with a population of 7,835. Saguache has a population of 569 and is approximately 20 miles from the northern end of the planning area. Other towns in the vicinity of the planning area include Crestone (pop. 66), Moffat (pop. 107), Hooper (pop. 119), Mosca (pop. 102), and Blanca (pop. 418). Two subdivisions, Baca Grande Subdivision (pop. 261) and Zapata Subdivision (pop. 25) (population data from SLVDRG 2002), are also located adjacent to the planning area. Approximately 71% of the population is white in both Saguache and Alamosa Counties according to the 2000 U.S. Census (Census Bureau 2000).

The economy of the SLV is primarily based on agriculture, wholesale and retail trade, the service industry (including health services, private household services, social services, and recreational services), and government. According to the "San Luis Valley Economic Development District 2002 Comprehensive Economic Development Strategy", the largest employers in the region include Rakhra Mushroom Farm, Farm Fresh Direct growers & shippers, Smokin' Spuds, SLV Medical PC, Valley Wide Health Services, SLV Regional Medical Center, SLV Comprehensive Mental Health, Conejos County Hospital, Alamosa School District, Adams State College, SLV Board of Cooperative Services, North Conejos School District, Monte Vista Public Schools, Del Norte Consolidated School District, Center Consolidated School District, City of Alamosa, Alamosa County, Colorado Department of Transportation, Conejos County, Costilla County, Rio Grande County, Saguache County, Rio Grande National Forest, Wal- Mart Supercenter, and Wolf Creek Ski Corp (SLVDRG 2002). The 2000 Census Bureau reports a median household income of $25,495 for Saguache County and $29,447 for Alamosa County (Census Bureau 2000).

In 2001, an analysis of the Great Sand Dunes National Monument's visitors spending activities was conducted using a money generation model (http://www.prr.msu.edu/MGM2//). Table 10 presents the output from this model. In 2001, the Monument had a total of 277,523 visitors of which 19% were local day users, 51% were non- local day users, and 32% were overnight visitors (Table 10). Of the overnight visitors, 19% stayed at local hotels and 13% stayed at either private or public campsites. The model estimated that in 2001 each group of visitors spent an average of $61 dollars per day, and that total visitor spending was approximately $8,960,000.

Broken down even further, the model estimated that approximately $7,150,000 was spent by visitors on direct sales within the region (e.g. motels, restaurants, retail, etc.), which provided approximately $2,470,000 in personal income, 207 jobs, and $3,710,000 in value added (Table 11). With direct and indirect effects combined, the total amount of sales was $9,460,000, which provided approximately $3,250,000 in personal income, 242 jobs, and $5,150,000 in value added. Expansion of the Park and creation of the Refuge should increase the number of visitors to the region (Weiler et al. 2001).

Table 10. Visitation and spending by visitor segments within Great Sand Dunes National Monument in 2001 (http://www.prr.msu.edu/MGM2//)

| | Local Day Visitors | Non- Local Day Visitors | Hotel Visitors | Camp Visitors | Total |
|---|---|---|---|---|---|
| Recreation Visits (number of visitors) | 51,122 | 140,584 | 51,122 | 34,698 | 277,523 |
| Percent of Recreation Visits | 19% | 51% | 19% | 13% | 100% |
| Party Days [a] | 20,779 | 57,141 | 41,557 | 28,201 | 147,676 |
| Average Spending Per Party Day | $25 | $38 | $114 | $58 | $61 |
| Total Spending (million's) | $0.51 | $2.12 | $4.72 | $1.62 | $8.96 |

a: the number of days each visitor group spent in the local region.

Table 11. Economic impacts of visitor spending by sectors for Great Sand Dunes National Monument in 2001 (http://www.prr.msu.edu/MGM2//)

| | Sales (million's) | Personal Incomes (million's) | Jobs | Value Added [a] (million's) |
|---|---|---|---|---|
| Direct Effects | | | | |
| Motel, Hotel, B&B and Cabins | $2.23 | $0.65 | 58 | $0.98 |
| Campsites | $0.39 | $0.11 | 10 | $0.17 |
| Restaurants & Bars | $1.99 | $0.63 | 63 | $0.87 |
| Admissions & Fees | $1.00 | $0.34 | 30 | $0.56 |
| Retail | $1.11 | $0.57 | 40 | $0.88 |
| Others | $0.43 | $0.17 | 9 | $0.24 |
| **Total Direct Effects** | **$7.15** | **$2.47** | **207** | **$3.71** |
| Secondary Effects [b] | $2.32 | $0.78 | 36 | $1.44 |
| **Total Effects** | **$9.46** | **$3.25** | **242** | **$5.15** |

a: sum of employee compensation, proprietary income, and indirect business tax
b: includes both indirect and induced effects

Currently, the Great Sand Dunes National Park and Preserve and the Medano- Zapata Ranch have approximately 16 and 8 full time employees, respectively, that work at the sites year round. The Baca National Wildlife Refuge will initially have approximately 6 to 7 full time staff. Additional staff levels at each location vary throughout the year. The

National Park Service has approximately 5-8 seasonal employees annually and a number (approximately 10 per year) of other volunteers, Student Conservation Association participants, and WNPA members who operate the bookstore and assist at the visitor center. The Ranch has approximately 3-6 interns each year that work and live at the site between spring and fall.

## Methodology

The impact threshold definitions for socioeconomics shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

# IMPACTS OF ALTERNATIVE 1: NO-ACTION ALTERNATIVE

## Impact Analysis

Under Alternative 1, all wildfires would be suppressed, which could result in short-term, indirect beneficial or adverse impacts to the local economy. Beneficial impacts might include the need to provide firefighters with food, lodging, and supplies. Adverse impacts would result if all or portions of the area were closed due to wildfire or if general fire conditions resulted in visitors avoiding or leaving the area meaning a decline in revenues from food, lodging, and other sales. Loss of recreational and tourism revenues would be expected to be a short-term, minor, and indirect adverse impact. A very large wildfire could also have short-term, minor, and indirect beneficial impacts for similar reasons, however adverse impacts could be longer-term as visitors may tend to stay away from the area not only during the fire event but also for a longer time afterward. The extent of adverse impacts would depend upon the location, timing, duration and severity of the fire and the resources or infrastructure affected. It is most likely that a severe wildfire would happen during peak visitation months (i.e. June – August) and so adverse impacts from decreased visitation could be greater.

In addition, actual costs of firefighting would present short-term and minor to long-term and moderate indirect adverse impacts on agency budgets depending again upon the duration and severity of the fire event.

## Cumulative Effects

Cumulative effects to the local and regional economies include those as described above, but which may be recurring if successive fire events happen. Multiple, successive large fire events within and outside of the planning area, would result in potential long-term, moderate adverse impacts that would outweigh beneficial impacts, because the loss in tourism income is more than any gains made by provisioning fire suppression efforts. Other issues such as recreational opportunities, the overall state of the economy, and the general public's knowledge about fire and fire suppression activities would also affect socioeconomics.

### Conclusion

Alternative 1 presents the potential for short to long- term, minor to moderate and indirect adverse impacts to socioeconomics. Adverse impacts include loss of revenue from decreased visitation plus the costs of suppressing a wildfire. The nature and extent of adverse impacts would depend upon the extent and duration of a wildfire or successive fires. Some beneficial impacts could result from revenue generated due to fire suppression efforts.

## IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

### Impact Analysis

Under Alternative 2, fuel reduction actions would occur reducing the risks associated with wildfires, especially in those areas most heavily visited. The result would be minor, long- term beneficial impacts to the local economy, because the potential of long- term loss of revenue during severe fire events would be reduced. Avoiding wildfire damage and the resulting costs of firefighting would add to the beneficial impacts of this alternative. Although certain areas could be closed during prescribed fire or fuels management activities, there would probably be negligible effects on visitation because of the short duration of activities and off- season times when such management actions would be planned. Short- term beneficial impacts would also result when money to complete such projects is inserted into the economic stream plus the potential for short- term employment.

### Cumulative Effects

Cumulative effects to the economy would be beneficial in the long- term as described above, because fewer extensive wildland fires are likely to occur. Even when such fires do occur, they are likely to be of shorter duration and occur in areas less likely to affect visitors. Therefore, adverse impacts are more likely to be minor and short- term. In the long- term, the local economy is less likely to be adversely affected as a result of repeated or long duration wildfires. Other issues such as recreational opportunities, the overall state of the economy, and the general public's knowledge about fire and fire suppression activities would also affect socioeconomics.

## Conclusion

Under Alternative 2, fuel reduction projects would reduce the chances for extreme fire events, primarily in the main visitor use areas, so that potential adverse economic impacts are more likely to be minimized that may otherwise result during extreme fires. Overall, impacts would be minor. This is not to say, however, that severe or extreme fire events are not possible, only that their likelihood in the primary visitor use areas and other areas where fuels reduction has occurred would be lessened.

# IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

## Impact Analysis

Adverse and beneficial impacts under Alternative 3, the preferred alternative, would be similar to those described for Alternative 2 above for fire suppression and fuels treatment. Wildland fire use would occur within the Mosca and Herard FMU's, and although there may be some impacts due to smoke or temporary closures of some remote areas, associated adverse economic impacts would probably be short- term, indirect, and negligible to minor. There may be some short- term and minor indirect beneficial impacts during wildland fire use due to the provisioning needs of monitoring crews.

## Cumulative Effects

Cumulative effects would be similar to those described for Alternative 2 above.

## Conclusion

Under Alternative 3, the array of available management actions would result in negligible to minor, short- term, indirect adverse impacts during the periods of some fuels reduction activities. However, long- term beneficial impacts would result from the decreased potential of extreme fire events including the direct costs of fire suppression efforts and indirect costs to the local economy from reduced tourism and recreation revenues. Short- term beneficial impacts would result from expenditures during fuel reduction and wildland fire use monitoring projects.

# PUBLIC HEALTH AND SAFETY

## Affected Environment

The health and safety of visitors, staff, and neighbors of the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and the Medano- Zapata Ranch and the health and safety of fire personnel are of primary importance to NPS, FWS, and TNC. Wildfires and fire management activities can pose risks to the public, fire personnel, and NPS, FWS, and TNC employees.

A number of towns, subdivisions, and individual residences occur adjacent to or near the planning area boundaries, including Crestone, Baca Grande Subdivision, Moffat, Hooper, Mosca, and the Zapata Subdivision. In addition, the Park and the Ranch currently have a number of seasonal and full- time employees. The Baca National Wildlife Refuge will also have both seasonal and approximately 6 to 7 full- time employees once it begins operations. The Park and Ranch also have staff that lives on-site at least part of the year. Currently, there are 11 permanent residents (including family members of staff), 8 seasonal employees, and approximately 6 other residents (i.e. researchers and contractors) at the Park and approximately 12 full- time and seasonal residents at the Ranch. Between 1990 and 2003, an average of 285,250 individuals visited the Monument with peak months between June and August (NPS unpublished data). The Park currently has the capacity to have a maximum of 650 people in the Piñon Flats Campground, 42 people in the designated backcountry sites, and approximately 400 people in the primitive campsites along the Medano Pass Road. The Ranch also has a number of guests annually with a majority of them visiting between March and October.

All current employees and visitors at the Park and Ranch are at risk of wildfires, but firefighters and other fire staff face direct risks. The National Park Service currently posts various messages at different locations throughout the Park about health and safety, including fire danger warnings. Although the National Park Service probably would not close the Park due to fire danger, they do establish fire restrictions, usually in concert with the Rio Grande National Forest. These restrictions range from prohibiting campfires in the backcountry to prohibiting campfires in the campground.

## Methodology

The impact threshold definitions for public health and safety shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

## IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

### Impact Analysis

The health and safety of visitors, staff, and neighbors is the overarching objective of all wildland fire management objectives. Departmental and agency policies direct that life, health, and safety be the primary consideration in all management and suppression actions. Direct impacts during wildland fires include exposing firefighters to inherent risks including exposure to heat, smoke, noise, falling trees, steep and rocky terrain, and other dangers. Similarly, park visitors and residents plus neighbors face direct and indirect impacts such as injuries and loss of property or exposure to smoke.

Under Alternative 1, the potential for exposure would increase as fuel treatment would not occur, especially in high risk areas. Obviously, the location, size, and intensity of a wildland fire would determine the potential risks to firefighters and other people in the area and subsequently the magnitude and duration of impacts. Immediate, rapid response and suppression, if possible, would lessen the degree and duration. Overall, the direct and indirect impacts of Alternative 1 would be minor to moderate with short-term effects.

### Cumulative Effects

Cumulative adverse effects to public health and safety under Alternative 1 could occur if multiple wildfires occur near one another and within a short time span. These effects would be minor to moderate and short- to long- term depending on the number of fire starts and would be dependent upon the location, size, and intensity of the fires.

### Conclusion

Alternative 1 does not provide for any active fuels management programs. Therefore, the potential for large and intensive wildland fires exists, which would have minor to moderate and short- term to long- term impacts to public health and safety.

## IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

### Impact Analysis

Because fuels would be actively managed under Alternative 2, the fuel load and the risk of extreme or widespread wildfires would be reduced. Prescribed fires have many of the same health and safety impacts as wildland fires described above. Prescribed fire, mechanical and manual thinning would involve pre- planning for the protection of health and safety, and operations would take place under more controlled conditions. Therefore, the potential for direct and indirect impacts associated with management actions, though it's not possible to eliminate them entirely, would overall be reduced. Unavoidable impacts would be negligible or minor and short- term and would be localized with minimal health and safety concerns for visitors, staff, and neighbors.

### Cumulative Effects

Cumulative effects to health and safety under Alternative 2 would be negligible and short- term. The cumulative effects to health and safety because of management actions would also be negligible to minor and short- term because of careful pre- planning and actions conducted within thoroughly prepared prescriptions.

### Conclusion

Because Alternative 2 allows for active fuels management actions, the potential adverse impacts would be lessened, subsequently leading to beneficial effects over the long-term for public health and safety. Adverse impacts related to management actions are likely to be negligible to minor and short- term.

## IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

Impacts under Alternative 3, the preferred alternative, would be similar to those described under Alternative 2 above for fuels management activities and fire suppression. Providing for wildland fire use within the Mosca and Herard FMU's would allow for naturally ignited fires to continue burning to provide resource benefits, but such fires would be closely monitored and if prescription limits were exceeded they would be actively suppressed. Such fires could result in longer periods of exposure to some smoke but adverse impacts would still be expected to be minor and short- term.

### Cumulative Effects

Cumulative effects under Alternative 3 would be similar to those described for Alternative 2 above for fire suppression and fuels treatment. Adverse cumulative effects from on- going wildland fire use fires would continue to be minor while beneficial impacts would be long- term due to resource objectives being achieved.

## Conclusion

Adverse impacts under Alternative 3 would be negligible to minor and short term while beneficial impacts would be long- term.

# WILDLAND- URBAN INTERFACE

## Affected Environment

A number of communities and residential properties occur adjacent to or very near the planning area. Communities that are located near the planning area include Crestone (population 66) to the north, Moffat (pop. 107) to the northwest, and Hooper (pop. 119) and Mosca (pop. 102) to the west. The Baca Grande Subdivision (pop. 261) is nestled between Crestone and the planning area to the north. The Zapata Subdivision (pop. 25) is located east of the site. The vegetation type in which the wildland- urban interface exists is primarily piñon- juniper woodlands, but also includes grasslands and greasewood and rabbitbrush dominated shrublands.

Currently, neither NPS nor TNC have any active wildland- urban interface projects on their properties. FWS plans to complete an Assessment of Wildland Fuels at the Baca National Wildlife Refuge in fall and winter 2004. This assessment will look at areas of hazardous fuels in both the wildland urban interface as well as throughout the Refuge. Hazardous fuels will include areas where fire needs to be reintroduced to the landscape. Project areas will be identified through the assessment and may include recommendations for mechanical or manual thinning, prescribed fire, and grazing to reduce the fuels. Also, in areas of the wildland- urban interface, an information and education project will also be identified.

NPS has sponsored Rural Fire Assistance grants, which is used for wildland- urban interface fire management projects, for both the Mosca- Hooper and Baca Grande volunteer fire departments for the past 4 years and for Kundalini Fire Management this past year. FWS also has sponsored Rural Fire Assistance grants and provided grants outside the planning area to Monte Vista, Stonewall, Fisher's Peak, and Spanish Peaks in 2003.

In fiscal years 2001- 2003, NPS engaged in activities to create defensible space around the employee housing and maintenance areas and within the campground. These activities included mechanical fuel reduction projects within approximately 30 acres of the Monument. The objective was to clear an approximately 150- foot wide perimeter around each location with additional thinning in the housing area and to create a 30- foot wide crown spacing. Most of the work occurred within the piñon- juniper woodlands and involved removing or limbing up trees. All slash was removed and burned off- site at TNC's Medano Ranch corrals.

The two subdivisions, which are adjacent to the planning area, have conducted wildland fire assessment and mitigation plans for their respective properties. The Zapata Subdivision's plan calls for creation of defensible space, clean up of vegetation along roads, installation of dry hydrants, creating or enhancement of fuelbreaks, and better maps of the subdivision for fire departments (Forest Stewardship Concepts 2002a). The Baca Grande Subdivision's plan discusses the need for enhanced fuelbreaks, clean up of vegetation along roadsides, dry hydrants, and better road signs for ease of navigation through the subdivision (Forest Stewardship Concepts 2002b). Both subdivisions have very active wildland- urban interface mitigation measures in place.

## Methodology

The impact threshold definitions for wildland- urban interface shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

# IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

## Impact Analysis

Under this alternative all fires would be suppressed and no fuels management activities would occur. Although all fires would be suppressed, the lack of fuels management could result in the spread of a large, intense wildfire into the wildland- urban interface that could threaten neighboring residential, businesses, and other developments. Both the Zapata and Baca- Grande developments have active wildland- urban interface mitigation measures in place (Forest Stewardship Concepts 2002 a,b), but their effectiveness could be lessened if fuels management activities are not conducted on planning area lands. Potential adverse effects to the wildland- urban interface would be moderate with short- to long- term impacts because fuel buildups would not be lessened with treatments.

## Cumulative Effects

Cumulative effects under this alternative would be continued moderate risk to neighboring developments that could damage or destroy businesses, residences, and infrastructure. Overall, the potential for a large, intense wildfire would persist without any fuels management. However, fuels treatment by adjacent land owners would reduce the risk of adverse impacts.

## Conclusion

Under this alternative, potential adverse impacts are moderate with short to long- term duration, depending upon the nature and intensity of any ensuing wildland fire, because of continued risks associated with fuel loads.

# IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

## Impact Analysis

Under Alternative 2, fuels management activities would be allowed, which would have the effect of reducing risks associated with fuels. Mitigation efforts would be ongoing and may successfully reduce or eliminate the chances of a large wildland fire crossing planning area boundaries and entering into neighboring developments or communities. Adverse impacts associated with this alternative are primarily minor and short- term in nature and associated with fuel management activities, such as smoke from prescribed fires and noise during mechanical reduction operations. Long term beneficial impacts would result from reduced risk of uncontrollable fires in the wildland- urban interface.

## Cumulative Effects

Cumulative effects associated with this alternative would primarily be beneficial in the long- term because of fuel reduction accomplishments resulting in reduced risk of uncontrollable fires in the wildland- urban interface. Adverse cumulative effects would be minimal and associated with fuel management activities and their short- term adverse environmental effects. In addition, fuels treatment by adjacent land owners would reduce the risk of adverse impacts.

## Conclusion

Under Alternative 2, adverse impacts would be negligible to minor, short- term in nature, and associated with fuels management activities. Cumulative effects would be beneficial because fuel buildups would be reduced resulting in a long- term reduction in the risk of uncontrollable wildfires carrying over onto neighboring lands.

## IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

### Impact Analysis

Impacts associated with Alternative 3, the preferred alternative, would be similar to those described for Alternative 2 above for fuel management activities and fire suppression. Wildland fire use in most instances would not be allowed to burn in wildland- urban interface areas due to potential risk to neighboring properties, and therefore, would have negligible impacts.

### Cumulative Effects

Cumulative effects would also be similar to those described for Alternative 2.

### Conclusion

Under Alternative 3, adverse impacts would be negligible to minor, short- term in nature, and associated with fuels management activities. Cumulative effects would be beneficial because fuel buildups would be reduced resulting in a long- term reduction in the risk of uncontrollable wildfires carrying over onto neighboring lands. Wildland fire use, in most instances, would not be allowed to burn in the wildland urban interface due to potential risk.

## RECREATIONAL OPPORTUNITIES AND VISITATION

### Affected Environment

The three individual properties included here have or may have a variety of recreational opportunities, as well as different visitation numbers. The Great Sand Dunes National Park and Preserve currently receives the most visitors and is the only property currently open to the public year round. Between 1990 and 2003, an average of 285,250 individuals visited the Monument, ranging from a low of 235,305 visitors in 2002 and a high of 312,695 visitors in 1994 (NPS unpublished data). The highest visitor use period between 1992 and 2003 was during the months of June, July, and August. Activities within the Park include a visitor center, interpretive programs, hiking, horseback riding, camping, backpacking, climbing the sand dunes, star gazing, photography, picnicking, auto touring, biking, cross country skiing, snowshoeing, mountaineering, and bird and wildlife viewing. Hunting is allowed in the preserve portion of the Park. Visitor use includes both day use and overnight use. A majority of visitors stay near the visitor center, the campgrounds, and/or the eastern side of the sand dunes including Medano Creek.

In the expanded park and preserve, which includes portions of the Medano and Baca ranches as well as the former boundary of the monument and preserve, there are 136 miles of roads, 8 of which are paved, and over 60 miles of trails. Planning for these roads and trails will be completed in the General Management Plan for the Park. Currently the majority of hiking in the Park occurs on the dune mass itself. Developments within the Park include an entrance station, Park headquarters, laboratory and office space, housing and maintenance areas, barn/corral, visitor center, picnic area, campground, roads, trails and parking areas.

The mid- eastern portion of the Park (adjacent to the Preserve boundary) contains developments consisting of an entrance station, headquarters, housing and maintenance areas, barn/corral, visitor center, picnic area, campground, roads, trails and parking areas. Backcountry campsites are found along the Little Medano and Sand Creek Trails, and several non- historic cabins are located east of the main dune ridge. Access into the Park is limited to the south entrance at the northern terminus of Colorado State Highway 150. The main road through the Park currently leads from the south entrance to a parking area that provides access to the dunes and Medano Creek and to the Park's campground (88 sites, 3 group sites). The current visitor center is located 3.3 miles from the entrance. About 30- 50% of the visitors stop at the visitor center. A new visitor center is being constructed approximately 2 miles from the entrance and is scheduled to be open by the end of 2004.

