National Park Service
U.S. Department of the Interior

Guadalupe Mountains National Park
Texas

Fire Management Plan

August 2005

Updated: February 2012

Fire Management Plan

National Park Service

Guadalupe Mountains National Park

TEXAS

August 2005

Prepared by: _____ Date: 09/27/2005

Fire Management Officer, Guadalupe Mountains National Park

Approved by: _____ Date: 09/27/05

Superintendent, Guadalupe Mountains National Park

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Updated: February 2012

Updated By: _____ **Date:** 3-1-12

Fire Management Officer, Guadalupe Mountains National Park

Approved By: _____ **Date:** 3/2/12

For **Superintendent, Guadalupe Mountains National Park**

Revision incorporates terminology changes primary the addition of Wildland Fire Decision Support System (WFDSS) replacing WFIP / WFSA. Preparedness Staffing Step Up Plan Indices updated. Pinery / THEBOWL RAW's average temperatures and precipitation updated.

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Chapter I. Introduction

Guadalupe Mountains National Park sits at the southwest end of the Guadalupe Mountains in Hudspeth and Culberson Counties, Texas (Figure I-1). The range rises abruptly from Chihuahuan Desert plains on the Texas-New Mexico border about 110 miles east of El Paso, Texas and 60 miles southwest of Carlsbad, New Mexico. This mountain mass forms a portion of the world's most extensive Permian limestone fossil reef. In addition to significant geological features, the 86,500-acre national park hosts a diversity of habitats for plants and animals over its 5000-foot elevational range. Visitors experience grand expanses of desert, chaparral-covered slopes, canyon woodlands, and forested highlands. Over half of the park (46,850 ac) is designated wilderness. Tree rings within the park record regular fires over a 500-year period beginning in A.D. 1496 (Ahlstrand 1981). Consequently, we conclude that fire has shaped the landscape in this mountain range, and local fauna and flora have adapted to or are even dependent upon disturbances created by periodic fires.

A mixture of private and government lands borders the park. Public lands on the New Mexico side (north of north boundary) include holdings of USDA Forest Service, Lincoln National Forest-Guadalupe District; DOI Bureau of Land Management (BLM), Las Cruces and Pecos District (Carlsbad Resource Area); and the state of New Mexico. Public lands adjacent to the park in Texas are primarily school and General Land Office lands. Some private land borders the park in New Mexico. In Texas, except for several subdivided parcels, mostly large ranches lie next to the park. A few rights-of-way (pipelines, utilities) cross the park.

It is against this background that we have developed the current fire management plan (FMP). The National Park Service Director's Order 18 (1998) states:

> Wildland fire may contribute to or hinder the achievement of park management objectives. Therefore, park fire management programs will be designed to meet resource management objectives prescribed for the various areas of the park and to ensure that firefighter and public safety are not compromised. Each park with vegetation capable of burning will prepare a FMP to guide a fire management program that is responsive to the park's natural and cultural resource objectives and to safety considerations for park visitors, employees, and developed facilities.

This fire plan is an interpretation and application of national direction at the local level for Guadalupe Mountains National Park and is the primary reference for conducting all fire management activities in the park. People consulting this plan must put it in the perspective of the enabling legislation, other related legislation, policies, regulation, and guidelines. This plan will be revised periodically to incorporate new knowledge of fire effects and fire behavior, as well as changing policies and guidelines.

The park's first FMP was approved in 1975, when full suppression was the rule. A 1985 plan allowed "full spectrum" fire management as did the subsequent 1996 plan. This 2004 document is a revision of the 1996 plan based on changes to Service-wide fire policies and more knowledge of ecology and fire management in the park. The plan has been written to provide the justification and foundation of a complete fire management program, addressing both fire suppression and prescribed fire. Like the 1996 fire plan, the current one also includes cooperation with neighbors, particularly with the Lincoln National Forest (LNF) Guadalupe District and BLM Pecos (formerly Carlsbad) District.

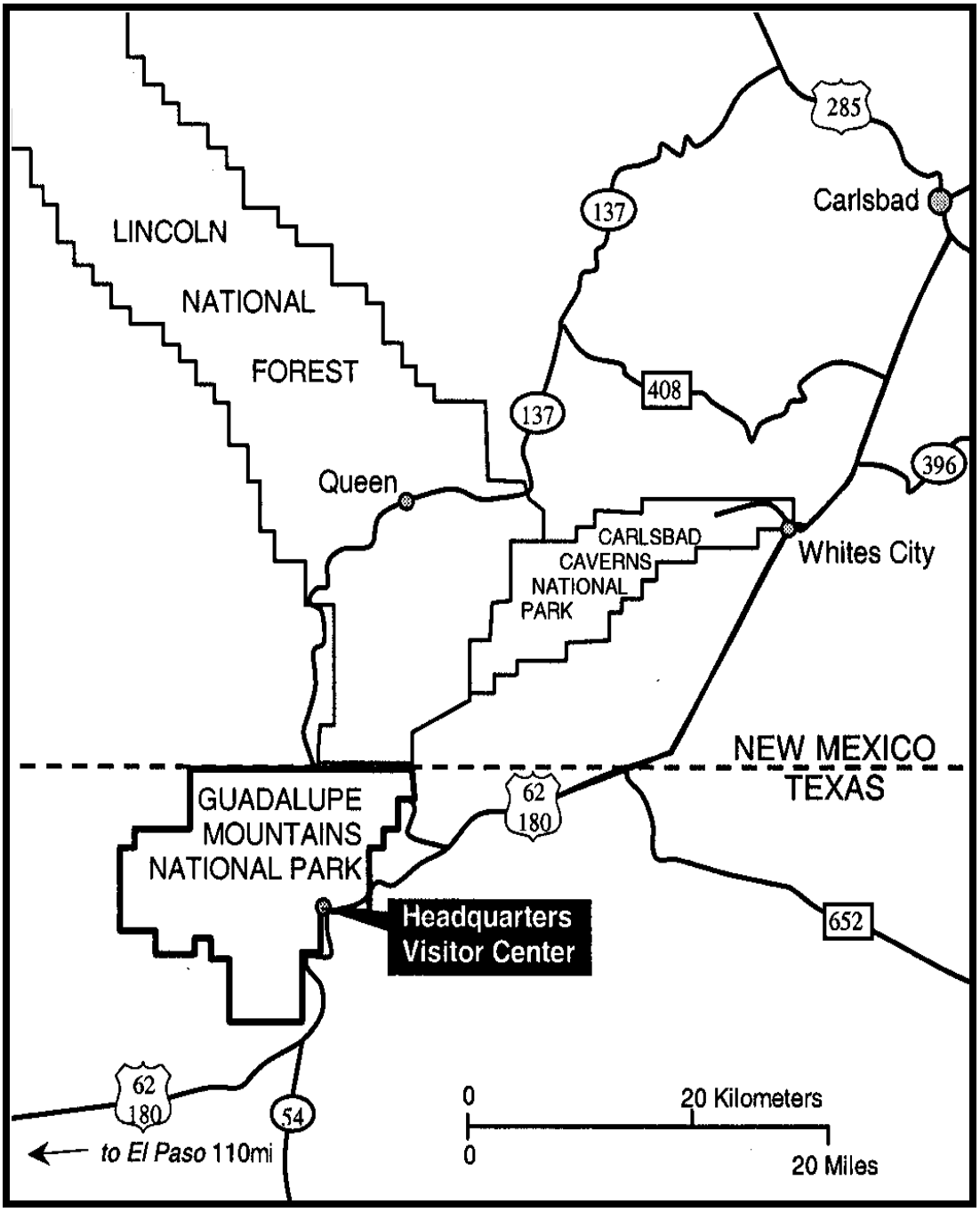


Figure I-1. Location of Guadalupe Mountains National Park.

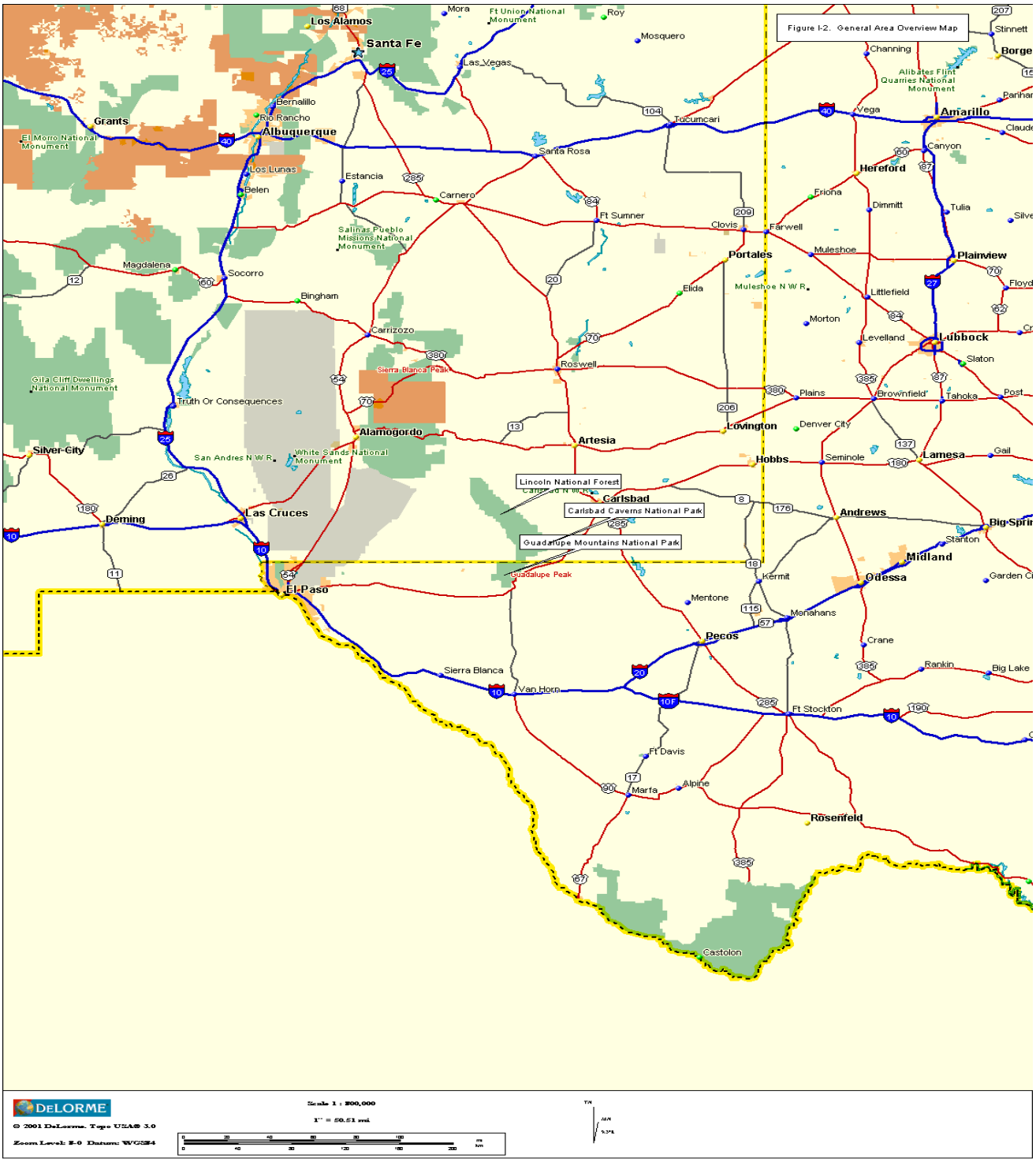


Figure I-2. General Area Overview Map

The National Park Service (NPS), LNF, and BLM will continue to cooperate on suppression actions and plan to work together on wildland fire for resource benefits, prescribed burns, and non-fire treatments. The agencies agree that it is appropriate for projects to cross boundaries when all involved parties have agreed to goals (and prescriptions designed to meet those goals) beforehand. The Guadalupe District of the LNF understands the interest of the NPS in the management of Upper McKittrick Canyon, north of the park boundary, since the area is part of the headwaters of an important park drainage. A Memorandum of Agreement, (cooperative agreement) has been developed to address common management concerns and activities in the Upper McKittrick Canyon. This separate agreement further defines NPS and LNF collaboration in the management of a sensitive area important to both agencies.

An interdisciplinary team prepared an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) to comply with the National Environmental Policy Act (NEPA).

On October 7, 2003, the USFWS concurred with a species list provided by the park. On January 27, 2004, the park submitted a biological assessment and requested formal consultation. The Service subsequently began working on a biological opinion while the park provided the Service with a draft environmental assessment with a preferred alternative identified. On June 10, 2005, the park sent the Service Mexican spotted owl (MSO) survey data from the last three years and maps of recently designated MSO protected activity centers (PACS). On June 27, 2005, the park submitted a letter identifying the NPS as the lead Federal agency to the proposed action. The biological opinion was completed and issued by the Service on August 4, 2005 as a result of the aforementioned materials, email and telephone conversations between agency staffs. The proposed action is not likely to jeopardize the Mexican spotted owl. Archeologists of the Western Archeological and Conservation Center and of the Southern Arizona Group Office, NPS addressed National Historical Preservation Act (NHPA) requirements. Additional review was requested from the Texas State Historic Preservation Office. The NHPA Assessment of Effects is included with the EA. The interdisciplinary team composed of managers and subject matter experts, gathered information, developed alternatives, prepared the draft and final documents, and involved the public to carry out the compliance process. Chapter XI lists the team members and information about their specialties and experience.

The authorities and guidelines for implementing this plan are contained in:

- NPS Management Policies (NPS 2001a)
- Director's Order 18—Fire Management (1998)
- Reference Manual 18—Fire Management (NPS 2001)
- Statement for Management (NPS 1997)
- Guadalupe Mountains National Park Resources Management Plan (1992 with updates)
- Reference Manual 77—Natural Resources Management (NPS 1999 and in progress)
- USDI Fire Management Policy (910 DM; DATE)
- Director's Order 12—NEPA and NHPA Requirements (NPS 2001c)
- Director's Order 28—Cultural Resources Management (2000)
- Reference Manual 28—Cultural Resources Management (2001)
- Wildland and Prescribed Fire Management Policy: Implementation Procedures and Reference Guide (1998)

Recommendations contained in the Federal Wildland Fire Management Policy (National Interagency Fire Center 2001) have been included where applicable.

