







National Park Service,

U.S. Fish and Wildlife Service, and

The Nature Conservancy

Great Sand Dunes National Park and Preserve, San Luis Valley National Wildlife Refuge Complex, and Medano-Zapata Ranch

Colorado

Greater Sand Dunes Interagency Fire Management Plan

November 30, 2006

Greater Sand Dunes Interagency Fire Management Plan

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Greater Sand Dunes Interagency Fire Management Plan

CHAPTER 1: INTRODUCTION TO THE FIRE MANAGEMENT PLAN

INTRODUCTION

LOCATION

The Greater Sand Dunes landscape, which is located in Alamosa, Conejos, Costilla, Rio Grande 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.

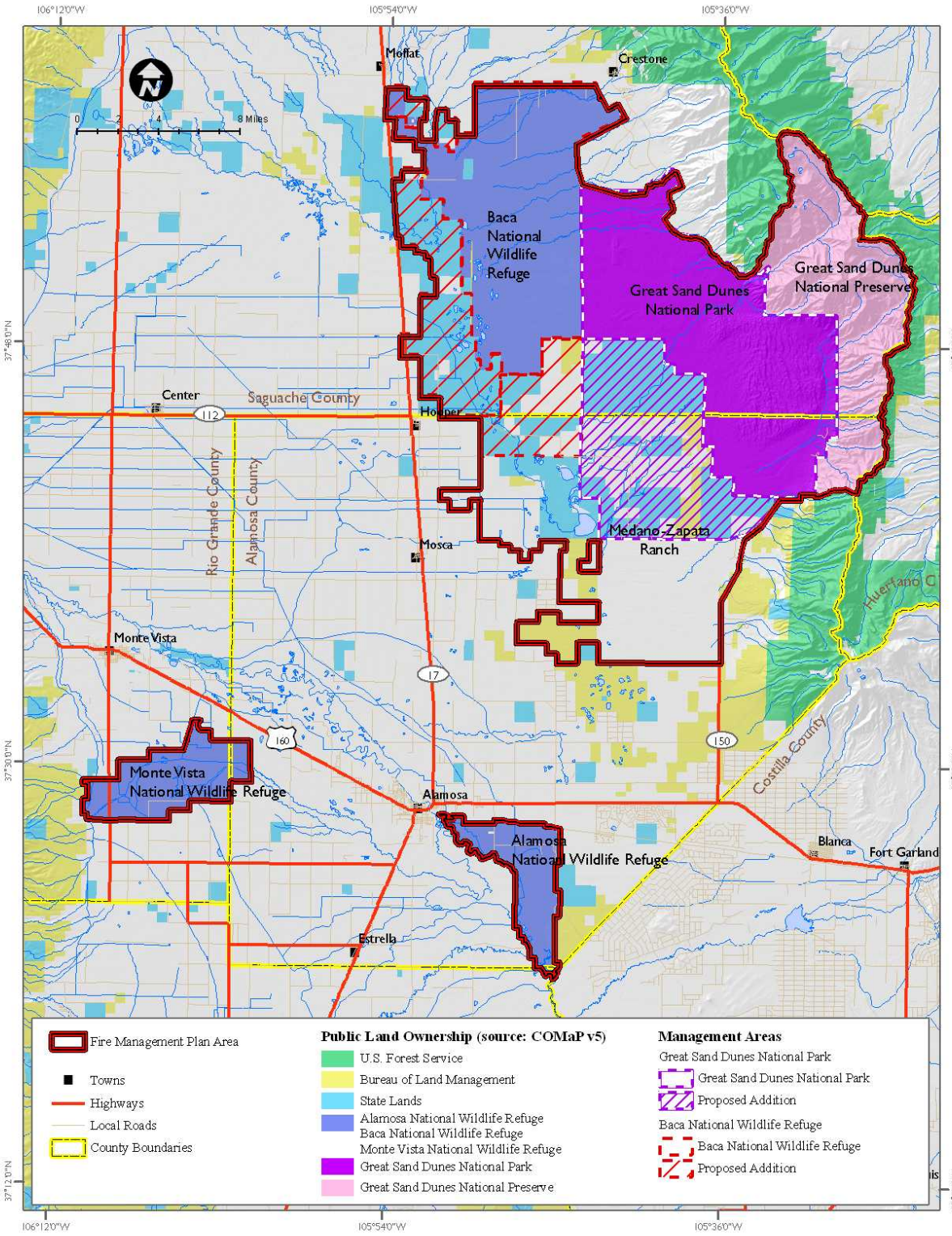
The Greater Sand Dunes Interagency Fire Management Plan (FMP) is an ecologically based program of action to implement joint wildland fire management policy and objectives in the Greater Sand Dunes Fire Management Area (FMA), across jurisdictional boundaries. This planning effort develops and implements an integrated, comprehensive, ecologically-based FMP through an interagency partnership that collectively addresses the needs of the National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), Colorado State Land Board, and The Nature Conservancy (TNC). This plan strives to develop cooperation between and address the wildland fire management needs of several entities within the San Luis Valley, including the Baca National Wildlife Refuge (92,623 acres), the San Luis Valley National Wildlife Refuge Complex (26,614 acres), the Great Sand Dunes National Park and Preserve (149,137 acres), and the Conservancy's Medano-Zapata Ranch (32,725 acres following land transfers) (Figure 1). Colorado State Land Board parcels are also included in the FMA – many of these parcels may eventually be transferred to either the FWS or NPS. Each of the participating agencies has agreed to work cooperatively to achieve the wildland fire programmatic goals across the FMA.

The FMA 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 area 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). 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.

The foundation of this FMP is ecologically based fire management. During the environmental assessment, fire histories were evaluated and ecological models created for three fire dependent systems. This evaluation determined that these systems are within their natural variation for fire (NPS, FWS, and TNC 2005). Therefore, the activities proposed in this plan are based on maintaining these systems within their natural range of variation, while providing for the protection of human health, property,

and other resources at risk, The FMP documents a framework for cooperation and coordination among interagency FMA participating entities and across jurisdictional boundaries in the achievement of mutual goals related to wildland fire management, including joint operations, mutual aid, cross-boundary operations, and shared responsibilities. This FMP provides for the protection of human life, property, and other resources at risk, guides fire management in the variety of ecological systems included within the planning area, and works to preserve the San Luis valley and adjacent western Sangre de Cristo Mountain’s irreplaceable landscape.

Figure 1: Greater Sand Dunes Interagency Fire Management Plan– Fire Management Planning Area.



PARTICIPATING ENTITIES

National Park Service Properties

The Great Sand Dunes National Park was established by the U.S. Congress on November 22, 2000, under The Great Sand Dunes National Park and Preserve Act of 2000 (Public Law 106-530), with the purpose of "providing for the establishment of the Great Sand Dunes National Park and Preserve." The proclamation amended the March 17, 1932, Presidential Proclamation No. 1991 (17 Stat. 2506), which established the Great Sand Dunes National Monument for "the preservation of the great sand dunes and additional features of scenic, scientific, and educational interest." Upon acquisition of the Baca Ranch property on September 13, 2004, the designation officially changed from National Monument to National Park. The Preserve portion of the property will retain its Preserve status.

U. S. Fish and Wildlife Service Properties

The Baca, Alamosa, and Monte Vista Wildlife Refuges share management resources, and are collectively called the SLV National Wildlife Refuge Complex. All refuges are authorized under the Migratory Bird Conservation Act of 1929 (16 U.S.C. 715D), ". . . for use as inviolate sanctuaries, or for any other management purpose, for migratory birds." In addition, the Baca NWR is authorized under Section 6 of The Great Sand Dunes National Park and Preserve Act of 2000 (Public Law 106-530). The FWS and others have acquired the properties that will compose the Refuge. The Monte Vista NWR was approved for acquisition on June 10, 1952, and established on December 1965 under Public Land Order 3899. The Alamosa NWR was approved for acquisition on June 27, 1962 and established on September 1960 under Public Land Order 2204.

Nature Conservancy Properties

In 1999, the Conservancy acquired the approximately 100,000-acre Medano-Zapata Ranch. The Conservancy manages the Medano-Zapata ranch to protect its globally significant natural values, including one of the largest naturally managed bison herds in North America. A cattle operation is also present on the property. Portions of the ranch, including significant areas of State Land Board properties, are within the acquisition boundaries of the Baca NWR and Great Sand Dunes National Park.

PURPOSE OF FIRE MANAGEMENT PLAN

This plan is a working reference for wildland fire program implementation for all areas within the FMA subject to wildland fire. The plan formally documents the interagency fire management program elements, objectives, strategies, and resource considerations. The plan also documents the most efficient ways to meet fire management program elements, including organization, facilities, equipment, staffing needs, activities, timing, locations, and related costs. The FMP will be updated annually to reflect changes in knowledge, staffing and the planning process.

To the extent practical, the plan develops an interagency fire management program that is compatible and integrated with the enabling legislation, mission, and organizational policies of participating entities, and their existing land, resource, and fire management plans. In addition, and to the extent practicable, the FMP is also compatible and integrated with the FMPs of neighboring properties. The information within this FMP will guide fire management efforts throughout the entire FMA, while allowing each agency and organization to meet their own protection and resource management objectives.

NEED FOR FIRE MANAGEMENT PLAN

The Nature Conservancy and Federal agency regulations require that lands with burnable vegetation have a FMP (TNC Fire Management Manual; NPS Director's Order No. 18; FWS Service Manual Part 621). Wildland fire management activities are still essential for the protection of human life, natural and cultural resources, and other properties and resources at risk. Wildland fire management is also a vital tool that can be used by the planning area's land managers to maintain ecological systems within their natural range of variability for fire.

Wildland fire management is essential for the protection of human life, resources, and properties at risk. Furthermore, while many of the ecological systems within the FMA are within their natural range of variability for fire, the disturbance process of fire is still essential to ensuring the long-term survival of many of the landscape's ecological systems, including the presence of healthy plant communities in a variety of successional and structural stages.

LINK TO POLICY

For Federal lands, the FMP articulates fire management policies and achieves 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).

FMA BACKGROUND INFORMATION

Location

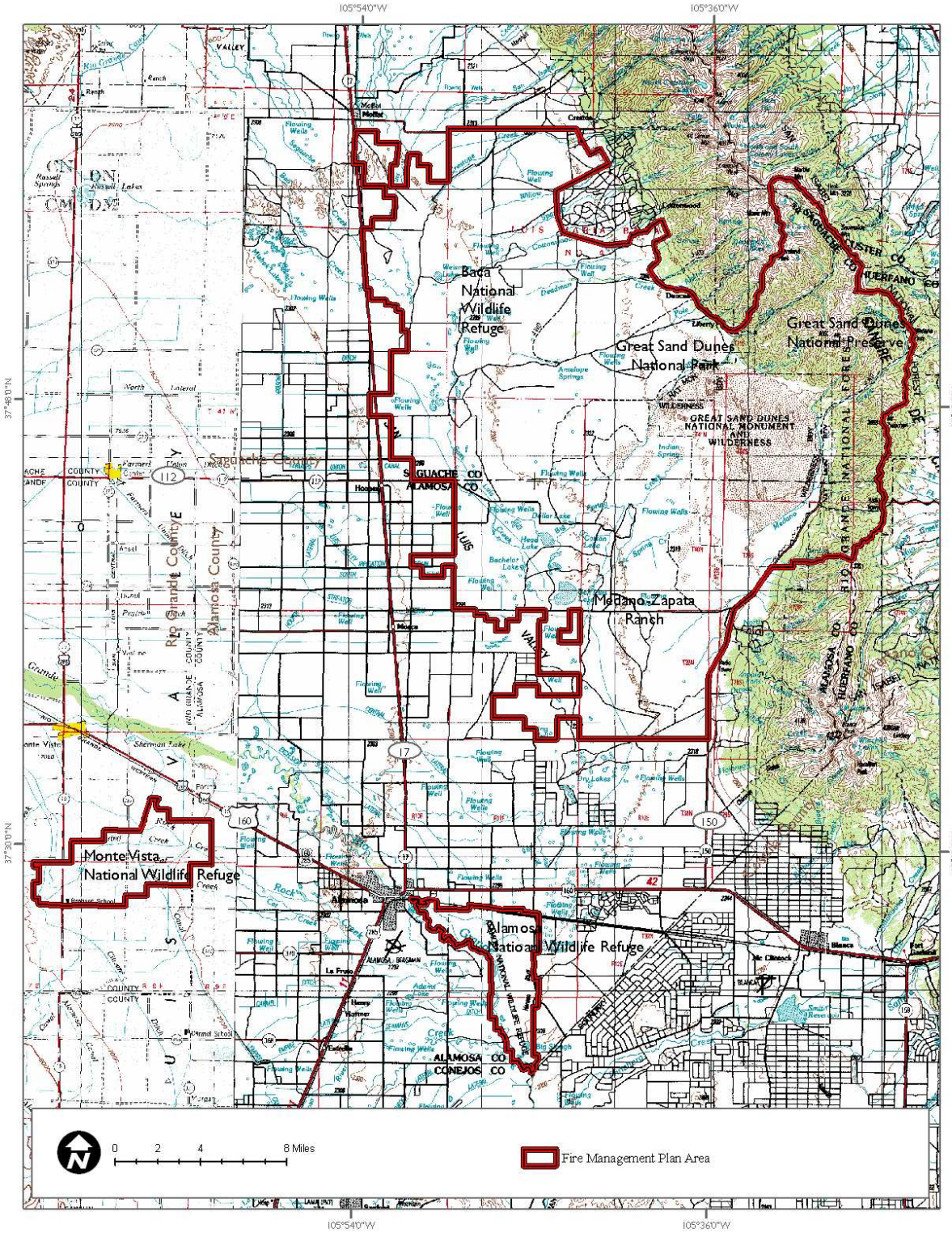
The FMA is located in Alamosa and Saguache Counties and situated within the east-central portion of the San Luis Valley, a high mountain basin located in south-central Colorado (population 46,190)[1]. The northern portion of the FMA is located within Saguache County (pop. 5,917); the southern portion is located in Alamosa County (pop. 14,966) (Figure 1). The towns of Alamosa and Saguache are the county seats for Alamosa and Saguache Counties, respectively. Alamosa is located approximately 15 miles from the southwest corner of the FMA, is the largest town in the vicinity, (pop. 7,835). Saguache is located approximately 20 miles from the northern corner of the FMA (pop. 569). Other towns in the FMA vicinity include Crestone (pop. 66), Moffat (pop. 107), Hooper (pop. 119), Mosca (pop. 102), Blanca (pop. 418) and Monte Vista (pop. 4691). Two subdivisions, Baca Grande Subdivision (pop. 261) and Zapata Subdivision (pop. 25) (population data from SLVDRG 2002), are also located adjacent to the Great Sand Dunes area.

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).

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.

[1] Population data from U.S. Census Bureau (2000).

Figure 2: Greater Sand Dunes Interagency Fire Management Plan– Planning Area Location.



Climate

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 climate of the San Luis Valley is marked by cold winters and moderate summers light precipitation and much sunshine. This arid valley receives an average of seven inches of precipitation a year, most of which is in the form of rain in mid-summer. The growing season around the Alamosa NWR averages about 90 days. July and August are usually the only frost free months. Winds are light except for the spring and early summer months when speeds of 40 miles per hour can commonly occur with higher gusts.

Average annual precipitation in the San Luis Valley is seven inches. Sixty percent of this falls between July and August, mostly from erratic thundershowers of short duration. Wide seasonal and yearly variations in precipitation are common. Mean annual temperature is 42 degrees Fahrenheit. Summer daytime temperatures are frequently in the 80s, but rarely exceed 90 degrees Fahrenheit; nights are cool. Temperatures of minus 20 degrees to minus 30 degrees Fahrenheit can be expected each year and are common most winters. Temperatures lower than minus 40 degrees Fahrenheit are frequently recorded. High velocity winds are common, especially in the spring. Relative humidity is usually low, but evaporation rates average lower than those of many other dry regions because of the cool climate. Snow cover may be light and is sometimes lacking through much of the winter (USDI, BLM 1989). In addition, some habitat is influenced by irrigation water applied to non-Refuge lands that flows onto Refuge lands(FWS, 2003).

Vegetation

This landscape contains globally significant biological and cultural resources, a variety of vegetation types, an abundance of natural resources, and numerous recreational opportunities. Ecological systems located within the FMA include wet meadows, grasslands, shrublands, piñon-juniper woodlands, mixed conifer forests, and spruce-fir forests (Figure 3). Note that the area is recognized for its globally significant biodiversity (Appendix C, Neely et al. 2001, Pineda et al. 1999, Rondeau et al. 1998). Fire has undoubtedly influenced the formation and

maintenance of most, if not all, of the FMA ecological systems (Alington 1998, Romme 1996, USFS 1996, Appendix E). The majority of these systems within this 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).

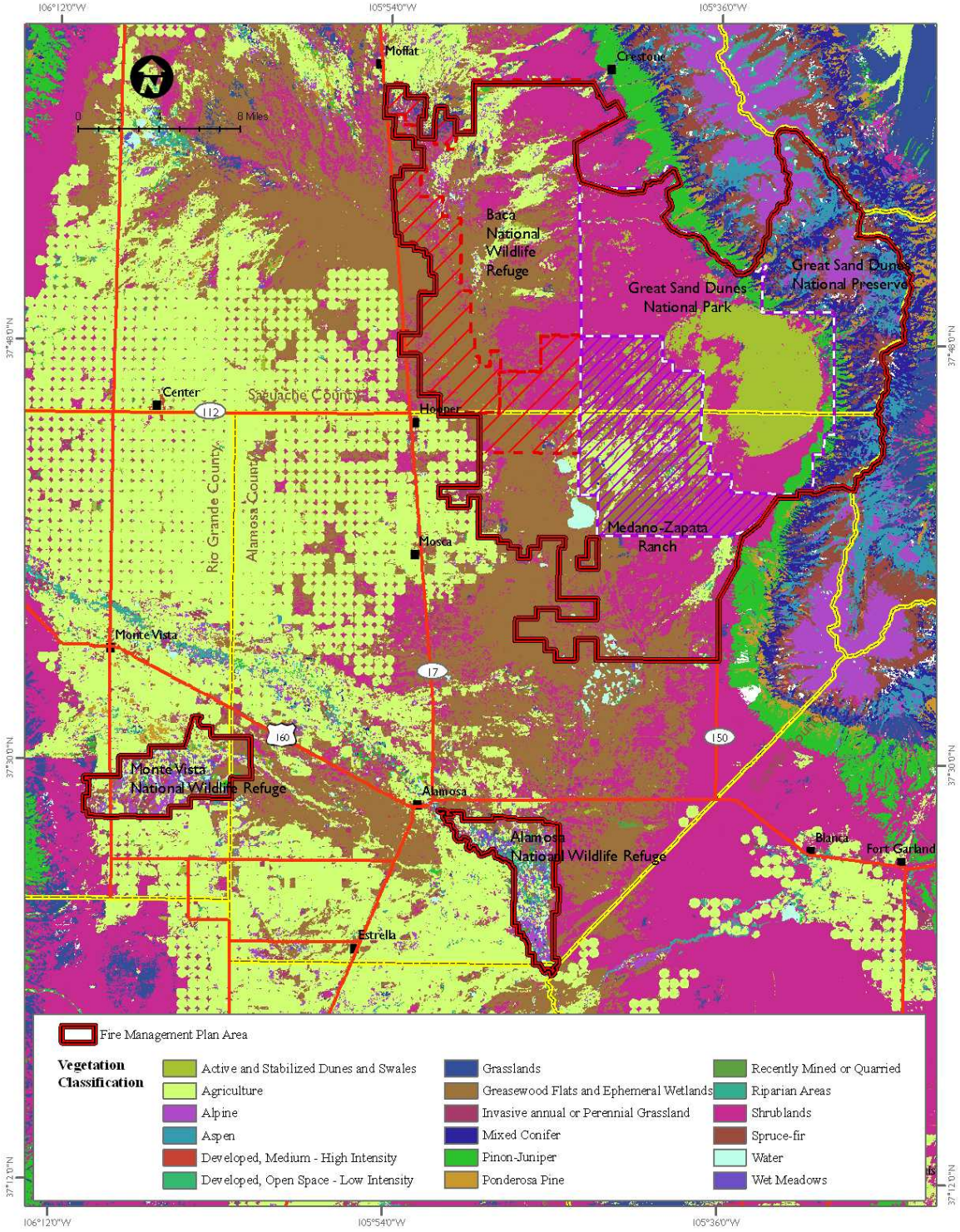
Fire is a natural ecological process that has historically influenced the vegetation in the San Luis Valley. The Greater Sand Dunes Fire Management Plan planning area has a number of ecological systems each with different fire histories. Most of the upland systems in the region including shrublands,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

SIGNIFICANT RESOURCES AND VALUES

The FMA contains a number of significant natural and cultural resources and values. The EA/AEF analyzes these resources and values in detail. A summary of FMA resources and values include:

- The tallest dunes in North America and one of the most fragile and complex dune and swale systems in the world.
- Protection of a globally significant, water- and wind-driven system, which includes creeks that demonstrate surge flow (a rare hydrologic phenomenon).
- Tremendous scenic settings that, for many, provoke strong emotional responses. These settings (including massive dunes surrounded by alpine peaks, a desert valley, creeks flowing on the surface of the sand, pristine mountains, and rural range land) offer spacious relief from urban America, exceptional solitude and quiet, and a remarkably unspoiled day and night sky.
- A great diversity of plants and animals, including insect species found nowhere else on earth (Appendix C). The FMA, which spans high desert to alpine life zones, supports rare biological communities that are mostly intact and functional
- A mosaic of wetland and riparian habitats for migratory bird species, including Sandhill cranes.
- Several of the oldest known archeological sites in America (9,000+ years before present). The dunes are identified as having special importance by people of various cultures, and the area is recognized for the culturally diverse nature of human use.
- Unique opportunities for recreation, exploration, and education in the highly resilient dune mass and adjoining creek environments.

Figure 3: A map of the Ecological Systems and Vegetation Types found within the Greater Sand Dunes Interagency Fire Management Planning Area.



SUMMARY OF ENVIRONMENTAL AND CULTURAL COMPLIANCE

This FMP meets National Environmental Policy Act (NEPA) requirements for Federal lands, as well as other State and Federal regulatory requirements, including those mandated by the National Historic Preservation Act (NHPA) and the Endangered Species Act (ESA).

An Environmental Assessment / Assessment of Effect (EA/AEF) was prepared for the area Great Sand Dunes area (Baca NWR, Great Sand Dunes National Park and Preserve and the Medano-Zapata Ranch). The EA/AEF was made available for review to the general public; local, State, and Federal agencies; associated Native American tribes; the State Historic Preservation Office (SHPO); and U.S. Fish and Wildlife Service's Ecological Services (FWS-ES) on April 25, 2005. A Biological Assessment was provided to the U.S. Fish and Wildlife Service's Ecological Services on August 29, 2006. A Finding of No Significant Impact was signed by the National Park Service on November 13, 2006 by Michael Snyder, Regional Director (Appendix D). A Finding of No Significant Impact was signed by the Fish and Wildlife Service on December 11, 2006 by James Black, Deputy Regional Director (Appendix D).

The results of the Section 7 and 106 consultation, including stipulations of mitigation measures or actions in agency consultation responses have been included within this document. The FONSI's and cultural compliance letters have been included in Appendix D.

For the San Luis Valley National Wildlife Refuge Complex, NEPA requirements were completed through the Comprehensive Conservation Plan and Environmental Assessment (2002) and an amendment to the Fire Management Plan (2004).

Prior to the implementation of on-the-ground fire management projects, additional environmental and cultural resource inventories and assessments, as mandated under NHPA, ESA, Clean Water Act, and Clean Air Act, may be required. Additional consultation documents/ requirements may be necessary before the implementation of future projects.

COLLABORATIVE PROCESSES

A Memorandum of Understanding (MOU), signed in 2003 by the NPS, FWS, Bureau of Land Management (BLM), U.S. Forest Service (USFS), and TNC-Colorado, provides a framework for cooperation and coordination among all entities in the achievement of mutual goals related to the implementation of a comprehensive wildland fire management program in the San Luis Valley. The MOU enabled the NPS, FWS, TNC, and others to work together towards the preparation of this FMP, which coordinates across ownership and jurisdictional boundaries to addresses the fire management needs of the San Luis Valley National Wildlife Refuge Complex (FWS); the Great Dunes National Park and Preserve (formally National Monument) (NPS); and the Medano-Zapata Ranch (TNC). This FMP was developed through a collaborative process amongst a number of Federal and State agencies, including the NPS, FWS, USFS, Colorado State Forest Service (CSFS), and TNC.

To guide FMA wildfire management decisions including the creation of this FMP, an interdisciplinary (ID) team of specialists from the FWS, NPS, TNC, USFS, and CSFS established a set of wildfire fire management goals and objectives for every burnable acre in the FMA. Goals and objectives are based on each each agency's local administrative unit(s) enabling legislation and federal, departmental, and agency-specific policies. The ID team also identified a number of potential fire management strategies, designed to provide support for achieving the goals and objectives. Fire histories for the ecological systems occurring within the FMA were developed. These histories are based on literature reviews, expert and local

knowledge and opinion, and the creation of ecological models for the three key forested systems. The ID team established that fire management goals, objectives, and strategies across shared boundaries would correspond to the extent possible, and that, wherever possible, similar fire management goals and objectives would be met through joint operations and shared positions.

The staff of the NPS, FWS, and TNC identified fire management units (FMU) for every burnable acre of land in the FMA.

FMU designation was based on the activities used to achieve resource management objectives, and included the identification of locations where wildland fire management would be desirable and advantageous in achieving resource management objectives, and areas where wildland fire use (WFU) would not be currently desirable. Areas where the threat to private property and life would preclude wildland fire use (i.e. in the WUI) were further defined. Developed sites, including recreational and cultural sites, were identified where any type of fire was not desired. Fire management activities including fire suppression, nonfire fuels treatments, and prescribed fire, were also identified for each FMU as other means to achieve fire management objectives. FMUs tend to share common natural disturbance patterns (i.e. fire history) and physical features such as land forms, and fuel types.

It is anticipated that this fire management planning effort will provide a collaborative model that will be useful for other landscapes within the San Luis Valley and beyond. To be the most effective, this plan should be coordinated across ownership and jurisdictional boundaries to address the needs of the San Luis Valley (SLV) Fire Planning Unit. It should be noted that this plan should be integrated with the USFS, Rio Grand National Forest FMP and the SLV BLM fire planning efforts. It is hoped that, at some future date, all agencies in the SLV will create a valley-wide Master FMP. Until such time that this valley-wide FMP is fully developed, The Greater Sand Dunes Interagency FMP will address immediate needs of the identified interagency FMA and provide a model for future efforts.

AUTHORITIES

The statutes cited herein authorize and provide the means for fire management activities on lands under the jurisdiction of the U.S. Department of the Interior, or lands adjacent thereto:

1. NPS Organic Act of 1916 (39 Stat. 535; 16 U.S.C. l 2 3, and 4)
2. Protection Act of 1922 (42 Stat. 857; 16 USC 594)
3. Economy Act of 1932 (47 Stat. 417; 31 USC 1535)
4. Taylor Grazing Act of 1934 (48 Stat. 1269; 43 USC 315)
5. Reciprocal Fire Protection Act of 1955 (69 Stat. 66; 42 USC 1856a)
6. National Wildlife Refuge System Administration Act of 1966, as amended (80 Stat. 927; 16 USC 668dd-668ee)
7. Federal Fire Prevention and Control Act of 1974 (88 Stat. 1535; 15 USC 2201)
8. Disaster Relief Act of May 22, 1974 (88 Stat. 1431 42 USC 5121)
9. Authorities Act of 1976 (84 Stat. 825)
10. Federal Grants and Cooperative Act of 1977 (Pub. L. 95-244, as amended by Pub. L. 97-258, September 13, 1982. 96 Stat. 1003 31 USC 6301-6308)
11. Redwoods Act of 1978 (92 Stat. 166)
12. Wildfire Suppression Assistance Act of 1989 (PL 100-428 as amended by PL 101-11)
13. Federal Wildland Fire Management Policy of 1995 (USDA/USDI 1995)
14. National Wildlife Refuge System Improvement Act of 1997 (111 Stat. 1252; 16 USC

668dd note)
15. National Fire Plan of 2000
16. Review and Update of the 1995 Federal Wildland Fire Management Policy (USDA/USDI 2001)
17. Interagency Standards for Fire and Fire Aviation Operations (USDA/USDI 2004)
18. U.S. Department of Interior's Departmental Manual 620 Chapter 1, Wildland Fire Management, General Policy and Procedures
19. U.S. Fish and Wildlife Service's Service Manual, Part 621, Fire Management
20. U.S. Fish and Wildlife Service's Fire Management Handbook
21. National Park Service's Director's Order No. 18
22. National Park Service's Reference Manual No. 18
23. Wildland Fire Use Implementation Procedures Reference Guide (2005)
24. Federal Fire and Aviation Operations 2005 Action Plan
25. Interagency Standards for Fire and Fire Aviation Operations (i.e. the Redbook) (2004)
26. Wildland and Prescribed Fire Management Policy – 2005
27. The Nature Conservancy's Fire Management Manual

CHAPTER 2: RELATIONSHIP TO LAND MANAGEMENT PLANNING AND FIRE POLICY

The following enabling legislation, fire management policies and guidance documents, and site-specific management plans are the guiding policy documents for fire management in the FMA. The FMP will be consistent with the goals and objectives for each agency's priorities and properties as stated in the following documents.

ENABLING LEGISLATION

National Park Service Organic Act of 1916: Through the National Park Service (NPS) Organic Act, 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, 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).

Presidential Proclamation No. 1994 of 1932: This Presidential Proclamation established the Great Sand Dunes National Monument in 1932, with the purpose of "preserving 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." The Monument was subject to the provisions of the Organic Act.

Great Sand Dunes National Park and Preserve Act of 2000 (Public Law 106-530): This Act established the Great Sand Dunes National Park and Preserve following the expansion of Great Sand Dunes National Monument and Preserve. The National Park and Preserve are subject to the provision of the Organic Act. The Act also authorized the creation of the Baca NWR.

Migratory Bird Conservation Act of 1929 (16 U.S.C. 715D): The Act established the enabling legislation for the San Luis Valley National Wildlife Refuge complex systems. "…for use as inviolate sanctuaries, or for any other management purpose, for migratory birds."

Public Land Order 2204 (1960): This Public Law Order established the Alamosa NWR. This order withdrew these lands from all forms of appropriation under public land laws, including mineral laws (Title 30, U.S.C. Chapter 2). This refuge is authorized under the Migratory Bird Conservation Act of 1929. The Alamosa NWR is established for "use as an inviolate sanctuary, or for any other management purpose, for migratory birds." The NWR is also "...suitable for-(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, and (3) the conservation of endangered species or threatened species."

Public Land Order 3899 (1965): This Public Law Order established the Monte Vista NWR. This order withdrew these lands from all forms of appropriation under public land laws, including mineral laws (Title 30, U.S.C. Chapter 2). This refuge is authorized under the Migratory Bird Conservation Act of 1929. The Monte Vista NWR is established for "use as an inviolate sanctuary, or for any other management purpose, for migratory birds." The NWR is also "... suitable for-(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, and (3) the conservation of endangered species or threatened species."

National Wildlife Refuge System Improvement Act of 1997: This Act provides the first "organic" legislation for the management of the National Wildlife Refuge (NWR) System. The NWR 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.” The Act amends the National Wildlife Refuge System Administration Act of 1966, strengthens the mission of the Refuge System, clarifies the compatibility standard for public uses of refuges, and requires the completion of comprehensive management plans for every refuge.

Great Sand Dunes National Park and Preserve Act of 2000 (Public Law 106-530): The Act authorized the creation of the Baca NWR. The Baca NWR is established for “use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” The NWR is “... suitable for-(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, and (3) the conservation of endangered species or threatened species.” This Act also established the Great Sand Dunes National Park and Preserve following the expansion of Great Sand Dunes National Monument and Preserve.

FIRE MANAGEMENT POLICIES AND GUIDANCE DOCUMENTS

NPS Director’s Order-18 (DO-18) (1997): DO-18 provides Wildland Fire Management guidance to the NPS. The Order states, “Every NPS unit with burnable vegetation must have an approved Fire Management Plan (FMP).” DO-18 defines requirements to be included in an approved FMP. The order stresses that firefighter and public safety is the first priority, and promotes an interagency approach to managing fires on an ecosystem basis across agency boundaries. This order supersedes Reference Manual-18 (RM-18), which provides required contents of an FMP and procedures for completion, review, and approval. Until an FMP is approved, NPS units must take an aggressive suppression action on all wildland fires.

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. DM 620 requires the incorporation of fire management into planning documents provides for the use of wildland 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; non-certified 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.

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.

NPS Management Policies (NPS 2000): The NPS "Management Policies" are derived from the laws that have been enacted to establish and guide the administration of the national park system. These policies provide general guidance for the management of a variety of park resources. Regarding fire management, NPS Management Policies states, "Park fire management programs will be designed to meet park resource management objectives, while ensuring that firefighter and public safety are not compromised" (see Chapter 4: Natural Resource Management, Section 4.5: Fire Management). In addition, NPS Management Policies state "All fires burning in natural or landscaped vegetation in parks will be classified as either wildland fires or prescribed fires. All wildland fires will be effectively managed through the application of the appropriate strategic and tactical management options. These options will be selected after comprehensive consideration of the resource values to be protected, firefighter and public safety, and costs. Prescribed fires are those fires ignited by park managers to achieve resource management and fuel treatment objectives. Prescribed fire activities will include monitoring programs that record fire behavior, smoke behavior, fire decisions, and fire effects to provide information on whether specific objectives are met. For all unplanned ignitions, and for any prescribed fires that are no longer meeting resource management objectives, all parks will use a systematic decision-making process to determine the most appropriate management strategies."

Federal Wildland Fire Management Policy (USDA/USDI 2001): The *Review and Update of the 1995 Federal Wildland Fire Management Policy* (January,2001) replaces the 1995 Federal Wildland Fire Management Policy. This policy update 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, the policy directs agencies to utilize the appropriate management response for all wildland fires, regardless of the ignition source.

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.

The 2001 Federal Wildland Fire Management Policy also includes the following policies, which 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.

Interagency Federal Fire and Aviation Operations Action Plan: The purpose of this plan is to establish the Chief of the USDA Forest Service and the Secretary of the Department of the Interior's direction for the upcoming fire season. The direction introduces operational expectations, reinforces performance expectations, and clarifies existing policies and procedures. It provides for consistent implementation of policy by agency administrators, incident management/area command teams, and fire and aviation management personal. The plan is also responsive to administration goals of fiscal integrity and the agencies' goals to deliver a safe, effective fire and aviation management program.

This plan establishes direction for the fire season from the Secretary of the Interior and the Chief of the U.S. Forest Service. This direction introduces operational expectations, reinforces performance, and clarifies existing policies and procedures. It provides for consistent implementation of policy by agency administrators (e.g. Park Superintendents), Incident Management/Area Command Teams, and fire and aviation management personnel. It is also responsive to the administration goals of fiscal integrity and delivery of a safe, effective Fire and Aviation Management Program.

The plan normally focuses attention on six areas:

- Federal Wildland Fire Management Policy Implementation
- Wildland fire operations and aviation safety
- Preparedness, suppression operations and Wildland Fire Use
- Support to the National Response Plan
- Cost containment
- Hazardous fuel treatments

Interagency Standards for Fire and Aviation Operations: The Redbook, updated annually, is a reference for current operational policies, procedures, and guidelines for managing wildland fire and fire aviation operations. The Redbook states, references, and supplements the fire and fire aviation program management policies of the BLM, FS, FWS, and NPS. The interagency standards provided by this reference are designed to ensure safe and efficient wildland fire, fuels, and aviation operations.

U.S. Fish and Wildlife Service Manual, Part 621, Fire Management (USFWS 2004a): The Service Manual, Part 621 describes the FWS wildland fire management program, including the policies, objectives, definitions, and responsibilities necessary inherent to wildland fire management; the wildland fire planning requirements; and the basic policy guidance for the agency's prescribed fire program. The Service Manual, Part 621, states, "Firefighter and public safety is the first priority of the Fire Management Program… An approved Fire Management Plan must be in place for all of our lands with burnable vegetation. Our Fire Management Plans must be consistent with firefighter and public safety, protection values, and land, natural, and cultural resource management plans, and must address public health issues. Our Fire Management Plans must also address all potential wildland fire occurrences and may include the full range of appropriate management responses. The responsible agency administrator

must coordinate, review, and approve Fire Management Plans to ensure consistency with approved land management plans…We will integrate fire, as an ecological process, into resource management plans and activities on a landscape scale, across bureau boundaries, based upon the best available science." The FWS Service Manual implements the FWS Director Policies and authorities, and steps down the FWS compliance with other requirements, including statutes, Executive Orders, Departmental directives, and regulations of other agencies. Within the FWS, this document has regulatory force and effect.

U. S. Fish and Wildlife Service Fire Management Handbook (USFWS 2004b): The FWS "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.

The Nature Conservancy's Fire Management Manual (TNC 2004): The Conservancy's "Fire Management Manual" is part of the organization's standard operating procedures, which require all preserves with burnable vegetation to have a FMP in place. This manual also provides guidance on conducting fire management activities on TNC lands (http://www.tncfiremanual.org).

SITE-SPECIFIC MANAGEMENT PLANS

Great Sand Dunes National Park and Preserve General Management Plan (publication in process): The revised "General Management Plan" (GMP) is currently being prepared for Great Sand Dunes National Park and Preserve, expected to be completed in July 2007. The revised GMP will provide management direction, for the next 15-20 years, for resource stewardship, visitor understanding and appreciation, partnerships, facilities, and operations. Draft goals are developed, but not yet finalized.

A draft Great Sand Dunes National Park and Preserve mission statement, presented in the GMP Newsletter #2, (November 2003), reads:

> "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 Great Sand Dunes National Park and Preserve purpose statement, presented in the GMP Newsletter #2, (November 2003), states that the purpose of the Park and Preserve 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; and to
- Facilitate research to support park management and to promote scientific knowledge and education."

Great Sand Dunes National Monument Fire Management Plan (NPS 1997a): The 1997 Great Sand Dunes FMP addresses fire management in the original Great Sand Dunes National Monument, and does not include the Great Sand Dunes Preserve and other areas included in Park expansion. The Monument FMP permits fire suppression and fuels management within various fire management units. The 2005 Greater Sand Dunes Interagency Fire Management Plan (the FMP you are reading) replaces the Great Sand Dunes National Monument fire plan (NPS 1997a).

Alamosa - Monte Vista Comprehensive Conservation Plan (FWS 2003): The Alamosa - Monte Vista National Wildlife Refuge Complex Comprehensive Conservation Plan (CCP) is a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats, and provides opportunities for compatible wildlife-dependent recreation uses.

The CCP, when fully implemented, should achieve the purposes of the Refuge Complex; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity of each Refuge and the Refuge system; and facilitate the achievement of National Wilderness Preservation System goals; among other mandates.

The vision of the Alamosa – Monte Vista Wildlife Refuge Complex is:

> "The lands of the Alamosa and Monte Vista National Wildlife Refuge Complex and those owned by our partners will be managed in a way that contributes to the migratory bird resource in the San Luis Valley to the greatest extent possible to benefit people of the Valley and the United States. Management will emphasize protection, enhancement, restoration, and where appropriate, creation of a variety of wetland and riparian habitats in this water rich, yet arid mountain valley. Local residents and visitors will view Refuge lands with a sense of pride and value their relationships and accomplishments with the U.S. Fish & Wildlife Service."

The goals of the Alamosa - Monte Vista Complex CCP include:

- Goal 1. Provide short-emergent vegetation in conjunction with various hydrologic conditions for migrating and breeding water birds, raptors, and passerines on the refuge complex
- Goal 2. Provide short-emergent vegetation in a range of structures necessary to meet the requisites of nesting waterfowl, water birds, raptors, passerines, and the habitat needs for small mammal populations on the refuge complex.
- Goal 3. Maintain areas of saltgrass in suitable condition for migrating and breeding water birds and passerines on the refuge complex.
- Goal 4. Provide tall-emergent vegetation with other suitable habitat conditions for breeding water birds and marsh passerines on the refuge complex.
- Goal 5. On Monte Vista National Wildlife Refuge, provide agricultural grains in adequate amounts for migrating Sandhill cranes and waterfowl.
- Goal 6. Provide submergent wetland vegetation for foraging migrant and breeding water birds, molting waterfowl, foraging raptors, aerial foraging birds, and nesting grebes and diving ducks.
- Goal 7. Provide shallow (< 1 foot) seasonal water in conjunction with other habitat conditions for migrating and breeding water birds and aerial foraging birds.
- Goal 8. Enhance the Rio Grande corridor and its tributaries on Refuge lands to provide habitat for river, riparian-dependent, and other wetland species.
- Goal 9. Provide native shrub (primarily greasewood and rabbitbrush on the Monte Vista NWR and four-wing saltbush on Alamosa NWR) communities on the Refuge Complex for the benefit of nesting, migrating and wintering migratory birds and other wildlife species dependent upon them.
- Goal 10. Provide native short-grass communities on the Complex but primarily on Alamosa NWR for the benefit of nesting, migrating and wintering migratory birds and other wildlife species dependent upon this habitat.
- Goal 11. Actively participate in protecting the San Luis Valley Ecosystem (Upper Rio Grande Ecosystem) and achieving the goals contained in the North American Waterfowl Management Plan and the North American Bird Conservation Initiative through coordination with local, regional, and national partners.
- Goal 12. Control noxious weeds on refuge complex roads, levees, and ditch banks to improve the quality of adjacent habitat and to slow or cease the spread of these

species to neighboring private lands.

Goal 13. Foster understanding, appreciation, and advocacy of wetlands within the San Luis Valley Ecosystem (Upper Rio Grande Ecosystem).

Alamosa - Monte Vista National Wildlife Refuge Complex Fire Management Plan (2001): The Alamosa - Monte Vista National Wildlife Refuge Complex Fire Management Plan (FMP) was signed in FY2001, but without the prescribed fire option (the use of wildland fire as a management tool had never been addressed through the NEPA process). The 2004 Prescribed Fire Amendment approved prescribed fire as a resource management tool at the Complex (see below). The 2005 Greater Sand Dunes Interagency Fire Management Plan (the FMP you are reading) replaces the Alamosa - Monte Vista National Wildlife Refuge Complex FMP.

Alamosa - Monte Vista National Wildlife Refuge Complex Prescribed Fire Amendment (FWS 2004): The 2004 Prescribed Fire Amendment approved prescribed fire as a tool for resource management, including authorization of prescribed fire as tool for resource management and hazardous fuels reduction. Regarding resource management, the amendment approves the use of prescribed fire to restore, create, and/or maintain a diversity of plant communities in order to enhance and perpetuate native plant and wildlife species. Regarding hazardous fuels reduction, the amendment approves the use of prescribed fire within or near Refuge development zones, sensitive resources, and boundary areas to reduce the risk of property damage by wildfires. To the greatest extent possible, prescribed fire for hazardous fuels reduction is only to be used when it compliments resource management objectives. This amendment updates the 2001 The Alamosa - Monte Vista National Wildlife Refuge Complex Fire Management Plan (FMP). The 2005 Greater Sand Dunes Interagency Fire Management Plan (the FMP you are reading) replaces the Alamosa - Monte Vista National Wildlife Refuge Complex FMP.

Baca National Wildlife Refuge Draft Conceptual Management Plan (FWS 2004c): A Conceptual Management Plan (CMP) is currently in preparation for the Baca NWR. The CMP is provides area landowners, governmental agencies, and the interested public with a broad overview of the FWS proposed management approach to wildlife and their relative habitats, public uses, facilities, interagency coordination, and other operational needs for the Baca NWR. The site does not have a Comprehensive Conservation Plan (CCP), which provides guidance on how the Refuge will be managed for the longer term (15 years) or FMP.

The CMP is not intended to provide substantive detail regarding issues (i.e. citing of new facilities, implementation of approved public uses), the details of which will be addressed in the CCP planning process. The CCP planning process includes significant input from the public and others, as required by FWS policy and NEPA. The CCP

A draft Baca National Wildlife Refuge statement of purpose, presented in the CMP, 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 Management Plan (2001): The Medano – Zapata Ranch Management Plan defines broad goals and objectives for the ranch that account how the 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 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".

The Conservancy accomplishes this mission through strategic, science-based planning and taking action in an adaptive management framework. The 2001 Southern Rocky Mountain Ecoregional Assessment, conducted by TNC and many State and Federal partners (Neely et al. 2001), which identified the Greater Sand Dunes landscape as an area of importance for conserving the ecoregion's biodiversity.

CHAPTER 3: WILDLAND FIRE MANAGEMENT STRATEGIES

The Greater Sand Dunes Interagency Fire Management Plan (FMP) is a detailed program of action to implement joint wildland fire management policy and objectives in the Greater Sand Dunes Interagency Fire Management Area (FMA), across jurisdictional boundaries. This planning effort develops and implements an integrated, comprehensive, ecologically-based FMP through an interagency partnership that collectively addresses the needs of the of the National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), Colorado State Land Board, and The Nature Conservancy (TNC). This plan strives to develop cooperation between land management entities within the San Luis Valley, including the Great Sand Dunes National Park and Preserve, Baca, San Luis Valley National Wildlife Refuge Complex, and the Medano-Zapata Ranch. Each of the participating agencies has agreed to work cooperatively to achieve the wildland fire programmatic goals across the FMA.

The wildland fire management program is comprehensive in scope and includes a wide variety of interconnected elements including:

- Wildland fire prevention
- Wildland fire suppression
- Wildland fire use
- Fuels management activities (e.g. prescribed fire, nonfire fuels treatments)
- Project planning
- Fire effects monitoring
- Fire education
- Research

Chapter 3 displays the scope of wildland fire management program elements that will be implemented within the FMA. The FMA develops and implements an integrated action plan where all wildland fires are effectively managed to achieve resource objectives. The protection of human life, public/private property, and cultural/natural resources from the undesired impacts of a wildfire are a primary management concern.

GENERAL MANAGEMENT CONSIDERATIONS

Overview

The FMP incorporates the elements addressed under the preferred alternative in the associated Environmental Assessment to develop and implement an interagency, integrated action plan under which all wildland fires occurring within the FMA and across jurisdictional boundaries are effectively managed to achieve interagency resource objectives. The primary wildfire management considerations in the FMA are to first and foremost protect human life and safety, and secondarily to protect natural and cultural resources, facilities, properties, and other values at risk from the undesired impacts of a wildfire.

This wildland fire management program is comprehensive in scope, and provided that management does not compromise firefighter and public safety, cost-effectiveness, benefits, and resource values to be protected, a full range of strategic options for managing wildland fires is available to land managers and Fire Management Officers (FMO). Management strategies also strive to utilize fire, to the extent possible, to meet resource and management objectives.

The FMP outlines how wildfires will be safely suppressed in an efficient, cost-effective manner; the role wildland fire plays in the protection and management of natural and cultural resources; and how public and private property will be protected from the impacts of wildland fire.

The Pueblo Interagency Dispatch Center (PIDC) Advisory Board coordinates interagency efforts on fire prevention and education, dispatching, training, fuels management, suppression, rural fire assistance and preparedness. This committee includes Fire Management Officers (FMO) from within the San Luis Valley, including those from Great Sand Dunes National Park and Preserve; San Luis Valley NWR Complex; U.S. Forest Service (FS); Bureau of Land Management(BLM); Colorado State Forest Service (CSFS), Alamosa District; and Alamosa and Monte Vista Counties. These same representatives work collaboratively on many other programs and projects outside the scope of the PIDC Advisory Board.

In the event of a wildland fire on TNC properties, because the organization is a private entity, it will work with the County Sheriff to ensure resources on its property are protected.

ADAPTIVE MANAGEMENT

All wildland fire management strategies will be reviewed using an adaptive management framework, which provides the management flexibility needed to handle unanticipated changes in environmental conditions, inaccurate predictions, and/or subsequent information. The adaptive management framework is critical to meeting the desired outcomes. The adaptive management process includes the following steps:

1. Plan: Using current scientific knowledge and the current management goals and objectives, develop a plan of action.
2. Predict: Using current information and understanding, predict the outcome of the plan.
3. Mitigate: Mitigate for any anticipated impacts resulting from predicted plan outcomes.
4. Implement: Implement the plan of action.
5. Monitor: Monitor the resources prior, during, and following the actions taken in the management plan.
6. Adapt: Based on new information and understanding gained from monitoring results revise management plans and begin adaptive management process again.

POLICY CONSIDERATIONS

This FMP is supported by rigorous environmental analysis and incorporates the relative policies, guidelines, and elements addressed under Alternative 3, the preferred alternative in the associated National Environmental Policy Act (NEPA) documents. The goals and objectives outlined in the NEPA document guide the interagency wildland fire management program, including how wildfires will be safely suppressed in an efficient, cost-effective manner; the role wildland fire plays in the protection and management of natural and cultural resources; and how public and private property will be protected from the impacts of wildfire.

In compliance with NEPA, all wildland fire management options in this plan are covered under an Environmental Assessment / Assessment of Effect (EA/AEF), which was written concurrently written with this plan. Compliance with the Endangered Species Act, Section 7 and the National Historic Preservation Act, Section 106 were also obtained. All wildland fire management

activities on Federal lands not covered under the EA/AEF for this FMP may require additional NEPA analysis. Additional consultation with the FWS under Section 7 of the Endangered Species Act and with the Colorado State Historic Preservation Office under Section 106 of the National Historic Preservation Act was completed, and will be periodically reviewed and updated.

WILDLAND FIRE MANAGEMENT GOALS

Wildland fire management objectives provide programmatic direction for the FMA wildland fire program (Table 1). These goals reflect federal, state, and local wildland fire policy, and are supported by each agency's mission and the enabling legislation and management direction for each agency's local administrative unit(s). Each of the participating agencies has agreed to work cooperatively to achieve the wildland fire programmatic goals across the FMA.

Fire management goals, objectives, and strategies across shared boundaries will correspond to the extent possible. Similar fire management goals and objectives will be met through joint operations and shared positions, wherever possible.

This strategy is dynamic and subject to annual review. Annual review of the FMP is essential to ensure that it continues to conform to current laws, objectives, procedures, and strategies. As experience is gained with fire and fuels management, and as national and regional direction evolves, the inclusion of additional or revised actions may be required.

Table 1. Greater Sand Dunes Interagency Fire Management Plan Fire Management Goals and Objectives for Fire Management Units (FMUs). These goals reflect the programmatic direction for the Fire Management Planning Area.

GOAL[2]	OBJECTIVES[3]
GOAL 1: ***Develop and implement an interagency FMP that specifically addresses the individual fire management needs of the NPS, FWS, Colorado State Land Board, and TNC, while promoting interagency participation across the greater landscape of the San Luis Valley***	Ensure that the FMP is followed and that annual reviews and updates are completed and approved by administrators by March 1.
GOAL 2: ***Provide for the protection of human health and safety during all phases of the interagency wildland fire management program***	Provide for the safety of visitors, employees, in-holders, and neighbors during all wildland fire management operations, by ensuring that safety comes first on every fire and every fuels management activity, every time. (All FMUs)
	Ensure that all fire personnel are appropriately trained and qualified for the wildland fire assignment they receive. (All FMUs)
GOAL 3: ***Protect facilities, natural resources, and cultural resources from the effects of wildfires and suppression actions***	Suppress all wildfires in a cost-effective manner with consideration for environmental impacts, while ensuring that firefighter and public safety is the highest priority, using an appropriate management response. (All FMUs)
	Prevent human-caused wildfires by instituting a pro-active and coordinated fire prevention program. This will be accomplished by using a variety of means including posting fire danger indicator signs in prominent locations, instituting restrictions during times of elevated high fire danger, and conducting prevention patrols aimed at educating the public. (All FMUs)
	To the maximum extent possible, protect willow/cottonwood riparian habitat essential to Southwestern Willow Fly Catcher and other critical species from unwanted Wildland fire. (All FMUs)
	To the maximum extent possible, protect important scientific, scenic, historic, and prehistoric cultural resources from fire. (All FMUs)
	Use a variety of prescribed fire and non-fire treatments to reduce the concentration of fuels in areas where facilities and resources may be threatened or damaged from wildfire. (All FMUs)

[2] Goals taken directly from Greater Sand Dunes Interagency Fire Management Plan Environmental Assessment/Assessment of Effect

[3] Objectives have been developed from objectives found in Greater Sand Dunes Interagency Fire Management Plan Environmental Assessment/Assessment of Effect, the Fire Management Plan for Rocky Mountain National Park, Draft Greater Sand Dunes Interagency Fire Management Plan, the Fire Management Plan for Alamosa and Monte Vista National Wildlife Refuges 2001, and the Prescribed Fire addendum to the Fire Management Plan for Alamosa and Monte Vista National Wildlife Refuges 2003.

GOAL[2]	OBJECTIVES[3]
GOAL 4: Apply fire management techniques in *a coordinated manner to accomplish desired resource management objectives*	Ensure that 100% of all fuels management activities are executed in accordance with specific objectives and requirements as defined in land management plans and related planning documents. (All FMUs)
	Work with all affected landowners and managers on fuels management actions so that the actions provide the greatest benefit to public and private assets, including the ecological, wilderness, preserve, and refuge values. (All FMUs)
	Re-establish and maintain a high forb to grass ratio in short grass habitats through the use of prescribed fire and demonstrated through accepted monitoring protocols. (Alamosa/Monte Vista FMU)
	Ensure that 100% of all naturally ignited wildland fires are evaluated and considered as potential wildland fire use events. (Mosca and Herard FMUs)
	Prevent and/or reduce over rested residual growth accumulation in short emergent habitats to maintain quality nesting cover for waterfowl and other migratory birds by prescribed burning at least 5% of these habitats annually. (Alamosa/Monte Vista FMU)
	Maintain vigor of tall emergent habitats that are essential for important colonial nesting wading bird species by burning at least 5% of these habitats annually. (Alamosa/Monte Vista FMU)
	Control, reduce, or eradicate noxious weed species by at least 5% annually using prescribed fire as part of the treatment. (Alamosa/Monte Vista FMU)
GOAL 5: *Protect air and water quality related values across all affected airsheds and watersheds within the respective FMU*	To the maximum extent possible, ensure that all fire management actions are conducted in accordance with federal, state, and local water quality regulations. (All FMUs)
	Ensure that 100% of all prescribed fire activities are conducted consistent with agency and departmental policy, as well as federal and state air quality requirements. (All FMU's)
GOAL 6: *Base the interagency fire management program on sound data obtained through scientific investigation and monitoring*	By using the best available science and technology, maintain an acceptable range of ecological conditions that is consistent with existing scientific literature and land management planning documents. (All FMUs)
GOAL 7: *Provide educational opportunities for the public regarding fire ecology, management, and operations.*	Develop and maintain a public education program supported by all field units focused on fire management actions within the interagency area. (All FMUs)

WILDLAND FIRE MANAGEMENT OPTIONS

The fire management strategy is to manage wildland fire based on the *natural fire regimes* and/or *desired future conditions* of ecological systems while protecting human health and safety, facilities, natural resources and cultural resources. *The FMP fire management strategy includes: (1) Wildland fire suppression; (2) Fuels management (prescribed fire and non-fire fuel treatments); and (3) Wildland fire use. Fire suppression and fuels management activities, including prescribed fires and non-fire fuel treatments, are utilized when appropriate to restore fire to its nature role and to perpetuate fire dependent ecosystems. Wildland fire use is allowed within designated portions of the FMA. The impacts of wildland fire use activities are expected to be overall beneficial to the ecological systems in the planning area.* The success of this strategy is dependent on the use of local collaborative processes to ensure community protection needs and firefighter and public safety. Fire management goals, objectives, and strategies are shared and correspond to the extent possible across boundaries. Whenever possible, where agency boundaries are shared, similar fire management goals and objectives are to be met through joint operations and shared positions.

All wildland fires, whether naturally ignited or human caused, will be managed using the Appropriate Management Response (AMR) commensurate with values at risk[4]. The AMR will be based on specific, pre-defined FMU fire management goals and objectives, the ability to accomplish these goals and objectives, the current environmental and fuel conditions, any overriding constraints, and safety concerns. In addition, the AMR will seek to minimize costs, considering firefighter and public safety, benefits, and values to be protected.

Wildland Fire Suppression

Wildfires will be suppressed with firefighter and public safety as the primary goal; and to protect facilities, developments, fire sensitive natural resources, fire sensitive cultural resources, and air and water quality.

The current and predicted wildland fire situation will be analyzed carefully when determining the suppression strategy. This strategy will also be commensurate with the fire potential to spread or to cause undesirable social, economic, and/or ecological impacts, the value of threatened resources, as well as the FMU-specific fire management goals. Depending on the many factors, such as location within each FMU, a range of management response strategies may be appropriate in achieving successful fire suppression. A rapid response is often important for safety and cost efficiency. A strategic suppression response and strategy will be tailored to each incident dependent on safety considerations, weather conditions, cost of suppression, fuel conditions, availability of resources and location of the fire in relation to structures and cultural resource sites. Specific tactics will be determined by the on-scene Incident Commander (IC).

Aggressive initial attack, will be initially considered as the Appropriate Management Response (AMR) for wildfires and generally be the suppression strategy for the areas within the FMA that are not designated for wildland fire use. To the extent possible and where appropriate (i.e. increased safety, reduced cost over direct attack, risk to resources from direct attack), indirect means of wildfire suppression (i.e. using natural features that enable a confinement or containment strategy) will be utilized to contain and/or confine fires. The use of indirect attack

[4] The AMR is any specific action taken in response to a wildland fire to meet protection and/or fire use objectives.

when appropriate will likely reduce the level of impacts to cultural and natural resources during suppression efforts. If the initial response is not successful in fire confinement or containment, a complexity analysis and Wildland Fire Situation Analysis will be prepared to select the appropriate extended attack strategy.