The Baca National Wildlife Refuge currently is not open to the public. Although the types of recreational opportunities that the Refuge will provide have not been determined, they may potentially include any of the “Big 6” compatible uses that are allowed on National Wildlife Refuges. These include hunting, fishing, wildlife observation, environmental education, interpretation, and wildlife photography. Any of these uses may be allowed if they are compatible with the Refuge’s purpose and objectives. A number of roads and buildings exist within the Baca National Wildlife Refuge, but are currently not open to the public.

The recreational opportunities at the Nature Conservancy’s Medano- Zapata Ranch currently include a variety of overnight workshops that are open to the public. In 2003, 191 people attended 14 workshops that were conducted between March and October. The workshop participants stay overnight at the ranch and travel to various points on the property and within the San Luis Valley during their stay depending on the type of workshop being held. In addition, a number of meetings are held at the Ranch by various groups including The Nature Conservancy. The main entrance to the Zapata Ranch along Highway 150 is closed to unescorted public access. A number of other roads occur throughout the remainder of the Ranch, but are also closed to unescorted public access.

A variety of recreational opportunities are also provided outside the limits of the planning area. The planning area is bordered by the Rio Grande National Forest (primarily wilderness) on the north and east. Private lands are found adjacent to the planning area on all directions including a number of towns and subdivisions. Development on the south boundary of the Park includes a private campground, restaurant, gas station, store and limited lodging. State and Bureau of Land Management recreation areas, including San Luis Lakes State Park, Zapata Falls and Blanca Wetlands, are also found within the planning area.

## Methodology

The impact threshold definitions for recreational opportunities and visitation shown in Table 6 were used to assess the effects of each fire management alternative on this resource. Information regarding potential impacts was obtained from interdisciplinary team members, participating agency representatives, and relevant literature. The area of analysis includes all lands covered in this plan, as well as the local and regional environment.

## IMPACTS OF ALTERNATIVE 1: NO- ACTION ALTERNATIVE

## Impact Analysis

Under Alternative 1, impacts to recreational opportunities and visitation would be negligible unless and until significant wildland fires occurred in or near the planning area. In this case, the fire itself and suppression activities would take center stage and disrupt, or even forestall, recreational opportunities and visitation during the incident. These adverse impacts would likely be short- term and include such possibilities as certain areas being closed to public entrance, facilities being closed or inaccessible, or opportunities (such as wildlife viewing or hiking) being detracted or disrupted by the fire or suppression activities. Moderate effects would be possible if a large wildfire occurred and damaged or destroyed facilities, cultural resources, or other recreational sites (e.g. trails), or caused significant natural resource damage that could take several years to restore the esthetics of the natural landscape.

## Cumulative Effects

Cumulative adverse effects to recreational opportunities and visitation would primarily result from other wildfire and suppression activities. Effects would mostly be minor and short- term depending upon the location, intensity, extent, and duration of any fires and associated suppression efforts. Minor and short- term cumulative effects would include temporary closures or restrictions, smoke accumulations, noise from suppression activities, dispersed wildlife, and temporarily charred landscapes. Moderate impacts caused by wildfire could include damaged or destroyed facilities or other recreational sites (e.g. trails) and irreplaceable cultural resources.

## Conclusion

Implementation of Alternative 1 would result in negligible to minor impacts to recreational opportunities and visitation unless and until wildland fires occurred, in which case minor and short- term to moderate and long- term impacts could result depending upon the nature, location, and extent of the fire.

## IMPACTS OF ALTERNATIVE 2: FIRE SUPPRESSION PLUS FUELS MANAGEMENT ALTERNATIVE

## Impact Analysis

Under Alternative 2, impacts would primarily result from temporary closures or restrictions during prescribed fire or other treatment operations. These impacts would mostly be minor and short- term because projects would be undertaken in certain defined and limited locations (often during off- seasons when visitation is less) and few visitors would be affected by any one project. Impacts may include, as stated above, temporary closures of certain areas, minor smoke accumulations during prescribed fires, short- term wildlife displacement resulting in diminished viewing opportunities, and noise from the treatment operation. Some wildfires would still occur under this alternative and need to be suppressed. These suppression activities are likely to have similar impacts as described above under Alternative 1 with short- term closures and the potential of some facilities, cultural resources, and recreational sites (e.g. trails) being damaged or destroyed.

However, under this alternative, the risks associated with wildfires (particularly in the primary visitor use areas) would be reduced because of fuel reduction projects. The resulting impact would be beneficial and long- term because the possibility of large, intense wildfires and all that occurs during suppression operations and as a result of the fire and suppression activities would be reduced. Active habitat management with prescribed fire would also improve some types of wildlife habitat, thus potentially increasing wildlife- dependent recreation opportunities. This means that recreational opportunities overall would be less disrupted and potentially improved.

## Cumulative Effects

Cumulative effects to recreational opportunities and visitation under Alternative 2 are likely to be beneficial and long- term because of the diminished possibility of intense wildfires, especially near recreation facilities, and all that accompanies them as described above. There is always the possibility that prescribed fires could escape and result in some resource damage. However, well planned and conducted fuel reduction, habitat management or restoration activities, whether completed by prescribed fire or manual and mechanical means, will result only in short- term impacts with no long-term and adverse cumulative effects.

## Conclusion

Implementation of Alternative 2 would result in negligible and short- term adverse effects on recreational opportunities and visitation directly associated with ongoing prescribed fire or manual and mechanical fuel treatment projects. Minor to moderate and long- term effects are likely to be beneficial and with a generally positive public opinion.

# IMPACTS OF ALTERNATIVE 3 (PREFERRED ALTERNATIVE): FIRE SUPPRESSION AND FUELS MANAGEMENT PLUS WILDLAND FIRE USE ALTERNATIVE

## Impact Analysis

Under Alternative 3, the preferred alternative,, impacts to recreational opportunities and visitation are likely to be similar as described under Alternative 2 above for fire suppression and fuels treatment. Wildland fire use would be permitted in the Mosca and Herard FMU's and could result in certain areas being closed to visitor use for extended periods, higher and longer smoke accumulations, and displaced visitor opportunities while the fire is ongoing. Potential minor to moderate, short- to long-term effects to recreational opportunities and visitation could occur.

## Cumulative Effects

Cumulative effects to recreational opportunities and visitation would be expected to be similar to those described in Alternative 2 above.

## Conclusion

Implementation of Alternative 3 would result in negligible and short- term adverse effects on recreational opportunities and visitation directly associated with ongoing prescribed fire, wildland fire use fires, and mechanical and manual fuel treatment projects. Minor to moderate and short- to long- term effects are likely to be beneficial and with a generally positive public opinion.

# CHAPTER 4: CONSULTATION AND COORDINATION

## AGENCIES, TRIBES, ORGANIZATIONS, AND INDIVIDUALS CONTACTED

This section lists the persons, organizations, tribes and agencies contacted for information, or that assisted in identifying important issues, developing alternatives, or analyzing impacts.

### Tribes

Native American tribes were contacted during the public scoping process (see list of contacts below). The Southern Ute tribe responded, but did not identify any Traditional Cultural Properties or other sites or areas of concern. No other tribes commented on the proposed FMP during the public scoping process. This environmental assessment will be sent to the tribes for review and comment.

### Colorado State Historic Preservation Office

Consultation with the Colorado State Historic Preservation Office (SHPO) is ongoing. A pre- consultation letter was sent to the SHPO on March 16, 2004, followed by a phone call. The SHPO did not provide any comments at that time. A baseline data search for cultural resources was conducted at the SHPO's office on February 1, 2005. This included searching the SHPO's database for all reports and inventories of cultural resources that have been prepared for the planning area. This environmental document will be sent to the SHPO for review and comment as part of the Section 106 process. In addition, the SHPO will be contacted in the future for consultation under Section 106 of the National Historic Preservation Act for individual fire management projects.

### U.S. Fish and Wildlife Service – Ecological Services

Consultation with U.S. Fish and Wildlife Service – Ecological Services (FWS- ES) is ongoing. A pre- consultation letter was sent to FWS- ES in March 8, 2004, followed by a phone call. FWS- ES provided a list of threatened and endangered species within Alamosa and Saguache Counties, Colorado, on March 16, 2004. The list of species that was provided is included in the analysis of impacts for threatened, endangered, and candidate species within this document. In addition, this environmental document will be forwarded to FWS- ES for review and comment as part of the Section 7 process. FWS- ES will also be contacted in the future to provide clearance for individual fire management projects.

### Colorado Division of Wildlife

The Colorado Division of Wildlife (CDOW) was contacted by phone on June 7, 2004, to determine state- listed threatened, endangered, and candidate species that may occur within the planning area. A list of state- listed species occurring within Alamosa and Saguache Counties was then determined by reviewing CDOW's list of threatened, endangered, and candidate species (http://wildlife.state.co.us/) and the list of species occurrence by county at the Natural Diversity Information Source's web site (http://ndis.nrel.colostate.edu).

### Colorado Department of Public Health and Environment

The Colorado Department of Public Health and Environment (CDPHE) was contact to determine air quality regulations and concerns within the planning area. Information regarding air quality standards and regulatory procedures were provided by CDPHE and included in this document. CDPHE will be contacted in the future to provide clearance for individual fire management projects (i.e. prescribed fire plans and wildland fire use permits).

## INTERNAL SCOPING

Internal scoping was conducted by an interdisciplinary team of professionals from National Park Service, U.S. Fish and Wildlife Service, The Nature Conservancy, Colorado State Forest Service, Colorado Division of Wildlife, U.S. Bureau of Land Management, and U.S. Forest Service (see Appendix B for list of attendees). Interdisciplinary team members met on December 18, 2003, to discuss the purpose and need for the planning effort, goals and objectives for fire management, various fire management alternatives, potential environmental impacts, the planning effort schedule and roles, and data needs and sources. Subsequent meetings by the Core Team (Appendix B) were conducted on January 9, February 12, March 4 and 5, June 1, and August 4, 2004 to revise the proposed planning effort's purpose and need, goals and objectives, list of impact topics, fire management alternatives, plan the public scoping process and meetings, coordinate pre- consultation with the State Historic Preservation Office (§106 consultation) and the U.S. Fish and Wildlife Service (§7 consultation), and strategize about and begin the preparation of this EA/AEF. In addition, e- mail and phone correspondence was conducted amongst Core Team members during this time.

During internal review of the draft EA/AEF, it was determined that the proposed alternatives descriptions within the draft document did not present enough specific information regarding the fuels treatment plans or the fire management units for the planning area. A meeting was subsequently held via conference call on October 14, 2004, to discuss these issues. It was determined at this meeting that specific fuels treatment plans needed to be incorporated into the final EA/AEF, and that the EA/AEF should not be released for public review until this was accomplished. Following the necessary approvals, the release of the EA/AEF and the FMP was postponed until fuels treatment options and fire management units were identified by the Core Team and added to the EA/AEF.

NPS staff met at the Great Sand Dunes Park and Preserve in October 2004 to discuss potential fuel treatment options and fire management units (FMU) for the Park and Preserve. On November 5, 2004, the Core Team met to discuss the FMU's and fuel treatment plans. With some minor changes, the team agreed to extend across the entire planning area the proposed FMU's that the NPS staff had developed for the Park and Preserve. Following the meeting, fuels treatment plans for the Baca National Wildlife Refuge, Great Sand Dunes National Park and Preserve, and the Medano- Zapata Ranch were developed and incorporated into the EA/AEF. Subsequent meetings were held by the Core Team to discuss the status of the EA/AEF.

## PUBLIC SCOPING

External, or public, scoping was conducted between March 15, 2004 and April 14, 2004. A newsletter (Appendix B) was mailed to approximately 310 individuals, organizations, and Native American groups. The purpose of the newsletter was to inform the public about the proposed fire management plan and the public scoping meetings and to seek comments regarding the proposed fire management alternatives and potential impacts of these alternatives.

Two public scoping meetings were conducted in an open- house format during the external scoping period. A news release (Appendix B) was submitted to the local newspapers to notify the public regarding these meetings. The first meeting was held on March 24, 2004, in Alamosa, Colorado, at Trinidad State Junior College's Student Center. The second public scoping meeting was held on March 25, 2004, at the Baca Grande Fire Department near Crestone, Colorado. The purpose of these meetings was to present the proposed purpose and need, goals and objectives, and fire management alternatives established by the interagency planning team and to solicit comments from the public regarding the alternatives and the potential impacts of these alternatives.

Comments were received from 12 individuals and 1 Native American group (Appendix B). The primary concern (5 comments) was the proposed use of chemical treatments as part of the fire management plan. Six of the comments received were in favor of using natural fire regimes and/or wildland fire use in the management options. Appendix B provides a summary of the comments received during public scoping and the responses to those comments.

Following the public scoping period, the use of chemicals (i.e. herbicides) to treat non-native species before and after fire management activities was removed from the fire management alternatives. The use of herbicides to meet land management objectives may be covered in future Invasive Species Management Plans.

# LIST OF CONTRIBUTORS

The following individuals from National Park Service, U.S. Fish and Wildlife Service, The Nature Conservancy, U.S. Forest Service, and Colorado State Forest Service contributed to the planning, design, and writing of this EA/AEF.

| Name | Role | Title | Agency | Office |
|---|---|---|---|---|
| Brian DeVries | Planning, Design, and Contributing Author | Refuge Operations Specialist | FWS | Alamosa/Monte Vista/Baca Wildlife Refuges |
| Ken Kerr | Planning and Design | Zone Fire Management Officer | FWS | Lakewood |
| Connie Young-Dubovsky | Planning and Design | NEPA Coordinator | FWS | Denver |
| Kelli Stone | Contributing Author | Biologist | FWS | Alamosa/Monte Vista/Baca Wildlife Refuges |
| Jim Bowman | Planning, Design, and Contributing Author | Chief Ranger | NPS | Great Sand Dunes National Park and Preserve |
| Fred Bunch | Planning, Design, and Contributing Author | Resource Specialist | NPS | Great Sand Dunes National Park and Preserve |
| Phyllis Bovin | Contributing Author | Biologist | NPS | Great Sand Dunes National Park and Preserve |
| Andrew Valdez | Document Figures | Geologist | NPS | Great Sand Dunes National Park and Preserve |
| Nathan Williamson | Planning and Design | Fire Effects Specialist | NPS | Rocky Mountain National Park |
| Jesse Duhnkrack | Planning and Design | Fire Management Officer | NPS | Rocky Mountain National Park |
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| Name | Role | Title | Agency | Office |
| --- | --- | --- | --- | --- |
| Lisa Hanson | Contributing Author | NEPA Coordinator | NPS | Denver |
| Boyd Lebeda | Planning and Design | District Forester | CSFS | Alamosa |
| Jim Jaminet | Planning and Design | Fire Management Officer | USFS | Rio Grande National Forest |
| Terri Schulz | Planning, Design, and Contributing Author | Conservation Ecologist | TNC | Boulder |
| Paul Robertson | Planning and Design | San Luis Valley Project Director | TNC | Medano- Zapata Ranch |
| Ernst Strenge | Project Coordinator, Planning, Design, and Contributing Author | San Luis Valley Restoration Coordinator | TNC | Medano- Zapata Ranch |

# LIST OF RECIPIENTS

The following government agencies, tribal contacts, media, individuals, and interest group received notification regarding the environmental assessment/assessment of effect during public scoping (March 16 – April 14, 2004) and will be notified during the public comment period for this document. A summary of comments received during the public scoping process may be found in Appendix B.

## County Government

- Alamosa County, Administrator
- Alamosa County Commission, Chairman
- Alamosa County Sheriff
- Alamosa County Tourism Development Board, President
- Alamosa Lodging Tax Board, Chairman
- Conejos County Commission, Chairman
- Conejos County Tourism Board, Chairman
- Costilla County Commission, Chairman
- Custer County Commission, Chairman
- Huerfano County Commission, Chairman
- Rio Grande County Commission, Chairman
- Rio Grande County Lodging Tax Board, Chairman
- Rio Grande County Tourism, Chairman
- Rio Grande Water Conservation District, General Manager

- Saguache County Commission, Chairman
- Saguache County Lodging Tax Board ,Chairman
- Saguache County Sheriff
- Saguache County Tourism Board, Chairman
- San Luis Valley Development Resources Group, Executive Director

## State Government

- Colorado Dept of Natural Resources
- Colorado Division of Water Resources, Division Engineer
- Colorado Division of Wildlife, Area Manager
- Colorado Division of Wildlife, John Koshak
- Colorado Farm Bureau, Roger Bill Mitchell
- Colorado Division of Wildlife, Southwest Regional Manager, Tom Spezze
- Lewis Entz
- Colorado State Forest Service
- Colorado State Land Board, South District Manager
- Colorado State Museum, President, Colorado State Historical Preservation Office
- Colorado Historic Society, Division of Archaeology and Historic Preservation
- Colorado State Patrol
- Colorado Water Conservation Board, Director
- Fort Garland Museum, Rick Manzanares
- Lathrop State Park, Park Manager
- Governor Bill Owens

## Federal Government

- Alamosa Field Division, BOR, Manager
- Colorado Plateau Research Station, U.S. Geological Survey/BRD
- Conejos Peak District, U.S. Forest Service, District Ranger
- Natural Resource Conservation Service
- Office of Congressman Scott Mcinnis, Office Manager
- Office of Senator Wayne Allard, Area Director
- Pike and San Isabel National Forest, Forest Supervisor
- Rio Grande National Forest, Forest Supervisor
- Rocky Mountain National Park, Larry Gamble, Chief, Branch of Planning and Compliance
- Saguache District, U.S, Forest Service, District Ranger
- San Luis Resource Area, Bureau of Land Management, Area Manager
- U.S. Fish and Wildlife Service, Area Manager
- U.S. Deptarment of Agriculture, Resource Conservation & Development, Coordinator
- U.S. Department of Interior, Office of Collaborative Action and Dispute Resolution, Director

- U.S. Geological Survey, Office of Alternative Dispute Resolution

## Tribal Contacts

- Cheyenne and Arapaho Business Committee, Cheyenne and Arapaho Tribes of Oklahoma, Chairman Robert Taylor
- Comanche Tribal Business Committee, Commanche Nation of Oklahoma, Chairman Johnny Wauqua
- Jicarilla Apache Tribal Council, Jicarilla Apache Nation, President Claudia J. Vigil Muniz
- Navajo Nation, President Joe Shirley
- Northern Arapaho Business Council, Chairman Burton Hutchinson
- Northern Ute Tribe, Uintah & Ouray Tribal Business Committee, Chairman D. Floyd Wopsock
- Picuris Pueblo, Governor Gerald Nailor
- Pueblo of Acoma, Governor Fred S. Vallo
- Pueblo de Cochiti, Governor Simon Suina
- Pueblo of Isleta, Governor Alvino Lucero
- Pueblo of Jemez, Governor Raymond Loretto
- Pueblo of Laguna, Governor Roland E. Johnson
- Pueblo of Nambe, Governor Tom Talache
- Pueblo of Pojoaque, Governor Jacob Viarrial
- Pueblo of San Felipe, Governor Anthony Ortiz
- Pueblo of San Ildefonso, Governor
- Pueblo of Sandia, Governor Stewart Paisano
- Pueblo of Santa Ana, Governor Myron Armijo
- Pueblo of Zia, Governor Gilbert Lucero
- San Ildefonso Pueblo, Governor John Gonzalez
- San Juan Pueblo, Governor Earl Salazar
- Santa Clara Pueblo, Mr. Denny Gutierrez
- Santo Domingo Tribe, Governor Everett F. Chavez
- Shoshone Business Council, Shoshone Tribe, Chairman Vernon Hill
- San Juan Southern Paiute Tribal Council, President Johnny Murphy Lehi
- Southern Ute Indian Tribe, Chairman Howard Richards
- Taos Pueblo, Governor Allen R. Martinez
- Tesuque Pueblo, Governor Marvin Herrera
- The Hopi Tribe, Chairman Wayne Taylor
- The Indian Pueblo Cultural Center
- Ute Mountain Ute Tribe, Acting Chairman Howard Cuthair
- Ute Mountain Ute Tribe, Culture Liaison
- The Hopi Tribe Hopi, Cultural Preservation Office, Leigh Kuwanwiswma, Director
- Southern Ute Tribe, Director, Cultural Resources
- Southern Ute Tribe, NAGPRA Contact, Niel Cloud

- Pueblo de Cochiti, Department of Historic Preservation
- Pueblo of Acoma, Department of Historic Preservation
- Northern Ute Tribe, NAGPRA Representative, Ms Betty Chapoose
- Navajo Nation, Historic Preservation Department, Mr. Alan S. Downer
- Jicarilla Apache Nation, Department of Historic Preservation
- White Mesa Ute Council
- Zuni Pueblo, Governor Arlen Quetawki

## Media

- Albuquerque Journal
- Costilla County Free Press
- Crestone Eagle
- Denver Post
- Durango Herald
- Monte Vista Journal
- Rocky Mountain News
- Saguache Crescent
- Santa Fe New Mexican
- South Fork Times
- Taos News
- The Pueblo Chieftain
- The Valley Courier
- Gazette Telegraph
- Fox KSAZ- TV
- KCNC TV Channel 4
- KMGH TV Channel 7
- KWGN TV Channel 2
- KGIW- KALQ Radio Station
- KILO 94 Radio Station
- KIMN Radio Station
- KLTT Radio Station
- KRCC Radio Station
- KRZA Radio Station
- KSLV Radio Station
- KSPK Radio Station

## Individuals

- Gene White
- R.D. Antiel, D.D.S.
- Charles and Diane Winger
- Cheryl and Philip Baker
- Glen Bean
- Mark Belles
- Audrey Benedict
- Robert Benson
- Charlotte and Tom Bobicki
- Peter Bond
- Patricia and Mike Boring
- Jim and Anita Bowman
- Ellen Corinne Briggs
- Nichol Bronson
- Tracy Ruth Williams
- Jeff Woodward
- Haskell and Linda Bullard
- Fred Bunch
- Janice Bunch
- John Burt
- Eric Burt
- Betty and C.K. Caldwell
- Earl and Connie Casteel
- Linda Ciulla
- Hada Clarke
- Linda Clement
- Carla Clutter
- Jack Cooper
- Jean Corlett
- Jeff Corlett
- Skip Crowe
- Janet Czyzewski
- Gigi Darricades
- Margaret Davis

- Bill DeSouchet
- Hobart Dixon
- Alan Downer
- Tim and Penny Younce
- Deborah Eisenstein
- Robert Elmer
- Jim Erickson
- Bill and Eleanor Fischer
- Mona Herndon
- Richard and Mary Fluker
- Mark Frauenglass
- Margaret Fry
- Mary Eleanor Fry
- Reginaldo Garcia
- Larry Gardner
- Dale Hettinger
- Dan Gentile
- David and Bonnie Geppert
- Glenda Geu
- Miriam Gilbert
- Mayebelle Gilfillan
- Mary Goddard
- Fred Godfrey
- Ellen Golden
- Greg Gosar
- Mary Goulden
- Donald Hammarstrom
- Kristy Harbour
- Anna- Leah Hathaway
- Tom Hawk
- Hicks and Teed
- Lynne Young
- Elizabeth Holland
- Janet Lee and Ted Morrison
- Hank and Audrey Illenberger
- Kris and Sutida Illenberger
- Barbara and Bill Irwin
- Kos and Diana Jarrell
- Carolyn Jayne
- Judy Jeffs
- Richard and Mary Johnston
- Diana and Martin Jones
- Suzanne Jones
- Sheryl Josselyn
- Pamela Justice
- George and Judy Kelloff
- Ron and Franis Kessler
- Martha and Charles Morey
- Fran Koski
- Barbara and Michael Kruse
- David Laird
- Libbie Landreth
- Craig Lehmann
- Ron Loser
- Richard Madole
- Marilyn Martorano
- Kim and Connie Marvel
- Dr. James McCalpin
- Tom and Rebecca McKaig
- Barbara Medina
- Cheyenne and Joe Mendel
- Julie Mordecai
- Jack Mozzetti
- John and Eleanor Mueller
- Mike Murray
- David Nicholas
- Andrew Nigrini
- Lynn Strickler
- Suzanne Off
- Robert Ogburn
- Hisa Ota
- Bob Owens
- Sam Pace
- Antonio Pineda, Jr.
- Phyllis Pineda
- Barbara Pitner
- Kristin Emmons
- Eddie Prados
- Hal and Doris Reinhart
- Budd and Carolyn Rice
- Joel Richey
- Bonnie Ross
- Wayne and Nancy Starling Ross
- Arlene Ruark

- Betty and Gary Stephens
- R. Neil and Elise Rudolph
- Terry Sandmeier
- Dr. Stephen Schiffer
- Eugene Schwartz
- Irene Scidmore
- Betty Shawcroft
- Seaton DeVore
- Ron Seybold
- John Zulauf
- Karla Shriver
- Michael and Roberta Skinner
- Erin Smith
- Linda Spade
- Ann and Steve Starch
- Whitney Strong
- Sally and John Sunderland
- Nancy Taylor
- Lucy Adams
- Mike Tisdale
- LaVeta Trezise
- Stephen Trimble
- Tweit and Cabe
- Nelson and Julie Van Valen
- Dwane Vickstrom
- John Villyard
- Visty and Allen
- Richard and Edna Wallace
- Kay Watkins
- Gary Hasty
- Paul Weaver
- John Weller
- Jo Anne and Lee Westerman
- George Whitten
- Jeff Woodward
- Ray Wright
- Robert Zimmerman

# PUBLIC COMMENT PERIOD

We welcome your comments on this environmental assessment/assessment of effect. The public comment period on this environmental assessment / assessment of effect will be thirty (30) days. Your comments must be received in writing by close of business on May 24, 2005.