Chapter II. Land Management Planning and Fire Policy

Management Policies Statements

The NPS recognizes the occurrence as well as the absence of fire as integral factors influencing parks. Fire management policies are set forth in section 4.5 of 2001 Management Policies (NPS 2001a) and are summarized below:

- fire management programs will meet resource management objectives while ensuring protection of life and property
- parks with vegetation capable of burning will prepare FMPs and address funding and staffing required by fire programs
- fire plan development will include the NEPA compliance process and necessary collaborations with outside parties
- fires in vegetation are to be classified as wildland or prescribed fires
- wildland fires are managed according to considerations of resource values, safety, and cost
- prescribed fires are ignited to achieve resource management goals and closely monitored to determine whether they successfully meet objectives
- parks lacking approved plans must suppress all wildland fires using methods that minimize impacts while protecting life, property, and resource values
- suppression in wilderness will be consistent with the "minimum requirement" concept.

Legislative Mandates

This FMP directly supports the mission of Guadalupe Mountains National Park, as defined by the legislation that established the NPS and the park's enabling legislation.

The Organic Act of August 25, 1916 created the National Park Service and directed it "...to conserve the scenery and the natural and historic objects and the wild life within...." It also gave the Secretary of the Interior authority to conduct certain management actions.

Public Law 89-667 created Guadalupe Mountains National Park on October 15, 1966 "to preserve in public ownership an area in the State of Texas possessing outstanding geological values together with scenic and other natural values of great significance." The park was formally established September 30, 1972 on 76,293 acres.

Congress formally designated 46,850 acres of the park as wilderness in 1978. The Guadalupe Mountains National Park Enlargement Act (102 Stat. 2720) (Public Law 100-541) of October 28, 1988, expanded the park by 10,123 acres. It provided for "…the further protection of the Guadalupe Mountains in keeping with its true significance…"

Chapter III of this plan describes the specific resources protected by the park.

Meeting General Management Plan and Resources Management Plan Objectives

General Management Plan Objectives

Work on a new General Management Plan (GMP) was on-going while this FMP was developed. The October 2000 "Park Management Topic Outlines," is a document to help outline fire planning considerations (among others) for the new GMP. Important headings are fire history, current management practices, resources at risk, desired conditions, and program needs. Fire is seen as an objective for natural resource management promoting preservation and restoration of ecosystem function, and the draft GMP offers this direction: "Where possible, allow fire to resume its natural role on the landscape of Guadalupe Mountains National Park while protecting cultural and natural resources through the use of wildland fire, prescribed fire, and suppression as described in the park's Fire Management Plan."

Resource Management Plan Objectives

Implementation of this FMP helps the park meet some resources objectives listed in the Resources Management Plan (RMP) (Guadalupe Mountains NP 1992). This fire plan addresses the perpetuation of native species and communities, protection of cultural resources, human safety, interpretation to the public, and enactment of NPS philosophies and policies. In addition, the FMP is a detailed program of action to carry out fire management policies and objectives.

The following fire-related objectives from the Guadalupe Mountains National Park RMP (1992*)* integrate legislative mandates with NPS policy:

- Ensure the preservation and health of endangered species and park endemics.
- Reintroduce the natural role of fire in park ecosystems to the maximum extent possible.
- Manipulate terrain and vegetative cover in order to restore natural conditions on lands altered by human activity.

Fire may be utilized as a resource management tool to meet other objectives of the Resources Management Plan**:**

- Re-establish native plants and animals upon their original range.
- Perpetuate native animal life for its essential role in natural ecosystems.
- Manipulate population numbers of exotic plant and animal species, up to and including total eradication, whenever such species threaten protection or interpretation of park resources.

Chapter III. Wildland Fire Management Strategies

This 2005 update of the Guadalupe Mountains National Park FMP continues many of the strategies of the 1996 plan. Wildland fire for resource benefits, suppression, prescribed burning, and non-fire fuels treatments remain the basis for action. Ideally, the park will one day be in a condition that safely allows maximizing wildland fire for resource benefits. It will take an aggressive prescribed burning program to achieve these goals. The current plan particularly emphasizes the treatment of problem fuels areas and cooperation with the Forest Service along the northern park boundary.

Fire Management Plan Goals and Objectives

The interdisciplinary team overseeing the writing of the present plan developed the following goals and objectives (bulleted) for the Guadalupe Mountains National Park fire program.

Protect people and property as the highest priority.

- Provide for the safety of visitors, firefighters, and staff.
- Directly protect real and personal property from the effects of fire.
- Reduce fuels with prescribed fire and thinning in places where wildfire is a threat to people and property.
- Implement programs to prevent unplanned human-caused ignitions and reduce human-caused wildfires.
- Strive to meet health and safety standards that relate to fire, particularly for air quality and on-the-job safety (for example, OSHA regulations).

Protect park natural and cultural resources from undesirable effects of fire and suppression.

- Reduce fuels with prescribed fire and thinning in places where fire would adversely affect park resources.
- Avoid negative effects to sensitive areas.
- Employ minimum impact suppression tactics, particularly in wilderness or other sensitive areas.

Suppress unwanted fire.

- Ensure park is adequately prepared to suppress unwanted wildland fire.
- Suppress all human-caused fire.
- Prevent unwanted fire from spreading onto neighboring government and private lands.

Allow fire to assume its natural role in park ecosystems with justification.

- Determine fire-related data needs relative to natural resources.
- In particular, attempt to determine (1) range of natural variation related to fire (in time, space, and intensity), (2) role of fire, and (3) fire effects on species in Chihuahuan Desert and Guadalupe Mountains ecosystems.
- Search for scientific results relative to data needs and apply to fire program.
- Promote research in the park relative to data needs and apply results to fire program.
- Tap the experience of individuals familiar with fire in the Guadalupe Mountains.
- Monitor fire effects and incorporate results into fire program.
- Determine desired conditions before allowing or introducing fire.

Use wildland and prescribed fire for resource management purposes.

- Return fire to fire-dependent ecosystems.
- Specify and aim for desired conditions.
- Keep fire for resource benefits within the natural range of variation (in time, space, and intensity).
- Reduce fuels in places where fire would adversely affect resources.
- Look for opportunities to use fire to restore and maintain cultural landscapes.

Manage fire cooperatively with neighboring agencies and private land owners as well as other stakeholders.

- Maintain open lines of communication.
- Collaboratively plan and implement fire operations.
- Enter cooperative agreements covering fire-related activities.
- Jointly conduct fire research programs.
- Jointly deliver consistent messages about fire prevention and management.

Coordinate fire activities with all park divisions and the public.

- Openly communicate about fire activities with all park divisions.
- Incorporate appropriate fire management tasks into all park divisions.
- Keep the public informed about park fire operations, taking advantage of interpretive opportunities when presented.

Wildland Fire Management Options

Four strategies play important roles in fire management at the park.

- Appropriate management (suppression) response is applied around developed areas and certain sensitive resources or at times when wildland fire use is not feasible or safe
- Wildland fire for resource benefits allows natural ignitions to burn when they meet predetermined prescriptions related to safety and ecological goals.
- Prescribed fire is used to reduce fuels in high-risk areas and accomplish ecological goals.
- Non-fire applications—most notably mechanical treatments and herbicides—are used instead of prescribed burning in areas where fire is inherently unsafe or undesirable or in areas that are unsafe given current fuel conditions.

Fire management units (FMUs) are areas of the park governed by distinct fire management strategies. Boundaries are clear, and procedures are laid out in detail for each FMU. The 1996 FMP delineated four FMUs along watershed boundaries; this 2004 document designates two FMUs, one small and one large. The small unit encompasses the main developed areas of the park and permits no wildland fire for resource benefits. In the larger FMU, the full range of management strategies is available—appropriate management response, wildland fire for resource benefits, prescribed burning, and non-fire applications. The large FMU includes a number of small treatment subunits (areas around isolated developments and resources) where suppression or other special handling is necessary. This plan increases the use of fire to achieve desired ecological conditions while continuing to protect life, park property, and surrounding lands.

The current plan also includes a "zone of cooperation" that extends north of the park boundary with the Forest Service to the edge of the McKittrick drainage. Here NPS and Forest Service will jointly decide the appropriate management response, and the Forest Service would maintain responsibility for

suppression. Both agencies could plan (with mutual review) and conduct prescribed fires that burn beyond the state line that separates agency properties.

Descriptions of resources, values, and sites to be protected appear at the end of the FMU descriptions. These areas are defined to ensure that sensitive species, cultural resources, developments, and unique park features are protected from harm by fire program activities. Specific locations of these features are on file in the Resource Management Office.

Physical and Biotic Characteristics

The U.S. Congress set aside Guadalupe Mountains National Park to preserve "outstanding geological values together with scenic and other natural values of great significance." Fire is one of the processes that have shaped the character of the park, and it is a constant consideration relative to protection of important park resources.

Topography and Geology

Park elevations range from 3,650 ft to over 8,749 ft on Guadalupe Peak, the highest point in Texas. Desert floor terrain is relatively level. In contrast, the topography of the escarpment is severe. Steep talus slopes, sheer cliffs, decomposing rock ledges, and long side canyons hamper access to the parks high country.

Guadalupe Mountains National Park is world-renowned for its outstanding geological values. The mountains are a remnant of a marine fossil reef that formed about 250 million years ago. Geologists assign the Guadalupe's to Trans-Pecos Texas, a mixed-age, mixed-origin basin-and-range complex that is part of the energy-rich Permian Basin west of the Pecos River (Brand and Jacka 1979). The mountains have been well studied due to this proximity to oil and natural gas fields, and the international benchmark for the Middle Permian period lies within the park. There are no living examples of this type of reef; modern reefs are mostly composed of corals.

As the sea evaporated and the reef subsided, it was buried in a thick blanket of sediments and mineral salts and remained so for millions of years until orogenic uplifting exposed parts of it. The ancient reef complex now towers above the Chihuahuan Desert in the Guadalupe Mountains, and other parts are exposed in the Glass Mountains (ENE of Van Horn) and the Apache Mountains (due E of Alpine).

Climate

While the park's Chihuahuan Desert location shapes the local climate, other influences are apparent. The northern portions in Dog Canyon show Great Basin affinities; northern and eastern portions have Great Plains connections; and higher elevations can be classified as an isolated extension of the Rocky Mountains. "Critical fire weather" occurs frequently in the Guadalupes, thanks to aridity, high winds and abundant lightning.

Precipitation. Two Remote Area Weather Stations (RAWS) currently record precipitation at the park, and a third operated from 1995 to 2000. Weather is discussed in more detail in Chapter IV, *Fire Weather and Fire Danger*.

Average annual precipitation:

- 17.72" at Bowl RAWS in FMU 2 at 8112 ft—see comment immediately below
- 17.40" at Pinery RAWS in FMU 1 at 5440 ft
- 9.10" at PX Well in FMU 2 at 3867 ft

The Bowl RAWS gauge is not heated, and snowfall is not recorded. It is reasonable to assume that Bowl station precipitation in the winter months exceeds that at the Pinery (see Chapter IV, Tables IV-2 and IV-3).

Winter fronts and summer convectional storms are primary sources of precipitation in the Guadalupe Mountains region. The higher elevations of the park tend to receive more winter precipitation, while the lower elevations receive more in the summer months. Winter fronts come from the west. Precipitation is generally gentle, widespread, and often of long duration. Storms usually begin around the end of October, and precipitation often falls as snow, with the relative amounts increasing both with elevation and latitude.

Summer storms are fast moving, accompanied by high winds, thunder and lightning, and short-duration late afternoon or evening rainfall. Rainfall from these cells is generally localized and heavy once the pattern sets up, with the initial development often bringing only dry lightning with virga (rainfall that evaporates before reaching the ground). Heavy downpours often cause flash flooding via rapid runoff over sparsely vegetated desert uplands. These storms usually begin early in July, and the monsoonal pattern persists until the end of September, when the interior of the Southwest begins to cool down. The lightning associated with summer thunderstorms is the primary cause of natural fires.

Temperatures. The average daily maximum for the warmest month (June) at the eastern base of the mountain (5,500 ft) is approximately 88º F, with temperatures over 90º F common. The average monthly temperature for the coldest month (January) is 42º F at the same elevation, with lows in the 20s common. Chapter IV contains average high and low temperatures by month from the three park weather stations.

Relative Humidity. Humidity fluctuates between 10 and 25% during the fire season months of May, June, and early July, with diurnal recovery averaging 50-60%.

Winds. The prevailing air movement is from the west. Local topography channels wind essentially into northeast-southwest directions, with southwest being the predominant direction. Strong winds, often exceeding 60-80 mph, occur with cold fronts from winter to early summer. Mountain terrain normally retards the passing air masses while inducing a unpredictable field of wind vectors.

Topographic heating and cooling effects translate into daytime upslope flow and nighttime down slope flow. The changing position of the sun causes a predictable change of direction and speed at any one location in the valley or on a slope. These upslope and down slope winds may add 10 or 20 mph to the velocity of wind from another source.

Fire Season. Fire season runs from about March until about November, but fires are possible at any time of the year given the arid climate and frequent high winds. The amount of winter/spring moisture drives the fire season start date. Chapter IV, *Fire Weather and Fire Danger*, contains more details.

Hydrology

Most of the water sources of the Guadalupe Mountains originate in the upper mountainous regions and appear as springs and seeps at the base of the escarpment. Springs and tributaries between mountain peaks and ridges are few. Water resources in the park are rare, with only nine permanent springs identified, although numerous intermittent springs and seeps exist. Streams cut through the rock layers allowing the ground waters to drain into the canyons. Surface waters tend not to collect, and streams are intermittent due to the permeability of the substrata.

McKittrick Creek is a unique aquatic ecosystem. It is a small, discontinuous, spring-fed stream with two primary branches. The principal direction of flow is easterly, cutting through the Permian limestone of the Guadalupe escarpment where the surface flow ends. Travertine deposits seal the bed and keep flow in the channel most of the time.

Soils

Soils differ considerably as a function of both elevation and aspect in the Guadalupe Mountains. Soils tend to be shallow, held in place by rock cover which also defends against erosion and keeps moisture from escaping. Flooding is regular in canyons, with deposition and cutting normal events. As elevation increases, more leaching of $CaCO_3$ is evident; soils also become more clay based, exhibit evidence of clay translocation, contain more organic carbon, and show decreased percent base saturation. Soils on north aspects, compared to south aspects, exhibit similar trends.

Vegetation

Vegetation types in Guadalupe Mountains National Park are desert scrub, grasslands, chaparral, woodlands, and coniferous forest, depending on the elevation and exposure. Striking desert succulents, canyon fall color, and high country conifers are all part of the park's appeal.