For federal lands, the initial attack response will be planned and designated based on the values at risk and the cost of suppression. As called for in the national firefighting standards, Minimum Impact Suppression Tactics (MIST) will be utilized whenever possible, provided these tactics do not pose unnecessary risk to firefighters. Wildfire suppression activities are dependent on the characteristics and location of the wildfire, and may include: the 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 will be established, where deemed necessary. Following a wildfire, mop-up, rehabilitation, and other post fire activities will occur as necessary.

Wildland fire suppression on land owned by TNC is the responsibility of the County Sheriff. If and when a wildland fire is suppressed on its property, TNC will work with the Sheriff to ensure that resources are protected.

Wildland Fire Use

Wildland fire use is only permitted within Great Sand Dunes National Preserve. A number of safety and resource protection issues, as well as insufficient information regarding the fuels and potential fire behavior, limit the area to which wildland fire use may be permitted across the FMA. Under the wildland fire use management option, the protection of human health and safety, fire-sensitive natural and cultural resources, facilities, and developments are also of primary importance. Wildland fire use activities will ensure that firefighter and public safety are the primary goal and will be managed to accomplish resource benefits that include maintenance of natural fire regimes and preservation of natural processes across the landscape.

The management of wildland fires for the purpose of meeting resource management objectives requires stricter planning and documentation than other fire management activities. All wildland fires managed under the wildland fire use strategy will adhere to national fire management policy. A long-term goal for the FMA is to maximize the extent to which wildland fire use is an allowable wildland fire management strategy. Substantial changes to the FMP require public input and environmental analysis as required under NEPA.

An unplanned fire ignition permit is required under Regulation Number 3 of the Colorado Air Quality Control Act for any fire managed for wildland fire use. This permit must be obtained by an agency prior to allowing a wildland fire to burn, and if granted, provides a set of conditions and mitigation measures.

Prescribed Fire

Within the FMA, prescribed fire will be used to manage prescribed fire with firefighter and public safety as the primary goal; and to mimic the natural fire regime to the extent possible; achieve a reduction in the fuel load that may threaten a resource at risk; manage wildland fuels to enhance implementation of the wildland fire use program; create a fuel break or buffer to

reduce the risks associated with a wildland fire; and/or alter the composition and structure of a plant community to achieve a desired future condition, including a reduction in the amount of non-native species or to alter the composition and structure of the vegetation for wildlife habitat.

A prescribed burn may be conducted in any plant community throughout the planning area in order to meet predefined management objectives set forth in a land or natural resource management plan. A prescribed burn will 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 will be required for all prescribed burns occurring within the planning area.

All prescribed burn activities on Federal lands not covered under the EA and other NEPA documents for this FMP may require additional NEPA analysis. In addition, under Regulation Number 9 of the Colorado Air Quality Control Act, a permit must be attained 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. Additional consultation with FWS under Section 7 of the Endangered Species Act and with the Colorado State Historic Preservation Office under Section 106 of the National Historic Preservation Act will also be required for all prescribed burn activities.

Non-Fire Fuels Treatments

The primary goal of non-fire fuels treatment activities is the protection of human health and safety, fire-sensitive natural and cultural resources, facilities, and developments. Within the FMA, non-fire fuels treatment will be designed with firefighter and public safety as the primary goal; reduce fuel loads in areas with resources are at risk from hazardous fuel accumulations; manage wildland fuels to facilitate implementation of prescribed fire projects and to enhance implementation of the wildland fire use program; and/or to reduce the risk of wildland fire impacts to the wildland urban interface (WUI).

Fuels management planning will analyze the impact of a fuel treatment project within the landscape. Planning will address the accumulation of fuels on a site over time, including those fuels generated from management activities such as thinning. Fuel management planning will also analyze the cumulative effect of a given project on the landscape with respect to the impact of future wildland fire. The fire and fuels personnel will work with other interdisciplinary team members in analyzing the effect of fire, fuels treatment, or the lack of fire, on all resources.

Fuels treatment activities will be utilized on a limited basis throughout the planning area. Non-fire fuels treatment sites include areas of high visitor use; the perimeter of structures and developments; the perimeters and jurisdictional boundaries of the NPS and FWS lands; the perimeters of cultural resources sites; and in other locations with values that could be adversely affected by prescribed fire and/or wildland fires.

Guidelines to be utilized when developing fuel treatment plans include:

- Firewise Guidelines and Standards will be adhered to for all fuels treatment activities around structures and developments (http://www.firewise.org)
- Minimum Requirement Analysis will be utilized for fuels management activities within designated or proposed wilderness areas

- Buffer Requirements: Fuel treatment activities around critical resources will be limited to a maximum 328-foot (100 meter) buffer
- Collaboration: Fuels treatment planning and implementation will be collaborative in nature.

Fuel reduction levels are determined based on factors including:

- Resource Impacts: Impacts to aesthetics, cultural resources, and natural resources;
- Required Protection: Level of protection required per resource at risk;
- Vegetation: Type, age, amount, diversity, volatility, fire history, and size of the affected vegetation within and around the area of concern;
- Wildland Urban Interface (WUI): Proximity to WUI;
- Weather: General weather patterns;
- Structures: Construction, design, materials, and value of structures at risk;
- Risk: Risk of human-caused fire, human density, and ease of evacuation;
- Access; Access routes;
- Topography; and
- Jurisdiction.

Depending upon the requirements set forth in the prescription for individual projects, a range of actions for manual and mechanical treatments is available. Treatment options 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 will 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 will be disposed of in select areas using the method of 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.

All non-fire fuel treatment activities on Federal lands not covered under the EA/AEF for this FMP may require additional NEPA analysis. In addition, additional consultation with the FWS under Section 7 of the Endangered Species Act and with the Colorado State Historic Preservation Office under Section 106 of the National Historic Preservation Act may be required for any non-fire fuel treatment activities.

The fire regime concept is used to characterize the traits of a fire in a given vegetation type; namely, how often it recurs on the landscape, the type of pattern created, and the ecological effects. The following natural fire regimes are arranged along a temporal gradient, from the most frequent to the least frequent fire return interval:

Table 2. Fire Regime Types and Representative Ecosystems

Fire Regime Type	Fire Frequency	Fire Effect To Dominant Aboveground Vegetation	Representative Ecosystem in the Greater Sand Dunes Fire Management Area
I	0-35 years	Low severity	Lower montane, ponderosa pine forests
II	0-35 years	Stand replacement	Grasslands, upland shrub communities
III	35-100+ years	Mixed severity	Douglas-fir, mixed conifer forests, salt desert shrub
IV	35-100+ years	Stand replacement	Lodgepole pine, wetlands, aspen forests
V	200+ years	Stand replacement	Limber pine, spruce-fir forests

The current structure, species composition, and dynamics of many ecosystems are often the direct result of past fires or in other cases, the result of other processes that have themselves been affected by fire. In general, fire regimes in the southern Rockies can be thought of as following an elevation gradient (Peet 1981, Romme and Knight 1981). The lower montane is often characterized by more frequent surface fires (fire regime type I), while forests in the subalpine typically experience infrequent stand replacement fire events (fire regime types IV and V). However, fires of any intensity can occur in both elevational zones (Veblen 2000).

Condition Class definitions:

Condition Class 1 (CC1): Fire regimes are within a historical range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range. Fires burning in CC1 lands pose little risk to the ecosystem and have positive effects to biodiversity, soil productivity, and hydrologic processes.

Example of typical management: Historical fire regime is replicated through periodic application of prescribed fire or through wildland fire use.

Condition Class 2 (CC2): Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range. Wildland fires burning in CC2 lands can have moderately negative impacts to species composition, soil conditions, and hydrological processes.

Example of typical management: Moderate levels of restoration treatments are required, such as a combination of prescribed fire with mechanical treatment.

Condition Class 3 (CC3): Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range. Wildland fires burning in CC3 lands may eliminate desired ecosystem components, exacerbate the spread of unwanted non-native species, and result in dramatically different ecological effects compared to reference conditions.

Example of typical management: High levels of restoration treatments, such as mechanical treatments, are required before fire can be used to restore desired ecosystem function. Intensive efforts, which may include seeding, herbicide application, biomass removal, and other types of rehabilitation, are required for CC3 lands.

Geospatial data utilized to create and display FMU boundaries, biotic features, and physical features will reside in permanent archive on the refuge- and park-managed networks, as well as TNC databases. Geospatial data will be kept as Arcview shapefiles and ArcInfo coverages. Associated metadata will adhere to current NPS and Federal Geographic Data Committee (FGDC) metadata standards.

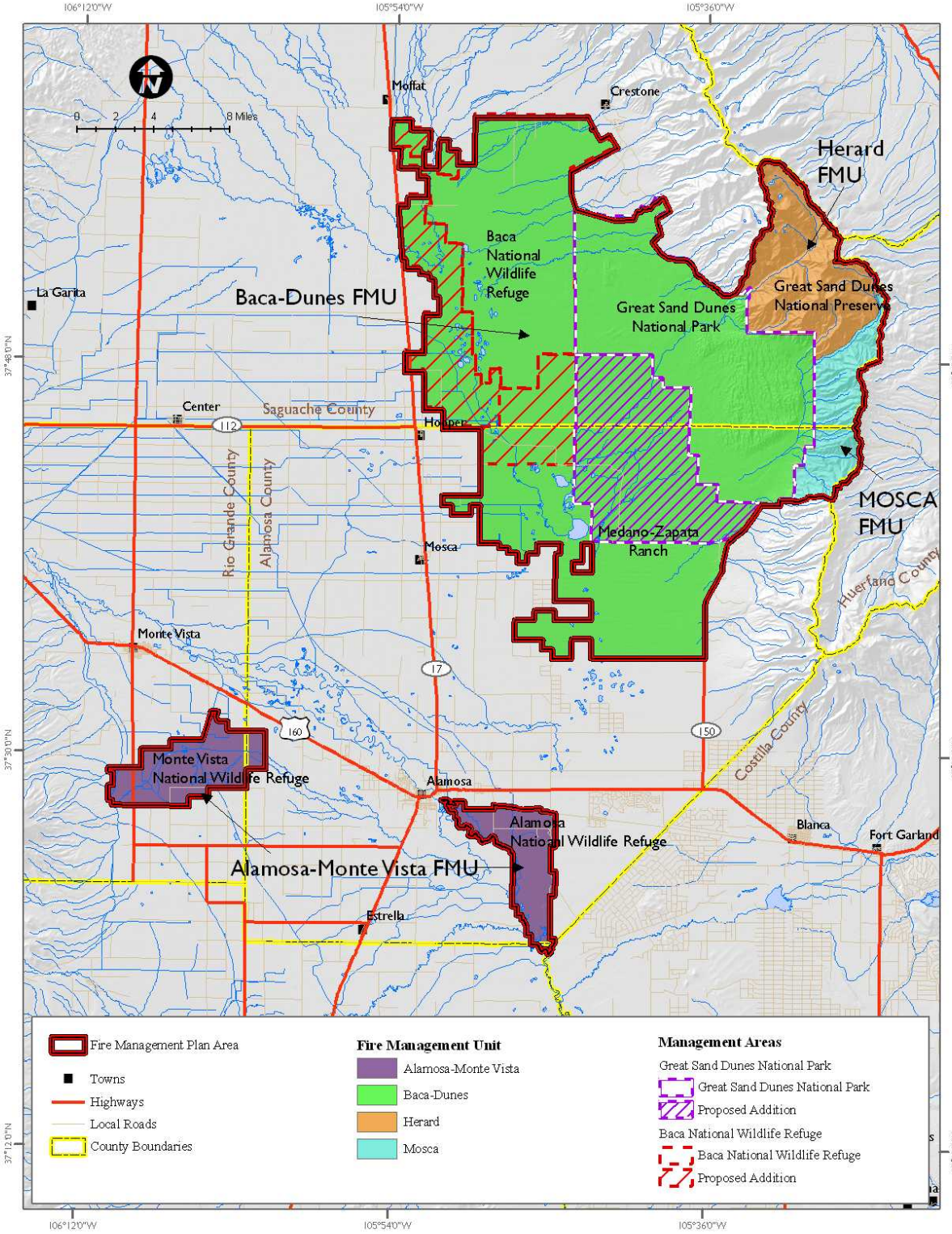
WILDLAND FIRE MANAGEMENT STRATEGIES BY FIRE MANAGEMENT UNIT (FMU)

The FMA is divided into four (4) Fire Management Units[5] (FMU): Herard, Mosca, Baca Dunes, and Alamosa-Monte Vista (Figure 4). FMU delineation is based upon land management goals and objectives for each location; values to be protected; safety concerns; wildland-urban interface; access for fire management activities; land features; political boundaries and jurisdictions; fuel types; natural fire regimes; and special management areas (e.g. wilderness). These FMUs are the cornerstone for FMA wildfire planning and management. Each is unique as evidenced by management strategies, objectives, and attributes.

Fire is a natural ecological process that has historically influenced the vegetation in the Sangre de Cristo Mountains and the San Luis Valley. The vegetation types found within these FMUs (i.e. forest, shrubland, and grasslands systems) are generally characterized by infrequent mixed severity fires, as well as high intensity, stand replacing fires occurring at long fire return intervals. Due to the historical fire regime and general stand replacing nature of these systems, in combination with known fire history, these vegetation types have not been significantly affected by fire suppression.

[5] A Fire Management Unit (FMU) is any land management area definable by goals and objectives, management constraints, topographic features, access, values- to- be- protected, political boundaries, fuel types, or major fire regime groups, etc., that sets it apart from management characteristics of an adjacent unit.

Figure 4. Greater Sand Dunes Interagency Fire Management Plan – Fire Management Unit



BACA DUNES FIRE MANAGEMENT UNIT

Baca Dunes FMU Location

The approximately 240,000-acre Baca Dunes FMU includes the entirety of the Great Sand Dunes National Park, Baca National Wildlife Refuge, and the Conservancy's Medano-Zapata Ranch (Figure 4). The majority of the Baca Dunes FMU occurs along the floor of the San Luis Valley, with portions of the Sangre de Cristo Mountain foothills and the Great Sand Dunes also included in the boundaries.

The Baca Dunes FMU includes a variety of fuel conditions and management challenges, characterized by very small (1 - 10 acres), generally stand-replacing fire regimes and a complex jurisdictional landscape. An active and mostly non-vegetated sand dune and swale complex is the dominant geographic feature of the Baca Dunes FMU, with large star dunes towering up to 700 feet (210 m) above the valley floor. The Baca Dunes FMU is dominated by intermingled grassland and shrubland vegetation types, which occur along the lower sections of the foothills of the Sangre de Cristo Mountains and on stabilized sand dunes and sabkha across the San Luis Valley floor.

The Baca Dunes FMU lies on the eastern edge of the San Luis Valley floor. The western, northern, and southern boundaries contain rangeland and some irrigated hay meadows. The majority of the western edge of the Baca Dunes FMU borders private rangelands and lands managed by the BLM, while some of this FMU is adjacent to Forest Service managed lands. The eastern boundary lies along the foothills of the Sangre de Cristo Mountain Range, including the Mosca and Herard FMUs. Cooperators in this FMU include the FWS, the NPS, CSFS, Alamosa and Saguache Counties, and TNC. Designated and proposed wilderness areas are included within the FMU boundary.

The Baca Dunes FMU can be accessed from the following paved roads: County Road T, Colorado Highway 17, County Road 6 North, Colorado Highway 150, and/or the north end of Colorado Highway 150 at the entrance road to the GSD National Park and Preserve. The primarily unpaved dirt and gravel roads leaving these paved roads create multiple access points within the FMU.

Baca Dunes FMU Fire Management Objectives

All wildland fires within this FMU will be managed for protection objectives and suppressed using an appropriate management response. In addition, fuels management activities will be executed in identified areas within this FMU. Based on existing planning documents, the strategic objectives for the Baca Dunes FMU are:

- Provide for the safety of visitors, employees, in-holders, and neighbors during all wildland fire management operations, by ensuring that safety comes first on every fire and every fuels management activity, every time.
- Ensure that all fire personnel are appropriately trained and qualified for the wildland fire assignment they receive.
- Suppress all wildfires in a cost-effective manner with consideration for environmental impacts, while ensuring that firefighter and public safety is the highest priority, using an appropriate management response.
- Prevent human-caused wildfires by instituting a pro-active and coordinated fire prevention program. This will be accomplished by using a variety of means including posting fire danger indicator signs in prominent locations, instituting restrictions during times of elevated high fire danger, and conducting prevention patrols aimed at educating the public.
- To the maximum extent possible, protect willow/cottonwood riparian habitat essential to Southwestern Willow Fly Catcher and other critical species from unwanted wildland fire.
- To the maximum extent possible, protect important scientific, scenic, historic, and prehistoric cultural resources from fire.
- Use a variety of prescribed fire and non-fire treatments to reduce the concentration of fuels in areas where facilities and resources may be threatened or damaged from wildfire.
- Ensure that 100% of all fuels management activities are executed in accordance with specific objectives and requirements as defined in land management plans and related planning documents.
- Work with all affected landowners and managers on fuels management actions so that the actions provide the greatest benefit to public and private assets, including the ecological, wilderness, preserve, and refuge values.
- To the maximum extent possible, ensure that all fire management actions are conducted in accordance with federal, state, and local water quality regulations.
- Ensure that 100% of all prescribed fire activities are conducted consistent with agency and departmental policy, as well as federal and state air quality requirements.
- By using the best available science and technology, maintain an acceptable range of ecological conditions that is consistent with existing scientific literature and land management planning documents.
- Develop and maintain a public education program supported by all field units focused on fire management actions within the interagency area.

Fire management strategies include suppression, prescribed fire, non-fire fuels treatments, post fire rehabilitation and/or restoration, and community protection/community assistance. To protect cultural resources, visitors, and property, all wildfires will be controlled using AMR. To the extent possible, indirect suppression activities using existing roads and natural barriers is the preferred suppression method. Approved fuels treatment activities include manual and mechanical fuels treatments and prescribed fire. These treatments will be used to protect cultural resources, visitors, and the WUI, to protect the unit's perimeters and jurisdictional boundaries, and to manage habitat with the purpose of meeting specific wildlife management objectives. Wildland fire use is not currently allowed within this unit.

Baca Dunes FMU Wildland Fire Environment

Historical Weather Analysis

The FMA is characterized by a high-altitude, cold climate. Weather conditions are strongly influenced by the 14,000 foot San Juan Mountain Range located to the west of the Valley. The San Juan Mountains form an effective barrier to moisture laden weather systems. Average annual

precipitation includes only 10.6 inches of rain and 36.7 inches of snow (1951-1995 at GSD Headquarters). Solar radiation is extreme; clouds obstruct sunlight from reaching the Valley floor only 30 - 40 days, annually.

Consistent south and southwest winds, (which formed the sand dunes) occur during March, April, May and June. These winds commonly reach velocities of 45 miles per hour. During this period, the surface of the dune mass creates a "heat low", causing surface winds to accelerate over the dunes.

Strong storms periodically enter the FMA from the northeast, with winds gusting up to 80 miles per hour. These storm fronts collide with the eastern side of the Sangre de Cristo Mountains, and winds flow down three mountain passes – the Music, Medano and Mosca – and onto the San Luis Valley Floor. These winds, accelerated by constriction, rush downslope, and then decrease in velocity after passing over the dune field. Classified as "reversed" winds, this weather pattern creates a microclimate in the dune complex rarely experienced on the valley floor. These high, sporadic winds are difficult to predict and are an important consideration for fire management.

A US Weather Station has been maintained at the monument since January, 1951. Temperature, precipitation and unusual weather occurrences are recorded daily. Annual summaries of climatological data are provided by the National Oceanic and Atmospheric Administration. Summaries of monthly climatic data are provided by Colorado Climate Center in Fort Collins, Colorado. From March 1987 to October 1991, meteorologic data were logged 24 hours a day by a SUMX data recorder located in the air quality monitoring station. Data included wind speed and direction, temperature, dew point, solar radiation, and precipitation. Monthly reports are available from AeroVironment, Inc. A fire weather station, installed by the USFS and operated by the NPS, monitored temperature, humidity, wind speed and direction from May through October from 1970 - 1993. Data will be compiled from past records to reconstruct fire weather summaries.

Wind data (speed and direction) from an anemometer located at the Visitor Center has logged data 24 hours a day since 1984. Currently, wind studies are being conducted on the dunes.

In 2004, a National Fire Danger Rating System remote automated weather station (Sand Dunes RAWS ID 055503) was installed for the FMA. At the current time, current RAWS stations from the surrounding representative areas are used in conjuction with data from this station for decision making purposes. In the future, this station will primarily be used for decision-making purposes.

Fire Season
The fire season generally lasts from May through September. June is typically the driest month of the year; mean precipitation is 0.9 inches and mean maximum temperature of 76.6 F. July is the hottest month with a mean maximum temperature of 80.6 F. Thunderstorms generally occur from late June through mid-September. The mean rainfall during this period is approximately 5.9 inches. Fires can occur throughout the year because of dry and windy conditions prevalent in the San Luis Valley.

The vegetation types, acres, fire regime types, and current condition classes in the Baca Dunes FMU can be found in Table 3.

Table 3 Vegetation, Acres, Fuel Model, Fire Regime, Condition Class for Baca Dunes FMU

Vegetation Type	Total Acres	Percent of area	FBPS (Anderson, 1982) Fuels Model(s)	NFDRS Fuel Model(s)	Fire Regime Type	Condition Class *
Aspen	56	< 1	8, 9	E, R	3, 4	1
Ponderosa Pine	943	< 1	2, 8, 9, 10	C, H, U, G	1, 3	1
Mixed Conifer	702	< 1	8, 9, 10	H, G	3, 4	1
Pinon-Juniper	3,662	2	2, 4, 6, 8	B, F, I, C, H	3, 4	1
Active and Stabilized Dune and Swales	24,689	0	NA	NA	NA	1
Shrublands	101,729	42	4, 6	F, B	2	1
Greasewood Flats and Ephemeral Wetlands	70,475	29	1, 2, 4, 6	L, F, B, T	3	1
Wet Meadows	14,592	6	1, 3	L, N	4	1
Riparian Areas	10,058	4	8, 9, 10	E, R, G, H	4	1
Grasslands	6,204	3	1, 2, 3	A, L, C,, T, N	2	1
Invasive annual or Perennial Grassland	3,714	2	1, 3	A, L, N	2	1
Agriculture	975	< 1	1, 3	A, N	2	n/a
Developed, Medium - High Intensity	312	< 1	NA	NA	NA	n/a
Developed, Open Space - Low Intensity	18	< 1	NA	NA	NA	n/a
Water	1,661	< 1	NA	NA	NA	n/a
Recently Mined or Quarried	36	< 1	NA	NA	NA	n/a
Total acreage	**239,847**					

*Estimation of condition class based on scientific literature. A formal evaluation of condition class that meets FRCC standards has not been performed.

Fire Behavior Concerns and Dominant Topographic Features
In this FMU, the fuel is discontinuous in most areas. During normal to dry conditions the greatest factor affecting fire behavior throughout various fuel types is wind. The absence of wind or the presence of light winds will not quickly advance a fire through the majority of Baca Dunes FMU grasslands and shrublands. Under drier conditions, if winds increase or become gusty, extreme fire behavior could occur. Most wildland fires are associated with thunderstorms and human-caused ignitions. High winds can cause a fire to burn a large amount of acreage quickly, but as soon as winds decrease, the fire will likely drop to a creeping rate. Slope would become a second primary factor along the east and north boundaries.

Currently wind is being monitored at the National Park Service headquarters and Sand Dunes RAWS station and in the southwest section of the main dunes. Prevailing winds are from the southwest. Winds along the edge of the dune field are complex and variable in speed and direction. The dune mass may act as a huge heating source and influence local winds within the dunefield and along its eastern front. The interactions of local dune winds, prevailing southwesterly winds and the foothills could cause frequently changing wind directions. Winds should be carefully monitored during all wildland fires.

The Role of Fire in the Baca Dunes FMU
Baca Dunes Fire History
The fire history of the Baca Dunes FMU is currently not well documented. However, based on local knowledge and limited fire records, fires are typically small (i.e. less than 10 acres) and occur as frequently as every few years. The GSD National Monument (i.e. prior to expansion and addition of Preserve) averaged 1.3 recorded wildland fires per year between 1983 and 1997 (NPS 1997). One human-caused wildfire is recorded from the spring of 2000 (Medano-Zapata Ranch and Great Sand Dunes National Monument), which was fueled by high winds. The 2000 fire burned mainly in grassland and shrubland habitat, but also burned portions of the piñon-juniper woodland and riparian areas into the Mosca FMU.

Recent shrub and grassland fires within the boundaries of the GSD National Park and Preserve have been small and confined to within 1-acre or less of their ignition source, generally a single woody plant (NPS 1996). Following ignition, grassland fires may spread quickly by the wind until rain comes, the wind dies down, or the fire reaches sandy areas with little fuel. In the last 50 years, interviews with local residents and NP officials indicate, that few fires greater than 10 acres occur in the sandsheet region.

In 1869 there were about 2,500 Utes in the San Luis Valley (Schroeder 1965). Human-caused fires before 1870 were sometimes attributed to American Indians (Agee, 1924), though Native American practices of setting fire to the grasslands are not well known. After 1870 many fires were attributed to miners, sheepherders, cattle ranchers and railroads (Agee 1924, RGNF 1970).

The fire history of Valley's grasslands and shrublands prior to 1880 is unknown (Romme 1996). The majority of the dominant plant species are at least moderately fire tolerant (see http://www.fs.fed.us/database/feis). If adequate soil moisture is available, many species have the ability to resprout after fire.

A number of factors over the last century may have substantially altered the composition and structure of these systems. Because of this, high stand density (e,g. rabbitbrush and winterfat) may

indicate an influence from wildland fire suppression, historic heavy grazing, climatic change, or a combination of these factors (Romme 1996). Interactions with disturbances such as wind scour, soil types, fluctuations in moisture, and other environmental factors also influence species composition and density, making it difficult to determine the relative importance of fire in this system. However, the natural discontinuity of fuels within much of this system suggests that fire may be a minor factor in controlling vegetation structure and species composition.

With respect to fire regime, piñon-juniper woodlands within the FMA, a small portion of this FMU, have not been heavily altered by human activity with respect to fire regime. Fire suppression efforts have not had as large of an impact on the piñon-juniper density levels or its expansion into adjacent shrublands and grasslands, as compared to other Southwestern piñon-juniper systems. The woodlands are thought to be relatively close to their natural range of variation for fire (Romme 1996). Higher elevation woodlands are considered within their natural range of variability. However, portions of the lower elevation piñon-juniper woodlands may need some management treatments to protect property and people. The boundary between the piñon-juniper woodlands and the higher elevation forests remains relatively unchanged from the time of park establishment (1932). However at the lower end of the elevational gradient, encroachment[6] on the shrubland and grasslands is occurring.

Baca Dunes FMU Fire Ecology

Fire is a natural ecological process that has historically influenced the vegetation in the San Luis Valley, including the structure, species composition, and dynamics. Most of the ecological systems in the Baca Dunes FMU, including grasslands, shrublands, and piñon-juniper woodlands are thought to be influenced by periodic fire (Rondeau 2001, Loftin 1999). The lower montane forests (piñon-juniper) are often characterized by more frequent surface fires than the lower elevation grass and shrublands (fire regime type I).

Baca Dunes FMU Fire Regime by Vegetation Type

The Fire Regime of the Baca Dunes Shrublands and Grasslands

Shrublands and grasslands within the FMA occur along the foothills of the Sangre de Cristo Mountains down to the floor of the San Luis Valley. Within the Greater Sand Dunes area, grasslands and shrublands are intermixed with salt flats and blowouts, which lead to discontinuous fuels. Grasslands are sparse to nonexistent over most of the dune field and fuels will generally not support a wildfire. Approximately one-fifth of the dunefield is lightly vegetated, usually in isolated interdunal sections. Exclusive of the dune fields, grasslands fuels are continuous to discontinuous. Grasses and other annuals are predominate and shrubs such as rabbitbrush, winterfat, and snake-weed. are common. Often the ground is bare sand with little organic matter.

Under normal conditions wind will quickly advance a fire. Flame length is usually in the 3'-6' range, but may exceed this range. Under calm conditions fire may advance slowly, or burn itself out because of discontinuity in fuels.

[6] The piñon- juniper expansion into adjacent grasslands and shrublands and unnaturally high tree densities may be the result of historic heavy livestock grazing and fire suppression (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).

Although the exact fire return intervals for FMA grassland and shrubland systems is unknown, small areas of these systems did occasionally burn by either natural or anthropogenic causes. The extent, intensity, and severity of these burns would have been dependent on a multitude of factors including weather (e.g. temperature, wind speed, and relative humidity) and vegetation (e.g. species composition, density, fuel load, and moisture content).

Recent shrub and grassland fires within the boundaries of the GSD National Park and Preserve have been small and confined to within 1-acre or less of their ignition source, generally a single woody plant (NPS 1996). Following ignition, grassland fires may spread quickly by the wind until rain comes, the wind dies down, or the fire reaches sandy areas with little fuel. In the last 50 years, interviews with local residents and NP officials indicate that few fires greater than 10 acres occured in the sandsheet region.

The 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 (West 1994). Sparsely vegetated salt flats, like those found within the greasewood and ephemeral wetland system have a fire regime described as nonexistent (Paysen et al. 2000).

Few studies have been conducted regarding historic fire patterns in the saltbush-greasewood type (Paysen et al. 2000). The sparse understory vegetation and bare soil are typically thought limited fire in this system. However, fine fuels may increase during wet years, resulting in an increased fire risk.

The Fire Regime of the Baca Dunes Wet Meadow Communities

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. Natural wet meadow areas 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.).

Wet meadows generally do not support fire, and thus fire ecology of these communities is not widely studied (Paysen et al. 2000, West 1994). The wet meadows within the planning area are assumed to naturally burn infrequently. Fire occurrence is dependent on a multitude of factors, including weather (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 at the time of ignition. The wet meadow mean fire return interval may be as frequent as every 50-100 years, with individual fires occurring every 5 years or greater.

The Fire Regime of the Baca Dunes Piñon-Juniper Woodlands

Within the FMA, piñon-juniper woodlands can be found between 7,600 – 9,500 feet. These woodlands are associated with the lower montane foothills zone, located below mixed conifer and spruce-fir forests and above grassland and shrubland systems (Neely et al. 2001, USFS 1996). Piñon pine (*Pinus edulis*) and Rocky Mountain juniper (*Juniperus scopulorum*) are the dominant species within this ecological system. Stand composition of these woodlands show approximately 85% of the cover to be piñon pine and about 10% to be Rocky Mountain juniper (Rowlands 1997). The canopy is typically open (i.e. less than 30% canopy cover), but the patchy occurrence of closed canopy stands is not uncommon (i.e. greater than 30% canopy cover). The understory includes a variety of grasses, forbs, and shrubs, including mountain mahogany and wax current (Rondeau 2001). Topography ranges from steep to gentle, and soils are a combination of alluvium deposits and rock.

Fire historically influenced the structure, composition, and maintenance of piñon-juniper woodlands (Arno 2000, Romme 1996, USFS 1996). Within the Baca Dunes FMU, piñon-juniper is typically characterized by a mixed severity to stand replacing fire regime, with infrequent stand replacing fires occurring every several hundred years (Havlina 2003; Romme 1996). The mean fire return interval for replacement fire and mixed-severity fire mean return intervals is approximately 425 years and 170 years, respectively (Baker and Shinneman 2004). Forest canopy density appears relatively sparse. A crown fire could carry through certain portions of these forests into developed areas, however, it would probably be under highly unusual weather conditions requiring strong or reversal winds, ignition in pre- or post-fire months and severe drought.

VDDT models for western Sangre de Cristo Mountains piñon-juniper woodlands suggest, that these areas are within their natural range of variability for fire and are characterized by an open-canopy and late-development state. Higher elevation piñon-juniper woodlands (i.e. along rocky slopes), generally correspond with the model predictions. At lower elevations and along alluvial fans, woodlands patches may have greater canopy closure than normally expected (i.e. greater than 30% cover).

Piñon-Juniper Woodland Assumptions: The FMP assumes piñon-juniper woodlands within the FMA have not been heavily altered by human activity and are relatively close to their natural range of variation for fire (Romme 1996). Is also assumed that fire suppression efforts have not had a large impact on piñon-juniper expansion into shrublands and grasslands, as in other parts of the Southwest (Romme 1996).

The Fire Regime of the Baca Dunes Riparian Systems

Riparian systems are assumed to naturally burn infrequently. Fire occurrence is dependent on a multitude of factors, including weather (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 at the time of ignition.

Baca Dunes FMU Biotic Characteristics

Grassland and Shrubland Vegetation

The Baca Dunes FMU is dominated by intermingled grassland and shrubland vegetation types, which occur along the lower sections of the foothills of the Sangre de Cristo Mountains and on stabilized sand dunes and sabkha across the San Luis Valley floor. Grass and shrubland species include blue grama (*Bouteloua gracilis*), Indian ricegrass (*Oryzopsis hymenoides*), needle-and-thread grass (*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).

The vegetated portions of the sand dune and swale complex are scattered with small pockets of *Redfieldia flexuosa/Psoralidium lanceolatum*, a rare plant community that can be found in locations where blowouts are beginning within the stabilized sandsheet (Pineda et al. 1999). The dominant vegetation on the vegetated portions of the dunes and swales includes blowout grass (*Redfieldia flexuosa*) and scurfpea (*Psoralidium lanceolatum*) (Pineda et al. 1999). Interdunal wetlands can be found in locations where the watertable intersects the complex.

Wetlands and Floodplains, including wet meadows and greasewood flats

The National Wetland Inventory identifies a large number of Palustrine[7] wetland and riverine systems located throughout the Baca Dunes FMU (USFWS 2004d), the majority of which are found west of the sand dune and swale complex. These wetlands are broadly categorized as wet meadows or ephemeral wetlands and greasewood flats.

Wet meadows are primarily found at the terminus of streams. As the overall elevational gradient lowers, the watertable comes close to the ground surface, creating areas of naturally wet meadows. These 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*), a rare plant that is restricted to moist alkaline soils, found in a relatively natural setting (Pineda et al. 1999). This system of wet meadows has been greatly enhanced through a system of irrigation canals and water spreading created over the last century on the Baca and Medano-Zapata Ranches. A series of interdunal wetlands occur on the active dune portion of the Baca Dunes FMU. The area that these wetlands encompass has been found to fluctuate over time, primarily due to changes in annual precipitation levels (Hammond 1998).

Ephemeral wetlands and greasewood flats are associated with connected systems of shallow depressions or basins. Large patches of greasewood flats are restricted to the San Luis Valley floor on the prehistoric sabkha (Rondeau 2001). The flats contain a

[7] Palustrine systems are defined as non- saline, non- tidal wetlands that are less than 8 hectares in area, less than 2 meters deep, and lack wave- formed or bedrock shoreline features (Cowardin et al.1979).

connected system of shallow depressions or basins that support a variety of wetland types. Historically each spring, the basins would fill with snowmelt runoff and spring-fed flow. 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.). Irregularly flooded basins are generally dominated by saltgrass (*Distichilis spicata*) or become barren salt flats (Rondeau et al. 1998). The landscape surrounding the basins is dominated by greasewood (*Sarcobatus vermiculatus*) and rabbitbrush shrublands with an understory of saltgrass (Pineda et al. 1999).

Lower Montane – Foothill Riparian Woodlands

Woodlands are found within riparian corridors and the lower montane-foothill zone, the transitional zone between the grasslands and shrublands of the valley floor and the mixed conifer forests of the Sangre de Cristo Mountains). Woody vegetation associated with riparian areas include cottonwood (*Populus* spp.), alder (*Alnus* spp.), Rocky Mountain juniper (*Juniperus scopulorum*), coyote willow (*Salix exigua*), and other willow species (*Salix* spp.). Several high quality globally rare plant communities are found along Sand Creek (Pineda et al. 1999).

Piñon-Juniper Woodlands

Piñon-juniper woodlands are found between 7600 and 9500 feet, 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. 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).

Small Ponderosa pine groves (*Pinus ponderosa)* occur along the east and north edges of the sand dune and swale complex.

Water Resources

The Baca Dunes FMU is 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 FMU and is supplied with water that is pumped from the unconfined aquifer.

The Baca Dunes FMU is underlain by two relatively distinct aquifers, the unconfined and the confined aquifers, which are separated by a clay layer. Water enters the unconfined

aquifer by way of precipitation and surface water infiltration 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 FMU, including areas of seeps, wet meadows, and interdunal wetlands. Within the FMA, the confined aquifer is primarily recharged through infiltration of water from streams near the foot of the Sangre de Cristo Mountain range (the aquifer-dividing clay layer is absent).

The majority of the water within the Baca Dunes FMU originates from the Sangre de Cristo Mountain range as snow melt[8]. This water flows primarily in southwest direction via a number of streams and ditches. Beginning in the north and heading south, the major streams are 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. 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. .Sand Creek and Medano Creek are integral to the erosion, transport and deposition of sand to the dune field (Geary 1997). Other large streams in this system include Medano Creek and Deadman Creek.

Of the streams located within the Baca Dunes FMU, Big Spring and Little Spring Creeks are the only low elevation perennial water courses. Perennial streams are spring-fed, arise from interdunal wetlands within the active dune field and have remarkably stable flow year round (Browne and Sanderson 2003). The remaining streams are ephemeral, with highly variable monthly and annual flows. Ephemeral streams may not be an available water source past mid-summer. All of the streams eventually infiltrate into the ground or terminate in terminal ponds and wetlands not connected to any major stream or river. Major ephemeral riverine systems include Medano[9] and Sand Creeks[10].

A group of lakes occurs 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 dune fields.

Baca Dunes FMU Soils

The primary soil associations found within the Baca Dunes FMU include the - Dune Land – Space City, Space City – Costilla – Cotopaxi, Hooper – San Luis – Corlett, Alamosa – Lajara – Vastine, and Gunbarrel – Mosca – San Luis. Table 4 provides a description of these associations.

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[8] Annual precipitation across the FMPA ranges from approximately 7 inches in the west to over 30 inches at the higher elevations within the Sangre de Cristo Mountains.

[9] Medano Creek is classified by NWI as an intermittent, temporarily flooded, streambed (FWS 2004d).

[10] Sand Creek is classified by NWI as a lower perennial, upper perennial and intermittent system with "unconsolidated shore" and "streambed" (FWS 2004d).

Table 4 Primary soil associations found within the Baca Dunes FMU.

Soil Association	Description
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.
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.

Baca Dunes FMU Wildlife

A wide variety of wildlife species utilize the various habitats available throughout the Baca Dunes FMU. It is estimated that there are 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 thought to be present or possible within the GSD National Park and Preserve. This information is based on GSD National Monument species lists and supplemental occurrence data from The Nature Conservancy's Medano-Zapata Ranch. Appendix C provides lists of species known to occur or potentially occurring within the planning area.

Baca Dunes FMU Management Considerations

Baca Dunes Air Quality

Air quality within the GSD NP is categorized under the Clean Air Act (as amended) as a Class I airshed, having the highest air quality protection. Class I airshed standards are higher than those of the National Ambient Air Quality Standards. Theses standards provide little allowance for air quality deterioration. Air quality within the Baca National

Wildlife Refuge and the Medano-Zapata Ranch is categorized as a Class II airshed. Class II airsheds have less stringent air quality standards than Class I airsheds; slight increases in the concentrations of certain air pollutants over baseline conditions may be allowed.

Baca Dunes FMU Designated Wilderness Areas

The Baca Dunes FMU includes 32,643 acres of designated wilderness area, all within the former GSD National Monument boundaries. Neither the Baca NWR nor the Conservancy's Medano-Zapata Ranch contains designated wilderness areas.

Baca Dunes FMU Infrastructure (Facilities and Structures)

Developments within GSD National 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.

Baca Dunes FMU Cultural and Historic Resources

Baca Dunes FMU Cultural Resources[11]

Approximately 32,320 acres of the Baca Dunes FMU have been surveyed for cultural resources. Abundant cultural resources occur throughout this FMU representing human use during the Paleoindian, Archaic, Late Prehistoric/Ceramic, Protohistoric, Historic American Indian, and Historic Euro-American periods have been recorded (~100,000 years).

More than 747 sites within and adjacent to the Baca Dunes FMU 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).

Baca Dunes FMU Archeological Resources

The majority of archeological sites recorded within the Baca Dunes FMU are classified as open camp sites. Most 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

[11] 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).

project area includes andesite, granite, sandstone, schist, and unclassified igneous and volcanic material.

Other aboriginal archeological site types include burials, jump/kill site, prehistoric quarry sites, stone circles, rock cairns, wickiups, and culturally scarred trees. Material types 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 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.

Baca Dunes FMU Historic Resources

Within this FMU, 48 sites are listed or 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. Within the FMU, 257 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.

The majority of historic structures in the Baca Dunes FMU are elements of historic-era homesteads. Building types include homes, bunkhouses, cook houses, barns, corrals, sheds, and miscellaneous structures. Material types 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.

Baca Dunes FMU Cultural Landscapes

Although no cultural landscapes have been inventoried, several potential cultural landscapes are apparent. Potential cultural landscapes include a stand of culturally modified trees located within the GSD NP; the Conservancy's Medano, Trujillo, and Zapata Ranch complexes, and various viewsheds on NPS, FWS, and Conservancy lands. These potential cultural landscapes fall into the categories of vernacular, ethnographic, and historic (NPS Cultural Landscapes Program 2002).

Baca Dunes FMU Ethnographic Resources

Both the NPS and the FWS 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.

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).

Baca Dunes FMU Threatened, Endangered, and Candidate Species
Potential habitat for several Federal and State threatened, endangered, and candidate species occurs within the Baca Dunes FMU (Table 5).

Table 5. Federal and State Threatened, Endangered, and Candidate Species thought to occur within the Baca Dunes FMU.

Common Name	Scientific Name	Listing
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Federal and State Endangered
Bald Eagle	*Haliaeetus leucocephalus*	Federal and State Endangered
Burrowing Owl	*Athene cuniculave*	State Endangered
Rio Grande Sucker	*Catostomus plebeius*	State Endangered
Yellow-biller Cuckoo	*Coccyzus americanus*	Federal and State Candidate
Rio Grande Cutthroat Trout	*Oncorhynchus clarki virginalis*	State Candidate
Northern Leopard Frog	*Rana pipiens*	State Candidate
Ferruginous Hawk	*Buteo regalis*	State Candidate
American Peregrine Falcon	*Falco peregrinus anatum*	State Candidate
Western Snowy Plover	*Charadrius alexandrinus nivosus*	State Candidate
Mountain Plover	*Charadrius montanus*	State Candidate
Long Billed Curlew	*Numenius americanus*	State Candidate

Baca Dunes FMU Wildland-Urban Interface
The communities at the greatest risk to wildfire include the town of Crestone, and the Baca Grande and Zapata Subdivisions, and additional scattered single family dwellings within and near the FMU boundary. The GSD National Park staff housing and the Zapata Ranch housing near the ranch headquarters are also at risk. Other communities located within near proximity to the FMU include Mosca, Hooper, and Moffat.

Baca Dunes FMU Public Uses

Great Sand Dunes National Park and Preserve
The GSD National Park and Preserve is the only property within the Baca Dunes FMU that is currently open to the public year round. It is also the most visited property, with an average of 285,250 individuals annually, with the highest visitor used occurring in the summer months of June, July, and August (1990-2003) (NPS unpublished data). Public uses include hiking, horseback riding, camping, backpacking, climbing the sand dunes, star gazing, photography, picnicking, auto touring, biking, cross country skiing, snowshoeing, and bird and wildlife viewing.

Visitor 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). There are 136 miles of roads, 8 of which are paved, and over 60 miles of trails located within the boundaries of the Medano-Zapata Ranch, of the former Baca ranch, and of the former monument and preserve.

Visitor use includes both day use and overnight use. Use is currently concentrated at the visitor center, located 2 miles from the park entrance, the campgrounds, and/or the eastern side of the sand dunes including Medano Creek. Approximately 30-50 percent of the visitors stop at the visitor center. The majority of the hiking is centralized to the dune complex. Backcountry campsites are found along the Little Medano and Sand Creek Trails

Baca National Wildlife Refuge

The Baca NWR is currently not open to the public. However, if found compatible with the Refuge's purpose and objectives, future recreational opportunities may include uses compatible with refuge management objectives. A number of roads and buildings exist within the Baca National Wildlife Refuge. These are currently not open to the public.

The Nature Conservancy's Medano-Zapata Ranch

The recreational opportunities at the Conservancy's Medano-Zapata Ranch currently include a variety of overnight workshops. Workshop participants stay on the property overnight, and travel to various points on the Ranch and within the San Luis Valley. In 2003, 191 people attended 14 workshops that were conducted between March and October. In addition, a number of meetings are held at the Ranch by various groups, including the 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 these are also closed to unescorted public access.

State Lands

State lands, including San Luis Lakes State Park, are also found within the Baca Dunes FMU. A variety of recreational opportunities are also provided outside the limits of the Baca Dunes FMU but within the boundaries of the FMA.

MOSCA FIRE MANAGEMENT UNIT[12]

Mosca FMU Location

The approximately 14,000 acre Mosca FMU is located on the western flank of the Sangre de Cristo Mountains, and includes the portion of the Great Sand Dunes National Preserve south of and on either side of Medano Pass Road (Figure 4). This road is passable only with a high-clearance 4WD vehicle (ATVs are not permitted). From the east, trailheads at Music Pass, Medano Pass, and Mosca Pass provide hiker and equestrian access can be accessed by 4WD vehicle from US Forest Services roads leading off Colorado State Highway 69, between Gardner and Westcliffe, Colorado. With the exception of Mosca Pass Road, the FMU is located within the Sangre de Cristo designated wilderness area. Formerly managed by the US Forest Service as part of Rio Grande National Forest, the preserve was established as part of the Great Sand Dunes National Park and Preserve Act of 2000.

The Mosca FMU stretches from the eastern boundary of the Baca Dunes FMU (i.e. old national monument) to the crest of the Sangre de Cristos from just west of Carbonate Mountain on the south side, then north to Mendo Pass. Including the watersheds for Sand Creek and Medano Creek, the preserve boasts high alpine tundra and lakes, barren scree slopes, and 13,000+ foot Rocky Mountain peaks. The northern boundary of the Mosca FMU is the Herard FMU.

The Mosca FMU includes a variety of fuel conditions and management challenges, characterized by stand-replacing fire regimes, a wilderness landscape, and a limited Wildland Fire Use (WFU) prescription. The current structure, species composition, and dynamics of its ecosystems are the direct result of past fires, or in other cases, the result of processes that have themselves been affected by fire. The ecological systems in the Herard FMU, including alpine, spruce-fir, mixed-conifer, and piñon-juniper forests, are thought to be dependent on periodic fire (Rondeau 2001, Loftin 1999). Wildfires are a dominant disturbance process in the spruce-fir forest (Arno 2000, Alington 1998, USFS 1996), and are typically large-scale, stand replacing events (Rondeau 2001). The lower montane forests (ponderosas pine and piñon-juniper) are often characterized by more frequent surface fires (fire regime type I).

The majority of the boundaries of the Mosca FMU borders US Forest Service managed land.. Cooperators in this FMU include the FWS, the NPS, USFS, CSFS, county and TNC.

The Mosca FMU can be accessed from the following paved roads: Highway 150 and Medano Pass Road.

[12] The vegetation types and ecological systems within the Herard FMU are similar to those within the Herard FMU.

Mosca FMU Fire Management Objectives

The Mosca FMU is designated for wildland fire use, but as a result of proximity of the unit to the WUI and the number of sensitive resources located within unit boundaries, candidate wildland fires will be closely evaluated and analyzed for fire spread potential using fire behavior prediction methods and the Wildland Fire Implementation Plan process. This FMU is considered within its natural range of variability for fire (see the fire histories presented in the EA/ AEF). Therefore, fuels treatment activities are not necessary to return the site to its natural condition.

AMR will be utilized to manage wildland fires occurring along unit and jurisdictional boundaries. Fuel treatments, including manual hazardous fuels reduction and prescribed fire, will be used to perpetuate fire as a natural ecological process; to protect unit perimeters and jurisdictional boundaries; and to protect visitors, cultural resources, improvements and the WUI. Fuel treatments can 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.

Mosca FMU Fire Management Objectives

All naturally ignited wildland fires within this FMU will be evaluated as wildland fire use candidates using the WFIP process, and if approved, will be managed for resource benefits and designated wildland fire use. In addition, fuels management activities will be executed in identified areas within this FMU. Based on existing planning documents, the strategic objectives for the Baca Dunes FMU are:

- Provide for the safety of visitors, employees, in-holders, and neighbors during all wildland fire management operations, by ensuring that safety comes first on every fire and every fuels management activity, every time.
- Ensure that 100% of all naturally ignited wildland fires are evaluated and considered as potential wildland fire use events.
- Ensure that all fire personnel are appropriately trained and qualified for the wildland fire assignment they receive.
- Suppress all wildfires in a cost-effective manner with consideration for environmental impacts, while ensuring that firefighter and public safety is the highest priority, using an appropriate management response.
- Prevent human-caused wildfires by instituting a pro-active and coordinated fire prevention program. This will be accomplished by using a variety of means including posting fire danger indicator signs in prominent locations, instituting restrictions during times of elevated high fire danger, and conducting prevention patrols aimed at educating the public.
- To the maximum extent possible, protect willow/cottonwood riparian habitat essential to Southwestern Willow Fly Catcher and other critical species from unwanted wildland fire.
- To the maximum extent possible, protect important scientific, scenic, historic, and prehistoric cultural resources from fire.
- Use a variety of prescribed fire and non-fire treatments to reduce the concentration of fuels in areas where facilities and resources may be threatened or damaged from wildfire.
- Ensure that 100% of all fuels management activities are executed in accordance with specific objectives and requirements as defined in land management plans and related planning

documents.

- Work with all affected landowners and managers on fuels management actions so that the actions provide the greatest benefit to public and private assets, including the ecological, wilderness, preserve, and refuge values.
- To the maximum extent possible, ensure that all fire management actions are conducted in accordance with federal, state, and local water quality regulations.
- Ensure that 100% of all prescribed fire activities are conducted consistent with agency and departmental policy, as well as federal and state air quality requirements.
- By using the best available science and technology, maintain an acceptable range of ecological conditions that is consistent with existing scientific literature and land management planning documents.
- Develop and maintain a public education program supported by all field units focused on fire management actions within the interagency area.

Fire management strategies include wildland fire use, suppression, prescribed fire, non-fire fuels treatments, post fire rehabilitation and/or restoration, and community protection/community assistance. To protect cultural resources, visitors, and property, all wildfires will be controlled using AMR. To the extent possible, indirect suppression activities using existing roads and natural barriers is the preferred suppression method. Approved fuels treatment activities include manual and mechanical fuels treatments and prescribed fire. These treatments will be used to protect cultural resources, visitors, and the WUI, to protect the unit's perimeters and jurisdictional boundaries, and to manage habitat with the purpose of meeting specific wildlife management objectives.

Mosca FMU Wildland Fire Management Environment

Historical Weather Analysis

The Mosca FMU is characterized by a high-altitude, cold climate. Weather conditions are strongly influenced by the adjacent 14,000 foot San Juan Mountain Range located to the west of the Valley. The San Juan Mountains form an effective barrier to moisture laden weather systems. Average annual precipitation includes only 10.6 inches or rain and 36.7 inches of snow (1951-1995 at GSD Headquarters). Solar radiation is extreme; clouds obstruct sunlight from reaching the Valley floor only 30 - 40 days, annually.

Consistent south and southwest winds occur during March, April, May and June. These winds commonly reach velocities of 45 miles per hour. During this period, the surface of the dune mass creates a "heat low", causing surface winds to accelerate over the dunes.

Strong storms periodically enter the FMA from the northeast, with winds gusting up to 80 miles per hour. These storm fronts collide with the eastern side of the Sangre de Cristo Mountains, and winds flow down three mountain passes – the Music, Medano and Mosca – and onto the San Luis Valley Floor. These winds are accelerated by constriction they rush downslope, and then decrease in velocity after passing over the dune field. Classified as "reversed" winds, this weather pattern creates a microclimate in the dune complex rarely experience on the valley floor. These high, sporadic winds are difficult to predict and are an important consideration for management.

A US Weather Station has been maintained at the monument since January, 1951.

Temperature, precipitation and unusual weather occurrences are recorded daily. Annual summaries of climatological data are provided by the National Oceanic and Atmospheric Administration. Summaries of monthly climatic data are provided by Colorado Climate Center in Fort Collins, Colorado. From March 1987 to October 1991, meteorologic data were logged 24 hours a day by a SUMX data recorder located in the air quality monitoring station. Data included wind speed and direction, temperature, dew point, solar radiation, and precipitation. Monthly reports are available from AeroVironment, Inc. A fire weather station, installed by the USFS and operated by the NPS, monitored temperature, humidity, wind speed and direction from May through October from 1970 - 1993. Data will be compiled from past records to reconstruct fire weather summaries.

Wind data (speed and direction) from an anemometer located at the Visitor Center has logged data 24 hours a day since 1984. Currently, wind studies are being conducted on the dunes.

Fire Season

The fire season generally lasts from June through September. June is typically the driest month of the year; mean precipitation is 0.9 inches and mean maximum temperature of 76.6 F. July is the hottest month with a mean maximum temperature of 80.6 F. Thunderstorms generally occur from late June through mid-September. The mean rainfall during this period is approximately 5.9 inches.

The vegetation types, acres, fire regime types, and current condition classes in the Mosca FMU can be found in Table 6.

Table 6 Cover Type, Approx Acres, Fuel Model, Fire Regime, Condition Class, Comments

Vegetation Acreage for Mosca FMU

Vegetation Type	Total Acres	Percent of area	FBPS (Anderson, 1982) Fuels Model(s)	NFDRS Fuel Model(s)	Fire Regime Type	Condition Class *
Alpine	412	3	1	L	5	1
Spruce-fir	2268	16	8, 9, 10	G, H	5	1
Aspen	2493	17	8, 9	E, R	3, 4	1
Ponderosa Pine	60	< 1	2, 8, 9, 10	C, H, U, G	1	1
Mixed Conifer	6320	43	8, 9, 10	H, G	3	1
Pinon-Juniper	1605	11	2, 4, 6, 8	T, C, B, F, G	4, 5	1
Active and Stabilized Dune and Swales	11	< 1	NA	NA	NA	n/a
Shrublands	40	< 1	4, 6	F, B	2	1
Riparian Areas	320	2	8, 9, 10	E, R, G, H	4	1
Grasslands	1065	7	1, 2, 3	A, L, C, N	2	1
Invasive annual or Perennial Grassland	3	< 1	1, 3	A, L, N	2	1
Total acreage	**14597**					

*Estimation of condition class based on scientific literature. A formal evaluation of condition class that meets FRCC standards has not been performed.

Fire Behavior Concerns and Dominant Topographic Features

During normal to dry conditions the greatest factor affecting fire behavior throughout various fuel types is wind. The absence of wind or the presence of light winds will not quickly advance a fire through the majority of Mosca FMU forests. Under drier conditions, if winds increase or become gusty, extreme fire behavior could occur. Most wildland fires are associated with thunderstorms; rain usually follows to extinguish or slow down the fire until it burns itself out. High winds can burn large amount of acreage quickly, but as soon as winds decrease, the fire will likely drop to a creeping rate.

Weather parameters are being monitored by the Sand Dunes RAWS station. Prevailing winds are from the southwest. The interactions of prevailing southwesterly winds and the foothills could cause frequently changing wind directions. Winds should be carefully monitored during all wildland fires.

Slope is also a primary factor affecting wildland fire in the Mosca FMU. The dominant topographic feature in this FMU is the Sangre de Cristo mountain range. The upper elevations are marked by steep mountain slopes. Soils consist of rock outcrops, coarse textured soils, and glacial moraines (USFS 1996). The rugged nature of these mountains makes much of FMU difficult to access to inaccessible. Avalanches occur

along certain steep drainages. Because of the steepness of the terrain, avalanche-prone areas are not likely to contain forest systems in their late-development stages. Wind and slope alignment can cause fast-moving crown fires which could run to the crest of the Sangre de Christo Mountains. North facing slopes are typically more mesic and, therefore, have fewer fires than south facing slopes. Open canopy conditions are more likely found on south-facing slopes, and closed canopy conditions are more likely found on north-facing slopes.. However, dependent on site characteristics and fire history, it is possible for open and closed canopies to occur on either slope.

The Role of Fire in the Mosca FMU

Mosca FMU Fire History

Limited local fire history data is available for the forest types found within the Mosca FMU. Based on literature reviews, local knowledge, and ecological models, the natural fire regimes for these plant communities include mixed severity and stand replacing fires with fairly long fire return intervals. Detailed fire history information for the vegetation types found within the Mosca FMU can be found in Appendix E. This appendix includes descriptions of ecological models prepared for piñon-juniper woodlands, mixed conifer forests, and spruce-fir forests.

Mosca FMU Fire Ecology

The current structure, species composition, and dynamics of many ecosystems are often the direct result of past fires, or the result of other disturbance processes that have themselves been affected by fire. Fire is a natural ecological process that has historically influenced the vegetation in the Sangre de Cristo Mountains. The ecological systems in the Mosca FMU, including spruce-fir, mixed-conifer, and piñon-juniper forests, are thought to be dependent on periodic fire (Rondeau 2001, Loftin 1999). The lower montane forests (ponderosas pine and piñon-juniper) are often characterized by more frequent surface fires (fire regime type I). Appendix E includes descriptions of ecological models prepared for piñon-juniper woodlands, mixed conifer forests, and spruce-fir forests.

Mosca FMU Fire Regime per Vegetation Type

The fire regime of the Mosca FMU alpine systems

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 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

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 larger-scale, mixed severity to stand replacing events (Barrett 2003 a, b, Rondeau 2001). The mean

fire return interval for mixed severity and stand replacing fire are predicted by ecological model as approximately 235 and 330 years, respectively. Fire, insects, windthrow, and avalanches are also important disturbances within spruce-fir forests. In the FMA, it is thought that spruce-fir forests are within their natural range of variability for fire.