You can submit your comments by one of the following methods:

**By mail**: Jim Bowman, Chief Ranger
Great Sand Dunes National Park and Preserve
National Park Service
11500 Highway 150
Mosca, CO 81146- 9798

**By fax**: (719) 378- 6310

**By e- mail**: jim_bowman@nps.gov

**Hand deliver**: Jim Bowman, Chief Ranger
Great Sand Dunes National Park and Preserve
Park Headquarters
Mosca, Colorado

**You must include your name and mailing address with any comments you provide.** We will make comments including names and addresses of respondents available for public review during regular business hours. Also, we may be required to release your name and/or address if we receive a request for information that is covered by the Freedom of Information Act (5 U.S.C. 552, as amended). Individual respondents may request that we withhold their address from the record, which we will honor to the extent allowable by law. There also may be circumstances in which we would withhold from the record a respondent's identity, as allowable by law. **If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comments.** We will make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

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# DEFINITIONS

**Adverse Effect (under Section 106):** One of the three categories of effect under Section 106 compliance. An adverse effect diminishes the integrity of the characteristics that qualify a cultural resource for inclusion in the National Register of Historic Places.

**Alternative:** One of at least two proposed means of accomplishing planning objectives.

**Appropriate Management Response (AMR):** Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

**Archeological Resources:** Any material remains or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment. They are capable of revealing scientific or humanistic information through archeological research.

**Area of Potential Effect:** The geographic area or areas within which an undertaking may cause changes in the character or use of cultural resources, if any resources exist there. This area always includes the actual site of an undertaking, but may also include other areas where the undertaking will cause changes in land use, traffic patterns, or other aspects that could affect cultural resources, including visual, atmospheric, or audible changes.

**Assessment of Effect form (AEF):** "Assessment of Actions Having an Effect on Cultural Resources" form is used to describe and document proposed actions that may affect cultural resources.

**Best Management Practices (BMP):** Preventative measures taken during and/or after an activity to protect natural (e.g. soils and water) and other resources (e.g. cultural resources) from disturbance.

**Chemical Treatment:** The use of an approved herbicide or pesticide to reduce fuel loads or to accomplish other specific pre- stated fire management objectives in predefined geographic areas outlined in Fire Management Plans.

**Crown Fire:** A wildland fire that moves through the upper canopy of trees or shrubs more or less independently of the surface fire.

**Cultural Landscape:** A geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. There are four general kinds of cultural landscapes, not mutually exclusive:

1. **Historic Site:** A landscape significant for its association with a historic event, activity, or person.

2. **Historic Designed Landscape:** A landscape significant as a design or work of art; was consciously designed and laid out either by a master gardener, landscape architect, architect, or horticulturist to a design principle, or by an owner or other amateur according to a recognized style or tradition; has a historical association with a significant person, trend or movement in landscape gardening or architecture, or a significant relationship to the theory or practice of landscape architecture.
3. **Historic Vernacular Landscape:** A landscape whose use, construction, or physical layout reflects endemic traditions, customs, beliefs, or values; in which the expression of cultural values, social behavior, and individual actions over time is manifested in physical features and materials and their interrelationships, including patterns of spatial organization, land use, circulation, vegetation, structures, and objects; in which the physical, biological, and cultural features reflect the customs and everyday lives of people.
4. **Ethnographic Landscapes:** Areas containing a variety of natural and cultural resources that associated people define as heritage resources.

**Cultural Resources:** Aspects of a cultural system that are valued by or significantly representative of a culture or that contains significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as districts, sites, buildings, structures, and objects for the National Register of Historic Places, and as archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources for NPS management purposes.

**Cumulative Actions:** Actions that, when viewed with other actions in the past, the present, or the reasonably foreseeable future regardless of who has undertaken or will undertake them, have an additive impact on the resource the proposal would affect.

**Direct Attack:** Any treatment of burning fuel, such as by wetting, smothering, or chemically quenching the fire or by physically separating burning from unburned fuels.

**Direct Effect:** An impact that occurs as a result of the proposed action or alternative in the same place and at the same time as the action.

**Ecoregion:** A relatively large unit of land and water defined by the biotic and environmental factors that regulate the structure and function of the ecosystems within it.

**Eligible Property (under NRHP criteria):** A historic property meets one of four criteria: 1) a property associated with an important event; 2) a property associated with an important person; 3) a property with a distinctive design or construction; or 4) a property that has yielded or may likely yield information important in history or prehistory.

**Environmental Assessment (EA):** EAs were authorized by the National Environmental Policy Act (NEPA) of 1969. They are concise, analytical documents prepared with public participation that determine if an Environmental Impact Statement (EIS) is needed for a particular project or action. If an EA determines an EIS is not needed, the EA becomes the document allowing agency compliance with NEPA requirements.

**Environmental Impact Statement (EIS):** EIS's were authorized by the National Environmental Policy Act (NEPA) of 1969. Prepared with public participation, they assist decision makers by providing information, analysis and an array of action alternatives, allowing managers to see the probable effects of decisions on the environment. Generally, EIS's are written for large- scale actions or geographical areas.

**Environmentally Preferred Alternative:** Of the action alternatives analyzed, the one that would best promote the policies in NEPA section 101. This is usually selected by the Interdisciplinary Team members.

**Ethnographic Resources:** A site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

**Extended Attack Incident:** A wildland fire that has not been contained or controlled by initial attack forces and for which more firefighting resources are arriving, en route, or being order by the initial attack incident commander.

**Fire Adapted:** Term used to describe plant or animal species or the plant communities in which these species occur, which have historically been subject to periodic natural or human- caused fires. The species within fire- adapted plant communities typically have adaptations (e.g. thick bark, regeneration from sprouts, ability to burrow in the ground, flight, etc.) that allow them to continue to survive and reproduce following a fire.

**Fire Intensity:** A general term relating to the heat energy released by a fire.

**Fire Line:** A break in fuel made by cutting, scraping, or digging to stop the progress of fire; must be wide enough to prevent smoldering, burning, or spotting across the line

**Fire Management Plan (FMP):** A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational plans such as preparedness plans, preplanned dispatch plans, prescribed fire plans and prevention plans.

**Fire Management Unit (FMU):** Any land management area definable by objectives, topographic features, access, values to be protected, political boundaries, fuel types, or major fire regimes, among other characteristics, that set it apart from management characteristics of an adjacent unit. FMU's are delineated in Fire Management Plans.

These units may have dominant management objectives and pre- selected strategies assigned to accomplish these objectives.

**Fire Regime:** The combination of fire frequency, predictability, intensity, seasonality and size characteristics of fire in a particular ecosystem.

**Fire Return Interval:** The number of years between two successive fire events at a specific site or an area of a specified size.

**Fire Sensitive Cultural Resource:** Fire sensitive cultural resources are any material remains that are readily flammable (wood, paper, fabric, petroleum products, and organic remains), material remains that would lose data potential due to smoke damage (ceramics, rock art, historic- era paint, etc), and material remains that would lose data potential due to heat damage at anticipated temperatures of the fire (possibly ceramics, some lithic material, some structural rock, rock art, and some historic- era materials).

**Fire Severity:** The effect of fire on plants. It is dependant on intensity and residence of the burn. An intense fire may not necessarily be severe. For trees, severity is often measured as percentage of basal area removed.

**Fuels:** Combustible materials including vegetation, such as grass, leaves, ground litter, plants, shrubs and trees that feed a fire.

**Fuels Reduction:** Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

**Hazard Reduction:** Any treatment of a hazard that reduces the threat of ignition and fire intensity or rate of spread.

**Historic District:** A geographically definable area, urban or rural, possessing a significant concentration, linkage, or continuity of sites, landscapes, structures, or objects, united by past events or aesthetically by plan or physical developments. A district may also be composed of individual elements separated geographically but linked by association or history.

**Impact Topics:** Specific natural, cultural, or socioeconomic resources that would be affected by the proposed action or alternatives (including no action). The magnitude, duration, and timing of the effects to each of these resources are evaluated in the impact section of an EA or EIS.

**Incident:** A human- caused or natural occurrence, such as a wildland fire, that requires emergency service action to prevent or reduce the loss of life or damage to property or natural resources.

**Indirect Attack:** Method of suppressing a wildland fire by setting or using a pre-existing control line (e.g. road, stream, etc.) that is located away from the edge of the fire.

**Indirect Impact:** Reasonably foreseeable impacts that occur removed in time and space from the proposed actions. These are "downstream" impacts, future impacts, or the impacts of reasonably expected connected actions (e.g. growth of an area after a highway to it is complete).

**Initial Attack:** The actions taken by the first firefighters to arrive at a wildland fire to protect lives, property, and resources at risk, and prevent further extension of the fire.

**Ladder Fuels:** Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.

**Mean Fire Return Interval:** Arithmetic average of all fire- return intervals for a specific site for a specific interval of time.

**Mechanical Treatment:** The use of motorized and non- motorized tools to reduce fuel loads or to accomplish specific pre- stated fire management objectives in predefined geographic areas outlined in Fire Management Plans.

**Minimum Impact Suppression Tactics:** Wildland fire suppression method utilizing the minimum amount of forces needed to effectively achieve the fire management protection objectives for a given fire management unit with the intent of limiting the amount and degree of disturbance.

**Mitigation:** A modification of a proposal or alternative that lessens the intensity of its impact on a particular resource. Mitigation measures are constraints, requirements, or conditions imposed to reduce the significance of or eliminate an anticipated impact to environmental, socioeconomic, or other resource value from a proposed land use.

**Mixed Severity/Mosaic Fire:** A wildland fire that burns with a range of intensity and severity and includes non- replacement and replacement fires. This type of fire may create gaps of various sizes within the canopy where a combination of non- replacement and replacement fires has occurred.

**Mop- up:** To make a fire safe or reduce residual smoke after the fire has been controlled by extinguishing or removing burning material along or near the control line, felling snags, or moving logs so they won't roll downhill.

**Museum Objects:** All significant historic objects that may or may not be tied to a particular setting.

**National Environmental Policy Act:** NEPA is the basic national law for protection of the environment, passed by Congress in 1969. It sets policy and procedures for environmental protection and authorizes Environmental Impact Statements and Environmental Assessments to be used as analytical tools to help federal managers make decisions.

**National Register of Historic Places (NRHP):** The comprehensive list of districts, sites, buildings, structures, and objects of national, regional, state, or local significance in American history, architecture, archeology, engineering, and culture kept under the authority of the National Historic Preservation Act of 1966.

**Natural Range of Variability:** The natural range of variability describes the extent, intensity, severity, and magnitude of environmental conditions, disturbances (e.g. fire), or other natural processes over which a species or an ecological system has evolved or adapted.

**No Adverse Effect (under Section 106):** One of three categories of effect under Section 106. There could be an effect, but the effect would not be harmful to those characteristics that qualify the property for inclusion in the National Register of Historic Places.

**Non- native, Invasive Species:** Plant and animal species that did not previously inhabit a site, and therefore are not considered a part of the natural plant and animal communities of an area. Non- native, invasive species spread quickly throughout an area once established and typically have a competitive advantage over native species for nutrients, water, and/or sunlight. Non- native, invasive species threaten native biodiversity and the stability of ecological systems.

**Non- replacement fire:** A wildland fire that does not remove or removes only a portion of the existing dominant vegetation. Surface fires and mosaic fires are considered non-replacement fires.

**Preferred Alternative:** The alternative identified as preferred at the draft EA or EIS stage. It may be the same as the initial proposal or proposed action, or it may be different. It is identified to show the public which alternative is likely to be selected to help focus its comments.

**Prescribed Fire:** Any fire ignited by management actions under certain, predetermined conditions (prescriptions) to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved Prescribed Fire Plan must exist, and NEPA requirements must be met, prior to ignition.

**Prescription:** Measurable criteria which define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social, or legal considerations.

**Prevention:** Activities directed at reducing the incidence of fires, including public education, law enforcement, personal contact, and reduction of fuel hazards.

**Rehabilitation:** The activities necessary to repair damage or disturbance caused by wildland fires or the fire suppression activity.

**Replacement Fire:** a wildland fire of such intensity and severity that nearly all trees in a stand is killed and all grass and herbaceous vegetation is burned to the ground surface, moving the ecological system back to an early development stage. Forests succeeding a stand replacing fire are generally composed of trees that quickly re- establish and are consequently evenly aged.

**Size- up:** Act of evaluating a wildfire to determine the appropriate course of action.

**Structure:** A constructed work, usually immovable by nature or design, consciously created to serve some human activity. Examples are buildings of various kinds, monuments, dams, roads, railroad tracks, canals, millraces, bridges, tunnels, locomotives, nautical vessels, stockades, forts and associated earthwork, Indian mounds, ruins, fences, and outdoor sculpture. In the National Register of Historic Places program, "structure" is limited to functional constructions other than buildings.

**Suppression:** All the work of extinguishing or containing a fire, beginning with its discovery.

**Surface Fire:** A wildland fire that burns primarily within the understory without significant movement into the overstory. This type of fire typically does not directly kill mature overstory trees, but may remove the understory layer of a forest.

**Surface Fuels:** Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branches, downed logs, and stumps interspersed with or partially replacing the litter.

**Undertaking:** An undertaking means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit, license, or approval; and those subject to state or local regulation administered pursuant to a delegation or approval by a Federal agency.

**Vegetation Type:** A standardized description of the vegetation in which a fire is burning. The type is based on the dominant plant species and the age of the forest and indicates how moist a site may be and how much fuel is likely to be present.

**Wildland Fire:** Any non- structure fire, other than prescribed fire, that occurs in the wildland.

**Wildland Fire Implementation Plan:** A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response for a wildland fire being managed for resource benefits.

**Wildland Fire Situation Analysis (WFSA):** A decision- making process that evaluates alternative suppression strategies against selected environmental, social, political and economic criteria. WFSA provides a record of decisions.

**Wildland Fire Use:** The management of naturally ignited wildland fires to accomplish specific pre- stated resource management objectives in predefined geographic areas outlined in Fire Management Plans.

**Wildland Urban Interface:** The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

# APPENDIX A: VDDT MODELS FOR GREATER SAND DUNES SITE

## Pinon- Juniper Woodlands

## Mixed Conifer Forests

## Spruce- Fir Forests

# Greater Sand Dunes Fire Management Plan
# Greater Sand Dunes Piñon- Juniper Woodland
# VDDT Model
# August 1, 2004

## INTRODUCTION

### Site Description

Piñon- juniper woodlands occur between 7600 and 9500 feet elevation within the lower montane- foothill zone (Neely et al. 2001, USFS 1996). The topography is steep to gentle, and soils are a combination of alluvium and rock. The canopy is typically open (i.e. less than 30% canopy cover), but the system also has patches with closed canopy (i.e. greater than 30% canopy cover). Piñon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) are the dominant species within this ecological system. The understory is composed of grasses, forbs, and shrubs. Piñon- juniper woodlands occur below mixed conifer forests and above grassland and shrubland communities.

Fire and insect outbreaks are dominant disturbance processes of piñon- juniper woodlands (West 1999). The fire regime is characterized by somewhat frequent surface and mosaic fire with very infrequent replacement fires (Rondeau 2001).

## VDDT MODEL

The Vegetation Dynamics Development Tool (VDDT) is a quantitative state and transition computer model, which is used to create and analyze different successional pathways and landscape- level changes within a potential vegetation type (PVT) over time (http://www.essa.com/downloads/vddt/). VDDT allows the user to change the probabilities that different events (i.e. disturbances and/or management actions) will occur, as well as the successional pathways between different user- defined successional classes to test the effects of these changes on landscape successional patterns. This model was created by Nature Conservancy, National Park Service, Fish and Wildlife Service, and Colorado State Forest Service ecologists, biologists, and land managers through a collaborative process with review from other local and regional experts.

### Assumptions

The following assumptions were made in the models:

- Fire historically has played a role in influencing the structure, composition, and maintenance of piñon- juniper woodlands within the planning area (Arno 2000, Romme 1996, USFS 1996). The piñon- juniper woodlands are characterized by moderately long to long return intervals with a combination of mosaic fires (i.e. mixed severity) and stand replacing fires (Havlina 2003). The mean fire return interval for replacement fire and mixed- severity fire mean return intervals were assumed to be approximately 425 years and 170 years, respectively. The estimate for replacement fires is consistent with a literature review which found only two studies have estimated high severity fire return interval, 400 and 480 years (Baker and Shinneman 2004).

- It was assumed that the piñon- juniper woodlands within the project area have not been heavily altered by human activity. We assumed that the forests are relatively close to their natural range of variation for fire (Romme 1996). In addition, we assumed fire suppression efforts have not had as large of an impact on these forests or the surrounding plant communities (i.e. piñon- juniper expansion into shrublands and grasslands) as it has had in other piñon- juniper woodlands within the Southwest (Romme 1996).

**Model Inputs**

This model was developed starting with a standardized VDDT model developed for the Fire Regime Condition Class project (http://frcc.gov) and modified using local and regional expert opinion. Some local fire history information was available from Catherine Alington's graduate work (Alington 1998) and USFS plan revision documents (USFS 1996). As additional review and validation is completed, these models will be revised.

The successional model used for piñon- juniper woodland was:

A: early development- post- replacement (age = 0- 39 years)
B: mid- development with closed canopy (age = 40- 139 years)
C: mid- development with open canopy (age = 40- 139 years)
D: late- development with open canopy (age = 140+ years)
E: late- development with closed canopy (age = 140+ years)

**Early Development- Post Replacement (A):** The early development- post replacement state includes grasses, forbs, and shrubs with little to no piñon pine or juniper seedlings. This state ranges in age from 0 to 39 years. This state succeeds to mid- development open canopy (B). Replacement fires setting the time back to 0 were given a 200- year return interval. An alternative successional pathway (closed path) was also modeled.

**Mid- Development with Closed Canopy (B):** The mid- development with closed canopy state includes a relatively dense (greater than 30% cover) mix of young piñon pine and juniper saplings and ranges in age from 40 to 139 years since the last stand replacing disturbance. This state succeeds to late- development closed canopy (E). Replacement fires (B to A) were given a 200- year return interval. Mosaic fire opens up the canopy (B to C) and was given a 150- year return interval. Because of the relative lack of ground cover and continuous nature of the canopy, these forests are more likely to have a replacement fire than more open conditions. Mortality by insect and pathogen outbreaks (B to C) was set at 100 years. Climate stress mortality (B to C) was set at 150 year return interval.

**Mid- Development with Open Canopy (C):** The mid- development with open canopy state includes a relatively sparse (less than 30% cover) mix of young piñon pine and juniper saplings intermixed with grasses, forbs, and shrubs, and ranges in age from 40 to 139 years since the last stand replacing disturbance. This type then succeeds to late-development open canopy (D). Replacement fires (C to A) were given a 500 year return interval. Three types of disturbance maintain the open nature of this system. Mosaic fires (C to C) maintain the system and were given a 200- year return interval. Mortality by insect and pathogen outbreaks (C to C) also maintains the system and was set at 500 years. Because of the variable and discontinuous nature of the fuel, mosaic fires are more likely to occur than replacement fires. An alternative "closed path" successional pathway (C to B) was also modeled.

**Late- Development with Open Canopy (D):** The late- development with open canopy state includes a relatively sparse (less than 30% cover) mix of mature piñon pines and junipers and includes areas that are 100+ years old since the last stand replacing disturbance. Replacement fires (D to A) were given a 1000- year return interval. Two types of fire maintain the open nature of these stands. Mosaic fires (D to D) were given a 200- year return interval. Mortality by insects (D to D) was set at 150 years. A competition for seed/seedling establishment also maintains this state with a return interval of 100 years. An alternative "closed path" successional pathway (D to E) was modeled. Because of the variable and discontinuous nature of the fuel, surface and mosaic fires are more likely to occur than replacement fires.

**Late- Development with Closed Canopy (E):** The late- development with closed canopy state includes a relatively dense (greater than 30% cover) mix of mature piñon pine and juniper and includes areas that are 140+ years old since the last stand replacing disturbance. Replacement fires (E to A) were given a 200- year return interval. Two types of disturbance open up these stands to a late- development open canopy condition. Mosaic fires (E to D) were given a 150- year return interval. Mortality by insects (E to D) was set at 100 years. Because of the relative lack of ground cover and continuous nature of the canopy, these forests are more likely to have a replacement fire than more open conditions.