The fall displays of Knowlton's hophornbeam *(Ostrya knowltonii)* and bigtooth maple *(Acer grandidentatum)* in particular attract a great amount of attention. The only known Texas populations of hophornbeam are common in park riparian woodland above 6,000 ft or somewhat lower in McKittrick Canyon (Northington and Burgess 1979). According to the USDA Forest Service Fire Effects Information System, its fire ecology is not entirely understood (www.fs.fed.us/database/feis); it generally reproduces by seed and is probably killed or at least top killed by most fires. Work in Utah suggests lack of fire allows bigtooth maples to displace oaks, although fires are generally uncommon in maple habitats because they are moist and shade limits understory growth (Bradley et al. 1991). Bigtooth maples reproduce primarily through layering (rooting and sprouting where stems contact the ground), but they are capable of limited sprouting after fires.

Endemic plants are also a special feature of Guadalupe Mountains National Park. Unique taxa occur (1) in nooks on limestone cliffs and ledges, (2) in high-elevation forested canyon bottoms, and (3) along streams at lower elevation (Northington and Burgess 1979). Chapter IX, "Protection of Sensitive Resources," describes these plants in more detail.

For the purposes of this FMP, seven vegetation types have been defined. These types correspond with Brown-Lowe-Pase biomes as summarized most recently in Brown (1994—U of Utah Press reprinting of *Biotic Communities of the Southwest*).

- Rocky Mountain (Petran) Conifer Forests (122.3 in Brown)
- Great Basin Conifer Woodland (122.4)
- Madrean Evergreen Woodland (123.3)

- Interior Chaparral (133.3)
- [Chihuahuan] Semi-desert Grassland (143.1)
- Chihuahuan Desertscrub (153.2)
- Interior Deciduous Forest and Woodland

Figure III-1 shows the distribution of these types in the park and the FMU boundaries.

Wildlife

This section generally discusses park wildlife; rare and protected species are treated separately in Chapter IX. Park species lists name 9 amphibians and 46 reptiles (Grace 1980 revised by Wauer 1991), 94 breeding birds (303 species total) (Newman 1983, revised 1997), and 60 mammals (Cornely 1991).

Several springs are important wildlife-sustaining and viewing areas: Upper Pine, Smith, Manzanita, Choza, Guadalupe, and Bone springs. Reliable water in these places and in McKittrick Canyon attract mule and white-tailed deer (*Odocoileus hemionus* and *O. virginianus*, respectively), mountain lion *(Felis concolor),* bobcat *(Felis rufus),* ringtail *(Bassariscus astutus),* gray fox *(Urocyon cinereoargenteus),* and black bear *(Ursus americanus*).

The desert lowlands are home to several species of sparrows, verdin, the roadrunner, and the cactus wren, to name a few. Bird species commonly seen at moderate elevations in the park are the canyon towhee (*Pipilo fuscus*), rufous-crowned sparrow (*Aimophila ruficeps*), juniper titmouse (*Baeolophus ridgwayi*), western scrub jay (*Aphelocoma californica*), and scaled quail (*Callipepla squamata*). In summer the Scott's oriole (*Icterus parisorum*), Say's phoebe (*Sayornis saya*), white-throated swifts (*Aeronautes saxatalis*), and turkey vultures (*Cathartes aura*) are commonly present. The high country forests of Douglas fir and western white and ponderosa pine provide a whole different habitat for birds such as mountain chickadee (*Poecile gambeli*), Steller's jay (*Cyanocitta stelleri*), red-breasted nuthatch (*Sitta canadensis*), pygmy nuthatch (*Sitta pygmaea*), red crossbill (*Loxia curvirostra*), and hairy woodpecker (*Picoides villosus*). Birdwatchers who come to the park hope to see rare magnificent and blue-throated hummingbirds (*Eugenes fulgens* and *Lampornis clemenciae,* respectively) and Montezuma quail (*Cyrtonyx montezumae*).

Rio Grande leopard frog *(Rana berlandieri),* western box turtle *(Terrapene ornata),* Texas banded gecko *(Coleonyx brevis),* crevice spiny lizard *(Sceloporus poinsetti),* roundtail horned lizard *(Phrynosoma modestum),* Chihuahuan spotted whiptail *(Cnemidophorus exsanguis),* Trans-Pecos rat snake *(Bogertophis subocularis),* Gray-banded kingsnake *(Lampropeltis alterna),* western hooknose snake *(Gyalopion canum),* and rock rattlesnake *(Crotalus lepidus)* are amphibians and reptiles of particular interest. "Possible" species of interest—suspected to be present but not documented—include the barking frog *(Eleutherodactylus augusti),* smooth green snake *(Opheodrys vernalis),* and desert massasauga *(Sistrurus catenatus)* (Grace 1980 revised by Wauer 1991).

Invertebrates. Light infestations of Douglas fir beetle (*Dendroctonus pseudotsugae*), Budworm (*Choristoneura* sp.*),* and Western pine beetle (*Dioryctria* sp.*)* are present within the park; numbers wax and wane cyclically. A survey of butterflies and moths has inventoried over 1,250 species in the park as documented by Knudson and Bordelon in *Checklist of the Lepidoptera of the Guadalupe Mountains National Park, Texas,* Texas Lepidoptera Society Publication 4, Houston TX 1999. and at least 90 taxa of aquatic invertebrates have been found in McKittrick Canyon.

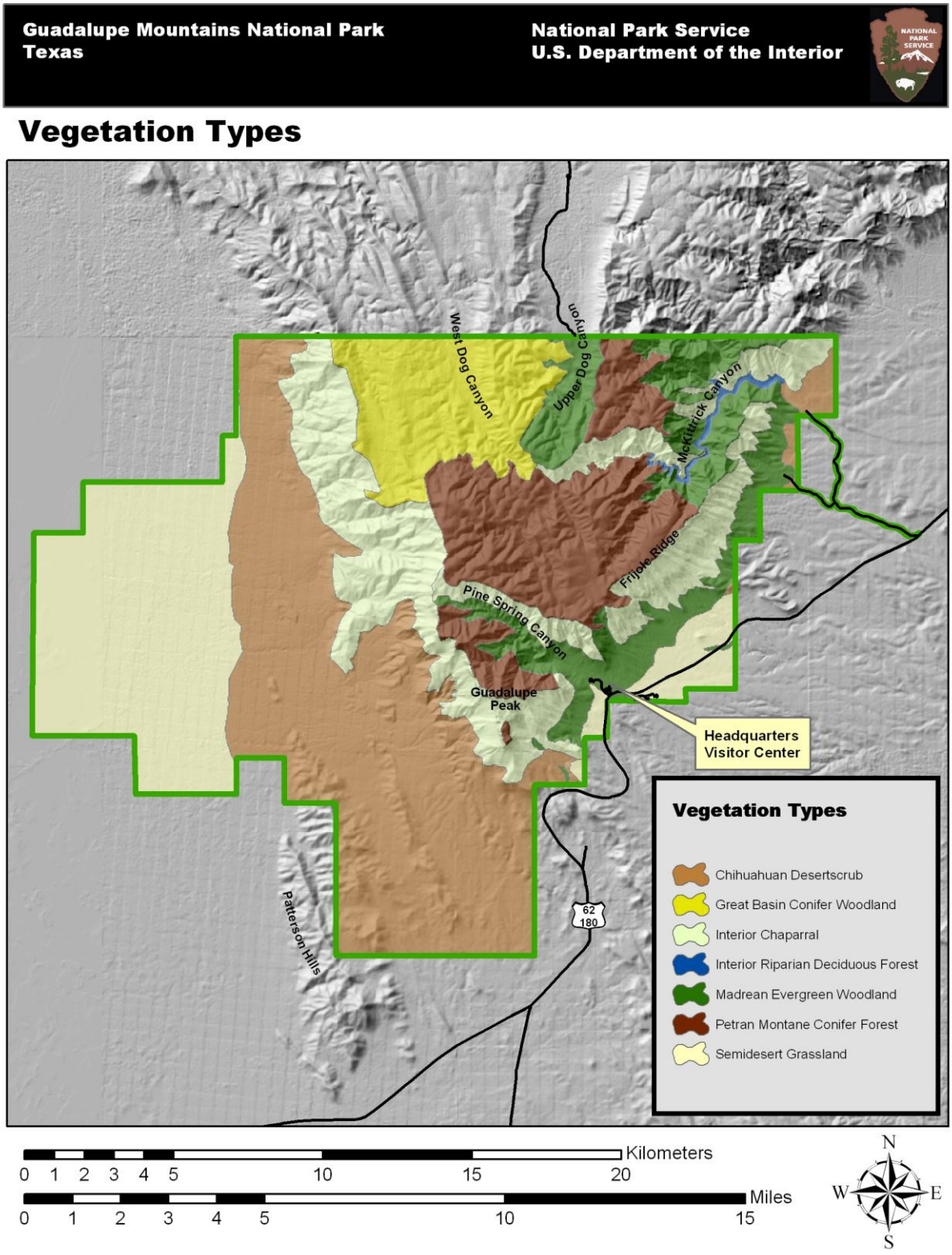


Figure III-1. Distribution of Vegetation Types at Guadalupe Mountains National Park

Air

Guadalupe Mountains National Park was designated as a Class I airshed by the 1977 amendments to the Clean Air Act (Public Law 95-217). Class I airshed designation allows for very little deterioration in air quality in order to give added protection to areas of unique scenic value. The 1977 amendments require State Implementation Plans to protect visibility in a 100 kilometer region around the Class I areas. Air quality monitoring at Guadalupe Mountains has been ongoing since 1987 and currently, the NPS operates a sampling station at Signal Peak, with 24-hour sampling analyzing particulate matter, sulfur dioxide, nitrogen oxide, ozone and heavy metals.

Visibility at Guadalupe Mountains averages 80 miles and can exceed 155 miles on the clearest days. Dust, particularly during the spring windy season, decreases visibility, and pollution from sources in the region's metropolitan areas, power plants, and smelters is increasing. Haze has reduced visibility at times to less than 50 miles and presently maximum visibility only occurs one percent of the time, with a fifty percent reduction fifty percent of the time. The net effect has been a measurable reduction in visibility, which is of paramount importance to visitor appreciation of the mountain and its environs. Smoke management is a factor in fire planning, but in general, smoke dispersion is excellent.

Cultural History

For many centuries, the remote Guadalupe backcountry was the domain of the Ndé (Mescalero Apache). In the 1880s, the Guadalupe Mountains became the last stronghold for Apache chief Victorio, whose last battle with the legendary "Buffalo Soldiers" occurred not far to the south. Ranching played a prominent role in the history of the area, as did the Butterfield Overland Mail Stage which ran through Guadalupe Pass for a brief time. Approximately 5,000 acres of McKittrick Canyon were owned by William Pratt, a petroleum geologist who donated the property to the National Park Service in the 1960s.

Numerous historic structures exist in the park (Figure IV-2 in FMU discussion later in this chapter shows locations). These structures are located primarily at (1) Frijole Ranch, (2) Pratt Cabin and the Grisham-Hunter Line Cabin in McKittrick Canyon, (3) Ship-On-The-Desert, (4) the Pinery (an old station of the Butterfield Stage route), and (5) Williams Ranch. In addition, there are several historic structures scattered around the park. All of these structures are included in the List of Classified Structures (LCS) for the park. The LCS for the park lists a total of 19 buildings and 34 miscellaneous structures in the park. In addition, more than 400 archeological sites have been identified in the park, including burned rock hearths, midden rings and mounds, lithic and ceramic scatters, rock shelters, caves and pictographs.

The Pinery, the structures at Frijole Ranch, and those at Pratt Cabin in McKittrick Canyon are included on the National Register of Historic Places. Also, 27 of the recorded archeological sites are presently listed in the National Register of Historic Places, as the McKittrick Canyon Archeological District. The Butterfield Stage route itself and the Wallace Pratt residence (Ship on the Desert) have been determined as eligible for listing in the National Register, but additional documentation is needed. Management emphasis for these resources is on preservation, protection, and interpretation of cultural resources and their settings.

Historic Role of Fire in Park Ecosystems

The fire ecology literature discusses how fire affects plant communities and how plant communities affect fire. The following fire ecology scenarios for the park's vegetation communities and fire effects

information for specific plants guide this FMP. Appendix A contains tables that review fire effects on the plant species found in the vegetation communities described below. Chapter IX discusses sensitive resources, including plant species, and lists rare plants by vegetation type.

Rocky Mountain (Petran) Conifer Forest

Around 1980, Gary Ahlstrand conducted a fire history study in the park's high country. The sampled area included areas of heavy visitation between 7,050 and 8,370 ft elevation. Ahlstrand dated fire scars from 49 southwestern white pine stems. His data showed that fires occurred in the study area, all the high-country mixed-conifer forest in the park, during at least 71 of the years between 1496 and 1980. The mean fire return interval, considering all fires in the study area between 1554 and 1842, was 4.7 years. Sixty-three of the 71 fire years occurred before 1850. On study area north-facing slopes, white pine and Douglas-fir dominated, with ponderosa and Colorado pinyon included in the mix. Drier south-facing slopes supported a woodland of ponderosa pine, Colorado pinyon pines, and alligator juniper.

Ahlstrand (1981a and 1981b) suggests that a 5-15 year fire return interval in the mixed conifer forest would open up thickets of Douglas-fir and ponderosa pine. These thickets developed in the absence of fire for most of the 20th century, likely aided by seeds trampled down to mineral soil by the hooves of grazing livestock before the park was established. Higher frequency of fire would also favor ponderosa pine over Douglas-fir. Table A-1 (in Appendix A) summarizes fire effects data for the major species in the Guadalupe Mountains Petran Conifer Forest and describes the differential fire tolerances of these plants.

Great Basin Conifer Woodland

Great Basin or pinyon-juniper woodland shifts between being woodier or grassier depending on fire frequency, moisture conditions, grazing, and competition. At Guadalupe Mountains, it is likely this formation is growing grassier in the absence of grazing. With grassiness comes more frequent lightning fires and vice versa, as woody species are reduced by fire. A type conversion to Plains and Great Basin Grassland (Brown 1994—142.1) might result with continuing short fire return intervals. Mean fire interval in the Sacramento Mountains in pinyon-juniper habitat was 28 years, with a range of 10-49 (Kaufman et al. 2000). Models for southwestern Colorado and northern Arizona estimate 300 years from stand-replacing fire (leaving bare ground and skeleton forest) to mature pinyon-juniper woodland; observations in Utah found junipers well developed 85-90 years post-fire (Paysen et al. 2000).