North facing slopes are typically more mesic and, therefore, have fewer fires than south facing slopes. Open canopy conditions are more likely found on south-facing slopes, and closed canopy conditions are more likely found on north-facing slopes. The more mesic conditions of north facing slopes may potentially increase their tendency towards a longer fire return intervals and, therefore, a higher probability of stand replacing fires due to greater fuel loads (i.e. closed canopy), as compared to south facing slopes. However, dependent on site characteristics and fire history, it is possible for open and closed canopies to occur on either slope. Successional classes with closed canopies are thought to have a higher probability of stand replacing fires and a lower probability of surface and mosaic fires, as compared to successional classes with open canopies.

VDDT models for western Sangre de Cristo Mountains spruce-fir forests suggest, that forests within their natural range of variability should be characterized by a closed-canopy, late-development state. Overall, the results of the VDDT model appear to correspond well to the FMA spruce-fir forest condition.

Spruce – Fir Forest Assumptions: The FMP assumes spruce- fir forests within the FMA have not been heavily altered by human activity and are within their natural range of variation for fire. Based on the rugged nature and inaccessibility of much of this vegetation type within the FMA, 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). North facing slopes are assumed more mesic and thus, prone to higher fuel densities and a longer fire return interval than south facing slopes. Successional classes with closed canopies are 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. Wind and weather stress and insect and pathogen-caused mortality were assumed to only affect relatively small patches, rather than the whole landscape.

Bristlecone pine forests

Bristlecone pine (*Pinus aristata*) is also present within the the high elevation forests on dry ridges. This type may be mapped as spruce-fir forest. 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).

Mixed conifer forests

The mixed conifer forest occurs within the upper montane zone of the western flank of the Sangre de Cristo Mountains (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 plays a dominant role in the maintenance of southwest mixed conifer forests (Arno 2000, Alington 1998, USFS 1996). These forests are characterized by 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). Stand replacing wildland fire occurs less frequently within the forests of the western Sangre de Cristo Mountains than other similar Southern Rocky Mountain forest types (Alington 1998, Romme 1996). Thus, the mean fire interval for stand replacing fire in the Greater Sand Dunes mixed conifer forests is assumed to be slightly higher that average for the region. The character of wildfire within mixed conifer forests (e.g. degree of severity, length of fire return interval), however, is dependent on factors including forest location, microclimate, land uses, and other disturbance processes such as avalanches and insect outbreaks. In the FMA, it is thought that mixed-conifer forests are within their natural range of variability for fire.

Open canopy conditions are more likely found on south-facing slopes, and closed canopy conditions are more likely found on north-facing slopes. However, dependent on site characteristics and fire history, it is possible for open and closed canopies to occur on either slope. Successional classes with closed canopies are thought to have a higher probability of stand replacing fires and a lower probability of surface and mosaic fires, as compared to successional classes with open canopies.

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 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 in steep drainages.

Conifer species react differently in the presence of fire. 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).

VDDT models for western Sangre de Cristo Mountains mixed – conifer forests suggest that forests are within their natural range of variability for fire. The majority of these forests are in a late development state and the area is somewhat evenly divided between open (south facing) and closed (north facing) canopies. Overall, the results of

the VDDT model appear to correspond well to the FMA spruce-fir forest condition.

Mixed - Conifer Forest Assumptions: The FMP assumes mixed - conifer forests within the FMA have not been heavily altered by human activity and are within their natural range of variation for fire. Based on the rugged nature and inaccessibility of much of this vegetation type within the FMA, 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). North facing slopes are assumed more mesic and this, prone to higher fuel densities and a longer fire return interval that south facing slopes. Successional classes with closed canopies are 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. Wind and weather stress and insect and pathogen-caused mortality were assumed to only affect relatively small patches, rather than the whole landscape. Avalanches occur along certain steep drainages. Because of the steepness of the terrain, it is assumed that avalanche-prone areas are not likely to contain forest systems in their late-development stages.

Aspen Forests

In the FMA, Aspen forests are confined to relatively moist sites and along riparian areas. Aspen are intermingled with spruce-fir and mixed conifer forests (Neely et al. 2001, USFS 1996). Quaking aspen (*Populus tremuloides*) occur in recently disturbed areas, especially after wildland fire. 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).

Piñon-Juniper Woodlands

Within the Mosca FMU, piñon-juniper woodlands are associated with the lower montane foothills zone, located below mixed conifer and spruce-fir forests and above grassland and shrubland systems (Neely et al. 2001, USFS 1996). 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 canopy is typically open (i.e. less than 30% canopy cover), however, patchy occurrences of closed canopy stands is not uncommon (i.e. greater than 30% canopy cover). The understory includes a variety of grasses, forbs, and shrubs, including mountain mahogany and wax current (Rondeau 2001). Topography ranges from steep to gentle, and soils are a combination of alluvium deposits and rock.

Fire historically influenced the structure, composition, and maintenance of these piñon-juniper woodlands (Arno 2000, Romme 1996, USFS 1996). Within the Mosca FMU, piñon-juniper is typically characterized by a mixed severity to stand replacing fire regime, with infrequent stand replacing fires occurring every several hundred years (Havlina 2003; Romme 1996). The mean fire return interval for replacement fire and mixed-severity fire mean return intervals is approximately 425 years and 170 years,

respectively (Baker and Shinneman 2004). Forest canopy density appears relatively sparse. A crown fire could carry through certain portions of these forests into developed areas, however, it would probably be under highly unusual weather conditions requiring strong or reversal winds, ignition in pre- or post-fire months and severe drought.

VDDT models for western Sangre de Cristo Mountains piñon-juniper woodlands suggest that these areas are within their natural range of variability for fire and are characterized by an open-canopy and late-development state. Higher elevation piñon-juniper woodlands (i.e. along rocky slopes), generally correspond with the model predictions. At lower elevations and along alluvial fans, woodlands patches may have greater canopy closure than normally expected (i.e. greater than 30% cover).

Piñon-Juniper Woodland Assumptions: The FMP assumes piñon-juniper woodlands within the FMA have not been heavily altered by human activity and are relatively close to their natural range of variation for fire (Romme 1996). It is also assumed that fire suppression efforts have not had a large impact on piñon-juniper expansion into shrublands and grasslands, as in other parts of the Southwest (Romme 1996).

Ponderosa Pine Forests

Fire frequencies for ponderosa pine vary considerably according to site conditions and geographical area.. There is generally a 12-25 year fire interval in Colorado (Hendrickson, 1972). Litter buildup over 3 years may carry a fire, but 8-9 years is more common (Dieterich 1980). Crane (1982), Wright (1990), Stokes and Dietrich (1980), and Dr. Phil Omi (CSU-Omi, Personal Communication to RGNF 1992) suggest 5-20 year intervals in dry ponderosa pine stands.

The ponderosa pine groves that occur in the Mosca FMU, particularly within portions of the National Park, also appear to be quite different from other classic fire regimes 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 may need to be reintroduced, but at significantly longer intervals than elsewhere (Romme, 1996).

MOSCA FMU BIOTIC CHARACTERISTICS

Alpine and Subalpine Meadows

Within the Mosca FMU, alpine ecological systems occupy the high mountain summits, slopes, and ridges, above the upper elevational limits of tree species (elevation 10,000 and 14,000 feet) (Barbour and Billings 2000). Species presence is controlled by snow retention, wind desiccation, permafrost, and a short growing season (Rondeau 2001).

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. Dominant alpine dry meadow species include a mosaic of sedges, grasses, and forbs, including 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. Dominant species in this system are also generally a mosaic of sedges, grasses and forbs, including 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).

Spruce - Fir Forests

Spruce-fir forests, which occur between 9000 and 11,500 feet, are the primary forest type in the montane and subalpine zones of the Mosca FMU. The topography within this system is moderately steep to very 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 sub-alpine fir is largely absent in the upper 300 m of the forest (Barbour and Billings 2000). Iinsects, windthrow, and avalanches are other important disturbances within spruce-fir forests.

Quaking aspen (*Populus tremuloides*) occurs within the spruce-fir forests in areas that have been recently disturbed. Bristlecone pine (*Pinus aristata*) is present 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). As the elevational gradient lowers, spruce-fir forests grade into mixed conifer forests and piñon-juniper woodlands.

Mixed Conifer Forests

Mixed conifer forest occurs within the Mosca FMU along the western flank of the Sangre de Cristo Mountains, between 7500 and 10,500 feet, within the upper montane zone (Neely et al. 2001, USFS 1996). The topography within the mixed conifer system varies from 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.

Aspen Forests

In the Mosca FMU, aspen forests are found between 8,000-10,000 feet, from the subalpine to the montane zones. Aspen is confined to relatively moist sites (16 to 40 plus inches annual precipitation) and riparian areas that have cold winters and a relatively long growing season. Stands are dominated by quaking aspen (*Populus tremuloides*) (Neely et al. 2001, USFS 1996), and are usually surround by a mosaic of plant associations, including grasslands and coniferous forests (Rondeau 2001).

Aspen may dominate the forest community for many decades following disturbance (e.g. fire), but its presence will gradually decline as conifers reestablish. In the sub-alpine spruce-fir forests, aspen may persist in its seral stages. In the montane mixed-conifer forests, after disturbance aspen occurs as a temporarily dominant seral species (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.

Montane Grasslands

Patches of montane grasslands are also found within the montane and subalpine zone, between 9,000 and 11,500 feet, 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).

Piñon-Juniper Woodlands

Piñon-juniper woodlands are found between 7600 and 9500 feet, 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.

Wetlands and Floodplains

Medano Creek begins within the Mosca FMU. In addition, a number of smaller tributaries and unnamed drainages occur throughout the FMU. These ephemeral systems are primarily snow-melt dominated systems.

Aquatic Resources

Aquatic resources within the Mosca FMU include the upper reaches of Medano Creek and its tributaries, as well as other unnamed drainages. These streams are primarily fed by snow melt and precipitation and continue to flow downslope into the Baca Dunes FMU.

Soils

The primary soil associations found within the Mosca FMU include the -Mirror – Teewinot – Bross, Leadville – Granile – Lakehelen, and Uracca – Comodore – Blackhall. Table 7 provides a description of these associations.

Table 7 Primary soil associations found in the Mosca FMU.

Soil Association	Description
Major Soil Associations	
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.
Minor Soil Associations	
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.

Mosca FMU Wildlife

A wide variety of wildlife species utilize the various habitats available throughout the Mosca FMU. It is estimated that there are 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 thought to be present or possible within the GSD National Park and Preserve. This information is based on GSD National Monument species lists and supplemental occurrence data from The Nature Conservancy's Medano-Zapata Ranch. Appendix C provides lists of species known to occur or potentially occurring within the planning area.

MOSCA FMU MANAGEMENT CONSIDERATIONS

Mosca FMU Air Quality

Air quality within the Mosca FMU is categorized as Class I under the Clean Air Act, as amended. Class I areas are provided the highest air quality protection with air quality standards that are higher than the National Ambient Air Quality Standards. These standards provide little allowance for air quality deterioration.

Mosca FMU Designated Wilderness Areas

The entire Mosca FMU is located within a designated wilderness area. The Mosca and Herard FMU's combined have 40,512 acres of designated wilderness, and form a portion of the of the Sangre de Cristo Wilderness Area.

Mosca FMU Cultural and Historic Resources

Mosca FMU Cultural Resources

The entire FMA has been subjected to 18 cultural resource surveys for past projects. Approximately 29,000 acres have been surveyed for past projects; survey levels varied by project (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 600 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).

Forty-eight sites within the FMA 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.

The FMU includes a diverse array of cultural resources which represent human use of the area for the past 11,500 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. Within this FMU, a portion of the ponderosa pine scar tree grove located on Medano Pass Road is on the National Register of Historic Places. 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).

Archeological Resources. The majority of archeological sites recorded within the entire FMA 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 FMA includes andesite, granite, sandstone, schist, and unclassified igneous and volcanic material.

Other aboriginal archeological site types within the FMA 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 FMA, 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.

Mosca FMU Endangered, Threatened, and Candidate Species
Potential habitat for several Federal and State threatened, endangered, and candidate species occurs within the Mosca FMU (Table 8).

Table 8. Federal and State Endangered, Threatened, and Candidate Species thought to occur within the Mosca FMU.

Common Name	Scientific Name	Listing
Canada Lynx	*Lynx Canadensis*	Federal and State Endangered
Mexican Spotted Owl	Strix occidentalis lucida	Federal and State Threatened
Rio Grande Sucker	*Catostomus plebeius*	State Endangered
Rio Grande Cutthroat Trout	*Oncorhynchus clarki virginalis*	State Canidate

Mosca FMU Wildland-Urban Interface
The communities at the greatest risk to wildfire include the town of Crestone, the Baca Grande and Zapata Subdivisions, and additional scattered single family dwellings within and near the FMU boundary. In addition, the staff housing within Great Sand Dunes National Park is also at risk.

Mosca FMU Recreational Opportunities
Recreational opportunities within the Mosca FMU are similar to those described under the Baca Dunes FMU. In addition, some activities such as hunting are allowed within the Mosca FMU as part of the Preserve. Car camping in the backcountry is available without a permit along the Medano Pass Road. This road is passable only with a high-clearance 4WD vehicle (ATVs are not permitted).

Great Sand Dunes National Park and Preserve
The GSD National Park and Preserve is currently open to the public year round. It is also the most visited property within the FMA, with an average of 285,250 individuals annually, with the highest visitor use occurring in the summer months of June, July, and August (1990-2003) (NPS unpublished data).Recreational opportunities include hiking, horseback riding, camping, backpacking, climbing the sand dunes, star gazing, photography, picnicking, auto touring, biking, cross country skiing, snowshoeing, and bird and wildlife viewing.

The preserve is also part of the Sangre de Cristo Wilderness area, and offers superb opportunities for backcountry hiking and camping in the summer months. Significant winter snowfall usually makes the area difficult to access from November through April, except by back-country skiing or snowshoes. Four wheel drive access in summer from the west is by the Medano Pass Primitive Road, which leaves from just north of the Great Sand Dunes National Park Visitor Center. Four-wheel drive, high clearance vehicles are required for this road. The Medano Pass Primitive Road is closed by snow in the winter months. From the east, trailheads at Medano Pass, and Mosca Pass provide hiker and equestrian access. With the exception of the Medano Pass Road, there is no vehicular access through or into the Mosca FMU. All three trailheads can be accessed by 4WD vehicle from US Forest Services roads leading off Colorado State Highway 69, between Gardner and Westcliffe, Colorado. Within the national preserve, hunting in season and by license is a legal activity.

HERARD FIRE MANAGEMENT UNIT

Herard FMU Location

The 27,000 acre Herard FMU includes the portion of the Great Sand Dunes National Preserve that is located north of Medano Pass Road (Figure 4). This road is passable only with a high-clearance 4WD vehicle (ATVs are not permitted). From the east, trailheads at Music Pass and along Sand Creek provide hiker and equestrian access. Music Pass can be accessed by 4WD vehicle from US Forest Services roads leading off Colorado State Highway 69, between Gardner and Westcliffe, Colorado. The entirety of the FMU is located within the Sangre de Cristo designated wilderness area. Formerly managed by the US Forest Service as part of Rio Grande National Forest, the preserve was established as part of the Great Sand Dunes National Park and Preserve Act of 2000.

The Herard FMU occurs along the western flank of the Sangre de Cristo Mountains, north of the Mosca FMU. The Herard FMU stretches from the northeastern boundary of the Baca Dunes FMU (old national monument) to the crest of the Sangre de Cristos, from just north of Mosca Pass on the south side to Milwaukee Peak on the north, then south through Music Mountain, Tijeras Peak, and Cleveland Peak. Including the watersheds for Sand Creek, the Herard FMU boasts high alpine tundra and lakes, barren scree slopes, and 13,000+ foot Rocky Mountain peaks. The majority of the eastern edge of the Herard FMU borders is adjacent to Forest Service land zoned for a suppression response. The Herard FMU can be accessed from Medano Pass Road.

The current structure, species composition, and dynamics of many ecosystems are often the direct result of past fires, or in other cases, the result of processes that have themselves been affected by fire. Fire is a natural ecological process that has historically influenced the vegetation in the Sangre de Cristo Mountains. The ecological systems in the Herard FMU, including spruce-fir, mixed-conifer, and piñon-juniper forests, are thought to be dependent on periodic fire (Rondeau 2001, Loftin 1999). The lower montane forests (ponderosas pine and piñon-juniper) are often characterized by more frequent surface fires (fire regime type I). This FMU is considered within its natural range of variability for fire (see the fire histories presented in the EA/ AEF). Therefore, fuels treatments are not necessary to return the site to its natural condition.

Herard FMU Fire Management Objectives

To meet the stated goals, the Herard FMU is designated for wildland fire use. AMR will be utilized to suppress wildfires. Limited fuel treatment activities will be used to perpetuate fire as a natural ecological process, achieve ecosystem sustainability, protect unit perimeters and jurisdictional boundaries, and to protect visitors, cultural resources, and improvements. Limited fuel treatments, including manual hazardous fuels reduction and prescribed fire, will be undertaken to ensure cultural and resource protection along the FMU perimeters, jurisdictional boundaries, and around specific sites for cultural resource and visitor protection.

Herard FMU Fire Management Objectives

All naturally ignited wildland fires within this FMU will be evaluated as wildland fire use candidates using the WFIP process, and if approved, will be managed for resource benefits and designated wildland fire use. In addition, fuels management activities will be executed in identified areas within this FMU. Based on existing planning documents, the strategic objectives for the Baca Dunes FMU are:

- Provide for the safety of visitors, employees, in-holders, and neighbors during all wildland fire management operations, by ensuring that safety comes first on every fire and every fuels management activity, every time.
- Ensure that 100% of all naturally ignited wildland fires are evaluated and considered as potential wildland fire use events.
- Ensure that all fire personnel are appropriately trained and qualified for the wildland fire assignment they receive.
- Suppress all wildfires in a cost-effective manner with consideration for environmental impacts, while ensuring that firefighter and public safety is the highest priority, using an appropriate management response. (All FMUs)
- Prevent human-caused wildfires by instituting a pro-active and coordinated fire prevention program. This will be accomplished by using a variety of means including posting fire danger indicator signs in prominent locations, instituting restrictions during times of elevated high fire danger, and conducting prevention patrols aimed at educating the public.
- To the maximum extent possible, protect willow/cottonwood riparian habitat essential to Southwestern Willow Fly Catcher and other critical species from unwanted wildland fire.
- To the maximum extent possible, protect important scientific, scenic, historic, and prehistoric cultural resources from fire.
- Use a variety of prescribed fire and non-fire treatments to reduce the concentration of fuels in areas where facilities and resources may be threatened or damaged from wildfire.
- Ensure that 100% of all fuels management activities are executed in accordance with specific objectives and requirements as defined in land management plans and related planning documents.
- Work with all affected landowners and managers on fuels management actions so that the actions provide the greatest benefit to public and private assets, including the ecological, wilderness, preserve, and refuge values.
- To the maximum extent possible, ensure that all fire management actions are conducted in accordance with federal, state, and local water quality regulations.
- Ensure that 100% of all prescribed fire activities are conducted consistent with agency and departmental policy, as well as federal and state air quality requirements.
- By using the best available science and technology, maintain an acceptable range of ecological conditions that is consistent with existing scientific literature and land management planning documents.
- Develop and maintain a public education program supported by all field units focused on fire management actions within the interagency area.

Fire management strategies include wildland fire use, suppression, prescribed fire, non-fire fuels treatments, post fire rehabilitation and/or restoration, and community protection/community assistance. To protect cultural resources, visitors, and property, all wildfires will be controlled using AMR. To the extent possible, indirect suppression activities using existing roads and natural barriers is the preferred suppression method. Approved fuels treatment activities include manual and mechanical fuels treatments and prescribed fire. These treatments will be used to

protect cultural resources, visitors, and the WUI, to protect the unit's perimeters and jurisdictional boundaries, and to manage habitat with the purpose of meeting specific wildlife management objectives.

Herard FMU Wildland Fire Management Environment

Historical Weather Analysis

Weather for the Herard FMU is similar to that described for Mosca FMU above

Fire Season

The fire season generally lasts from June through November. June is typically the driest month of the year; mean precipitation is 0.9 inches and mean maximum temperature of 76.6 F. July is the hottest month with a mean maximum temperature of 80.6 F. Thunderstorms generally occur from late June through mid-September. The mean rainfall during this period is approximately 5.9 inches.

The vegetation types, acres, fire regime types, and current condition classes in the Herard FMU can be found in Table 9.

Table 9. Vegetation Type, Acres, Fuel Model, Fire Regime, Condition Class, Comments for Herard FMU

Vegetation Type	Total Acres	Percent of area	FBPS (Anderson, 1982) Fuels Model(s)	NFDRS Fuel Model(s)	Fire Regime Type	Condition Class *
Alpine	6,578	24	1	L	5	1
Spruce-fir	6,005	22	8, 9, 10	G, H	5	1
Aspen	5,118	19	8, 9	E, R	4	1
Ponderosa Pine	182	1	2, 8, 9, 10	C, U, G, H	1	1
Mixed Conifer	5,290	20	8, 9, 10	G, H	3	1
Pinon-Juniper	819	3	2, 4, 6, 8	T, C, B, F, H	4, 5	1
Active and Stabilized Dune and Swales	33	< 1	NA	NA	NA	n/a
Riparian Areas	1,594	6	8, 9, 10	E, R, G, H	4	1
Grasslands	1,376	5	1, 2, 3	A, L, C, N	2	1
Open water	53	< 1	NA	NA		n/a
Total acreage	**27,050**					

*Estimation of condition class based on scientific literature. A formal evaluation of condition class that meets FRCC standards has not been performed.

Fire Behavior Concerns and Dominant Topographic Features

During normal to dry conditions the greatest factor affecting fire behavior throughout various fuel types is wind. The absence of wind or the presence of light winds will not quickly advance a fire through the majority of Herard FMU grasslands and forests within the monument. Under drier conditions, if winds increase or become gusty, extreme fire behavior could occur. Most wildland fires are associated with thunderstorms; rain usually follows to extinguish or slow down the fire until it burns itself out. High winds in can burn a large amount of acreage quickly, but as soon as winds decrease, the fire will likely drop to a creeping rate.

Currently wind is being monitored at the headquarters and in the southwest section of the main dunes. Prevailing winds are from the southwest. The interactions of prevailing southwesterly winds and the foothills could cause frequently changing wind directions. Winds should be carefully monitored during all wildland fires.

Slope is also a primary factor affecting wildland fire in the Herard FMU. The dominant topographic feature in this FMU is the Sangre de Cristo mountain range. The upper elevations are marked by steep mountain slopes. Soils consist of rock outcrops, coarse textured soils, and glacial moraines (USFS 1996). The rugged nature of these mountains makes much of FMU difficult to access to inaccessible. Avalanches occur along certain steep drainages. Because of the steepness of the terrain, avalanche-prone areas are not likely to contain forest systems in their late-development stages.

Wind and slope alignment can cause fast-moving crown fires which could run to the crest of the Sangre de Christo Mountains. North facing slopes are typically more mesic and, therefore, have fewer fires than south facing slopes. Open canopy conditions are more likely found on south-facing slopes, and closed canopy conditions are more likely found on north-facing slopes. However, dependent on site characteristics and fire history, it is possible for open and closed canopies to occur on either slope.

THE ROLE OF FIRE IN THE HERARD FMU

Herard FMU Fire History

Limited local fire history data is available for the forest types found within the Herard FMU. Based on literature reviews, local knowledge, and ecological models, the natural fire regimes for these plant communities include mixed severity and stand replacing fires with fairly long fire return intervals. Appendix E includes descriptions of ecological models prepared for piñon-juniper woodlands, mixed conifer forests, and spruce-fir forests.

Herard FMU Fire Ecology

The current structure, species composition, and dynamics of many ecosystems are often the direct result of past fires, or the result of other disturbance processes that have themselves been affected by fire. Fire is a natural ecological process that has historically influenced the vegetation in the Sangre de Cristo Mountains. The ecological systems in the Mosca FMU, including spruce-fir, mixed-conifer, and piñon-juniper forests, are thought to be dependent on periodic fire (Rondeau 2001, Loftin 1999). The lower montane forests (ponderosas pine and piñon-juniper) are often characterized by more frequent surface fires (fire regime type I).

A detailed description of the fire ecology of vegetation types found within the Herard FMU is provided in Appendix E. This appendix includes descriptions of ecological models prepared for piñon-juniper woodlands, mixed conifer forests, and spruce-fir forests.

Herard FMU Fire Regime per Vegetation Type

The fire regime of the Herard FMU alpine systems

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 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

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 larger-scale,

mixed severity to stand replacing events (Barrett 2003 a, b, Rondeau 2001). The mean fire return interval for mixed severity and stand replacing fire are predicted by ecological model as approximately 235 and 330 years, respectively. Fire, insects, windthrow, and avalanches are also important disturbances within spruce-fir forests. In the FMA, it is thought that spruce-fir forests are within their natural range of variability for fire.

North facing slopes are typically more mesic and, therefore, have fewer fires than south facing slopes. Open canopy conditions are more likely found on south-facing slopes, and closed canopy conditions are more likely found on north-facing slopes. The more mesic conditions of north facing slopes may potentially increase their tendency towards a longer fire return intervals and, therefore, a higher probability of stand replacing fires due to greater fuel loads (i.e. closed canopy), as compared to south facing slopes. However, dependent on site characteristics and fire history, it is possible for open and closed canopies to occur on either slope. Successional classes with closed canopies are thought to have a higher probability of stand replacing fires and a lower probability of surface and mosaic fires, as compared to successional classes with open canopies.

VDDT models for western Sangre de Cristo Mountains spruce-fir forests suggest, that forests within their natural range of variability should be characterized by a closed-canopy, late-development state. Overall, the results of the VDDT model appear to correspond well to the FMA spruce-fir forest condition.

Spruce – Fir Forest Assumptions: The FMP assumes spruce- fir forests within the FMA have not been heavily altered by human activity and are within their natural range of variation for fire. Based on the rugged nature and inaccessibility of much of this vegetation type within the FMA, 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). North facing slopes are assumed more mesic and thus, prone to higher fuel densities and a longer fire return interval than south facing slopes. Successional classes with closed canopies are 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. Wind and weather stress and insect and pathogen-caused mortality were assumed to only affect relatively small patches, rather than the whole landscape.

Bristlecone pine forests

Bristlecone pine (*Pinus aristata*) is also present within the the high elevation forests on dry ridges. This type may be mapped as spruce-fir forest. 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).

Mixed conifer forests

The mixed conifer forest occurs within the upper montane zone of the western flank of the Sangre de Cristo Mountains (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 plays a dominant role in the maintenance of southwest mixed conifer forests (Arno 2000, Alington 1998, USFS 1996). These forests are characterized by 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). Stand replacing wildland fire occurs less frequently within the forests of the western Sangre de Cristo Mountains than other similar Southern Rocky Mountain forest types (Alington 1998, Romme 1996). Thus, the mean fire interval for stand replacing fire in the Greater Sand Dunes mixed conifer forests is assumed to be slightly higher that average for the region. The character of wildfire within mixed conifer forests (e.g. degree of severity, length of fire return interval), however, is dependent on factors including forest location, microclimate, land uses, and other disturbance processes such as avalanches and insect outbreaks. In the FMA, it is thought that mixed-conifer forests are within their natural range of variability for fire.

Open canopy conditions are more likely found on south-facing slopes, and closed canopy conditions are more likely found on north-facing slopes. However, dependent on site characteristics and fire history, it is possible for open and closed canopies to occur on either slope. Successional classes with closed canopies are thought to have a higher probability of stand replacing fires and a lower probability of surface and mosaic fires, as compared to successional classes with open canopies.

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 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 in steep drainages.

Conifer species react differently in the presence of fire. 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).

VDDT models for western Sangre de Cristo Mountains mixed – conifer forests suggest that forests are within their natural range of variability for fire. The majority of these forests are in a late development state and the area is somewhat evenly divided

between open (south facing) and closed (north facing) canopies. Overall, the results of the VDDT model appear to correspond well to the FMA spruce-fir forest condition.

Mixed - Conifer Forest Assumptions: The FMP assumes mixed - conifer forests within the FMA have not been heavily altered by human activity and are within their natural range of variation for fire. Based on the rugged nature and inaccessibility of much of this vegetation type within the FMA, 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). North facing slopes are assumed more mesic and this, prone to higher fuel densities and a longer fire return interval that south facing slopes. Successional classes with closed canopies are 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. Wind and weather stress and insect and pathogen-caused mortality were assumed to only affect relatively small patches, rather than the whole landscape. Avalanches occur along certain steep drainages. Because of the steepness of the terrain, it is assumed that avalanche-prone areas are not likely to contain forest systems in their late-development stages.

Aspen Forests

In the FMA, Aspen forests are confined to relatively moist sites and along riparian areas. Aspen are intermingled with spruce-fir and mixed conifer forests (Neely et al. 2001, USFS 1996). Quaking aspen (*Populus tremuloides*) occur in recently disturbed areas, especially after wildland fire. 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).

Piñon-Juniper Woodlands

Within the Herard FMU, piñon-juniper woodlands are associated with the lower montane foothills zone, located below mixed conifer and spruce-fir forests and above grassland and shrubland systems (Neely et al. 2001, USFS 1996). 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 canopy is typically open (i.e. less than 30% canopy cover), however, patchy occurrences of closed canopy stands is not uncommon (i.e. greater than 30% canopy cover). The understory includes a variety of grasses, forbs, and shrubs, including mountain mahogany and wax current (Rondeau 2001). Topography ranges from steep to gentle, and soils are a combination of alluvium deposits and rock.

Fire historically influenced the structure, composition, and maintenance of these piñon-juniper woodlands (Arno 2000, Romme 1996, USFS 1996). Within the Mosca FMU, piñon-juniper is typically characterized by a mixed severity to stand replacing fire regime, with infrequent stand replacing fires occurring every several hundred years (Havlina 2003; Romme 1996). The mean fire return interval for replacement fire and

mixed-severity fire mean return intervals is approximately 425 years and 170 years, respectively (Baker and Shinneman 2004). Forest canopy density appears relatively sparse. A crown fire could carry through certain portions of these forests into developed areas, however, it would probably be under highly unusual weather conditions requiring strong or reversal winds, ignition in pre- or post-fire months and severe drought.

VDDT models for western Sangre de Cristo Mountains piñon-juniper woodlands suggest that these areas are within their natural range of variability for fire and are characterized by an open-canopy and late-development state. Higher elevation piñon-juniper woodlands (i.e. along rocky slopes), generally correspond with the model predictions. At lower elevations and along alluvial fans, woodlands patches may have greater canopy closure than normally expected (i.e. greater than 30% cover).

Piñon-Juniper Woodland Assumptions: The FMP assumes piñon-juniper woodlands within the FMA have not been heavily altered by human activity and are relatively close to their natural range of variation for fire (Romme 1996). It is also assumed that fire suppression efforts have not had a large impact on piñon-juniper expansion into shrublands and grasslands, as in other parts of the Southwest (Romme 1996).

Ponderosa Pine Forests

Fire frequencies for ponderosa pine vary considerably according to site conditions and geographical area.. There is generally a 12-25 year fire interval in Colorado (Hendrickson, 1972). Litter buildup over 3 years may carry a fire, but 8-9 years is more common (Dieterich 1980). Crane (1982), Wright (1990), Stokes and Dietrich (1980), and Dr. Phil Omi (CSU-Omi, Personal Communication to RGNF 1992) suggest 5-20 year intervals in dry ponderosa pine stands.

The ponderosa pine groves that occur in the Herard FMU, particularly within portions of the National Park, also appear to be quite different from other classic fire regimes 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 may need to be reintroduced, but at significantly longer intervals than elsewhere (Romme, 1996).

HERARD FMU BIOTIC CHARACTERISTICS

Alpine and Subalpine Meadows

Within the Herard FMU, alpine ecological systems occupy the high mountain summits, slopes, and ridges, above the upper elevational limits of tree species (elevation 10,000 and 14,000 feet) (Barbour and Billings 2000). Species presence is controlled by snow retention, wind desiccation, permafrost, and a short growing season (Rondeau 2001).

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. Dominant alpine dry meadow species include a mosaic of sedges, grasses, and forbs, including 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. Dominant species in this system are also generally a mosaic of sedges, grasses and forbs, including 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).

Spruce - Fir Forests

Spruce-fir forests, which occur between 9000 and 11,500 feet, are the primary forest type in the montane and subalpine zones of the Herard FMU. The topography within this system is moderately steep to very 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 sub-alpine fir is largely absent in the upper 300 m of the forest (Barbour and Billings 2000). Iinsects, windthrow, and avalanches are other important disturbances within spruce-fir forests.

Quaking aspen (*Populus tremuloides*) occurs within the spruce-fir forests in areas that have been recently disturbed. Bristlecone pine (*Pinus aristata*) is present 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). As the elevational gradient lowers, spruce-fir forests grade into mixed conifer forests and piñon-juniper woodlands.

Mixed Conifer Forests

Mixed conifer forest occurs within the Herard FMU along the western flank of the Sangre de Cristo Mountains, between 7500 and 10,500 feet, within the upper montane zone (Neely et al. 2001, USFS 1996). The topography within the mixed conifer system varies from 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.

Aspen Forests

In the Herard FMU, aspen forests are found between 8,000-10,000 feet, from the subalpine to the montane zones. Aspen is confined to relatively moist sites (16 to 40 plus inches annual precipitation) and riparian areas that have cold winters and a relatively long growing season. Stands are dominated by quaking aspen (*Populus tremuloides*) (Neely et al. 2001, USFS 1996), and are usually surround by a mosaic of plant associations, including grasslands and coniferous forests (Rondeau 2001).

Aspen may dominate the forest community for many decades following disturbance (e.g. fire), but its presence will gradually decline as conifers reestablish. In the sub-alpine spruce-fir forests, aspen may persist in its seral stages. In the montane mixed-conifer forests, after disturbance aspen occurs as a temporarily dominant seral species (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.

Montane Grasslands

Patches of montane grasslands are also found within the montane and subalpine zone, between 9,000 and 11,500 feet, 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).

Piñon-Juniper Woodlands

Piñon-juniper woodlands are found between 7600 and 9500 feet, 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.

Wetlands and Floodplains

Medano Creek and Sand Creek begin within the Herard FMU. In addition, a number of smaller tributaries and unnamed drainages occur throughout the FMU. These

ephemeral systems are primarily snow-melt dominated systems.

Aquatic Resources
Aquatic resources within the Herard FMU include the upper reaches of Medano Creek and its tributaries, as well as other unnamed drainages. These streams are primarily fed by snow melt and precipitation and continue to flow downslope into the Baca Dunes FMU.

Soils
The soil associations within the Herard FMU include Mirror – Teewinot – Bross, Leadville – Granile – Lakehelen, and Uracca – Comodore – Blackhall. Table 10 provides a description of these associations.

Table 10. Primary soil associations found within the Herard FMU.

Soil Association	Description
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.

Wildlife
A wide variety of wildlife species utilize the various habitats available throughout the Herard FMU. It is estimated that there are 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 thought to be present or possible within the GSD National Park and Preserve. This information is based on GSD National Monument species lists. Appendix C provides lists of species known to occur or potentially occurring within the planning area.

Herard FMU Additional Management Considerations

Herard FMU Air Quality
Air quality within the Herard FMU is categorized as Class I under the Clean Air Act, as amended. Class I areas are provided the highest air quality protection with air quality standards that are higher than the National Ambient Air Quality Standards. These standards provide little allowance for air quality deterioration.

Herard FMU Designated Wilderness Areas
The entire Herard FMU is located within a designated wilderness area. The Mosca and Herard FMU's combined have 40,512 acres of designated wilderness, and form a portion of the of the Sangre de Cristo Wilderness Area.

Herard FMU Cultural and Historic Resources
The FMU includes a diverse array of cultural resources which represent human use of the area for the past 11,500 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 entire FMA has been subjected to 18 cultural resource surveys for past projects. Approximately 29,000 acres have been surveyed for past projects; survey levels varied by project (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 600 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).

Forty-eight sites within the FMA 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

entire FMA 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 FMA includes andesite, granite, sandstone, schist, and unclassified igneous and volcanic material.

Other aboriginal archeological site types within the FMA 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 FMA, 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.

Herard FMU Historic Resources
Medano and Mosca Pass were used by early explorers and settlers to access the SLV, especially in the mid-1800s after gold was discovered in the San Juan Mountains west of the valley.

Herard FMU Endangered, Threatened, and Candidate Species
Potential habitat for several Federal and State threatened, endangered, and candidate species occurs within the Herard FMU (Table 11).

Table 11. Federal and State Endangered, Threatened, and Candidate Species thought to occur within the Herard FMU.

Common Name	Scientific Name	Listing
Canada Lynx	*Lynx canadensis*	Federal and State Endangered
Mexican Spotted Owl	Strix occidentalis lucida	Federal and State Threatened

Herard FMU Wildland-Urban Interface
The communities at the greatest risk to wildfire include the town of Crestone, the Baca Grande and Zapata Subdivisions, and additional scattered single family dwellings within and near the FMU boundary. In addition, the staff housing within Great Sand Dunes National Park is also at risk.

Herard FMU Recreational Opportunities
Recreational opportunities within the Herard FMU are similar to those described under the Mosca FMU. In addition, some activities such as hunting are allowed within the Herard FMU as part of the Preserve.

Great Sand Dunes National Park and Preserve
The GSD National Park and Preserve is currently open to the public year round. It is also the most visited property in the FMA, with an average of 285,250 individuals annually, with the highest visitor used occurring in the summer months of June, July, and August (1990-2003) (NPS unpublished data).Recreational opportunities include hiking, horseback riding, camping, backpacking, climbing the sand dunes, star gazing, photography, picnicking, auto touring, biking, cross country skiing, snowshoeing, and bird and wildlife viewing.

Sangre de Cristo Wilderness
The preserve is also part of the Sangre de Cristo Wilderness area, and offers superb opportunities for backcountry hiking and camping in the summer months. Significant winter snowfall usually makes the area difficult to access from November through April, except by back-country skiing or snowshoes. Four wheel drive access in summer from the west is by the Medano Pass Primitive Road, which leaves from just north of the

Visitor Center. Four-wheel drive, high clearance vehicles are required for this road. Note the Medano Pass Primitive Road is closed by snow in the winter months. Medano Pass Primitive Road Guide is availabe at the Visitor Center. From the east, trailheads at Music Pass, Medano Pass, and Mosca Pass provide hiker and equestrian access. With the exception of the Medano Pass Road, there is no vehicular access through or into the preserve. All three trailheads can be accessed by 4WD vehicle from US Forest Services roads leading off Colorado State Highway 69, between Gardner and Westcliffe, Colorado. Within the national preserve, hunting in season and by license is a legal activity.

ALAMOSA - MONTE VISTA FIRE MANAGEMENT UNIT

Alamosa – Monte Vista Location

The 27,255 acre Alamosa-Monte Vista FMU includes the Alamosa and Monte Vista NWRs (Figure 4). The FMU is located outside of a designated wilderness area. The majority of the Alamosa – Monte Vista FMU is dominated by wetlands intermingled with grassland and shrubland vegetation types, which occur across the San Luis valley floor.

The Alamosa NWR boundary encompasses approximately 12,425 acres along the Rio Grande River, east of the town of Alamosa. The Alamosa NWR can be accessed three miles east of the town of Alamosa off of State Highway 160. The Alamosa NWR is located approximately 15 miles east of the Monte Vista NWR.

The Monte Vista NWR boundary encompasses 14,800 acres of uplands within the western side of the San Luis Valley. The Monte Vista NWR is located on the west side of the San Luis Valley, about eight miles south of the town of Monte Vista. It can be accessed on State Highway 15.

The majority of the Alamosa – Monte Vista FMU borders is WUI and agricultural lands, zoned for a suppression response. Cooperators in this FMU include the FWS.

Alamosa – Monte Vista Fire Management Objectives

All wildland fires occurring within the Alamosa – Monte Vista FMU will be suppressed using the AMR, with the purpose of protecting cultural resources, visitors, and property. The IC may consider a full range of suppression options, commensurate with values at risk. The primary suppression strategy employed will be direct attack. To the extent possible, indirect suppression activities using existing roads and natural barriers is the preferred suppression method. On the occasion when direct attack on high intensity, rapidly spreading wildland fire would jeopardize firefighter safety and not be appropriate. In these cases indirect attack will be employed utilizing natural and human-made features as wildfire control points. Minimum impact suppression techniques (MIST) will be utilized, where appropriate.

In the Alamosa – Monte Vista FMU, approved fuels treatment activities include prescribed fire and non-fire treatments. These treatments will be used to protect cultural resources, visitors, and the WUI, to protect the unit's perimeters and jurisdictional boundaries, and to manage habitat with the purpose of meeting specific wildlife management objectives. Prescribed fire will be utilized as a management tool in two arenas to accomplished resource management and hazardous fuels reduction activities. Prescribed fire to accomplish resource management will be used to restore, create, and/or maintain a diversity of plant communities in order to enhance and perpetuate native plant and wildlife species. Prescribed fire for hazardous fuels reduction activities will be sued to reduce the risk of damage by wildfire to FMU property and within or near Refuge development zones, sensitive resources, and boundary areas s. To the greatest extent possible, prescribed fire for hazardous fuels reduction will only be used when it

compliments resource management objectives. Due to its cultural resources, close proximity to the WUI, and numerous of safety concerns, WFU is not be allowed within this unit.

Alamosa/Monte Vista FMU Fire Management Objectives

All wildland fires within this FMU will be managed for protection objectives and suppressed using an appropriate management response. In addition, fuels management activities will be executed in identified areas within this FMU. Based on existing planning documents, the strategic objectives for the Baca Dunes FMU are:

- Provide for the safety of visitors, employees, in-holders, and neighbors during all wildland fire management operations, by ensuring that safety comes first on every fire and every fuels management activity, every time.
- Ensure that all fire personnel are appropriately trained and qualified for the wildland fire assignment they receive.
- Suppress all wildfires in a cost-effective manner with consideration for environmental impacts, while ensuring that firefighter and public safety is the highest priority, using an appropriate management response.
- Prevent human-caused wildfires by instituting a pro-active and coordinated fire prevention program. This will be accomplished by using a variety of means including posting fire danger indicator signs in prominent locations, instituting restrictions during times of elevated high fire danger, and conducting prevention patrols aimed at educating the public.
- To the maximum extent possible, protect willow/cottonwood riparian habitat essential to Southwestern Willow Fly Catcher and other critical species from unwanted wildland fire.
- To the maximum extent possible, protect important scientific, scenic, historic, and prehistoric cultural resources from fire.
- Use a variety of prescribed fire and non-fire treatments to reduce the concentration of fuels in areas where facilities and resources may be threatened or damaged from wildfire.
- Ensure that 100% of all fuels management activities are executed in accordance with specific objectives and requirements as defined in land management plans and related planning documents.
- Work with all affected landowners and managers on fuels management actions so that the actions provide the greatest benefit to public and private assets, including the ecological, wilderness, preserve, and refuge values.
- To the maximum extent possible, ensure that all fire management actions are conducted in accordance with federal, state, and local water quality regulations.
- Ensure that 100% of all prescribed fire activities are conducted consistent with agency and departmental policy, as well as federal and state air quality requirements.
- By using the best available science and technology, maintain an acceptable range of ecological conditions that is consistent with existing scientific literature and land management planning documents.
- Re-establish and maintain a high forb to grass ratio in short grass habitats through the use of prescribed fire and demonstrated through accepted monitoring protocols.
- Prevent and/or reduce over rested residual growth accumulation in short emergent habitats to maintain quality nesting cover for waterfowl and other migratory birds by prescribed burning at least 5% of these habitats annually.
- Maintain vigor of tall emergent habitats that are essential for important colonial nesting wading bird species by burning at least 5% of these habitats annually.
- Control, reduce, or eradicate noxious weed species by at least 5% annually using prescribed fire as part of the treatment.

Fire management strategies include suppression, prescribed fire, non-fire fuels treatments, post fire rehabilitation and/or restoration, and community protection/community assistance. To protect cultural resources, visitors, and property, all wildfires will be controlled using AMR. To the extent possible, indirect suppression activities using existing roads and natural barriers is the preferred suppression method. Approved fuels treatment activities include manual and mechanical fuels treatments and prescribed fire. These treatments will be used to protect cultural resources, visitors, and the WUI, to protect the unit's perimeters and jurisdictional boundaries, and to manage habitat with the purpose of meeting specific wildlife management objectives. Wildland fire use is not currently allowed within this unit.

Alamosa - Monte Vista FMU Wildland Fire Management Environment
Alamosa – Monte Vista FMU Historical Weather Analysis

The FMA is characterized by a high-altitude, cold climate. Weather conditions are strongly influenced by the 14,000 foot San Juan Mountain Range located to the west of the Valley. The San Juan mountains form an effective barrier to moisture laden weather systems. Average annual precipitation includes only 10.6 inches or rain and 36.7 inches of snow (1951-1995 at GSD Headquarters). Solar radiation is extreme; clouds obstruct sunlight from reaching the Valley floor only 30 - 40 days, annually.

Consistent south and southwest winds, (which formed the sand dunes) occur during March, April, May and June. These winds commonly reach velocities of 45 miles per hour. During this period, the surface of the dune mass creates a "heat low", causing surface winds to accelerate over the dunes.

Strong storms periodically enter the FMA from the northeast, with winds gusting up to 80 miles per hour. These storm fronts collide with the eastern side of the Sangre de Cristo Mountains, and winds flow down three mountain passes – the Music, Medano and Mosca – and onto the San Luis Valley Floor. These winds are accelerated by constriction they rush downslope, and then decrease in velocity after passing over the dune field. Classified as "reversed" winds, this weather pattern creates a microclimate in the dune complex rarely experience on the valley floor. These high, sporadic winds are difficult to predict and are an important consideration for management.

A US Weather Station has been maintained at the monument since January, 1951. Temperature, precipitation and unusual weather occurrences are recorded daily. Annual summaries of climatological data are provided by the National Oceanic and Atmospheric Administration. Summaries of monthly climatic data are provided by Colorado Climate Center in Fort Collins, Colorado. From March 1987 to October 1991, meteorologic data were logged 24 hours a day by a SUMX data recorder located in the air quality monitoring station. Data included wind speed and direction, temperature, dew point, solar radiation, and precipitation. Monthly reports are available from AeroVironment, Inc. A fire weather station, installed by the USFS and operated by the NPS, monitored temperature, humidity, wind speed and direction from May through October from 1970 - 1993. Data will be compiled from past records to reconstruct fire weather summaries. Wind data (speed and direction) from an anemometer located at the NPS Visitor Center has logged data 24 hours a day since 1984. Currently, wind studies are being conducted on the dunes.

Alamosa – Monte Vista FMU Fire Season
The fire season generally lasts from June through September.. June is typically the driest month of the year; mean precipitation is 0.9 inches and mean maximum temperature of 76.6 F. July is the hottest month with a mean maximum temperature of 80.6 F. Thunderstorms generally occur from late June through mid-September. The mean rainfall during this period is approximately 5.9 inches.

Alamosa – Monte Vista FMU The vegetation types, acres, fire regime types, and current condition classes in the Alamosa - Monte Vista FMU can be found in Table 12

Table 12 Vegetation Type, Approx Acres, Fuel Model, Fire Regime, Condition Class, Comments for Alamosa/Monte Vista FMU

Vegetation Type	Total Acres	Percent of area	FBPS (Anderson, 1982) Fuels Model(s)	NFDRS Fuel Model(s)	Fire Regime Type	Condition Class *
Greasewood Flats and Ephemeral Wetlands	10694	39.3	1,2,3,4,6	L, N, F, B, T	3	1
Wet Meadows	13612	50.0	1, 3	L, N	2	1
Grasslands	1361	5.0	1, 2, 3	A, L, N	2	1
Riparian Areas	540	2.0	8 , 9, 10	E, R	3	1
Agriculture	750	2.7	1, 3	A, N	2	n/a
Water (Non-burnable)	271	1.0	NA	NA	NA	n/a
Total acreage	**27,225**					

*Estimation of condition class based on scientific literature. A formal evaluation of condition class that meets FRCC standards has not been performed.

Fire Behavior Concerns and Dominant Topographic Features
During normal to dry conditions the greatest factor affecting fire behavior throughout various fuel types is wind. The absence of wind or the presence of light winds will not quickly advance a fire through the majority of Alamosa - Monte Vista grasslands. Under drier conditions, if winds increase or become gusty, extreme fire behavior can occur. Most wildland fires are associated with thunderstorms; rain usually follows to extinguish or slow down the fire until it burns itself out. High winds in can burn a large amount of acreage quickly, but as soon as winds decrease, the fire will likely drop to a creeping rate. Slope would become a second primary factor along the east and north boundaries.

Currently wind is being monitored at the headquarters and in the southwest section of the main dunes. Prevailing winds are from the southwest. Winds along the edge of the dunefield are complex and variable in speed and direction. The dune mass may act as a huge heating source and influence local winds within the dunefield and along its eastern front. The interactions of local dune winds, prevailing southwesterly and the foothills could cause frequently changing wind directions. Winds should be carefully monitored during all wildland fires.

The role of fire in the Alamosa – Monte Vista FMU
Alamosa – Monte Vista Fire History
The fire history of the Alamosa – Monte Vista FMU indicates a low occurrence of wildland fire. The Complex has recorded of only two wildfires – human caused ignition burned 780 acres in April of 1981, burned 780 acres and a lightning ignition burned 0.2 acres in 1995. These records have no statistical significance. However, the records do indicate that although at any give time the FMU has a low likelihood of wildfire occurrence, when wildland fires do occur it is possibility for the wildfire will grow to significant size. Since the time of ownership, all wildland fires occurring in the Alamosa – Monte Vista have historically been suppressed using the most effective methods.

Prescribed fire has been utilized as a management tool on the Complex since 1981. Between 1985-1989, 4,100 acres were burned under prescribed burn prescription (averaging 820 acres annually). Prescribed fire was not used as a management tool on the Complex from 1990-1996. One twenty-acre burn was completed in 1997 and two burns totaling 1,300 acres were completed in 1999. (FWS 2001).

Prescribed burning is primarily used to reset plant succession and to provide a mosaic of vegetation composition and structure for wildlife species. Habitats have been periodically burned to remove excess litter buildup, stimulate vegetation growth, enhance nutrient cycling, increase soil temperatures, and control weeds. Prescribed burning has also been used to reduce extremely dense or weedy vegetation to prepare a site for other management activities.

Alamosa – Monte Vista Fire Ecology
Fire is a natural ecological process that has historically influenced the vegetation in the San Luis Valley. The current structure, species composition, and dynamics of many ecosystems are often the direct result of past fires, or in other cases, the result of processes that have themselves been affected by fire.

Alamosa – Monte Vista FMU Fire Regime per Vegetation Type
Grasslands and Shrublands
Within the Alamosa – Monte Vista FMU, grasslands and shrublands are intermixed with salt flats and blowouts, which lead to discontinuous fuels. Shortgrass prairie grassland fuels are continuous to discontinuous. Grasses and other annuals are the predominate species. Shrubs such as rabbitbrush, winterfat, snake-weed, etc. are also common. Often the ground is bare sand with little organic matter.

Under normal conditions wind will quickly advance a fire. Flame length is usually in the 3'-6' range, but may exceed this. Under calm conditions fire may advance slowly, or burn itself out due to discontinuity in fuels.

Although the exact fire return intervals for Alamosa – Monte Vista grassland and shrubland systems is unknown, small areas of these systems did occasionally burn by either natural or anthropogenic causes. The extent, intensity, and severity of these burns would probably have been dependent on a multitude of factors including weather (e.g. temperature, wind speed, and relative humidity) and vegetation (e.g. species composition, density, fuel load, and moisture content).

The 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 (West 1994). Sparsely vegetated salt flats, like those found within the greasewood and ephemeral wetland system have a fire regime described as nonexistent (Paysen et al. 2000).

Few studies have been conducted regarding historic fire patterns in the saltbush-greasewood type (Paysen et al. 2000). The sparse understory vegetation and bare soil are typically thought limited fire in this system. However, fine fuels may increase during wet years, resulting in an increased fire risk.

Wet Meadow Communities
Wet meadows within the Alamosa – Monte Vista FMU 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. Natural wet meadow areas are greatly enhanced through systems of irrigation canals and water spreading. The wet meadows are dominated by saltgrass (*Distichilis spicata*), alkali sacaton (*Sporobolus airoides*), Baltic rush (*Juncus balticus*) and sedges (*Carex* spp.).

Wet meadows generally do not support fire, and thus, fire ecology of these communities is not widely studied (Paysen et al. 2000, West 1994). The wet meadows are assumed to naturally burn infrequently. Fire occurrence is dependent on a multitude of factors,

including weather (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 at the time of ignition. The mean fire return interval for wet meadow systems may be as frequent as every 50-100 years, with individual fires occurring every 5 years or greater.

Alamosa – Monte Vista Biotic Characteristics

Wetlands and Floodplains, including Wet Meadows and Greasewood Flats

The National Wetland Inventory identifies a large number of Palustrine[13] wetland and riverine systems located throughout the Alamosa - Monte Vista FMU (USFWS 2004d). These wetlands are broadly categorized as wet meadows or ephemeral wetlands and greasewood flats. This wetland system has been greatly enhanced through a system of irrigation canals and water. Within the FMU, most of the wetland basins are man-made using the following common design. Dirt is removed from a "borrow area" at one or two sides of an existing wetland to form the dike or levee. The resulting borrow area is the lowest portion of the wetland basin. From the borrow area, the elevation gradually increases until it becomes upland. The result is a zone of elevation changes which, depending on natural events and management actions, provides an array of water depths and vegetation conditions. Through the season or at any one time, an impoundment often contains several habitat types. The area that these wetlands encompass has been found to fluctuate over time, primarily due to changes in annual precipitation levels (Hammond 1998).

It is believed the Monte Vista NWR portion of the FMU is largely devoid of Palustrine emergent wetlands (wetlands permanently or semipermanently flooded) (wetland definitions by Cowardin, et al. 1979) - these wetlands were located in the floodplains of Spring Creek, Rock Creek and possibly Cat Creek, but natural flows in these creeks have been drastically reduced in the last 50 to 150 years due to the construction of irrigation canals and extensive groundwater withdrawal.

The Alamosa NWR lies in the Rio Grande floodplain and is part of the "Alamosa Marshes," one of the largest wetland complexes in the SLV (1878) (U.S. Army Corps of Engineers 1878). In the late 1800s, several irrigation ditches were established to irrigate meadows for the production of livestock forage. Few improvements were made in the original water management infrastructure used by cattle ranchers, and water is still moved through this system to irrigate wetland vegetation throughout the refuge. Although water to the floodplain is no longer naturally supplied by the Rio Grande, currently, flooding on the Alamosa NWR occurred more frequently and over most of the refuge that thought to have occurred historically. Oxbow and other wetland depressions still exist and relatively few wetland impoundments were artificially created.

[13] Palustrine systems are defined as non- saline, non- tidal wetlands that are less than 8 hectares in area, less than 2 meters deep, and lack wave- formed or bedrock shoreline features (Cowardin et al.1979).

Wet Meadows
As the overall elevational gradient in the SLV lowers, the watertable comes close to the ground surface, creating areas of naturally wet meadows. Wet meadows are seasonally and shallowly (< one foot) flooded grasslands, primarily found at the terminus of streams. These wet meadows are dominated by Baltic rush (*Juncus balticus*), saltgrass (*Distichilis spicata*), alkali sacaton (*Sporobolus airoides*), sedges (*Carex* spp.). Other species may also be very common including spike rush, alkali muhly, curly dock, *Calimagrostis*, foxtail barley, and short-awn foxtail. The timing of flooding determines whether the community is dominated by rushes or grasses, whereas soil richness and other factors including water seasonality determines sedge occurrence.

In the transition zone between short-emergent and salt grass communities, the wet meadows may harbor the populations of slender spiderflower (*Cleome multicaulis*), rare plant is restricted to moist alkaline soils, found in a relatively natural setting (Pineda et al. 1999). Wet meadows are also most susceptible to invasion by noxious species such as tall whitetop and Canada thistle, foxtail barley, rabbitsfoot grass, dandelion, and curly dock (Dixon 1986).

Ephemeral Wetlands
Within the Alamosa – Monte Vista FMU, ephemeral wetlands are associated with shallow (<one foot), seasonally flooded alkali or mudflat portions of wetland or greasewood uplands with little to no vegetetation. These communities are found at the shallow ends of gradually sloping semi-permanent wetlands or within connected systems of shallow depressions or basins. Each spring, the basins are filled with snowmelt runoff and spring-fed flow. 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.). Irregularly flooded basins are generally dominated by saltgrass (*Distichilis spicata*) or become barren salt flats (Rondeau et al. 1998). Due to the warmer temperatures of the shallow water and nutrient recycling which occurs during the dry cycles, these newly flooded areas often support higher densities and varieties of invertebrates and avian fauna.

In upland areas, this habitat type may be dominated by greasewood (*Sarcobatus vermiculatus*) and rabbitbrush shrublands with an understory of no vegetation to saltgrass (Pineda et al. 1999). Soil usually accumulated around the bases of greasewood plants, forming small un-vegetated islands above the water level. Large patches of greasewood flats are restricted to the San Luis Valley floor on the sabkha (Rondeau 2001). The flats contain a connected system of shallow depressions or basins that support a variety of wetland types.

Saltgrass
Saltgrass communities are usually associated with alkali soils in a variety of hydrologic conditions. Dominate species include salt tolerant grass species such as inland saltgrass, alkali sacaton, alkali muhly, and alkali grass, and scattered greasewood and rabbitbrush plants. When higher soil moisture occurs, large amounts of slender spiderflower appear. This habitat type is rarely impacted by invasive species, probably

due to the high salinity (Dixon 1986).

Grasslands and Shrublands

The Alamosa – Monte Vista FMU is dominated by grassland and shrubland vegetation types intermingled with permanent and ephemeral wetlands. Grass and shrubland species include blue grama (*Bouteloua gracilis*), Indian ricegrass (*Oryzopsis hymenoides*), needle-and-thread grass (*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).

At higher elevations with sandy soils, the community is dominated by Indian rice grass with an intermix of alkali sacaton and four-wing saltbush. In higher elevations with less porous soils, winterfat, fringed sage and blue grama dominant. The upland shrub areas primarily support greasewood and rabbitbrush; however, the eastern edge of the Alamosa NWR contains areas of four-wing saltbush and Indian ricegrass, and the foothills along the western boundary of the Monte Vista NWR supports primarily winterfat.