## RESULTS AND DISCUSSION

The results of the VDDT model for piñon- juniper woodland within the western Sangre de Cristo Mountains indicate that a majority of this forest type should be in an open canopy state (Table 1). The model results show that approximately 66% of piñon-juniper woodland would be in open canopy states and 24% would be in closed canopy states if the system were within its natural range of variability. The landscape is divided between the early development- post replacement state (10.5%), mid- development state (20%), and late- development state (69%).

**Table 1. VDDT model results showing the percent of the landscape each seral class contributes within reference conditions for piñon-juniper woodlands within the western Sangre de Cristo Mountains.**

| Class | Percent of Landscape |
|---|---|
| Early Development - Post Replacement | 10.5% |
| Mid-Development with Closed Canopy | 7.8% |
| Mid-Development with Open Canopy | 12.3% |
| Late-Development with Open Canopy | 53.3% |
| Late-Development with Closed Canopy | 16.1% |

The current condition of the piñon-juniper woodlands within the planning area may not correspond with the model results across the landscape. Areas within the piñon-juniper woodlands, particularly at lower elevations and along alluvial fans, appear to have more of a closed canopy (i.e. greater than 30% cover). However, a large portion of the forest at higher elevations (i.e. along rocky slopes) is in an open-canopy, late-development state, which fits well with the model results. Fire within this system is typically mixed severity with infrequent (i.e. 100's of years) stand replacing fires (Romme 1996). A portion of the forest at higher elevations is within its natural range of variability, while some of the lower elevation piñon-juniper woodlands may need some management treatments to protect property and people.

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# Greater Sand Dunes Fire Management Plan
# Greater Sand Dunes Mixed Conifer
# VDDT Model Explanation
# August 1, 2004

## INTRODUCTION

### Site Description

The Greater Sand Dunes mixed conifer forest occurs along the western flank of the Sangre de Cristo Mountains between 8000 and 10,500 feet elevation within the upper montane zone (Neely et al. 2001, USFS 1996). The topography of the mixed conifer forest within the planning area is mostly steep mountain slopes. Soils consist of rock outcrops, coarse textured soils, and glacial moraines (USFS 1996). The canopy is typically closed (i.e. greater than 30% canopy cover) on the more mesic north facing slopes and typically open (i.e. less than 30% canopy cover) on more xeric south facing slopes and rock outcrops. The dominant tree species within this forest type is Douglas fir (*Pseudotsuga menziesii*). Associate species include ponderosa pine (*Pinus ponderosa*), white fir (*Abies concolor*), aspen (*Populus tremuloides*), and Colorado blue spruce (*Picea pungens*). White fir occurs predominantly on the mesic north facing slopes, while Ponderosa pine occurs at lower elevations in more xeric conditions (Rondeau 2001).

Fire, insects, and avalanches are important disturbances within mixed conifer forests. Fires are typically surface or mixed severity fires with stand-replacing events uncommon (Dietrich 1983). Different conifer species react different in the presence of fire and therefore, fire regime is a controlling influence on the forest structure (Neely et al. 2001). In the absence of fire, the density of white fir increases (Hopkins 1982 in www.fs.fed.us/database/feis; Neely et al. 2001). Aspen will occupy a site following disturbance, particularly fire, and may form a relatively stable-state (Wolf 1995). Pinyon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) occur at lower elevations, while Engelmann spruce (*Picea engelmannii*) and sub-alpine fir (*Abies lasiocarpa*) occur at higher elevations (Rondeau 2001)

## VDDT MODEL

The Vegetation Dynamics Development Tool (VDDT) is a quantitative state and transition computer model, which is used to create and analyze different successional pathways and landscape-level changes within a vegetation type over time (http://www.essa.com/downloads/vddt/). VDDT allows the user to change the probabilities that different events (i.e. disturbances and/or management actions) will occur, as well as the successional pathways between different user-defined successional classes to test the effects of these changes on landscape successional patterns. This model was created by Nature Conservancy, National Park Service, Fish and Wildlife

Service, and Colorado State Forest Service ecologists, biologists, and land managers through a collaborative process with review from other local and regional experts.

**Assumptions**

The following assumptions were made in the Greater Sand Dunes mixed conifer model:

- Fire plays a dominant role in the maintenance of mixed conifer forests (Arno 2000, Alington 1998, USFS 1996). Southwest mixed conifer forests are characterized by fire regime, which has a mean fire return interval that ranges from 0- 35 years and includes frequent surface and mixed severity fires with occasional stand replacing fires (Alexander et al. 1984, Dieterich 1983; Pohl 2003). Because fire occurs less frequently within the forests of the western Sangre de Cristo Mountains than other similar forest types in the Southern Rocky Mountains (Alington 1998, Romme 1996), the mean fire interval for the Greater Sand Dunes mixed conifer forests was assumed to be slightly higher. These forests are, therefore, assumed to have replacement fire and mixed severity fire mean return intervals of approximately 550 years and 90 years, respectively. These mean fire return intervals were determined based on input from local experts and from Alington (1998) and Romme (1996). The actual mean fire return intervals for this forest type will need to be validated with local fire history data.

- It was assumed that the Greater Sand Dunes mixed conifer forests have not been heavily altered by human activity. We assumed that the forests are within their natural range of variation for fire (Alington 1998), and that fire suppression efforts have not had a large impact on these forests as they have had in other forest ecosystems of the Southern Rocky Mountains. These assumptions are based on the rugged nature and inaccessibility of much of this vegetation type.

- This model includes both north and south facing slopes. The primary difference between north and south facing slopes is that north facing slopes are typically more mesic and, therefore, have fewer fires than south facing slopes. Because of the different site characteristics, open canopy conditions typically are found on south- facing slopes, and closed canopy conditions are typically found on north-facing slopes. Because of the more mesic conditions, north facing slopes would potentially have longer fire return intervals and, therefore, a higher probability of stand replacing fires due to greater fuel loads (i.e. closed canopy) compared to south facing slopes. However, open and closed canopies may occur on either slope depending on site characteristics and fire history.

- Successional classes with closed canopies were assumed to have a higher probability of stand replacing fires and a lower probability of mosaic fires compared to those with open canopies. This assumption is based on there being greater fuel loads in closed canopy forests compared to open canopy forests. A higher percentage of fire starts in a closed canopy system will therefore lead to stand replacing fires rather than mixed severity fires.

- Wind and weather stress and insect and pathogen-caused mortality were assumed to only affect relatively small patches, rather than the whole landscape at any given time, within closed canopy systems. It was decided that these disturbances would not move a closed canopy state back to an earlier state, but instead would move the closed canopy mid-development and late-development states to open canopy mid-development and late-development states, respectively.

- Avalanches occur along certain steep drainages. In the models, they were assumed to occur more frequently in the early development stage and less likely in closed mid development. It was assumed that because of the steepness of the terrain, no avalanche-prone areas would make it to late-development stages.

**Model Inputs and Transitions**

This model was developed starting with a standardized VDDT model developed for the Fire Regime Condition Class project (http://frcc.gov) and modified using local and regional expert opinion. Some local fire history information was available from Catherine Alington's graduate work (Alington 1998) and USFS plan revision documents (USFS 1996). As additional review and validation is completed, these models will be revised.

The successional model used for Greater Sand Dunes mixed conifer was:

A: early development-post-replacement (age = 0-39 years)
B: mid-development with closed canopy (age = 40-139 years)
C: mid-development with open canopy (age = 40-139 years)
D: late-development with open canopy (age = 140+ years)
E: late-development with closed canopy (age = 140+ years)

**Early Development-Post Replacement (A).** The early development-post replacement state includes grasses, forbs, and shrubs with little to no conifer seedlings. This state ranges in age from 0 to 39 years then succeeds to mid-development open canopy state (C). Replacement fires setting the time back to 0 were given a 200-year return interval. Avalanches also set the time back to 0 and were given a 200-year return interval. In addition, an alternate "closed path" successional pathway was also modeled (successional pathway = A to B).

**Mid-Development with Closed Canopy (B):** The mid-development with closed canopy state includes a relatively dense (greater than 30% cover) mix of young conifer saplings and poles aged from 40 to 139 years since the last stand replacing disturbance. This state succeeds to late-development closed canopy (E) in the absence of disturbance. Replacement fires (B to A) were given a 200 year return interval. Avalanches (B to A) were given a 500 year return interval. Three types of variable disturbance, mosaic fires, climatic events, and insects, open up this state to mid-development open canopy (C). Mosaic fires (B to C) were given a 200-year return interval. Mortality by wind and weather stress (B to C) was set at 200 years, and by insect and pathogen outbreaks (B to C) was set at 150 years.

**Mid-Development with Open Canopy (C):** The mid-development with open canopy state includes a relatively sparse (less than 30% cover) mix of young conifer saplings and poles and aged from 40 to 139 years since the last stand replacing disturbance. This state succeeds to late-development open canopy (D). Replacement fires (C to A) were given a 1000-year return interval. Avalanches (C to A) were given a 200 year return interval. Mosaic fires maintain this state (C to C) and were given a 100-year return interval. Insects also maintain this state (C to C) and were given a 110 year return interval. An alternative "closed path" successional pathway (C to B) was also modeled.

**Late-Development with Open Canopy (D):** The late-development with open canopy state includes a relatively sparse (less than 30% cover) mix of mature conifers and includes areas that are 140+ years since the last stand replacing disturbance. Replacement fires (D to A) were given a 1000-year return interval. Mosaic fires maintain this state and were given a 50-year return interval. Competition and lack of seed source will also maintain this state and was set at 100 years. Insects also maintain this state with a 100 year return interval. An alternative "closed path" successional pathway (D to E) was also modeled.

**Late-Development with Closed Canopy (E):** The late-development with closed canopy state includes a relatively dense (greater than 30% cover) mix of mature conifers and includes areas that are 100+ years since the last stand replacing disturbance. Replacement fires (E to A) were given a 200-year return interval. Two types of disturbance open up these stands to late-development open canopy conditions. Mosaic fires (E to D) were given a 110-year return interval. Mortality by insects and pathogens (E to D) was set at 150 years.

## RESULTS AND DISCUSSION

The VDDT model for Greater Sand Dunes mixed conifer was run for 1000 years with 10 Monte Carlo simulations. The results of the VDDT model for Greater Sand Dunes mixed conifer forests within the western Sangre de Cristo Mountains indicates that a majority (approximately 62.8%) of this forest type should be in a late-development stage (Table 1). The remainder of the landscape is divided amongst early development (12%) and mid-development (25.5%) states. Model results show that approximately 42% of the mixed conifer forest would be in a closed canopy state and 46% would be in an open canopy state. This corresponds well to a relatively even distribution between north and south facing slopes. North facing slopes typically have closed canopies due to the more mesic conditions compared to the south facing slopes, which have open canopies.

**Table 1. VDDT model results showing the percent of the landscape each seral class contributes within reference conditions for Greater Sand Dunes mixed conifer forests.**

| Class | Percent of Landscape |
|---|---|
| Early Development - Post Replacement | 11.6% |
| Mid- Development with Closed Canopy | 14.1% |
| Mid- Development with Open Canopy | 11.4% |
| Late- Development with Closed Canopy | 28.3% |
| Late- Development with Open Canopy | 34.5% |

Overall, the results of the model appear to correspond well to the condition of the mixed conifer forests within the Greater Sand Dunes site. The majority of the forest is in a late- development state and is somewhat evenly divided between open (south facing) and closed (north facing) canopies. Fire within this system is typically mixed severity with infrequent (i.e. 100's of years) stand replacing fires (Alington 1998). Therefore, fire within the project area appears to be within its natural range of variability.

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**Greater Sand Dunes Fire Management Plan**
**Greater Sand Dunes Spruce- Fir**
**VDDT Model**
**August 1, 2004**

# INTRODUCTION

### Site Description

Spruce- fir forests are the primary forests in the montane and subalpine zones of the Southern Rocky Mountains (Neely et al. 2001). These forests occur between 9000 and 11,500 feet elevation within the sub- alpine zone (Neely et al. 2001, USFS 1996). The topography is generally moderately steep to steep, and soils are relatively rocky. The canopy is either closed (i.e. greater than 40% canopy cover) or open (i.e. less than 40% canopy cover). Engelmann spruce (*Picea engelmannii*) and sub- alpine fir (*Abies lasiocarpa*) are co- dominant species. Quaking aspen (*Populus tremuloides*) occurs in areas recently disturbed. Limber pine (*Pinus flexilis*) and bristlecone pine (*Pinus aristata*) also are present within this forest type on dry ridges. Spruce- fir forests grade into mixed conifer forests at lower elevations.

Fire, insects, windthrow, and avalanches are important disturbances within spruce- fir forests. Fires are typically large- scale, stand replacing events (Rondeau 2001).

# VDDT MODEL

The Vegetation Dynamics Development Tool (VDDT) is a quantitative state and transition computer model, which is used to create and analyze different successional pathways and landscape- level changes within a potential vegetation type (PVT) over time (http://www.essa.com/downloads/vddt/). VDDT allows the user to change the probabilities that different events (i.e. disturbances and/or management actions) will occur, as well as the successional pathways between different user- defined successional classes to test the effects of these changes on landscape successional patterns. This model was created by Nature Conservancy, National Park Service, Fish and Wildlife Service, and Colorado State Forest Service ecologists, biologists, and land managers through a collaborative process with review from other local and regional experts.

### Assumptions

The following assumptions were made in the Greater Sand Dunes spruce- fir model:

- Fire plays a dominant role in the maintenance of spruce- fir forests (Arno 2000, Alington 1998, USFS 1996). Spruce- fir forests are characterized by fire regime which includes moderately long to very long fire return intervals with a combination of mixed severity fires and stand replacing fires (Barrett 2003 a, b).

The mean fire return interval for replacement fire and non- replacement (mixed severity) fire mean return intervals were assumed to be approximately 330 years and 235 years, respectively.

- We assumed that the spruce- fir forests within the project area have not been heavily altered by human activity, and therefore, within their natural range of variation for fire. Fire suppression efforts have not had a large impact on these forests as they may have had in other forest ecosystems of the Southern Rocky Mountains (Alington 1998). These assumptions are based on the rugged nature and inaccessibility of much of this vegetation type within the Greater Sand Dunes area.

- For this model, we combined north and south facing slopes. The primary difference between north and south facing slopes is that north facing slopes are typically more mesic and, therefore, have fewer fires than south facing slopes. Because of the different site characteristics, open canopy conditions are more likely found on south- facing slopes, and closed canopy conditions are more likely found on north- facing slopes. Because of the more mesic conditions, north facing slopes would potentially have longer fire return intervals and, therefore, a higher probability of stand replacing fires due to greater fuel loads (i.e. closed canopy) compared to south facing slopes. However, open and closed canopies may occur on either slope depending on site characteristics and fire history.

- Successional classes with closed canopies were assumed to have a higher probability of stand replacing fires and a lower probability of surface and mosaic fires compared to those with open canopies. This assumption is based on there being greater fuel loads in closed canopy forests compared to open canopy forests. A higher percentage of fire starts in a closed canopy system will therefore lead to stand replacing fires rather than non- replacing fires.

- Wind and weather stress and insect and pathogen- caused mortality were assumed to only affect relatively small patches, rather than the whole landscape, within open and closed canopy states. It was assumed that these disturbances would not move either a mid- or late- development state back to an earlier state. Instead, the closed and open canopy states would move to or remain in an open state.

### Model Inputs and Transitions

This model was developed starting with a standardized VDDT model developed for the Fire Regime Condition Class project (http://frcc.gov) and modified using local and regional expert opinion. Some local fire history information was available from Catherine Alington's graduate work (Alington 1998) and USFS plan revision documents (USFS 1996). As additional review and validation is completed, these models will be revised.

The successional model used for spruce- fir forest was:

A: early development- post- replacement (age = 0- 59 years)
B: mid- development with closed canopy (age = 60- 139 years)
C: mid- development with open canopy (age = 60- 99 years)
D: late- development with open canopy (age = 140- 189 years)
E: late- development with closed canopy (age = 140+ years)

**Early Development- Post Replacement (A).** The early development- post replacement state includes grasses, forbs, and aspen with little to no conifer seedlings. This state ranges in age from 0 to 59 years succeeding to mid- development closed (B). An alternative successional pathway moves this state to mid- development open (C). This pathway reflects the more xeric conditions on south- facing slopes. Replacement fires setting the time back to 0 were given a 200- year return interval. Competition and lack of seed source leads to a slower transition into the mid- development condition and was set at 1000 year return interval. Avalanches maintain the state and are a common occurrence in a small portion of the area and were set at 1000 year return interval.

**Mid- Development with Closed Canopy (B):** The mid- development with closed canopy state includes a relatively dense (greater than 40% cover) mix of aspen and young conifer saplings and ranges in age from 60 to 139 years since the last stand replacing disturbance. This state succeeds to late- development closed canopy (E). Replacement fires (B to A) and mosaic fires (B to C) were given 500- year and 175- year return intervals, respectively. Two types of disturbance open up the stands. Mortality by wind and weather stress (B to C) was set at 300 years, and mortality by insect and pathogen outbreaks (B to C) was set at 500 years. Avalanches (B to A) were given a 1000 year return interval.

**Mid- Development with Open Canopy (C):** The mid- development with open canopy state includes a relatively sparse (less than 40% cover) mix of aspen and young conifer saplings and ranges in age from 60 to 99 years since the last stand replacing disturbance. This state succeeds to mid- development closed canopy (B) if it is not disturbed. Replacement fires (C to A) were given a 1000- year return interval. Avalanches (C to A) were also given a 1000 year return interval. Mosaic fires, which maintain the current state, were given a 150- year return interval. Mortality by wind and weather stress (C to C) was set at 1000 years, and mortality by insect and pathogen outbreaks (C to C) was set at 500 years. An alternative "open path" successional pathway (C to D) was set at 50 years. This successional pathway would keep the canopy open in the late development stage.

**Late- Development with Open Canopy (D):** The late- development with open canopy state includes a relatively sparse (less than 40% cover) mix of mature conifers and includes areas that are 140 to 189 years old since the last stand replacing disturbance. In the absence of disturbance, this successional state would move to a closed canopy, late- development state (E) after 49 years. Replacement fires (D to A) were given a 700- year return interval. Three variable types of disturbance, mosaic fires, climatic events, and insects, maintain the open nature of these stands. Mosaic fires (D to D) were given a 200- year return interval. Mortality by wind and weather stress (D to D) was set at 500 years, and mortality by insect and pathogen outbreaks (D to D) was set at 200 years. Avalanches (D to A) were given a return interval of 1000 years.

**Late- Development with Closed Canopy (E):** The late- development with closed canopy state includes a relatively dense (greater than 40% cover) mix of mature conifers and includes areas that are 140+ years old since the last stand replacing disturbance. Replacement fires (E to A) were given a 250 year return interval. Three variable types of disturbance open up the stands changing the state to late- development open canopy (D). Mosaic fires (E to D) were each given a 250- year return interval. Mortality by insects and pathogens (E to D) was set at 300 years. Mortality by wind and weather stress (E to D) was set at 500 years. Avalanches (E to A) were given a return interval of 1000 years.

## RESULTS AND DISCUSSION

The results of the VDDT model for spruce- fir forests within the Greater Sand Dunes area indicates that a majority of this forest type should be in a closed canopy state (Table 1). The results show that approximately 61% would be in a closed canopy state and 21% would be in an open canopy state. The early development- post replacement state would account for approximately 18% of the landscape, mid- development states would be 35%, and late- development states would be 47%.

**Table 1. VDDT model results showing the percent of the landscape each seral class contributes within reference conditions for spruce- fir forests within the western Sangre de Cristo Mountains.**

| Class | Percent of Landscape |
|---|---|
| Early Development - Post Replacement | 17.8% |
| Mid- Development with Closed Canopy | 26.2% |
| Mid- Development with Open Canopy | 8.9% |
| Late- Development with Open Canopy | 12.4% |
| Late- Development with Closed Canopy | 34.7% |

Overall, the results of the model appear to correspond well to the condition of the spruce- fir forests within the Greater Sand Dunes site. Fires within spruce- fir forests are typically infrequent with a combination of mixed severity (i.e. mosaic fires) and stand replacing fires (Alington 1998). Therefore, fire within the project area appears to be within its natural range of variability.

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# APPENDIX B: INTERNAL AND PUBLIC SCOPING

## Interdisciplinary and Core Teams

## Public Scoping Newsletter

## Public Scoping News Release

## Public Comments

## Summary of Public Scoping Comments

# Greater Sand Dunes Fire Management Plan
# Interdisciplinary and Core Teams

## INTERDISCIPLINARY TEAM

(*attendees at first internal scoping meeting)

**U.S. Fish and Wildlife Service**
Ken Kerr*
Kelli Stone*
Rich Sterry*
Galen Green*
Neal Beech*
Ron Garcia*
Brian DeVries*
Michael Blenden
Connie Young- Dubovsky
Galen Burgett

**National Park Service**
Nate Williamson*
Len Dems*
Phyllis Pineda*
Steve Chaney*
Jim Bowman*
Fred Bunch*
Andrew Valdez*
Eva Long

**The Nature Conservancy**
Ernst Strenge*
Terri Schulz*
Brian McPeek*
Paul Robertson

**U.S. Forest Service**
Jim Jaminet

**Bureau of Land Management**
Mark Swinny*
Jim Rhett*

**Colorado Division of Wildlife**
Brent Woodward*

**Colorado State Forest Service**

Boyd Lebeda*

## MEMBERS OF CORE TEAM

**National Park Service**
Nate Williamson
Jim Bowman
Fred Bunch

**U.S. Fish and Wildlife Service**
Ken Kerr
Brian DeVries
Galen Burgett
Connie Young- Dubovsky

**The Nature Conservancy**
Ernst Strenge
Terri Schulz
Paul Robertson

**Colorado State Forest Service**
Boyd Lebeda

**U.S. Forest Service**
Jim Jaminet

# Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and Medano-Zapata Ranch

**Notice of Public Scoping: Interagency Fire Management Plan**

## INTRODUCTION AND BACKGROUND

The National Park Service and U.S. Fish and Wildlife Service in conjunction with The Nature Conservancy are in the process of preparing an environmental assessment/assessment of effect for a comprehensive, interagency fire management plan. The boundaries of the fire management plan will include Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and The Nature Conservancy's Medano-Zapata Ranch. The environmental assessment/assessment of effect is a requirement of the National Environmental Policy Act (NEPA), which all federal agencies must follow when considering such actions.

Public scoping is an early part of the NEPA process that provides information about the proposed action to members of the general public and to other local, state, and federal agencies. It also provides an opportunity for the public and the other agencies to comment on potential social, cultural, and environmental issues and the proposed fire management alternatives.