Table A-2 (in Appendix A) summarizes fire effects data for Great Basin Conifer Woodland. The dominant junipers—Rocky Mountain and alligator—respond differently to fire, with the former a non-sprouter that is highly susceptible, and the latter a sprouter that is difficult to kill with fire. However, it takes years for alligator juniper to regain previous coverage, and grasses are able to compete in the meantime.

Madrean Evergreen Woodland

Oaks dominate this woodland type. While the subject of few fire ecology studies, Madrean oak woodlands are thought to be shaped by fire (Caprio and Zwolinski 1995; Ffolliott and Bennett 1996; Abbott 1998). A woodland-grassland dynamic potentially exists in these systems, as in the pinyon-juniper woodland. As the canopies of woody species grow denser, herbaceous production decreases and with it the fuel to carry fire. More open canopies allow more understory growth, more fine fuels buildup, and more frequent fire. Abbott (1998) suggests minimal return interval of 10-30 years for

southeastern Arizona oak woodlands based on conservative estimates of fire frequency for neighboring coniferous forest and grasslands.

Ffolliott and Bennett (1996) examined oaks after the1988 Peak fire in Sonora, Mexico, and neighboring Coronado National Memorial in southeastern Arizona. While Abbott (1998) cautions against generalizing from single-fire studies, Ffolliott and Bennett's work showed that fire intensity had a big effect on the post-fire response of individual trees. Fifty percent of oak trees on the low-intensity site showed no visible damage, while over 80% of oaks in the high-intensity area were root-killed.

Texas madrone is sensitive to fire, though fire-scarred individuals are visible in the park. While it seems to survive and resprout after low-intensity fires, wildlife heavily browse new growth. Beautiful madrone trees are part of the park's charm, and their loss via fire would be noticed.

Table A-3 (in Appendix A) reviews fire effects data for Madrean evergreen woodland species at the park.

Interior Chaparral

Chaparral vegetation experiences stand-replacing fires at intervals measured in decades (Wright 1990; Paysen et al. 2000). The buildup of litter and dry conditions promote fire, vegetation recovery takes at least 10 to 15 years, and the next fire follows when litter and dryness once again team up (Wright 1990). While chaparral tends to replace chaparral after fire, species composition can change depending on post-fire seed bank composition.

Table A-4 (in Appendix A) reviews fire effects data for interior chaparral species at the park.

Chihuahuan Semi-desert Grassland

Ecologists conclude grazing and lack of fire in semi-desert grasslands encourage shrubs at the expense of grass (Wright and Bailey 1982). Paysen et al. (2000) cautions that while fire can be used to accomplish objectives in grassy desert shrublands, it may also contribute to loss of desirable species. Ahlstrand (1982), working in "mountain shrub" vegetation at Carlsbad Caverns (that greatly overlaps in species composition with this type for Guadalupe Mountains), suggested burning in this community every 10-15 years would make it grassier; absence of fire would allow shrubs to increase.

Table A-5 (in Appendix A) reviews fire effects data for Chihuahuan Semi-desert Grassland species at Guadalupe Mountains National Park.

Chihuahuan Desertscrub

Chihuahuan desertscrub occupies the lowlands of the park. Nicknamed the "asbestos formation" by park fire staff, stands of widely spaced, small-leaved shrubs on bajadas and flats have difficulty carrying fire. Dunes and bolsons host some fire-tolerant species. While these areas may have been grassier before grazing, it is not a goal of the park to reverse the trend, nor is there evidence that fire could do so. However, invading grasses may someday change the present no-fire regime.

Table A-6 (in Appendix A) reviews fire effects data for Chihuahuan desertscrub species at the park.

Interior Deciduous Forest and Woodland

Fires occur in this wet type when conditions are right for them to move from neighboring communities. At the park, fires have been observed to jump springs. Fire return might synchronize with adjacent grassy communities, but the natural breaks present in wetter, rockier canyon bottoms would limit extent of fires. McKittrick Canyon is the key representative of this community type; a large, high intensity fire through McKittrick would dramatically alter its character.

Table A-7 (in Appendix A) reviews fire effects data for interior deciduous forest and woodland species at the park.

Fire Management Units

FMU 1 (Developments)

Figure III-2 shows the boundary and major features of the Developments FMU. This fire management unit is a suppression unit with a wildland-urban interface component and complicated boundaries. It contains most of the park developed areas. FMU 1 is designed to protect the Visitor Center, housing, offices, Dog Canyon developments, other facilities, and sensitive cultural resources from wildland fire. The southeast corner of FMU 1 abuts private land. This unit is divided into three sections. Two are located at Pine Springs and are divided by Hwy 62/180, and the third is located in Dog Canyon. They are described as follows:

The *southern section* is the area south of Hwy 62/180 encompassing the park maintenance facilities and staff housing area. It includes the area on the south side of Hwy 62/180 from the Frijole Ranch road west to where the highway intersects the park boundary (west of the Visitor Center entrance road), then follows the park boundary on the south side of the park, east to the AT&T fiber optic cable, then north to the bone-yard road, then east on the bone-yard road to the dirt road which leads north back to the Frijole Ranch road junction. The *northern section* is the area north of Hwy 62/180 where the Pinery Station, Visitor Center, Headquarters, and Pine Springs Campground complex is located. This parcel lies north of Hwy 62/180 beginning across from the Pine Springs housing entrance road and running northwest on the southern edge of Pine Spring Canyon arroyo to a point mid-wash on the Tejas Trail, then goes up-canyon in the center of Pine Spring Canyon arroyo to a point above the Pine Spring Reservoir, then south out of the wash to the Devils Hall Trail at a point just beyond the reservoir, then southeast along the trail to where it intersects the Guadalupe Peak hiker trail, then continuing southeast following the El Capitan Trail to the point where the trail begins turning south and west, then directly southeast to the park boundary where the boundary intersects Hwy 62/180 and joins the southern section of FMU 1.

The *Dog Canyon section* is located on the northern boundary of the park in Dog Canyon where the Dog Canyon Ranger Station, campground, maintenance facility and housing area are located. This unit comprises those lands in the bottom of the canyon south of the state line from a point east of the entrance road, following the arroyo up canyon to a point beyond the horse corrals, then west to the Tejas Trail and following that trail back to the junction with the Bush Mountain trail, then west along the Bush Mountain trail for a few hundred feet to the foot of the rise on the west side of the canyon, then north along the toe of the canyon wall just west of the water tank and continuing north to the toe of the hill behind the duplex, then following the toe of the hill west along that contour line in the small canyon west of the house, to a point west of the power line, and then straight north back to the state line boundary.

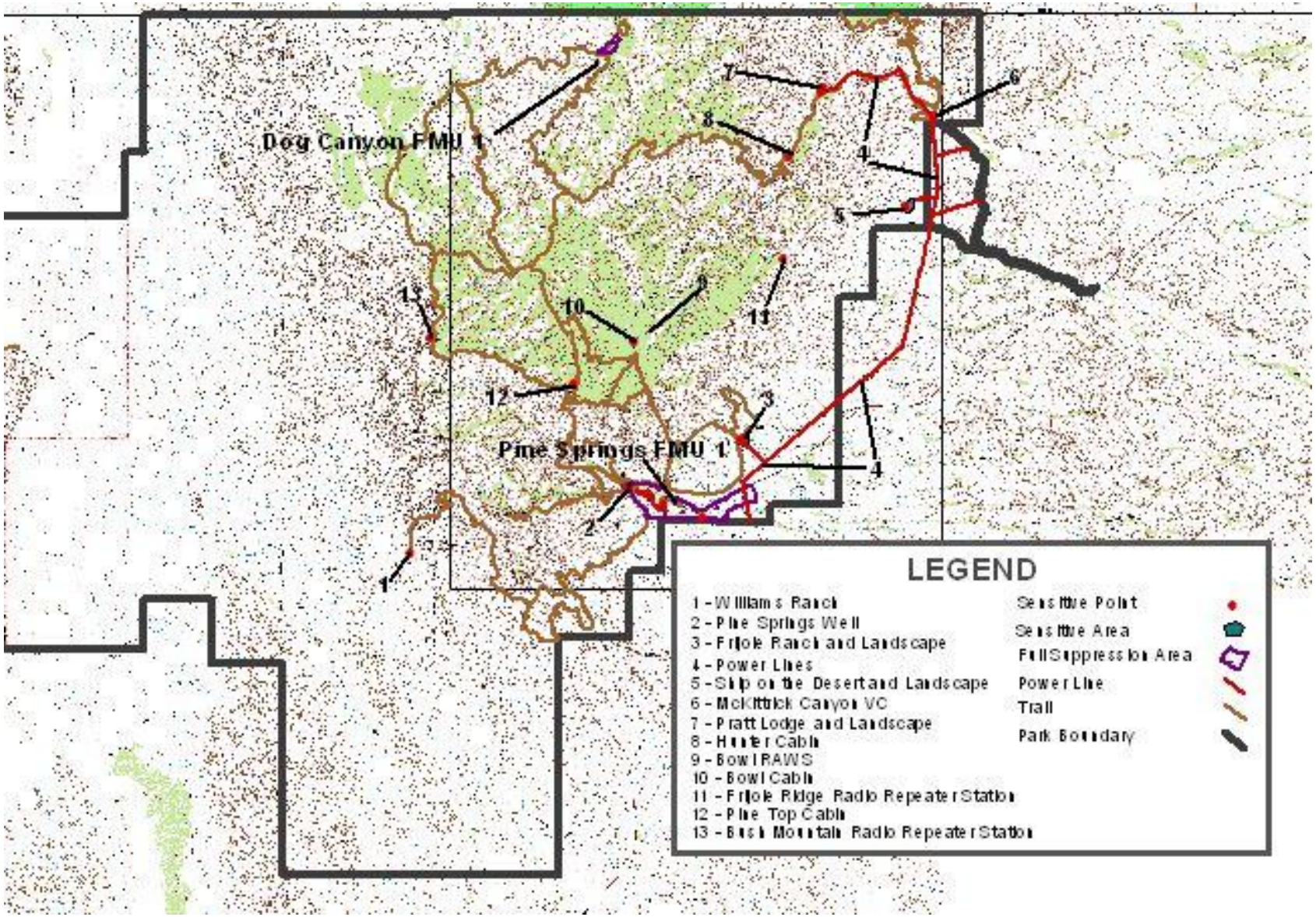


Figure III-2. FMU 1 and Park Developments Requiring Protection

Objectives. In FMU 1, primary objectives are:

- Protect infrastructure and landscaping
- Protect all visitors and staff
- Use fire activities as educational opportunities

Management Considerations. This area of the park contains key structures and other developments. as well as cultural resources. Fire operations in FMU 1 must first protect these components—values—that are intrinsic to the existence and functioning of the park.

Sensitive Cultural Resources in FMU 1

- Pine Springs Butterfield Stage Station (aka Pinery)
- Archeological features among heavy fuels

Sensitive Natural Resources in FMU 1

- None

Sensitive Developments in FMU 1

- Visitor Center
- Housing, office, maintenance buildings south of highway 62/180
- Pine Spring Campground
- Pinery RAWS
- Pine Spring Reservoir
- Utilities throughout the areas on both sides of highway 62/180
- Dog Canyon developed area and utilities

Fuel Characteristics. Table III-1 fits fuel models and lists fire behavior observations for the vegetation types in the park. Four types are found in FMU 1:

- Madrean Evergreen Woodland
- Semi-desert Grassland
- Chihuahuan Desertscrub
- Interior Deciduous Forest and Woodland

Fire Regime Alteration in FMU 1. The natural interval between fires in the Madrean evergreen woodland is estimated at 10-30 years. For semi-desert grassland, the average interval is shorter—on the order of 10-15 years, but irregular. In a broad system of fire regimes, these communities fall into Fire Regime I, defined as follows:

- Frequency 0-35 years, and low (surface fires frequent) to mixed severity (less than 75% of the dominant overstory replaced).

As of the date of this FMP, wildland areas of FMU 1 are best characterized by Fire Regime Condition Class (FRCC) 3, defined as follows:

- High departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances.

Control Problems. Potential exists around the Visitor Center for wind-driven fires to move very fast, generating multiple spot fires in advance of the flaming front.

FMU 2 (Backcountry)

Figure III-3 maps the backcountry FMU, which includes all lands not part of FMU 1. All the designated wilderness lies within FMU 2. The north boundary that separates the park from Lincoln National Forest also is the state line between Texas and New Mexico. This FMU also encompasses the Upper McKittrick watershed on Forest Service land.

Access on the ground throughout FMU 2 is limited. Hiking, horses, and helicopters offer the only access to areas not served by Frijole Ranch, Ship on the Desert, McKittrick Canyon, and Dog Canyon roads. These roads can accommodate wildland fire vehicles and crew buses.

Objectives. In FMU 2, primary objectives are:

- Protect all visitors and staff
- Protect infrastructure and landscaping
- Base management on current research and desired conditions
- Broadly reduce fuel loads to promote low-intensity, natural fires
- Restrict overstory mortality to no more than 20% in Petran Montane Conifer Forest, Madrean Evergreen Woodland, and Deciduous Riparian Woodland
- Allow more than 20% of the overstory to be consumed in Great Basin Woodland and Interior Chaparral
- Create mosaics of burned and unburned areas that provide for recolonization
- Use adaptive management to refine objectives as more experience is gained with prescribed burning
- Use fire activities as educational opportunities

Management Considerations. The backcountry FMU contains the natural wonders that are the reason for the existence of Guadalupe Mountains National Park. A number of historically significant structures and hundreds of archeological sites also lie within the unit. Fire operations in FMU 2 must first protect these values. Communication with neighboring agencies and private landowners is important; collaboration on prescribed burns, sensitivity regarding wildland fire for resource benefits, and cooperation on wildland fire suppression are all key management considerations in FMU 2. For firefighter safety and ecological reasons it is desirable to allow fires to burn across the north park boundary in Upper McKittrick Canyon; as such actions are considered, the concerns of the Lincoln National Forest Guadalupe District (the recipients of such fires) must come first.