Riparian and Riverine Communities

Riparian and riverine communities, including those vegetation types associated with and along rivers or waterway edges or within the river channel, respectively, are located along the Rio Grande River (Alamosa NWR). The riparian community consists primarily of crack willow (*Salix fraglis*), sandbar willow (*Salix exiqua),* and narrow leaf cottonwoods (*Populus angustifolia*), with an understory of grasses, sedges, and forbs. Monte Vista NWR has a limited amount of riparian habitat; sandbar willows line many of the water delivery canals and small patches of the same species are located in low lying areas. The oxbows and water delivery canals within Alamosa NWR support willows and a few cottonwoods. Some cottonwood regeneration, or seedling establishment, is occurring on Alamosa NWR; however, since these species depend on the river flooding for establishment, and flooding frequency has been reduced, overall tree establishment is infrequent. In about the last 2 years, the noxious weed, Eurasian Milfoil has become prevalent in portions of the Rio Grande, including some portions of the Alamosa NWR.

Aquatic Resources

The majority of the water within the Alamosa - Monte Vista FMU originates from the Sangre de Cristo Mountain range as snow melt. This water flows primarily in southwest direction via a number of streams and ditches. The Alamosa - Monte Vista FMU is 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 Alamosa - Monte Vista FMU is underlain by two relatively distinct aquifers, the unconfined and the confined aquifers, which consist mainly of unconsolidated clay, silt, sand, and gravel. The unconfined aquifer is separated from the confined aquifer by clay

layers and lava flows. Water enters the unconfined aquifer by way of precipitation and surface water infiltration and via upward movement of water from the confined aquifer at occasional fractures in the clay layer (Browne and Sanderson 2003, NPS 1997b). The Alamosa – Monte Vista FMU overlays the confined aquifer. The aquifers provide water that is adjudicated for wildlife and irrigation uses on the refuges.

Water from the unconfined aquifer reaches the surface at numerous locations throughout the FMU, including areas of seeps, wet meadows, and interdunal wetlands. Within the FMA, the confined aquifer is primarily recharged through infiltration of water from streams near the foot of the Sangre de Cristo Mountain range (the aquifer-dividing clay layer is absent). The Closed Basin Canal, which is maintained and operated by the U.S. Bureau of Reclamation, runs through the FMU and is supplied with water that is pumped from the unconfined aquifer.

Upon establishment of the Refuges, the aquatic resources were improved to emphasize wildlife habitat production. Water feature improvements include the construction of low level levees, artificial wetlands, canals, ditches, and borrow areas. Water is the primary instrument to produce and maintain wildlife habitat on the Refuges, and without it, the presence of wetland-dependent wildlife would be greatly reduced.

The most dramatic changes in the Alamosa NWR have been the alteration of hydrology in the Rio Grande and the 1983 construction of the Bureau of Reclamation's Closed Basin Conveyance Channel which bisects the refuge. Water in the Rio Grande headwaters is generated from snowfall in the San Juan and Sangre de Cristo Mountains. Peak river flows usually occur in June with a peak 40 year average of about 5,348 cubic feet per second (cfs) measured at Del Norte, Colorado.

Alamosa Refuge is rarely flooded by the Rio Grande, due to the extensive use of water along the 48 irrigation ditch diversions upstream of the Refuge. The Rio Grande usually leaves its banks annually during the first or second week of June, flooding only a small area of riparian vegetation for a short period of time. Since the Alamosa Refuge was established, major floods (those greater than the annual activity described above) occurred in 1965, 1970, 1979, 1986, 1987, and 1995. If the Rio Grande is typical of other stream systems that are used for irrigation of arid lands, it floods less frequently due to upstream diversions but flows are prolonged after the period of summer run while irrigation water flows back to the River.

Alamosa Refuge receives irrigation water from the Rio Grande primarily from the Costilla Ditch, the San Luis Ditch, the Chicago Ditch, and the New Ditch. The Chicago and New Ditch diversions are entirely owned by the Refuge. The New Ditch Dam is the last dam on the Rio Grande in Colorado. Annual Refuge diversion of water, for 27 years, averaged 13,750 acre-feet. The primary use of this water is to irrigate wetland vegetation throughout Refuge bottomlands. Water delivery is facilitated by two major dikes, 20 smaller dikes, over 200 water control structures, and 5 major canals.

The Monte Vista Refuge receives irrigation water from the Rio Grande primarily through

the Empire and Monte Vista canals and water draining off neighboring private lands. Refuge diversions from the Rio Grande average about 8,500 acre-feet. The primary use of this irrigation water is to maintain wetland vegetation throughout the Monte Vista Refuge as well as to irrigate cropland. Water delivery is facilitated by a complicated infrastructure consisting of over 30 major dikes, more than 100 smaller dikes, over 400 water control structures, and 61 miles of ditches.

Alamosa – Monte Vista FMU Soils Associations

The primary soil associations found in the Monte Vista portion of the FMU are the – Luhon -Garita-Travelers; Hooper-Arena-San Luis; and Torrifluvents – Torssido - Alamosa Associations. The primary soil associations found in the Alamosa portion of the FMU are the - Costilla-Space City Association; Hapney-Hooper-Corlett Association; and the Alamosa-Vastine-Alluvial land Association. Detailed descriptions of these and the many minor soil associations present on the Refuge can be found in *Colorado Field Office Technical Guide, Range Site Descriptions* (USDA, SCS 1975). Table 13 provides a general description of these associations

Table 13. Primary soil associations found within the Alamosa – Monte Vista FMU.

Soil Association	Description
Monte Vista Major Soil Associations	
Luhon -Garita-Travelers Association	The extreme western edge of the Refuge consists of is associaion. It is found in very gently sloping to moderately steep areas, with well drained to somewhat excessively drained, medium textured to moderately coarse textured, deep to shallow, cobble and stony soils. The soils were formed in mixed alluvium and in residuum weathered from basalt.
Hooper-Arena-San Luis Association	This association is interingled throughout the refuge. It is found at the lower end of alluvial fans and on old floodplains on the valley floor. The topography is nearly level, and moderately fine textured to coarse textured soils are well to poorly drained. Soils are alkali soils and are 20 to 60 inches deep over sand and gravel. The soils formed in mixed alluvium.
Torrifluvents-Torssido-Alamosa Associations	This association is intermingled throughout the refuge. It is found on nearly level floodplains and nearly level or very gently sloping alluvial fans and terraces. The soils formed in mixed alluvium. Soils are excessively to poorly drained and are moderately coarse to moderately fine textured ranging in depth from 10 to 60 inches deep over sand and gravel, on floodplains, alluvial fans, and terraces.
Alamosa NWR Soil Associations	
Costilla-Space City Association.	The eastern part of the Alamosa NWR contains a narrow strip (approximately 900 acres) of Costilla-Space City Association. These soils are level to gently sloping, very permeable and coarse textured.
Hapney-Hooper-Corlett Association.	Soils in the northern 2,200 acres of the Refuge are in the Hapney-Hooper-Corlett Association. These soils are level except for a few dunes. They too are very permeable but have no pattern of surface drainage so surface water either soaks into the ground, evaporates or transpires.
Alamosa-Vastine-Alluvial land Association	These soils comprise approximately 7,900 acres of the Rio Grande Floodplain. They are deep, level, or undulating and range from fine to coarse texture. These soils tend to be very saline due to the high water table; however, most of this area is subject to frequent spring flooding that tends to flush salt from the soil.

Alamosa – Monte Vista FMU Wildlife

The FMU is rich in wildlife with numerous herds of antelope, elk, and deer and abundant small game, waterfowl, and water birds. The wetland types that dominate the Alamosa – Monte Vista FMU are very productive and support many groups of nesting, migrating,

and wintering birds including grebes, herons, ibis, ducks, geese, hawks, eagles, falcons, shorebirds, owls, songbirds, and others. Approximately 11 species of ducks nest on the Refuges. Monte Vista NWR has one of the highest number of duck nests per acre in North America (Gilbert, et al. 1996). The Complex also supports many species of nesting water birds, shorebirds, and songbirds including the largest nesting colony of white-faced ibis in Colorado. American avocets, black-necked stilts, common snipe, spotted sandpipers and Wilson's phalarope nest on the Complex as do American bittern, sora, and Virginia rails.

The Refuges are also important staging areas for many migrating birds. Approximately 95 percent of the Rocky Mountain population of greater Sandhill cranes spend several weeks in the Valley during the spring and fall migrations feeding and resting to replace critical fat reserves. Wintering bald eagles are very abundant at the Alamosa NWR as well as wintering ferruginous hawks and short-eared owls. Many species of mammals use the Refuges including elk, deer, coyote, porcupine, rabbits, beaver, muskrats, weasels, and others.

Alamosa – Monte Vista FMU Management Considerations

Alamosa – Monte Vista FMU Air Quality

Class 2 airshed. Prescribed burns within this FMU can affect the Class 1 airshed at the Great Sand Dunes National Park.

Alamosa - Monte Vista FMU Designated Wilderness Areas

The Alamosa – Monte Vista FMU is located outside the boundaries of a designated wilderness area.

Alamosa – Monte Vista FMU Agricultural Considerations

Agricultural habitat does not occur on the Alamosa NWR. The Monte Vista NWR contains approximately 750 acres of agricultural fields. Of these, 510 acres are annually farmed in a 5 year crop-rotation; 3 years alfalfa and 2 years of small grains (barley and wheat). The majority of this annually farmed ground (462 acres) is located under four large center pivot sprinkler systems ranging in size from 71 acres to 147 acres. The remaining 48 acres are flood irrigated using siphon tubes. This component of the agricultural habitat is managed to provide a food source primarily for migrating sandhill and whooping cranes as well as for migrating and wintering waterfowl. Approximately 240 acres of this habitat type is planted into semipermanent cover and is actively farmed on a 4 to 6 year schedule. These areas, all of which are flood irrigated, contain a variety of plant species usually containing a grass mix, such as intermediate wheatgrass (for structure) and forb (such as alfalfa or clover) for density. These areas are managed to provide breeding and winter cover for a variety of migratory and resident birds, resident small mammals and large ungulates, primarily deer.

Alamosa - Monte Vista FMU Cultural and Historic Resources

Alamosa - Monte Vista FMU Cultural Resources

Mammoth bone, teeth, and ivory were recovered from the Magna Site located south of Little Spring Creek. Remains of extinct bison were discovered in Folsom levels at the Linger, Cattleguard, and Reddin sites near Medano Springs Ranch in northeastern Alamosa County. The bison likely occurred in the San Luis Valley in modern times after the Pleistocene in to the early 20th century (Fitzgerald, et al. 1994)

Alamosa - Monte Vista FMU Archeological Resources

Documented prehistoric and historic archaeological sites total 14 on Monte Vista NWR and 11 on Alamosa NWR. All but four sites (three on Monte Vista and one on Alamosa) have been determined as non-eligible for nomination to the National Register of Historic Places. The remaining four sites require further investigation and data collection before eligibility can be determined. These sites are being protected in accordance with the National Historic Preservation Act of 1996. Extensive archaeological sites exist in the headwaters of Spring Creek on Monte Vista Refuge and along Hansen's Bluff on the Alamosa NWA.

Alamosa - Monte Vista FMU Cultural Landscapes

After years of summer grazing by small flocks of sheep in the early1800s, permanent livestock production was established in the San Luis Valley around 1840. Settlement and ranching expanded rapidly in the second half of the 19th Century, with sheep use predominant in the lower half of the SLV and cattle and sheep grazing about equal in the upper part of the Valley. Experiencing severe winter losses, most ranchers developed the use pattern that exists today which consists of moving livestock from lower private lands in the late spring to higher public lands for the summer and fall, and subsequently back onto private lands during winter when hay is the primary source of forage.

Alamosa - Monte Vista FMU Endangered, Threatened, and Candidate Species

Potential habitat for several Federal and State threatened, endangered, and candidate species occurs within the Alamosa - Monte Vista FMU (Table 14).

Table 14. Federal and State Endangered, Threatened, and Candidate Species thought to occur within the Herard FMU.

Common Name	Scientific Name	Listing
Whooping Crane	*Grus americana*	Federal and State Endangered
Bald Eagle	*Haliaeetus leucocephalus*	State Threatened
American Bittern	*Botaurus lentiginosus*	Species of Management Concern
Black Tern	Chlidonias niger	Species of Management Concern
Burrowing Owls	Athene cunicularia	Species of Management Concern
Ferruginous Hawk	Buteo regalis	Species of Management Concern
White-faced Ibis	Plegadis chihi	Species of Management Concern
Southwestern Willow Flycatcher	*Empidonax leucocephalus*	Federal and State Endangered

Alamosa - Monte Vista FMU Wildland-Urban Interface

The communities at the greatest risk to wildfire include the city of Alamosa, as well as East Alamosa including scattered rural residential areas and subdivisions within and near the FMU boundary. In addition, the refuge infrastructure within the refuge complex is also an interface area of concern. Hazard fuel and wildland-urban interface assessments have been completed for this FMU.

Alamosa – Monte Vista FMU Recreational Uses

Alamosa – Monte Vista Wildlife Refuge Complex
The Refuge Complex provides opportunities for hunting, fishing, wildlife observation, off-highway vehicle use, hiking, picnicking, camping, vegetation and mineral gathering, snowmobiling, cross-country skiing, general leisure, and sightseeing. About 30,000 people visit the Alamosa and Monte Vista National Wildlife Refuges annually. The Refuges have visitor facilities, auto tour routes, several wildlife observation areas, and waterfowl - small game hunting areas.

CHAPTER 4: WILDLAND FIRE PROGRAM COMPONENTS

This Chapter addresses the wildland fire program components for each of the wildland fire management options included in the Greater Sand Dunes Interagency Fire Management Program (FMP). Wildland fire management options include suppression, manual and mechanical fuels treatments, prescribed fire, and wildland fire use (see Chapter 3 for details). These wildland fire management options are the core components of the wildland fire management program components.

Fire management strategies within the Greater Sand Dunes Interagency Fire Management Area (FMA) will, to some degree, differ amongst each agency and organization, as well as between the two Federal agencies and the Conservancy. Each agency and The Nature Conservancy will follow their respective departmental, agency, and/or organizational fire management policies. In addition, all wildland fires occurring on TNC property will be reported to and managed by the appropriate fire control agency (i.e. County Sheriff). FWS and NPS will follow departmental and agency policies if and when a wildland fire occurs within their jurisdiction (see below for details).

The Wildland Fire Program Components include

- Fire Suppression
- Preparedness
- Wildland Fire Use
- Fuels management
- Education
- Prevention

GENERAL IMPLEMENTATION PROCEDURES

Wildland fire management within the FMA is conducted to support resource management and community protection objectives. A full range of strategic options for managing wildland fires is available to Federal land managers provided that selected options do not compromise firefighter and public safety, cost-effectiveness, benefits, and values to be protected. Suppression of unwanted and potentially environmentally damaging wildland fires is guided by actions identified in this fire management plan.

In order to achieve the fire management goals for each of the Four Fire Management Units (FMU) in this FMA (see Chapter 3 for more information), the individual FMUs are designated as either fire suppression only or a combination of suppression plus wildland fire use. In all FMUs, all wildland fires, including those caused by humans, will be managed using an appropriate management response (AMR) consistent with departmental, agency, and organizational policy. Naturally ignited wildland fires in the Mosca and Herard FMUs, which are designated for wildland fire use, may be managed for resource and wilderness benefits.

For Federal lands, a Wildland Fire Implementation Plan (WFIP) will be initiated for all

wildland fires occurring in FMUs designated for wildland fire use (i.e. Mosca and Herard FMUs). The Park FMO and/or FDO are responsible for completing the Stage I: Initial Fire Assessment that provides the decision framework for selecting the AMR. Specific WFIP requirements are outlined in the "Wildland Fire Use Implementation Procedures Reference Guide" (National Interagency Fire Center 2005) hereafter referred to as the Implementation Guide.

The Stage I: Initial Fire Assessment will be utilized by NPS for wildland fires occurring within their respective jurisdictions. The Stage I assessment includes the Fire Situation and the Decision Criteria Checklist. The Stage I analysis documents the current and predicted situation, as well as all appropriate administrative information, and aids managers by providing them with decision criteria to make the initial decision whether to manage the fire for resource benefits or to take suppression action.

Where the FMU development determines suppression is the only appropriate response (Baca Dunes and Alamosa/Monte Vista FMUs) or when the unplanned ignition is determined to be human-caused, the Federal requirement for a decision checklist as part of the Stage I analysis is considered to be met. Subsequently, the Stage I analysis is satisfied at the programmatic level in the FMP through designation of the FMUs and determinations made by combinations of values to be protected and/or fire behavior thresholds.

For fire management on Federal lands, the Interagency Standards for Fire and Fire Aviation Operations "Red Book" (National Interagency Fire Center), which is issued annually by cooperating Federal land management agencies, is the primary reference for policy direction, performance requirements, and operational standards.

The Conservancy will work with the County Sheriff to determine the AMR for wildland fires occurring within TNC jurisdiction. The Conservancy's Standard Operating Procedures for Fire Management and the TNC "Fire Management Manual" are the Conservancy's primary program components for policy, performance criteria, and operational standards.

The Fire Management Coordinating Group (FMCG) will meet a minimum of twice per year to review wildland fire program components (see Chapter 5 for details). This group will be responsible for tasks related to pre-planning, preparedness, budgets, fuels and weather evaluation, fire management organization, delegation of authority, annual review and updates of the FMP, review of Annual Operating Plans (AOP), cooperating with adjacent public and private entities, and communicating with the Pueblo Interagency Dispatch Center (PIDC), among other tasks.

WILDLAND FIRE SUPPRESSION

Great Sand Dunes National Park and Preserve and San Luis Valley National Wildlife Refuge Complex Wildland fire suppression is an integral part of wildland fire management. Wildland fires will be managed safely and efficiently to accomplish protection objectives, as described in NPS Reference Manual #18, Chapter 9 and FWS Service Manual, Part 621. Protection priorities are human life and property, natural and cultural resources. If the prioritization between property and natural and cultural resources becomes necessary, prioritization will be based on the resource and property values to be protected, commensurate with fire management costs. Once human resources are committed to an incident, they become the highest value to be protected.

The full spectrum of tactical suppression options is available to federal managers of wildland fires. Management of wildland fire suppression actions, including Initial and Extended Attack, will be conducted in accordance with agency standards established in Chapter 9 of NPS Reference Manual #18 and Part 621 of FWS Service Manual, as well as Federal wildland fire management policies.

As identified in Chapter 3, the Fire Management Program includes strategic goals related to suppression, including the protection of life, property, natural and cultural resources from unwanted wildland fire. In addition, the program seeks to avoid unacceptable effects of wildland fire and suppression actions.

The potential range of fire behavior encountered on suppression actions is wide and highly variable. Fire behavior is a factor of fuel type, weather, climate, and topography. Park and Refuge managers and firefighters can expect a full range of fire behavior. NPS and FWS policy requires that a pre-season risk assessment be prepared and updated periodically throughout the fire season.

Fuel types within the FMA include alpine tundra, spruce-fir forests, aspen forests, mixed conifer forests, pinon-juniper woodlands, shrublands, grasslands, wet meadows, and riparian systems. These fuel types are capable of high intensity fire behavior that can pose a high resistance to direct fire control efforts. However, most of these ecosystems are also capable of producing benign fire behavior, characterized by smoldering and creeping fire with little resistance to fire control.

The Nature Conservancy's Medano-Zapata Ranch The Conservancy's Standard Operating Procedures for Fire Management and "Fire Management Manual" are TNC's primary program components for policy, performance criteria, and operational standards.

Because the Medano Zapata Ranch is private property, all wildland fires occurring on TNC lands must be reported to the appropriate fire control agency, which is the County Sheriff's Department. The County Sheriff will decide, in consultation with TNC's San Luis Valley Project Director and Fire Program Manager, the appropriate management

response. Once a wildfire has been reported on the Medano-Zapata Ranch, responsibility for wildland fire control will be turned over to the County Sheriff and the Volunteer Fire Department. Federal and state resources may be called into action to support suppression efforts.

The fire management goals and objectives for TNC lands will be the same as those stated in Chapter 3. Fire suppression actions will be based upon fire fighter and public safety as first priority. Protection of natural and cultural resources will have the next highest priority. The SLV Project Director will work with the County Sheriff and Volunteer Fire Departments to ensure sensitive natural and cultural resources on the Medano-Zapata Ranch are protected, to the extent possible, during all suppression activities. Natural fire breaks will be utilized wherever possible.

WILDLAND FIRE PREPAREDNESS

Preparedness includes activities conducted before a wildland fire occurrence to ensure the ability of the fire management organization to initiate effective actions and manage wildland fire incidents. The objective of preparedness is to have a well-trained and equipped fire management organization to implement appropriate management responses for all wildland fires. Preparedness activities include recruitment, training, planning and organization, fire equipment maintenance and procurement of equipment and supplies. These activities will be reviewed and planned annually by the FMCG and may include suppression strategies or the evaluation and decision process for WFU strategies.

Wildland Fire Preparedness Levels

Preparedness Levels are planning levels that are used to indicate the types of preparedness activities needed to meet fire objectives. The Preparedness Levels are determined by the following criteria:

- Fire Situation (e.g. number of recent fires, fires uncontrolled at the present time, fire sizes, and difficulty in controlling fires)
- Current and Forecasted Weather
- Fire Severity Indices (ERC and 1000 hour fuels moisture) and Haines Indices.
- Availability of Resources

Annual preparedness reviews of suppression resources, support, and administration should occur prior to June 1, with early May more desirable. Funding and seasonal fire personnel on-board will drive the actual date for reviews.

The PIDC Dispatcher may assist the Park and Refuge FMO and/or FDO in determining the appropriate Preparedness Level. The Preparedness Level will generally be disseminated along with the afternoon weather forecast and fire danger forecast or whenever changes in conditions warrant a change in the level. These preparedness

levels will impact not only the decisions on wildland fire suppression, but will also impact the planning and implementation of wildland fire use and prescribed fire.

Fire Weather and Fire Danger

Fire Weather

The weather within the FMA is influenced by the presence of the Continental Divide to the west, the large, the Sangre de Cristo mountain range on the east, and the flat, wide SLV in between. The area experiences afternoon and evening thunderstorms, usually accompanied by precipitation, from mid to late June through August. Precipitation amounts associated with these orographic thunderstorms tends to decrease as they move away from the Sangre de Cristo Mountains across the Valley. General wind patterns commonly have a westerly to southwesterly component, with occasional northwest fronts creating northwesterly winds across the mountain passes. In the spring, these westerly component winds are commonly very strong and sustained and could drive a fire quickly. Monitoring winds is crucial in predicting fire behavior, especially on the grasslands and shrublands along the Valley floor. Combined with the post-green-up, pre-monsoon dry spell, which often occurs, very high to extreme fire dangers can occur. Freezing temperatures are generally experienced by early to mid September, which results in the herbaceous vegetation moving into the cured state for the last month or two of the fire season, which also poses fire danger. See Table 15 for a list of the four Remote Automated Weather Stations (RAWS) that will be utilized to collect weather information for the FMA.

Table 15. Information about Remote Automated Weather Stations (RAWS) for Greater Sand Dunes Fire Planning Unit.

	Blue Park	**Lujan**	**Bighorn**	**Sand Dunes**
WS Number	055305	054702	056005	055503
Field Office/Unit	Del Norte	Saguache	La Jara	Great Sand Dunes National Park
Type	RAWS	RAWS	RAWS	RAWS
Fuel Model	H & G	H & G	C, L, & U	A, F, & U
Site Type	Flat Ridgetop	Ridgetop	Open	Open
Aspect	Southeast	Southwest	Level	West
Elevation	10,300’	11,154’	8,600’	8324’
Latitude	37° 47’ 35”	38° 15’ 16”	37° 01’ 15”	37° 43’ 36”
Longitude	106° 46’ 43”	106° 34’ 04”	106° 12’ 04”	105° 30’ 39”
Legal	T41N R2E S 31	T46N R4E S7	T32N R7E S 15	T27S R7W S2

Wildland Fire Suppression National Fire Danger Rating System

Data from the weather stations listed in Table 15 above are used for weather forecasting and for fire danger rating information. The National Fire Danger Rating System (NFDRS) uses this information to determine a fire danger rating. The Federal agencies will use these fire danger ratings, combined with additional criteria (fire situation, current and forecasted weather, fire severity indices, and availability of resources), in determining planning levels for implementing the "Specific Action Preparedness Guides", which details the appropriate actions and responsibilities for fire personnel in response to the current Preparedness Level. This section describes the process for identifying fire danger levels and the appropriate actions taken to address them.

Weather and fire danger readings will start in the spring when snow has melted over a significant portion of the FMA. Once the station has been started in the spring normally April 1, the readings should be on a continuous basis until the station is closed in the fall, normally October 31. Readings are generally taken from April 1 through October 31. An unbroken record of accurate observations is necessary for effective use of the fire danger forecasting program.

Additional fire weather observations (state of the weather) need to be relayed to PIDC no later than 1330 MDT, for input into the Weather Information Management System (WIMS). FMO's will identify personnel responsible for this relay of information. PIDC will post the observations and forecast generated from the RAWS information on their webpage - http://www.fs.fed.us/r2/fire/pbc/index.html

At the end of the fire season, daily weather readings will continue if slash or other prescribed burning projects are planned. The decision to burn will be based on the latest weather forecasts and fire danger rating measurements as well as the Regional and National Preparedness Levels.

Annual Training Activities

All personnel will actively work to meet or exceed the specialized experience, incident management qualifications (as defined in the Wildland and Prescribed Fire Qualifications System Guide, PMS 310-1), required training, and developmental training as identified in the "Interagency Fire Program Management Qualifications Standards and Guide" (2004). An annual fire safety refresher, consistent with agency policy, is required for all personnel with fireline position qualifications. The National Park Service and Fish and Wildlife Service currently maintain the option to utilize the Wildland Fire Safety Training Annual Refresher website format for this training (Available online: http://www.nifc.gov/safety_study/annual-refresh/).

Fire training will continue throughout the season for Park and Refuge personnel, with both formal sessions and on-the-job experience. The majority of formal training will continue to be accomplished through sessions held off-site. Personnel who have specific training needs or interests should discuss with their FMO so that enrollment in

the appropriate classes can be arranged.

Wildland Fire Qualifications and Needs Assessment
The Fire Management Coordinating Group will compile annual fire training needs assessments each winter.

Wildland Fire Suppression Annual Readiness of Equipment and Supplies

Annual Inventory of Equipment and Supplies
The work needed annually to ensure the fire fighting readiness of equipment and supplies includes:

- Fire engine(s) equipment and supplies will be inventoried each spring.
- The fire cache should be inventoried each winter and replace or purchase needed items.
- Fire packs should be inventoried, inspected, and assigned to fire fighters each spring. Packs shall remain hung in the cache, unless kept in a patrol vehicle.

Inventories and assessments of fire readiness will be coordinated and reviewed by the Fire Management Coordinating Group (FMCG) on an annual basis.

Wildland Fire Suppression Preparedness Level and Danger Rating Adjective Class

Two weather stations are used because of their representativeness for the FMA. Current Preparedness Level Break Points (annually review and updated) are found the following tables:

Table 16. Preparedness Level Break Points from the Bighorn Weather Station, for the analysis period of 04/01 through 10/31, from 1994 through 2004.

BIGHORN WEATHER STATION (056005) **Data 1994 through 2004; Analysis Period 04/01 – 10/31**					
DESCRIPTION		MODEL G		MODEL L	
Danger Rating Adjective Class	Prepardeness Level	ERC Actual	BI Actual	ERC Actual	BI Actual
Low	1	0 – 19	0 – 23	0 - 2	0 – 17
Moderate	2	20 – 39	24 – 48	3-Feb	18 – 35
High	3	40 – 87	49 – 97	5-Mar	36 – 71
Very High	4	80 – 88	98 – 119	6	72 – 86
Extreme	5	89 +	120 +	7 +	87 +

Table 17. Preparedness Level Break Points from the Blue Park Weather Station, for the analysis period of 04/01 through 10/31, from 1994 through 2004.

BLUE PARK WEATHER STATION (056005) **Data 1994 through 2004; Analysis Period 04/01 – 10/31**					
DESCRIPTION		MODEL G		MODEL L	
Danger Rating Adjective Class	Prepardeness Level	ERC Actual	BI Actual	ERC Actual	BI Actual
Low	1	0 – 17	0 – 19	0 – 9	0 – 8
Moderate	2	18 – 35	20 – 40	10 – 19	9 – 17
High	3	36 – 71	41 – 80	20 – 39	18 – 34
Very High	4	72 – 90	81 – 98	40 – 50	35 – 42
Extreme	5	91 +	99 +	51 +	43 +

Table 18. Preparedness Level Determination Guide for Greater Sand Dunes Interagency Fire Management Planning Area

LEVEL	DESCRIPTION	REMARKS
Level 1 LOW	ERC or BI is within the level 1 range of the weather station within the geographical area. 1000 HR. FUEL MOISTURES greater than 20-perecent. 1000 HR. YEARLY PRECIPITATION of weather stations at normal or above.	Two of the three meet the criteria for this severity level.
Level 2 MODERATE OR NORMAL	ERC or BI is within the level 2 range of the weather stations within the geographical area. 1000 HR. FUEL MOISTURES range between 16-20-percent. 1000 HR. YEARLY PRECIPITATION at weather stations averages 10% below normal.	Two of the three meet the criteria for this severity level.
Level 3 HIGH	ERC or BI is within the level 3 range of weather stations within the geographical area. 1000 HR. FUEL MOISTURES range between 13-16-percent. 1000 HR. YEARLY PRECIPITATION at weather stations averages 10 to 25% below normal.	Two of the three meet the criteria for this severity level.
Level 4 VERY HIGH	ERC or BI is within the level 4 range of the weather stations within the geographical area. 1000 HR. FUEL MOISTURES range between 8-12-percent. 1000 HR. YEARLY PRECIPITATION at weather stations averages between 25-45% below normal.	Two of the three meet the criteria for this severity level.
Level 5 EXTREME	ERC or BI is greater than the level 5 range of the weather stations within the geographical area. 1000 HR. FUEL MOISTURE is less than 8-percent. 1000 HR. YEARLY PRECIPITATION at weather stations averages more than 45% below normal.	Two of the three meet the criteria for this severity level.

Wildland Fire Preparedness Planning and Actions

Step-Up Plan

The step-up plan is designed to direct incremental preparedness actions in response to increasing or decreasing fire danger. The Park and Refuge will use the ERC from the NFDRS as the primary basis for preparedness planning and step-up actions. Step-up actions, identified in this plan, are implemented according to the "staffing class". In accordance with NPS Reference Manual #18 and FWS Fire Management Handbook, the step-up plan addresses the five staffing classes and corresponding adjective classes (1, low; 2, moderate; 3, high; 4, very high; and 5, extreme). The Park and Refuge will use the 90th and 97th percentile of ERC as the break points for staffing class 4 and 5, respectively. The Park and Refuge will monitor the Burning Index (BI) value and will consider BI, among other factors, in establishing the daily staffing and preparedness level.

The step-up plan outlines the responses to five classes of fire danger, which generally correspond with adjective class ratings (see Table18 above). While in staffing class (preparedness level) 1 (low fire danger), 2 (moderate), and 3 (high), no additional funding is available to increase staffing or resource availability. All step-up activities at staffing class 1, 2, or 3 will consist of in-park/refuge resources (changing personnel schedules to obtain desired coverage and using in-park equipment). When in staffing classes 4 (very high) or 5 (extreme), additional funding is available to activate more resources. The step-up plan is based on fire danger indices derived from weather information taken at four weather stations (see above).

The step-up plan for the Park and Refuge is based on the ERC derived from the weather stations shown above and applied to the three primary fuel models found in the park: NFDRS Model C, Model G, and Model H. Model C is catalogued for the new Sand Dunes RAWS, but not at Bighorn and Blue Park. In addition, trends in the BI are also reviewed, especially in determining step-up activities above Preparedness Level 3. The ERC and BI are both reviewed because the BI has a high sensitivity to wind conditions. The ERC is not directly affected by wind speed and accurately reflects trends in fuel moisture. The preparedness level and adjective rating will be determined based on the worst-case ERC value from the calculated staffing class from a combination of both stations, with an emphasis on fuel types in the wildland-urban interface. The adjective class as calculated by NFDRS may often fluctuate widely from day to day. Normally, the Park, Refuge, and Ranch will strive to incrementally raise or lower the adjective class (fire danger) only when an upward or downward trend is occurring.

The Fire Duty Officer (FDO) or the Park and/or Refuge FMO may determine the need to move up to the next higher preparedness level during increased visitation (e.g., holiday weekends or hunting seasons on adjacent lands) or when the geographic area preparedness level is elevated due to resource drawn-down or fire activity.

Table 19. Wildland Fire Preparedness Level (i.e. staffing class) / corresponding adjective rating and related management actions to be taken.

PREPAREDNESS LEVEL (STAFFING CLASS) AND CORRESPONDING ADJECTIVE RATING	ACTIONS TO BE TAKEN
Level 1 LOW FIRE DANGER	Normal preparedness activities including: • Maintain radio contact with headquarters; • Carrying PPE while on duty; • Notify Pueblo Dispatch Center (PBC) of staffing class at intervals requested by PBC • Normal tours of duty • Minimum ICT5 + FFT2 respond to reported fire • 7-day effective coverage during defined fire season as calculated by computer programs (FIREBASE – FWS; FIREPRO – NPS; and FMA) • In early season, complete pre-season risk analysis for SLV
Level 2 MODERATE FIRE DANGER	All Preparedness Level 1 activities plus: • All initial attack equipment ready in cache at all times. • Engines, Pumps and Saws checked weekly
Level 3 HIGH FIRE DANGER	All Preparedness Level 2 activities plus: • Minimum ICT5/ENOP + FFT2 with engine respond to reported fire • Ensure that dispatch coverage is sufficient to handle incident activities • Engines. Pumps, and Saws checked daily • Detection patrol following lightning activities and around high public use areas • Post fire danger signs at entrances and high public use areas • Stage 1 or Stage 2 Fire Restrictions may be implemented • Begin coordination of potential closures with adjacent agencies • Monitor availability of local fire suppression resources • Begin preparing request for Emergency Preparedness and / or Severity Funding
Level 4 VERY HIGH FIRE DANGER	All Preparedness Level 3 activities plus: • Minimum ICT5 + ENOP (or trainee) + FFT2 with engine respond to reported fire • ICT4 available to respond • 7-day effective coverage, including extended hours of coverage as determined by FDO • Request activation of Emergency Preparedness and / or Severity Funding • Detection Patrol Conditional • Ensure that dispatch coverage maintains the capability to handle fire prevention, detection, and incident management activities

	• Consider having Information Officer working in conjunction with Pueblo Fire Board distribute press releases regarding fire danger • Coordinate Stage 1 or Stage 2 fire restrictions with adjacent agencies • Coordinate potential closures with adjacent agencies • If there is a fire start, FDO will identify new initial attack suppression module with qualified ICT5 • FDO will monitor availability of PIDC Type III team and aviation resource • Consider staging of additional outside resources to handle anticipated fire starts and/or serve as backup resources. May include but is not limited to overhead, engines, handcrews, water tenders, aircraft, etc.
Level 5 EXTREME FIRE DANGER	All Preparedness Level 4 activities plus: • Consider closure of public lands • Consider aerial detection flights

Other Considerations

- When PREPAREDNESS LEVEL 3 or 4 is accompanied by a Lightning Activity Level of 4, 5, or 6 for the current day or within the previous 5 days, the PREPAREDNESS LEVEL may be adjusted to the next higher level respectively.
- Drought Monitor Index of D2 (Severe Drought) or higher (D3, D4, etc) may be used to justify adjustment of PREPAREDNESS LEVEL 3 and 4, to 4 and 5 respectively.
- Periods of elevated probability of human-caused fire occurrence, such as holiday weekends with increased visitation, may also be used to adjust the PREPAREDNESS LEVEL to the next highest level
- PREPAREDNESS LEVELS 3 and 4 may be adjusted to 4 and 5 respectively if the Rocky Mountain Area preparedness level is Level 4 or Level 5
- At all preparedness levels, the FDO will monitor the availability of other staff. Once initial attack resources are committed to an incident, the FDO will determine the need(s) for ensuring that adequate staffing is maintained for any additional response that may simultaneously occur.

Wildland Fire Adjective Class Rating

For public information purposes, it is helpful to use adjectives to describe the fire danger (e.g., low, moderate, high). The adjective class rating for the SLV will be obtained from the Pueblo Interagency Dispatch Center at http://www.fs.fed.us/r2/fire/pbc/firewx.htm or the Weather Information Management System (WIMS) program located at http://famweb.nwcg.gov/wims/jsp/default.htm. The WIMS system requires a username and password. The adjective class as calculated by NFDRS may often fluctuate widely from day to day. Normally, the Refuges and Park will strive to incrementally raise or

lower the adjective class (fire danger) only when an upward or downward trend is occurring.

Wildland Fire Emergency Preparedness, Severity Planning and Funding

Severity planning involves both short and long duration. Short duration is generally for a period of one to several days. These conditions are expected to fluctuate within short time periods. Long duration severity planning is for extended time periods, generally more than two weeks. The previous section, Planning and Preparedness Levels, contains information which needs to be considered within Emergency Preparedness and Severity Planning. Short duration planning or Emergency Preparedness Planning is conducted by the appropriate staff to prepare for conditions that are in the Very High and Extreme Danger Rating Adjective Class. This may be accomplished by increased staffing, prepositioning of local forces, contacting other parks or refuges, and increased prevention efforts. Reprogramming of Park or Refuge dollars may be considered.

The long duration severity planning is conducted by the Park and Refuge staff. An interagency severity request will be made through the appropriate interagency severity funding process. Anticipated needs should be based on:

- Fire Severity Guide and Preparedness Level
- Long range weather Forecasts
- Actual fire behavior and fuel conditions.

The Fire Severity Guide uses the ERC, BI, 1000 Hr. fuel moistures and drought indices obtained by monitoring yearly precipitation (Table 19).

Emergency Preparedness Funds

Emergency preparedness involves action taken to provide extra protection during extreme or unusual fire danger. These conditions may be the result of strong and/or dry winds, dry thunderstorms, or prolonged local or regional drought. Appropriate activities for emergency preparedness may include hiring of emergency temporary firefighters, placing existing staff on extended tours of duty, increasing or initiating special detection operations, and leasing initial attack aircraft. All of these actions are aimed at ensuring prompt response should fires occur.

The authority to spend emergency preparedness funds is linked to the National Fire Danger Rating System's Energy Release Component (ERC) and Burning Index (BI), the 90th percentile break point, and approval of pre-identified expenditures in the Step-up Plan. Federal staff will inform the appropriate office justifying each use of an Emergency Preparedness funds. Emergency expenditures will be initiated by the FMO(s).

Special Conditions (Pre- and Post-Season)

Because environmental conditions change rapidly, a normal fire season varies widely from year to year within the FMA. Sudden changes in weather can escalate fire danger into very high or extreme conditions at any time of the year. The ability to step-up fire preparedness at any time of year is important to a successful fire management program.

PRE-ATTACK PLAN

The specific components to the pre-attack plan for the FMA are listed in Table 20.

Table 20. Location of pre-attack planning documents, materials, and information.

Document	Location/Where to Find Information
Wildland Fire Staffing Plan	Greater Sand Dunes Interagency Fire Management Plan
Wildland Fire Response Plan	Greater Sand Dunes Interagency Fire Management Plan
County Annual Operating Plans (Saguache and Alamosa Counties)	Park and Refuge Fire Management Office
Pueblo Dispatch Center Mobilization Guide	Park and Refuge Fire Management Office
Delegation of Authority	Park and Refuge Fire Management Office
Transfer of Command Package	Park and Refuge Fire Management Office
Park and Refuge Emergency Operations Plan	Park and Refuge Fire Management Office
Structure Defense Data Sheets	Park and Refuge Fire Management Office and the WCF T6 Engine
Pueblo Interagency Supply and Service Plan	Pueblo Interagency Dispatch Center
Incident Business Management Plan	Park and Refuge Fire Management Office
GIS Database	Park and Refuge Fire Management Office
Pueblo Interagency Dispatch Center Operating Plan	http://www.fs.fed.us/r2/fire/pbc/index.html

Aviation Management Information

The FDO must approve any request prior to aircraft being procured for fire or project use to ensure the correct procedures and procurement requirements are being met, including any end-product contracts. After approval is given, all personnel requiring aircraft services shall place their order with Pueblo Interagency Dispatch Center (PIDC).

The most commonly used aircraft are light single and multi-engine airplanes utilized periodically for point to point transportation of passengers and for fire and insect/disease detection flights. Helicopters and air tankers are used for initial attack on fires. Helicopters are also used for aerial reconnaissance, detection, aerial ignition, seeding, spraying, mapping, and other resource management projects. During part of

the fire season, airtankers are contracted and available from Region 2 Dispatch at the Jefferson County Airport (JEFFCO), Grand Junction Air Center (GJAC) in Grand Junction, and Durango Airtanker Base in Durango. Several exclusive use helicopters are available in the region as well as Call-When-Needed (CWN). These aircraft may be ordered through PIDC, who relays the orders to Rocky Mountain Area Coordination Center (RMACC). The Colorado State BLM will have a Single Engine Airtanker (SEAT) on contract and based out of the Canon City (1V6) airport for 2005. This three year contract will have a 500 gallon Turbine Thrush available for aerial delivery of retardant from the end of May until mid August. This aircraft will be available for dispatch to incidents through the State.

Pre-Attack Plan Outside Assistance

Federal Agencies
Outside assistance will be determined by the location, fire behavior, and size of the fire. Support units include the following:

Pueblo Interagency Dispatch Center (PIDC)
2840 Kachina Drive
Pueblo, CO 81008
PHONE (719) 553-1600
FAX (719) 545-7701

The interagency dispatch center includes agencies from the U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, Colorado State Forest Service and National Park Service.

The following Volunteer Fire Department is also available to assist with wildland fire activities:

Mosca-Hooper Volunteer Fire Department
5235 N. HWY 17
Mosca, CO 81146
Chief: Blaine Witherspoon (Home: 719-588-3732, Work: 719-852-4775)
Dispatched by Colorado State Patrol (719-589-5807; or 911)

The Nature Conservancy
If and when a wildfire occurs on the Medano-Zapata Ranch, the following individuals should be contacted:

1. **Contact the County Sheriff's Department**
   Alamosa County Sheriff's Office: 719-589-6608
   Saguache County Sheriff's Office: 719-655-2544

   Choose county office based on where fire is burning. Fires occurring on Medano Ranch (north of Lane 6) may be within either Alamosa County or Saguache

County. Fires occurring on Zapata Ranch (south of Lane 6) are within Alamosa County.

2. **Contact TNC's San Luis Valley Project Director**
   Paul Robertson: 719-378-2356 x 15 (office)/719-588-4734 (cell)

3. **Contact TNC's Fire Program Manager**
   Mike Babler: 303-541-0357

When a report of a wildland fire is given, the approximate location of the wildland fire shall be given. Any persons threatened by the wildland fire shall also be notified and evacuated to a safe location. All TNC staff will be instructed about proper wildfire response including the notification process for contacting fire control authorities and the appropriate TNC staff.

Pre-Attack Planning Dispatch and Mobilization

A PIDC Zone Mobilization Guide and Operating Guide is developed to address all aspects of dispatch and mobilization from initial attack to large fire support, both within the Greater Sand Dunes Fire Management Planning Area and Pueblo Interagency Dispatch Zone.

The Mobilization Guide will outline the specific processes, personnel, resources, and responsibilities necessary to take immediate and appropriate management action on all fires in a safe, effective, and efficient manner, and in accordance with National standards and this FMP. This Mobilization Guide will also address mobilization procedures and needs for dispatches outside of the FMA. The following is for informational purposes and provides additional guidance regarding dispatching. All of these items will be addressed more specifically in the PIDC Zone Mobilization Guide and Operating Plan.

In addition to the obvious duties involved with active fires, additional duties of dispatch may include (but are not limited to) the following:

A. Receive and disseminate relevant Fire Weather Watches and Red Flag Warnings to the Park and Refuge. The forecast at 1600 covers the current afternoon and evening, the next day, and an extended forecast covering the next 36-72 hours. The forecaster also includes other elements that are believed significant. The 1000 forecast will be an update for the current day, giving a general forecast and any other changes to the previous forecast.

B. Issue Preparedness Levels. The Preparedness level will be issued in the afternoon along with the weather when the level is at III or above, or when changes in the fire situation warrant a change in the Level. Fire Weather Forecasts will be read over the radio when Preparedness level is 4 or above.

C. Receive and compile updated resource availability information from the Refuge and Park.

D. Coordinate contacts with PIDC regarding the availability of overhead, crews, and engines. Utilize ROSS to provide off-Area miscellaneous overhead availability list to PBC on a pay period basis. People accepting off-Area assignments will inform their FMOs and supervisors.

E. Provide radio assistance for field personnel (fire, law enforcement, etc.) during periods when their respective offices are not staffed.

F. PIDC will be able to contact Refuge and Park FMOs and suppression resources/personnel. Dispatcher should be notified of their locations and/or telephone numbers where they can be reached (or use cellular phones).

G. PIDC will be contact for the Refuge and/or Park requests for air support (i.e. airtankers, helicopters, and/or reconnaissance flights) and coordinate with Refuge or Park Aviation Officer.

I. Process resource orders from Overhead Teams operating within the Area (with the assistance of an Expanded Dispatch, when necessary).

J. Keep record of Refuge's and Park's fires and issue management codes for fires.

Reporting of Wildland Fires

All wildland fires occurring on Federal lands, whether wildfires or wildland fire use incidents, shall be reported to PIDC by the Park and/or Refuge as soon as possible in order to facilitate preplanning and possible activation of additional resources. "After hours" reporting procedures will be more fully addressed in the PIDC Mobilization Guide and Operating Plan. Information requirements for the reporting of wildfires will follow the San Luis Valley Incident Organizer and Dispatch Incident Action Report.

Detection

A routine detection program is not normally utilized within the FMA, because of the low fire occurrence. Fire detection is usually reported by on-the-ground staff or visitors. Early fire detection protocols and procedures are established and are based on those times or periods that increased ignition sources and/or critical fuel conditions have been identified. Increased patrol personnel and extensions of duty-day are implemented during holidays and hunting seasons if conditions warrant, and also on days identified with issuance of a Fire Weather Watch or Red Flag Warning. Aerial detection may be intiated during prolonged periods of PL 4 or PL 5.

Lightning maps are also evaluated and utilized for the increased detection patrol

capability and presence. Ground patrols and aerial detection flights are utilized as conditions indicate. Any aerial detection flights will be ordered through PIDC after coordination through the Park Chief Ranger or Refuge Operations Specialist.

If and when a wildfire is detected, the first individual to reach the fire will immediately notify PIDC via radio with the following information:

Location of wildfire
Suspected cause of wildfire
Approximate size of wildfire
Fuel model
Rate and direction of spread
Any threats to developments or adjacent lands

The FDO and PIDC will then coordinate to arrange necessary personnel, supplies and equipment, and notify the proper

INITIAL ATTACK

General Considerations and Responsibilities

This section addresses responsibilities and actions for the Federal agencies when the Appropriate Management Response (AMR) is determined to be suppression oriented, as determined by fire location. Initial attack is an aggressive suppression action consistent with firefighter and public safety, as well as values to be protected. In the event of multiple wildland fires requiring initial attack, the Fire Duty Officer and/or Fire Management Officer will establish protection priorities using the following criteria, listed in descending order:

1. threat to human life
2. threat to property and natural/cultural resources

The relative value of resources to be protected will be determined by the Fire Duty Officer and/or Fire Management Officer, in consultation with the Park Superintendent and/or Refuge Project Leader, if necessary.

If the fire is in an area that has been identified as one with little chance of fire spread, the amount of fire fighting equipment (i.e. vehicles) should be limited. A confinement strategy may be implemented as the initial attack action if it is selected as the AMR (appropriate management response) and as long as it is not used to meet resource objectives. Confinement may be selected in lieu of an aggressive initial attack in order to maximize firefighter and public safety, minimize suppression costs, or to maximize availability of critical suppression and management resources during periods of high fire danger associated with fire in areas with highly valued resources to be protected. Confinement can also be selected through the WFSA process when the fire is expected

to exceed initial attack capability or planned management capability.

Typical fire response time varies greatly. Response times can be from a few minutes to many hours depending upon remoteness of the reported fire. If there is an imminent or expected threat to human life or values to be protected, the response time is reduced to the maximum extent possible. All wildland fire responses on Federal land are coordinated through the Pueblo Interagency Dispatch Center. Aviation resources requested by an Incident Commander for initial attack operations will be ordered through the PIDC. Use of aircraft will conform to all established departmental and agency policies. A helispot is maintained in the Saguache area that provides a central location for basing helicopter operations. No other helispots are actively maintained for wildland fire management purposes, although numerous suitable landing areas are located in the Park and Refuge.

The Chief Ranger and Refuge Operations Specialist are directly responsible for all fire management activities within their respective protection boundaries; i.e., safety, training, prevention, preparedness, and suppression, unless relieved by the Park Superintendent or Refuge Project Leader. Authority to act may be delegated, but responsibility will remain with the Chief Ranger and Refuge Operations Specialist.

Even though fire management responsibility on Federal lands remains with the Park and Refuge, the closest available and qualified resources will respond in the initial attack, without regard to jurisdictional boundaries, as identified in the respective county Annual Operating Plan (AOP). Other agencies assisting on a wildland fire within the Greater Sand Dunes FMA must be instructed in and understand the suppression protocol outlined in this FMP.

Suppression of on-going fires will take priority over most other work for Park and Refuge employees. However, it may be necessary at times for certain individuals or groups to be exempt from fire suppression activities in order to meet critical targets or deadlines, or accomplish other high priority jobs. For coordination purposes, it is requested that the supervisor notify the respective FMO of the specific individual(s) and what time periods are involved. Consideration of night travel and work will be thoroughly evaluated for safety conditions such as weather, fire behavior, snags or falling/rolling rocks, and difficult or unfamiliar terrain

The majority of Great Sand Dunes National Park and Preserve is either designated or recommended as wilderness. Therefore, initial attack actions are conducted using minimum impact suppression tactics (MIST). Use of chainsaws is permitted in WFU and suppression actions. Fireline explosives may be used only with written approval from the Superintendent. Wildland fire engines must remain on established roadways unless there is an imminent threat to life or other significant values to be protected. Bulldozers and other heavy equipment may not be used in wilderness areas without the written approval of the Superintendent.

Initial Attack Organization and Management
Types of fire suppression organizations that may be used on Park and Refuge lands include:

1. Initial Attack (Type 5 and 4 Incidents)
2. Type 3 Incident Management Team (Extended Attack)
3. Type 1 or 2 Incident Management Team
4. Fire Use Management Team

All incidents, regardless of complexity level (Types 5 through 1), must have a single, dedicated Incident Commander (IC). IC's are not given and do not accept collateral duties. The only exceptions are functioning as a trainer/evaluator for an IC trainee or temporarily performing un-filled Command & General Staff position duties (i.e. logistics).

Determination of the incident command structure necessary to manage an incident will be based on a Complexity Analysis. For Type 5, 4, & 3 incidents, the complexity analysis contained in the Incident Response Pocket Guide (IRPG) will be utilized. When considering whether an incident is or has potential to become a Type 2 and 1 incident the process and form contained in the Red Book will be utilized.

Type 5 and Type 4 Incidents
Type 5 and Type 4 incidents initial attacks are made up of the first suppression personnel to arrive at a fire, plus reinforcements arriving during the first burning period. An Incident Commander (IC), who must be qualified as a Type 5 IC at a minimum, must be identified and will be responsible for all the suppression actions on the incident. Reference the 310-1 Fire Qualifications Guide for training and experience requirements of the various IC positions.

Type 5 Incident characteristics are:

- Command and General Staff positions are not activated.
- Resources may vary from 1 to 6 firefighters.
- The incident is normally contained rapidly during initial attack in the first operational period.
- A written action plan is not required.

Type 4 Incident characteristics are:

- Command and General Staff positions are not activated.
- Resources on incident may vary from a few firefighters to several single resources or a single Task Force or Strike Team.
- The incident is normally limited to one operational period in the containment phase. Mop-up may extend into multiple periods.
- A written action plan is not required.

Initial attack strategies and tactics will be based on the current and predicted weather and fire behavior. Firefighter and public safety is always the first priority. As fire complexity increases, additional staffing will be requested as appropriate and consistent

with incident complexity.

Red Flag Warnings and Fire Weather Watches
These warning and watches are issued by the National Weather Service when fuel conditions or critical weather patterns develop that could lead to large and dangerous fires that could be difficult to suppress.

Conditions that can warrant the issuance of a Fire Weather Watch or Red Flag Warning are located in the NWS Pueblo Fire Weather Operating Guide.

A Fire Weather Watch will be posted whenever the potential for a red flag warning are possible. A Red Flag Warning will be issued whenever Red Flag conditions are imminent or occurring. PIDC will notify FMOs when the National Weather Service in Pueblo forecasts Red Flag conditions. On these days, a special effort must be made to prevent, detect, and suppress wildfires. FMOs should be sure that their jurisdictions have adequate resources to meet appropriate preparedness levels.

Spot Weather Forecasts
Spot weather forecasts are required for prescribed burning, and are commonly needed to assist with plans for wildfire suppression. The procedures for obtaining a Spot forecast are as follows:

1. Wildland fire (or prescribed fire) personnel take weather observations at site of fire and fill in information on form WS D-1
2. Appropriate dispatch office calls or faxes weather observations using form WS D-1 into the National Weather Service in Pueblo (Phone: 719-948-3838 / Fax: 719-948-9729) or utilizes on-line service.
3. Forecaster works up forecast and relays to requesting dispatch.
4. Forecast is relayed to fire scene by requesting dispatch.

EXTENDED ATTACK AND LARGE FIRE SUPPRESSION

Extended attack occurs when a fire on Park or Refuge lands has not been contained or controlled by the initial attack forces and continues, either until transition to a higher level incident management team is completed, or until the fire has been contained and/or controlled. Extended attack action requires a Wildland Fire Situation Analysis (WFSA) to guide the evaluation of suppression strategies. The WFSA is a decision process that employs a systematic and reasonable approach to determine the most appropriate management strategy for a particular situation. A WFSA will be completed in accordance with agency policies and as defined in “Interagency Standards for Fire and Fire Aviation Operations”.

If a large fire were to occur within the FMA, it is likely that it would need to be managed in cooperation with other agencies, particularly the FS, the County Sheriff of the affected

area, and local volunteer fire departments. An example “Delegation of Authority” can be found in the Transfer of Command documents on file at the Fire Management Office. Aviation resources requested by an Incident Commander for extended attack and large fire suppression will be ordered directly through the Pueblo Interagency Dispatch Center. Use of aircraft will conform to policies established in NPS Directors Order #60, Reference Manual #60, and the Intermountain Region Aviation Policy and Reference Manual.

Type 3 Incident Management Organization or Group
A Type 3 Incident Management organization is used for non-complex, short duration incidents (extended attack) or during interim periods between when a fire has grown beyond local management capabilities and/or a Type 1 or Type 2 incident management team assumes command. Team members should have ICS qualifications for their positions or be working toward those qualifications. Ideally, the team members should be qualified at one “level” below the true ICS designator (i.e., Type 3 Operations Section Chief should be Division/Group qualified); however, depending on the complexity of the incident, this may be extended to two “levels” below Type 1 & 2 incident qualifications. The Type 3 Team will generally manage fires up to a single division size (30-60 people), but situations may occur where the Type 3 Team will be managing two divisions or more (100+ people).

Type 3 Incident characteristics are:

- Some of the Command and General Staff positions may be activated, as well as the Division/Group Supervisor and Unit Leader levels.
- Resources may vary from several single resources to several Task Forces/Strike Teams.
- The incident may be separated into divisions, but usually does not meet the Division/Group Supervisor position for complexity or span-of-control.
- The incident may involve multiple operational periods prior to control, which requires a written action plan.
- Staging areas and a base camp may be utilized.

The IC, through PIDC, will request the Type 3 Organization. Dispatch should be notified when a situation shows the potential for developing into a Type 3 incident so that preparation can be initiated and personnel located.

The assumption of a fire by the Type 3 Organization should be as smooth and orderly as possible. The incoming IC will contact the local unit's line officer immediately upon notification of dispatch to obtain information about the fire and determine a location for a briefing. The Type 3 Logistics Section Chief (LSC), immediately upon notification, shall contact Dispatch to obtain information about what resources are on the fire, what has been ordered, and have Dispatch order any necessary additional items.

Type 1 or Type 2 Incident Management Team
A Type 1 or Type 2 Incident Management Team (IMT) is brought in from off-Park/Refuge at the request of the Superintendent or Refuge Project Leader to manage

an incident. The type ordered depends on the complexity and severity of the situation, as addressed through the Complexity Analysis.

The ordering unit should do the following prior to the arrival of the incoming team:

- Prepare Wildland Fire Situation Analysis (WFSA), Delegation of Authority, and Agency Administrators Briefing package.
- Determine potential ICP/fire camp locations.
- Order fire camp supplies, as directed by the Logistics Section Chief.
- Order or make ample supply of topographic maps, base maps, photos, etc.
- Determine line officer briefing time and location.
- Obtain necessary information for the line officer briefing.

There may be two briefings of the incoming fire management team. The first briefing should be by the Line Officer/Agency Administrator (LO/AA) at a site away from the fire. The second briefing should be by the Initial or Extended Attack Incident Commander and the staff at the fire site. Regardless of location, every effort should be made to arrange a meeting between the Initial or Extended Attack IC and the incoming IMT.

The LO/AA briefing should be as soon as possible after the arrival of the team's Incident Commander and their Command and General Staff. It is impossible to list everything a team needs to know, however, as a minimum the Wildland Fire Situation Analysis (WFSA) and Line Officer/Agency Administrator Briefing Checklist or package should be completed.