In particular, the interagency team is interested in comments from the public that will help:

- Define issues that should and should not be examined in detail within the environmental assessment/assessment of effect
- Develop a range of reasonable alternatives that address the project's purpose and needs and that resolve important issues.

Two public scoping meetings will be held and will be open-house format. The first meeting will be held from 5:00 p.m. to 8:00 p.m. on March 24, 2004, in Alamosa at Trinidad State Junior College's Student Center (1015 Fourth Street, Alamosa). The second public scoping meeting will be held from 5:00 p.m. to 8:00 p.m. on March 25, 2004, at the Baca Grande Fire Department near Crestone. The purpose of these meetings is to present the proposed fire management alternatives established by an interagency planning team and to solicit comments from the public.

## PURPOSE AND NEED FOR A FIRE MANAGEMENT PLAN

Past land management practices in the San Luis Valley of Colorado have impacted many native species and their habitats. These land management practices have potentially altered fire regimes, and in some cases, created hazardous fuel build-up, which can threaten important natural and cultural resources and property values. In addition, the policies of National Park Service, U.S. Fish and Wildlife Service, and The Nature Conservancy require that land with burnable vegetation have a fire management plan in place. A fire management plan must be approved and in place before any fire management activities can occur on lands managed by these agencies. Fire management is an important tool that can be used on the landscape as a restorative process and for habitat management. A cooperative, interagency fire management plan will provide the framework for actions to enhance and maintain wildlife habitat, biodiversity, healthy ecosystems, and cultural resources, while preventing catastrophic wildfires. This project can also provide a collaborative model that will be useful for other landscapes within the San Luis Valley and beyond.

## PROJECT GOAL

The goal of the proposed project is to develop and implement an interagency, comprehensive, ecologically based fire management plan for the Western Sangres/Greater Sand Dunes landscape. The fire management plan will address the needs of the National Park Service, Fish and Wildlife Service, Colorado State Land Trust, and The Nature Conservancy, while developing interagency cooperation across the greater landscape of the San Luis Valley. The plan will follow the Interagency Fire Management Plan Template and be supported by a rigorous environmental analysis.

## ALTERNATIVES

Through internal scoping meetings, an interdisciplinary team consisting of local and regional agency staff members has developed three potential fire management alternatives that will be analyzed in the environmental assessment/assessment of effect. The interdisciplinary team consisted of staff from National Park Service, U.S. Fish and Wildlife Service, U.S. Forest Service, Bureau of Land Management, Colorado State Forest Service, Colorado Division of Wildlife and The Nature Conservancy. Please note that these alternatives are only preliminary and may be changed based on public comments.

The three preliminary alternatives that have been proposed are:

**No-Action/Fire Suppression Alternative (Alternative 1)**: Under the No-Action Alternative, all fires occurring within the project area would be suppressed and no active fuels management actions would occur within the project boundaries.

**Fire Suppression Plus Prescribed Fire and Mechanical and Chemical Treatment Alternative (Alternative 2)**: The Fire Suppression Plus Prescribed Fire and Mechanical and Chemical Treatment Alternative would be based on the “natural fire regimes” and/or “desired future conditions" of ecological systems within the project area. This alternative would allow for fuels management and prescribed fires to occur within appropriate limits of the project area. However, wildland fire use would not be allowed. All wildland fires would be suppressed regardless of ignition source or resources at risk.

**Fire Suppression, Prescribed Fire, and Mechanical and Chemical Treatment Plus Wildland Fire Use Alternative (Alternative 3):** The Fire Suppression, Prescribed Fire, and Mechanical and Chemical Treatment Plus Wildland Fire Use Alternative would be based on the "natural fire regimes" and/or "desired future conditions" of ecological systems within the project site. This alternative would allow for fuels management, prescribed fires, and wildland fire use within appropriate limits of the project area.

# ISSUES

The interdisciplinary team has identified the following issues and concerns regarding the fire management plan, which will be analyzed in the environmental assessment/assessment of effect:

1. Public Health and Safety
2. Legislation, Policies, and Management Plans
3. Water Quality
4. Water Rights
5. Air Quality
6. Cultural and Archeological Resources
7. Wildland/Urban Interface
8. Local Communities/Neighbors/Inholders
9. Native Americans Concerns
10. Vegetation Health/EcologicalSystem Integrity
11. Threatened and Endangered Species
12. Wildlife/Wildlife Habitat
13. Watershed Health
14. Socioeconomics
15. Ethnographic – Subsistence Use (e.g. Pinon Nuts)
16. Recreational Opportunities/Visitation
17. Public Access
18. Wilderness/Wilderness Designation
19. Facilities/Roads/Trails
20. Non-native and Invasive Species
21. Disease (e.g. White Pine Blister Rust)
22. Insects (e.g. Ips or Other Engravers)
23. Bison
24. Land Management/Land Use Allocation
25. Geological Resources
26. Streamflow Characteristics
27. Soundscapes
28. Floodplain and Wetlands
29. Gateway Communities

## WHEN AND HOW TO COMMENT

The comment period on the proposal is 30 days, March 16 to April 14, 2004. If you wish to comment please send your remarks to:

Jim Bowman, Chief Ranger
Great Sand Dunes National Monument and Preserve
National Park Service
11500 Highway 150
Mosca, CO 81146-9798

jim_bowman@nps.gov

Note that the names and address of people who comment become part of the public record. If you would like us to withhold your name and/or address, state so prominently at the beginning of your comments. Submissions from organizations, businesses, and individuals identifying themselves as representatives or officials of organizations or businesses will be available for review in their entirety.

Great Sand Dunes National Monument and Preserve
11500 Highway 150
Mosca, CO 81146

**WESTERN SANGRES/GREATER SAND DUNES**
**FIRE MANAGEMENT PLAN**
**PUBLIC COMMENT FORM**

Other issues and concerns you wish to see addressed or information about the project that you would like to provide:

## Alternatives

Internal scoping meetings resulted in the development of three preliminary alternatives. Do you have any ideas or concerns about these alternatives? Are there any other alternatives you think we should consider?

Please fold and return this comment form with your comments. If you wish to be added to the mailing list for this project, please provide your name and address below:

## What Comes Next

Once we review and analyze the information we get from public scoping, the interagency team along with The Nature Conservancy will evaluate public comments to determine if it is appropriate to proceed with an environmental assessment. If so, the EA will be prepared and distributed for public comment. Following public comment on the EA, a determination will be made as to whether additional NEPA documentation is required for the project or whether a decision document can be prepared. If during any part of this process it becomes apparent that there would be a potential for significant effects in implementing the FMP, then the EA process would be terminated, and the agencies would prepare a notice of intent to prepare an environmental impact statement for the plan.

*Fold so that return address on back is showing, tape closed, add a first-class stamp, and mail. Please send us your comments by April 14, 2004.*

Great Sand Dunes National Monument and Preserve
11500 Highway 150
Mosca CO 81146

Postage
Required

Great Sand Dunes National Monument and Preserve
Attention:  Jim Bowman
11500 Highway 150
Mosca, CO 81146

# NEWS RELEASE

**March 9, 2004**
For Immediate Release

**Contact**
Ernst Strenge, 719-378-2356 x 12,
estrenge@tnc.org
The Nature Conservancy in Colorado

**Greater Sand Dunes Area Interagency Fire Management Plan**
***Notice of Public Scoping Meeting***

ALAMOSA, CO — Great Sand Dunes National Monument and Preserve Superintendent, Steve Chaney, and Mike Blenden, Refuge Manager of the Alamosa, Monte Vista, and Baca National Wildlife Refuges, have announced the dates for public scoping meetings for an interagency fire management planning effort. This collaborative planning effort amongst the U.S. Fish and Wildlife Service, the National Park Service, and The Nature Conservancy will ultimately lead to the development of an interagency Fire Management Plan. The Fire Management Plan will establish the direction for fire-related operations at the Great Sand Dunes National Park and Preserve, the Baca National Wildlife Refuge, and The Nature Conservancy's Medano-Zapata Ranch. The public scoping meetings will be open-house format. The first meeting will be held from 5:00 p.m. to 8:00 p.m. on March 24, 2004, in Alamosa at Trinidad State Junior College's Student Center (1015 Fourth Street, Alamosa). The second public scoping meeting will be held from 5:00 p.m. to 8:00 p.m. on March 25, 2004, at the Baca Grande Fire Department near Crestone. The purpose of these meetings is to present the proposed fire management alternatives established by an interagency planning team and to solicit comments from the public. Comments obtained during public scoping will be analyzed in an environmental assessment.

The interagency team is currently considering three potential alternatives: a no-action/fire suppression alternative, a fire suppression plus prescribed fire and mechanical and chemical treatment alternative, and a fire suppression plus wildland fire use, prescribed fire and mechanical and chemical treatment alternative. These alternatives are only preliminary and may be changed based on public comments.

To evaluate alternatives and determine environmental consequences, the interagency team will be preparing a combined Environmental Assessment/Assessment of effect for this project. If you are unable to attend one of the open-house meetings, the team would still like to receive your comments regarding implementation of the proposed fire management plan and welcomes your interest in developing alternatives for this plan.

Please send your comments to: Jim Bowman, Chief Ranger
Great Sand Dunes National Monument and Preserve
National Park Service
11500 Highway 150
Mosca, CO 81146-9798

Or e-mailed to: jim_bowman@nps.gov

The public comment period on the proposed fire management plan is 30 days between March 15 and April 13, 2004. Please note that names and addresses of individuals who comment become part of the public record. If you would like us to withhold your name and or address, you must state this prominently at the beginning of your comments. We will make all submissions from organizations, businesses, and individual representatives of organizations available for public inspection in their entirety. Additional information can be found on the Great Sand Dunes National Monument and Preserve's website, http://www.nps.gov/grsa/press_room.htm

# Greater Sand Dunes
# Fire Management Plan
# Public Scoping - Public Comments
# March 16 – April 14, 2004

**Southern Ute Indian Tribe**

**Other issues and concerns:**
"Alternative "B" and keep us informed of the EA so we may comment."

**Alternatives**
No comment

**No Name Provided**

**Other Issues and Concerns**
"A missing partner is the Zapata Homeowners Association. The ZHA has been very active in doing fire mitigation on the subdivision. We have done some work on developing an ISO protection system. Water is the first component (getting water within a 1000' of clusters of homes). A second part of this should include the Mosca FD, the park, Zapata Ranch, BOR, WR, the Oasis, ZHA, FS, BLM, CSFS. The subdivision has removed insect damaged Pinyon, Ponderosa."

**Alternatives**
"Yes, to Alternative 2, add the formation of a fire subdistrict. It is important to think about this from an ecological stance, but a fire mgt. plan should include the people factor. Your alternatives address the resource and leave out people. The Park Service places people on the landscape where they want them, how about including your neighbors in the equation."

**Linda Ciulla**
**Shumei International Institute**
**Box 998**
**Crestone, CO 81131**

**Other Issues and Concerns**
No comments

**Alternatives**
"Alternative #3 sounds best to me – more options – allowing small, contained wildfires to burn, if <u>not</u> catastrophic, where appropriate – makes sense, as long as you have sufficient resources & personnel on hand to contain & monitor"

**Charles Sykes**
**14440 Estrella Road**
**Alamosa, CO 81101**

**Other Issues and Concerns**
No comments

**Alternatives**
"I prefer alt. #3 with concentration on achieving as near as possible to a natural fire occurrence."

**Budd Rice**
**3225 Nickel St.**
**Deming, NM 88030**

**Other Issues and Concerns**
No comments

**Alternatives**
"#3. I think this is the best way for fire management. Thank you."

**Patricia Skroch**
**PO Box 201**
**Alamosa, CO 81101**

**Other Issues and Concerns**
"The use of chemicals concerns me because of their adverse affect on wildlife and the likelihood they will be washed into the shallow and deep aquifers and pollute drinking water. The Valley's water supply comes from wells."

**Alternatives**
"Alternative 3 without using chemicals"

**Kimberly (last name not included)**
**(no address)**

**Other Issues and Concerns**
"A coordinated plan for mutual aid with the Baca Grande V.F.D."

**Alternatives**
"I like #3 Fire + Fire option with NO chemical application at all."

**George Hill**
**POB 1235**
**Crestone, CO 81131**

**Other issues and concerns:**
"NO CHEMICALS. NO HERBICIDES."

"Allow natural wildfires that occur within the natural fire regime and ecosystem succession. Use mitigation techniques, prescribed burns, fuels management to meet objectives. NO ACCESS ROADS TO PARK/WILDLANDS THROUGH BACA SUBDEVELOPMENT."

**Alternatives:**
"NO CHEMICALS/HERBICIDES. Hire BGVFD firefighters to manage fuels, perform mitigation activities, and controlled/prescribed burns. DO NOT suppress all wildland fires…allow burns that further goals of healthier ecosystem."

**No name or address provided**

**Other issues and concerns:**
No comment

**Alternatives:**
"Please let wildfires burn and don't use chemicals for suppression."

**No name or address provided**

**Other issues and concerns:**
No comment

**Alternatives:**
"Allow fires to burn that do not threaten urban areas, or possibly actively burn as a mitigation practice. No chemical usage. Perhaps study the ecosystem of the

past, before the valley was full of rabbitbrush, and aid the ecosystem returning to a state of biodiversity."

**Mark Belles**
**9318 Willard Street**
**Rowlett, TX 75088**
**(via letter)**

"Thank you for the Notice of Public Scoping: Interagency Fire Management Plan for the Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and Medano- Zapata Ranch. Please retain my name on the mailing list for this project."

I strongly recommend that all measures consistent with protection of life, property, and other resources (for instance historical and cultural) be taken to utilize wildland fire as much as possible to achieve the management scheme that most closely mimics a natural fire regime.

Thank you for the opportunity for input."

**Anna- Leah Hathaway**
**426 N. Hancock**
**Colorado Springs, CO 80903**

"Keep me on your mailing list, I broke my left foot. Therefore, I'm unable to walk but hope to.

Some of the public and private schools in the S.L.V. visit the Sand Dunes as a field trip. Please ask the teachers what they would like at the Sand Dunes. Please give the history on how the Sand Dunes were formed. The children like Medano Creek to play in. The picnic area is needed plus overnight areas. The fire that came through was very unmanageable – it jumped from place to place.

It is not a free area. We still pay to visit the Sand Dunes. The gate area seems a entrance. Could be more attractive and modern looking. How is the deer population? Are bears invading the camp grounds?

I'm a native of Monte Vista and remember when the Sand Dunes was free and open to the public. The Beans of Alamosa advertised the Sand Dunes. The Mosca Pass area was open but the road has been flooded and dirt washed into it. Medano Creek is a Jeep road to Wet Mt. area. Interesting but rough.

The pass to the north is open – coming out near Ark. River Highway. I miss the log cabin on way to Orient.

Keep the Visitor Center for explanations, movie and books, postcards, etc. for sale – restrooms too. You should be allowed money & get grants for improvements."

**No name provided**

**Other issues and concerns:**

"There are at least 2 studies out that address pinon- juniper fire regimes. I would like to see that the committee at least considers these in the context of the FMP. One study: Baker, W.L. & D.J. Shinneman. 2004. Fire and restoration of pinon-juniper woodlands in the western U.S.: a review. Forest Ecology and Management 189: 1- 21. The other (a book): Flood, L.M. 2003. Ancient Pinon-Juniper Woodlands. Hanna, D.D., W.H. Romme & M. Colyer, eds. 432 pp."

**Alternatives:**

"Alternative idea: Consider that some grasslands in the SLV may be ecologically managed by ground water levels rather than periodic fire regimes."

# Greater Sand Dunes Fire Management Plan
# Summary of Public Scoping Comments
# April 19, 2004

## SUMMARY OF COMMENTS

**Total Number of Comments Received: 13**

**Summary of Alternatives**

Alternative 1: Fire Suppression Only

Alternative 2: Fire Suppression Plus Prescribed Fire and Mechanical and Chemical Treatment

Alternative 3: Fire Suppression, Prescribed Fire, and Mechanical and Chemical Treatment Plus Wildland Fire Use

- Number of Comments in Favor of Alternative 1 = 0
- Number of Comments in Favor of Alternative 2 = 2
- Number of Comments in Favor of Alternative 3 = 5 (includes 2 comments for alternative 3 , but opposed to chemical use)
- Number of Comments Not Stating Specific Alternative Preference: 6

**Summary of Management Options**

- Number of Comments Opposed to Chemical Treatment = 5
- Number of Comments In Favor of Using Natural Fire Regimes/Wildland Fire Use in Management Options = 6

**Summary of General Issues and Concerns**
**(Note: these statements have been paraphrased from public comments)**

**Issue and Concern:** Include other partners in FMP (3 comments) (Note: other partners listed include Mosca Fire Department, Baca Grande Volunteer Fire Department, Zapata Homeowners Association, BOR, WR, the Oasis, U.S. Forest Service, Bureau of Land Management)

**Response:** The current project focuses on specific lands owned and managed by NPS, FWS, and TNC and does not currently address adjacent lands. However, an expanded FMP that includes the entire western flank of the Sangre de Cristo Mountains within the San Luis Valley may be produced in the future with cooperating private and public land owners. In addition, all partners listed have had the chance to participate in the current planning process for this FMP through the internal scoping and public scoping processes and will have the chance to comment on the Environmental Assessment for this project.

**Issue and Concern:** Adverse effect of chemicals on wildlife, aquifers, and drinking water supply (1 comment)

**Response:** The impacts of chemical treatments on wildlife and water resources will be analyzed in the Environmental Assessment. Impacts to wildlife and water resources will be minimized.

**Issue and Concern:** Include the "people factor" and include neighbors (1 comment)

**Response:** Human health and safety including the safety of fire fighting teams, agency personnel, neighbors, and the general public will be the number one priority of the Fire Management Plan, as well as the protection of facilities, private property, cultural resources, and natural resources.

**Issue and Concern:** Wildfires should be "small, contained" and "not catastrophic" (1 comment)

**Response:** All wildland fires will be assessed using the Wildland Fire Situation Analysis (WFSA), which is used to determine whether a wildfire will be allowed to burn or be suppressed. All efforts will be made to prevent uncharacteristically intense fires.

**Issue and Concern:** Sufficient resources and personnel to contain and monitor wildland fires (1 comment)

**Response:** All efforts will be made to ensure sufficient resources and personnel to contain and monitor wildland fires. The Fire Management Plan will provide details regarding resources and personnel, which will be updated annually.

**Issue and Concern:** Study past ecosystems within San Luis Valley and restore biodiversity (1 comment)

**Response:** The intent of the Fire Management Plan will be to preserve the potential natural vegetation within the planning area with the intent of maintaining biodiversity. Literature reviews of the potential natural vegetation within the planning area has been conducted.

**Issue and Concern:** "Consider that some grasslands in the SLV may be ecologically managed by ground water levels rather than periodic fire regimes."

**Response:** The Core Team is aware of the importance of water within the San Luis Valley and its influence on plant species composition. Fire will be used in portions of the planning area in conjunction with groundwater levels to manage the desired plant community.

**Issue and Concern:** Consider these publications for pinyon- juniper management:

Baker, W.L. & D.J. Shinneman. 2004. Fire and restoration of pinon- juniper woodlands in the western U.S.: a review. Forest Ecology and Management 189: 1-21.

Floyd, L.M. 2003. Ancient Pinon- Juniper Woodlands. Hanna, D.D., W.H. Romme & M. Colyer, eds. 432 pp.

**Response:** Members of the Core Team have reviewed these and other scientific publications regarding pinyon- juniper forests and other vegetation types within the project area.

**Issue and Concern:** No access roads to park/wildlands through Baca sub-development. (1 comment)

**Response:** The locations of access roads will be dealt with in the General Management Plans for the Great Sand Dunes National Park and Preserve and Baca National Wildlife Refuge.