Sensitive Cultural Resources in FMU 2

- Frijole ranch and landscape. The site consists of a historic ranch house and outbuildings and is presently in use as a museum.
- Ship-on-the-desert and landscape
- Pratt Lodge and landscape
- Hunter Line Cabin
- Frijole Ranch and landscape
- Williams Ranch and landscape
- Bowl Cabin

Table III-1. Fuel Models and Fire Behavior in Seven Vegetation Types at Guadalupe Mountains National Park

Vegetation Type	Fuel Models*	Fire Behavior Notes
Chihuahuan Desertscrub	Potential 4	Lack of contiguous fuel.
Semi-desert Grassland	lightly loaded 2 or L	With normal precipitation and low wind speeds, fire creeps through cured grass; summer green up hinders spread. Intense behavior (rapid spread) is possible during high wind periods after curing due to dryness (rather than frost).
Interior Chaparral	6	With normal precipitation, fires creep through deep duff layers under the shrub canopy and spread to other pockets of brush through herbaceous fuels. Steep slopes and high winds can foster dangerous fast-moving fires. With prolonged drought when live fuel moistures drop below 80%, extreme behavior possible, with all foliage readily burning and shrub "crown" fires occurring when aided by wind or steep slope.
Madrean Evergreen Woodland	2/6	Model 2—Fire spreads though either curing or dead fine herbaceous fuels. Herbaceous layer plus litter and dead-down wood stems contribute to fire intensity. Model 6—Fires carry through shrub layer, but require moderate winds.
Great Basin Conifer Woodland	2/6 or L	See above.
Petran Montane Conifer Forest	8/10 or lightly loaded G	"Normal" fires are slow burning with low flame lengths, and they stay on the ground near single ignited trees. After dry periods, 1000-hr TLFM fuels can dry to 12% moisture. Fires torch individual trees, spread on the ground and in understory vegetation, and can involve more trees. Continued drought can bring extreme fire behavior, with 1000-hr fuels drying to 10%. Single thunderstorms can start multiple ignitions. High-intensity fires spread in surface fuels, and when wind is a factor, crowning is common and long-range spotting possible. Duff and litter are consumed to expose mineral soil.
Interior Deciduous Forest and Woodland	5/11 or 6/11 if more decadent.	Generally very little fire activity in riparian zone due to high moisture levels.

* numbered models follow Anderson (1982); lettered models follow Deeming et al. (1977)

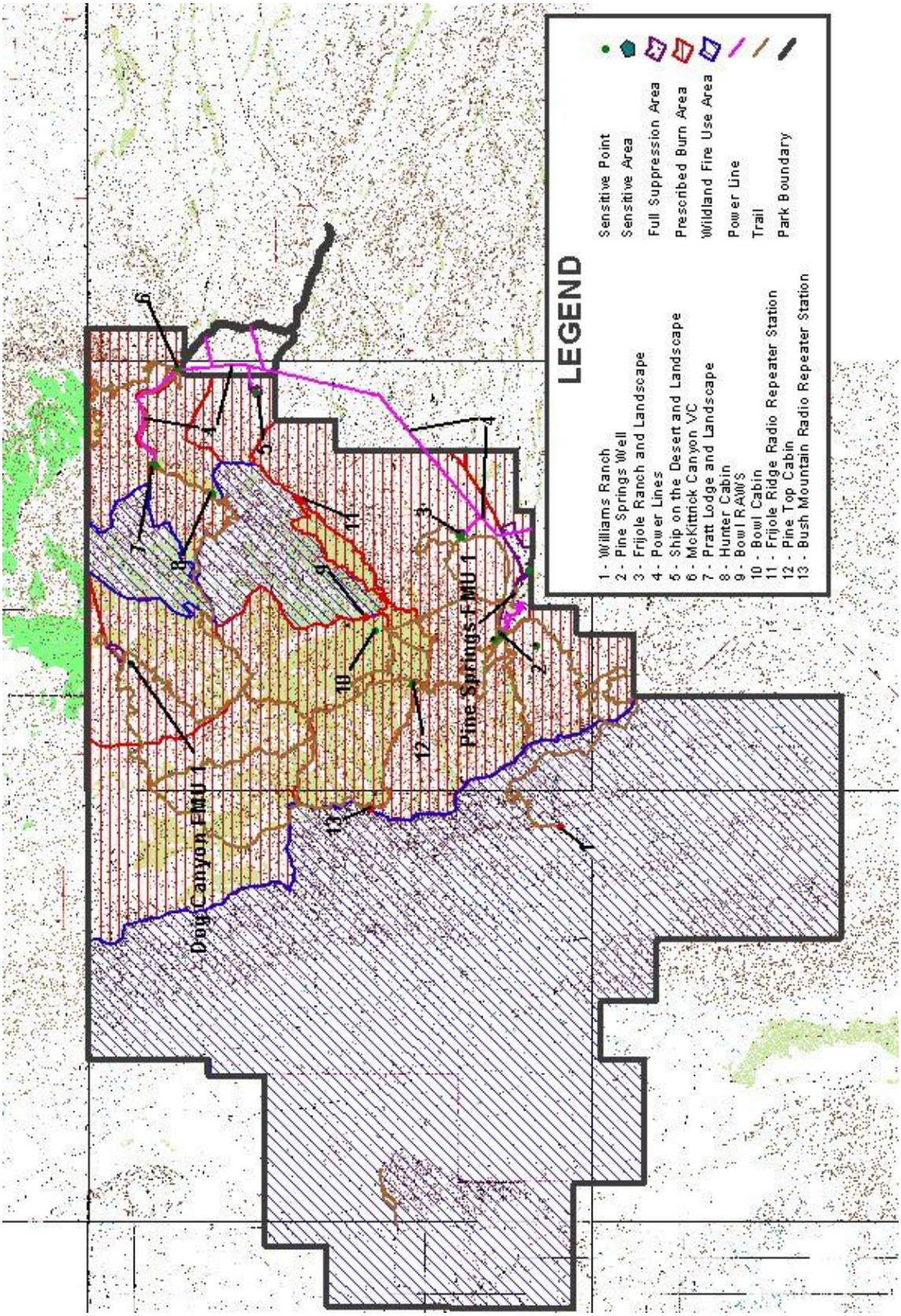


Figure III-3. FMU 2 Details

Sensitive Natural Resources in FMU 2
The significant geological features, sensitive plant species, and charismatic/sensitive wildlife mainly inhabit the backcountry FMU. Fire operations will particularly be concerned with:

- Mexican spotted owl (MSO) Protected activity centers (PACs)
- Guadalupe violet and other rare plants
- Other endemic plants on limestone ridges
- Aspen groves up on top
- Springs
- Research natural areas

See also Chapter IX, "Protection of Sensitive Resources."

Sensitive Developments in FMU 2

- McKittrick Canyon Visitor Center
- Pinetop Cabin
- 2 radio repeater stations (Bush Mountain and Frijole Ridge)
- Bowl RAWS
- Rio Grande Electric power lines (Pratt Lodge and Ship on the Desert to McKittrick VC; Frijole Ranch to Ligon's Ranch)

Fuel Characteristics. Table III-1 fits fuel models and lists fire behavior observations for the vegetation types in the park. All seven types are found in FMU 2:

- Madrean Evergreen Woodland
- Semi-desert Grassland
- Chihuahuan Desertscrub
- Interior Chaparral
- Petran Montane Conifer Forest
- Great Basin Conifer Woodland
- Interior Deciduous Forest and Woodland

Fire Regime Alteration in FMU 2. In a broad system of fire regimes, the above communities fall into Fire Regime I, defined as follows:

- Frequency 0-35 years, and low (surface fires frequent) to mixed severity (less than 75% of the dominant overstory replaced).

Interior Deciduous Forest and Woodland, the riparian zone, is a possible exception to this regime (I), since these wet places burn highly infrequently even when surrounding vegetation experiences regular fire.

As of the date of this FMP, most wildland areas of FMU 2 are best characterized by Fire Regime Condition Class (FRCC) 3, defined as follows:

- High departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances.

Three areas in FMU 2 are characterized by FRCC 2. These areas are burn units described in Chapter IV—Foothills Archeology, Foothills Execution, and Dog Canyon. FRCC 2 is defined as follows:

- Moderate departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated disturbances.

Control Problems. Control problems in the high country include:

- Crown fires in dense coniferous canopies
- Lack of access
- Slope-driven fire behavior (on very steep canyon slopes)
- Wind, topography, and heavy fuels in FMU 2 pose serious threats to firefighter safety.

Chapter IV. Wildland Fire Management Program Components

The strategies introduced in Chapter III each receive detailed treatment here—wildland fire suppression, wildland fire for resource benefits, prescribed fire, and non-fire treatments. The fire management goals and objectives presented in Chapter III guides employment of these strategies at Guadalupe Mountains National Park; protection of life and property remain the highest priorities through all activities.

Over the long term, the park intends to continue suppression, prescribed fire, and non-fire treatments in FMU 1 because of cultural resource and visitor protection concerns. Eventually, after several decades of an active prescribed fire program, FMU 2 should be ready for primarily wildland fire for resource benefits to maintain vegetation.

General Implementation Procedures

Implementation of wildland fire management components must be consistent with fire management capabilities and should consider the current and predicted conditions affecting wildland fire behavior. *Preplanned decisions* based on historical fire behavior indices should govern Wildland Fire Decision Support System (WFDSS) decisions requiring appropriate management response.

For all park ignitions, a WFDSS decision will be completed by the ICT 4, SOPL, FMO or qualified Duty Officer, The Superintendent, or designated acting, is authorized to approve a WFDSS decision . The Superintendent, or their designated acting will retain full authority to approve or disapprove the management decisions or appropriate management response chosen in the WFDSS document. Other staff roles and responsibilities are described in Chapter V. Delegation of authority to an external team is discussed under *Extended Attack and Large Fire Suppression*, later in this chapter.

The initial WDSS includes management objectives and strategies in the decision document. Programmatic decision criteria for each FMU are listed in Chapter III. The WFDSS analysis documents the current and predicted situation plus all appropriate administrative information, and provides managers with criteria for deciding whether to manage a fire for resource benefits or suppress with appropriate management action.

Wildland Fire Suppression

Automatic suppression applies to fires in FMU 1, human-caused fires, or natural ignitions failing to qualify for wildland fire for resource benefits. These fires will receive prompt, safe suppression actions that minimize resource damage and suppression costs. Under an appropriate management response, fire perimeter increases may be allowed to protect firefighter safety and take advantage of natural barriers or other site conditions.

Potential Fire Behavior

"Fire season" at Guadalupe National Park runs from about March until about November. During these months wildland fires will spread from a point of ignition at varying intensities and rates. Wildland fires have occurred in the Guadalupe Mountains area during every month of the year.

During the height of fire season, normally May and June, there is a potential for fires to move very rapidly (i.e. 100 feet/minute) and to grow very large very quickly (i.e. 500 acres/hour). Safety of

firefighters is a very real concern during this period and suppression strategies must always be crafted accordingly. Extreme fire behavior is typically the result of high winds, very low relative humidity, and hot temperatures. During periods of extreme fire behavior most suppression resources have proven to be ineffective until a change in the weather occurred. Fire behavior during these periods has even remained extreme overnight (for example the Frijole fire in 1990 and Pine fire in 1993).

The fire history map of the park (Figure IV-1) shows locations of fires in the park over the period of record (1960 – 2003). Figure IV-2 is a fire size distribution; the majority of fires in the record are under an acre in size. Many lightning ignitions occur after the onset of the monsoon rainy season (July through October). These fires are typically very slow spreading and confined to the vegetation in the immediate area of the ignition, due to increased humidity and the presence of greened-up herbaceous surface fuels during this period.

The potential exists in the Guadalupe Mountains for very large, wind driven fires. High wind events occur during prolonged dry periods prior to the onset of monsoon rains, and many last five or more days. In times of increased backcountry visitor use in and around the park these high wind events should cause particular reason for concern and preparedness. Crown fires in overgrown forest or continuous pinyon-juniper may occur under extreme conditions.

Preparedness Actions

The fire *Preparedness Plan* is the master guide to annual fire management activities. Guadalupe Mountains fire staff put together the document each year before the fire season begins. It spells out the details for operations introduced in this plan. Preparedness actions include fire prevention activities, community education, the annual training needs assessment, fire readiness, fire weather and fire danger assessments, index-trend monitoring, step-up staffing, and pre-attack planning.

Prevention Activities and Community Education. The park Wildland Fire Prevention Analysis and Action Plan (Appendix B) details by geographic area of the park patrol and other activities that will occur to prevent human caused fires. The park Preparedness Staffing Step-up Plan (Table IV-1) also details stepped up patrols of high use areas of the park during periods of high to extreme fire danger. There have also been some efforts in recent years to provide for public education regarding fire prevention using the park's Education Coordinator.