The incoming team will not assume responsibility for the fire until they are thoroughly briefed and comfortable with the situation. Both the Incident Commander and the LO/AA shall determine the exact time of command change, and this should be documented in the Delegation of Authority. After the briefing, the team should start phasing into their areas of responsibility, but shall not assume control until the predetermined time.

Consider the Delegation of Authority as the performance objectives for the team on this incident. If the document is vague, the team cannot be held accountable for specific intentions the agency may have, but failed to clearly communicate in writing. If it is too restrictive, the team loses the necessary latitude to be responsive to changed conditions in the fire environment that may require immediate action. The direction provided in the delegation and the strategic objectives in the WFSA should serve as the basis for evaluating the performance of the IMT at the conclusion of their assignment.

The delegation of authority should articulate objectives and important issues identified by the Park, Refuge, and/or Ranch, placing performance expectations on the IMT. It should identify and explain:

- Jurisdictional and protection responsibility for the lands involved in the fire, including responsibility for structural and cultural resource protection

where relevant.

- The line officer's representative who is authorized to speak for the delegating line officer.
- Suppression objectives and their priority.
- Specific suppression tactics or areas that require line officer approval.
- Initial attack responsibilities and areas that may be assumed by the IMT.
- Resource Advisor who will represent the line officer's specific direction to the IMT.
- Basic documents that guide incident management on the agency/unit.
- Cost constraints and guidelines including an estimated "budget", normally derived using the WFSA.
- Property accountability; fire loss/use rate expectations.
- Incident Business Advisor (IBA) and required coordination with the IMT.
- Guidelines for media relations and incident information management.
- Procedures dealing with threats to other jurisdictions and private property.
- Any logistical considerations, including procurement and supply procedures.
- Any other constraints or issues, such as current activities by the Forest or other local social/political issues.

WILDAND FIRE SITUATION ANALYSIS (WFSA)

The WFSA is a decision-making process that evaluates alternative wildfire suppression strategies against selected environmental, social, political, and economic criteria, and provides a record of those decisions. A WFSA and Delegation of Authority will be completed whenever a widlfire escapes initial attack. A more detailed description of the WFSA process is included in the "Red Book".

General directions for developing a WFSA include the following:

A. Identification of Evaluation Criteria: Document the criteria used to evaluate suppression alternatives. The criteria shall reflect land and resource management objectives (including environmental, political, and social concerns), potential suppression costs and resource damages, safety, and include considerations of local, Regional, and national fire suppression activities and reinforcement capabilities. The criteria must be clearly stated and measurable.

B. Development of Suppression Alternatives:Develop a sufficient number of alternatives to represent a reasonable range for the situation. Each alternative must be viable and include a concise strategic plan of control forces required, probability of success and estimated time of containment/control, acreage burned, suppression cost, and resource damage. Do not consider a "no suppression" alternative.

C. Analysis of Suppression Alternatives: Use the evaluation criteria to analyze alternatives. Be certain that estimates of potential fire consequences are consistent with resource objectives, values, and fire effects identified for the area in the Forest planning

fire management analysis. Identify the alternative that minimizes the sum of suppression costs plus resource damage, consistent with the expected probability of success/failure.

D. Approval Documentation and Notification: The line officer shall approve the escaped fire situation analysis and any revisions. Document the analysis including any revisions, Individual Fire Report. Inform the public and cooperators of the selected alternative as appropriate.

E. Monitoring and Evaluation: Evaluate the validity of the suppression decision daily based on the current and predicted situation. If needed, revise and update the analysis prior to the next burning period.

Decision Authority
Agency administrators are responsible for all aspects of fire management, including financial oversight of a wildland fire incident. Unlike other responsibilities, financial oversight cannot be delegated. Agency administrators have the responsibility to certify a WFSA and issue delegations of authority to the appropriate level of the fire management team. The appropriate authority is based on the estimated suppression cost of an incident or by the complexity level developed in the WFSA.

The FMCG will ensure that delegation of authorities is established annually for wildland fire and fuels management activities.

Transfer of command from incident to managememt team
A designated representative must approve the date and time of release. The transition must be as smooth as possible and the incident management organization assuming the incident should be assigned and start working with the out-going team members at a predetermined time. The in-coming organization should be rested and, if possible, off of fire duty 24 hours prior to takeover.

The out-going organization should begin phasing in the new organization as soon as demobilization planning is completed and implementation started. Fire management activity should be at a level and workload that Park and Refuge personnel can reasonably handle.

The following criteria shall be considered before the release of Type 1, 2, or 3 teams:

1. Fire should be controlled within predetermined WFSA objectives.
2. Most line crews should be released that are not needed for patrol and/or mop-up.
3. Base camp shutdown, reduced, or in the process.
4. Plans Chief has prepared a narrative fire report and individual fire report as part of final fire package.
5. Finance Chief should have all financial problems resolved. Contact made

with Forest budget and financial personnel. (Finance and/or Logistics Chief may have to stay longer or return to resolve problems.)
6. Fire rehabilitation work completed to satisfaction or plan written to satisfaction.
7. Overhead ratings completed and submitted as final package.

The appropriate Line Officer and FMO should debrief the IMT and prepare evaluation before release. Items to cover in the debriefing meeting include:

1. Park Supervisor and/or Refuge Project Leader should give overall team performance evaluation in writing.
2. Were objectives met?
3. Cost effectiveness.
4. Outstanding or poor performance of individuals, crews, or others involved in the suppression, mobilization, and demobilization of the fire.
5. Special problems and recommendations to be brought to the attention of Regional Fire Coordinator.

Table 21. Wildland Fire (a) Staffing and (b) Initial Response Plan Effective During the Fire Season as Determined by Analysis or as Seasonal Conditions Indicate

a. Staffing Plan

Resource(s) Description	PL 1/ 2	PL 3	PL 4	PL 5
Incident Commander Type 5 (ICT5) and Firefighter (FFT2) - Pre-designated, on duty	√			
Engine; ICT5 and FFT2		√		
Engine Module; ICT5, Engine Operator (ENOP) or trainee, and FFT2			√	√
Incident Commander Type 4 (ICT4) Pre-designated, on-duty			√	√
Fire Duty Officer – Pre-designated, on-duty *	√	√	√	√

Staffing requirements for PL 1 and 2 are 5-day effective coverage.
Staffing requirements for PL 3, 4, and 5 are 7-day effective coverage.

b. Response Plan for FMA

Resource(s) Description	PL 1/2	PL 3	PL 4	PL 5
ICT5 and FFT2	Respond			
Engine; ICT5 and FFT2		Respond		
Engine Module; ICT5, ENOP or trainee, and FFT2			Respond	Respond
Incident Commander (ICT4)			Notify	Notify
Prescribed Fire Monitor or Field Observer (FEMO or FOBS)**	Respond	Respond	Respond	Respond
Law Enforcement	Notify	Notify	Notify	Notify
Fire Management Officer(s)	Notify	Notify	Notify	Notify
After a wildland fire is **confirmed**, the following personnel/offices will be notified.				
• NPS				
▪ Superintendent	Notify	Notify	Notify	Notify
▪ Chief, Natural Resources Management	Notify	Notify	Notify	Notify
▪ Chief Ranger,	Notify	Notify	Notify	Notify
▪ Public Information Office	Notify	Notify	Notify	Notify
• USFWS				
▪ Project Leader and Refuge Operations Specialist	Notify	Notify	Notify	Notify
▪ Wildlife Biologist	Notify	Notify	Notify	Notify
Pueblo Interagency Dispatch Center	Notify	Notify	Notify	Notify

* In Preparedness Level 4/5, the Fire Duty Officer may simultaneously serve as the available ICT4. If the Fire Duty Officer is activated as ICT4 for an incident, the duties of the FDO will be assigned to a qualified individual and/or assistance will be requested from outside the park.

** FEMO or FOBS will respond to smoke reports in FMUs designated for wildland fire use

Minimum Impact Suppression Tactics

Fire management activities within the FMA will be carried out in a way that minimizes impacts to the Park's and Refuge's natural and cultural resources. Fire camp facilities, when practical, will be located outside of natural and historic zones. Suppression forces will choose methods and equipment commensurate with suppression needs and a strategy that will least alter the landscape or disturb natural and cultural resources. Of primary importance is the need to convey upon suppression forces the minimum impact suppression guidelines found in NPS Directors Order #18 and Reference Manual #18. The most recent minimum impact suppression guidelines are identified in the Interagency Standards for Fire and Fire Aviation Operations.

Techniques and policies of minimum impact fire management that will be used in the FMA, as conditions dictate, include (but are not limited to):

- Cold-trail the fire edge when practical.
- Use wetline or natural firebreaks wherever possible (in lieu of handline construction) if water and pumps are available. Waterbars will be installed on handline on steep slopes. In the tundra ecosystem, wetline will be used to the maximum extent possible.
- Use soaker hose or foggers in mop-up to avoid "boring" and hydraulic action on soils.
- Fireline should be kept to the minimum width needed to allow backfiring, burnout, or the creation of a safe blackline. Use natural barriers wherever possible to avoid "tunnel effect."
- Do minimal tree-falling. Snags within or adjacent to fireline will be removed only if they show evidence of fire, present excessive hazard to firefighters, or constitute a legitimate threat to the fireline integrity. Leave living trees undisturbed whenever possible. Prune lower branches to remove ladder fuels.
- Take archaeological protection measures to protect cultural resources (an archaeologist or qualified individual from the park will be assigned as a resource advisor).
- Scatter or remove debris as determined by the Resource Advisor.
- Rehabilitate all constructed fireline, spike camps, or other disturbance in visually sensitive areas to maintain a natural appearance.
- Transport of personnel, equipment, and trash out of the park will be consistent with park resource management objectives.
- Use engines only on established roads within park boundaries, unless an imminent threat exists to human life or critical resources.
- Possible use of fireline explosives. Trees severed with explosive cord do not leave cut planar surfaces as do trees cut with chainsaws. This reduces the need for rehabilitation, and the shattered boles and stumps may look more natural in less time than trees cut with chainsaws. The use of

explosives on either prescribed or wildland fire requires approval from the Superintendent or Project Leader.

Fire Reports

Federal Agency Fire Records and Reports

The following archived records in the Park and Refuge will be held as permanent historic resource management records:

- individual fire reports (DI-1202);
- a fire history atlas;
- fire weather records for any extended attack fires, wildland fire use projects, and prescribed fires;
- fire equipment inventories; and
- other maps or records pertinent to fire management actions.

During the fire season, the Park and Refuge will follow the appropriate fire reporting procedure in-place for the interagency dispatch center and the agency. An Individual Fire Report (DI-1202) will be prepared and archived for all wildland fire activity in accordance with current agency and departmental policy. This will include, but is not limited to documenting every fire in the Park and Refuge, every incident for which assistance was given to mutual aid cooperators, and for every fire response that required fiscal actions but was declared a false alarm. The respective FMOs and/or FDO will provide daily briefing reports to the Park Superintendent and Refuge Project Leader whenever the Park or Refuge is involved in significant wildland fire management actions.

TNC Fire Records and Reports

Review of wildland fires on Nature Conservancy lands will be conducted in accordance with procedures outlined in the Conservancy's Fire Management Manual. A Fire Summary Report will be used to document each fire occurrence and include information on fire behavior, weather conditions, fuel conditions, smoke behavior, area covered by the fire, crew and equipment problems, and any other events associated with the fire. The Fire Summary Report is a tool used to "remember" fire events and learn how to improve the logistical aspects of future fire management. It is not a Monitoring Report. A Fire Summary Report is prepared for each fire event. In most cases, these reports document prescribed fire, blacklining done separately from the rest of a prescribed fire, and wildfire events. Individual suppression agencies would be responsible for their agency-specific reporting requirements.

At the end of each fiscal year, an Annual Fire Management Summary must be submitted to the Conservancy's Global Fire Initiative office for insurance reporting and tracking purposes.

After Action Reviews

Wildland fires will be reviewed in accordance with NPS Reference Manual #18 and FWS Service Manual and Fire Management Handbook. The respective FMO will arrange to review any Park or Refuge fire that is Class C or larger as soon as it is considered controlled. Class A and Class B fires may be reviewed if necessary. After Action Reviews (AARs) are generally conducted at the fire. Where fires have involved serious injury, fatalities, or other special circumstances, a written report will be necessary. Any prescribed fire that is converted to suppression actions will be appropriately reviewed. For all extended attack fires (involving Type 1, 2, or 3 Incident Management Teams) an in-depth review will be conducted. The FMCG will also review any wildland fire use incidents.

Initial Attack Wildland Fire Investigation

All wildfires will be investigated for cause. If human-cause is suspected, then a qualified fire investigator may be called in for investigation, if one is not on-site. **All fire evidence and fire start locations need to be protected**. Also, Park and Refuge personnel entering a fire area should make note of and record information about persons and/or vehicles seen in or leaving the area (e.g. descriptions, state and number on license plate, etc.). If arson is suspected, a special investigator will be called in.

WILDLAND FIRE USE

Wildland fire use refers to the management of naturally ignited wildland fires to accomplish specific, pre-stated resource management objectives in predefined geographic areas as allowed for in enabling legislation, agency policy, land and resource management plans and outlined in this Fire Management Plan. This section of the Fire Management Plan develops the information necessary to prepare for and implement a Wildland Fire Implementation Plan (WFIP) for wildland fire use.

Wildland fire use is allowed within the Mosca and Herard FMUs, which occur within the boundaries of the Great Sand Dunes National Preserve. Primary authority to manage wildland fire for resource benefits is founded on the National Park Service Organic Act of 1916, as well as the park enabling legislation. Further direction and authority for managing wildland fire for resource benefits is derived from NPS Directors Orders #18 and Reference Manual #18, as well as Federal and department fire management policies. Lightning-caused wildland fires have been a significant influence in the development and perpetuation of the forests, woodlands, meadows, and grasslands within the Preserve.

The primary goal of the wildland fire use program is to permit lightning-caused fires to burn in order to preserve the natural conditions and processes within the Preserve to the greatest extent possible. The program is designed to enhance the use of wildland fire to achieve resource benefits and, through the maintenance of the natural fire history mosaic, to ensure the protection of life, property, and valuable resources from wildland fire.

The implementation process for all managed wildland fires is outlined in this Fire Management Plan. That process includes procedures identified in the “Wildland Fire Use Implementation Procedures Reference Guide”, hereafter referred to as the Implementation Guide.

Wildland Fire Use Decision Authority and Responsibility

The decision-making authority for a wildland fire use rests with the Park Superintendent. Any delegation of this authority will be in writing from the Park Superintendent for a specific time period to a specific individual.

Wildland Fire Use Implementation Procedures

Wildland fires ignited by lightning in Fire Management Units (FMUs) that are designated for wildland fire use (i.e. Mosca and Herard FMUs) may be managed to achieve resource benefits. Wildland fires ignited by lightning in the Baca Dunes and

Alamosa/Monte Vista FMUs, which are designated for wildland fire suppression, will be suppressed using the appropriate management response. When a lightning-caused fire is confirmed within an FMU designated for wildland fire use, the FDO and Incident Commander will immediately inform the Park Chief Ranger.

Mosca and Herard FMU

Upon receiving a report of a fire in either the Mosca or Herard FMU, dispatch will also send the closest fire fighting forces to the fire. While these forces are enroute and after they have arrived on the scene, the dispatcher/fire management officer will continue to collect information about the fire, such as the cause of fire, exact location and size, potential for spread, weather observations, closest natural barriers, proximity to private/urban areas, sites and structures threatened, etc., in order to answer the questions in Stage I of the WFIP.

The FMO and/or FDO will initiate the WFIP – Stage I as described in the Implementation Guide. A Stage I WFIP provides the decision framework for selecting the appropriate management response (AMR), which may be either wildland fire use or a suppression-oriented response (i.e. initial attack). Stage I consists of the Fire Situation and a Decision Criteria Checklist and documents the current and predicted situation, documents all appropriate administrative information, and aids managers by providing them with decision criteria to make the initial decision whether to manage a fire for resource benefits or to take suppression action. The checklist ("Go/No-Go") will serve as the initial action assessment and approval or disapproval for managing the wildland fire for resource benefits. Completion of the WFIP – Stage I may require additional detailed site information, and thus the FDO may dispatch a response module to the site to collect environmental information, possibly supported by aerial reconnaissance. The level of monitoring including the frequency of monitoring will meet or exceed agency and departmental standards and will be determined by the Fire Use Manager assigned to the wildland fire.

The Park Superintendent will review and approve the Stage I analysis, with consideration for management objectives. This decision-making process will be ongoing while the fire remains active. Managers will recertify their decision at a pre-determined interval to ensure that all considerations remain valid, in which case, the course of action will be maintained. The monitoring and certification/validation interval is determined based on criteria outlined in the "Implementation Guide". All management decisions will be in accordance with the Federal and Agency wildland fire management policy.

If the outcome of the WFIP – Stage I is to approve the wildland fire use project, the Chief Ranger will ensure that either a quality ICT4, FUM2, or FUM1 is assigned and receives a delegation of authority from the Superintendent. The determination for selecting an ICT4 versus a FUM2 versus a FUM1 is influenced by fire complexity.

The management of a wildland fire in the park must not present a burden on in-park initial attack resources that might compromise adequate response to additional wildland

fires. If additional resources are needed to manage a wildland fire or staff initial response appropriate out-of-park fire management personnel should be ordered through proper dispatch channels. Prior to ordering a Fire Use Management Team, the FMO will initially assign a Fire Use Manager and determine the other staffing needs to configure a “short team”, such as individuals skilled with wildland fire use operations, planning, logistics, finance, information, safety and a fire behavior analyst or technical specialist. Consideration for ordering a Fire Use Management Team should be made by the FMO and Park Superintendent.

If the Recommended Response Action is “No Go”, a suppression-oriented approach will be considered the appropriate management response. The Park FMO and/or FDO will inform the Great Sand Dunes Communications Center, who will follow procedures for initial response as established in the Initial Response Plan

A WFIP will be completed for all wildland fires that are not suppressed, in accordance with processes outlined in the Implementation Guide. However, only the most complex fires being managed for resource benefits will require completion of all parts of the WFIP. This document represents the operational management plan for wildland fire use.

A wildland fire being managed for resource benefit will be allowed to burn under the specific set of criteria set forth in the Wildland Fire Implementation Plan (WFIP). During the management of wildland fire use projects, the Superintendent or designee will certify (in writing) through a Periodic Fire Assessment (as identified in the Implementation Guide) that the wildland fire can continue to be managed for resource benefits as described in the WFIP. Information for making this certification will be submitted by the ICT4 or FUM, but the certifying signature must be the Superintendent's or his/her Acting, unless delegated to a specified position on his/her staff. In order to provide signature to the Periodic Fire Assessment, the Superintendent may convene an interdisciplinary working team of subject matter experts from the various park divisions. That team would serve to discuss, develop, and make recommendations for the WFIP, as well as provide input to the response to the questions on the periodic fire assessment.

If the fire is predicted to exceed the established criteria in the WFIP or the maximum manageable area, a Wildland Fire Situation Analysis will be prepared, and an alternative action will be selected and implemented.

Aviation resources requested by an Incident Commander for initial attack operations will be ordered through the PIDC. Use of aircraft will conform to all established departmental and agency policies.

Preparation Activities for Wildland Fire Use

To assist with possible fire use implementation, the park fire management office

maintains an implementation guide in the form of a single binder. This guide is a compilation of information gathered into a single location to facilitate fire use operations. The guide contains several pieces of information that will require periodic updates and should be checked annually for currency. Items to be checked in the guide include:

- GIS Data
- Smoke Permits/Information
- Weather Data
- Policy Information
- Communication Plan

Staff Positions Necessary to Manage Wildland Fire Use

Chapter 5 of the Fire Management Plan identifies the fire management organization, as well as the roles and responsibilities of other related staff positions. The Park FMO and/or FDO will ensure that wildland fires being managed will be staffed with only qualified individuals per agency standards.

If adequate staffing and/or qualified individuals are not available to successfully manage any particular wildland fire, a suppression response will be activated using an appropriate management strategy. To further facilitate successful wildland fire use operations, an annual examination of in-park qualifications will be undertaken to ensure appropriately qualified personnel are readily available, or to identify qualification gaps. If key qualifications for fire use implementation are not available locally, efforts should be made by the Fire Management Coordinating Group (FMCG) to pre-identify possible candidates for these roles or ordered through the dispatch system.

Environmental Effects of Managing Wildland Fire Use

The 2005 Environmental Assessment/Assessment of Effect for the Great Sand Dunes Fire Management Plan explored the environmental effects of managing wildland fires for resource benefits and was made available for public and agency comments. The Regional Director(s) approved a Finding of No Significant Impact (FONSI) for the EA/AEF in November 2006.

The EA/AEF and FONSI are on file in the Regional Fire Management Office. The EA/AEF evaluated the environmental consequences of managing wildland fire and documented those impacts to air quality, water resources, soils, wetlands and floodplains, vegetation health and ecological integrity, threatened/endangered/candidate species, wildlife and wildlife habitat, non-native invasive species, wilderness, cultural resources, socioeconomics, public health and safety, wildland-urban interface, and recreational opportunities and visitation, as well as cumulative impacts.

Wildland Fire Use Inter- and Intra-agency Notification and Coordination Process

It is essential that the wildland fire use program activities exhibit a high degree of continuity, consistency in application, and open coordination. Inter- and intra-agency notification and coordination will occur (1) during pre-season and post-season planning and evaluation meetings and (2) during a wildland fire use incident

Pre and Post Season Planning and Evaluation Meetings
Review of the wildland fire use program, including findings and recommendations of the post season evaluation process, will be included in pre-season meetings and/or sessions. Consultation with the following agencies and groups will occur during the pre-season meetings and/or sessions:

- Colorado State Historic Preservation Office (SHPO): Monitoring and post burn results will be shared with the SHPO by way of field trips and shared information from the Park's archeologists and FMO.
- United States Fish and Wildlife Service, Ecological Services (FWS-ES): Documented findings and recommendations from the annual evaluation process will be shared with the FWS-ES.
- Colorado Department of Public Health and Environment (DPHE): Documented findings and recommendations from the annual evaluation process will be shared with the DPHE.
- Colorado State Forest Service (COFS): during County - Federal Coop meetings and spring review of pre-planned dispatch areas.

Public and Constituent Information for the Wildland Fire Use Program
It is imperative that the Park notify the public about wildland fire use and prescribed fires. A notification list will be kept at Great Sand Dunes Headquarters and updated regularly in order to achieve a wider audience of stake holders, neighbors, and other interested groups or individuals.

The Public Information Officer (PIO) will be responsible for informing the public and the media about the Park's fire management program. They will also work cooperatively to serve as Fire Information Officers during wildland fire management activities or as liaisons with assigned Incident Management Team Information Officers.

Communication plans will be developed as required, identifying objectives, audiences, messages or talking points, communication methods and tools, organization and assignments that will detail the following actions:

- The objectives of fire information are to proactively provide the public, media and park staff with accurate and timely information and to enlist public support for professional fire management practices.

- Audiences may include local residents, local business community, park visitors, park management, employees and volunteers, regional or national office staff, cooperating agencies, legislators, media, etc.
- Messages or talking points may include such topics as prescribed fire, fuel management activities, wildland fire use, wildland-urban interface issues, fire safety and prevention, Firewise and defensible space concepts, Rural Fire Assistance Program, implementation of fire restrictions, etc.
- Communication methods or tools may include press releases, public service announcements, newsletters, signs, displays, web sites, direct, e-mail telephone and personal contacts, interpretive programs, public meetings, etc.

The PIO will also conduct public outreach activities and interpretive programs in coordination with the Interpretation Division. Annual training programs to keep staff informed of fire management activities and the ecological role of fire will be presented to seasonal interpretive employees and other divisions as requested. A site bulletin about fire management will be available and updated as necessary.

The Park's interagency and mutual aid agreements provide opportunities for annual review and information exchange about the fire program with cooperating agencies. The Colorado State Forest Service and county governments have the primary responsibility for private land issues but work in partnership with the PIO on communicating wildland-urban interface issues in surrounding communities.

Fire information and education efforts will be conducted on a year round basis. Prevention and fire information activities will increase as the fire danger and activity level escalates. Staff from other divisions may be recruited to assist with information duties as required. All Park staff should have a basic understanding of fire management to respond to visitor inquiries or be able to properly direct them to obtain the requested information. Whenever possible, implementation of fire restrictions and closures will be closely coordinated with cooperating agencies to promote consistency and avoid confusion.

Standard Format for Wildland Fire Use Reporting

To adequately record events and decisions associated with wildland fire use implementation, a permanent project record will be kept for each event. These records will be archived in the Park and held as a permanent historic resource management document containing:

- Approved planning documents, including all amendments, revisions, and WFIP/WFSA materials.
- All monitoring documentation.
- Signed Periodic Fire Assessment documentation.
- Complete funding codes and cost accounting records.

- Project maps.
- Relevant media documents and photos.

Exceeding Wildland Fire Implementation Plan
The WFIP is used for all wildland fires that have the potential to be managed for resource benefits. If, during the course of managing a WFU project, the management response has not been successful, a new strategy must be selected and a WFSA will be completed. The selection of a new strategy will follow the process identified in the current version of NPS Reference Manual #18 (Chapter 9) and the “Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide”.

PRESCRIBED FIRE

There are both opportunities and needs for prescribed burning in the FMA. Vegetation consists of alpine tundra, spruce-fir forests, aspen forests, mixed conifer forests, pinon-juniper woodlands, grasslands, shrublands, riparian forests, and wet meadows. The current structure, species composition, and dynamics of many of these vegetation types are often the direct result of past fires, or in other cases, the result of other processes that have themselves been affected by fire. Research about the role of fire in shaping the vegetative landscape of the Park, Refuge, and Ranch is limited. A fire history of the main vegetation types is found in Appendix E. Based on the limited research available, it appears that the landscape is a complex combination of stand-replacing and low to moderate intensity fire regimes.

As a management tool, prescribed fire will be used to achieve fuel reduction, resource protection, community protection, and habitat management goals. These goals are not mutually exclusive, and in some combination will be part of the overall goals for any prescribed fire operation. This will ultimately allow these areas to achieve a more resilient and sustainable condition while providing community protection dividends.

The specific and measurable objectives for the use of prescribed fire will vary amongst projects. The 2005 EA/AEF is the core decision document per NEPA. The FONSI is the decision document representing coverage that allows for prescribed fire and non-fire treatments to be applied within portions of the FMA. These areas are proximal to resources at risk and/or the Park, Refuge, or Ranch boundaries. The use of prescribed fire within the Area, in general, would seek to treat accumulations of hazardous fuels. Compliance with the National Historic Preservation Act and Endangered Species Act for all prescribed fire projects is described in the FONSI(s) and Chapter 1 of this plan.

Hazardous fuel reduction may be accomplished in some instances with prescribed fire. When used alone, prescribed fire can be effective in achieving the goals and objectives for the particular project area. Prescribed fire may also be used in combination with manual and mechanical fuels reduction projects to meet the goal of reduced fuel loads. As combined treatments, manual and mechanical fuels work can provide successful manipulation of the crown spacing as well as crown height of hazardous fuel complexes while prescribed fire is generally effective at reducing ground fuels and also may be used to maintain mechanically treated areas.

Prescribed fire may also be utilized to meet specific natural resource management objectives including influencing the composition and structure of vegetation for wildlife habitat. This use of prescribed fire will mainly occur on the Refuge.

Prescribed fire may also be implemented for scientific research purposes especially in wet meadow habitat. As the need for data related to the effect of fire on the landscape continues to expand, so will the need for burns conducted solely to acquire that data. Research burns will likely be smaller sized projects with objectives specifically related to unanswered research questions. Project objectives and operational constraints will

dictate the location, timing, and tactical issues associated with these burns.

Planning and implementation of prescribed fire activities will conform to each agencies and organization's policies and procedures, and include the NPS Reference Manual No. 18, the FWS Service Manual and Fire Management Handbook, the Interagency Prescribed Fire Planning and Implement Procedures Reference Guide (2006) and the TNC Fire Management Handbook.

Preparation Activities for Prescribed Fire

The use of prescribed fire as a management tool requires that certain annual activities be performed to implement the program. Detailed project planning is necessary, and by agency policy, a Prescribed Fire Burn Boss or trainee must be the primary preparer of each prescribed fire plan. Additional personnel necessary for project planning and implementation will vary according to specific requirements of individual burns and may be brought in to assist as needed. The funding cycle associated with fuels activities requires that project funds for the next fiscal year be requested the spring before the end of the current fiscal year. This cycle necessitates that on-the-ground project reconnaissance and assessment must be completed at least six months or more prior to the intended project implementation date. Additional annual needs for prescribed fire implementation include:

- ***Annually Update GIS data:*** GIS data must be updated to include previous year fuels activities and accomplishments to reflect the current state of fuels and vegetation. This updated data will provide the ability to reexamine assessments and reapply models to verify current activities.

- ***Identify Areas Requiring Treatment:*** Applying the best available science and technological tools, areas requiring treatment will be identified. This analysis will incorporate elements of values, hazards, and risks as they relate to treatable areas for each of the FMUs. This analysis will consider the greater landscape as well to ensure treatments are consistent with adjoining efforts from private landowners and cooperating agencies.

- ***Select Priorities:*** The prioritization process will be based upon the analysis of values, hazards, and risks. This process will add weight in the analysis to any areas adjacent to the park that are currently receiving or are planned to receive treatment from private landowners or other land management agencies.

- ***Submit Project Proposals:*** Annual preparation for project implementation requires that project clearance be secured from Park, Refuge, and/or Ranch management. A project proposal is required for all fuels reduction activities and constitutes a delegation of authority for fire

management personnel to proceed with on-the-ground preparations and burn plan development according to the signed proposal.

- ***Complete an Annual Fuels Treatment Plan:*** An annual work plan will be created that identifies the location of treatments, the rationale for the selection of the treatment areas, the work needed to complete projects, funding requirements, and timeframes for project accomplishments.

- ***Complete Burn Plans:*** Burn plans will be completed for all prescribed fire events far enough in advance of their anticipated implementation date to allow all internal and external concerns to be adequately dealt with. Individual prescribed fire burn plans require internal review and approval by the Refuge Project Leader, Park Superintendent, or SLV Project Director. Plans shall be prepared by qualified individuals and technically reviewed in accordance with each agency's or organization's policies and guidance documents (i.e. NPS Reference Manual 18, FWS Service Manual and Fire Management Handbook, or TNC's Fire Management Manual).

- ***Obtain Smoke Permits:*** A smoke permit is required for all open burning through the Air Pollution Control Division of the Department of Public Health and Environment for the State of Colorado. The permits issued by this body at a minimum require strict adherence to Colorado Air Quality Regulation 9 and that burns be conducted in a manner that does not result in a violation of national ambient air quality standards (NAAQS). Smoke permits are issued on a calendar year basis. Additional requirements of individual permits may vary and can include periods of public review of up to 30 days or consultation with the National Weather Service prior to burn implementation. Under the Clean Air Act of 1977, Great Sand Dunes National Park and Preserve is designated a Class 1 airshed and as such is required to protect Air Quality Related Values from adverse impacts by this regulation (Title I, Part C). Baca National Wildlife Refuge and the Medano-Zapata Ranch are designated as Class II airsheds, which have less stringent requirements for air quality.

Project Reports

In addition to the preparation activities, the NPS, FWS, and/or TNC will keep and maintain an individual project file for all prescribed fire projects, in accordance with each agency's or organization's policies and guidance documents (i.e. NPS Reference Manual 18, FWS Service Manual and Fire Management Handbook, or TNC's Fire Management Manual). Specifically, the file for the Park, Refuge, and/or Ranch will contain (depending on agency or organization):

- Original Signed Prescribed Fire Burn Plan

- Pre-Burn Checklist
- Reviewer Comments
- Maps
- Notification List
- Necessary Permits
- Monitoring Data
- Weather Forecasts
- Agency Administrator Go/No-Go Checklist
- Incident Action Plans
- Unit Logs
- Public Comments/Press Releases
- Post Fire Evaluations
- DI-1202

Prescribed Fire Project Implementation

The timing of prescribed fire implementation will be dictated by the specific objectives of individual projects. The generally bimodal precipitation patterns, seasonal wind patterns, and attendant naturally occurring wildfire patterns give rise to a narrow set of conditions under which prescribed fires may be ignited in the FMA.

With pile burning activities, prescribed burning could occur year-round during appropriate conditions to achieve management objectives. Relative to broadcast burning, the winter, spring and early summer generally present moderate prescribed burning conditions with adequate burn windows while the late summer and fall tend to provide fewer burn opportunities. The spring and late fall seasons are prone to experiencing extreme winds and unexpected weather events. Late spring and summer prescribed implementation offers the effects of green-up conditions that are likely to inhibit fire spread in herbaceous fine fuels while allowing for consumption of dead and downed fuels.

Manual and mechanical fuels reduction will require the production of piled material that will be burned at a later date. This will also include the burning of large piles comprised of material from fuels activities and other Park, Refuge, and Ranch projects that generate vegetative and burnable materials. Pile burning activities must meet all necessary planning and implementation elements of regular broadcast burning activities for each agency and organization.

Prescribed fire implementation requires several elements be considered prior to project initiation. These include but are not limited to the following actions:

- ***Monitoring Weather and Fuel Conditions:*** Weather and fuel conditions must be within prescriptive constraints during project implementation. Prior to project implementation, these elements should be closely

monitored as per the approved burn plan to ensure plan compliance and to ensure optimum conditions are present for smoke dispersal and successful attainment of project objectives.

- ***Brief Park, Refuge, and/or Ranch Management:*** Key Park, Refuge, and/or Ranch staff members will be briefed on project status and the intent to implement prior to project initiation. This will include obtaining a signed administrative "Go/No-Go" decision on burn implementation from the Park Superintendent, Refuge Project Leader, or SLV Project Director, or their designees.

- ***Public Notification:*** All prescribed fire projects require that the public be notified prior to burn implementation at some specified time interval identified in the approved burn plan.

- ***Pre-Burn Briefing:*** A review of pre-burn considerations and preparations will be conducted to ensure all necessary project elements are in place prior to implementation.

- ***Implement Burn According to Approved Plan:*** All prescribed fire activities will be conducted according to the management approved burn plans.

In the event that a prescribed fire on Federal lands exceeds pre-identified standards of controllability as defined by the individual burn plan, a suppression action will be activated as identified in the burn plan. This preplanned component of each burn plan will identify all actions and notifications required within the Park and/or Refuge to declare an escaped wildfire. This plan will specifically identify the conditions that constitute an escaped prescribed fire and the interim organization required to manage that incident. A Wildland Fire Situation Analysis (WFSA) will be completed in accordance with Reference Manual #18 and FWS Service Manual and Fire Management Handbook, in order to provide direction for further actions and strategies.

If a prescribed burn on TNC land exceeds the pre-defined prescription for the burn, then the prescribed burn will be considered an escaped wildfire. The appropriate fire control agency will be contacted immediately and responsibility for fire control will be turned over to this agency.

Prescribed Fire Project Compliance

Prescribed fire activity in the Park and/or Refuge will conform to current agency and departmental policy direction related to the National Environmental Policy Act. At the time of preparation of this plan, prescribed fire activities are planned for areas that are currently detailed in existing Environmental Assessment/Assessment of Effect for this Fire Management Plan. Compliance with the National Historic Preservation Act and the

Endangered Species Act for all prescribed fire projects is described in Chapter 1 of this plan.

In accordance with agency policies, all areas that are to be treated for hazardous fuels accumulations must receive adequate survey for rare, threatened, or endangered plant and animal species. Most areas in the current fuels treatment areas have few, if any, known species of such plants and animals, but if any are discovered, the Refuge or Park biologists will be consulted and mitigating procedures will be established. Mitigation may include the creation of species specific buffers, seasonal restrictions, or no-treatment buffers.

Cultural resources will similarly be managed to protect the integrity of the resource and, if necessary, to preserve historic conditions surrounding the resource that add to its uniqueness. The Refuge or Park cultural resource specialists will be consulted on all prescribed fire projects and mitigating procedures will be established if necessary. The protection of the FMA's natural and cultural resources will remain a high priority in all fuels reduction activities.

Prescribed Fire Monitoring and Evaluation

All prescribed fires will be monitored in accordance with the NPS Fire Monitoring Handbook, the FWS Fire Management Handbook, and the TNC Fire Management Manual. Monitoring will seek to record and analyze fire weather and fire behavior during project implementation, as well as short- and long-term fire effects on vegetation and fuels. The intensity and character of monitoring will vary with the complexity and purposes of the burn. This monitoring will allow managers to document basic information that can detect trends and ensures that the actions are meeting fire and resource management objectives. Where changes in fuels or alteration of habitat are desired, sampling will continue over a period of years. All prescribed burns on Federal lands will be evaluated and critiqued, preferably by the Park and/or Refuge FMO soon after their completion.

Each prescribed burn project will be critiqued post-burn by the burn boss or designee using the protocol included in each burn plan. The evaluation will include an estimate of overall achievements specifically related to burn objectives and operational effectiveness. Critiques will be completed within 30 days of burn completion. Overall burn accomplishments will be recorded as part of the original project file and will be incorporated in year-end updates and analyses.

Wilderness Preservation

A significant portion of Great Sand Dunes National Park and Preserve is designated or recommended wilderness. Within these areas, as well as other lands within the FMA that are not recommended for wilderness, fire management activities will be implemented using methods that minimize impacts to cultural and natural resources, including wilderness values. Within designated and recommended wilderness areas, the Park Service will apply the "minimum requirement" concept procedures "minimum tool", and "primitive tool" as defined in NPS Reference Manual #41, in accordance with NPS Director's Orders #41.

Fire management actions, including prescribed fire, wildland fire use, and wildland fire suppression, will conform to the basic purposes of wilderness. This plan identifies the appropriate management response to all wildland fires within the park.

Prescribed fires planned for implementation within recommended wilderness areas are intended to maintain the natural role of fire to various park ecosystems and protect sensitive natural and cultural resources. Any prescribed fire project within designated wilderness will be implemented using the minimum requirement concept. Application of the minimum requirement concept and minimum/primitive tool procedures will be conducted as specified in the Wilderness Act (1964), NPS Management Policies (1988), and NPS Reference Manual #41.

NON-FIRE TREATMENT APPLICATIONS

The vast majority of the non-fire fuels treatment strategies in the FMA involve the reduction of fuel loads in or within areas proximal to the wildland urban interface that pose an unacceptable level of risk to life and property and within areas containing structures, developments, and/or other resources at risk, which includes cultural resources. This fuel reduction is achieved using manual and mechanical equipment. Whenever feasible, an emphasis will be placed on biomass utilization such as using material for firewood, trail stabilization, and buck and rail fence material. When biomass material can not be efficiently or economically accessed for utilization, on-site disposal methods such as pile burning, scattering, and chipping are utilized.

Annual Preparation Activities

Reporting and documentation requirements contained in NPS's Reference Manual #18, FWS's Fire Management Handbook, and TNC's Standard Operating Procedures: Removal of Plants and Animals will be used as a guide for tracking non-fire activities. Additional year-end reporting requirements will include internal accomplishment updates for Park, Refuge, and Ranch management and regional fiscal and project accomplishment reports detailing activities. The overall cost accounting for projects on Federal lands is currently tracked utilizing the National Fire Plan Operations and Reporting System (NFPORS). All hazard fuel project documentation will be kept and maintained in an individual project file and will contain the following at minimum:

- Original Signed Project Proposal and Plan
- Maps of Project
- Notification Information
- Necessary Permits
- Monitoring Data
- Activity Documentation
- Contract Information

The Federal funding cycle associated with fuels activities requires that project funds for the next fiscal year be requested the spring before the end of the current fiscal year. This cycle necessitates that on the ground project reconnaissance and assessment of planning must be completed six months or more prior to intended project implementation.

Other activities that must occur annually to ensure fuels treatment projects can be initiated include:

- ***Annual Updates of GIS Data:*** GIS data must be updated to include previous year fuels activities and accomplishments to reflect the current state of fuels and vegetation. This updated data will provide the ability to reexamine assessments and reapply models to verify current activities.

- ***Identify Areas Requiring Treatment:*** Applying the best available science and technological tools, areas requiring treatment will be identified. This analysis will incorporate elements of values, hazards, and risks as they relate to treatable areas identified in the 2005 EA/AEF. This analysis will consider the greater landscape to ensure treatments within the FMA are consistent with adjoining efforts from private landowners and cooperating agencies.

- ***Select Priorities:*** The prioritization process will be based upon the analysis of values, hazards, and risks. This process will add weight in the analysis to any areas adjacent to the FMA that are currently receiving or are planned to receive treatment from private landowners or other land management agencies.

- ***Submit Project Proposals:*** Annual preparation for project implementation requires that project clearance be secured from Park, Refuge, and/or Ranch management. A project proposal is required for all fuels reduction activities and constitutes a delegation of authority to fire management personnel to implement projects according to the signed proposal.

- ***Complete an Annual Fuels Treatment Plan:*** An annual work plan will be created that identifies the location of treatments, the rationale for the selection of the treatment areas, the work needed to complete projects, funding requirements, and timeframes for project accomplishments. Individual project plans will be created for each non-fire fuels activity to provide guidance on project specifications, restrictions, and timeframes.

The FMCG will annually review all proposed fuel treatment proposals and suggest any necessary revisions.

Contractors, the seasonal fire crew and fuels crew, and volunteers generally perform on the ground implementation of non-fire fuels reduction projects. Oversight for these projects is the direct responsibility of the Fuels Management Specialist, Fire Management Officer, Chief Ranger, Refuge Operations Specialist, and/or the Chief of Natural Resources Management. The climate in the FMA is often conducive to year round manual and mechanical fuels management activities. The winter months generally present excellent opportunities for pile burning and occasionally present dry periods that have allowed for prescribed fire implementation.

Project Compliance

The 2005 EA/AEF is the required environmental analysis document per NEPA. The 2006 FONSI is the decision document for implementation of all hazardous fuels

reduction activities in the FMA. The 2005 EA/AEF allows for a combination of several fire management strategies to achieve large-scale programmatic goals including the use of non-fire fuels treatments. Non-fire fuels treatments in the Park and Refuge will conform to current agency, organization, and departmental policy direction related to the National Environmental Policy Act. At the time of preparation of this plan, non-fire fuel treatments are planned for areas that are currently covered by NEPA compliance documents. A multi-year plan for non-fire fuels strategies is described in the Long-term Fuels Treatment Plan.

Biomass Disposal

The material generated by manual and mechanical fuel reduction will require disposal methods that will be determined by project locations and access. As projects move greater distances from road and trail access, it becomes necessary to implement on-site disposal techniques. This will usually take the form of slash pile creation with pile burning occurring at a time when adequate moisture is present to prevent fire spread beyond individual piles. All pile burning activities will be conducted in accordance with guidance set forth in the NPS Reference Manual #18, the FWS Fire Management Handbook, and TNC Fire Management Manual.

Whenever feasible, material that is deemed appropriate for firewood will be separated or removed from the project site and will be made available to the public through a special use permit system. Material that is greater than 3 inches in diameter may also be used for Park, Refuge, and/or Ranch projects or potentially used as a goods-for-services payment to offset the costs for treatment work completed by contractors.

The program will generally involve construction of shaded fuel breaks in areas adjacent to values at risk that are designed to provide defensible areas from which fire suppression efforts may be based. These fuel breaks will provide an anchor point from which further fuels treatments may be sequenced. This will include the potential use of additional manual and mechanical fuel reduction and/or prescribed fire.

Monitoring and Evaluation

Fuels and vegetation monitoring is a critical element in the successful implementation of the fuels management program. Data gathered from monitoring plots allows managers to determine if fuels reduction objectives are being met. This monitoring data is essential to evaluating if projects are achieving objectives, allowing for the assessment of changes in vegetation structure and composition, and the detection of undesirable effects from project implementation.

To accurately measure project success, manual and mechanical treatment plots will be installed in areas that are to be treated. These plots will provide information on

vegetation and fuel conditions for the pre-treatment and post-treatment environment. This data will also be used to assess achievements and determine overall effectiveness of treatments for future project refinement. Permanent photo points may also be used to provide an additional source of information.

The protection of the natural and cultural resources will remain a high priority in all fuels reduction activities. Specific mitigation measures have been established in the 2005 EA/AEF, which provides regulatory compliance for the implementation of these various types of projects. These measures should be adhered to during all such activities.

EMERGENCY STABILIZATION AND REHABILITATION

Large wildland fires that involve suppression actions or resource damage may necessitate rehabilitation efforts. Rehabilitation will conform to policies identified in each agency's and organization's management policies. Rehabilitation efforts will likely be required where the impacts of the fire or associated suppression actions to human life, physical improvements, cultural resources, and threatened or endangered species are considered significant and where those efforts have a high likelihood of success in mitigating those impacts. If the minimum impact suppression actions are used, only minimal rehabilitation will be necessary.

The Park, Refuge, and Ranch will utilize the least intrusive stabilization, rehabilitation and restoration actions required to mitigate actual or potential damage caused by wildland fire. Erosion following wildland fire is an element of natural landscape change and should not necessarily be viewed as a deleterious effect, especially in natural areas. Natural recovery by native plant species is preferable to seeding. In most cases, burned areas will not be seeded; residual seed and sprouting from surviving rootstalks will provide natural revegetation. This is far superior to any introduction of even "native" seeds. Seed-bearing materials cut along the line can be scattered on top of the fireline that improves the likelihood of indigenous seed dispersal in the desired area. Seeding should be used only when approved to prevent unacceptable erosion or to resist competition from exotics or invasive species. Annual ryegrass or a sterile wheatgrass may be used to control erosion. Consideration should also be given to the use of organic mats for controlling erosion.

Mitigation of damage caused by fire suppression activity will be specified in incident action plans. Burned area emergency rehabilitation plans will be prepared as necessary to specify long-term actions for mitigating the deleterious effects of wildland fires.

Park and Refuge management will play an active role in approving suppression and/or holding actions on Federal lands. The Delegation of Authority to Incident Commander, the Wildland Fire Situation Analysis, and/or the Wildland Fire Implementation Plan are key components in this process. Rehabilitation efforts will include (but are not be limited to):

- flush-cutting all stumps that are cut with a chainsaw
- water-barring any constructed line where erosion is likely
- re-contouring any line trenches
- spreading any material piled in berms along fireline
- raking debris over constructed fireline
- removing any abandoned supplies, equipment, or garbage, and rehabilitation and cleanup of spike camps, helispots, or drop points.

Rehabilitation of firelines and other efforts to control erosion will start as soon as possible, perhaps even before a fire is declared out. The "Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook" will be the primary source of guidance for FWS and NPS on emergency stabilization, rehabilitation and restoration policies and procedures on Federal lands, and will be implemented as prescribed in NPS's Reference Manual #18 and FWS's Fire Management Handbook. Planning, funding, and timing requirements for fire suppression activity damage and burned area emergency rehabilitation are specified in NPS's Reference Manual #18 and FWS's Fire Management Handbook.

CHAPTER 5: ORGANIZATIONAL AND BUDGETARY PARAMETERS

This chapter discusses organization and budgetary parameter as they relate to the Greater Sand Dunes Interagency Fire Management Plan (FMP). The National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), and The Nature Conservancy (TNC or the Conservancy) are responsible for managing their respective lands included within the scope of this plan. Respective lands per agency include the Great Sand Dunes National Park and Preserve; the San Luis Valley National Wildlife Refuge Complex; and the Medano-Zapata Ranch, respectively. This plan identifies the organizational requirements and budgetary parameters necessary to conduct an effective fire management program.

Great Sand Dunes National Park and Preserve is located within the NPS Intermountain Region. The Park and Preserve are supported by Rocky Mountain National Park as a component of the Colorado Front Range Park Group. Park Group establishment is based on attributes including location, program complexity, and related others. The Colorado Front Range Park Group is currently recognized by the NPS FIREPRO analysis process.

The San Luis Valley (SLV) National Wildlife Refuge Complex, including the Alamosa, Monte Vista, and Baca NWR, is located within the FWS Mountain Prairie Region. The Complex is also part of the Colorado Fire Management District.

The Medano-Zapata Ranch is included in the Colorado Chapter of the Conservancy's San Luis Valley Program. Portions of the Medano Ranch will be transferred will at a

later date to the NPS and the FWS.

Fire Management Coordination Group (FMCG)

The Fire Management Coordination Group (FMCG) is established to implement FMP wildland fire management operational components. The FMCG is intended to coordinate FMP implementation and to augment the actions of pre-existing interagency agreements. This group is not intended to replace or supplant the SLV Fire Planning Unit Group or the Pueblo Interagency Dispatch Center Board of Directors.

The FMCG is composed of representatives from each of the management units, along with other critical support personnel and cooperating entities. The FRCG initially includes the following positions:

- Chief Ranger, Great Sand Dunes National Park and Preserve
- Fire Management Officer, Rocky Mountain National Park (advisory)
- Refuge Operations Specialist, San Luis Valley National Wildlife Refuge Complex
- Zone Fire Management Officer, FWS Mountain Prairie Region (advisory)
- San Luis Valley Project Director, San Luis Valley Program of TNC (advisory)
- Fire Program Manager, TNC - Colorado Field Office (advisory)
- FMO or designee, USFS/BLM (advisory)
- District Forester or designee, Colorado State Forest Service (advisory)

The FMCG will meet a minimum of twice a year, or more frequently as needed. All FMCG members, including those serving in advisory roles, may request additional meetings. The FMCG will designate a chairperson annually (by calendar year). The position of chairperson will rotate between each unit's active FMCG members (those members serving non-advisory roles), in the order of FMCG membership (see above).

The FMCG serves as the focal point for strategic fire management planning for all wildland fire management and fuels management activities, and thus, is responsible for ensuring that preparedness, suppression, hazard fuel reduction, prescribed fire implementation, and managing wildland fires are coordinated in a mutually beneficial method. Under the authority of the FMP, the FMCG will complete the following wildland fire management program activities:

- Coordinate initial and extended attack pre-planning by establishing a clear line of authority between Incident Commanders and the unit(s) involved. The Fire Duty Officer concept will be utilized.
- Coordinate annual preparedness and fuels management budget submittal(s), including community assistance and rural fire assistance line items.
- Evaluate fuel and weather conditions to ensure coordination of preparedness, wildland fire, and fuels management activities.

- Develop and maintain an organizational chart of personnel assigned to wildland fire and fuels management activities.
- Ensure that delegation of authorities is established annually for wildland fire and fuels management activities.
- Ensure that the interests of all units are considered in the implementation of Fire Program Analysis (FPA) in the San Luis Valley Fire Planning Unit (FPU).
- Conduct the annual review and, as necessary, revision of the FMP.
- Assist in the review of Annual Operating Plans for involved counties.
- Ensure that adjoining Federal, State, county, municipal, and local entities are kept apprised of fire management activities.
- Ensure that the Pueblo Interagency Dispatch Center is made aware of FMA wildland fire management operational activities
- As necessary, coordinate fire severity requests for the units involved with this plan, as well as the immediate neighboring agencies.

FUNDING

The NPS currently uses the FIREPRO wildland fire budget analysis tool. The FWS fire budget tool is currently FIREBASE. The budget analysis tool Fire Program Analysis (FPA) is scheduled to replace both in FY 2008. The Refuge Complex currently receives limited funding for its fire management program. Current funding is designated to support hazard fuel and WUI fuels reduction projects. FIREBASE analysis for the Colorado Fire Management District shows several permanent positions are needed but currently unfunded, including a Prescribed Fire Specialist and an Engine Foreman. The NPS currently funds a permanent, subject to furlough Engine Foreman. Each year, the FMCG, in coordination with regional and state offices, will seek funding from the interagency partners, including the CSFS, BLM, and USFS for seasonal engine crewmembers. At the time of FMP preparation, the CSFS has provided the wildland fire engine to this interagency effort, on a seasonal, loaned basis.

Both the FWS and the NPS provide a limited amount of funding to support the Pueblo Interagency Dispatch Center (PIDC). Support is mostly in the form of equipment and software purchases difficult for PIDC to purchase through USFS channels. In 2004, the FWS did fund a PIDC GS-5 Seasonal Dispatcher.

Funding to conduct individual fuels management projects and activities on Federal land is requested annually using the National Fire Plan Operations and Reporting System (NFPORS) process.

The Conservancy's Colorado Chapter will fund TNC employees and any approved fire management activity occurring on its properties. Funding for TNC-related expenses is apportioned and approved through the TNC funding process.

The Colorado State Forest Service contributes funds for support of Fire Management on state and private land.

FIRE MANAGEMENT PROGRAM RESPONSIBILITIES

The complexity and magnitude of the fire management program in the area requires the participation of many employees to accomplish the fire management goals. All employees must, by necessity, support the fire management activities outlined in this plan. All Federal employees are responsible for immediately reporting any possible fire, regardless of jurisdiction, to PIDC. TNC employees are to report any possible fire to the County Sheriff or call 911. During a potential wildland fire emergency, each unit will render all possible assistance, contributing personnel, equipment, and supplies.

All personnel working in federally funded positions will actively work to meet or exceed the specialized experience, incident management qualifications (as defined in the Wildland and Prescribed Fire Qualifications System Guide, PMS 310-1), required training, and developmental training as identified in the "Interagency Fire Program Management Qualifications Standards and Guide" (2004). The Nature Conservancy has also agreed to meet the standards in PMS 310-1.

The Red Book identifies the NPS and FWS wildland fire program organization and responsibilities. The Nature Conservancy's *Fire Management Manual* identifies its wildland fire program organization and responsibilities.

GREAT SAND DUNES NATIONAL PARK AND PRESERVE

Superintendent

Fire management in Great Sand Dunes National Park and Preserve is ultimately the responsibility of the Superintendent. The Superintendent is responsible to the Regional Director for the safe and efficient implementation of fire management activities with other agencies or landowners in accordance with delegations of authorities. The Superintendent will meet the required elements outlined in the Redbook.

His/her duties include:

- Ensuring that the program is managed within Departmental and Park Service policy, the NPS Wildland Fire Management Guidelines (Directors Orders #l8), Red Book, and all relevant legal compliance requirements.
- Responsibility for periodic assessment signatures to certify that continued management of wildland fire use actions is acceptable (this responsibility may be delegated to another organizational level).
- Ensuring that a comprehensive fire management program at the park is adequately planned and implemented, and that the FMP is reviewed annually, and revised as necessary.
- Approving individual prescribed burn plans and ensuring that hazard fuel reduction plans are completed.
- Ensuring that adequate suppression capabilities and training are maintained at a level that provides an adequate supply of qualified personnel for a normal fire year.
- Ensuring that both an appropriate delegation of authority and a transfer of command package are prepared for Wildland Fire Incident Management Teams.

- Maintaining public and media relations pertaining to wildland fire, prescribed fire, and fuels management activities.
- Ensuring effective cooperative relationships with other fire entities, adjacent landowners and inholders.
- Ensuring the implementation of a viable and effective fire prevention program.

Chief Ranger

The Chief Ranger at Great Sand Dunes National Park and Preserve is responsible to the Park Superintendent for providing guidance to the Fire Management Officer.

His/her duties are:

- Recommends approval of the FMP to the Superintendent.
- Assists the Fire Management Officer (FMO) in coordinating fire management activities with other park divisions.
- Briefs the Superintendent and others on current fire management activity.
- Consults with Resource Management Specialist on any fire-related research proposals or recommendations.
- Reviews project proposals and prescribed fire plans.
- Facilitates intra-divisional coordination of fire management actions with key personnel.
- Provides division support for wildland and prescribed fire activities.
- Maintains responsibility for public safety and law enforcement activities during wildland and prescribed fires.
- Recommends to the Superintendent and enforces area closures for fire restrictions when fire danger reaches critical levels.
- Ensures that identified individuals within the Division of Resource Protection and Visitor Management are available, prepared, and qualified to perform fire duties as requested by the FMO.
- Provides personnel and equipment support to implement prescribed fire activities.
- Responsible for serving as the agency representative at Multi-Agency Coordination Group meetings for the Pueblo Interagency Dispatch Center during critical wildland fire periods or designating a representative (usually the Colorado District FMO).
- Ensures that a Fire Duty Officer is assigned during the normal fire season to ensure that the staffing plan objectives are met and to provide technical assistance to Incident Commander(s) for incident management activities (safety, public information, operations, plans, finance, and logistics).

Fire Management Officer (Rocky Mountain National Park)

The Rocky Mountain National Park FMO will work with the Chief Ranger and Park Supertindent to perform the following duties and actions related to wildland fire management and fuels management activities at Great Sand Dunes National Park and Preserve, as defined in the inter-park agreement and accompanying Delegation of Authority.

His / her duties are:

- Coordinates all prescribed fire activities on NPS lands in accordance with approved plans.

- Formulates work plans and directs the implementation of non-fire fuels management activities in accordance with approved project proposals.
- Assures that only fully qualified personnel are used in wildland fire operations.
- Coordinates, prepositions, sends and orders fire and aviation resources in response to current and anticipated fire conditions.
- Coordinates with the Pueblo Interagency Dispatch Center on behalf of the NPS.
- Requests and oversees distribution of severity funding for park wildland fire activities.
- Reviews and approves fire program requests of overtime, hazard pay and other premium pay for work performed on wildland fires.
- Authorizes the use of management directed time-off to ensure the well being and safety of wildland fire personnel, as specified in the Interagency Incident Management Handbook.
- Ensures all incidents are managed in a safe and cost-effective manner.
- Coordinates and provides all fire and prevention information to provide internal and external individuals with necessary information.
- Coordinates all fire funding accounts with the Administrative Officer to assure agency and departmental fiscal guidelines are adhered to.
- Approves Red Cards and initiates taskbooks in accordance with NWCG, NPS, guidance identified in the Red Book.
- Authorizes the hiring of Emergency Firefighters in accordance with the Department of Interior Pay Plan for Emergency Workers.
- Ensures that an Agency Representative is assigned to wildland fires to work between Park Superintendent and Incident Commander (IC) of an Incident Management Team.
- Recommends to Chief Ranger possible closure of areas or restriction of fire use when fire danger reaches critical levels.
- Prepares and revises Annual Operating Plans with Saguache and Alamosa Counties.
- Reviews and certifies individual fire reports required by the Department of the Interior.
- Coordinates with designated Public Information Officer for news media activity related to wildland fire management.
- Reviews and analyzes fire research recommendations, makes recommendations for additions or changes to the research program.
- Prepares and administers the FMP.
- Provides overall direction for the annual fire program budget.
- Plans and develops fuels management actions, including wildland-urban interface hazard fuel reduction, ecosystem restoration projects, and all prescribed fire activities.
- For all wildland fires, serves as subject matter expert for all appropriate management strategies, including suppression strategies, ground and aerial tactics, and wildland fire use opportunities.
- For wildland fire use strategies, validates decision flowchart, analyzes implementation actions, prepares Wildland Fire Implementation Plan (WFIP), and recommends initial approval/daily assessment document to Park Superintendent.
- Prepares Wildland Fire Situation Analysis (WFSA) for any wildland fire suppression action that exceeds initial attack operations.