# APPENDIX C: BIODIVERSITY AND WILDLIFE SPECIES WITHIN GREATER SAND DUNES SITE

**Significant Biodiversity**

**Mammals**

**Birds**

**Herpetiles**

**Arthropods**

# Species, Plant Communities and Ecological Systems of Biodiversity Significance WithinGreat Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and Medano- Zapata Ranch

| Conservation Targets | Global Rank | State Rank |
|---|---|---|
| **Plant Communities** | | |
| Alpine wetlands<br>*Cardamine cordifolia – Mertensia ciliata – Senecio triangularis* | G4 | S4 |
| Blowout grassland<br>*Redfieldia flexuosa* | G1? | S1? |
| Bulrush Wetland<br>*Schoenoplectus pungens (Scirpus pungens)* | G3G4 | S3 |
| Coyote Willow<br>*Salix exigua*/Bare ground | G5 | S5 |
| Emergent Wetland<br>*Eleocharis palustris* | G5 | S4 |
| Indian ricegrass- scurfpea grassland<br>*Oryzopsis hymenoides- Psoralidium lanceolatum* | G3Q | S1 |
| Montane Aspen Forest<br>*Populus tremuloides*/tall forbs | G5 | S5 |
| Montane Aspen Forest<br>*Populus tremuloides/Salix drummondiana* | GU | SU |
| Montane Riparian Forests<br>*Abies concolor – Picea pungens – Populus angustifolia/Acer glabrum* | G2 | S2 |
| Montane Riparian Forests<br>*Populus angustifolia/Alnus incana* | G3 | S3 |
| Montane Riparian Forests<br>*Populus angustifolia/Juniperus scopulorum* | G2G3 | S3 |
| Montane Riparian Forests | G2 | S1S2 |

| Conservation Targets | Global Rank | State Rank |
|---|---|---|
| *Populus tremuloides/Acer glabrum* | | |
| Montane Riparian Forests<br>*Pseudotsuga menziesii/Betula occidentalis* | G3 | S3? |
| Narrowleaf cottonwood/skunkbush<br>*Populus angustifolia/Rhus trilobata* | G3 | S3 |
| Narrowleaf cottonwood/willow alder riparian<br>*Populus angustifolia/Salix drummondiana- Acer glabrum* | G2? | S1 |
| Narrowleaf cottonwood/willow riparian forest<br>*Populus angustifolia/Salix lucida* var. *caudata* | G1Q | S1 |
| Narrowleaf cottonwood sand dune forest<br>*Populus angustifolia* sand dune forest | G1 | S1 |
| Needle- and- thread- Indian ricegrass grassland<br>*Hesperostipa comata- Oryzopsis hymenoides* | G2 | S1 |
| Saline Bottomland Shrublands<br>*Sarcobatus vermiculatus/Distichlis spicata* | G4 | S2 |
| Saltgrass Meadows<br>*Sporobolus airoides* | G5 | S3 |
| Spring Wetland<br>*Catabros aquatica- Mimulus* spp. | GU | S3 |
| Subalpine riparian/wetland carr<br>*Salix brachycarpa/Carex aqualtilis* | G2G3 | S2S3 |
| Thinleaf Alder/Mesic Forb Riparian Shrubland<br>*Alnus incana*/Mesic Forb | G3G4Q | S3 |
| Thinleaf Alder- Mixed Willow Species<br>*Alnus incana*- Mixed *Salix* spp. | G3 | S3 |
| Two- Needle Pinyon/Scribner's Needle Grass Woodland<br>*Pinus edulis/Hesperostipa scribneri* | G3 | S2 |
| Wet Meadow *Carex simulata* | G3 | S3 |

| **Conservation Targets** | **Global Rank** | **State Rank** |
|---|---|---|
| **Plants** | | |
| Catseye *Cryptantha pustulosa* | G5T? | S1 |
| Canyon Bog Orchid *Limnorchis ensifolia* | G4G5T3? | S3 |
| Slender Spiderflower *Cleome multicaulis* | G2G3 | S2S3 |
| Smith whitlowgrass *Draba smithii* | G2 | S2 |
| **Animals – Invertebrates** | | |
| A Circus Beetle *Eleodes hirtipennis* | G1 | S1 |
| A Sphinx Moth *Sphinx dollii* | G? | S2? |
| Colorado Blue *Euphilotes rita coloradensis* | G4T2T3 | S2 |
| Giant Sand Treader Cricket *Daihinibaenetes giganteus* | G3? | S1 |
| *Golden- edged gem* Schinia avemensis | G3 | S1 |
| Great Sand Dunes Anthicid Beetle *Amblyderus triplehorni* | G? | S? |
| Great Sand Dunes Anthicid Beetle *Amblyderus werneri* | G1? | S1 |
| Rhesus Skipper *Polites rhesus* | G4 | S2S3 |
| San Luis Dunes Tiger Beetle *Cicindela theatina* | G1 | S1 |
| San Luis Sandhill Skipper *Polites sabuleti ministigma* | G5T3 | S5 |
| Xanthus Skipper *Pygrus xanthus* | G3G4 | S3 |
| **Animals – Birds** | | |
| Ferruginous Hawk *Buteo regalis* | G4 | S3B, S4N |
| Sage Sparrow *Amphispiza belli* | G5 | S3B, SZN |
| Short- eared Owl *Asio flammeus* | G5 | S2B,SZN |
| Western Snowy Plover *Charadrium alexandrinus* | G4T3 | S1B, SZN |
| White- faced Ibis *Plegadis chihi* | G5 | S2B, SZN |

| Conservation Targets | Global Rank | State Rank |
|---|---|---|
| **Animals – Fish** | | |
| Rio Grande Chub *Gila pandora* | G3 | S1? |
| Rio Grande Cutthroat Trout *Oncorhynchus clarki virginalis* | G4T3 | S3 |
| Rio Grande Sucker *Catostomus plebeius* | G3G4 | S1 |
| **Animals – Mammals** | | |
| American Bison *Bos bison* | G4X | SX |
| Gunnison's prairie dog *Cynomys gunnisoni gunnisoni* | G5T3 | S3 |
| Townsend's big- eared bat<br>*Corynorhinus townsendii pallescens* | G4T4 | S2 |
| Plain's Pocket Mouse *Perognathus flavescens relictus* | G5T2 | S2 |
| Silky Pocket Mouse *Perognatus flavus sanluisi* | G5T3 | S3 |
| Pine Martin *Martes americana* | G5 | |

## Rank/Status Legend for Table

| Global and State Ranks | |
|---|---|
| G/S1 | Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction. |
| G/S2 | Imperiled globally/state because of its rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range. |
| G/S3 | Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences). |
| G/S4 | Apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. |
| G/S5 | Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery. |
| G/S#? | Indicates uncertainty about an assigned rank. |
| G/SU | Unable to assign rank due to lack of available information. |
| G/SX | Exterpated |

# MAMMALS OF THE GREATER SAND DUNES PLANNING AREA

**(Based on Armstrong 2003 and Valdez 2003)**

## ORDER INSECTIVORA

### Family Soricidae—Shrews

Montane Shrew (*Sorex monticolus*)
Water Shrew (*Sorex palustris*)

## ORDER CHIROPTERA—BATS

### Family Vespertilionidae—Common Bats

Western Small- footed Myotis (*Myotis ciliolabrum*)
Long- eared Myotis (*Myotis evotis*)
Little Brown Bat (*Myotis lucifugus*)
Occult myotis (*Myotis occultus*)
Long- legged Myotis (*Myotis volans*)
Hoary Bat (*Lasiurus cinereus*)
Silver- haired Bat (*Lasionycteris noctivagans*)
Big Brown Bat (*Eptesicus fuscus*)
Townsend's Big- eared Bat (*Plecotus townsendii*)

### Family Molossidae—Free- tailed Bats

Brazilian Free- tailed Bat (*Tadarida brasiliensis*)

## ORDER LAGOMORPHA—RABBITS AND ALLIES

### Family Leporidae- - Rabbits and Hares

Desert Cottontail (*Sylvilagus audubonii*)
Nuttall's Cottontail (*Sylvilagus nuttalli*)
White- tailed Jackrabbit (*Lepus townsendii*)
Snowshoe Hare (*Lepus americanus*)

## ORDER RODENTIA—RODENTS

### Family Sciuridae—Squirrels

Least Chipmunk (*Tamias minimus*)
Colorado Chipmunk (*Tamias quadrivittatus*)
Yellow- bellied Marmot (*Marmota flaviventris*)
Golden- mantled Ground Squirrel (*Spermophilus lateralis*)
13- Lined Ground Squirrel (*Spermophilus tridecemlineatus*)
Rock Squirrel (*Spermophilus variegatus*)

Gunnison’s Prairie Dog (*Cynomys gunnisoni*)
Abert’s Squirrel (*Sciurus aberti*)
Pine Squirrel (*Tamiasciurus hudsonicus*)

**Family Geomyidae—Pocket Gophers**
Northern Pocket Gopher (*Thomomys talpoides*)

**Family Heteromyidae—Pocket Mice and Allies**
Plains Pocket Mouse (*Perognathus flavescens*)
Silky Pocket Mouse (*Perognathus flavus*)
Ord's Kangaroo Rat (*Dipodomys ordii*)

**Family Castoridae—Beavers**
American Beaver (*Castor canadensis*)

**Family Muridae—Mice and Rats**
Western Harvest Mouse (*Reithrodontomys megalotis*)
Deer Mouse (*Peromyscus maniculatus*)
Northern Rock Mouse (*Peromyscus nasutus*)
Northern Grasshopper Mouse (*Onychomys leucogaster*)
Bushy- tailed Woodrat (*Neotoma cinerea*)
House Mouse (*Mus musculus*)
Long- tailed Vole (*Microtus longicaudus*)
Meadow Vole (*Microtus pennsylvanicus*)
Montane Vole (*Microtus montanus*)
Muskrat (*Ondatra zibethicus*)

**Family Zapodidae—Jumping Mice**
Western Jumping Mouse (*Zapus princeps*)

**Family Erethizontidae—New World Porcupines**
Porcupine (*Erethizon dorsatum*)

**ORDER CARNIVORES—CARNIVORES**

**Family Canidae—Dogs and Allies**
Coyote (*Canis latrans*)
Red Fox (*Vulpes vulpes*)
Gray Fox (*Urocyon cinereoargenteus*)

**Family Ursidae—Bears**
Black Bear (*Ursus americanus*)

### Family Procyonidae—Raccoons and Allies
Raccoon (*Procyon lotor*)

### Family Mustelidae—Weasels and Allies
Long- tailed Weasel (*Mustela frenata*)
Badger (*Taxidea taxus*)
Western Spotted Skunk (*Spilogale gracilis*)
Striped Skunk (*Mephitis mephitis*)

### Family Felidae—Cats
Mountain Lion (*Felis concolor*)
Bobcat (*Felis rufus*)

## ORDER ARTIODACTYLA—EVEN- TOED HOOFED MAMMALS

### Family Cervidae—Deer
American Elk (*Cervus elaphus*)
Mule Deer (*Odocoileus hemionus*)

### Family Antilocapridae—Pronghorn
Pronghorn—*Antilocapra americana*

### Family Bovidae—Cattle, Sheep, and Allies
Bison (*Bison bison*)
Bighorn Sheep (*Ovis canadensis*)

## Bird Species of the Greater Sand Dunes Planning area

(Based on bird checklist from Great Sand Dunes National Monument and Preserve
and Monte Vista and Alamosa National Wildlife Refuges)

**ABUNDANCE:**

**c - Common. Several may be seen in one day.**
**o - Occasional. Small number may be seen in one day.**
**r - Rare. Sightings are unusual, only a few expected in any one year.**
**acc – Accidental or extremely rare, seen only in occassional years.**

**STATUS:**

**P - Permanent, year- round resident.**
**S - Summer resident (usually including spring and fall migration)**
**W - Winter resident.**

*** Introduced species.**

| Category | Common Name | Scientific Name | Abundance | Status |
|---|---|---|---|---|
| **LOONS** | | | | |
| | Common Loon | *Gavia immer* | R | S |
| **GREBES** | | | | |
| | Eared Grebe | *Podiceps nigricollis* | O | S |
| | Horned Grebe | *Podiceps auritus* | r | S |
| | Red- necked Grebe | *Podiceps grisegena* | acc | |
| | Pied- billed Grebe | *Podilymbus podiceps* | O | S |
| | Clark's Grebe | *Aechmophorus clarkii* | O | S |
| | Western Grebe | *Aechmophorus occidentalis* | O | S |
| **PELICANS** | | | | |
| | American White Pelican | *Pelecanus erythrorhynchos* | O | S |
| **CORMORANTS** | | | | |
| | Double- crested Cormorant | *Phalacrocorax auritus* | R | S |
| **HERONS, BITTERNS, AND EGRETS** | | | | |
| | American Bittern | *Botaurus lentiginosus* | O | S |
| | Least Bittern | *Ixobrychus exilis* | Acc | |
| | Black- crowned Night- | *Nycticorax nycticorax* | C | S |

| | | | | |
|---|---|---|---|---|
| | Heron | | | |
| | Green Heron | *Butorides virescens* | r | S |
| | Little Blue Heron | *Egretta caerulea* | r | S |
| | Cattle Egret | *Bubulcus ibis* | R | S |
| | Snowy Egret | *Egretta thula* | C | S |
| | Great Egret | *Ardea alba* | O | S |
| | Great Blue Heron | *Ardea herodias* | C | P |
| | Tricolored Heron | *Egretta tricolor* | Acc | |
| **IBISES** | | | | |
| | White- faced Ibis | *Plegadis chihi* | C | S |
| | White Ibis | *Eudocimus albus* | Acc | |
| **VULTURES** | | | | |
| | Turkey Vulture | *Cathartes aura* | O | S |
| **GEESE AND DUCKS** | | | | |
| | Canada Goose | *Branta canadensis* | C | P |
| | Green- winged Teal | *Anas crecca* | O | S |
| | Mallard | *Anas platyrhynchos* | C | P |
| | Northern Pintail | *Anas acuta* | O | P |
| | Canvasback | *Aythya valisineria* | O | S |
| | Redhead | *Aythya americana* | O | S |
| | Common Goldeneye | *Bucephala clangula* | C | W |
| | Barrow's Goldeneye | *Bucephala islandica* | R | W |
| | Bufflehead | *Bucephala albeola* | O | S |
| | Common Merganser | *Mergus merganser* | O | S |
| | Red- breasted Merganser | *Mergus serrator* | R | S |
| | Hooded Merganser | *Lophodytes cucullatus* | R | S |
| | Tundra Swan | *Cygnus columbianus* | R | S |
| | Greater White- fronted Goose | *Anser albifrons* | R | S |
| | Snow Goose | *Chen caerulenscens* | O | W |
| | Ross's Goose | *Chen rossii* | R | W |
| | Wood Duck | *Aix sponsa* | R | P |
| | Gadwall | *Anas strepera* | C | P |
| | American Black Duck | *Anas rubripes* | Acc | |
| | Eurasian Wigeon | *Anas penelope* | Acc | |
| | American Wigeon | *Anas americana* | O | P |
| | Northern Shoveler | *Anas clypeata* | C | P |
| | Blue- winged Teal | *Anas discors* | C | C |
| | Cinnamon Teal | *Anas cyanoptera* | C | P |
| | Ring- necked Duck | *Aythya collaris* | O | S |

| | | | |
|---|---|---|---|
| Greater Scaup | *Aythya marila* | R | S |
| Lesser Scaup | *Aythya affinis* | O | S |
| Ruddy Duck | *Oxyura jamaicensis* | C | S |
| **EAGLES, HAWKS, AND FALCONS** | | | |
| Osprey | *Pandion haliaetus* | R | S |
| Bald Eagle | *Haliaeetus leucocephalus* | O | W |
| Northern Harrier | *Circus cyaneus* | C | P |
| Sharp- shinned Hawk | *Accipiter striatus* | O | P |
| Cooper's Hawk | *Accipiter cooperii* | O | P |
| Northern Goshawk | *Accipiter gentilis* | R | P |
| Swainson's Hawk | *Buteo swainsoni* | O | S |
| Red- tailed Hawk | *Buteo jamaicensis* | C | P |
| Ferruginous Hawk | *Buteo regalis* | O | P |
| Rough- legged Hawk | *Buteo lagopus* | O | W |
| Golden Eagle | *Aquila chrysaetos* | O | P |
| American Kestrel | *Falco sparverius* | C | P |
| Merlin | *Falco columbarius* | R | W |
| Peregrine Falcon | *Falco peregrinus* | R | P |
| Prairie Falcon | *Falco mexicanus* | O | P |
| **GROUSE AND TURKEYS** | | | |
| Blue Grouse | *Dendragapus obscurus* | O | P |
| White- tailed Ptarmigan | *Lagopus leucurus* | O | P |
| Wild Turkey | *Meleagris gallopavo* | R | P |
| **RAILS, COOTS, AND SHOREBIRDS** | | | |
| American Coot | *Fulica americana* | R | S |
| Virginia Rail | *Rallus limicola* | R | P |
| Sora | *Porzana carolina* | R | S |
| **CRANES** | | | |
| Greater Sandhill Crane | *Grus canadensis* | C | S |
| **PLOVERS** | | | |
| Killdeer | *Charadrius vociferus* | C | S |
| Mountain Plover | *Charadrius montanus* | R | S |
| Black- bellied Plover | *Pluvialis squatarola* | R | S |
| Semipalmated Plover | *Charadrius semipalmatus* | O | S |
| Snowy Plover | *Charadrius alexandrinus* | R | S |
| **STILTS AND AVOCETS** | | | |
| American Avocet | *Recurvirostra americana* | C | S |
| Black- necked Stilt | *Himantopus mexicanus* | R | S |

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| **SANDPIPERS, PHALAROPES** | | | | |
| | Willet | *Catoptrophorus semipalmatus* | O | S |
| | Greater Yellowlegs | *Tringa melanoleuca* | O | S |
| | Lesser Yellowlegs | *Tringa flavipes* | O | S |
| | Solitary Sandpiper | *Tringa solitaria* | R | S |
| | Spotted Sandpiper | *Actitis macularia* | O | S |
| | Long- billed Curlew | *Numenius americanus* | O | S |
| | Whimbrel | *Numenius phaeopus* | Acc | |
| | Marbled Godwit | *Limosa fedoa* | O | S |
| | Sanderling | *Calidris alba* | O | S |
| | Western Sandpiper | *Calidris mauri* | O | S |
| | Least Sandpiper | *Calidris minutilla* | O | S |
| | Dunlin | *Calidris alpina* | R | S |
| | White- rumped Sandpiper | *Calidris fuscicollis* | R | S |
| | Semi- palmated Sandpiper | *Calidris pusilla* | R | S |
| | Baird's Sandpiper | *Calidris bairdii* | O | S |
| | Pectoral Sandpiper | *Calidris melanotos* | O | S |
| | Long- billed Dowitcher | *Limnodromus scolopaceus* | O | S |
| | Short- billed Dowitcher | *Limnodromus griseus* | Acc | |
| | Stilt Sandpiper | *Calidris himantopus* | O | S |
| | Common Snipe | *Gallinagogallinago* | C | P |
| | Wilson's Phalarope | *Phalaropus tricolor* | C | S |
| | Red Phalarope | *Phalaropus fulicaria* | Acc | |
| | Red- necked Phalarope | *Phalaropus lobatus* | R | S |
| **GULLS, TERNS** | | | | |
| | Franklin's Gull | *Larus pipixcan* | R | S |
| | Bonaparte's Gull | *Larus philadelphia* | R | S |
| | California Gull | *Larus californicus* | R | S |
| | Herring Gull | *Larus argentatus* | R | S |
| | Glaucous- winged Gull | *Larus glaucescens* | Acc | |
| | Forster's Tern | *Sterna forsteri* | O | S |
| | Least Tern | *Sterna antillarum* | Acc | |
| | Black Tern | *Chlidonias niger* | R | S |
| | Ring- billed Gull | *Larus delawarensis* | O | S |
| **PIGEONS AND DOVES** | | | | |
| | Band- tailed Pigeon | *Columba fasciata* | O | S |
| | Mourning Dove | *Zenaida macroura* | C | S |
| | Rock Dove | *Columba livia* | C | P |
| **CUCKOOS** | | | | |
| | Yellow- billed Cuckoo | *Coccyzus americanus* | Acc | |

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|---|---|---|---|---|
| | Greater Roadrunner | *Geococcyx californianus* | R | S |
| **OWLS** | | | | |
| | Flammulated Owl | *Otus flammeolus* | R | S |
| | Western Screech Owl | *Otus kennicottii* | R | S |
| | Great Horned Owl | *Bubo virginianus* | O | P |
| | Northern Pygmy Owl | *Glaucidium gnoma* | R | P |
| | Short- eared Owl | *Asio flammeus* | R | P |
| | Burrowing Owl | *Athene cunicularia* | O | S |
| | Long- eared Owl | *Asio otus* | O | P |
| | Northern Saw- whet Owl | *Aegolius acadicus* | o | P |
| | Barn Owl | *Tyto alba* | R | S |
| **NIGHTHAWKS AND POORWILLS** | | | | |
| | Common Nighthawk | *Chordeiles minor* | C | S |
| | Common Poorwill | *Phalaenoptilus nuttallii* | o | S |
| **SWIFTS** | | | | |
| | White- throated Swift | *Aeronautes saxatalis* | C | S |
| | Black Swift | *Cypseloides niger* | O | S |
| **HUMMINGBIRDS** | | | | |
| | Black- chinned Hummingbird | *Archilochus alexandri* | O | S |
| | Broad- tailed Hummingbird | *Selasphorus platycercus* | C | S |
| | Rufous Hummingbird | *Selasphorus rufus* | O | S |
| | Calliope Hummingbird | *Stellula calliope* | R | S |
| **KINGFISHERS** | | | | |
| | Belted Kingfisher | *Ceryle alcyon* | O | P |
| **WOODPECKERS** | | | | |
| | Lewis' Woodpecker | *Melanerpes lewis* | O | S |
| | Red- headed Woodpecker | *Melanerpes erythrocephalus* | Acc | |
| | Yellow- bellied Sapsucker | *Sphyrapicus varius* | Acc | |
| | Williamson's Sapsucker | *Sphyrapicus thyroideus* | O | S |
| | Red- naped Sapsucker | *Sphyrapicus nuchalis* | O | S |
| | Downy Woodpecker | *Picoides pubescens* | C | P |
| | Hairy Woodpecker | *Picoides villosus* | O | P |
| | Three- toed Woodpecker | *Picoides tridactylus* | O | P |
| | Northern Flicker | *Colaptes auratus* | C | P |
| **TYRANT FLYCATCHERS** | | | | |
| | Olive- sided Flycatcher | *Contopus cooperi* | O | S |
| | Western Wood Pewee | *Contopus sordidulus* | O | S |
| | Dusky Flycatcher | *Empidonax oberholseri* | r | S |

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|---|---|---|---|---|
| | Hannomd'sFlycatcher | *Empidonax hammondii* | r | S |
| | Gray Flycatcher | *Empidonax wrightii* | R | S |
| | Cordilleran Flycatcher (formerly called W Flycatcher) | *Empidonax occidentalis* | O | S |
| | Say's Phoebe | *Sayornis saya* | C | S |
| | Black Phoebe | *Sayornis nigricans* | Acc | |
| | Ash- throated Flycatcher | *Myiarchus cinerascens* | R | S |
| | Cassin's Kingbird | *Tyrannus vociferans* | R | S |
| | Western Kingbird | *Tyrannus verticalis* | O | S |
| | Eastern Kingbird | *Tyrannus tyrannus* | R | S |
| | Willow Flycatcher | *Empidonax traillii* | R | S |
| **SHRIKES** | | | | |
| | Northern Shrike | *Lanius excubitor* | R | w |
| | Loggerhead Shrike | *Lanius ludovicianus* | O | P |
| **VIREOS** | | | | |
| | Plumbeous Vireo | *Vireo plumbeus* | O | S |
| | Warbling Vireo | *Vireo gilvus* | O | S |
| | Yellow- throated Vireo | *Vireo flavifrons* | Acc | |
| | Red- eyed Vireo | *Vireo olivaceus* | R | S |
| **JAYS, MAGPIES, CROWS** | | | | |
| | Gray Jay | *Perisoreus canadensis* | O | P |
| | Steller's Jay | *Cyanocitta stelleri* | C | P |
| | Blue Jay | *Cyanocitta cristata* | R | P |
| | Western Scrub Jay | *Aphelocoma californica* | O | P |
| | Pinyon Jay | *Gymnorhinus cyanocephalus* | C | P |
| | Clark's Nutcracker | *Nucifraga columbiana* | O | P |
| | Black- billed Magpie | *Pica hudsonia* | C | P |
| | American Crow | *Corvus brachyrhynchos* | O | P |
| | Common Raven | *Corvus corax* | C | P |
| **LARKS** | | | | |
| | Horned Lark | *Eremophila alpestris* | C | P |
| **SWALLOWS** | | | | |
| | Tree Swallow | *Tachycineta bicolor* | C | S |
| | Violet- green Swallow | *Tachycineta thalassina* | C | S |
| | Northern Rough- winged Swallow | *Stelgidopteryx serripennis* | O | S |
| | Bank Swallow | *Riparia riparia* | R | S |
| | Cliff Swallow | *Petrochelidon pyrrhonota* | O | S |
| | Barn Swallow | *Hirundo rustica* | C | S |