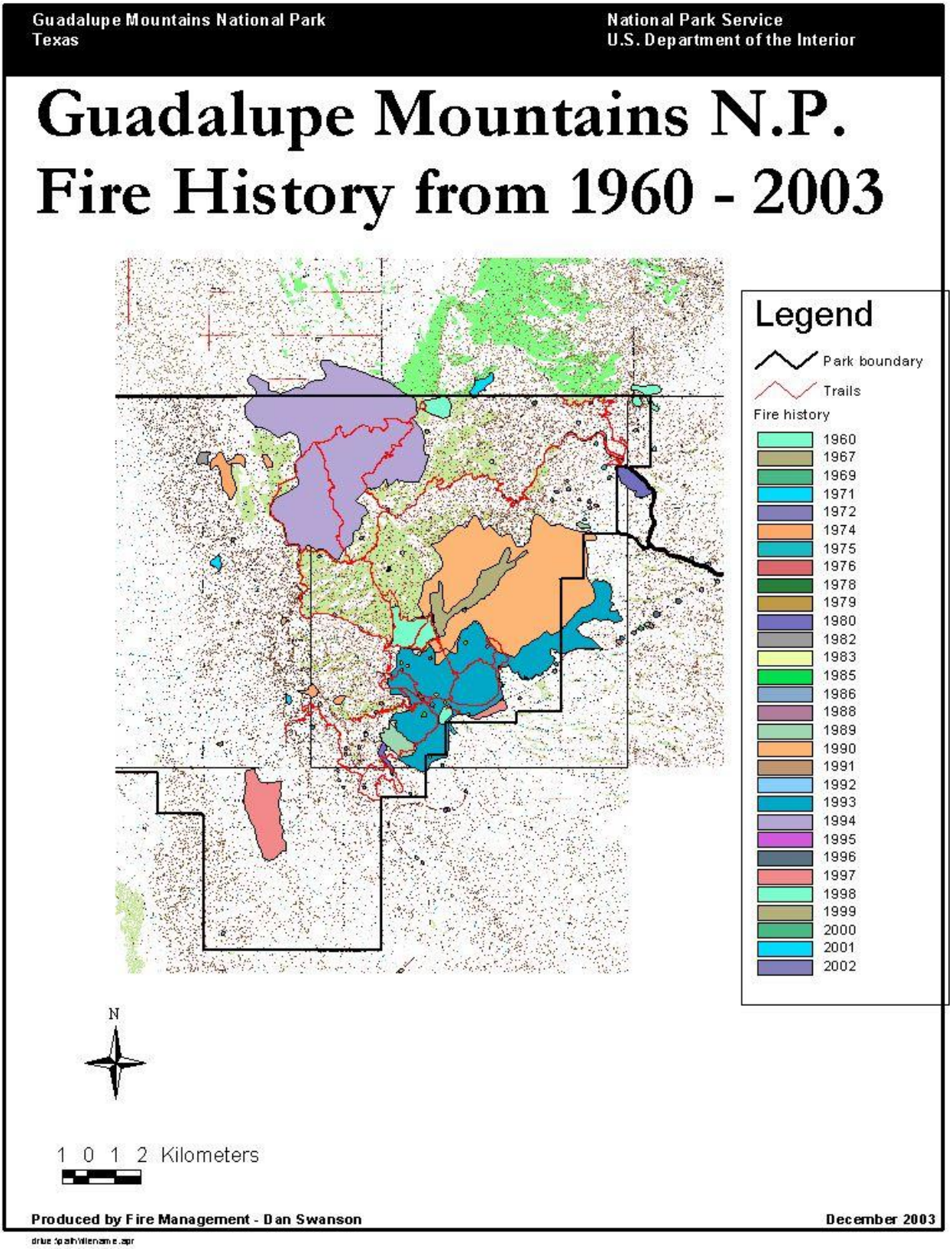


Figure IV-1. Guadalupe Mountains National Park Fire History Map

Figure IV-2. Fire size distribution at Guadalupe Mountains National Park

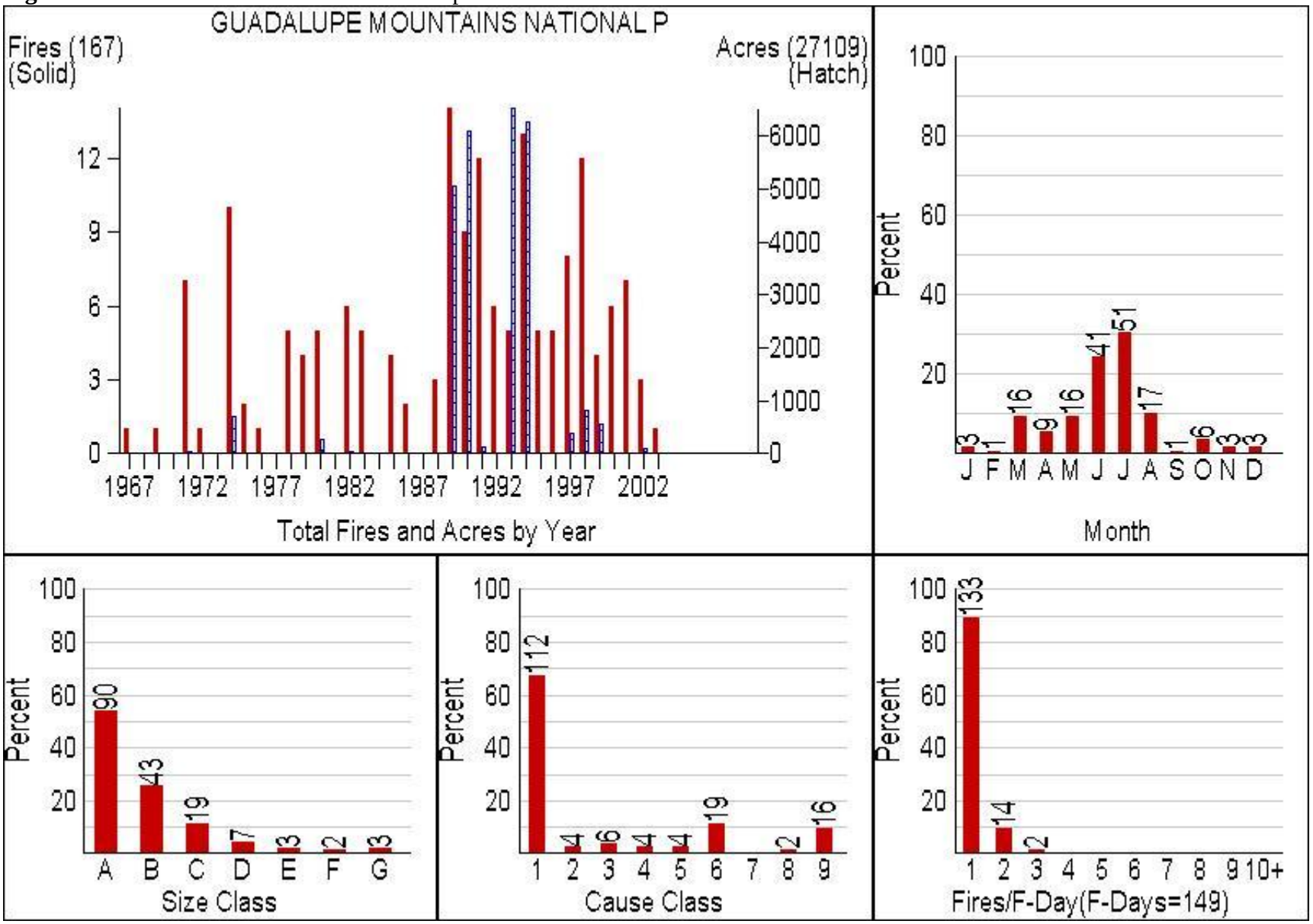


Table IV-1. Preparedness Staffing Step Up Plan. Next higher class adds to previous actions. The Burning Index (BI) from the Pinery RAWS will be utilized to determine the staffing class for the Park. The BI is based on NFDRS Fuel Model L. A twenty-five year period from 1987 – 2011 was used to determine Staffing Levels.

Staffing Class I BURNING INDEX: 0-19 LOW
Fuel moisture high (live fuel moistures > 100 and 10-hr TLFM > 10), with little fire spread.

- Initial attack resources prepared for potential appropriate management response.
- Normal tours of duty of 5 days per week and 8 hour days.
- Fire danger rating signs at visitor concentration areas activated at start of fire season.
- Trails will be cleared of all winter tree fall.
- Employees will review detection and reporting procedures, final equipment and supply inventories and servicing will be completed.
- Identification of areas of special concerns, i.e., frost kill, snow damage and/or activity fuels as far as potential fire risks, will be initiated.
- Red cards and pack tests will be completed.
- S-130, S-190 and I-100/200 will be offered to new seasonal employees.
- Personnel protective gear to be issued to red carded personnel.

Interpretive Step-up
- Identify potential Fire Information Officers, target for training.
- Develop fire ecology and fire effects evening program.
- Identify potential interpretive staff personnel for line qualification to assist with interpretive fire support and information escorts.

Class II BURNING INDEX: 20-37 MODERATE
Fire spreads evenly but with some retardation, ignites without difficulty.

- Initial attack resources prepared for action, normal tours of duty, at least one engine on each district fully staffed.
- Fire prevention materials will be prepared for distribution.

Class III BURNING INDEX: 38-74 HIGH
Fire spreads quickly and continuously, ignition is rapid.

- Maintain minimum initial attack resources, of one engine per district.
- Visitor information services will provide fire prevention materials to public.
- Pecos Zone Dispatch tracks resource locations and maintains dispatch board.
- Step-up to Staffing Class IV on holiday weekends or other periods with an expected increase in visitation, e.g., fall color weekends, spring break, etc.
- Step-up to Staffing Class IV if there are any going fires in the park.
- Initial attack units are assigned to respective response areas.

Interpretive Step-Up
- Present Fire Management Evening Program on a rotating basis.
- Identify available interpretive staff for fire management utilization

Class IV BURNING INDEX: 75-91 VERY HIGH
Spread vigorous, approaching limits of control by hand crews.

- Implement emergency presuppression account.
- Maintain 10 hour shifts and 6 and 7 day manning for IA resources.
- Maintain capability and readiness.
- Initiate aerial reconnaissance if justified by lightning activity or high backcountry use.
- Field units to implement prevention patrol in their response areas.
- On High Risk days preposition in-park IA resources, as necessary and appropriate.
- Step-up to SL V on holiday weekends or other periods with an expected increase in visitation, e.g., fall colors weekends, spring break, etc.
- Step-up to SL V if there are any going fires in the park.

Interpretive Step-Up
- Put Fire Danger message on the Travelers Information System (TIS) to be broadcast on radio.
- Notify all visitors of increasing fire danger.

Class V BURNING INDEX: 92+ EXTREME
Ignition and spread rapid and erratic, unusual fire behavior to be expected.

- Initiate 6-7 day workweek and 10 hour workdays for additional fire personnel and increase patrols.
- Implement EMERGENCY PRESUPPRESSION to order presuppression resources when preseason risk analysis of expected fire severity indicates that predicted initial and extended attack needs will exceed normal fire year response capability.
- Issue "No Smoking" restrictions for all or parts of the park as recommended by the Chief Ranger and approved by the Superintendent.
- Issue closures on all of parts of the park, as recommended by the Chief Ranger and approved by the Superintendent.
- At the Fire Management Officer's discretion, place personnel on stand-by duty, extend tours of duty, and if necessary, annual leave may be canceled.
- Notify cooperators (Intermountain Region, Pecos Zone).
- FMO monitors resource availability, i.e., air tankers, Type I and Type II crews through Pecos Zone dispatch.
- Restrictions and closures will be coordinated with Zone cooperators.
- Preposition personnel and equipment in park or provide cost sharing to preposition within zone.

Interpretive Step-Up
- Notify all visitors receiving backcountry permits of Fire Danger and any closures or restrictions.
- Issue Press Releases on Fire Danger and any closures or restrictions.

- When Staffing Class II is accompanied by cloud-to-ground lightning activity, detection flights may be made and Class adjusted to IV.
- When Staffing Class III is accompanied by a Lightning Activity Level (LAL) of 4, 5, or 6 for the day or the previous day, the Class should be adjusted to Staffing Level IV.
- The Pinery RAWS BI is based on NFDRS Fuel Model L.

The objectives of a Fire Prevention Program in Guadalupe Mountains National Park are:

- To reduce the threat of human-caused fires through employee, visitor, and park neighbor education.

- To integrate the prevention message into interpretive programs through involvement of the park's Interpretive Division.

Some general actions that will be undertaken to enhance fire prevention awareness and to prevent human-caused unwanted fires in the park are as follows:

- The park division chiefs will annually ensure that all of their employees are familiar with portions of this plan that are pertinent to fire prevention, and that they can properly explain fire prevention regulations and information to park visitors and neighbors. The Fire Management Officer (FMO) will assist the division chiefs by providing them with timely fire prevention information.
- Campfires will be prohibited at all times in all areas of the park.
- All other fire use (i.e., camp stoves, smoking, etc.) will be prohibited in all backcountry areas during prolonged periods of very high or extreme fire danger (i.e., Staffing Class IV or V). All such restrictions will be communicated by the FMO to the Pecos Zone Coordination Center (PEZ) for the purpose of coordinating restrictions with other agencies.
- During periods of extreme fire danger (i.e., Staffing Class V), the Superintendent may close any portion(s) of the backcountry deemed prudent to reduce the potential fire risk. In the event of a closure, all reasonable efforts will be taken by the park staff to locate and remove visitors from the closed areas.
- The Chief of Interpretation (Public Information Officer) will distribute information as necessary to advise both visitors and residents of extreme fire conditions and closures; the park-owned short range AM transmitters (AM 1610), which are used for information dissemination to park visitors, will also be utilized as necessary. The Superintendent will review releases to the public before they go out.
- Fire program personnel will produce signs, posters, displays, and appropriate interpretation for the Chief of Interpretation to place at trailheads, the Visitor Center lobby, parking areas, and bulletin boards to warn visitors of the danger and to solicit their cooperation in fire prevention. Signs notifying park visitors of the current fire danger will be maintained at the Pine Springs, Dog Canyon, and McKittrick Canyon visitor centers. The prevention analysis shows a very low risk of human-caused ignition for all of the backcountry of the park because of the prohibition on campfires. There does remain a risk of a human-caused ignition in the developed area (FMU 1) as compared to that of the backcountry with roughly 200,000 persons visiting the park each year. A carelessly discarded cigarette or match, an overheated vehicle, or a disintegrating catalytic converter along the highway or park roads are the most likely human-caused hazards.
- Roving foot, horse, and vehicle patrols will be utilized to enforce all park restrictions or regulations aimed at fire prevention.

Appendix B contains the specific prevention actions identified for specific areas of the park. This prevention analysis will be reviewed annually along with the rest of this plan and updated if changes occur which alter the identified risks, hazards, or values.

Annual Activities

Training, equipment readiness, and other tasks are performed annually to prepare for fire season. The FMO's annual work plan, prepared every fall, contains the details for the upcoming season.

The Superintendent will review the Fire Management Plan annually and approve any annual updates by signature.

Training. The Guadalupe Mountains National Park fire program shares its FMO and personnel with nearby Carlsbad Caverns National Park and other units in the region. The FMO periodically hosts a Basic Firefighter course, and the mandatory 8-hr refresher course is held in the area with cooperators each year. Other training opportunities are always provided, particularly on-the-job training opportunities on cooperator prescribed fires and suppression fires.

Annual Preparedness Review. An Annual Preparedness Review is held every year during the spring. It is an NPS Intermountain Region review every other year and otherwise completed with Pecos Zone interagency cooperators. Reviewers route recommendations to the FMO and Superintendent.

Fire Weather and Fire Danger

Park Weather Stations. The park currently maintains two Remote Automatic Weather Stations (RAWS) and has data covering 6 years from a third station.

- The Bowl station, #417103 (elevation 8,112 ft). The Handar 545 Data Collection Platform (installed in 1985) had been converted to an FTS station in 2008 and is totally National Fire Danger Rating System (NFDRS) Next compliant with data recorded and transmitted hourly. Data from this station are entered daily into the Weather Information Management System using NFDRS Fuel Models C and G (C=open pine with grass and G=dense conifers with heavy dead accumulation).

  Figure IV-3a through Figure IV-3c displays Burning Index (BI), Energy Release Component (ERC), and 1000-hr Time-lag Fuel Moisture (TLFM) from the Bowl RAWS. Table IV-2 compiles temperature and precipitation averages.

- The Pinery station, #417101 (elevation 5,440 ft). The FTS-G-4 Station was moved from PX Well in 2001 and it is now a GOES station with a solar radiation sensor. Data are recorded hourly and transmitted hourly. Data from this station are entered daily into the Weather Information Management System using NFDRS Fuel Models L and T (L=perennial grass and shrubs [sagebrush] and T=grass).