- Provides direction for all preparedness, prevention, detection, step-up, suppression, fire use, fire effects monitoring, fuel moisture sampling, and fuels management activities in the park.

SAN LUIS VALLEY NATIONAL WILDLIFE REFUGE COMPLEX

Project Leader

Wildland fire management in the National Wildlife Refuge Complex is ultimately the responsibility of the Project Leader. The Project Leader is responsible to the Regional Director for the safe and efficient implementation of fire management activities within the Refuge Complex, and to other agencies or landowners in accordance with current delegations of authority and Memorandums of Understanding. The Project Leader will meet the required elements outlined in the Redbook.

His/her duties are:

- Responsible for planning and implementing an effective interagency wildland fire management program on service lands under their jurisdiction.
- Ensuring that the program is managed within Departmental and Service policy, the FWS Fire Management Handbook, Red Book, and all relevant legal compliance requirements.
- In conjunction with fire management specialists, determines the level of interagency fire management effort required to meet the wildland fire management objectives of each unit.
- Ensure that an approved FMP is prepared for FWS lands under their jurisdiction.
- If the fire management program warrants, the Project Leader establishes a position to function as the Fire Management Officer (FMO) for the field office. If the fire management program does not warrant a FMO, the Project Leader will assign the fire management responsibilities to a staff member as a collateral duty. This staff member will meet fire management qualification requirements established by the service.
- Ensure that personnel hired in dedicated, fire funded positions are made available for dispatch to off-refuge and interagency wildland and prescribed fire management operations.
- Meets fire management training requirements established by the FWS for this position.
- Ensures that the wildland fire management program is managed within the requirements of the Departmental and FWS Fire Management Handbook, and that the program meets all relevant legal compliance requirements.
- Ensures that a comprehensive interagency fire management program at the Refuge Complex is adequately planned and implemented, and that the Interagency FMP is reviewed annually and revised as necessary.
- Approves prescribed fire project plans and signs or delegates signature authority for all Go/No-Go prescribed burning decisions.
- Ensures that adequate suppression capability and training is maintained with the purpose of providing an adequate supply of qualified personnel to handle a normal fire year.

- Ensures that both an appropriate delegation of authority and transfer of command package are prepared for wildland fire Incident Management Teams.
- Maintains public and media relations pertaining to wildland fire, prescribed fire, and fuels management activities.
- Ensures effective cooperative relationships with other fire entities, adjacent landowners and inholders.
- Ensures the implementation of a viable and effective interagency fire prevention program.
- Responsible for serving as the agency representative at Multi-Agency Coordination Group meetings for the Pueblo Interagency Dispatch Center (PIDC) during critical wildland fire periods or designating a representative (usually the Colorado District FMO).
- Delegates an Acting Project Leader in their absence.

Refuge Operations Specialist

The Refuge Operations Specialist (ROS) for the SLV National Wildlife Refuge Complex is responsible to the Project Leader for providing guidance to the Colorado District FMO.

His/her duties are:

- Carries out assigned fire management duties as a collateral responsibility. These duties include preparation for and implementation of initial attack of all wildfires and coordination of all prescribed fire and fuels management treatments on the refuge complex with the assistance of the Colorado District FMO.
- Reports directly to their Project Leader or designee for all wildland fire responsibilities.
- Recommends approval of the Fire Management Plan to the Project Leader.
- Assists the Colorado District FMO in coordination of fire management activities with other refuges.
- Briefs the Project Leader and others on current fire management activity.
- Consults with Refuge Complex Biologist on any fire-related research proposals or recommendations.
- Develops and/or reviews project proposals and prescribed fire plans.
- Facilitates coordination of fire management actions with key personnel within the Refuge Complex, the Colorado District FMO, the interagency community, and the public.
- Maintains responsibility for public safety and law enforcement activities during wildland and prescribed fires.
- Recommends to the Project Leader and enforces area closures for fire restrictions when fire danger reaches critical levels.
- Ensures that identified individuals within the Refuge Complex are available, prepared, and qualified to perform fire duties as requested by the Project Leader.
- May serve as the Project Leader's designated representative, if the Colorado District FMO is unavailable, for any Multi-Agency Coordination Groups needed during critical wildland fire periods within the Pueblo Interagency Dispatch Center sphere of influence.
- Formulates long-range work plans that include the use of wildland fire and/or mechanical treatments for Refuge Complex resource or fuels related needs.
- Works closely with the Colorado District FMO in planning and implementing a wildland fire management and fuels treatment program on the Refuge Complex.

- Coordinates all fire funding accounts with the Administrative Officer to assure agency and departmental fiscal guidelines are adhered to.
- Prepares and revises Annual Operating Plans with Saguache and Alamosa Counties.
- Prepares and administers the Fire Management Plan for the Refuge Complex.
- Ensures that a Fire Duty Officer is assigned during the normal fire season to ensure that the staffing plan objectives are met and to provide technical assistance to Incident Commander(s) for incident management activities (safety, public information, operations, plans, finance, and logistics).

FWS Colorado District Fire Management Officer

The Colorado District FMO is the delegated authority to act on behalf of the Project Leader for the following duties and actions related to wildland fire management and fuels management activities at the SLV National Wildlife Refuge Complex. In the absence of the District FMO, the Colorado Assistant District FMO or the CO/KS/NE Zone Wildland Urban Interface Coordinator may serve as the Acting District FMO.

His/her duties are:

- Assists the Refuge Operations Specialist (ROS) in coordinating all prescribed fire activities on FWS lands in accordance with approved plans.
- Assists the ROS in formulating work plans and directing the implementation of non-fire fuels management activities in accordance with approved project proposals.
- Assists Project Leader in assuring that only fully qualified personnel are used in wildland fire operations.
- Assists ROS in coordinating, pre-positioning, sending and ordering fire and aviation resources in response to current and anticipated fire conditions.
- Coordinates with the Pueblo Interagency Dispatch Center on behalf of the FWS.
- Assists ROS in requesting and overseeing distribution of severity funding for Refuge Complex wildland fire activities.
- Assists ROS in ensuring all incidents are managed in a safe and cost-effective manner.
- Approves Red Cards and initiates taskbooks in accordance with NWCG, FWS, guidance identified in the Red Book.
- Ensures that an Agency Representative is assigned to wildland fires to work between Park Superintendent and Incident Commander (IC) of an Incident Management Team.
- Assists ROS in preparing and revising Annual Operating Plans with Saguache and Alamosa Counties.
- Reviews and certifies individual fire reports required by the Department of the Interior.
- Reviews and analyzes fire research recommendations, makes recommendations for additions or changes to the research program.
- Assists ROS in preparation and administration of the Fire Management Plan for the Refuge.
- Provides overall direction for the annual fire program budget.

- Assists ROS in planning and developing fuels management actions, including wildland-urban interface hazard fuel reduction, ecosystem restoration projects, and prescribed fire activities.
- For all wildland fires, serves as subject matter expert for all appropriate management strategies, including suppression strategies, ground and aerial tactics, and wildland fire use opportunities.
- Prepares Wildland Fire Situation Analysis for any wildland fire suppression action that exceeds initial attack operations.
- Provides direction for all preparedness, prevention, detection, step-up, suppression, fire use, fire effects monitoring, fuel moisture sampling, and fuels management activities in the Refuge Complex.
- Assists the ROS in ensuring that a Fire Duty Officer is assigned during the normal fire season. The Fire Duty Officer ensures that the staffing plan is met and provides technical assistance to IC (s) for incident management activities (safety, public information, operations, plans, finance, and logistics).

MEDANO – ZAPATA RANCH

San Luis Valley Project Director

Fire management on the Medano-Zapata Ranch is the responsibility the Conservancy's Colorado Field Office San Luis Valley (SLV) Project Director. The SLV Project Director works closely with the Great Sand Dunes National Park superientendent and the SLV NWR Project Leader to ensure the fire management program on the Medano-Zapata Ranch is planned and managed efficiently and effectively.

His/her duties are:

- Serves as a resource advisor for fire management throughout the FMA and participates as an active member of the FMCG
- Ensures that the fire management program for the Medano-Zapata Ranch is managed according to the approved FMP and that all relevant legal compliance requirements are met.
- Ensures that a comprehensive fire management program for the Medano-Zapata Ranch is adequately planned and implemented and that the FMP is reviewed annually and revised as necessary.
- Recommends approval of the FMP to TNC Fire Program Manager.
- Provides overall direction for the annual fire program budget for the Medano-Zapata Ranch.
- Ensures effective cooperative relationships between TNC; local, state, and federal agencies; and Volunteer Fire Departments in regards to fire management for the Medano-Zapata Ranch.
- Ensures the implementation of a viable and effective fire prevention program for the Medano-Zapata Ranch.
- Maintains public and media relations pertaining to wildland fire, prescribed fire, and fuels management activities on the Medano-Zapata Ranch.
- Recommends area closures and fire restrictions within the Medano-Zapata Ranch when fire danger reaches critical levels. Closures and restrictions are

coordinated between all partners, county, and the USFS in accordance with the Pueblo Interagency Dispatch Center Fire Restriction Implementation Guide.
- Annually coordinates with Saguache and Alamosa Counties regarding fire related issues on the Medano-Zapata Ranch.
- Provides oversight for all preparedness, prevention, detection, step-up, suppression, fire effects monitoring, fuel moisture sampling, and fuels management activities on the Medano-Zapata Ranch.
- Works with the Saguache and Alamosa County Sheriffs Department and Volunteer Fire Departments to ensure protection of sensitive resources on the Medano-Zapata Ranch during fire suppression activities.
- Oversees the planning and development of fuels management actions, including wildland-urban interface hazard fuel reduction, ecosystem restoration projects, and all prescribed fire activities on the Medano-Zapata Ranch.
- Oversees the formulation of work plans and directs the implementation of non-fire fuels management activities on the Medano-Zapata Ranch in accordance with approved project proposals.
- Facilitates coordination amongst key personnel within TNCs Colorado Field Office regarding fire management activities on the Medano-Zapata Ranch.

Fire Program Manager

The Conservancy's Colorado Field Office Fire Program Manager provides overall fire management supervision and coordination for the geographic area for which he/she is designated. For this FMP, the Fire Program Manager works closely with SLV Project Director to ensure the fire management program on the Medano-Zapata Ranch is planned and managed efficiently and effectively.

His/her duties are:

- Serve as a resource advisor for fire management throughout the FMA in the Project Directors absence.
- Reviews all elements of the fire management program, and ensures that these actions are coordinated with various internal and external cooperators.
- Reviews and analyzes fire research recommendations, makes recommendations for additions, or changes to the research program.
- Provides Chapter support for wildland and prescribed fire activities.
- Coordinates all prescribed fire activities on the Medano-Zapata Ranch in accordance with approved plans.
- Authority to approve FMP and Prescribed Burn Plans.
- Authority to modify or exempt specific fire management guidelines or requirements as defined in the Conservancy's Fire Management Manual, with written justification.
- Evaluates and designates TNC Fire Leaders, in writing, with notification to the Fire Management Coordinator.
- Ensures that the Conservancy's fire operations guidelines and requirements are met or exceeded.
- Provides technical and scientific support for fire management to the Conservancy's SLV Program Director.
- Reviews proposed contracts for prescribed fire operations, and provides comments to TNC legal counsel.
- Approves qualifications of contractors hired to conduct prescribed burns.

OTHER POSITIONS AND RESPONSIBILITIES

PUEBLO INTERAGENCY DISPATCH CENTER

Duties are:

- Dispatches all fire management resources to wildland fires on FMA lands, and records all radio traffic concerning fires.
- Serves as initial contact point for smoke and fire reports on FMA lands.
- Provides interagency unit-wide communications for initial attack according to the Initial Response Plan.
- Provides interagency unit-wide communications for extended attack until such time as relieved of those responsibilities.
- Broadcasts daily preparedness level, fire danger level, and all prescribed and wildland fire activity in the Morning Radio Report.
- Broadcasts fire related updates as circumstances dictate (i.e. red flag warnings and significant meteorological updates).
- Maintains records of IC and number/type of resources assigned, as well as locations of ongoing fires. Fire personnel are responsible to keep the dispatchers current on fire conditions and logistics.
- Collects all relevant information (i.e. location, ownership, character of smoke or fire behavior) on any reported fire.
- Relays incident management information to the designated Fire Duty Officer for his/her action and facilitates the dispatch process by relaying messages from the local interagency dispatch centers.
- Notifies the appropriate individuals on the staffing and response plan (see Chapter 4 of this plan).

ASSIGNED WIDLAND AND PRESCRIBED FIRE OPERATIONAL POSITIONS

Fire Duty Officer (FDO)

To ensure daily coverage during normal fire season, a Fire Duty Officer (FDO) will be assigned by each Federal agency for lands under their jurisdiction. The designation will be shared with the Fire Management Coordination Group. The FDO will provide leadership to wildland fire response and incident management activities.

The FDOs primary duties are to ensure that elements of the Staffing Plan and Response Plan are met and that wildland fire personal are appropriately briefed. To prepare for these duties, the FDO will evaluate fire weather information and determine the appropriate preparedness level and fire danger rating. The FDO is also assigns a qualified IC to all wildland fires, ensures that a safe and effective initial response is conducted, provides guidance and support to the IC during all phases of incident management, and ensures that post-incident debriefings (After Action Reviews) are conducted. The FDO maintains communication with the Chief Ranger and the Refuge Operations Specialist during any initial response or incident management activities on Federal lands.

Incident Commander (IC)

An Incident Commander (IC) is assigned to all wildland fires on Federal lands, with qualifications commensurate to the wildland fire complexity. During the initial response, from assignment until the fire is declared out or until he/she is replaced, the IC is responsible for the wildland fire management effort and the safety of fire personnel. The IC is responsible for sizing up the fire situation and implementing an appropriate management response. The Incident Commander provides the initial fire size-up, the Individual Fire Report (DI-1202) and all fire-related time on the Crew Time Report.

A Fire Use Manager or ICType 4 (ICT4) is also assigned to all wildland fires being managed for resource benefits on Federal lands. The Fire Use Manager or ICT4 is responsible for all activities associated with managing the wildland fire until he/she transfers command of the fire or the fire is declared out. The Fire Use Manager or ICT4 will report to the Park Chief Ranger or Refuge Operations Specialist, or the designated Agency Representative as articulated in the Delegation of Authority executed by the Superintendent and Project Leader.

In the event that an Incident Management Team is ordered for a wildland fire on Federal land, the IC will devise implementation tactics that are consistent with this FMP, objectives and strategies contained in the Delegation of Authority, and other components as determined in the WFSA. He/she will remain aware of fire conditions, current and forecasted fire weather and burning indices, tactical progress and success, and the degree to which the fire meets resource management objectives.

Prescribed Fire Burn Boss

A Prescribed Fire Burn Boss will be assigned to all prescribed fires by each unit. The Burn Boss actively manages all phases of prescribed fires until he/she transfers command of the fire

or the fire is declared out. The Burn Boss will report to the Agency Administrator (or designee) or, if one is designated for the project, the Prescribed Fire Manager. Outside the Park or Refuge, the burn boss will receive a delegation of authority from the Superintendent and Project Leader, respectively.

Fire "Militia"

Federal units included within this FMP will train and maintain a reserve of firefighters from the general staff for support of initial attack, extended attack, local/regional/national mobilization, and prescribed fire support. Wildland fire management duties will be collateral to firefighter primary responsibilities. All fire personnel assigned to wildland fires will meet agency and departmental standards, meet the fitness qualifications required for their qualifications, and attend an annual 8-hour safety refresher course.

INTERAGENCY COORDINATION

The primary agencies cooperating with the interagency unit in fire management include:

- Rio Grande National Forest
- BLM Canon City
- Colorado State Forest Service
- Alamosa County Sheriff's Office
- Saguache County Sheriff's Office
- Monte Vista Volunteer Fire Department
- Alamosa Volunteer Fire Department
- Mosca-Hooper VFD
- Baca Grande Volunteer Fire Department
- National Weather Service
- Colorado Department of Health – Air Pollution Control Division.

The FMO(s) are responsible for coordination of fire management program activities with the other SLV agencies and organizations. The FMO(s) act as the FMA primary representative at interagency meetings and are responsible for communication with neighboring agencies during on-going wildfires.

Interagency Contacts

Agency	Position Title	Phone Number
Rio Grande National Forest	Fire Staff Officer	(719) 852- 6292
Rio Grande National Forest	Assistant Fire Staff Officer	(719) 655-2547
Rio Grande National Forest	Conejos FMO	(719) 274 -6316
Rio Grande National Forest	Divide FMO	(719) 657-6003
Rio Grande National Forest	Saquache FMO	(719) 655-2547
Bureau of Land Management	Same as USFS	(719) 852- 6292
Pueblo Interagency Dispatch Center	Center Manager	(719) 553-1600
Colorado State Forest Service	District Forester	(719) 587-0915
Colorado State Forest Service	State Forester	(970) 491-6304
Alamosa County	County Sheriff	(719) 589-6608
Rio Grande County	County Sheriff	(719) 657-4000
Saguache County	County Sheriff	(719) 655-2544
Colorado State Patrol		719.589.2503
Alamosa Fire Department	Chief	719-589-2593

FIRE RELATED AGREEMENTS

The Rocky Mountain Area Coordination Center (RMACC) is located in Lakewood, Colorado. The RMACC coordinates interagency fire management activities, for units are classified as being located within the Rocky Mountain Geographic Area, including the units covered by this FMP. Local (also referred to as “zone”) interagency coordination and dispatching is handled by the Pueblo Interagency Dispatch Center (PIDC).

The FWS and NPS are active members of the PIDC Board of Directors, which includes representatives of the Pike and San Isabel NF, Rio Grande NF, NPS, FWS, and CSFS. The purpose of this group is to provide a basis of cooperation among the various entities in all aspects of wildland fire management including prevention, education, training, suppression, and prescribed fire management. In addition, the core principles identified in “A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-year Comprehensive Strategy Implementation Plan” are incorporated into planning and implementation of fuels management projects. Equipment rental agreements and other wildland fire contracting details are updated annually and are located in the PIDC.

The NPS and FWS are a signatory to the Colorado Interagency Cooperative Fire Management Agreement, which is a written commitment to wildland fire management assistance and cooperation. This agreement also directs the individual counties of Colorado to prepare a countywide Annual Operating Plan (AOP) that addresses cooperation on a local level. An AOP is prepared each year for Alamosa, Rio Grande, Conejos, Costilla and Saguache Counties. The AOP is updated annually.

In the State of Colorado, the County Sheriff is responsible for wildland fire suppression on

private lands. Various wildland fire protection districts adjoin the Great Sand Dunes National Park and Preserve. Initial response to wildland fire is routinely conducted in these districts. It is the responsibility of the County Sheriff, or their designee, to become involved with a fire suppression activity if the incident increases beyond the complexity of a Type 4 or Type 5 incident, or as otherwise needed. Volunteer Fire Departments (VFD) adjoining the National Park and Preserve, as well as the Baca Refuge includes the Mosca-Hooper VFD and the Baca Grande VFD. For the Alamosa/Monte Vista NWRs, memorandums of understanding have been established with Alamosa and Monte Vista Fire Departments. The Colorado State Forest Service (CSFS) is responsible for assisting private landowners with designing and implementing fuel treatment and other risk reduction activities.

CHAPTER 6
MONITORING AND EVALUATION

SHORT AND LONG-TERM FIRE EFFECTS MONITORING PROGRAMS

Short and long term fire effects monitoring programs will be developed to assess the FMPs wildland fire management accomplishments and to determine the effects of fire management activities on cultural and natural resources. Monitoring the fire effects on natural and cultural resources will allow managers to determine whether fire management objectives are being met and if, not, when fire management strategies need revision. Monitoring fire efforts will be incorporated into the FMP adaptive management process.

The primary aim of these monitoring programs is to provide information to fire and resource managers, which allows them to determine whether treatment objectives (prescribed fire, fire use, or non- fire) are being met or to identify and correct deficiencies. Fire effects monitoring involves the systematic collection, documentation, and analysis of a variety of data such as fuel loading, vegetation structure and composition, topography, weather conditions, air quality, and fire behavior. Monitoring should, whenever possible, result in digital data including GIS-compatible data.

Wildland fire and resource staff will follow appropriate fire effects monitoring protocols to meet fire objectives. One example is the National Park Service Fire Monitoring Handbook (2003). However, as appropriate, other monitoring protocols may be used (for alternative fire monitoring protocols see Coulloudon et al. 1996, Elzinga et al.1998, Hall 2002a and b). Depending on treatment type, resource objectives, and variables to be monitored, a variety of monitoring techniques may be used. .

FIRE MONITORING LEVELS

Fire management activities will be monitored at the appropriate level with relation to the type and scale of each project. The NPS Fire Monitoring Handbook identifies four fire monitoring levels.

These levels include:

Level 1: Environmental Conditions

- Weather
- Fire Danger Rating
- Fuel Conditions
- Resource Availability
- Concerns and Values to be Protected
- Other Biological, Geographical, or Sociological Data

Level 2: Fire Observations:
Stage I: Reconnaissance

- Fire cause, location, and size
- Logistical information
- Fuel and vegetation types
- Current and predicted fire behavior
- Potential for spread

- Current and forecasted weather
- Resource or safety threats and constraints
- Smoke volume and movement.

Level 2: Fire Observations
Stage II: Fire Conditions

- Topographic variables
- Ambient conditions
- Fuel model(s)
- Fire characteristics
- Smoke characteristics
- Holding options
- Resource advisor concerns

Level 3: Short-term Change

- Fuel reduction
- Vegetative change within 2 years following a burn
- Other objective-dependent variables within 2 years following a burn

Level 4: Long-term Change

- Continued monitoring of Level 3 variables to measure trends and change over longer periods of time.

Monitoring data will be archived and reviewed for future refinement of target conditions and treatment prescriptions. Managers and staff will also use wildland fire and fuels treatment data to analyze program success and effectiveness by evaluate the actions and effects of the previous fire seasons, examine monitoring results, and incorporate new information into the management strategy. Data collected on the Park and Refuge will also be measured against the National Fire Plan and 10-Year Comprehensive Strategy Implementation Plan.

CHAPTER 7
WILDLAND FIRE RESEARCH

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Ballesteros, M.W. 1981. The effect of fire on chemical and physical properties of soils in high elevation mixed conifer ecosystems in Colorado. Honors thesis (B.A.). Williamstown, MA: Williams College. 129 p.

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Clagg, H.B. 1975. Fire ecology in high-elevation forests in Colorado. M.S. thesis. Fort Collins, CO: Colorado State University. 137 p.

Clements, F.E. 1910. The life history of lodgepole burn forests. USDA Forest Service, Bulletin No. 79.

Crane, M.F. 1982. Fire ecology of Rocky Mountain region forest habitat types. USDA Forest Service, Final Report Contract No. 43-83X9-1-884.

Donnegan, J.A. and A.J. Rebertus. 1998. Rates and mechanisms of subalpine forest succession along an environmental gradient. Ecology. 80(4):1370–1384.

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ONGOING WILDLAND FIRE RESEARCH

Fuels and vegetation mapping project

The primary objective of this study is to develop a fuels database and vegetation map for the Greater Sand Dunes FMA that will accurately described tree canopy as well as understory vegetation. This information will be used to generate the spatial data layers that are required to run the Fire Area Simulation (FARSITE) model and the Rare Event Risk Assessment Process (RERAP). This database will also include information about the physical characteristics of the fuels, thereby allowing utilization of fire effects models as well as smoke production and transport models.

The vegetation and fuels mapping uses standards, procedures and contracts established by the USGS Biological Resources Division, and the NPS Inventory & Monitoring program. The work includes acquisition of new aerial photography, air photo interpretation, statistical accuracy assessment and GIS database creation.

Needed fire research

The FMA has considerable need for fire information, and the Fire Management Plan outlines a great many mechanisms for collecting information. Some of the mechanisms involve routine data-gathering, some are a process of development and application, and some require in-depth research. It is important not to confuse these different needs. It is not necessary, for example, to contract for research to collect fuel samples, determine fuel loading, monitor rate of spread, or revise the Fire Management Plan. Similarly, the park will not attempt to go beyond routine data-gathering and technology transfer to

undertake original research. Thus, the park can and should use the FARSITE (Fire Area Simulator) and BEHAVE computer programs to monitor and project prescribed fires, but testing the effectiveness of fuelbreaks against simulated fires may be considered a research activity.

Among park research needs are the following:

- Smoke production from on-going fires. Smoke management will probably be the most difficult part of the park's fire management program. Some capacity to project the quantity of particulate emissions (particularly those of 10 microns or less in size) will be helpful.
- Research is needed within the FMA to refine the current understanding of fire regimes and vegetation condition classes in the Greater Sand Dunes landscape. Maps relating to fuels and vegetation types also need to be prepared and or updated. Research regarding the effect of fire and wildland fire management activities on FMA resources and vegetation types is also needed.

- Effectiveness of fuelbreaks and fuel reduction zones.
  Fuelbreaks are not regarded as impenetrable barriers to fire, but they should, at least, alter fire behavior in such a way that control is easier. In particular, the fuels programs should reduce the likelihood of crown fire and the propensity for spotting. It would be useful to test the projects against simulated fires - originating both from within and outside the park -- to better determine how they will influence wildland fire behavior.

- Fire ecology, as related to lynx habitat. The relationship of fire to habitat maintenance is not well-understood in the park. However, some prescribed fires will influence the habitat of the lynx, and the near-permanent removal of natural (and historic) fires from many areas of the park argues for some enlarged program of prescribed burning. The timing and extent of such burning, however, needs to be determined.

  As the fire program develops, other information and research needs will surely emerge. Some researchers may wish to conduct studies in coordination with prescribed fires, and such wishes should be accommodated whenever possible. But fires themselves need not be considered research burns, and the park, while making the opportunity for study available, need not fund the project.

CHAPTER 8
PUBLIC SAFETY

Firefighter and public safety is the first priority in every fire management activity. Firefighter and public safety always takes precedence over property and resource loss. The NPS Reference Manual #18, FWS Fire Management Handbook, and TNC Fire Management Manual each outline safety issues that are critical to wildland and prescribed fire management actions.

POLICY STATEMENTS FOR WILDLAND FIRE OPERATIONS

The following policy statements for wildland fire operations are accepted and endorsed by the Secretary of the Interior. These policy statements provide consistent wildland fire management practices among agencies involved with wildland fire operations:

- Firefighter and public safety is the first priority. All FMPs and activities must reflect this commitment.

- All fire personnel will meet appropriate training, experience, and qualification requirements for incident assignments including annual refresher training (See NWCG 310-1, Wildland and Prescribed Fire Qualifications System Guide).

- All fire personnel will be equipped with approved personal protective equipment (PPE) appropriate to their position.

- All wildland fire entrapments and fatalities will be reported using the current National Wildfire Coordinating Group (NWCG) initial entrapment/fatality report form.

- All wildland fire serious accidents will be investigated using the agency serious accident investigation procedures and interagency agreements, as appropriate.

- All agency personal will follow all safety policies, standards, and guidelines identified within the Interagency Incident Business Management Handbook (IIBMH), Fireline Handbook, Interagency Helicopter Operations Guide (IHOG), Interagency Standards for Fire and Fire Aviation Operations (Red Book), and Incident Response Pocket Guide.

INHOLDINGS AND NEIGHBOORING PROPERTIES

In the event of a wildland fire, the Park, Refuge, Ranch, and/ or local fire cooperators will provide the Park, Refuge, and/or Ranch inholders and neighboring property owners with accurate fire information, including details such as the current status of suppression or monitoring activities. When fire behavior predictions indicate that a fire may cross property boundaries, occupants in the potentially affected area will be notified as early as possible. If necessary, the evacuation of threatened areas outside the Park, Refuge, and/or Ranch will be accomplished by the County Sheriff with the cooperation of Park, Refuge, and/or Ranch staff.

Evacuation of in-holdings, if necessary, will also be accomplished with assistance from Park, Refuge, and/or Ranch staff. The Incident Commander (IC) of a wildland fire will assign resources to structure and property protection as appropriate.

VISITORS

When a fire is burning within the Park, Refuge, and/or Ranch or predicted to enter the Park, Refuge, and/or Ranch, decisions will be made regarding closures. Closures are justified by safety, fire danger, emergency pre-suppression step-up, or suppression concerns, or when visitors may interfere with suppression or monitoring efforts. Areas not threatened by the wildland fire itself, can still suffer the effects of drifting smoke, which may reduce visibility and cause traffic hazards. Traffic control and the proper placement of signs should adequately mitigate smoke problems on roads. However, road closures may become necessary to protect visitors. Road closures must be based on observed conditions, forecasted conditions, or the safety of firefighters and equipment using the roads.

On NPS lands, the Chief Park Ranger is responsible to the Superintendent for visitor protection activities and emergency operations. The Chief Ranger is responsible to coordinate wildland fire activities that involve visitor or public safety issues.

On FWS lands, Refuge Operations Specialist is responsible to the Project Leader for visitor protection activities and emergency operations. The Refuge Operations Specialist is responsible to coordinate wildland fire activities that involve visitor or public safety issues.

On TNC lands, the SLV Project Director is responsible for visitor protection activities and emergency operations. The SLV Project Director is responsible to coordinate wildland fire activities that involve visitor or public safety issues.

News Media

It is important for news media reporting about on fires in the Park, Refuge, and/or Ranch to understanding wildland fire conditions and wildland fire management decision-making. The news media is also important in raising public support for implementation and continuation of this wildland fire management program. However, news media personnel may expose themselves to hazardous situations and impair fire management efforts. To the greatest extent possible, the Park, Refuge, and Ranch will ensure that news media operate in a safe manner, and at the same time, are provided accurate information. For this reason, on Federal Lands, media personnel will be permitted to access portions of the affected area as deemed safe by the IC, Prescribed Fire Burn Boss, or Fire Information Officer, if accompanied by an incident representative. If news media personal are to be exposed to work environments with hazards, they must be fully outfitted with Personal Protective Equipment (PPE). The full outfitting of PPE is an effective way to impress upon news media personal the dangers of entering a hazardous area where conditions are not controlled. Coordination with the Air Operations Branch Director or the IC is critical to prevent unsafe news medial aircraft interference with incident aircraft.

Whether news media personnel report from aircraft, vehicles, or the ground, they must be

accompanied by knowledgeable personnel who can explain suppression/monitoring activities and can monitor fire activity and supervise escape if conditions deteriorate rapidly. Media personnel may be invited to fire training to become acquainted with fire behavior and fireline safety.

CHAPTER 9
PUBLIC INFORMATION

Fire Prevention and Community Education

Wildfire prevention is integrated into all management functions, including interpretation, visitor protection and maintenance. The primary goal of wildfire prevention is the reduction of fire suppression expenditures and damages from human-caused fires as well as meeting resource management objectives and fire management direction of the fire prevention program. Park and Refuge designated FMOs, or their designees, will continue to provide fire refresher training for agency personnel, post fire prevention signs throughout the FMA, and share current and expected fire hazard status with agency personnel and local volunteer fire departments.

Visitor information specialists will provide current and expected fire risk information to visitors to the Great Sand Dunes National Park and Preserve and SLV National Wildlife Refuge Complex. Applicable portions of interpretive programs (e.g. safety messages) will explain the reasons for any fire restrictions or regulations. In addition, programs will utilize fire management policy to illustrate the beneficial aspects of wildland fire.

Signs are to be posted during extreme fire danger at trailheads, visitor centers, campgrounds, and entrance stations. Patrols will be upgraded within the campgrounds, picnic areas, and at backcountry campsites. Interpretive activities should include warnings regarding open fires, smoking, etc.

Camping in Great Sand Dunes National Park and Preserve is only allowed within the designated campground or in the backcountry by permit and is currently not permitted in the National Wildlife Refuges except in Alamosa National Wildlife Refuge or at the Medano-Zapata Ranch. Within the Park, campfires are only allowed in fire grates at the campground and picnic area. Park roads and developments are patrolled several times daily. The Medano Pass Primitive Road is patrolled daily in the summer season. The park posts fire prevention reminders on public information boards in the campground and picnic area. Alamosa National Wildlife Refuge allows camping for permitted hunters in the fall, but no campfires are allowed. State and Federal laws prohibit throwing any type of burning substance from a motor vehicle (i.e. cigarette, match, etc.). Fireworks are prohibited throughout the FMA.

The Park Superintendent, Refuge Project Leader, and/or The Nature Conservancy's San Luis Valley Project Director, or their designee, will be the contact for the media, including local radio stations and newspapers, and function as the Public Information Officer. The Park's, Refuge's, and Ranch's immediate neighbors will receive immediate notice of any fire which may cross the area boundaries.

Wildland Fire Community Grant Programs and Assistance Activities

Wildland Fire Community Risk Assessment: Currently, neither the National Park Service nor The Nature Conservancy has active wildland-urban interface projects on their properties. The Fish and Wildlife Service has completed an Assessment of Wildland Fuels at the Baca National Wildlife Refuge. This assessment looked at areas of hazardous fuels in both the wildland urban interface as well as throughout the San Luis Valley Refuge Complex. Project areas were identified through the assessment and include recommendations for non-fire fuels treatment and

prescribed fire (Appendix I). Also, information and education projects were identified.

The National Park Service 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. The Fish and Wildlife Service also has sponsored Rural Fire Assistance grants and provided grants within the San Luis Valley and surrounding regions to Monte Vista, Stonewall, Fisher's Peak, and Spanish Peaks in 2003. Community grant programs and assistance activities will be coordinated and reviewed by the FMCG on an annual basis.

In fiscal years 2001-2003, the National Park Service 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 former National 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 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 at TNC's Medano Ranch corrals.

Two subdivisions, Zapata and Baca-Grande are adjacent to the FMA, 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.

Alamosa and Monte Vista NWR have conducted several prescribed burns in the Wildland Urban Interface adjacent to the communities of Alamosa and Monte Vista. Since 2004 approximately 1000 acres have been burned. The objective was to reduce hazardous fuels in the WUI.

The Greater Sand Dunes Interagency Fire Management Planning Area (FMA) is located within a relatively sparsely populated area of the San Luis Valley (SLV). Between 1990 and 2003, an average of 285,250 individuals visited the Great Sand Dunes National Monument, ranging from a low of 235,305 visitors in 2002 to a high of 312,695 visitors in 1994 (NPS unpublished data). With the expansion of the National Monument to the Great Sand Dunes National Park and Preserve, the creation of the Baca National Wildlife Refuge, and The Nature Conservancy's (TNC or the Conservancy) acquisition of the Medano – Zapata Ranch, it is anticipated that visitation will increase in the coming years. It is therefore very important that all fire management activities be proactively and accurately communicated to the general public.

Each respective organization will assign a Public Information Officer (PIO) responsible for informing the public and the media about the park's fire management program. The PIO will also work cooperatively to serve as Fire Information Officers during wildland fire management activities or as liaisons with assigned Incident Management Team Information Officers.

FMA communications plans will identify and develop wildland fire communication plan objectives, audiences, key messages or talking points, and communication methods and tools, as required. FMA communication plans will follow the subsequent guidelines:

- The objectives of wildland fire information are to proactively provide the public, media, and Park, Refuge, and/or Ranch staff with accurate and timely information and to enlist public support for professional fire management practices.

- Audiences may include local residents, the local business community, Park, Refuge, and/or Ranch visitors, inholders, management, employees and volunteers, regional or national office staff, cooperating agencies, legislators, media, etc.

- Messages or talking points may include such topics as prescribed fire, fuel management activities, wildland fire use, wildland-urban interface issues, fire safety and prevention, Firewise and defensible space concepts, the Rural Fire Assistance Program, implementation of fire restrictions, etc.

- Communication methods or tools may include press releases, public service announcements, newsletters, signs, displays, web sites, direct mail, e-mail, telephone, and personal contacts, interpretive programs, public meetings, etc.

The PIO will also conduct public outreach activities and interpretive programs in coordination with its representative agency communication division. The Great Sand Dunes National Park and Preserve PIO will conduct public outreach activities in coordination with the Park's Interpretation Division. The FWS PIO will conduct public outreach activities in coordination with the Refuge Complex's Project Leader. The TNC PIO will conduct public outreach activities in coordination with the Conservancy's Colorado Chapter Media Relations Specialist and the San Luis Valley Project Director. Agency training programs will keep staff apprised of fire management activities and the ecological role of fire will be presented to seasonal interpretive employees and other divisions as requested. A site bulletin about fire management will be available within the Park and Refuge and updated as necessary.

The Park, Refuge, and Ranch will work in partnership with the Colorado State Forest Service and county governments, on communicating wildland-urban interface issues in surrounding communities.

Fire information and education efforts will be conducted on a year round basis. Prevention and fire information activities will increase as the fire danger and activity level escalates. As required, staff from other divisions may be recruited to assist with information duties. All Park, Refuge, and Ranch staff should have a basic understanding of fire management in order to respond to visitor inquiries or be able to properly direct them to obtain the requested information. Whenever possible, implementation of fire restrictions and closures will be closely coordinated with cooperating agencies to promote consistency and avoid confusion.

Special Orders and Closures

The purpose of restrictions and closures is to reduce the risk of human-caused fire

during periods of extended very high to extreme fire danger.

Authority: The Park Superintendent and Refuge Project Leader have authority to issue restrictions and closures of their respective lands. The Chief Ranger and Refuge Operations Specialist, who are responsible for implementation and enforcement of the restrictions, will be contacted for proper coordination prior to a decision to enter any level of restriction.

Fire restrictions or closures are not normally put into effect until after coordinating with other agencies (Federal, State, and County) in the local area. Reference the Pueblo Interagency Dispatch Center (PIDC) Fire Restriction Implementation Guide for more specifics. The objectives of the Fire Restriction Guide are:

- Develop a plan which standardizes and simplifies the process for initiating and rescinding fire restrictions for all agencies of the Pueblo Interagency Dispatch Area.
- Establish fire restriction areas which have easily identifiable and describable boundaries, and which enter the upper levels of fire danger periods at approximately the same time.
- Develop a media plan which reduces confusion, provides a coordinated interagency approach, and better informs the public of restriction status.
- Develop standard definitions of Stage I and Stage II Restrictions that are interagency acceptable, understandable by the public, and legally enforceable.
- Develop standard, measurable, and predictive fire danger criteria that provide managers direction concerning when and where to initiate or remove restrictions.
- Establish responsibility and time frames for dealing with the different phases of the plan.

The interagency communication and coordination aspects of this document are the critical factors for successful implementation.

When no restrictions are in place, normal fire prevention programs and public awareness of pending fire conditions will continue. The permanent orders on spark arresters and use of fireworks will be enforced. Fire plans in contracts and permits will govern operations of contractors and permittees.

Stage I Restrictions: Stage I restrictions involve prohibition of fires and smoking to developed campgrounds and other areas as authorized by permit. This restriction applies to all users, including agency work crews, permittees, and contractors.

Stage II Restrictions: Stage II restrictions involve prohibition of fires, smoking, and chainsaw use except where authorized by a Park or Refuge officer. This restriction applies to all users, including agency work crews and contractors.

Stage III Restrictions: Stage III restrictions involve closure of total Park, Refuge, and/or Ranch. Access is prohibited in effected zones except by written permit by an authorized Park or Refuge officer. Activities within the FMA will be governed by the order signed by the Park Supervisor and/or Refuge Project Leader.

Restriction Orders: Refer to **State OEM web site** for sample Restriction Orders: http://www.dola.state.co.us/oem/.

Rescinding Restrictions and Closures: Restrictions and Closures should be rescinded when the conditions that caused the implementation have lessened. These criteria should be reviewed carefully and the interagency communication and coordination should be to the same degree as the implementation process.

CHAPTER 10
PROTECTION OF SENSITIVE RESOURCES

Site-specific plans will be prepared for all prescribed fire and non-fire treatments. These site-specific plans will include the all of the required elements listed in the National Park Service (NPS) Reference Manual #18, the U. S. Fish and Wildlife Service (FWS) Fire Management Handbook, and The Nature Conservancy's (TNC or the Conservancy) Fire Management Manual, including the protection of sensitive features.

A Resource Management Specialist (and/or other staff as appropriate) will assist in consultation concerning impacts on endangered, threatened, or rare species, air quality issues, and other resource concerns and will assist in the development of the Wildland Fire Situational Analysis (WFSA). For Federal lands, a WFSA will be prepared for suppression fires that are not contained or controlled by initial attack forces, wildland fires being managed for wildland fire use that exceed prescription parameters, or prescribed fires that exceed prescription parameters. The WFSA is a decision making process that evaluates alternative management strategies against selected safety, environmental (including air quality), wilderness, social, economic, political, and resource management objectives.

The 2005 Environmental Assessment / Assessment of Effect (EA/AEF) provides compliance for numerous prescribed fire and hazardous fuels reduction projects. With the exception of unplanned wildland fires, all wildland fire management activities on Federal lands must comply with the protection of sensitive resource requirements outlined in the FMPs associated National Environmental Policy Act (NEPA) documents. Future fire management projects not covered by this NEPA documents will require further NEPA review, in accordance with departmental and agency policies.

MITIGATION AND MONITORING MEASURES

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 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; and
e. Compensating for the impact by replacing or providing substitute

resources or environments.

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 Complex Project Leader, Park Superintendent, or San Luis Valley Project Director, will determine prior to the start of any fire management action which of the mitigation measures listed below are necessary.

AIR QUALITY

The Clean Air Act (CAA), as amended, established federal regulation of air quality. 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 the NP and NWR system, as well as on other public and private lands. To this end, the act establishes requirements for areas failing to attain National Ambient Air Quality Standards (NAAQS). It also provides for prevention of significant deterioration of areas where air is cleaner than NAAQS. In addition, the CAA provide Federal land managers with the 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.

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

For Wildland Fire Use activities, APPCA Regulation Number 3 requires an unplanned fire ignition permit. 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 WFIP is also required before WFU is allowed. The WFIP includes one or more documents that are developed for each wildland fire managed under the National Wildfire Coordinating Group's WFU Implementation Procedures Reference Guide (May 2005). Conformance to the Guide is required on all wildland fire use fires on federal lands. This information is available online at: www.fs.fed.us/fire/fireuse/wildland_fire_use/ref_guide/wildland_Fire_Use_20050608.pdf).

The FMA 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 Air Quality Areas. Class II areas have less stringent air quality standards than Class I airshed. Slight increases in the concentrations of certain air pollutants over baseline conditions may be allowed. APPCA Regulation Number 3 provides information regarding the air quality standards in each of these classes.

WATER RESOURCES

Water resources (i.e. water quality and quantity) are considered important FMA resources. NPS and FWS policies require the 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, CWA Section 404 authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, the discharge of dredged or fill material into United States waters.

The former Great Sand Dunes National Monument prepared a water resources management plan in 1997. The water resource management plan provides a reference to the water resources found within the boundaries of the former monument and a program to address certain water resource issues (NPS 1997b). This report includes information regarding wetlands, water quality, groundwater, and water rights. The Conservancy prepared a report on the water resources of the Medano-Zapata Ranch. Their report provides a framework for understanding the ecological impacts of water management practices on Ranch property and its vicinity (Browne and Sanderson 2003).

In accordance with the CWA, the State of Colorado, through the Colorado Department of Health – Water Quality Control Commission, established surface water quality standards and designated use classifications for all surface waters. Water within Medano and Sand Creeks are classified as excellent in quality (NPS 1997b). Due to the FMAs lack of point sources of pollution, it is assumed that the water resources in the rest of the area are 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.

SOILS

The landforms throughout the FMA include the alluvial fans along the western flank of the Sangre de Cristo Mountains, an active sand 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. Throughout the FMA, the prevailing winds, which blow from the southwest, have deposited large amounts of sand from the San Juan Mountains. 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 tallest active sand dune field in North America is located within the FMA. The dune field covers approximately 39 square miles and reaches heights of over 700 feet. The dunes beautifully represent the interplay of physical forces and geologic processes. The FMAs variety of vegetation types also influence and are influenced by sand movement and characteristics of the soil and the geologic resources.

WETLANDS AND FLOODPLAINS

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, CWA Section 404 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. The SOF must also 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.

VEGETATION AND ECOLOGICAL SYSTEMS

The FMA contains an array of ecological systems, which reflect the areas varying elevation, topography, hydrology, soils, micro-climates, fire history, and human land uses. This variety allows for a diverse range of species to inhabit the FMA. 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 (see Chapter 1, Figure 3).

Historic land use has altered some ecosystems within the planning area; however, 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. Across the SLV, 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.

THREATENED, ENDANGERED, AND CANDIDATE SPECIES

The Endangered Species Act (1973) requires an examination of impacts on all federally-listed threatened, endangered, and candidate species. The Endangered Species Act, Section 7 requires all Federal agencies to consult with the FWS 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, NPS and the FWS 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 FWS 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 action area (Saguache and Alamosa Counties, Colorado). The species analyzed in the Biological Assessment were:

- Mexican Spotted Owl (*Strix occidentalis lucida*) – Endangered
- Yellow-billed Cuckoo (*Coccyzus americanus*) – Candidate
- Canada Lynx (*Lynx canadensis*) – Endangered
- Southwestern Willow Flycatcher (*Empidonax traillii extimus*) – Endangered
- Bald Eagle (*Halieaeetus leucocephalus*) – Threatened

CONSERVATION MEASURES/MITIGATION MEASURES

The following mitigation measures will be taken for all wildland fire and fuels management activities in order to minimize adverse impacts to threatened, endangered, and candidate species:

- All proposed actions in the identified areas for fuel treatments will be reviewed in detail though the agency (NPS or FWS) project planning process to ensure that the action is compliant with this BA and related NEPA documents.
- When considering prescribed fire or non-fire fuel treatment activities in suitable habitat for any listed endangered, threatened, or candidate species present, the FWS and/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.
- Wildland fire use events will be evaluated by the Agency Administrator, in consultation with his/her staff through the period fire assessment and Decision Criteria Checklist processes.

Conservation Measures Specific to the Southwestern Willow Flycatcher will be:

- Flycatcher surveys, performed by trained employees and following accepted protocols, will be performed prior to implementation of any FMP activities in potentially-suitable habitat.
- All fuels treatment work within suitable habitat, whether the habitat is occupied or not, would occur outside of the flycatcher breeding and migratory seasons.
- NEW – Fuels treatments in suitable flycatcher habitat will be coordinated among the FWS, NPS and TNC, to achieve a staggered treatment cycle, rather than treating the entirety of habitat over a short period of time. No more than 20% of the available suitable habitat within the FMA will be treated each year. The purpose of this Conservation Measure is to assure that at least some habitat is maintained in suitable condition in each year, and that habitat patchiness is maintained at suitable intervals so as to not deter use of the habitat by the Southwestern Willow Flycatcher. The detection of southwestern willow flycatcher in the action area would necessitate additional Section 7 compliance for any projects in the area.

Conservation Measure Specific to the Bald Eagle will be:

- As a conservation measure under the ESA, surveys will be conducted for Bald Eagles prior to implementation of any activity in or near eagle roosting habitat

(cottonwood galleries). If eagles are detected in the area, projects will be deferred until the eagles are no longer in the vicinity. Projects may be deferred indefinitely. If a Bald Eagle nest territory should be established in the action area (none have been documented to date), additional conservation measures will be employed to assure the FMP activities are compatible with eagle nest success.

Conservation measures specific to the Mexican Spotted Owl will be:

- Surveys for Mexican spotted owls, using accepted protocols, will be conducted prior to the implementation of any fuels treatment projects in potentially suitable owl habitat (i.e., dense mixed conifer forests on steep slopes [greater than 40%] or rocky canyons). The purpose of the surveys would be to document presence or absence of owls in the project area, with the possibility of redesigning the project or applying seasonal restrictions, if spotted owls are present.
- Fuels treatment project implementation plans in the Herard and Mosca FMUs will limit removal to smaller trees, maintain an overall multi-age class forest, and avoid the complete removal of downed logs and snags. Also, the total width of the treatment area will be the minimum necessary to meet fire management objectives. The intent is to find an appropriate balance between retaining forest conditions for potential owl occurrence versus achieving fuels management objectives.
- The use of spotted owl surveys prior to the fuels treatment can determine if owls are in the vicinity of the projects. If owls are detected, additional Conservation Measures, such as modifying the fuels treatment prescription and use of seasonal restrictions during the breeding season, may be applied to reduce or eliminate any indirect effects. The detection of spotted owls in the vicinity would necessitate additional Section 7 compliance for any projects in the area.

Conservation measures specific to the Yellow-billed Cuckoos will be:

- Surveys for Yellow-billed Cuckoos performed by trained employees will be performed prior to implementation of any FMP activities in potentially-suitable habitat.
- All fuels treatment work within suitable habitat, whether the habitat is occupied or not, would occur outside of the cuckoo breeding and migratory seasons.
- Fuels treatments in suitable cuckoo habitat will be coordinated among the FWS, NPS and TNC, to achieve a staggered treatment cycle, rather than treating the entirety of habitat over a short period of time. No more than 20% of the available suitable habitat within the FMA will be treated each year. The purpose of this Conservation Measure is to assure that at least some habitat is maintained in suitable condition in each year, and that habitat patchiness is maintained at suitable intervals so as to not deter use of the habitat by the Yellow-billed Cuckoo.
- Surveys for the Yellow-billed Cuckoos prior to the fuels treatment can determine if cuckoos are in the vicinity of the projects. If cuckoos are detected, additional Conservation Measures, such as modifying the fuels treatment prescription, may

be applied to reduce or eliminate any indirect effects. The detection of Yellow-billed Cuckoos in the vicinity would necessitate additional Section 7 compliance for any projects in the area.

Conservation Measures for Canada Lynx will be:

The higher elevation areas of the Mosca and Herard FMUs contain some lynx habitat, primarily in the spruce-fir forests. The Mosca and Herard FMUs will be managed as the Sand Dunes Lynx Analysis Unit (LAU) and habitat will be mapped in accordance with the lynx habitat mapping criteria used by the adjacent Rio Grande National Forest.

The Sand Dunes LAU (map on page 55) will be managed following the guidelines provided in the Lynx Conservation Assessment and Strategy (Reudiger et al. 2000) (LCAS):

1) Lynx Standard: If 30% of the lynx habitat within a LAU is currently in an unsuitable condition, no further reduction of suitable conditions shall occur as a result of vegetation management by federal agencies. Management actions such as timber sales, salvage sales, and prescribed fire will not change more than 15 percent of lynx habitat within a LAU to unsuitable condition within a 10-year period.

2) Lynx Standard: Within a LAU, maintain denning habitat in patches larger than 5 acres, comprising at least 10 percent of lynx habitat. Where less than 10 percent denning habitat is currently present within a LAU, defer management actions in stands that have the highest potential for developing denning habitat structure in the future. Lynx Guideline: Use field verification to document denning habitat suitability, quantity, quality, and juxtaposition with other important habitat components, such as water and foraging habitats; design projects to avoid impacts at times when suitable sites may be occupied as natal or maternity dens.

3) Lynx Standard: Allow non-fire fuel treatments (designed to reduce risk from wildfires to important resources or human assests in order to enhance opportunites for wildland fire use) only when stands no longer provide snowshoe hare habitat.

4) Lynx Standard: In aspen stands, apply harvest prescriptions that favor regeneration of aspen.

5) Lynx Standard: Where over-snow access is required, restrict use to routes designated by the NPS. Reclaim or obliterate unnecessary roads if not needed for other objectives as documented in the appropriate NEPA document. Lynx Guidelines: New trails and roads should be located away from forested stringers. Provide for effective closure in the initial design of new temporary roads, if continued use of the road is not needed to meet overall resource management objectives. Roads should not be built on ridgetops, saddles, and other areas identified as important for lynx habitat connectivity. At this time, no new roads or trails are proposed by the FMP and/or the Environmental Assessment.

6) Lynx Guideline: Within key landscape linkage areas maintain or improve conditions that allow for lynx movement.

7) Lynx Guideline: Retain standing dead trees and coarse woody debris during fuels management activities to provide for adequate future denning habitat.

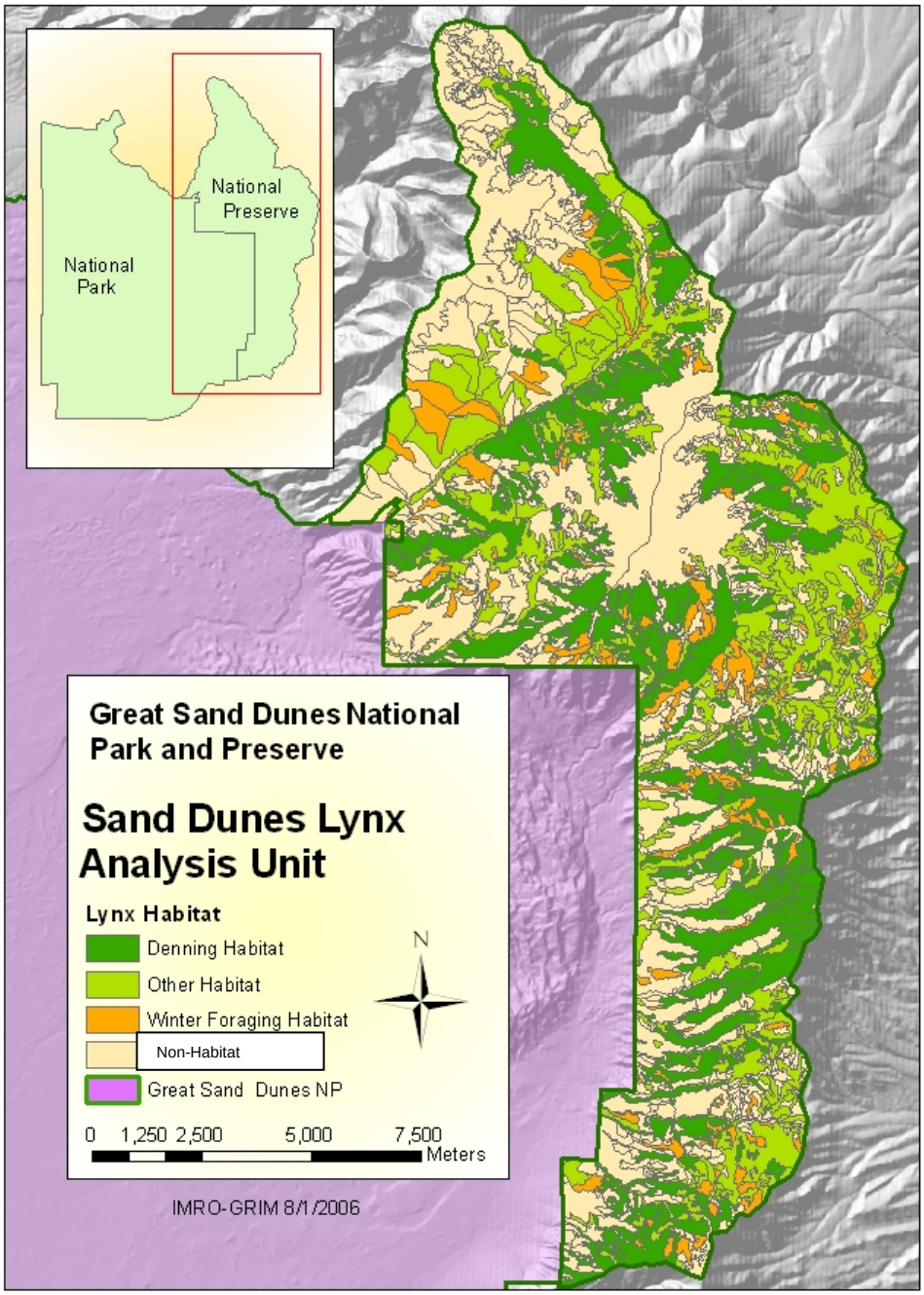
Historically, the spruce-fir and montane mixed conifer forest vegetation communities present within the project area have been largely undisturbed with little or no interruption in ecological processes, such as logging, timber sales, anthropogenic ignition of fires, etc.

The following Conservation Measures will be followed for the Canada lynx.:

- **Avoid and/or minimize helicopter activity associated with suppression activities, monitoring of WFU fires, and WUI fuels reduction treatments within 1.6 km (1 mile) of known active lynx den sites and/or suspected denning areas during the breeding season;**

- **Determine fire history and existing vegetation structure in the area during planning for WFU fires;**

Sand Dunes Lynx Analyis Unit (LAU) Map



- **Within areas of appropriate habitat, minimize the width of linear openings created as fuel breaks and soil disturbances;**

- **Locate backcountry firefighter camps at distances of > 1 mile (1.6 km) from identified active lynx dens;**

- **Leave clumps of dense coniferous stands of trees, shrubs, and woody debris to the maximum extent possible to provide cover for snowshoe hares within fuels treatment sites;**

- **Avoid implementation of non- fire fuels treatments within 1 mile (1.6 km) of known active lynx den sites and/or suspected denning areas during the breeding season, incorporating seasonal timing of denning and kitten mobility;**

- **Consider projected burn size, speed, pattern, and intensity, and terrain characteristics, as they relate to requirements of lynx and snowshoe hares**

It is recommended that the action agencies contact the Colorado Division of Wildlife lynx researchers prior to implementation of fuels treatments in the identified FMUs, to learn if lynx are in the area. This is recommended in order to adjust or change the project plans to reduce or eliminate any possibility of disturbing telemetered cats.

The action agencies will monitor the progress of the critical habitat designation for the lynx, in order to determine if any changes to the FMP activities are warranted. Section 7 consultation will be reinitiated if lynx critical habitat is designated in or near the action area of the San Luis Valley FMP.