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| **CHICKADEES AND TITMICE** | | | |
| Black- capped Chickadee | *Poecile atricapilla* | O | P |
| Mountain Chickadee | *Poecile gambeli* | O | P |
| Juniper (Plain) Titmouse | *Baeolophus griseus* | O | P |
| **BUSHTITS** | | | |
| Bushtit | *Psaltriparus minimus* | C | P |
| **NUTHATCHES** | | | |
| Red- breasted Nuthatch | *Sitta canadensis* | O | P |
| White- breasted Nuthatch | *Sitta carolinensis* | O | P |
| Pygmy Nuthatch | *Sitta pygmaea* | O | P |
| **CREEPERS** | | | |
| Brown Creeper | *Certhia americana* | O | P |
| **WRENS** | | | |
| Rock Wren | *Salpinctes obsoletus* | O | S |
| Canyon Wren | *Catherpes mexicanus* | R | S |
| House Wren | *Troglodytes aedon* | O | P |
| Marsh Wren | *Cistothorus palustris* | C | S |
| **DIPPERS** | | | |
| American Dipper | *Cinclus mexicanus* | O | P |
| **KINGLETS AND GNATCATCHERS** | | | |
| Golden- crowned Kinglet | *Regulus satrapa* | R | P |
| Ruby- crowned Kinglet | *Regulus calendula* | O | P |
| Blue- gray Gnatcatcher | *Polioptila caerulea* | R | S |
| **SOLITAIRES AND THRUSHES** | | | |
| Western Bluebird | *Sialia mexicana* | R | S |
| Mountain Bluebird | *Sialia currucoides* | C | P |
| Townsend's Solitaire | *Myadestes townsendi* | O | P |
| Swainson's Thrush | *Catharus ustulatus* | O | S |
| Hermit Thrush | *Catharus guttatus* | O | S |
| American Robin | *Turdus migratorius* | C | P |
| **MOCKINGBIRDS AND THRASHERS** | | | |
| Gray Catbird | *Dumetella carolinensis* | R | S |
| Northern Mockingbird | *Mimus plyglottos* | R | S |
| Sage Thrasher | *Oreoscoptes montanus* | O | S |
| Brown Thrasher | *Toxostoma rufum* | R | S |
| **STARLINGS** | | | |
| European Starling* | *Sturnus vulgaris* | O | P |
| **PIPITS** | | | |
| Water Pipit | *Anthus spinoletta* | O | S |

| | | | | |
|---|---|---|---|---|
| | American Pipit | *Anthus rubescens* | O | S |
| **WAXWINGS** | | | | |
| | Bohemian Waxwing | *Bombycilla garrulus* | R | W |
| | Cedar Waxwing | *Bombycilla cedrorum* | R | P |
| **WOOD WARBLERS** | | | | |
| | Orange- crowned Warbler | *Vermivora celata* | O | S |
| | Virginia's Warbler | *Vermivora viriniae* | R | S |
| | Tennessee Warbler | *Vermivora peregrina* | Acc | |
| | Yellow Warbler | *Dendroica petechia* | O | S |
| | Yellow- rumped Warbler | *Dendroica coronata* | C | S |
| | Black- throated Gray Warbler | *Dendroica nigrescens* | R | S |
| | Townsend's Warbler | *Dendroica townsendi* | R | S |
| | Grace's Warbler | *Dendroica graciae* | R | S |
| | Northern Parula | *Parula americana* | R | S |
| | Ovenbird | *Seiurus aurocapillus* | R | S |
| | McGillivray's Warbler | *Oporornis tolmiei* | O | S |
| | Worm- eating Warbler | *Helmitheros vermivora* | Acc | |
| | Black- and- white Warbler | *Mniotilta varia* | Acc | |
| | American Redstart | *Setophaga ruticilla* | R | S |
| | Common Yellowthroat | *Geothlypis trichas* | R | S |
| | Wilson's Warbler | *Wilsonia pusilla* | O | S |
| | Northern Waterthrush | *Seiurus noveboracensis* | O | S |
| **TANAGERS** | | | | |
| | Western Tanager | *Piranga ludoviciana* | C | S |
| **GROSBEAKS, BUNTINGS, AND SPARROWS** | | | | |
| | Northern Cardinal | *Cardinalis cardinalis* | Acc | |
| | Rose- breasted Grosbeak | *Pheucticus ludovicianus* | O | S |
| | Black- headed Grosbeak | *Pheucticus melanocephalus* | C | S |
| | Blue Grosbeak | *Guiraca caerulea* | R | S |
| | Lazuli Bunting | *Passerina amoena* | O | S |
| | Indigo Bunting | *Passerina cyanea* | R | S |
| | Green- tailed Towhee | *Pipilo chlorurus* | C | S |
| | Spotted Towhee | *Pipilo maculatus* | O | P |
| | Canyon Towhee | *Pipilo fuscus* | R | P |
| | American Tree Sparrow | *Spizella arborea* | O | W |
| | Chipping Sparrow | *Spizella passerina* | C | S |
| | Brewer's Sparrow | *Spizella breweri* | C | S |
| | Vesper Sparrow | *Pooecetes gramineus* | C | S |
| | Lark Sparrow | *Chondestes grammacus* | O | S |

| | | | |
|---|---|---|---|
| Sage Sparrow | *Amphispiza belli* | O | S |
| Lark Bunting | *Calamospiza melanocorys* | R | S |
| Savannah Sparrow | *Passerculus sandwichensis* | O | S |
| Fox Sparrow | *Passerella iliaca* | O | S |
| Song Sparrow | *Melospiza melodia* | C | P |
| Lincoln's Sparrow | *Melospiza lincolnii* | O | S |
| White- throated Sparrow | *Zonotrichia albicollis* | R | S |
| White- crowned Sparrow | *Zonotrichia leucophrys* | C | P |
| Harris' Sparrow* | *Zonotrichia querula* | R | W |
| Cassin's Sparrow | *Aimophila cassinii* | Acc | |
| Black- throated Sparrow | *Amphispiza bilineata* | R | S |
| Grasshopper Sparrow | *Ammodramus savannarum* | R | S |
| Dark- eyed Junco | *Junco hyemalis* | C | P |
| **BLACKBIRDS AND ORIOLES** | | | |
| Red- winged Blackbird | *Agelaius phoeniceus* | C | P |
| Western Meadowlark | *Sturnella neglecta* | C | P |
| Yellow- headed Blackbird | *Xanthocephalus xanthocephalus* | O | P |
| Brewer's Blackbird | *Euphagus cyanocephalus* | C | P |
| Brown- headed Cowbird | *Molothrus ater* | C | S |
| Bullock's Oriole | *Icterus bullockii* | O | S |
| Bobolink | *Dolichonyx oryzivorus* | R | S |
| Great- tailed Grackle | *Quiscalus mexicanus* | O | P |
| Common Grackle | *Quiscalus quiscalus* | C | S |
| **FINCHES** | | | |
| Brown- capped Rosy Finch | *Leucosticte australis* | O | P |
| Black Rosy Finch | *Leucosticte atrata* | R | W |
| Gray- crowned Rosy- Finch | *Leucosticte tephrocotis* | R | W |
| Pine Siskin | *Carduelis pinus* | O | P |
| Pine Grosbeak | *Pinicola enucleator* | R | P |
| Cassin's Finch | *Carpodacus cassinii* | O | P |
| House Finch | *Carpodacus mexicanus* | O | P |
| Red Crossbill | *Loxia curvirostra* | R | P |
| Common Redpoll | *Carduelis flammea* | R | S |
| Lesser Goldfinch | *Carduelis psaltria* | O | S |
| American Goldfinch | *Carduelis tristis* | O | P |
| Evening Grosbeak | *Coccothraustes vespertinus* | R | P |
| **OLD WORLD SPARROWS** | | | |
| House Sparrow* | *Passer domesticus* | R | P |

# Amphibians and Reptiles of the Greater Sand Dunes Planning Area

Based on Muth and Street (2002) and TNC Medano- Zapata collections

CLASS: AMPHIBIA

ORDER CAUDATA
FAMILY AMBYSTOMATIDAE – MOLE SALAMANDERS

__Tiger salamander – *Ambystoma tigrinum*

ORDER ANURA
FAMILY PELOBATIDAE – SPADEFOOT TOADS AND RELATIVES

__Plains Spadefoot – *Spea bombifrons*
__New Mexico Spadefoot – *Spea multiplicata*

FAMILY BUFONIDAE

__Woodhouse's Toad – *Bufo woodhousii*
__Great Plains Toad – *Bufo cognatusi*

FAMILY HYLIDAE

__Western Chorus Frog – *Pseudacris triseriatus*

FAMILY RANIDAE

__Bullfrog – *Rana catesbeiana*
__Northern Leopard Frog – *Rana pipiens*

CLASS: REPTILIA

ORDER TESTUDINES

FAMILY EMYDIDAE

__Western Painted Turtle – *Chrysemy picta*

ORDER SQUAMATA
FAMILY CROTAPHYTIDAE
__Short- horned Lizard – *Phrynosoma hernandesi*
__Fence Lizard – *Sceloporus undulatus*

FAMILY SCINCIDAE - - SKINKS

__Many- lined Skink – *Eumeces multivirgatus*

ORDER SQUAMATA
SUBORDER SERPENTES

FAMILY COLUBRIDAE

__Smooth Green Snake – *Liochlorophis vernalis*
__Bullsnake – *Pituophis catenifer*
__Western Terrestrial Garter Snake – *Thamnophis elegans*

FAMILY VIPERIDAE - - VIPERS

__Western Rattlesnake – *Crotalus viridis*

# AN INVENTORY OF ARTHROPOD SPECIES RECORDED TO DATE FROM GREAT SAND DUNES, COLORADO
**(Modified from Pineda 2002)**

[*** = apparently endemic species]
[†† = additions to the list from 1999 surveys at Indian Spring Natural Area]

HEXAPODA

MICROCORYPHIA
- Machilidae (unidentified)

EPHEMEROPTERA
- Baetidae
  - *Baetis tricaudatus*
  - †† *Callibaetis ferruginea* hageni
- Heptageniidae
  - *Cinygmula* sp.
  - *Epeorus longimanus*
- Leptophlebiidae
  - *Paraleptophlebia debilis*
- Leptohyphidae
  - †† *Tricorythodes minutus*
- Ephemerellidae
  - *Ephemerella infrequens*

ODONATA
- Aeshnidae
  - *Aeshna constricta*
  - *Aeshna palmata*
- Coenagrionidae
  - †† *Amphiagrion abbreviatum*
  - †† *Enallagma carunculatum*
  - †† *Enallagma clausum*
  - †† *Ischnura damula*
- Gomphidae
  - †† *Ophiogomphus severus*
- Libellulidae
  - *Sympetrum corruptum*
  - †† *Sympetrum internum*
  - *Sympetrum occidentale*
  - †† *Sympetrum pallipes*
  - †† *Sympetrum vicinum*
- Lestidae
  - *Lestes congener*
  - *Lestes dryas*
  - *Lestes unguiculatus*

PHASMIDA
- Heteronemiidae
  - *Parabacillus coloradus*

ORTHOPTERA
- Acrididae
  - *Acrolophitus hirtipes*
  - †† *Arphia conspersa*
  - *Amphitornus coloradus*
  - *Arphia pseudonietana*
  - *Camnula pellucida*
  - *Circotettix rabula rabula*
  - *Cordillacris occipitalis*
  - *Cratypedes neglectus*
  - *Dissosteira carolina*
  - *Hadrotettix trifasciatus*
  - *Hesperotettix speciosus*
  - *Melanoplus bowditchi*
  - *Melanoplus bowditchi canus*
  - *Melanoplus femur- rubrum*
  - *Melanoplus packardii packardii*
  - *Melanoplus* spp.
  - *Mestobregma plattei corrugata*
  - †† *Oecanthus argentinus*
  - *Psoloessa delicatula*
  - *Spharagemon campestris*
  - *Spharagemon collare*
  - *Trimerotropis agrestis*
  - *Trimerotropis cincta*
  - *Trimerotropis fratercula*
  - *Trimerotropis maritima*
  - *Trimerotropis verruculatus*

*suffusa*
  - *Xanthippus montanus*
- Gryllidae
  - *Oecanthus quadripunctatus*
- Rhaphidophoridae
  - *Ceuthophilus utahensis*
  - *Ceuthophilus* spp.
  - *Daihinibaenetes giganteus*
- Stenopelmatidae
  - *Stenopelmatus* sp.
- Tettigoniidae

*Anabrus simplex*
*Conocephalus fasciatus*

MANTODEA
Mantidae
*Yersiniops solitarium*

PLECOPTERA
Pteronarcyidae
*Pteronarcella badia*
Nemouridae
*Malenka coloradensis*
Perlodidae
*Isoperla quinquepunctata*
†† *Isoperla sobria*
Chloroperlodidae
*Plumiperla diversa*
*Sweltsa lamba*

HEMIPTERA
Pentatomidae
*Banasa sordida*
*Chlorochroa granulosa*
*Chlorochroa sayi*
*Chlorochroa uhleri*
*Murgantia histrionica*
*Perillus exaptus*
Scutelleridae
*Amaurochrous cinctipes*
(unidentified)
Cydnidae
*Microporus obliquus*
Coreidae
*Chelinidea vittiger*
*Leptoglossus clypealis*
*Leptoglossus occidentalis*
Alydidae
*Alydus pluto*
*Alydus* spp.
*Megalotomus quinquespinosus*
Rhopalidae
*Harmostes* sp.
*Liorhyssus* sp.
(unidentified)
Lygaeidae
*Lygaeus reclivatus* say
*Neocoryphus lateralis*
*Nysius* sp.
*Peritrechus fraternus*
*Xyonysius* c.f. *califonicus*
Phymatidae
†† *Phymata americana*
coloradensis
*Phymata* sp.
Reduviidae
*Arilus cristatus*
*Fitchia aptera*
*Sinea diadema*
Nabidae
*Nabis* sp.
Miridae
*Atractotomus striacolor*
*Hadronema picta* ?
*Ilnacora chloris*
*Litomiris debilis*
*Lopidea* sp.
*Lygidea rubecula*
*Lygus atriflavus*
*Lygus elisus*
*Lygus lineolaris*
*Lygus nubilatus*
*Lygus shulli*
*Orthotylus viridis*
*Phytocoris comulus*
*Phytocoris consors*
*Phytocoris heidemanni*
*Phytocoris inops*
*Phytocoris simulatus*
*Phytocoris validus*
*Polymerus balli*
*Stenodema pilosipes*
*Tupiocoris agilis* ?
Gerridae
†† *Gerris comatus*
(unidentified)
Corixidae
*Cenocorixa* sp.
*Graptocorixa abdominalis*
†† *Hesperocorixa laevigata*
*Sigara alternata*
Notonectidae
*Notonecta kirbyi*
*Notonecta undulata*

HOMOPTERA
Aphididae (unidentified)
Delphacidae (unidentified)
Membracidae
*Publilia modesta*
†† *Tortistilus* sp.
(unidentified)
Cicadellidae
*Aceratogallia arida*
*Aceratogallia uhleri*
*Aceratogallia* sp.
*Athysanella occidentalis*

*Idiocerus snowi*
*Kybos* sp.
*Laevicephalus parbulus*
*Oncometopia lateralis*
(unidentified)
Dictyopharidae
*Scolops* sp.

NEUROPTERA
Myrmeleontidae
*Brachynemurus nigrilabris*
*Brachynemurus peregrinus*
*Brachynemurus sackeni*
*Myrmeleon immaculatus*
Chrysopidae
*Chrysopa coloradensis*
*Chrysopa oculata*
*Chrysoperla* sp.
*Eremochrysa* sp.
Hemerobiidae
*Hemerobius* sp.
*Micromus* sp.
Raphidiidae
*Raphidia* sp.

COLEOPTERA
Carabidae
*Agonum placidum*
*Amara impuncticollis*
*Bembidion graphicum*
*Calosoma obsoletum*
*Cicindela cinctipennis*
*cinctipennis*
*Cicindela formosa*
*Cicindela fulgida fulgida*
*Cicindela hirticollis shelfordi*
*Cicindela lengi*
*Cicindela nevadica knausi*
*Cicindela oregona guttifera*
*Cicindela punctulata*
*Cicindela repanda*
*** *Cicindela theatina*
†† *Cicindela tranquebarica*
*Elaphrus lecontei*
*Euryderus grossus*
*Geopinus incrassatus*
*Harpalus amputatus*
*Harpalus erraticus*
*Harpalus paratus*
*Harpalus* spp.
*Omophron tessellatum*
Haliplidae
†† *Haliplus immaculicollis*

Dytiscidae
†† *Agabus griseipennis*
*Agabus lutosus*
*Colymbetes exaratus incognitus*
*Dytiscus* sp.
*Graphoderes occidentalis*
*Hydroporus* sp. (vilis complex)
*Hygrotus impressopunctatus*
*Hygrotus infuscatus*
*Hygrotus masculinus*
†† *Hygrotus sayi*
†† *Hygrotus sellatus*
*Hygrotus tumidiventris*
*Hygrotus* sp.
*Ilybius fraterculus*
*Laccophilus maculosus decipiens*
*Liodessus affinis*
†† *Liodessus obscurellus*
*Stictotarsus striatellus*
†† *Rhantus binotatus*
†† *Rhantus frontalis*
*Rhantus* sp.
Gyrinidae
*Gyrinus* sp.
Hydraenidae
†† *Octhebius lineatus*
Hydrophilidae
*Cercyon* sp.
†† *Enochrus hamiltoni*
*Hydrochus* sp.
*Sphaeridium scarabaeoides*
†† *Tropisternus sublaevis*
*Tropisternus* sp.
Histeridae
*Hypocaccus* n.sp.
†† *Hypocaccus* n. sp. near *bigener*
†† *Hypocaccus patruelis*
†† *Hypocaccus propensus*
†† *Hypocaccus* sp.
†† *Saprinus discoidalis*
*Saprinus lugens*
†† *Saprinus oregonensis*
†† *Spilodiscus ulkei*
*Spilodiscus* sp.
†† *Xerosaprinus* sp.
(unidentified)
Staphylinidae
*Aleochara bimaculata*
*Creophilus maxillosus*
Silphidae
*Heterosilpha ramosa*
†† *Nicrophorus carolinus*
*Nicrophorus guttula*

*Nicrophorus marginatus*
Lucanidae
*Pseudolucanus mazama*
Scarabaeidae
†† *Aphodius distinctus*
*Aphodius* sp.
*Diplotaxis belfragei*
*Eucanthus impressus*
*Glaresis ecostata*
*Ligyrus gibbosus*
*Phyllophaga fimbripes*
*Phyllophaga* sp.
*Polyphylla decimlineata*
*Serica alternata*
*Serica bruneri*
*Serica procula*
*Serica* sp. (prob. *anthracinia*)
*Trichiotinus assimilis*
*Trox sonorae*
Dryopidae
*Helichus striatus*
Elmidae
*Heterlimnius corpulenta*
*Optioservus divergens*
Elateridae
†† *Cardiophorus* undescribed
Buprestidae
†† *Agrilus politus* politus
*Dicerca tenebrica*
*Melanophila gentilis*
Lampyridae (unidentified)
Cantharidae
*Chauliognathus scutellaris*
Dermestidae
*Trogoderma* sp. (prob. *angustum*)
(unidentified)
Cleridae
*Enoclerus moestus*
*Phyllobaenus* sp.
*Trichodes ornatus ornatus*
Melyridae
*Collops bipunctatus*
(unidentified)
Nitidulidae
*Carpophilus* sp.
Phalacridae
*Phalacrus* sp.
Coccinellidae
*Anatis lecontei*
*Coccinella monticola*
*Coccinella septempunctata*
*Coccinella transversoguttata richardsoni*
*Hippodamia caseyi*
*Hippodamia convergens*
*Hippodamia quinquesignata*
*Hippodamia tredecimpunctata tribalis*
*Myzia interrupta*
Rhipiphoridae
†† *Rhipiphorus vierecki*
Tenebrionidae
*Bothrotes plumbeus*
*Coniontis obesa*
*Eleodes acuticaudus*
*Eleodes brunnipes*
*Eleodes caudiferus*
*Eleodes extricatus*
*** *Eleodes hirtipennis*
*Eleodes longicollis*
*Eleodes obscurus dispersus*
*Eleodes pimelioides*
*Eleodes snowi*
*Eleodes sponsus*
*Eleodes tricostatus*
*Embaphion contusum*
*Embaphion glabrum*
†† *Embaphion planum*
*Eusattus reticulatus*
*Helops* sp.
*Telabis aspera*
†† *Trox sonorae*
Mordellidae (unidentified)
Meloidae
*Epicauta* sp.
†† *Gnathium francillon*
†† *Gnathium minimum*
*Lytta nuttalli*
*Nemognatha* sp.
*Pyrota bilineata*
*Tricrania stansburyi*
†† *Zonitis atripennis*
(unidentified)
Anthicidae
*Amblyderus pallens*
*** *Amblyderus triplehorni*
*** *Amblyderus werneri*
*Anthicus lutulentus*
*Anthicus* sp.
*Notoxus* sp.
Cerambycidae
*Anoplodera canadensis*
*Arhopalus rusticus montanus*
*Batyle ignicollis*

*Batyle suturalis pearsalli*
*Cortodera longicornis*
*Crossidius coralinus jocosus*
*Crossidius hirtipes wickhami*
*Crossidius pulchellus*
*Grammopera subargentata*
*Moneilema appressum*
*Monochamus clamator*
*Monochamus scutellatus*
*Pachyta lamed liturata*
*Prionus californicus*
*Prionus emarginatus*
*Prionus integer*
*Typocerus balteatus*
†† *Typocerus serraticornis*
*Xylotrechus undulatus*

Chrysomelidae
*Altica bimarginata*
*Altica* sp.
*Cryptocephalus* spp.
*Disonycha alternata*
*Disonycha latifrons*
*Disonycha* sp.
*Galeruca costatissima*
*Macrohaltica* sp.
*Microhopala excavata cyanea*
*Pachybrachis* sp.
*Phyllotreta* spp.
*Saxinis saucia*
*Tricholochamaea* sp. ?
*Trirhabda lewisii*
*Trirhabda nitidicollis*
*Zygogramma conjuncta*

Curculionidae
*Epimechus* sp.
(unidentified)

TRICHOPTERA

Hydropsychidae
*Arctopsyche grandis*
*Cheumatopsyche* sp.

Glossosomatidae
*Agapetus boulderensis*
*Glossosoma* sp.

Hydroptilidae
*Hydroptila* sp.

Rhyacophilidae
*Rhyacophila coloradensis*

Brachycentridae
*Brachycentrus americanus*

Limnephilidae
*Limnephilus* sp.

LEPIDOPTERA

Oecophoridae
*Agonopterix* sp. ?