  Figure IV-4a through Figure IV-4c displays Burning Index (BI), Energy Release Component (ERC), and 1000-hr Time-lag Fuel Moisture (TLFM) data from the Pinery RAWS. Table IV-3 compiles temperature and precipitation averages.

Data were collected from a third station, PX Well (elevation 3,867 ft), from 1995 to 2000 (Table IV-4).

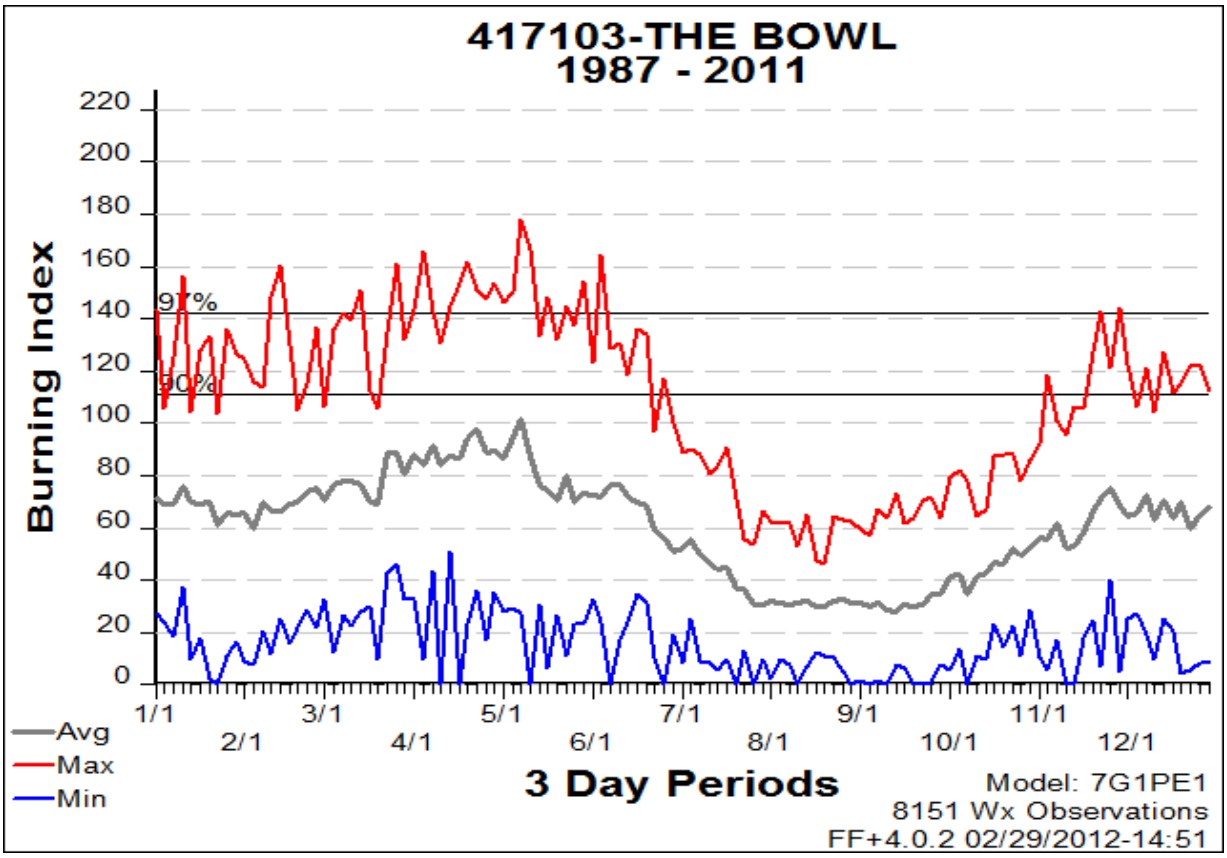


Figure IV-3a. Bowl RAWS Burning Index

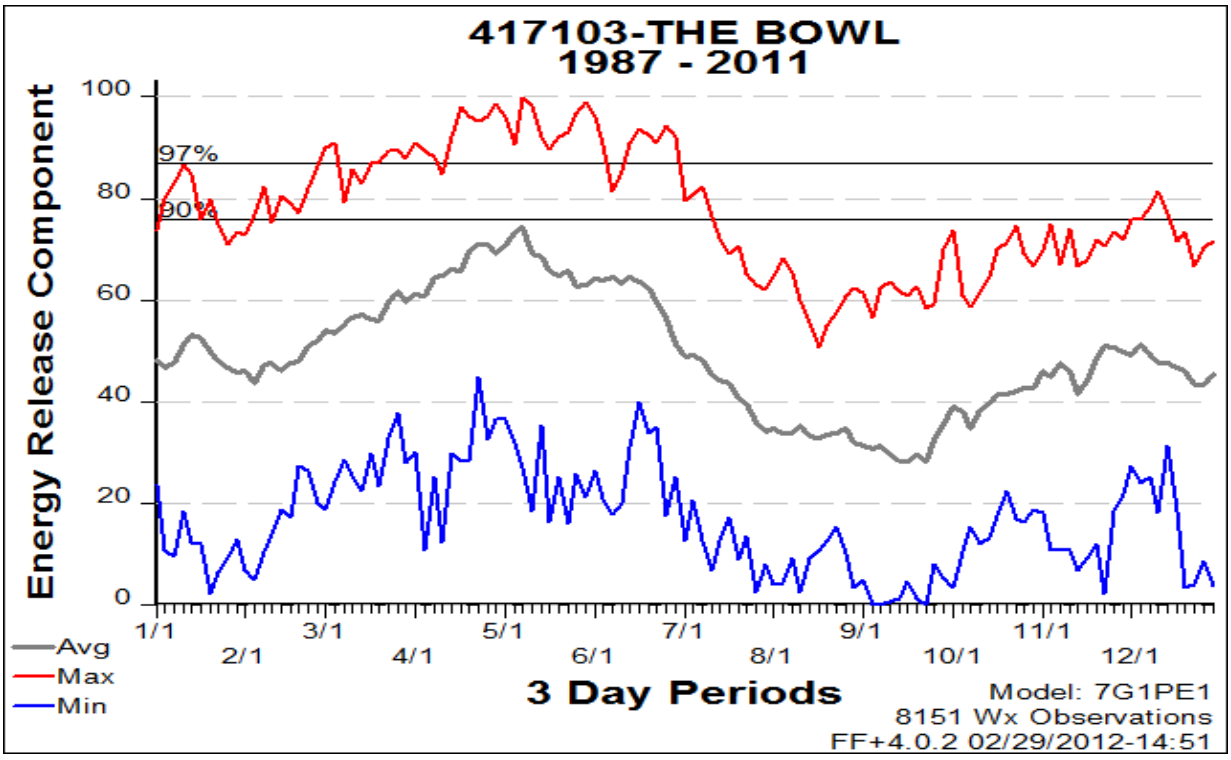


Figure IV-3b. Bowl RAWS Energy Release Component

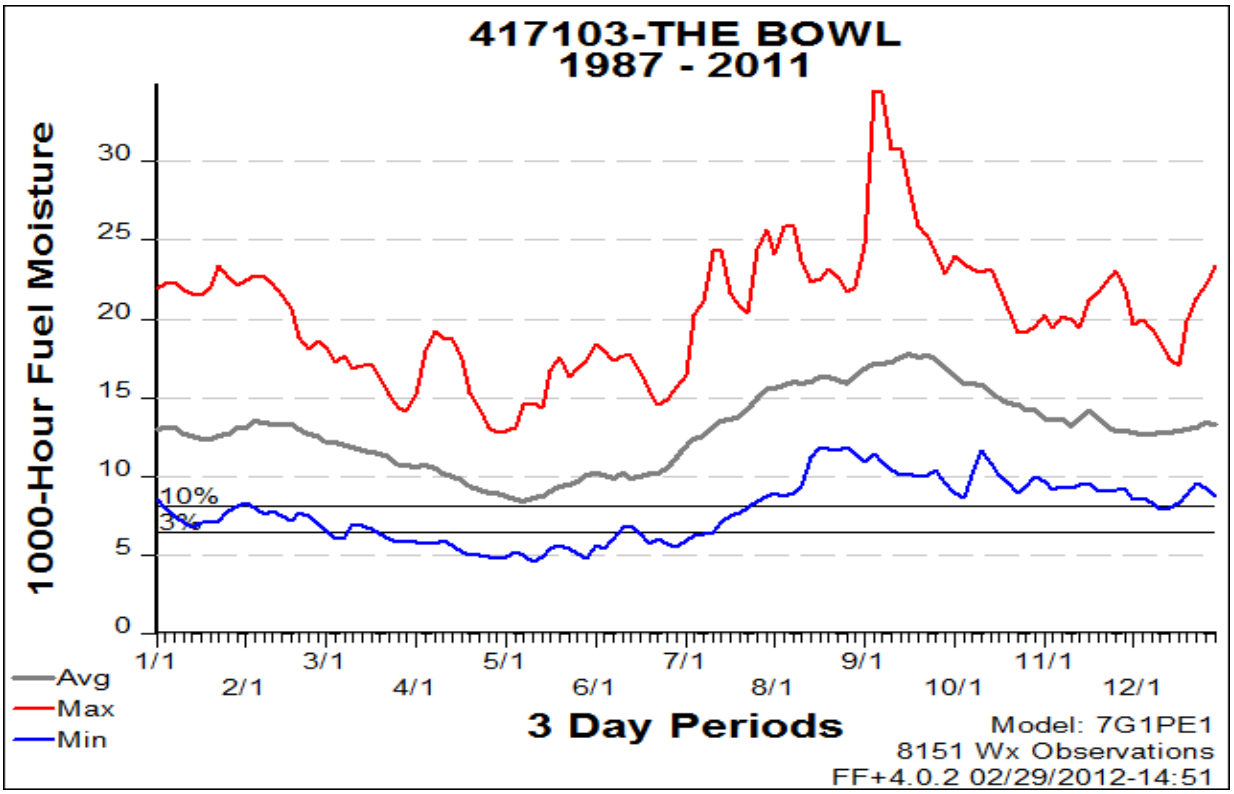


Figure IV-3c. Bowl RAWS 1000-hr Time-lag Fuel Moisture

Table IV–2. Annual temperature and precipitation averages for the Bowl RAWS. (Station number 417103, elevation 7,800 ft. Record covers 1987 – 2011)

Month	Air Temperature (◦F)			Precipitation (in)
	max	min	mean	
January	46	30	38	0.32
February	48	32	40	0.43
March	54	36	45	0.28
April	61	42	52	0.66
May	69	51	60	1.14
June	76	57	67	2.12
July	75	58	66	4.15
August	73	57	65	3.91
September	69	53	61	3.17
October	63	46	55	1.19
November	54	37	45	0.80
December	46	31	38	0.52
Annual	61	44	53	18.69

National Fire Danger Rating System (NFDRS) (Deeming 1977). The NFDRS-calculated Burning Indices at the Bowl and Pinery RAWS are used exclusively for fire danger trend monitoring (Figures IV-3 and IV-4), with the Pinery RAWS being the primary basis for calculations. The BI, a percentile rating of the difficulty of containing a fire, is the index most sensitive to wind speed, the most influential element in fire danger in grass fuels. New NFDRS staffing breakpoints are calculated yearly

by the FMO using FireFamily Plus. The most recent breakpoints can be found in the Preparedness Staffing Step-up Plan (Table IV-1).
Typically, ignitions will grow quickly and uncontrollably when the BI is greater than 55.

RAWS NFDRS-calculated 1000-Hour TLFM provides the best indices of drought, seasonal severity, and potential for extreme fire behavior. The park also uses measured (Computrac) live fuel moistures as indicators for prescribed fire purposes.

Fire for resource benefits and prescribed fire prescriptions both contain elements to account for drought. Typically if the 1000-hr TLFM index is under 8% there will be management concerns regarding controllability of wildland fire. Historic lows of this index of 5% coupled with even a little bit of wind have displayed uncontrollable extreme fire behavior (i.e. a BI of 70+). This lack of controllability during the height of a droughty fire season has led the park to engage in prescribed fire activities during the cooler months in the past. It has also led the park to suppress even lightning-caused ignitions during drought conditions as they often threatened to soon spread out of the park onto non-NPS lands.

The Park Preparedness Staffing Step-up Plan. As the fire danger increases, the level of preparedness must increase to ensure readiness for wildland fire for resource benefits or suppression. The Step-up Plan (Table IV-1) applies to wildland fire management at Guadalupe Mountains. The plan is tied to the NFDRS program; the BI (usually for fuel model L—woody plants occupying between one-third and two-thirds of the site) is used to indicate fire danger. Fuel model G may be utilized in order to accurately cover circumstances such as green up fuels in the lower elevations, but with dry carrier fuels (needle cast, etc.) at the higher elevations. Ongoing wildland fire for resource benefits may trigger staffing at Class IV or V based on fire conditions and the Fire Situation Analysis. Models L and G are the best fit but occasionally T (with L) and C (with G) may be useful fuel models.

Pre-attack Plans. The pre-attack plan compiles essential fire management information that must be available in the fire management and/or dispatch offices. The plan guides decision making and allocation of resources. It is the responsibility of the FMO and the Chief of Resource Management and Visitor Protection to annually conduct an interdisciplinary meeting to update the park's wildland fire pre-attack plans (Appendix C of this plan). A Pre-attack Plan for suppression wildland fires should minimally consist of a WFDSS dry-run completed for typical scenarios of human or lightning ignitions in the park. The primary consideration in all pre-attack plans will be firefighter and public safety.

Initial Attack

Initial attack will always deploy the "appropriate management response" which is defined as: "specific actions taken in response to a wildland fire to implement protection and fire for resource benefits objectives." Initial attack of any wildland fire will always be documented in WFDSS.

Initial attack will deploy an "appropriate management response" using suppression action consistent with firefighter and public safety and values to be protected. The aim of initial attack is to catch an ignition while it is still small and within the first burn period i.e. 24-hour period. The park has the standard goal of a 95% success rate at initial attack and maintains firefighter staffing to statistically achieve this goal. During initial attack, firefighter or public safety will never be compromised or risked unduly to protect any park resource or infrastructure.