At this time, there are no plant communities or vegetative associations within the National Park or National Preserve that should be considered “Currently Unsuitable” habitat for lynx.

In addition, the following table shows the amount of Lynx habitat and type of habitat (Table 22).

Table 22. Lynx habitat type and coverage within the preserve:

Habitat Type	Acres
Denning	10,796.1
Winter	2,957.9
Other Foraging	10,467.0
Currently Unsuitable	0.0
Total	24,221.0

To add clarification in regard to lynx habitat, there are currently no proposed fuels management projects defined in this Biological Assessment that are within lynx winter or denning habitat. If new projects or expansion of projects defined in this Biological Assessment, such as the continuation of the "Medano Road Treatment Area" are proposed within lynx habitat, additional Section 7 consultation with the U.S. Fish and Wildlife Service will be completed.

Additional clarification is needed relative to wildland fire use actions within the Herard and Mosca Fire Management Units. Consultation for new ignitions ("candidate" fires) with the U.S. Fish and Wildlife Service is not required. On an annual basis, the NPS Biologist will inform the Park Superintendent if, as the result of natural disturbance or other activity, the critical 30% threshold of impact to winter or denning habitat has been met within the "Sand Dunes Lynx Analysis Unit" and has become "Unsuitable" lynx habitat. If so, wildland fire use actions would be precluded pending habitat improvement and concurrence from the U.S. Fish and Wildlife Service.

During on-going wildland fire use events, the NPS may seek opinion from the U.S. Fish and Wildlife Service and neighboring land management agencies regarding the strategic plan of action defined in the Wildland Fire Implementation Plan for each individual wildland fire use event.

Additional clarification in regard to lynx "critical habitat" is provided in this paragraph. Although "critical habitat" has not yet been designated, there is no commitment by the NPS that there will be "no affect" to lynx "critical habitat" as a result of the proposed action. Rather, if "critical habitat" is designated, the NPS will reinitiate consultation with the U.S. Fish and Wildlife Service, relative to fire and fuels management actions.

OTHER WILDLIFE

A wide variety of wildlife species utilize the various habitats available throughout the FMA. Species lists of FMA fauna 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, Wildlife Refuge Complex, and Medano-Zapata Ranch. Additional species may also occur in areas that have not yet been surveyed and within the surrounding landscape. Relative to management of wildland fire and fuels management projects, no additional protection measures are proposed for wildlife species that are not threatened or endangered.

WILDERNESS

NPS wilderness management policies are based on provisions of the Organic Act and the Wilderness Act, as well as the enabling legislation of individual parks within the NPS system. As outlined in Director's Order #41 (DO-41), wilderness management programs and policies apply to parks that have suitable, study, proposed, recommended, and designated wilderness. According to the 2001 NPS Management Policies (6.3.1), all categories of wilderness are handled in the same manner. The policy states, "…the term 'wilderness' will include the categories suitable, study, proposed, recommended, and designated wilderness. Potential wilderness may be a subset of any of these five categories. The policies apply regardless of category."

The NPS will take no action that will diminish the wilderness suitability of an area recommended for wilderness study or for wilderness designation until all relevant legislative process are completed. Until the process is complete, management decisions pertaining to recommended wilderness and wilderness study areas will be made in expectation of wilderness designation.

The Baca Dunes FMU currently has 32,643 acres of designated wilderness area within the former monument boundaries. Potential wilderness areas include 2,363 acres, which include various parcels including areas along Sand Creek. These potential wilderness areas 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). The NPS does not have a final figure for the acreage that will be declared suitable for wilderness in the Great Sand Dunes National Park and Preserve. Neither the Baca NWR nor the Medano-Zapata Ranch contains wilderness areas. The here are no plans to designate any part of the Refuge as wilderness (B. DeVries, refuge operations specialist FWS, pers. com. June 23, 2004).

Fire management activities conducted in wilderness will conform to the basic purposes of these areas. This plan recognizes the need to integrate responsible wildland fire, ecosystem, and wilderness management practices, while providing for the protection of public safety and other valuable resources. The FMP identifies the natural and historical role of wildland fire in the wilderness. It also defines the appropriate management response to all wildland fires in wilderness areas, including the full range of management alternatives from aggressive suppression to wildland fire use (WFU).

CULTURAL RESOURCES

Humans have used the FMA landscape for approximately 10,000 years. Prehistoric and historic human material remains are located at all elevations and dispersed throughout the Park, Refuge, and Ranch. Great Sand Dunes National Park and Preserve and the FWS National Wildlife Refuge Complex work directly with the Colorado State Historic Preservation Office to guide compliance with National Historic Preservation Act (NHPA) with Section 106, for fire and fuel treatment activities. All cultural resources that are listed on, determined eligible for, or are unevaluated for inclusion on the National Register of Historic Places will be protected throughout the Area during ground disturbing activities. If activities associated with wildland fire suppression have the potential to affect cultural resources, the Park and/or Refuge archaeologist will be contacted. If the ground disturbing activities are associated with planned projects such as manual fuel reduction or site preparation for prescribed burns, the Park and/or Refuge archaeologist will be notified through the established project proposal process. Chapter 3 of this FMP identifies the specific known cultural resources known at the time of FMP preparation, per Fire Management Unit (FMU). Undoubtedly, additional undiscovered cultural resources exist within the FMA.

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

Direct effects from fire include consumption, smoke damage, and heat damage. While cultural resources are readily consumed by fire (wood, paper/cardboard, linoleum, petroleum product), others are not prone to consumption (lithic material, ceramics, metal, glass), but may be susceptible to damage by smoke or heat. Cultural resources, such as rock art, are particularly vulnerable to smoke damage. Table 23 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 in manual or mechanical fuel reduction projects. Indirect effects to cultural resources include increased erosion potential from the removal of vegetation and increased resource visibility, which may make the resource vulnerable to vandalism and/or more easily inventoried.

Table 23. 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 400-500°C for chert 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 500°C—oxidization, other color changes 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, discolorations, 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 327°C for lead 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. —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). —Erosion; alteration of drainage patterns. —Increased exposure to vandals, looters.
Dating Techniques and Other Information Potential	**Obsidian Hydration (OH), 350-430°C:** May destroy hydration rinds. **Thermoluminescence, 400°C:** Clock "reset", dating potential destroyed. **Archaeomagnetism, 750°C:** Clock "reset", dating potential destroyed. **Dendrochronology:** Datable wood consumed. **Radiocarbon (^{14}C):** Datable organics consumed (wood, bone, plaster, blood, etc.); modern charcoal can be mixed with ancient charcoal (destroys dating potential). **Ceramic Cross-dating:** If discoloration/blackening is sufficient, items cannot be typed, thus cannot be used to determine dates for sites/features. **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, and 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.*

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

Archeological resources and historic structures may also 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.

In addition, 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 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. In addition, consultation with the Colorado SHPO to develop a survey strategy to identify and avoid archeological resources and historic structures during fuel reduction projects will also mitigate impacts. Finally, 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 will also help to mitigate impacts to archeological resources and historic structures.

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.

Cultural landscapes may also 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.

In addition, 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 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. Other mitigation measures include avoidance and fuel reduction around any potential cultural landscapes, as well as implementing 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.

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.

Ethnographic resources may also 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.

Also, 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 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. Mitigation measures may also include consultation with ethnographically affiliated groups and the Colorado SHPO to develop a survey strategy to identify and avoid ethnographic resources during fuel reduction projects, as well as implementing 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.

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.

CHAPTER 11
FIRE CRITIQUES AND ANNUAL PLAN REVIEW

Wildland fire and prescribed fire critiques and reviews will be conducted in accordance with the NPS Reference Manual #18, FWS Fire Management Handbook, TNC Fire Management Manual, and the Interagency Standards for Fire and Fire Aviation Operations. Critiques and reviews will adhere to the following guidelines:

- All wildland fires and fire-related incidents will be reviewed in accordance with agency standards. All prescribed fires will be reviewed as appropriate.

- Reviews are conducted for one or more of the following purposes:
  - To examine the progress of an on-going fire incident and to confirm effective decisions or correct deficiencies.
  - To identify new or improved procedures, techniques, or tactics.
  - To compile consistent and complete information to improve or refine park, regional, or national fire management programs.
  - To examine unusual fire-related incidents in order to determine cause(s), contributing factors, and where applicable recommends corrective actions. If negligence is indicated, the circumstances will be reported and investigated in accordance with applicable regulations, policies or guidelines.
  - To determine the cost effectiveness of a fire operation.

- The authority to convene a fire review for their respective jurisdictions rests with the Park Superintendent, Intermountain Regional Director, NPS Associate Director of Park Operations and Education, Refuge Project Leader, and/or SLV Project Director, among others.

It is the clear responsibility of the Park Superintendent, Refuge Project Leader, and/or SLV Project Director to call for a review, to ensure timely completion, and to implement recommended actions.

The NPS Intermountain Regional Director, FWS Mountain Prairie Regional Director, and TNC – Colorado Fire Program Manager among others has responsibility to follow-up with the Park Superintendent, Refuge Project Leader, and/or SLV Project Director (respectively) that reviews are established and completed in a timely manner, and that recommended actions are completed.

The Park Superintendent, Refuge Project Leader, and/or SLV Project Director may request technical support from NPS Fire Management Program Center, Intermountain Regional Office, Park, Refuge, Ranch, or interagency personnel with the appropriate expertise (see Red Book for more information regarding wildland fire review).

- All wildland fire incidents which result in human entrapment, fatalities, or serious injuries, or result in incidents with potential, will be investigated and reviewed.

- The NPS Associate Director of Park Operations and Education, FWS Deputy

Regional Director for Refuges, and TNC Colorado Associate State Director will convene an ad-hoc team to review fire management programs subsequent to the occurrence of any significant, controversial or unusual wildland fire management activities.

- All reviews will be conducted as constructive critiques aimed at determining the facts related to the specific fire or fire management program. They will identify commendable actions, techniques and decisions as well as areas that need improvement. Reviews are intended to resolve operational issues, not impose punitive actions.

The FMA, through the FMCG, will review and update the fire management plan annually by March 1. This review is essential to ensure that the plan continues to conform to current laws, objectives, procedures, and strategies. A plan revision, and a review of NEPA compliance, is required by agency policy every five years.

CHAPTER 12
CONSULTATION AND COORDINATION

The Greater Sand Dunes Interagency Wildland Fire Management Plan (FMP) for Great Sand Dunes National Park and Preserve, San Luis Valley National Wildlife Refuge Complex, and The Nature Conservancy's Medano-Zapata Ranch is prepared based upon the fundamental principles set forth in Federal, departmental, agency, and organizational resource and fire management policies.

The information contained within this document is organized to conform to the format identified in the NPS Reference Manual #18, Chapter 4, as well as the FWS Fire Management Handbook and the TNC Fire Management Manual. The individuals and organizations that were consulted in the development of the Environmental Assessment/Assessment of Effect are identified in that document. The individuals and organizations that contributed to the development of this FMP are listed in Table 24.

Table 24. Individuals and organizations that contributed to development of the Greater Sand Dunes Interagency Wildland Fire Management Plan (FMP).

Name	Role	Title	Agency	Office
Brian DeVries	Planning and Design	Refuge Operations Specialist	FWS	Álamosa/Monte Vista/Baca Wildlife Refuges
Ken Kerr	Planning and Design	Zone Fire Management Officer	FWS	Lakewood
Richard Sterrt	Planning and Design	Fire Planning Specialist	FWS	Lakewood
Jim Bowman	Planning and Design	Chief Ranger	NPS	Great Sand Dunes National Park and Preserve
Fred Bunch	Planning and Design	Resource Specialist	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 Specialist	NPS	Intermountain Region
David Niemi	Planning and Design	Crew Superintendent, Alpine IHC	NPS	Rocky Mountain National Park
Eva Long	Planning and Design	NEPA	NPS	Denver

Name	Role	Title	Agency	Office
		Coordinator		
Lisa Hanson	Contributing Author	NEPA Coordinator	NPS	Denver
Boyd Lebeda	Planning and Design	District Forester	CSFS	Formerly Alamosa/Currently Fort Collins
Jim Jaminet	Planning and Design	Fire Management Officer	USFS	Rio Grande National Forest
Terri Schulz	Planning and Design	Conservation Ecologist	TNC	Boulder
Paul Robertson	Planning and Design	San Luis Valley Project Director	TNC	Medano-Zapata Ranch
Ernst Strenge	Project Coordinator/ Planning and Design	San Luis Valley Restoration Coordinator	TNC	Boulder
Christina Supples	Planning and Design	Ecologist Technician	TNC	Boulder

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APPENDIX B: DEFINITIONS

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.

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 pre- defined geographic areas outlined in Fire Management Plans. Operational management is described in the Wildland Fire Implementation Plan (WFIP). Wildland fire use is not to be confused with "fire use," which is a broader term

encompassing more that just Wildland fires (see definition below):

Fire Use: The combination of wildland fire use and prescribed fire application to meet resource objectives.

Wildland Urban Interface: The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

APPENDIX C: SPECIES LISTS AND OTHER KEY ASPECTS OF BIODIVERSITY IN THE GREATER SAND DUNES FMU

Table C- 1. Species, Plant Communities and Ecological Systems of Biodiversity Significance Within Great Sand Dunes National Park and Preserve, Baca National Wildlife Refuge, and Medano- Zapata Ranch

Conservation Targets	**Global Rank**	**State Rank**
Plant Communities		
Alpine wetlands *Cardamine cordifolia – Mertensia ciliata – Senecio triangularis*	G4	S4
Blowout grassland *Redfieldia flexuosa*	G1?	S1?
Bulrush Wetland *Schoenoplectus pungens (Scirpus pungens)*	G3G4	S3
Coyote Willow *Salix exigua*/Bare ground	G5	S5
Emergent Wetland *Eleocharis palustris*	G5	S4
Indian ricegrass- scurfpea grassland *Oryzopsis hymenoides- Psoralidium lanceolatum*	G3Q	S1
Montane Aspen Forest *Populus tremuloides*/tall forbs	G5	S5
Montane Aspen Forest *Populus tremuloides/Salix drummondiana*	GU	SU
Montane Riparian Forests *Abies concolor – Picea pungens – Populus angustifolia/Acer glabrum*	G2	S2
Montane Riparian Forests *Populus angustifolia/Alnus incana*	G3	S3
Montane Riparian Forests *Populus angustifolia/Juniperus scopulorum*	G2G3	S3
Montane Riparian Forests *Populus tremuloides/Acer glabrum*	G2	S1S2

Conservation Targets	**Global Rank**	**State Rank**
Montane Riparian Forests *Pseudotsuga menziesii/Betula occidentalis*	G3	S3?
Narrowleaf cottonwood/Skunkbush *Populus angustifolia / Rhus trilobata*	G3	S3
Narrowleaf cottonwood/willow alder riparian *Populus angustifolia/Salix drummondiana- Acer glabrum*	G2?	S1
Narrowleaf cottonwood/willow riparian forest *Populus angustifolia / Salix lucida* var. *caudata*	G1Q	S1
Narrowleaf cottonwood sand dune forest *Populus angustifolia* sand dune forest	G1	S1
Needle- and- thread- Indian ricegrass grassland *Hesperostipa comata- Oryzopsis hymenoides*	G2	S1
Saline Bottomland Shrublands *Sarcobatus vermiculatus / Distichlis spicata*	G4	S2
Saltgrass Meadows *Sporobolus airoides*	G5	S3
Spring Wetland *Catabros aquatica- Mimulus* spp.	GU	S3
Subalpine riparian/wetland carr. *Salix brachycarpa/Carex aquatilis*	G2G3	S2S3
Thinleaf Alder/Mesic Forb Riparian Shrubland *Alnus incana*/Mesic Forb	G3G4Q	S3
Thinleaf Alder- Mixed Willow Species *Alnus incana*- Mixed *Salix* spp.	G3	S3
Two- Needle Pinyon/Scribner's Needle Grass Woodland *Pinus edulis / Hesperostipa scribneri*	G3	S2
Wet Meadow *Carex simulata*	G3	S3
Plants		
Catseye *Cryptantha pustulosa*	G5T?	S1
Canyon Bog Orchid *Limnorchis ensifolia*	G4G5T3?	S3

Conservation Targets	**Global Rank**	**State Rank**
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
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		

Conservation Targets	**Global Rank**	**State Rank**
American Bison *Bos bison*	G4X	SX
Gunnison's prairie dog *Cynomys gunnisoni gunnisoni*	G5T3	S3
Townsend's big- eared bat *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-Heron	*Nycticorax nycticorax*	C	S
	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
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	
	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
	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
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*

APPENDIX D: ENVIRONMENTAL AND CULTURAL COMPALIANCE DOCUMENTS

Cultural Compliance from SHPO
Finding of No Significant Impact – NPS
Finding of No Significant Impact - FWS

MITIGATION OF POTENTIAL ADVERSE EFFECTS

This section describes the mitigation and monitoring measures that will be implemented to reduce potential impacts to key resources from wildland fire management activities. The purpose of these mitigation measures is to minimize the degree or severity of potential adverse impacts caused by an fire management action to the key resources and their associated environments. According to the Code of Federal Regulation (40 CFR 1508.20) "mitigation" includes:

(1) Avoiding the impact: Circumventing certain action or portions of that action to minimize the adverse impacts caused by that action to the environment.
(2) Minimizing the impact: Limiting the degree/ magnitude of the action and its implementation on the environment.
(3) Rectifying the impact: Repairing, rehabilitating, or restoring the portion of the environment affected by the action.
(4) Reducing or eliminating the impact over time: Performing preservation and maintenance operations during the period of time within which the action will have potentially adverse impacts on the environment.
(5) Compensating for the impact: Replacing or providing substitute resources or environments to compensate for the adverse impacts caused by the action.

The appropriate mitigation and monitoring measures will be implemented in conjunction with all wildfire management activities. The intent of the mitigation measures is to avoid, minimize, reduce, and / or eliminate the impacts to resources from wildland fire management actions. The intent of the monitoring measures is to document the results of the mitigation actions.

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 that may occur to air quality as a result of wildland fire management activities:

- For all prescribed fire and wildland fire use operations, coordinate activities with the Air Pollution Control Division of the Colorado Department of Public Health and Environment. Prior to the start of a prescribed burn or WFU activity, obtain all required permits from the Department
- For all prescribed fire and wildland fire use operations, follow State of Colorado smoke management reporting and implementation procedures, 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. Actions include monitoring and documenting smoke dispersal, column mixing height, and 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.
- To manage potential smoke impacts, keep burn piles small, dirt free, and as dry as possible.
- On the day of a burn, reevaluate meteorological conditions to ensure that circumstances are favorable for smoke dispersion and that air quality standards will not be threatened. If conditions are unfavorable for smoke dispersal, postpone the burn.
- To minimize exhaust conditions, maintain mechanized equipment in good operating condition.
- Notify public of all prescribed fire and wildland fire use activities.

Water Resources

The following mitigation measures will be taken to minimize adverse impacts that may occur to water resources as a result of wildland fire management activities:

- To reduce the risk of increased sedimentation in streams, best management practices will be utilized.
- To reduce the risk of waterway contamination, fire retardant will not be applied within a 300-foot buffer zone around any waterway.
- To minimize the risk of gasoline or oil spills, chainsaws, vehicles, or other equipment will be maintained over ground protection. Refueling stations with ground protection will also be utilized
- MIST will be employed whenever possible.

Soils

The following mitigation measures will be taken to minimize adverse impacts that may occur to soils as a result of wildland fire management activities:

- To minimize or prevent erosion of disturbed soil during and after all fire management activities, natural barriers and wetlines will be utilized where feasible.
- To prevent soil movement, exposed soils will be rehabilitated where necessary during fire management activities. Measures include the installation of erosion-control devices on steep slopes and the coverage of bare soil .
- Use of a Burned Area Emergency Rehabilitation (BAER) team to identify specific mitigation measures during an on-site evaluation.
- MIST will be employed whenever possible.

Wetlands and Floodplains

The following mitigation measures will be taken to minimize adverse impacts that may occur to wetlands and floodplains as a result of wildland fire management activities:

- To limit impacts to wetlands, floodplains and riparian areas to the extent possible, these resources will be identified during the project planning period. Proposed project boundaries will be adjusted and if possible these resources will be entirely avoided.
- Equipment maintenance and fueling will not be conducted in wetlands or riparian areas.
- Slash will not be moved from upland sites to wetland or riparian areas or placed in open water without approval of resource specialist.
- The use of retardant and foam in or near wetlands or riparian areas will be avoided to the extent possible.
- MIST will be employed whenever possible.

Vegetation Health and Ecological Integrity

The following mitigation measures will be taken to minimize adverse impacts that may occur to vegetation health and ecological integrity as a result of wildland fire management activities:

- For management actions that may remove or disturb native vegetation and/or sensitive species, including the proposed locations of camps, staging areas, helispots, consult with natural resource specialists.
- When constructing control lines, 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.) to the extent possible.
- To restore native vegetation, utilize natural disturbance regimes and revegetation to the extent possible.
- When utilizing fire retardant and low-level aircraft, approval by the Refuge Manager or Park Superintendent must be obtained for each respective site.
- Keep fire lines to the minimum width necessary to allow backfiring or create of a safe blackline.
- To avoid unnecessary fire line construction, whenever possible, utilize natural barriers.
- Transport crews and equipment on established roads, whenever possible.
- To avoid resource damage, wherever possible, ensure that fire crews vehicles are parked in specified access areas and that project areas are accessed on foot within the Refuge, Park, and Ranch.
- Use wet lines in lieu of hand line construction when adequate water and pumps are available,.
- Rehabilitate all fire lines, camps, and other disturbances created during fire management activities including stabilizing slopes, and if necessary, re-seeding disturbed sites with native vegetation.
- Employ MIST whenever possible.

Threatened, Endangered, and Candidate Species

The following mitigation measures will be taken to minimize adverse impacts that may occur to threatened, endangered, and candidate species a result of wildland fire management activities:

- Where the presence of any listed endangered or threatened species is suspected, consult the FWS and/or NPS biologist to establish the need to survey for species occupancy.
- If species are found, steps will be taken to reduce or avoid impacts to the species, including a halting of activities during breeding or nesting seasons.
- USFWS Ecological Services will be contacted pursuant to Section 7 of the Endangered Species Act to ensure that appropriate and effective mitigation is implemented.

Wildlife and Wildlife Habitat

The following mitigation measures will be taken to minimize the adverse impacts that may occur to wildlife and wildlife habitat as a result of wildland fire management activities:

- Consult with a 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.
- To identify important wildlife resources in need of protection, conduct all necessary wildlife surveys as determined by FWS or NPS wildlife biologist prior to commencing fuels treatment or prescribed burn activities.
- Implement any fuels management programs, to the extent possible, outside the breeding and nesting season of most wildlife species.
- During fuels treatment activities, to the extent possible, avoid nests.
- Preserve the snags and fallen trees that can be retained without compromising wildland fire safety.
- During fuels treatment activities, to the extent possible, mark and avoid to the extent possible living or dead trees that show signs of active wildlife use (e.g. nests or occupied cavities).
- During fuels treatment activities, to the extent possible, do not disturb pinecone caches used by squirrels and other small mammals.

Non-native, Invasive Species

The following mitigation measures may be taken to minimize the introduction and spread of non-native invasive species that may occur as a result of wildland fire management activities:

- Prior to and following treatment, within the FMU, monitor for non-native and invasive plants.
- In all fire management planning efforts, incorporate measures that reduce the likelihood of non-native invasive introduction and spread. Measures include washing equipment prior to entering project site and limiting the overall disturbance area.
- Control or eradicate the non-native, invasive species with the FMU that are likely to invade following a fire management activity.
- During rehabilitation, utilize certified weed seed free straw.

Cultural Resources

For cultural resources, mitigation measures will be agreed upon by NPS, FWS, TNC personnel and the Colorado State Historical Preservation Officier (SHPO) office, on a project-specific basis. For wildland fire suppression actions, mitigation measures will be included in all treatment plans, WFIP, and Incident Management Plans.

The following mitigation measures may be taken to minimize adverse impacts to cultural resources that may occur as a result of wildland fire management activities. Additional mitigation measures may be developed and implemented in coordination with the SHPO. The mitigation measures include:

- Conduct project-specific Section 106 review and consult with SHPO
- Inventory and reporting will be completed by person(s) who meet the *Secretary of the Interior Standards*
- A Resource Advisor (READ), who meets the *Secretary of the Interior Standards,* will be assigned to WFU actions , prescribed burns, manual/mechanical fuel reduction projects, wildland fire suppression actions, and Burned Area Emergency Rehabilitation (BAER) as needed
- Protective tactics will be utilized in areas identified by NPS and FWS cultural resource specialists and/or ranch manager/personnel, as having cultural significance (e.g. archeological, historic, ethnographic, or landscape). Tactics to protect the resource, may include foaming or wetting the resource, wrapping it with fire-shelter fabric, installing a temporary sprinkler system, and black-lining the resource perimeter.
- Prior and during project implementation, locate and isolate historic properties that are vulnerable to fire, suppression, or manual/mechanical activities and in need of protection.
- Prior to implementation of project work, identify and protect/restore contributing elements of cultural landscapes.
- Work in coordination with Native American tribes and fire crews to identify and protect ethnographic resources.
- Work crews will be briefed regarding the need to protect any cultural resources encountered. Work crews will be informed to the illegality of collecting artifacts on federal and private land. A notification process will be created by which work crews can alert cultural resource specialist when new resources are encountered.
- Where appropriate, heavy fuels that may cause long-duration heating on and around cultural resources will be removed.
- Vehicle traffic will be confined to existing roadways.
- Avoid the aerial application of water or retardant to structures and structural remains.
- Slash will be disposed of away from the vicinity of cultural resources.
- During wildland fire suppression actions, route fire control lines around cultural resources.

Wilderness

For all fire management activities within designated and recommended wilderness areas, the following mitigation measures will be taken to minimize adverse impacts to wilderness resources that may occur as a result of wildland fire management activities:

- 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).
- Conduct initial attack actions using “minimum impact suppression tactics” (MIST).
- Heavy equipment, pumps, chainsaws, or off-road vehicles will not be utilized 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 the potential adverse impacts to socioeconomics, public health and safety, and recreational opportunities and visitation that may occur as a result of wildland fire management activities:

- Consider safety of the public, personnel, and fire crews as the highest priority for all fire management activities.
- Consider impacts of all fire management activities to socioeconomics, recreational opportunities, and visitation, including the impacts to local and regional businesses and economy.
- Ensure all fire personnel have had the proper training prior to a fire management project assignment.
- 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 the appropriate personal protection equipment for their incident assignment.
- Notify Park, Refuge, and Ranch neighbors and visitors, and local residents and businesses (“the public”) of planned and unplanned fire management activities that have the potential to impact the public. Notify the public about treatment activities using the procedures identified in project-specific work plans. Identified procedures 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, to the extent possible, within prominent viewsheds.

Wildland Urban Interface (WUI)

The following mitigation measures will be taken to minimize adverse impacts to the WUI that may occur as a result of wildland fire management activities:

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

COLORADO
HISTORICAL
SOCIETY

The Colorado History Museum 1300 Broadway Denver, Colorado 80203-2137

May 2, 2005

Steve Chaney
Superintendent
Great Sand Dunes National Park
11500 Highway 150
Mosca, CO 81146-9798

Re: Greater Sand Dunes Interagency Fire Management Plan

Dear Mr. Chaney:

This office has reviewed your April 25, 2005 correspondence and the environmental assessment for the project listed above.

We concur that the preferred alternative, Alternative 3, is better at managing the cultural resources within the Park and Preserve. We look forward to working with you as surveys and site specific plans are developed. We also concur with the no adverse effect determination to historic properties under Alternative 3.

If we may be of further assistance please contact Jim Green at 303-866-4674.

Sincerely,

Georgianna Contiguglia
State Historic Preservation Officer

GC/WJG

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Colorado Field Office
P.O. Box 25486, DFC (65412)
Denver, Colorado 80225-0486

IN REPLY REFER TO:
ES/CO: NPS/Sand Dunes
Tails: 65412-2006-I-0362

OCT 1 0 2006

Mr. Steve Chancy
Superintendent
Great Sand Dunes National Park and Preserve
11500 Highway 150
Mosca, Colorado 81146-9798

Dear Mr. Chaney:

The U.S. Fish and Wildlife Service (Service) received your letter and Biological Assessment (BA) on September 5, 2006, for the **Wildland Fire and Fuels Management Actions on the Baca National Wildlife Refuge and the Great Sand Dunes National Park and Preserve** in Alamosa and Saguache Counties, Colorado. An addendum to the BA was provided on September 29, 2006, via electronic mail. Your letter requested concurrence with your determination that the proposed plan may affect, but is not likely to adversely affect the bald eagle (*Haliaeetus leucocephalus*), Mexican spotted owl (*Strix occidentalis lucida*) (MSO), southwestern willow flycatcher (*Empidonax traillii extimus*) (SWWF), yellow-billed cuckoo (*Cocyzus americanus*), and the Canada lynx (*Lynx canadensis).* These following comments have been prepared under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C 1531 et. seq.) and the Interagency Cooperation Regulations (50 CFR 402).

The BA for the proposed Wildland Fire Management Plan (FMP) addresses prescribed fire, non-fire fuels treatments, and wildland fire use (WFU) in the combined areas of the Great Sand Dunes National Park and Preserve (GRSA), Baca National Wildlife Refuge (Baca NWR), and The Nature Conservancy (TNC) properties, plus the acreage of state-owned lands expected to be transferred to the Federal government. The managers/landowners of the state-owned lands intend to participate in the FMP process and would apply the same treatments and philosophy even if the transfer of state-owned lands does not occur. The FMP also addresses acreage on the Alamosa/Monte Vista National Wildlife Refuge through the Alamosa/Monte Vista NWR Complex Comprehensive Conservation Plan. ESA compliance on the Alamosa/Monte Vista plan was conducted separately and was completed in 2003.

The following text provides a brief summary of the BA:

The plan area is divided into three fire management units (FMUs): 1) Baca –Dunes FMU, which includes all lands in the Great Sands Dunes National Park, Baca NWR, and the Medano-Zapata Ranch; 2) Mosca FMU, which includes the southern portion of the Great Sand Dunes Preserve; and 3) Herard FMU, which includes the northern portion of the Great Sand Dunes Preserve.

Bald Eagle

Within the plan area, bald eagles use the Baca-Dune FMU for winter roosting, foraging, and migrating. No bald eagle nests are known to occur within the plan area. Fuels management will occur in bald eagle roosting habitat, but live cottonwoods, willows, or snags will not be removed. The treatments will consist of removal of dead, downed material and some shrubs in the vicinity of the cottonwood galleries at specific locations identified in the BA. A winter roosting site has been identified by the CDOW on Sand Creek near the western boundary of the park; no treatments are proposed in the vicinity of this roost site. Surveys will be conducted for bald eagles prior to implementation of any activity in or near cottonwood galleries. Additional conservation measures are provided in the BA.

Mexican Spotted Owls

MSO habitat is present in the Mosca and Herard FMUs. MSO have not been identified in the plan area, although not all areas of suitable habitat have been surveyed. Fuels treatments may occur in suitable habitat in the immediate vicinity of resource elements (i.e., human developments) but would not extend more than 100 meters from the resource. Other fuels treatments in these units generally will not affect MSO habitat and will be limited to the removal of smaller diameter trees. Surveys will be conducted for MSO in areas of suitable habitat (i.e., dense [greater than 40 percent canopy cover], mixed conifer forests [ponderosa pine and Douglas-fir] on steep slopes [greater than 40 percent slope], often with a canyon or rock outcropping structure) prior to the implementation of any activity in or near such habitat. Surveys will be conducted using the current Sevice-approved MSO survey protocol. Additional conservation measures are provided in the BA.

Wildland fire use (WFU) fires may occur in the Mosca and Herard units. While effects resulting from WFU are difficult to predict, evaluation of fires for WFU will include the consideration of MSO habitat and the conservation measures provided in the BA. The NPS may seek opinion from the Service and other neighboring land management agencies regarding the strategic plan of action during a WFU event.

Southwestern Willow Flycatcher

Habitat for the SWWF is present in the Baca-Dunes FMU and part of the Mosca FMU. SWWF have not been identified in the plan area, although the majority of the area has not been surveyed. Fuels management will occur in SWWF habitat, but live cottonwoods, willows, or snags will not be removed. The treatments will consist of removal of dead, downed material and some shrubs in the vicinity of the riparian vegetation at specific locations identified in the BA. Surveys will be conducted for SWWF prior to implementation of any activity in or near suitable riparian vegetation. Additional conservation measures are provided in the BA.

Wildland fire use (WFU) fires may occur in the Mosca FMU. While effects resulting from WFU are difficult to predict, evaluation of fires for WFU will include the consideration of SWWF habitat and the conservation measures provided in the BA. The NPS may seek opinion from the Service and other neighboring land management agencies regarding the strategic plan of action during a WFU event.

Yellow-billed Cuckoo

Habitat for the yellow-billed cuckoo is present in the Baca-Dunes FMU and part of the Mosca FMU. The yellow-billed cuckoo has not been identified in the plan area, although the majority of the area has not been surveyed. Fuels management will occur in yellow-billed cuckoo habitat, but live cottonwoods, willows, or snags will not be removed. The treatments will consist of removal of dead, downed material and some shrubs in the vicinity of the riparian vegetation at specific locations identified in the BA. Surveys will be conducted for yellow-billed cuckoo prior to implementation of any activity in or near suitable riparian vegetation. Additional conservation measures are provided in the BA.

Wildland fire use (WFU) fires may occur in the Mosca FMU. While effects resulting from WFU are difficult to predict, evaluation of fires for WFU will include the consideration of yellow-billed cuckoo habitat and the conservation measures provided in the BA. The NPS may seek opinion from the Service and other neighboring land management agencies regarding the strategic plan of action during a WFU event.

Canada Lynx

Lynx habitat is present in the Mosca and Herard FMUs. Radio-telemetry tracking of lynx by the CDOW has identified some lynx use of the plan area, although there does not appear to be a documented regular use. A map of lynx habitat is provided in the BA; lynx habitat has been mapped following the Rio Grande National Forest lynx habitat mapping criteria. For the purposes of this consultation, areas of suitable lynx habitat are considered to be occupied by lynx; field surveys are not required to determine the presence or absence of lynx. Little to no fuels treatments are proposed in lynx habitat. In the future, if additional fuels treatments

are proposed in lynx habitat along the Medano Pass Road, additional section 7 consultation will be occur. Additional conservation measures are provided in the BA.

The Mosca and Herard FMUs will be managed as the Great Sand Dunes Lynx Analysis Unit (LAU). Conservation measures in the BA follow the guidelines in the Canada Lynx Conservation and Assessment Strategy (Ruediger et. al, 2000). The NPS is responsible for tracking any changes that would alter lynx habitat and annually updating the LAU map and acreages. Please note that lynx habitat mapping criteria may be subject to change in the future; such changes will be coordinated by FWS Ecological Services Office.

Wildland fire use (WFU) fires may occur in the Mosca and Herard units. While effects resulting from WFU are difficult to predict, evaluation of fires for WFU will include the consideration of lynx habitat and the conservation measures provided in the BA. The NPS may seek opinion from the Service and other neighboring land management agencies regarding the strategic plan of action during a WFU event.

Conclusion

Based on the information provided, the Service concurs with your determination that implementation of the proposed plan may affect, but is not likely to adversely affect the southwestern willow flycatcher, bald eagle, Mexican spotted owl, yellow-billed cuckoo, and the Canada lynx.

If any additional species that are Federally-listed, proposed for Federal listing, or candidate for Federal listing are found in the project area, if critical habitat is designated in the project area, or if new information becomes available that reveals that the action may impact such species in a manner or to an extent that was not previously considered, this office should be contacted to determine if further section 7 consultation will be required. If the Service can be of further assistance, please contact Leslie Ellwood of my staff at (303) 236-4747.

Sincerely,

Susan C. Linner
Colorado Field Supervisor

cc: FWS-ES-CO (T. Ireland)
FWS-ES-CO (K. Broderdorp)

Reference: Projects\NPS\NPS_SandDunesFMP_FWSConcur

National Park Service
U.S. Department of the Interior

GSD Nat. Park & Preserve
11500 Hwy 150
Mosca, CO 81146-9798

FINDING OF NO SIGNIFICANT IMPACT
Greater Sand Dunes Interagency
Fire Management Plan
Great Sand Dunes National Park and Preserve
Alamosa and Saguache Counties, Colorado

SUMMARY

The National Park Service (NPS) at Great Sand Dunes National Park and Preserve (GRSA) has selected "Alternative 3 (Preferred): Fire Suppression and Fuels Management Plus Wildland Fire Use" as analyzed in the "Greater Sand Dunes Interagency Fire Management Plan: Environmental Assessment/Assessment of Effect; April, 2005".

PURPOSE AND NEED

GRSA is subject to agency policies and guidelines that direct wildland fire management. NPS *Director's Order #18: Wildland Fire* Management (DO- 18) states, "Each park with vegetation capable of burning will prepare a Fire Management Plan (FMP) to guide fire management that is responsive to the park's natural and cultural resource objectives and to safety considerations for Park visitors, employees, and developed facilities." As part of the environmental analysis related to the development of the FMP, an Environmental Assessment/ Assessment of Effect (referred to as the "EA") and Biological Assessment (BA) was prepared. The FMP and associated EA and BA will establish the future management direction for fire related activities at GRSA.

Project Goal. The overall goal for this project is to develop and implement an interagency, comprehensive, ecologically based Fire Management Plan for the approximately 275,000 acre Greater Sand Dunes project area which includes the Great Sand Dunes National Park and Preserve, the Baca National Wildlife Refuge, and the Medano- Zapata Ranch (The Nature Conservancy). 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.

Goal 1 - Provide for the protection of human health and safety during all phases of the interagency fire management program.

Goal 2 - 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, and The Nature Conservancy, while promoting interagency participation across the greater landscape of the San Luis Valley.

Goal 3 - Protect facilities, natural resources, and cultural resources from unplanned wildland fires.

Goal 4 - Apply fire management techniques in a coordinated manner to accomplish desired resource management objectives.

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

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

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

PROPOSED ACTION
ALTERNATIVE 3 (PREFERRED): Fire Suppression and Fuels Management plus Wildland Fire Use

The Fire Suppression and Fuels Management Plus Wildland Fire Use Alternatives (alternative 3) is the preferred alternative for fire management within the planning area. Alternative 3 is 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. Under Alternative 3 Wildland Fire Use for Resource Benefits (WFURB) would be allowed within portions of the planning area. Where boundaries are shared, similar fire management goals and objectives would be met through joint operations and shared positions, wherever possible.

Under Alternative 3, the planning area would be divided into three fire management units (FMUs): the Herard FMU, the Mosca FMU, and the Baca- Dunes FMU.

***The Herard FMU** includes the portion of the Great Sand Dunes National Preserve located north of Medano Pass Road. The entire FMU is located within designated wilderness. Based on the fire histories presented in the EA, 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.

***The Mosca FMU** includes lands primarily south of the Medano Pass Road within the Grant 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, 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 Appropriate Management Response (AMR) would be utilized along the unit and jurisdictional boundaries. Fuels treatments would include manual hazardous fuels reduction and prescribed fire for cultural resources, visitors, 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 onsite communication towers.

***The Baca- Dunes FMU** would include all lands within Great Sand Dunes National Park, the 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, wildand fire use for the 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.

All unplanned wildland fires throughout the entire planning area will be managed using the AMR, which may include aggressive initial attack, indirect attack, or wildland fire use for resource benefit, depending on the location and conditions. The following fire strategies may be applied to the three FMUs:

- ***Fire Suppression** – The current and predicted wildland fire situation will be analyzed carefully when determining the appropriate suppression method(s). All actions necessary to quickly and safely manage a wildland fire must be determined. The wildland fire suppression method(s) will also be commensurate with the wildland fire's potential to spread or to cause undesirable social, economic, and/or*

ecological impacts, the value of threatened resources, as well as the FMU fire management goals. Depending on the FMU, a range of response tactics may be appropriate. A rapid response is often important for safety and cost efficiency. Tactics will be unique to each incident dependent on safety considerations, weather conditions, cost of suppression, fuel conditions, availability fo resources and location of the fire in relation to values at risk. Specific tactics will be determined by the on-scene Incident Commander (IC). In addition, Minimum Impact Suppression Tactics (MIST) will be employed whenever possible.

- ***Manual and Mechanical Fuels Treatments -*** *The primary goal of the manual and mechanical fuels treatments will be to reduce fuel loads in areas with resources at risk that have heavy fuel accumulations and/or to protect the wildland urban interface. Treatment sites will 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 and/or wildland fires. The range of actions for manual and mechanical treatments 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 will primarily involve using chainsaws or, in wilderness areas, hand- saws. Grass and smaller diameter 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 will 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 slash, and/or hauling from the site for disposal outside the planning area.*
- ***Prescribed Fire*** *- Prescribed burns will be conducted in any plant community throughout the planning area to meet predefined management objectives set forth in a land or resource management plan. A prescribed burn will be utilized when it is determined that prescribed burning is the best method for achieving those objectives. An approved, site- specific Prescribed Burn Plan will be required for all prescribed burns occurring within the planning area.*
- ***Wildland Fire Use for Resource Benefit*** *– 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. A "Go/No- Go" decision making process will be utilized for all unplanned fire events to determine the appropriate management response. The decision to suppress a wildland fire or let it burn to meet resource management objectives will 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/natural resources; external constraints, such as air quality or safety concerns; and the overall ability to defend the boundaries of the fire. Wildland fire use, like all fire management operations, will be managed with firefighter and public safety as the primary goal.*

The following mitigation measures may be selectively applied to the three FMUs:

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 conduction 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 operation condition so that exhaust emissions are kept to a minimum.
- Notify public of all prescribed fire and wildland fire use activities.

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
- 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 Impacts Suppression Tactics" whenever possible.

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.
- Avoid using retardant and foam in or near wetlands or riparian areas.

- Employ “Minimum Impact Suppression Tactics” whenever possible.

Vegetation Health and Ecological Integrity

- Consult with natural resource specialist 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 and/or human-made features 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 Park Superintendent of by the delegated authority.
- Keep fire lines to a minimum width necessary to allow backfiring or creation of safe blacklines.
- 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 Park on foot to avoid resource damage.
- If adequate water and pumps area 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 Great Sand Dunes National Park and Preserve will comply with conservation measures included in the Biological Assessment for the Wildland Fire and Fuels Management Actions on the Baca National Wildlife Refuge and the Greater Sand Dunes National Park and Preserve (9/5/2006), and the subsequent USFWS – Ecological Services letter of concurrence (10/10/2006).

Wildlife and Wildlife Habitat

- Consult with a 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 NPS wildlife biologist prior to implementing fuel reduction activities to identify important wildlife resources that my need to be protected.
- Implement any fuels projects outside the breeding and nesting season of most wildlife species, to the extent possible.
- Avoid nests to the extent possible during fuels treatment activities.
- Preserve snags and dead fallen trees that can be retained per determined prescription.
- Mark and avoid trees showing signs of active wildlife use, to the extent possible.
- Maintain pinecone caches used by small mammals during fuels treatment activities, to the extent possible.

Non- native, Invasive Species

- Monitor for non-native, invasive plants within fire management areas prior to and following treatments.
- Incorporate measures that reduce the likelihood of non-native invasive introduction and spread in all fire management planning efforts.
- Control or eradicate non-native, invasive species that invade following fire management activities.
- Utilize certified weed seed free straw during rehabilitation.

Cultural Resources

- Conduct project- specific section 106 review and consultation with SHPO, conducted by person(s) meeting the Secretary of the Interior Standards.
- A Resource Advisor (READ) who meets the secretary of the Interior Standards for cultural resources will be assigned to wildland fire use actions, prescribed burns, manual/mechanical fuel reduction projects, wildland fire suppression actions, and BAER; as needed.
- Utilize protective tactics which 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.
- 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.
- Remove heavy fuels which cause long- duration heating on and around cultural resources, where appropriate.
- Confine vehicle traffic to existing roadways, when possible.
- 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, when possible.

Wilderness

- Apply the “minimum requirement” concept and “minimum tool” and “primitive tool” procedures, as specified in the Wilderness Act, NPS Management Policies, NPS Reference Manual #41, and “minimum Requirement Decision Guide, 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”.
- Do not utilize heavy equipment, pumps, chainsaws, or off- road vehicles within wilderness areas without the approval of the Park Superintendent.

Socioecomonics, Public Health and Safety, and Recreational Opportunity 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 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.
- 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. Notify the public about treatment activities through procedures identified in the project-specific work plans.
- 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

- Work with neighboring land owners to minimize risks within the wildland- urban interface.
- Apply fire wise standards 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.

ALTERNATIVES CONSIDERED BUT NOT SELECTED

Alternative 1: No Action Alternative. *The No Action Alternative 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.*

Alternative 2: Fire Suppression Plus Fuels Management Alternative. *The Fire Suppression Plus Fuels Management Alternative was based on the "natural fire regimes" and/or "desired future conditions" of ecological systems within the planning area, as well as local collaborative process for ensuring community protection needs and firefighter and public safety. This alternative allowed fules management activities, including manual and mechanical treatments and prescribed burns, to occur within appropriate limits of the planning area. Wildland fire use for resource benefits, however, would not be allowed under this alternative. All wildland fire would be suppressed regardless of ignition source and location of the wildland fire.*

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is determined by applying the criteria suggested in the National Environmental Policy Act of 1969 (NEPA), which is guided by the Council on Environmental Quality (CEQ). The CEQ provides direction that "the environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA Section 101:

1 - fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2 - assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
3 - attain the widest range of beneficial uses of the environment without degradation, risk of 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 that supports diversity and variety of individual choice;
5 - achieve a balance between population and resource use that 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 preferred is defined as "the alternative that will promote the national environmental policy as expressed in the National Environmental Policy Act's section 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. 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 wildland fires 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 Section 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). 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 Section 101 of the National Environmental Policy Act. Alternative 3 provides a high level of protection to natural and cultural resources for the long- term; maintains an environment that supports diversity and variety of individual choice; and 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).

WHY THE PREFERRED ALTERNATIVE WILL NOT HAVE A SIGNIFICANT EFFECT ON THE HUMAN ENVIRONMENT

As defined in 40 Code of Federal Regulations (CFR) §1508.27, significance is determined by examining the following criteria:

Impacts that may be both beneficial and adverse:
Implementation of the preferred alternative, Alternative 3, will not result in significant adverse or beneficial effects. Potential beneficial and adverse negligible to minor effects are to Wildlife and Wildlife Habitat, Socioeconomics, Public Health and Safety, and Recreational Opportunities and Visitation. Beneficial effects would result from implementation of AMR, fuels management projects (including prescribed fire), and long- term benefits from WFURB. Potential beneficial and adverse minor effects are to Wetlands and Floodplains; beneficial impacts will be from AMR, fuels management (including prescribed fire), and WFURB. Potential beneficial and adverse minor to moderate effects are to Soils, Vegetation Health and Ecological System Integrity, Cultural Resources, and Wilderness. Beneficial effects will be from AMR, fuels management (including prescribed fire), and WFURB.

Adverse effects to the resources are expected to be short- term in duration; adverse effects to Cultural Resources and Soils are additionally expected to by short- to long- term in duration. Direct and indirect and short- to long- term beneficial effects are expected for all of the above- listed impact topics.

Degree of effect on public health or safety:
The preferred alternative would reduce risks to wildland firefighters and visitors by allowing use of an appropriate management response to wildland fires. This

response may include selecting control lines along natural or man- made barriers which reduces the exposure of firefighters in unburned fuels adjacent to a fire perimeter. Direct and indirect effects to firefighters would be mitigated by application of the Ten Standard Firefighting Orders, LCES (acronym for "Lookouts, Communications, Escape routes, Safety zones") and other risk mitigation actions. Temporary closures would be used to reduce exposure to park visitors and neighbors. The risks associated with prescribed burning would be further mitigated by ensuring the burns are conducted within the approved prescription. Mechanical hazard fuel reduction activities would employ standard safety equipment and protocols. Wildland Fire Use for Resources Benefits will ultimately have beneficial effects due to reducing fuels and establishing a mosaic pattern of vegetation, thus affecting wildland fire patterns.

In addition to the Public Health and Safety, Air Quality was also analyzed in the EA. With mitigation measures in place, the effects on Public Health and Safety and Air Quality will be short- term, localized, and negligible to moderate. Beneficial effects will be long- term.

Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas:
Based on the analysis in the environmental assessment/assessment of effect, no major effects to park resources would occur. Ephemeral wetlands occur within the project area. Mitigation measures will reduce adverse effects to negligible to minor and short-term; wetlands are expected to experience beneficial effects from fuel treatments and WFU. Historic and cultural resources occur in the project area. Mitigation measures will reduce adverse effects to negligible to minor; beneficial effects will be minor to moderate and will result from fuel reduction projects and WFU. No prime farmlands, wild and scenic rivers, or ecologically critical areas occur within the project area.

Degree to which effects on the quality of the human environment are likely to be highly controversial:
The proposed action was found to not be highly controversial during public scoping or public comment period of the EA. Five comments were received during the public comment period of the EA; two adjacent or nearby organizations (Manitou Foundation, Baca Grande Volunteer Fire Department) want to be included in future fire management projects. The Colorado State Historic Preservation Officer (SHPO) supports the preferred alternative, and will be consulted for Section 106 of the National Historic Preservation Act (NHPA) on a project- specific basis. The Southern Ute Indian Tribe also supports the preferred alternative, and would like to be contacted in the event of inadvertent discoveries of cultural resources. The third comment from a private citizen would like to see a new FMU out of part of the Baca- Dunes FMU. The new FMU would allow WFU.

Degree to which the possible effects on the quality of the human environment are highly uncertain or involve unique or unknown risks:
While wildland fire has some associated risk, the proposed action will not have effects that are highly uncertain, or of unique or unknown risk on the quality of the human

environment. None of the Internal and external scoping, and public comment for the EA identified such risks.

Degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration:
The proposed action neither establishes a precedent for future actions with significant effects nor represents a decision in principle about a future consideration.

Whether the action is related to other actions with individually insignificant but cumulatively significant impacts:
The proposed action will not result in significant cumulative impact when added to other past, present, or reasonably foreseeable future actions. These findings are documented in the environmental assessment/assessment of effect.

Degree to which the action may adversely affect districts, sites, highways, structures, or objects listed on the National Register of Historic Places or may cause loss of destruction of significant scientific, cultural, or historic resources:

The direct adverse impacts of the preferred alternative on cultural resources would be localized, short to long term, and negligible to minor. Beneficial effects will be long-term and minor to moderate. Fuels treatments including prescribed fire and WFU will benefit cultural resources in the long- term due to reducing large, severe, uncontrollable fires damaging cultural resources. Some cultural landscapes and ethnographic resources may also be benefited by fire.

Compliance with Section 106 of the National Historic Preservation Act was initiated with the Colorado State Historic Preservation Officer (SHPO). In a letter dated May 2, 2005, the Colorado SHPO concurred with the park that the preferred alternative (Alternative 3) will have no adverse effect to historic properties. The Great Sand Dunes National Park and Preserve will complete the Section 106 compliance process on a project by project basis.

Degree to which the action may adversely affect an endangered or threatened species or its critical habitat:
Impacts of prescribed and/or WFU fires and fuel reduction efforts on endangered and threatened species were extensively analyzed in the Biological Assessment (BA) completed in September 2006. Species considered include bald eagle, Mexican spotted owl, Southwestern willow flycatcher, yellow- billed cuckoo, and the Canada lynx. The BA was sent to the U.S. Fish and Wildlife Service – Ecological Services; the BA includes all conservation measures to be applied.

Compliance with Section 7 of the Endangered Species Act was completed when the park received a letter from the U.S. Fish and Wildlife Service – Ecological Services on October 10, 2006. The letter included concurrence with the NPS determination that implementation of the proposed plan may affect, but is not likely to adversely affect the southwestern willow flycatcher, bald eagle, Mexican spotted owl, yellow-billed cuckoo, and the Canada lynx.

Whether the action threatens a violation of Federal, State, or local environmental protection laws:
The proposed action violates no Federal, State, or local environmental protection laws.

Impairment:
In addition to reviewing the list of significance criteria, the National Park Service determined that implementation of the preferred alternative will not constitute an impairment of resources and values at Great Sand Dunes National Park and Preserve. This conclusion is based on a thorough analysis of the impacts described in the environmental assessment/assessment of effect, the agency comments received, and the professional judgment of the decision- maker in accordance with the National Park Service's *Management Policies, 2001.* As described in the environmental assessment/assessment of effect, implementation of the preferred alternative will not result in major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing proclamation of Capulin Mountain National Monument; (2) key to the natural or cultural integrity of the monument or to opportunities for enjoyment of the park; or (3) identified as a goal in the park's general management plan or other relevant National Park Service planning documents.

PUBLIC INVOLVEMENT

The environmental assessment/assessment of effect was made available for public review and comment during a 30- day period from April 25 to May 24, 2005. A total of five responses were received, including letters from four government and non- government organizations, and one private citizen comment letter.

Three commentors supported the proposed action. Two commentors expressed strong interest in coordinating with the Great Sand Dunes National Park. Two commentors requested to be notified at the implantation of prescribed burns and/or discovery of previously unknown resources. One commentor proposed developing a new FMU within the current Baca- Dunes FMU in order to allow WFU in the new FMU. The EA interdisciplinary team considered WFU in all or parts of the Baca- Dunes WFU. Because this FMU has a number of cultural resources, occurs closer to the wildland- urban interface, and poses a number of safety concerns, the interdisciplinary team could not adopt WFURB in this FMU at this time. Logistical constraints including limited numbers of fire personnel, and ability to isolate resources at risk from the WFURB activity, the park will not adopt WFURB in the Baca- Dunes FMU at this time. Therefore, it is not necessary to re- write and re- release the environmental assessment in response to public comment.

CONCLUSION

The preferred alternative does not constitute an action that normally requires preparation of an environmental impact statement (EIS). The preferred alternative will not have a significant effect on the human environment. Negative environmental impacts that will occur will be minor in intensity. There are no significant adverse or beneficial impacts on public health,

public safety, threatened or endangered species, historic properties either listed in or eligible for listing in the National Register of Historic Places, or other unique characteristics of the region. No highly uncertain or controversial impacts, unique or unknown risks, significant cumulative effects, or elements of precedence were identified. Implementation of the action will not violate any federal, state, or local environmental protection law.

Based on the foregoing, it has been determined that an EIS is not required for this project and thus will not be prepared.

Approved: /s/ Michael D. Snyder
11/13/2006
Michael D. Snyder, Regional Director Date
National Park Service, Intermountain Region

United States Department of the Interior

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FINDING OF NO SIGNIFICANT IMPACT
Greater Sand Dunes Interagency
Fire Management Plan
Baca National Wildlife Refuge
Alamosa and Saguache Counties, Colorado

The U.S. Fish and Wildlife Service (FWS), in coordination with the National Park Service (NPS) and The Nature Conservancy (TNC), proposes to develop and implement a comprehensive, ecologically based Fire Management Plan (FMP) for the approximately 275,000-acre Greater Sand Dunes project area which includes the Great Sand Dunes National Park and Preserve, the Baca National Wildlife Refuge (NWR), and the Medano-Zapata Ranch (The Nature Conservancy). 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.

PURPOSE AND NEED

A Memorandum of Understanding (MOU) was signed in summer 2003 by Great Sand Dunes National Park and Preserve; Alamosa, Monte Vista, and Baca NWRs; Bureau of Land Management; Rio Grande National Forest; and The Nature Conservancy of Colorado which will provide a framework for cooperation and coordination among all entities in the achievement of mutual goals related to wildland fire management. The Baca, Alamosa, and Monte Vista NWRs are subject to agency policies and guidelines that direct wildland fire management including the (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). The FWS Service Manual Part 621 directs that the Service "will have an approved FMP for every area with burnable vegetation... The FMP is 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." As part of the environmental analysis related to the development of the

FMP, an Environmental Assessment/Assessment of Effect (referred to as the "EA") and Biological Assessment (BA) were prepared. The FMP and associated EA and BA will establish the future management direction for fire related activities at Baca, Monte Vista, and Alamosa NWRs. Monte Vista and Alamosa refuges were not included in this EA as the effects of fire management activities were addressed in the NEPA documents for the Comprehensive Conservation Plan for both refuges (USFWS, 2003).

Project Goal. The overall goal for this project is to develop and implement an interagency, comprehensive, ecologically based FMP for the approximately 275,000-acre Greater Sand Dunes project area which includes the Great Sand Dunes National Park and Preserve, the Baca NWR, and the Medano-Zapata Ranch (The Nature Conservancy). 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.

Goal 1 - Provide for the protection of human health and safety during all phases of the interagency fire management program.

Goal 2 - Develop and implement an interagency FMP that specifically addresses the individual fire management needs of the FWS, NPS, and TNC, while promoting interagency participation across the greater landscape of the San Luis Valley.

Goal 3 - Protect facilities, natural resources, and cultural resources from unplanned wildland fires.

Goal 4 - Apply fire management techniques in a coordinated manner to accomplish desired resource management objectives.

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

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

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

ALTERNATIVES

The FWS has analyzed a number of alternatives to the proposal, including the following:

Alternative 1: No Action Alternative. The No Action Alternative includes preparing a FMP 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.

Alternative 2: Fire Suppression Plus Fuels Management Alternative. The Fire Suppression Plus Fuels Management Alternative was based on the "natural fire regimes" and/or "desired future conditions" of ecological systems within the planning area, as well as local collaborative process for ensuring community protection needs and firefighter and public safety. This alternative allowed fuels management activities, including manual and mechanical treatments and prescribed burns, to occur within appropriate limits of the planning area. Wildland fire use for resource benefits, however, would not be allowed under this alternative. All wildland fire would be suppressed regardless of ignition source and location of the wildland fire.