Gelechiidae (unidentified)

Tortricidae
*Acleris* sp. ?
*Argyrotaenia coloradana*
*Dorithia semicirculana*
*Eucosma crambitana*
*Eucosma fernaldana*
*Eucosma* nr. *ridingsana*
*Eucosma* sp.
†† *Phaneta* sp.
*Syndemis* sp. [or *Pandemis* sp.]
*Xenotemna pallorana*

Hesperiidae
*Erynnis icelus*
*Hesperia comma colorado* ?
*Hesperia comma ochracea*
*Hesperia nevada*
*Hesperia uncas*
*Oarisma garita*
*Pyrgus communis*
*Pyrgus xanthus*
*Yvretta rhesus*

Papilionidae
†† *Papilio machaon bairdii*
*Papilio rutulus*
*Parnassius smintheus*
*psuedorotgeri*

Pieridae
*Colias eurytheme*
*Eurema nicippe*
*Neophasia menapia*
*Pieris rapae*
*Pontia beckerii*
*Pontia protodice*

Lycaenidae
*Agriades glandon rustica*
*Callophrys affinis homoperplexa*
*Callophrys gryneus siva*
*Callophrys niphon niphon*
*Celestrina ladon cinerea*
*Euphilotes rita coloradensis*
*Hemiargus isola alce*
*Icaricia acmon lutzi*
*Icaricia icarioides lycea*
*Leptotes marina*
*Lyaeides melissa melissa*
*Lycaena arota schellbachi*
*Lycaena rubida sirius*
*Satyrium behrii crossi*
*Strymon melinus franki*

Riodinidae
*Apodemia mormo pueblo*
Nymphalidae
*Chlosyne acastus*
*Euptoieta claudia*
*Limenitis weidemeyeri weidemeyeri*
*Nymphalis antiopa*
*Phyciodes pratensis camillus*
*Poladryas arachne arachne*
*Polygonia hylas*
*Speyeria aphrodite ethne*
*Vanessa atalanta atalanta*
*Vanessa cardui*
Satyridae
*Cercyonis meadi alamosa*
*Cercyonis oetus charon*
*Coenonympha ochracea*
*Cyllopsis pertepida dorothea*
*Neominois ridingsii ridingsii*
*Oeneis chryxus chryxus*
Danaidae
*Danaus gilippus*
*Danaus plexippus*
Pyralidae
†† *Loxostege commixtalis*
†† *Loxostege stictialis*
†† *Melitara* sp.
†† *Prorasea simalis*
(unidentified)
Geometridae
*Caripeta aequaliaria*
*Caripeta interalbicans*
*Cheteoscelis bistriaria*
*Chlorosea nevadaria*
*Enypia griseata*
*Epiplatymetra coloradaria*
*Eupithecia anticaria*
*Hydriomena morosata*
*Hydriomena perfracta centralis*
*Hydriomena similaris*
*Iridopsis emasculata*
*Itame bitactata*
*Itame decorata*
*Itame flavicaria*
*Metanema inatomaria*
*Perizoma custodiata*
*Pero behrensaria*
*Plataea trilinearia*
*Prionomelia spododea*
*Prochoerodes forficaria*
*Prochoerodes truxaliata*
*Prochoerodes* n.sp. [nr. *amplicineraria*]
*Scelidacantha triseriata*
†† *Semiothisa curvata*
*Semiothisa nubiculata*
*Semiothisa subminiata*
*Semiothisa* sp.
*Stamnodes formosata*
*Stamnodes morrisata*
*Synchlora aerata liquoraria*
Lasiocampidae
*Gloveria arizonensis*
*Malacasoma californica*
*Phyllodesma americana*
Saturniidae
*Antheraea polyphemus*
*Coloradia doris*
*Hemileuca nuttalli*
*Hyalophora gloveri*
Sphingidae
*Hemaris senta*
*Hyles lineata*
*Smerinthus cerisyi*
*Sphinx dollii*
Arctiidae
*Eilema bicolor*
†† *Estigmene albida*
†† *Grammia virguncula*
†† *Grammia williamsii*
*Hypercompe rmaculata*
*Lophocampa ingens*
*Lophocampa maculata*
Lymantriidae
*Dasychira* sp. ?
Noctuidae
*Abagrotis discoidalis*
*Abagrotis reedi*
*Agroperina conradi*
*Agrotis ipsilon*
*Anathix aggressa*
*Andropolia diversilineata*
*Apamea devastator*
*Apamea niveivenosa*
*Apamea occidens*
*Aseptis fumosa*
*Brachylomia populi*
†† *Caenurgina erechtea*
*Catocala grotiana*
*Catocala hermia*
*Copablepharon absidum*
*Copablepharon grande*
†† *** *Copablepharon* undescribed
*Copablepharon* sp.

*Crassivesica bocha*
*Cucullia* sp.
†† *Discestra trifolii*
*Drasteria mirifica klotsi*
*Enargia decolor*
*Enargia infumata*
*Eurois praefixa*
*Euxoa albipennis*
†† *Euxoa aurantiaca*
*Euxoa aurulenta*
*Euxoa auxiliaris*
*Euxoa brevipennis*
*Euxoa cicatricosa*
*Euxoa divergens*
*Euxoa messoria*
*Euxoa mimallonis*
*Euxoa moerens* ?
*Euxoa obeliscoides*
*Euxoa oblongistigma*? [or *olivalis*]
*Euxoa quadridentata*
*Euxoa ridingsiana*
*Euxoa scandens*
*Euxoa stigmatalis*
*Euxoa tessellata* ?
*Euxoa* sp.
†† *Hadenella pergentilis*
*Helicoverpa zea*
*Hemieuxoa rudens*
*Homohadena fifia*
*Lacanobia lilacina*
*Lacinipolia naevia*
*Lacinipolia olivacea megarena*
*Lacinipolia umbrosa*
*Lacinipolia vicina*
*Lacinipolia* sp.
*Litholomia napaea*
*Oligia* sp.
*Oncocnemis balteata*
*Oncocnemis colorado*
*Oncocnemis hayesi*
*Oncocnemis homogena*
*Oncocnemis iricolor*
*Peridroma saucia*
*Platyperigea camina*
*Platyperigea extima*
*Platyperigea meralis*
†† *Platysenta discistriga*
†† *Polia discalis*
*Ponometia sutrix*
*Protogygia* sp.
*Protorthodes utahensis*
*Protorthodes* sp. (prob. *akalus*)
*Pseudanarta caeca*
*Pseudanarta flavidens*
*Pseudanarta perplexa*
*Pseudanarta* sp.
*Raphia coloradensis* ?
*Richia parentalis*
*Schinia avemensis*
*Schinia balba brucei*
*Schinia* nr. *citrinella*
*Schinia meadi*
†† *Schinia obliqua*
†† *Schinia sexplagiata*
*Schinia unimacula*
*Schinia* sp.
*Scoliopteryx libatrix*
*Stiria rugifrons*
*Synedoida inepta*
*Trichocerapoda oblita*
*Trichocerapoda strigata*
(unidentified)

DIPTERA
Tipulidae
*Dicranota* sp.
*Hexatoma* sp.
*Tipula* sp.
Bibionidae
*Bibio femorata*
Mycetophilidae (unidentified)
Sciaridae (unidentified)
Cecidomyiidae
*Rhabdophaga strobiloides*
*Rhopalomyia chrysothamni*
Scatopsidae
*Aspistes* sp.
Culicidae
*Aedes malanimon*
*Aedes* sp.
*Culex tarsalis*
*Culiseta inornata*
Simuliidae
*Simulium* sp.
(unidentified)
Chironomidae (unidentified)
Tabanidae
*Chrysops* sp.
Rhagionidae
*Symphoromyia* sp.
Stratiomyidae
†† *Euparyphus mutabilis*
*Nemotelus* sp.
*Saragus cuprarius*
†† *Stratiomys* sp.

Therevidae

*Acrosathe* sp.
*Ozodiceromya* sp.
*Pherocera* sp. ?
*Psilocephala* sp. (nr. *lateralis*)
*Thereva* sp.

Asilidae

*Ablautus rufotibialis*
*Asilus formosus*
*Cyrtopogon plausor*
*Efferia frewingi*
*Efferia jubata*
*Efferia rapax*
*Efferia staminea*
*Efferia varipes*
*Efferia* sp. (prob. *subcuprea*)
*Eucyrtopogon* sp.
*Laphria* sp.
*Lasiopogon quadrivittatus*
*Lasiopogon* sp.
*Machimus adjustus*
*Machimus occidentalis* ?
*Proctacanthella cacopiloga*
*Proctacanthus micans*
*Proctacanthus milberti*
*** *Proctacanthus* n.sp.
*Promachus nigripes*
*Promachus* sp. (prob. *albifacies*)
*Stenopogon coyote*
*Stenopogon engelhardti*
*Stenopogon indistinctus*
*Stenopogon inquinatus*
*Stenopogon martini*
*Stenopogon* sp.
*Stichopogon argenteus*
*Stichopogon trifasciatus*

Bombyliidae

*Apolysis* sp.
*Dipalta serpentina*
*Exoprosopa* spp.
*Hemipenthes* sp.
*Oligodranes* sp.
*Paravilla* sp., nr. *fulviana*
*Phthiria* sp.
*Thevenemyia* sp.
*Villa* sp., nr. *lateralis*
*Villa* sp.

Empididae

*Platypalpus* sp.
(unidentified)

Phoridae (unidentified)

Syrphidae

*Allograpta obliqua*
*Baccha lemus*
*Chrysogaster parva*
*Crioprora femorata*
*Eristalis hirtus*
*Eristalis latifrons*
*Eristalis tenax*
*Eupeodes volucris*
*Helophilus latifrons*
*Melanostoma stegnum*
*Paragus bicolor*
*Paragus tibialis*
*Paragus variabilis*
†† *Polydontomyia curvipes*
*Scaeva pyrastri*
*Sphaerophoria cylindrica*
*Sphaerophoria philanthus*
*Spilomyia interrupta*
*Toxomerus marginatus*
*Volucella satura*
*Xylota* sp. ?

Pipunculidae

*Tomosvaryella* sp.

Conopidae

†† *Myopa flavopilosa*
*Physocephala texana*
*Zodion fulvifrons*

Micropezidae

*Micropeza turcana*

Otitidae

*Ceroxys latisculus*
*Oedopa ascriptiva*
*Otites* sp.

Pyrgotidae

*Sphecomyiella valida*

Tephritidae

*Tephritis* sp.

Agromyzidae

*Agromyza* sp.
(unidentified)

Sepsidae

*Sepsis* sp.

Sciomyzidae

*Limnia* sp.

Lauxaniidae

*Camptoprosopella dolorosa*
*Homoneura* sp.

Chamaemyiidae

*Chamaemyia* sp.
*Leucopis* sp.

Curtonotidae

*Curtonotum helvum*

Ephydridae (unidentified)

Chloropidae

- *Chlorops* sp.
- *Meromyza* sp.
- Heleomyzidae
  - *Pseudoleria* sp.
  - *Suillia* sp.
- Anthomyidae (unidentified)
- Muscidae
  - *Fannia* sp.
  - (unidentified)
- Calliphoridae
  - *Phaenicia sericata*
  - *Phormia regina*
  - *Protophormia terraenovae*
- Sarcophagidae
  - *Eumacronychia* sp., nr. *elita*
  - *Metoposarcophaga pachyproctosa*
  - *Phrosinella fulvicornis*
  - *Ravina lherminieri*
  - *Sarcophaga aldrichi*
  - *Senotainia* sp., nr. *trilineata*
  - *Senotainia* spp.
  - *Wohlfahrtia vigil opaca*
- Tachinidae
  - *Acroglossa hesperidarum*
  - *Archytas* sp.
  - *Clairvillia* sp. ?
  - *Cylindromyia armata*
  - *Cylindromyia* spp.
  - *Deopalpus* sp.
  - *Epalpus* sp. (prob. *signifer*)
  - *Frontiniella parancilla* ?
  - *Gonia* spp.
  - *Juriniopsis* sp.
  - *Leucostoma* sp. ?
  - *Linnaemya* sp.
  - *Microchaetina* sp.
  - *Parachytas* sp.
  - *Peleteria aldrichi*
  - *Peleteria* spp.
  - *Phasia* sp.
  - *Ptilodexia agilis*
  - *Ptilodexia* sp.
  - *Spallanzania* sp.
  - *Tachina* sp. ?
  - (unidentified)
- Oestridae
  - *Cuterebra approximata*

HYMENOPTERA

- Cephidae
  - †† *Cephus cinctus*
- Trigonalidae
  - †† *Lycogaster pullata* nevadensis
- Braconidae
  - †† *Aleiodes* sp.
  - *Apanteles* spp.
  - †† *Bracon* spp.
  - †† *Cardiochiles* sp.
  - †† *Chorebus* sp.
  - *Cremnops* sp.
  - *Iphiaulax* sp.
  - †† *Microplitis* spp.
  - *Rogas* sp.
  - (unidentified)
- Ichneumonidae
  - *Anomalon* sp.
  - †† *Coccygomimus varians*
  - †† *Cremastus orbitalis*
  - †† *Cremastus* sp.
  - †† *Enicospilus merdarius*
  - *Enicospilus* sp.
  - †† *Exetastes flavus*
  - *Exochus* sp.
  - *Glypta* sp.
  - †† *Hemiteles* sp.
  - *Megarhyssa* sp.
  - †† *Mesochorus* sp.
  - *Netelia* sp.
  - †† *Ophion bilineatus*
  - *Ophion* sp.
  - †† *Phaeogenes* sp.
  - (unidentified)
- Mymaridae (unidentified)
- Eulophidae
  - *Entedon* sp.
  - (unidentified)
- Encyrtidae (unidentified)
- Eupelmidae (unidentified)
- Torymidae
  - *Torymus koebeli*
  - *Torymus* nr. *tubularis*
- Pteromalidae
  - *Pteromalus* sp.
- Eurytomidae (unidentified)
- (unidentified family of Proctotrupoidea)
- Chalcididae
  - *Spilochalcis arcana*
  - †† *Conura subobsoleta*
- Chrysididae
  - *Ceratochrysis kansensis*
  - *Chrysis coerulans*
  - *Chrysis dorsalis*
  - †† *Chrysis nitidula*
  - *Chrysis scitula*
  - †† *Elampus marginatus*

†† *Holopyga* sp.
*Hedychridium nevadae*
*Hedychridium nigropilosum*

Bethylidae

*Epyris clarimontis*
*Epyris myrmecophilus*

Sphecidae

*Ammophila azteca*
*Ammophila harti*
*Ammophila ferruginosa*
*Ammophila juncea*
*Ammophila macra*
*Ammophila strenua*
†† *Ammophila polita*
*Ammophila procera*
†† *Ammophila pruinosa*
*Ammoplanops* sp.
*Ancistromma aurantia*
*Ancistromma capax*
†† *Ancistromma sericifrons*
*Aphilanthops frigidus*
*Bembecinus quiquespinosus*
*Bembix americana spinolae*
*Bembix pruinosa*
*Bembix sayi*
*Bicyrtes ventralis*
*Bothynostethus distinctus*
*Cerceris bicornuta bicornuta*
*Cerceris conifrons*
*Cerceris echo*
*Cerceris rhois*
*Cerceris sexta*
*Cerceris tepanica*
*Cerceris wyomingensis*
*Cerceris* sp.
*Clypeadon laticinctus*
*Crabro florissantensis*
*Crabro pallidus*
*Crossocerus* sp.
*Diodontus occidentalis*
*Diodontus rugosus*
*Dryudella caerulea*
*Dryudella rhimpa*
*Ectemnius dilectus*
*Ectemnius* sp.
*Encopognathus wenonah*
*Eucerceris fulvipes*
*Eucerceris superba superba*
*Eucerceris zonata*
*Gorytes canaliculatus*
*Hoplisoides placidus birkmanni*
*Hoplisoides spilopterus*
*Hoplisoides* sp.
*Larropsis uniformis*
*Larropsis vegeta*
*Larropsis* sp.
*Mellinus abdominalis*
*Microbembex californica*
*Microbembex monodonta*
†† *Microstictia femorata*
†† *Mimesa unicincta*
*Mimesa* sp.
†† *Mimumesa* sp.
*Miscophus* sp.
*Oryttus gracilis arapaho*
*Oryttus* sp.
*Oxybelus emarginatum*
*Oxybelus parvum*
†† *Oxybelus taenigaster*
*Oxybelus uniglumis*
*quadrinotatus*
*Palmodes carbo*
*Philanthus albopilosus*
*Philanthus basilaris*
*Philanthus bicinctus*
*Philanthus inversus*
*Philanthus psyche*
*Philanthus pulcher*
*Philanthus zebratus*
*Plenoculus davisi*
*Plenoculus propinquus*
*Plenoculus* sp.
†† *Podalonia argentifrons*
*Podalonia communis*
*Podalonia luctuosa*
*Podalonia mexicana*
*Podalonia mickeli*
*Podalonia occidentalis*
*Podalonia robusta*
†† *Prionyx atrata*
*Prionyx canadensis*
*Prionyx parkeri*
*Prionyx thomae*
*Pseudoplisus venustus* ?
*Pulverro* sp.
*Steniolia obliqua*
*Stictiella plana*
*Tachysphex quebecensis*
†† *Tachysphex similis*
†† *Tachysphex tarsata*
*Tachysphex* sp.
†† *Tachytes fulviventris*
*Tachytes spatulatus*
*Tachytes* spp.

Colletidae

*Colletes albescens*

*Colletes americanus*
*Colletes gypsicolens*
*Colletes lutzi lutzi*
*Colletes phaceliae*
*Colletes simulans*
*Colletes* sp.
*Hylaeus* sp.

Andrenidae

*Andrena andrenoides*
*Andrena barbilabris*
*Andrena birtwelli*
*Andrena colletina*
*Andrena cupreotincta*
*Andrena helianthi*
*Andrena hitei*
*Andrena illinoiensis*
*Andrena lupinorum*
*Andrena medionitens*
*Andrena mentzeliae*
*Andrena placida*
*Andrena prunorum*
*Andrena vulpicolor*
*Perdita fallax*
*Perdita hyalina*
*Perdita nigroclypeata*
*Perdita* sp.
*Pseudopanurgus* sp.

Halictidae

*Agapostemon angelicus* ?
†† *Agapostemon coloradinus*
*Agapostemon femoratus*
*Agapostemon splendens*
*Agapostemon texanus* ?
*Dialictus albohirtus*
*Dialictus pictus*
*Dialictus pruinosiformis*
*Dialictus pruinosus*
*Dialictus ruidosensis*
*Dialictus scrophulariae*
*Dialictus succinipennis*
*Evylaeus cooleyi*
*Evylaeus lusorius*
*Halictus* sp.
*Lasioglossum cyaneiceps*
*Lasioglossum sisymbrii*
*Lasioglossum trizonatum*
*Nomia heteropoda kirbii*
†† *Nomia triangulifera*
*Sphecodes* sp.

Megachilidae

*Anthidium emarginatum* ?
†† *Anthidium placitum*
*Anthidium rodecki*
*Anthidium tenuiflorae*
*Anthidium* sp.
*Ashmeadiella californica*
*Ashmeadiella* sp.
*Dianthidium ulkei*
*Dianthidium* sp.
*Heriades gracilior*
*Heriades* sp.
*Trachusa occidentale*
*Trachusa zebratum* ?
*Hoplitis albifrons*
*Lithurge apicalis*
*Megachile addenda*
*Megachile fidelis*
*Megachile fortis*
*Megachile nevadensis*
*Megachile perihirta* ?
*Megachile pugnata*
*Osmia atriventris* ?
*Osmia lignaria propinqua*

Anthophoridae

*Anthophora curta*
*Anthophora montana*
*Anthophora* sp.
*Ceratina neomexicana*
*Ceratina nanula* ?
*Diadasia* sp.
*Epeolus lutzi* ?
*Epeolus* pusillus
*Habropoda cineraria*
*Habropoda morrisoni*
*Melecta pacifica*
†† *Melissodes agilis*
*Melissodes* sp.
*Nomada vincta*
†† *Triepeolus* sp.
*Xenoglossodes* sp.
*Xeromelecta californica*

Apidae

*Apis mellifera*
*Bombus appositus*
*Bombus bifarius*
*Bombus centralis*
*Bombus fervidus*
*Bombus flavifrons*
*Bombus huntii*
*Bombus mixtus*
*Bombus morrisoni*
*Bombus nevadensis nevadensis*
*Bombus terricola occidentalis*
*Psithyrus insularis*

Tiphiidae

*Brachycistis glabrella*

*Neotiphia sulcata*
*Paratiphia* sp.
†† *Tiphia canamexica*
*Tiphia nona* ?
*Tiphia* sp.
Mutillidae
*Chyphotes albipes*
*Dasymutilla bioculata*
*Dasymutilla chiron ursula*
*Dasymutilla medea*
*Dasymutilla nigripes*
*Dasymutilla vesta*
*Dasymutilla vestita*
*Odontophotopsis obliquus*
*Odontophotopsis ocellatus* ?
*Odontophotopsis* sp.
*Photopsis clara* ?
*Pseudomethoca propinqua*
Pompilidae
*Anoplius brevihirta*
*Anoplius marginalis*
*Aporinellus completus*
†† *Anoplius semicinctus*
*Cryptocheilus terminatum terminatum*
*Episyron quinquinotatus hurdi*
†† *Evagetes hyacinthinus*
*Evagetes ingenuus*
*Evagetes padrinus minisculus*
*Pompilus scelestus*
Scoliidae
*Campsomeris pilipes*
*Campsomeris plumipes confluenta*
†† *Trielis octomaculata*
Masaridae
*Pseudomasaris vespoides*
Vespidae
†† *Euodynerus boscii* albivestis
*Vespula arenaria*
*Vespula atropilosa*
*Vespula maculata*
*Vespula norvegicoides*
*Vespula pennsylvanica*
Eumenidae
*Ancistrocerus adiabatus adiabatus*
*Ancistrocerus antilope antilope*
*Ancistrocerus bustemente bustemente*
*Ancistrocerus catskill*
*Ancistrocerus catskill albophaleratus*
*Ancistrocerus durangoensis*
*Ancistrocerus lineativentris lineativentris*
*Eumenes crucifera crucifera*
*Eumenes verticalis coloradensis*
*Euodynerus auranus albivestis*
*Euodynerus auranus auranus*
*Euodynerus foraminatus aequalis*
*Euodynerus* nr. *tempifera*
Formicidae
*Camponotus pennsylvanicus modoc*
*Camponotus vicinus*
*Dorymyrmex pyramicus*
†† *Formica argentea*
*Formica bradleyi*
*Formica fusca*
*Formica integroides coloradensis*
*Formica neoclara*
*Formica obscuripes*
*Lasius alienus americanus*
*Manica mutica*
*Monomorium minimum*
*Myrmica brevispinosa*
*Myrmica brevispinosa discontinua*
*Pheidole pilifera coloradensis*
*Pogonomyrmex occidentalis*
*Tapinoma sessile*

ARACHNIDA

ARANEAE
Dictynidae (unidentified)
Araneidae (unidentified)
Tetragnathidae
*Tetragnatha* sp.
Lycosidae
*Geolycosa rafaelana* Chamberlain
*Lycosa* sp.
Thomisidae (unidentified)
Salticidae (unidentified)
ACARI
Erythraeidae (unidentified)
(unidentified)
PSEUDOSCORPIONES (unidentified)
SOLIFUGAE
Eremobatidae
*Eremobates mormonus*
*Eremochelis bilobatus*
*Hemerotrecha fruitana*