Alternative 3 (Proposed Action, Preferred Alternative): Fire Suppression and Fuels Management plus Wildland Fire Use. The Fire Suppression and Fuels Management plus Wildland Fire Use Alternative is the preferred alternative for fire management within the planning area. Alternative 3 was selected over the other alternatives because it is 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. Under Alternative 3, Wildland Fire Use for Resource Benefits (WFURB) would be allowed within portions of the planning area. Where boundaries are shared, similar fire management goals and objectives would be met through joint operations and shared positions, wherever possible.

Under Alternative 3, the planning area would be divided into three fire management units (FMUs): the Herard FMU, the Mosca FMU, and the Baca-Dunes FMU. The Baca NWR is located entirely within the Baca-Dunes FMU. The Baca-Dunes FMU would include all lands within Great Sand Dunes National Park, the Baca NWR, and Medano-Zapata Ranch. This FMU would not include the Preserve, which would be included in the Herard and Mosca FMUs. 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 the resource benefit would not be allowed within this unit.

All wildfires would be controlled with an Appropriate Management response (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.

All unplanned wildland fires throughout the entire planning area will be managed using the AMR, which may include aggressive initial attack, indirect attack, or wildland fire use for resource benefit, depending on the location and conditions. The following fire strategies may be applied to all three FMUs:

- **Fire Suppression** – The current and predicted wildland fire situation will be analyzed carefully when determining the appropriate suppression method(s). All actions necessary to quickly and safely manage a wildland fire must be determined. The wildland fire suppression method(s) will also be commensurate with the wildland fire's potential to spread or to cause undesirable social, economic, and/or ecological impacts, the value of threatened resources, as well as the FMU fire management goals. Depending on the FMU, a range of response tactics may be appropriate. A rapid response is often important for safety and cost efficiency. Tactics will be unique to each incident dependent on safety considerations, weather conditions, cost of suppression, fuel conditions, availability of resources, and location of the fire in relation to values at risk. Specific tactics will be determined by the on-scene Incident Commander (IC). In addition, Minimum Impact Suppression Tactics (MIST) will be employed whenever possible.
- **Manual and Mechanical Fuels Treatments** - The primary goal of the manual and mechanical fuels treatments will be to reduce fuel loads in areas with resources at risk that have heavy fuel accumulations and/or to protect the wildland urban interface. Treatment sites will 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 and/or wildland fires. The range of actions for manual and mechanical treatments 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 will primarily involve using chainsaws or, in wilderness areas, hand-saws. Grass and smaller diameter 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 will 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 slash, and/or hauling from the site for disposal outside the planning area.
- **Prescribed Fire** - Prescribed burns will be conducted in any plant community throughout the planning area to meet predefined management objectives set forth in a land or resource management plan. A prescribed burn will be utilized when it is determined that prescribed burning is the best method for achieving those objectives. An approved, site-specific Prescribed Burn Plan will be required for all prescribed burns occurring within the planning area.
- **Wildland Fire Use for Resource Benefit** – 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 FMP. A "Go/No-Go" decision making process will be utilized for all unplanned fire events to determine the appropriate management response. The decision to suppress a wildland fire or let it burn to meet resource management objectives will 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/natural resources; external constraints, such as air quality or safety concerns; and the overall ability to defend the boundaries of the fire. Wildland fire use, like all fire management operations, will be managed with firefighter and public safety as the primary goal.

Mitigation measures may be selectively applied to the three FMUs and are attached in Appendix A.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is determined by applying the criteria suggested in the National Environmental Policy Act of 1969 (NEPA), which is guided by the Council on Environmental Quality (CEQ). Environmentally preferred is defined as "the environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA Section 10. 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" (Council on Environmental Quality's Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations (46 FR 18026, March 23, 1981)).

Alternative 1 represents the no action or current fire management direction for the three properties. 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 wildland fires 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 Section 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). 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 Section 101 of the NEPA. Alternative 3 provides a high level of protection to natural and cultural resources for the long-term; maintains an environment that supports diversity and variety of individual choice; and 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).

WHY THE PREFERRED ALTERNATIVE WILL NOT HAVE A SIGNIFICANT EFFECT ON THE HUMAN ENVIRONMENT

As defined in 40 Code of Federal Regulations (CFR) §1508.27, significance is determined by examining the following criteria:

Impacts that may be both beneficial and adverse:
Implementation of the preferred alternative, Alternative 3, will not result in significant adverse or beneficial effects. Potential beneficial and adverse negligible to minor effects are to Wildlife and Wildlife Habitat, Socioeconomics, Public Health and Safety, and Recreational Opportunities and Visitation. Beneficial effects would result from implementation of AMR, fuels management projects (including prescribed fire), and long-term benefits from WFURB. Potential beneficial and adverse minor effects are to Wetlands and Floodplains; beneficial impacts will be from AMR, fuels management (including prescribed fire), and WFURB. Potential beneficial and adverse minor to moderate effects are to Soils, Vegetation Health and Ecological System Integrity, Cultural Resources, and Wilderness. Beneficial effects will be from AMR, fuels management (including prescribed fire), and WFURB.

Adverse effects to the resources are expected to be short-term in duration; adverse effects to Cultural Resources and Soils are additionally expected to be short- to long-term in duration. Direct and indirect and short- to long-term beneficial effects are expected for all of the above-listed impact topics.

Degree of effect on public health or safety:
The preferred alternative would reduce risks to wildland firefighters and visitors by allowing use of an appropriate management response to wildland fires. This response may include selecting control lines along natural or man-made barriers which reduces the exposure of firefighters in unburned fuels adjacent to a fire perimeter. Direct and indirect effects to firefighters would be mitigated by application of the Ten Standard Firefighting Orders, LCES (acronym for "Lookouts, Communications, Escape routes, Safety zones") and other risk mitigation actions. Temporary closures would be used to reduce exposure to park visitors and neighbors. The risks associated with prescribed burning would be further mitigated by ensuring the burns are

conducted within the approved prescription. Mechanical hazard fuel reduction activities would employ standard safety equipment and protocols. Wildland Fire Use for Resources Benefits will ultimately have beneficial effects due to reducing fuels and establishing a mosaic pattern of vegetation, thus affecting wildland fire patterns.

In addition to the Public Health and Safety, Air Quality was also analyzed in the EA. With mitigation measures in place, the effects on Public Health and Safety and Air Quality will be short-term, localized, and negligible to moderate. Beneficial effects will be long-term.

Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas:

Based on the analysis in the EA, no major effects to park resources would occur. Ephemeral wetlands occur within the project area. Mitigation measures will reduce adverse effects to negligible to minor and short-term; wetlands are expected to experience beneficial effects from fuel treatments and Wildland Fire Use (WFU)[1]. Historic and cultural resources occur in the project area. Mitigation measures will reduce adverse effects to negligible to minor; beneficial effects will be minor to moderate and will result from fuel reduction projects and WFU. No prime farmlands, wild and scenic rivers, or ecologically critical areas occur within the project area.

Degree to which effects on the quality of the human environment are likely to be highly controversial:

The proposed action was found to not be highly controversial during public scoping or public comment period of the EA. Five comments were received during the public comment period of the EA; two adjacent or nearby organizations (Manitou Foundation, Baca Grande Volunteer Fire Department) want to be included in future fire management projects. The Colorado State Historic Preservation Officer (SHPO) supports the preferred alternative, and will be consulted for Section 106 of the National Historic Preservation Act (NHPA) on a project-specific basis. The Southern Ute Indian Tribe also supports the preferred alternative, and would like to be contacted in the event of inadvertent discoveries of cultural resources. The third comment from a private citizen would like to see a new FMU out of part of the Baca-Dunes FMU. The new FMU would allow WFU.

Degree to which the possible effects on the quality of the human environment are highly uncertain or involve unique or unknown risks:

While wildland fire has some associated risk, the proposed action will not have effects that are highly uncertain, or of unique or unknown risk on the quality of the human environment. None of the internal and external scoping, and public comment for the EA identified such risks.

Degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration:

[1] Wildland Fire Use 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).

The proposed action neither establishes a precedent for future actions with significant effects nor represents a decision in principle about a future consideration.

Whether the action is related to other actions with individually insignificant but cumulatively significant impacts:
The proposed action will not result in significant cumulative impact when added to other past, present, or reasonably foreseeable future actions. These findings are documented in the environmental assessment/assessment of effect.

Degree to which the action may adversely affect districts, sites, highways, structures, or objects listed on the National Register of Historic Places or may cause loss of destruction of significant scientific, cultural, or historic resources:

The direct adverse impacts of the preferred alternative on cultural resources would be localized, short- to long-term, and negligible to minor. Beneficial effects will be long-term and minor to moderate. Fuels treatments including prescribed fire and WFU will benefit cultural resources in the long-term due to reducing large, severe, uncontrollable fires damaging cultural resources. Some cultural landscapes and ethnographic resources may also be benefited by fire.

Compliance with Section 106 of the National Historic Preservation Act was initiated with the Colorado SHPO. The Colorado SHPO concurred with the FWS that the preferred alternative (Alternative 3) will have no adverse effect to historic properties. The Baca NWR will complete the Section 106 compliance process on a project-by-project basis.

Degree to which the action may adversely affect an endangered or threatened species or its critical habitat:
Impacts of prescribed and/or WFU fires and fuel reduction efforts on endangered and threatened species were extensively analyzed in the BA completed by NPS in September 2006 for both the Baca NWR and Great Sand Dunes National Park and Preserve. The BA was sent to the FWS – Ecological Services and included all conservation measures to be applied. Compliance with Section 7 of the Endangered Species Act was completed when NPS received a letter from the FWS – Ecological Services on October 10, 2006. The letter concurred with the NPS determination that implementation of the proposed plan may affect, but is not likely to adversely affect, the southwestern willow flycatcher, bald eagle, Mexican spotted owl, yellow-billed cuckoo, and the Canada lynx. The Baca NWR will comply with conservation measures included in the BA.

Whether the action threatens a violation of Federal, State, or local environmental protection laws:
The proposed action violates no Federal, State, or local environmental protection laws.

PUBLIC INVOLVEMENT

The proposal has been thoroughly coordinated with all interested and/or affected parties. A public scoping comment period was conducted from March 15, 2004, to April 13, 2004. Public scoping meetings were held in Alamosa, Colorado, March 24, 2004, and in Crestone, Colorado, on March 25, 2004. The EA was made available for public review and comment during a 30-day period from April 25 to May 24, 2005. A total of five responses were received, including letters from four government and non-government organizations, and one private citizen comment letter.

Three commenters supported the proposed action. Two commentors expressed strong interest in coordinating with the Great Sand Dunes National Park. Two commentors requested to be notified at the implantation of prescribed burns and/or discovery of previously unknown resources. One commenter proposed developing a new FMU within the current Baca-Dunes FMU in order to allow WFURB in the new FMU. The EA interdisciplinary team considered WFU in all or parts of the Baca-Dunes FMU. Because this FMU has a number of cultural resources, occurs closer to the wildland-urban interface, and poses a number of safety concerns, the interdisciplinary team could not adopt WFURB in this FMU at this time. Therefore, it is not necessary to re-write and re-release the environmental assessment in response to public comment.

Based on my review and evaluation of the enclosed EA and FMP and other supporting documentation, I have determined that the proposal to develop and implement a comprehensive, ecologically based Fire Management Plan for the approximately 275,000 acre Greater Sand Dunes project area which includes the Great Sand Dunes National Park and Preserve, the Baca NWR, and the Medano-Zapata Ranch (The Nature Conservancy) is not a major Federal Action which would significantly affect the quality of the human environment within the meaning of section 102(2)(c) of the NEPA of 1969. Accordingly, preparation of an environmental impact statement on the proposed action is not required. Therefore, an environmental impact statement will not be prepared.

References

National Park Service, The Nature Conservancy, and U.S. Fish and Wildlife Service. 2006a. Greater Sand Dunes Interagency Fire Management Plan. 219 p.

National Park Service, The Nature Conservancy, and U.S. Fish and Wildlife Service. 2006b. Greater Sand Dunes Interagency Fire Management Plan Environmental Assessment/Assessment of Effect. 316 p.

U.S. Fish and Wildlife Service. 2003. Comprehensive Conservation Plan for the Alamosa-Monte Vista National Wildlife Refuge Complex, Colorado. 157 p.

U.S. Fish and Wildlife Service. 2006. Letter of concurrence with the Biological Assessment (September 5, 2006) for the Wildlife Fire and Fuels Management Actions on the Baca National Wildlife Refuge and the Great Sand Dunes National Park and Preserve from Susan Linner, Field Supervisor, U.S. Fish and Wildlife Service, Ecological Services, Colorado Field Office. 4 p.

12/11/06

U.S. Fish and Wildlife Service **Date**
Deputy **Regional Director**

APPENDIX A

MITIGATION OF POTENTIAL ADVERSE EFFECTS

This section describes the mitigation and monitoring measures that will be implemented to reduce potential impacts to key resources from wildland fire management activities. The purpose of these mitigation measures is to minimize the degree or severity of potential adverse impacts caused by a fire management action to the key resources and their associated environments. According to the Code of Federal Regulation (40 CFR 1508.20) "mitigation" includes:

(1) Avoiding the impact: Circumventing certain action or portions of that action to minimize the adverse impacts caused by that action to the environment.
(2) Minimizing the impact: Limiting the degree/magnitude of the action and its implementation on the environment.
(3) Rectifying the impact: Repairing, rehabilitating, or restoring the portion of the environment affected by the action.
(4) Reducing or eliminating the impact over time: Performing preservation and maintenance operations during the period of time within which the action will have potentially adverse impacts on the environment.
(5) Compensating for the impact: Replacing or providing substitute resources or environments to compensate for the adverse impacts caused by the action.

The appropriate mitigation and monitoring measures will be implemented in conjunction with all wildfire management activities. The intent of the mitigation measures is to avoid, minimize, reduce, and/or eliminate the impacts to resources from wildland fire management actions. The intent of the monitoring measures is to document the results of the mitigation actions.

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 that may occur to air quality as a result of wildland fire management activities:

- For all prescribed fire and wildland fire use operations, coordinate activities with the Air Pollution Control Division of the Colorado Department of Public Health and Environment. Prior to the start of a prescribed burn or WFU activity, obtain all required permits from the Department .

- For all prescribed fire and wildland fire use operations, follow State of Colorado smoke management reporting and implementation procedures, 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. Actions include monitoring and documenting smoke dispersal, column mixing height, and 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.
- To manage potential smoke impacts, keep burn piles small, dirt free, and as dry as possible.
- On the day of a burn, reevaluate meteorological conditions to ensure that circumstances are favorable for smoke dispersion and that air quality standards will not be threatened. If conditions are unfavorable for smoke dispersal, postpone the burn.
- To minimize exhaust conditions, maintain mechanized equipment in good operating condition.
- Notify public of all prescribed fire and wildland fire use activities.

Water Resources

The following mitigation measures will be taken to minimize adverse impacts that may occur to water resources as a result of wildland fire management activities:

- To reduce the risk of increased sedimentation in streams, best management practices will be utilized.
- To reduce the risk of waterway contamination, fire retardant will not be applied within a 300-foot buffer zone around any waterway.
- To minimize the risk of gasoline or oil spills, chainsaws, vehicles, or other equipment will be maintained over ground protection. Refueling stations with ground protection will also be utilized.
- MIST will be employed whenever possible.

Soils

The following mitigation measures will be taken to minimize adverse impacts that may occur to soils as a result of wildland fire management activities:

- To minimize or prevent erosion of disturbed soil during and after all fire management activities, natural barriers and wetlines will be utilized where feasible.
- To prevent soil movement, exposed soils will be rehabilitated where necessary during fire management activities. Measures include the installation of erosion-control devices on steep slopes and the coverage of bare soil.

- Use of a Burned Area Emergency Rehabilitation (BAER) team to identify specific mitigation measures during an on-site evaluation.
- MIST will be employed whenever possible.

Wetlands and Floodplains

The following mitigation measures will be taken to minimize adverse impacts that may occur to wetlands and floodplains as a result of wildland fire management activities:

- To limit impacts to wetlands, floodplains and riparian areas to the extent possible, these resources will be identified during the project planning period. Proposed project boundaries will be adjusted and if possible these resources will be entirely avoided.
- Equipment maintenance and fueling will not be conducted in wetlands or riparian areas.
- Slash will not be moved from upland sites to wetland or riparian areas or placed in open water without approval of resource specialist.
- The use of retardant and foam in or near wetlands or riparian areas will be avoided to the extent possible.
- MIST will be employed whenever possible.

Vegetation Health and Ecological Integrity

The following mitigation measures will be taken to minimize adverse impacts that may occur to vegetation health and ecological integrity as a result of wildland fire management activities:

- For management actions that may remove or disturb native vegetation and/or sensitive species, including the proposed locations of camps, staging areas, and helispots, consult with natural resource specialists.
- When constructing control lines, 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.) to the extent possible.
- To restore native vegetation, utilize natural disturbance regimes and revegetation to the extent possible.
- When utilizing fire retardant and low-level aircraft, approval by the Refuge Manager or Park Superintendent must be obtained for each respective site.
- Keep fire lines to the minimum width necessary to allow backfiring or create of a safe blackline.
- To avoid unnecessary fire line construction, whenever possible, utilize natural barriers.
- Transport crews and equipment on established roads, whenever possible.
- To avoid resource damage, wherever possible, ensure that fire crews vehicles are parked in specified access areas and that project areas are accessed on foot within the Refuge, Park, and Ranch.
- Use wet lines in lieu of hand line construction when adequate water and pumps are available.

- Rehabilitate all fire lines, camps, and other disturbances created during fire management activities including stabilizing slopes, and if necessary, re-seeding disturbed sites with native vegetation.
- Employ MIST whenever possible.

Threatened, Endangered, and Candidate Species

The following mitigation measures will be taken to minimize adverse impacts that may occur to threatened, endangered, and candidate species as a result of wildland fire management activities:

- Where the presence of any listed endangered or threatened species is suspected, consult the FWS and/or NPS biologist to establish the need to survey for species occupancy.
- If species are found, steps will be taken to reduce or avoid impacts to the species, including a halting of activities during breeding or nesting seasons.
- USFWS Ecological Services will be contacted pursuant to Section 7 of the Endangered Species Act to ensure that appropriate and effective mitigation is implemented.

Wildlife and Wildlife Habitat

The following mitigation measures will be taken to minimize the adverse impacts that may occur to wildlife and wildlife habitat as a result of wildland fire management activities:

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

Non-native, Invasive Species

The following mitigation measures may be taken to minimize the introduction and spread of non-native invasive species that may occur as a result of wildland fire management activities:

- Prior to and following treatment, within the FMU, monitor for non-native and invasive plants.
- In all fire management planning efforts, incorporate measures that reduce the likelihood of non-native invasive introduction and spread. Measures include washing equipment prior to entering project site and limiting the overall disturbance area.
- Control or eradicate the non-native, invasive species with the FMU that are likely to invade following a fire management activity.
- During rehabilitation, utilize certified weed seed free straw.

Cultural Resources

For cultural resources, mitigation measures will be agreed upon by NPS, FWS, and TNC personnel and the Colorado SHPO office, on a project-specific basis. For wildland fire suppression actions, mitigation measures will be included in all treatment plans, WFIP, and Incident Management Plans.

The following mitigation measures may be taken to minimize adverse impacts to cultural resources that may occur as a result of wildland fire management activities. Additional mitigation measures may be developed and implemented in coordination with the SHPO. The mitigation measures include:

- Conduct project-specific Section 106 review and consult with SHPO.
- Inventory and reporting will be completed by person(s) who meet the *Secretary of the Interior Standards*.
- A Resource Advisor (READ), who meets the *Secretary of the Interior Standards,* will be assigned to WFU actions, prescribed burns, manual/mechanical fuel reduction projects, wildland fire suppression actions, and Burned Area Emergency Rehabilitation (BAER) as needed.
- Protective tactics will be utilized in areas identified by NPS and FWS cultural resource specialists and/or ranch manager/personnel, as having cultural significance (e.g. archeological, historic, ethnographic, or landscape). Tactics to protect the resource may include foaming or wetting the resource, wrapping it with fire-shelter fabric, installing a temporary sprinkler system, and black-lining the resource perimeter.
- Prior and during project implementation, locate and isolate historic properties that are vulnerable to fire, suppression, or manual/mechanical activities and in need of protection.
- Prior to implementation of project work, identify and protect/restore contributing elements of cultural landscapes.
- Work in coordination with Native American tribes and fire crews to identify and protect ethnographic resources.
- Work crews will be briefed regarding the need to protect any cultural resources encountered. Work crews will be informed to the illegality of collecting artifacts on federal and private land. A notification process will be created by which work crews can alert cultural resource specialist when new resources are encountered.

- Where appropriate, heavy fuels that may cause long-duration heating on and around cultural resources will be removed.
- Vehicle traffic will be confined to existing roadways.
- Avoid the aerial application of water or retardant to structures and structural remains.
- Slash will be disposed of away from the vicinity of cultural resources.
- During wildland fire suppression actions, route fire control lines around cultural resources.

Wilderness

For all fire management activities within designated and recommended wilderness areas, the following mitigation measures will be taken to minimize adverse impacts to wilderness resources that may occur as a result of wildland fire management activities:

- 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).
- Conduct initial attack actions using MIST.
- Heavy equipment, pumps, chainsaws, or off-road vehicles will not be utilized 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 the potential adverse impacts to socioeconomics, public health and safety, and recreational opportunities and visitation that may occur as a result of wildland fire management activities:

- Consider safety of the public, personnel, and fire crews as the highest priority for all fire management activities.
- Consider impacts of all fire management activities to socioeconomics, recreational opportunities, and visitation, including the impacts to local and regional businesses and economy.
- Ensure all fire personnel have had the proper training prior to a fire management project assignment.
- 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 the appropriate personal protection equipment for their incident assignment.
- Notify Park, Refuge, and Ranch neighbors and visitors, and local residents and businesses ("the public") of planned and unplanned fire management activities that have the

potential to impact the public. Notify the public about treatment activities using the procedures identified in project-specific work plans. Identified procedures 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, to the extent possible, within prominent viewsheds.

Wildland Urban Interface (WUI)

The following mitigation measures will be taken to minimize adverse impacts to the WUI that may occur as a result of wildland fire management activities:

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

APPENDIX E: VDDT models of dominant forest types

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 F: Long Term (5 Year) Fuels Treatment Plan

Fuels Treatment Plan

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 on NPS lands 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. 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 five-year fuels treatment plan calls for projects (approximately 325 acres total) within each of the three FMU's. Treatment areas would include fuel reduction along a portion of the Medano Pass Road corridor within both the park and preserve areas, residential and developed areas, and an important area of wildland-urban interface along the northwest boundary of the park near Crestone (see maps for details). Treatment options would include manual and mechanical operations, as well as prescribed fire, with the following objectives:

- Reduce dead and down fuel loadings of fuels greater than 1-inch diameter by 50 to 75 percent.
- For non-fire treatments, establish live canopy spacing in overstory trees and pole-sized trees ranging from 5 to 25 feet. As a general rule, this equates to an average of 15 feet between tree boles, which is approximately 80 square feet of basal area per acre over the entire treatment area.
- Trees to be thinned in non-fire treatments will be less than 8-inch diameter at breast height (DBH), except in high density stands of pinyon-juniper woodlands, where tree densities may require larger trees to be removed.
- Remove 50 to 75 percent of pole-sized trees that are growing into the overstory crowns in non-fire treatment areas.
- Limb 50 to 80 percent of all overstory trees up to 5 feet above ground level in non-fire treatment areas.

- For prescribed fire projects, reduce shrub cover by 20 to 60% immediately post-fire
- For prescribed fire projects, generate 5 to 25% mortality in pole-sized trees (1" to 6" diameter) within 5 years post-fire.
- For prescribed fire projects in pinyon-juniper woodlands, generate 5 to 25% mortality in overstory trees (>6" diameter) within 5 years post-fire.
- Protect and maintain 20 to 50 percent of all dead standing overstory and pole sized snags.
- Remove 50 to 80 percent of all dead standing overstory and pole-sized trees (snags).

In addition to these standards, 90 to 100 percent of all aspen, limber pine, and bristlecone pine overstory trees, pole-sized trees, and seedlings will be protected from non-fire fuels reduction activities. Snags retained will be either those identified by the Resource Management Specialist or those that meet criteria identified in the site specific fuel treatment plan.

In addition, a natural resource protection project and a cultural resource protection project are proposed. At this time, the exact location(s) for these projects have not been determined. Fuel reduction treatment activities associated with resource protection would be limited to a 100 meter radius surrounding the site and consist of the removal of fuels that pose an immediate risk to important resource values.

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 the treatment areas have not yet been surveyed for the specific resource elements to be protected. 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 unwanted wildland fires. For each fuels management project, a Resource Management Specialist or Biologist, in coordination with the Park Superintendent will determine which of the conservation measures listed below are appropriate and necessary for each specific project.

The distribution of vegetation types within the entire the Northwest Boundary Project is:

Vegetation Area	Percentage of Project
Southern Rocky Mountain Pinyon-Juniper Woodland (35)	33.637%
Inter-Mountain Basins Semi-Desert Shrub Steppe (67)	58.447%
Inter-Mountain basins Semi-desert Grassland (76)	6.398%
Invasive Annual and Biennial Forbland (122)	1.518%

The distribution of vegetation types within the entire the Dunes Parking Area Project is:

Vegetation Area	Percentage of Project
Inter-Mountain Basins Active and Stabilized Dune (11)	8.252%
Inter-Mountain Basins Semi-Desert Shrub Steppe (67)	54.825%
Inter-Mountain Basins Semi-Desert Grassland (76)	16.084%
Rocky Mountain Lower Montane Riparian Woodland and Shrubland (79)	12.867%
Open Water (110)	4.755%
Inter-Mountain Basins Mesic Meadow (2000)	3.217%

The distribution of vegetation types within the initial five (5) phases of the Medano Pass Corridor Project is:

Vegetation Area	Percentage of Project
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland (30)	1.116%
Rocky Mountain Ponderosa Pine Woodland (34)	33.539%
Southern Rocky Mountain Pinyon-Juniper Woodland (35)	16.446%
Inter-Mountain Basins Semi-Desert Shrub Steppe (67)	1.028%
Rocky Mountain Subalpine-Montane Riparian Shrubland (77)	41.087%
Rocky Mountain Subalpine-Montane Riparian Woodland (78)	4.816%
Rocky Mountain Lower Montane Riparian Woodland and Shrubland (79)	1.968%

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

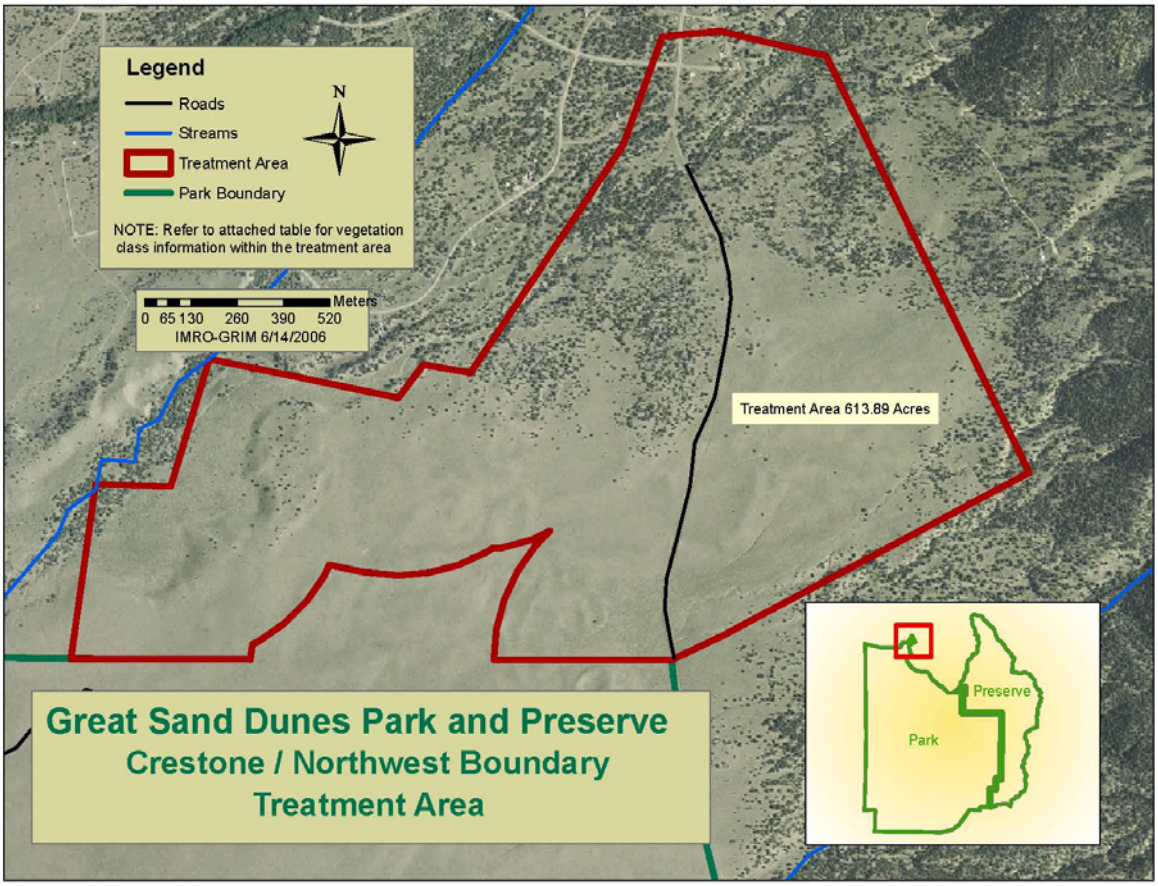
(a.) Fuels Treatments for Great Sand Dunes National Park and Preserve

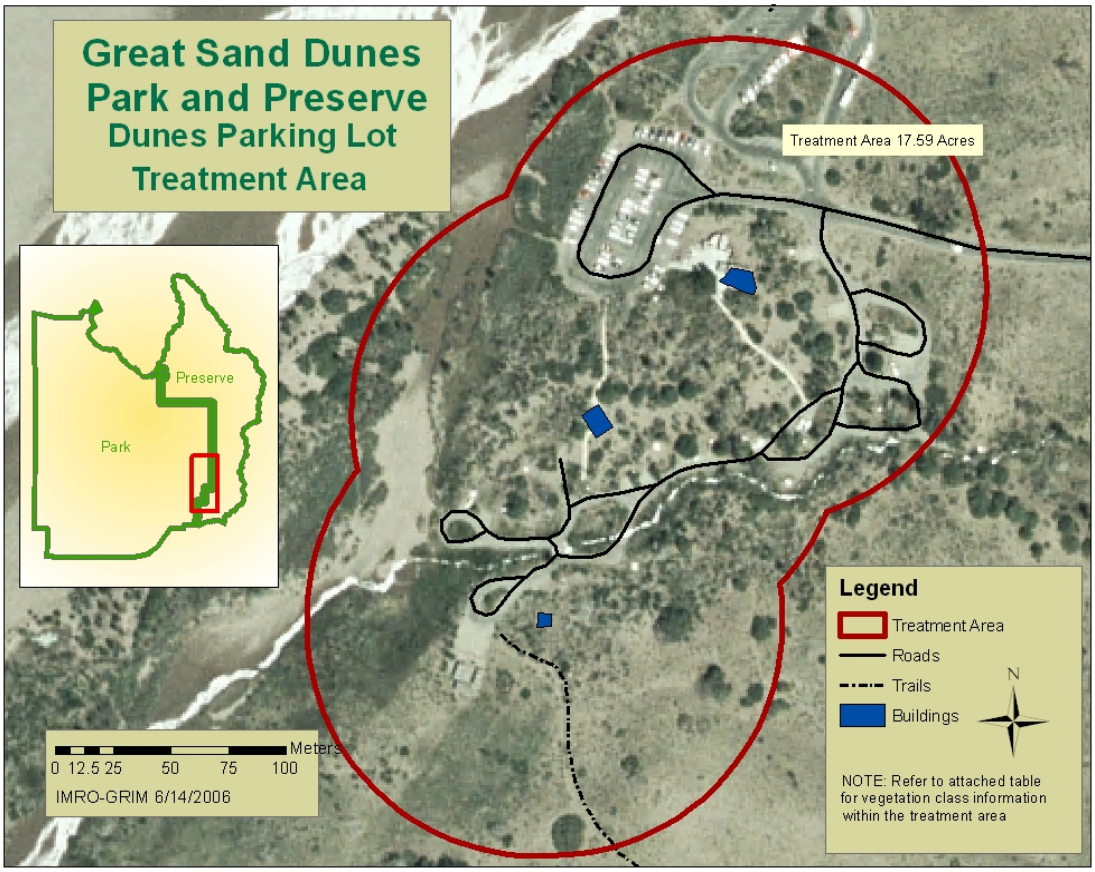
Fiscal Year	Treatment Name	WUI or HFR[1]	Treatment Type	Target Acres
FY08	Medano Pass Road Corridor (1)	WUI	Mechanical	20
FY08	Residential Area (Dunes Parking Lot and Developed Area)	WUI	Mechanical	10
FY09	Medano Pass Road Corridor (2)	WUI	Mechanical	19
FY09	Natural Resource Protection	WUI	Mechanical	20
FY09	Assessment - Interface	WUI	Other	0
FY10	Cultural Resource Protection	WUI	Mechanical	25
FY10	Medano Pass Road Corridor (3)	WUI	Mechanical	14
FY10	NW Boundary	WUI	Mechanical	20
FY11	Medano Pass Road Corridor (4)	WUI	Mechanical	20
FY11	NW Boundary	WUI	Fire	35
FY12	Medano Pass Road Corridor (5)	WUI	Mechanical	20
FY12	NW Boundary	WUI	Mechanical	30
FY12	NW Boundary	WUI	Fire	65

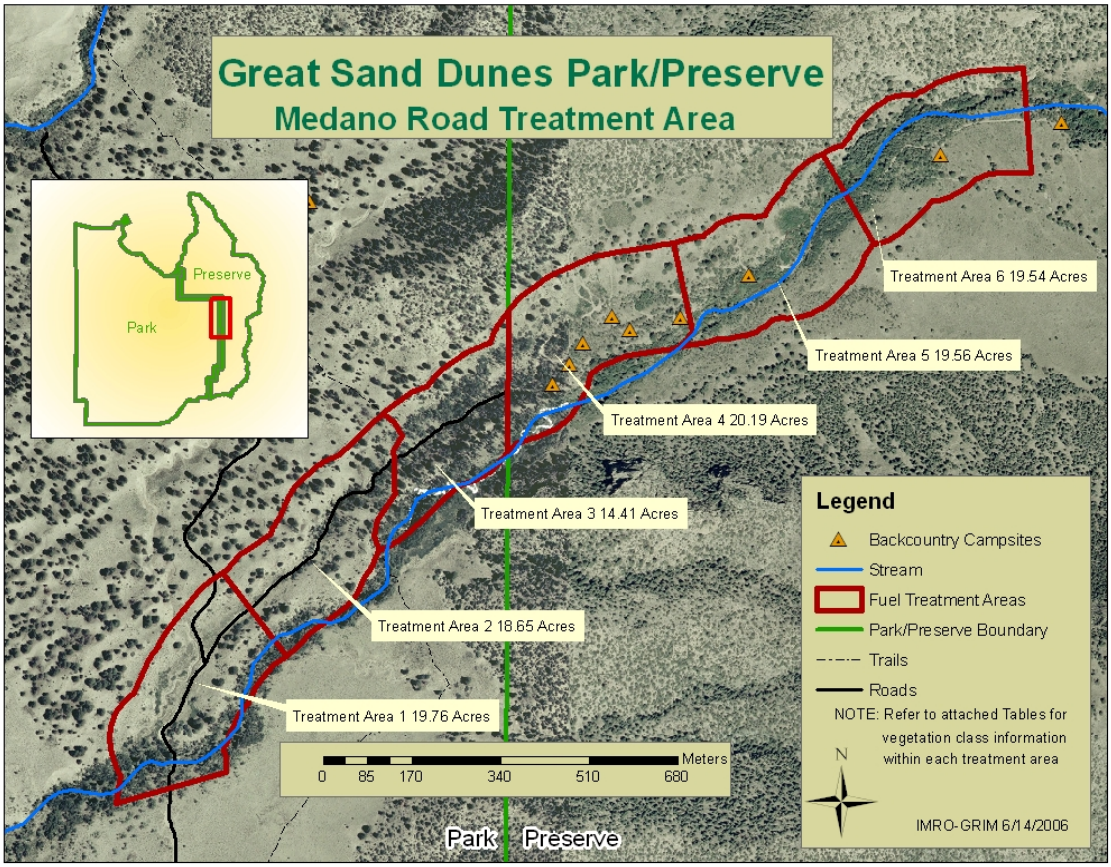
(b.) Fuel Treatments for Baca National Wildlife Refuge

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


Legend
Roads
Streams
Treatment Area
Park Boundary
N
NOTE: Refer to attached table for vegetation class information within the treatment area
Meters
0 65 130 260 390 520
IMRO-GRIM 6/14/2006
Treatment Area 613.89 Acres
Great Sand Dunes Park and Preserve
Crestone / Northwest Boundary
Treatment Area
Preserve
Park


Great Sand Dunes Park and Preserve
Dunes Parking Lot
Treatment Area
Treatment Area 17.59 Acres
Preserve
Park
Legend
Treatment Area
Roads
Trails
Buildings
N
Meters
0 12.5 25 50 75 100
IMRO-GRIM 6/14/2006
NOTE: Refer to attached table for vegetation class information within the treatment area


Great Sand Dunes Park/Preserve
Medano Road Treatment Area
Preserve
Park
Treatment Area 6 19.54 Acres
Treatment Area 5 19.56 Acres
Treatment Area 4 20.19 Acres
Treatment Area 3 14.41 Acres
Treatment Area 2 18.65 Acres
Treatment Area 1 19.76 Acres
Legend
Backcountry Campsites
Stream
Fuel Treatment Areas
Park/Preserve Boundary
Trails
Roads
NOTE: Refer to attached Tables for vegetation class information within each treatment area
N
IMRO-GRIM 6/14/2006
0 85 170 340 510 680
Meters
Park
Preserve

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 goal would be to reduce the dead downed fuel load by 50-100% within cottonwood stands. This will assist in protecting the cottonwoods and other vegetation by modifying and limiting high intensity fire behavior in the event of unwanted wildfires and provide protection to firefighters, the public, and structures within the Refuge and in the communities of Baca Grande and Crestone. This project would involve removing downed woody material by manual and mechanical means and mowing or removing some or all flammable shrubs, such as rabbitbrush, within these stands within a 15-foot radius around live cottonwoods. Woody material from these stands would be piled and burned in adjacent open areas during times of the year when fire danger is very low and there are no critical wildlife concerns. Treatment of shrubs as necessary to modify fire behavior would also only be completed during times of the year which would avoid critical wildlife concerns. Live willows would not be mowed. Willows create a fuelbreak favorable to reducing or retarding fire spread. Attached photos show successful projects within similar habitat types at Brown's Park NWR in northwest Colorado.



Above - Pre-treatment photo of similar riparian stands at Brown's Park NWR

Below – After removal of dead, downed fuels in riparian stands at Brown's Park NWR





Above – After removal of dead, downed fuels in riparian stands at Brown's Park NWR

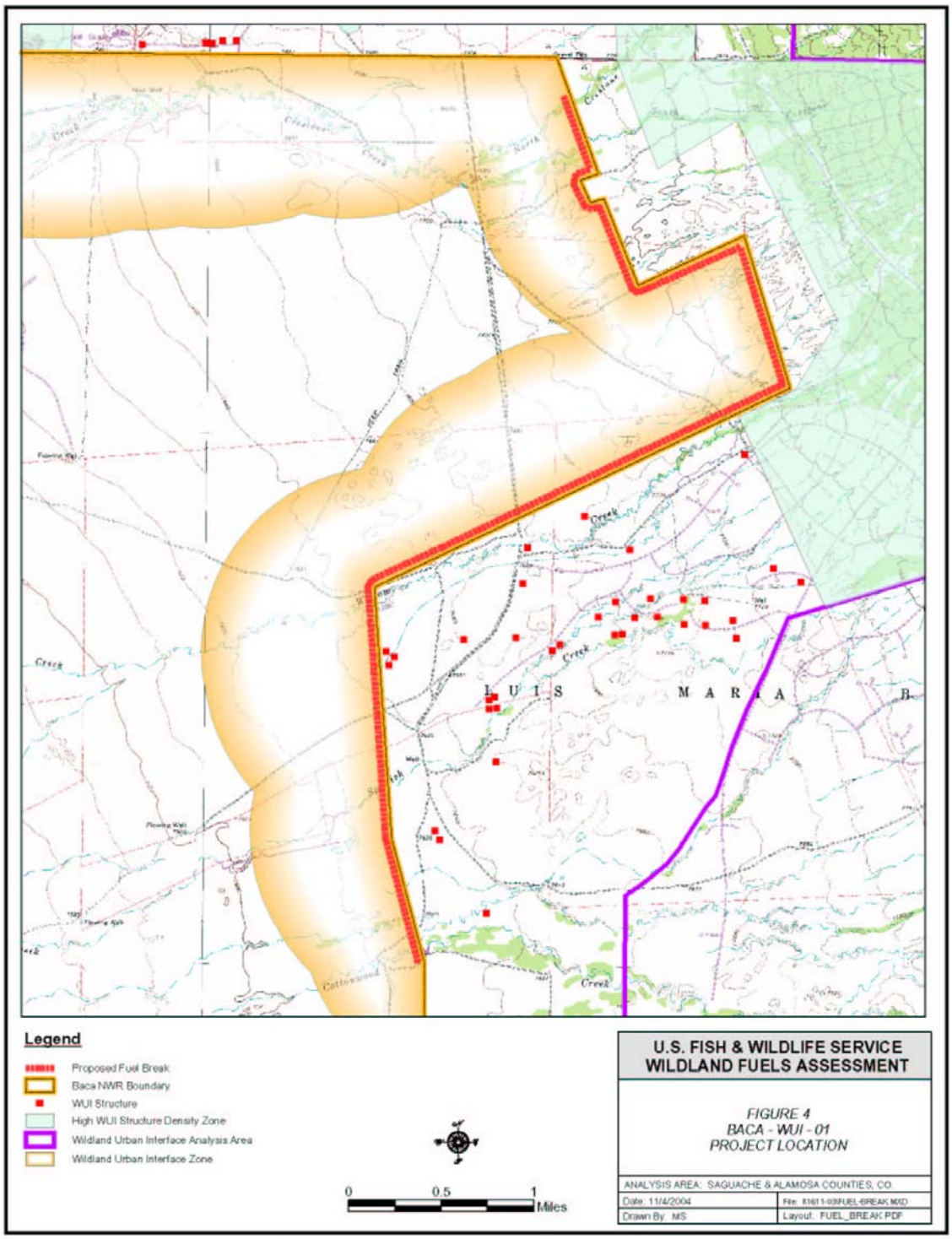
Below – Burning of piles during winter at Brown's Park NWR

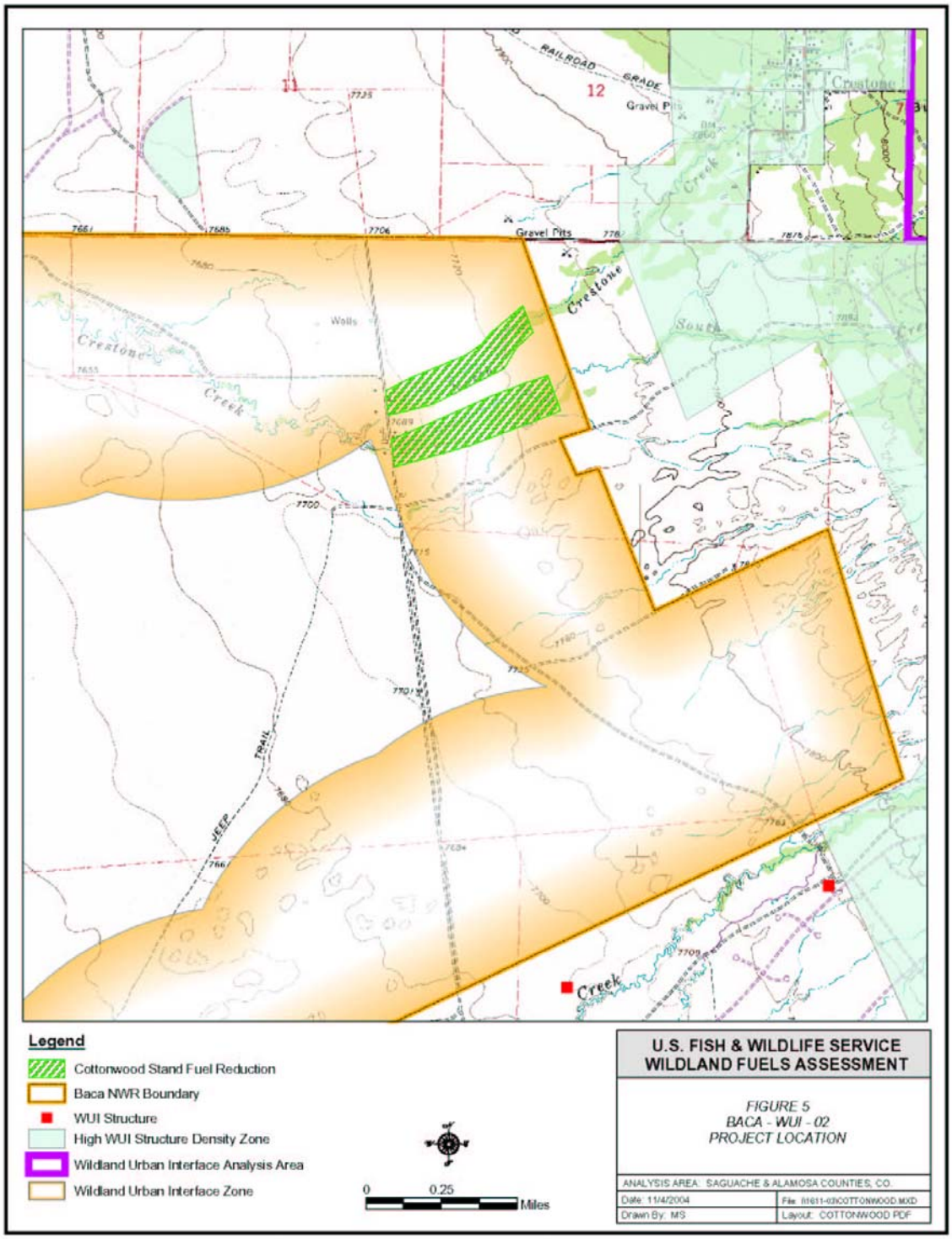


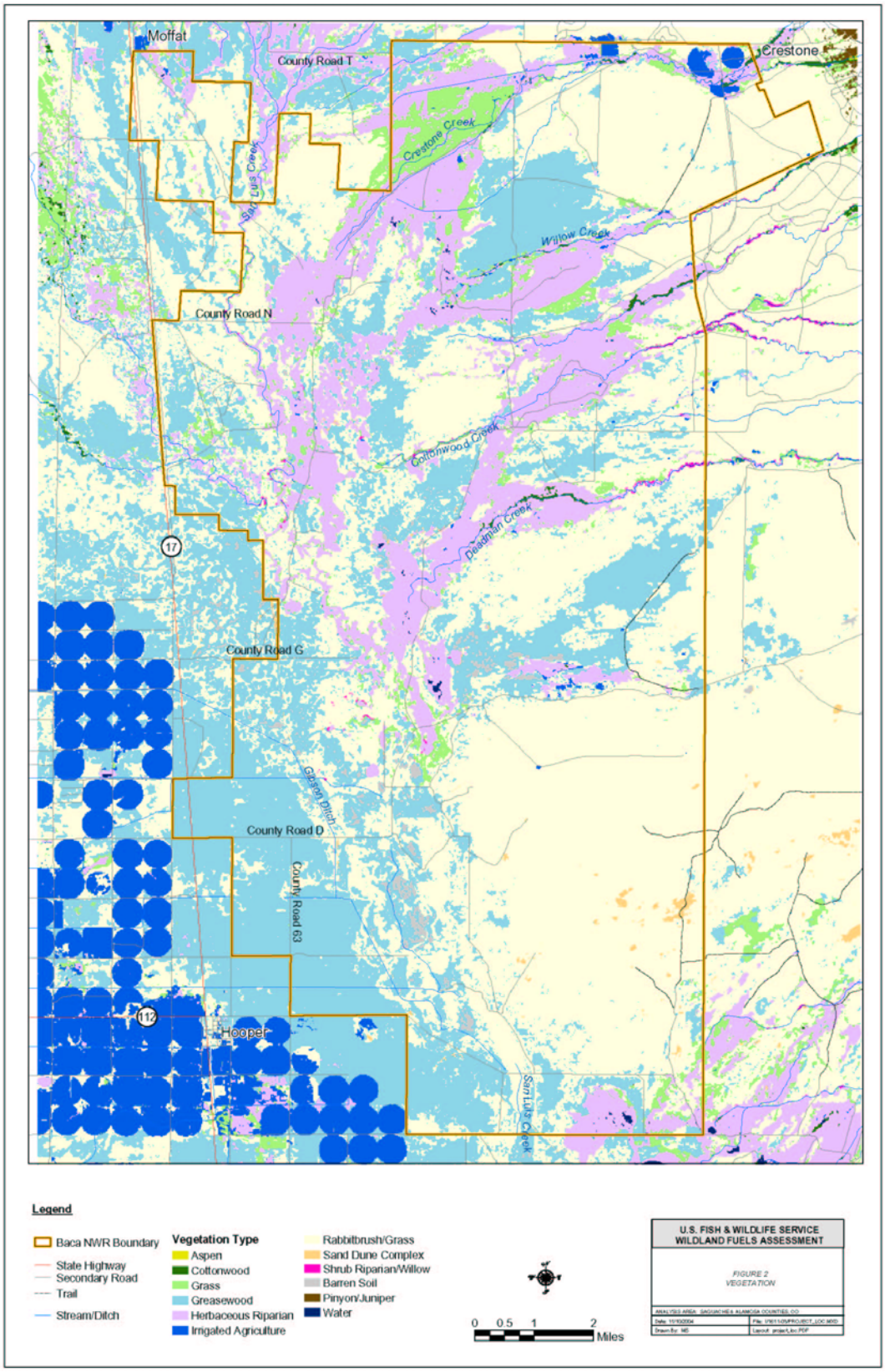
Baca-WUI/HFR-03. The Baca-WUI/HFR-03 project proposes to monitor fuels within wet meadow areas that may change in the near future with changes in the type of management, such as the cessation of grazing and haying within these areas. Goals of this monitoring would be to track changes in the vegetation 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.

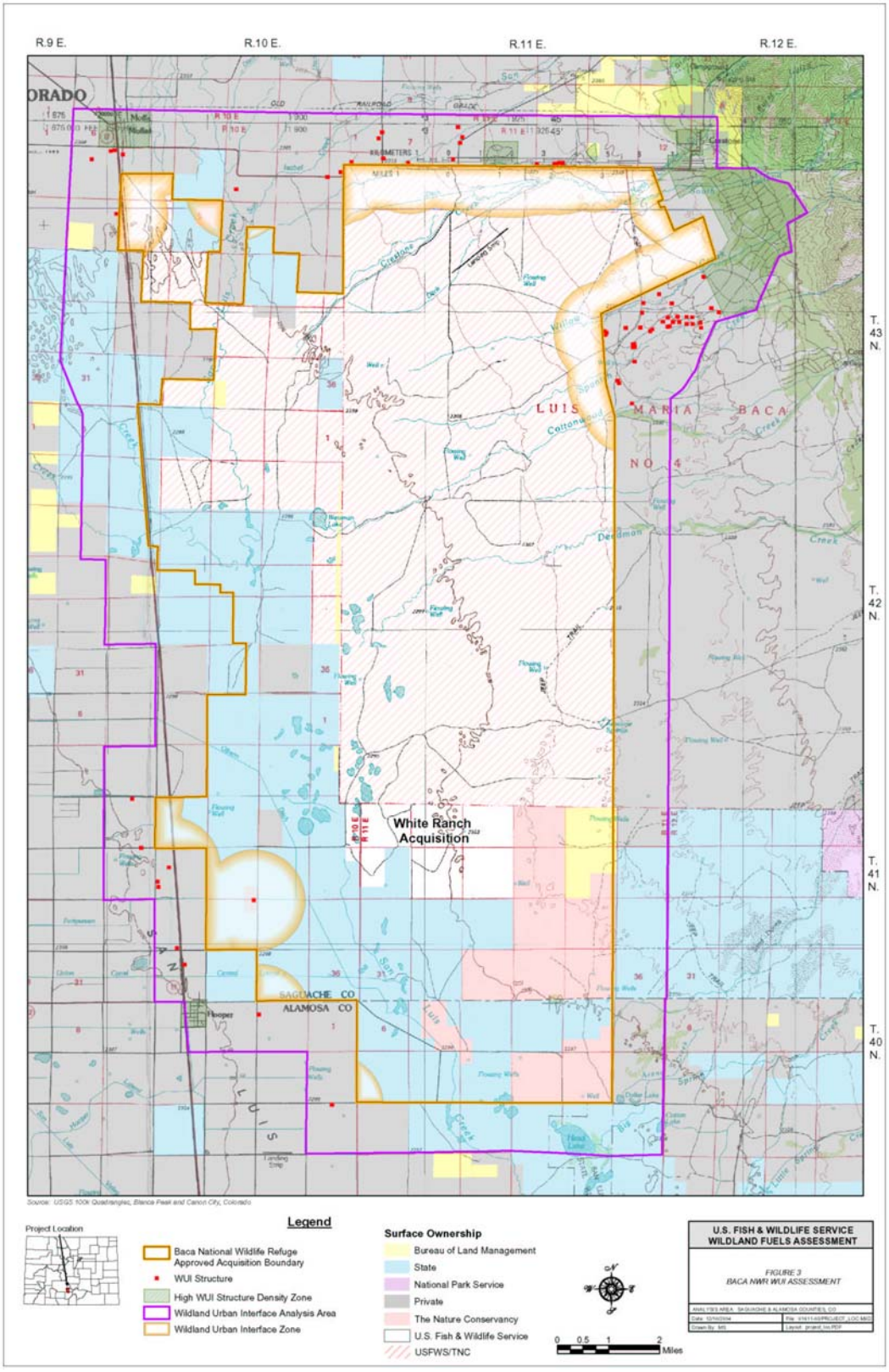
Baca-WUI-04. The Baca-WUI-04 project calls for the development of an information and education program, which FWS would use to educate and inform local residents and landowners about wildfire risks and wildfire risk reduction. This would partially be accomplished through the creation of a brochure about 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.


L U I S M A R I A B
Creek
Legend
Proposed Fuel Break
Baca NWR Boundary
WUI Structure
High WUI Structure Density Zone
Wildland Urban Interface Analysis Area
Wildland Urban Interface Zone
0
0.5
1
Miles
U.S. FISH & WILDLIFE SERVICE
WILDLAND FUELS ASSESSMENT
FIGURE 4
BACA - WUI - 01
PROJECT LOCATION
ANALYSIS AREA: SAGUACHE & ALAMOSA COUNTIES, CO.
Date: 11/4/2004
File: 81611-03\FUEL-BREAK.MXD
Drawn By: MS
Layout: FUEL_BREAK.PDF


RAILROAD GRADE
Gravel Pits
Crestone
Creek
Wells
JEEP TRAIL
Legend
Cottonwood Stand Fuel Reduction
Baca NWR Boundary
WUI Structure
High WUI Structure Density Zone
Wildland Urban Interface Analysis Area
Wildland Urban Interface Zone
0
0.25
Miles
U.S. FISH & WILDLIFE SERVICE
WILDLAND FUELS ASSESSMENT
FIGURE 5
BACA - WUI - 02
PROJECT LOCATION
ANALYSIS AREA: SAGUACHE & ALAMOSA COUNTIES, CO.
Date: 11/4/2004
File: fi1611-03\COTTONWOOD.MXD
Drawn By: MS
Layout: COTTONWOOD.PDF


Moffat
County Road T
Crestone
Crestone Creek
San Luis Creek
Willow Creek
County Road N
Cottonwood Creek
Deadman Creek
17
County Road G
Gibson Ditch
County Road D
County Road 63
112
Hooper
San Luis Creek
Legend
Baca NWR Boundary
State Highway
Secondary Road
Trail
Stream/Ditch
Vegetation Type
Aspen
Cottonwood
Grass
Greasewood
Herbaceous Riparian
Irrigated Agriculture
Rabbitbrush/Grass
Sand Dune Complex
Shrub Riparian/Willow
Barren Soil
Pinyon/Juniper
Water
0 0.5 1 2
Miles
U.S. FISH & WILDLIFE SERVICE
WILDLAND FUELS ASSESSMENT
FIGURE 2
VEGETATION


R.9 E.
R.10 E.
R.11 E.
R.12 E.
T. 43 N.
T. 42 N.
T. 41 N.
T. 40 N.
White Ranch Acquisition
SAGUACHE CO
ALAMOSA CO
Hooper
Project Location
Legend
Baca National Wildlife Refuge Approved Acquisition Boundary
WUI Structure
High WUI Structure Density Zone
Wildland Urban Interface Analysis Area
Wildland Urban Interface Zone
Surface Ownership
Bureau of Land Management
State
National Park Service
Private
The Nature Conservancy
U.S. Fish & Wildlife Service
USFWS/TNC
0 0.5 1 2
Miles
U.S. FISH & WILDLIFE SERVICE
WILDLAND FUELS ASSESSMENT
FIGURE 3
BACA NWR WUI ASSESSMENT

Monte Vista and Alamosa FMU 5 year Treatment Plans

Fuel Treatments for the Monte Vista National Wildlife Refuge

Fiscal Year	Treatment Name (unit)	WUI or HER(1)	Treatment Type	Target Acres
2007	8,17			940
2008	4,10			940
2009	1,18			510
2010	6,			250
2011	14,			650

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

Fuel Treatments for the Alamosa National Wildlife Refuge

Fiscal Year	Treatment Name (unit)	WUI or HER(1)	Treatment Type	Target Acres
2007	O,			644
2008	M,P			1,222
2009	Q,			831
2010	J,			972
2011	C,			544

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