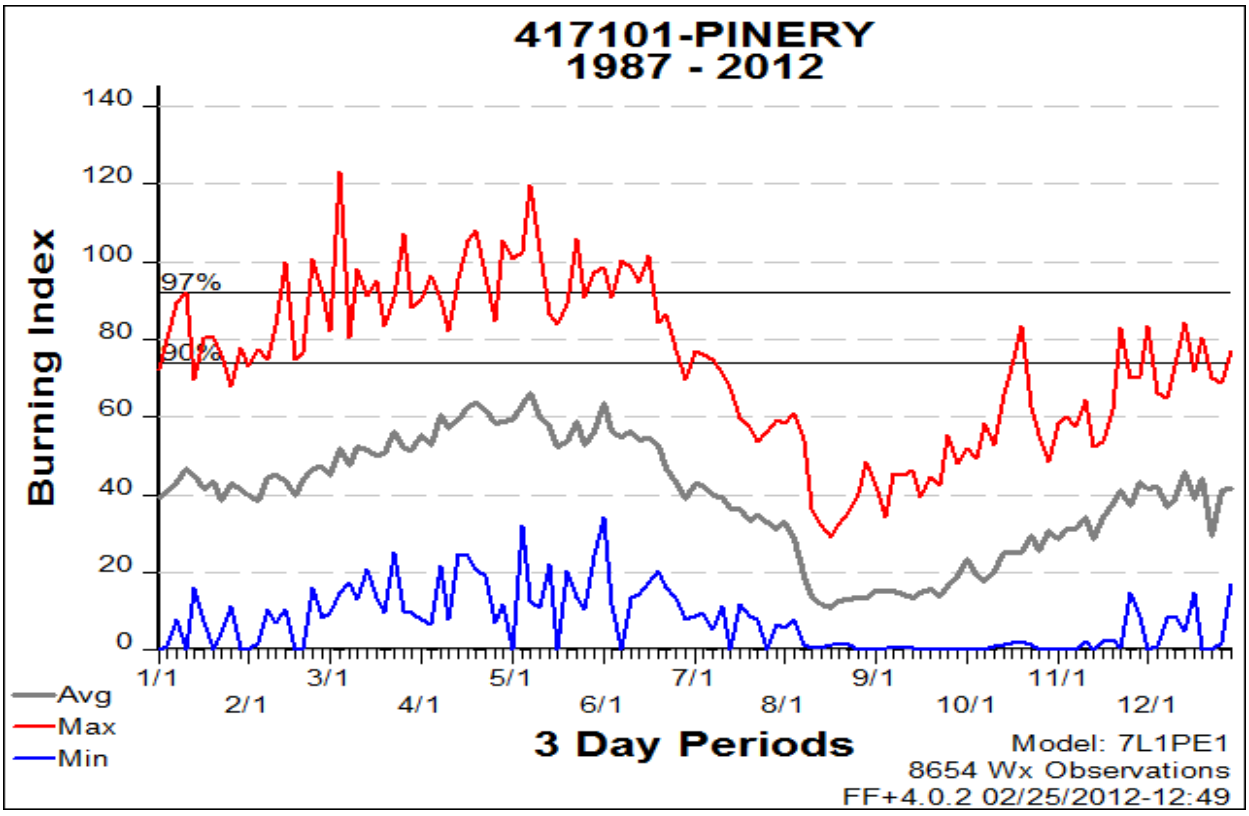


Figure IV-4a. Pinery RAWS Burning Index

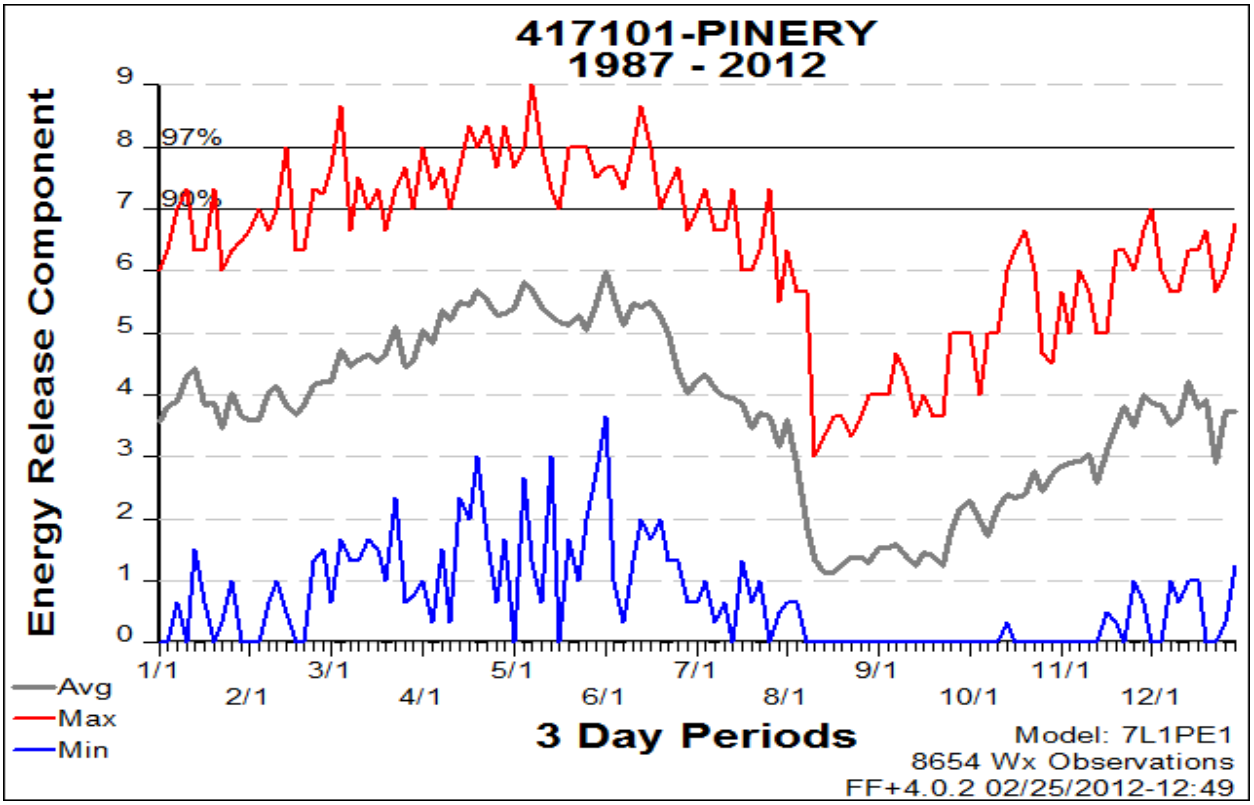


Figure IV-4b. Pinery RAWS Energy Release Component

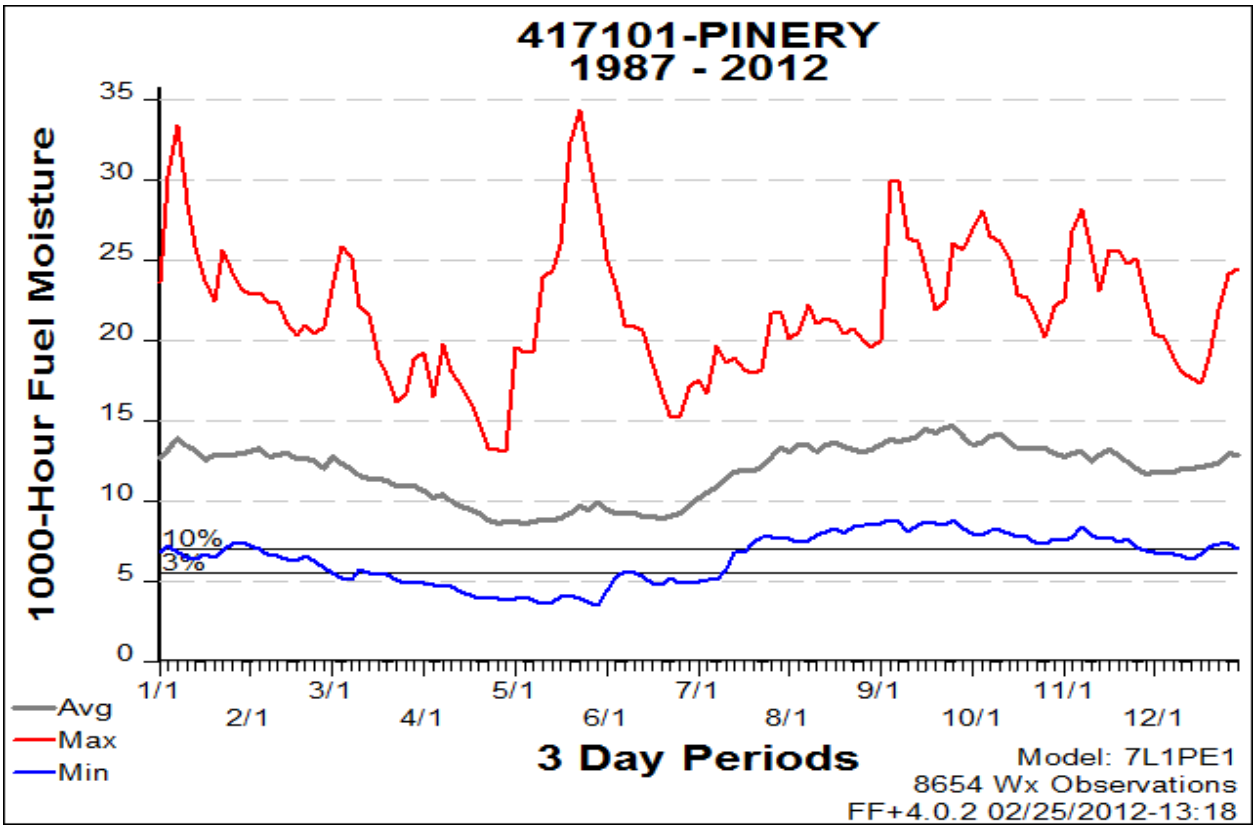


Figure IV-4c. Pinery RAWS 1000-hr Time-lag Fuel Moisture

Table IV-3. Annual temperature and precipitation averages for the Pinery RAWS. (Station number 417101, elevation 5,381 ft. Record covers 1987 – 2011).

Month	Average Air Temperature (◦F)			Precipitation Avg (in)
	max	min	mean	
January	56	34	45	0.66
February	59	36	48	0.84
March	65	41	53	0.54
April	73	48	61	0.59
May	82	56	69	1.14
June	88	62	75	1.76
July	88	64	76	3.65
August	86	63	74	3.02
September	81	58	70	2.54
October	73	50	61	1.24
November	63	41	52	0.91
December	56	33	45	0.85
Annual	73	49	61	17.74

Table IV-4. Annual temperature and precipitation averages for the PX Well RAWS. (Station number 417105, elevation 3,885 ft. Record covers 1995 – 2001) ** 2007 PXWELL RAWS setup as new RAWS station, number is 417001.

Month	**Average Air Temperature (◦F)**			*Precipitation (in)*
	max	**min**	**mean**	
January	62	35	49	0.06
February	67	39	53	0.22
March	72	47	60	0.90
April	81	51	66	0.48
May	91	62	77	0.18
June	96	68	82	1.71
July	97	71	84	1.94
August	95	70	82	1.52
September	91	65	78	0.81
October	82	53	68	0.61
November	70	42	56	0.27
December	60	34	47	0.40
Annual	80	53	67	9.1

All ignitions regardless of source in the park's full suppression FMU 1 will be subject to initial attack and suppressed. For FMU 2 the Wildland Fire Decision Support System may indicate a need to initiate initial attack as the appropriate management response.

Criteria for setting initial attack priorities. Initial attack suppression will routinely occur in FMU 1 and on all human-caused ignitions elsewhere. Priorities will be established based on the following concerns (in order of importance):

- Public and firefighter safety
- Threat to fire-sensitive natural or cultural resources
- Threat to fire-sensitive park infrastructure
- Threat to park cooperator or private land
- Cost
- Air quality

Initial Attack Resources and Dispatching

Initial Attack Resources. Most initial attack in the area involves an interagency response. The park has substantial involvement with the Lincoln National Forest - Guadalupe Ranger District and the BLM Pecos District - Carlsbad Field Office.

- The park shares with Carlsbad Caverns permanent staff, engines, and other equipment as well as collateral duty firefighters. The FMO maintains a Fire Call-up List of initial and extended attack qualified personnel at Guadalupe Mountains National Park and Carlsbad Caverns.
- A well stocked Fire Cache is located at the park that is shared with the cluster of parks.

Initial Attack Dispatching. All initial attack dispatching is performed by Alamogordo Interagency Dispatch Center located in Alamogordo, New Mexico.

See Appendix D for a summary of cooperative agreements detailing mutual assistance in initial and extended attack of wildland fires.

Confinement as an initial attack suppression strategy. A confinement strategy may be implemented as an initial attack option as long as it is not used primarily to meet resource objectives. Confinement is applied in lieu of wildland fire for resource benefits to maximize firefighter safety, minimize suppression costs, minimize loss in specific resource areas, and to maximize availability of critical suppression and management resources during periods of high fire danger associated with fire in highly valued resource areas.

Confinement can also be a strategic selection through the WFDSS process when the fire is expected to exceed initial attack capability or planned management capability. When confinement is selected as the initial action, the same management process applies as for wildland fire for resource benefits decisions. A long-term implementation plan is needed to guide the implementation of the confinement strategy. Ordering a Strategic Operational Planner (SOPL) will assist with developing a long-term plan.

Confinement in the remote portions of the park may be the most acceptable means of suppression based on the Southwest Area Preparedness Level (Table IV-5) at the time of the fire. A high preparedness level is usually the result of large fire activity in the Southwest, often in wildland urban interface areas with high values at risk. Confinement may be the strategy of choice due to simple shortage of firefighting resources. Also:

- Confinement can only be used on fires along the park boundary if the affected park cooperator or neighbor is a co-signer of the WFDSS detailing the terms of the confinement.
- Before a decision is made to manage lightning ignitions by confinement, assessment for possible managing wildland fire for resource benefits should take place.
- Confinement is an inappropriate strategy in FMU 1.

Table IV-5. Southwest Area Preparedness Levels. National and regional Preparedness Level requirements may require the Area Preparedness Levels to be raised.

Level	Description
I	Optimum conditions for normal prescribed fire operations. Wildfire activity within the Southwest Area is light, and large fires are of short duration. There is little or no commitment of Southwest Area and/or National Resources.
II	Zone and Area resources are adequate to manage all wildfires and prescribed fires. Numerous Class A, B, and C fires are occurring and a potential exists for escapes of larger fires for more than one burning period. Potential exists for frequent mobilization of additional resources from other zones.
III	There is a potential for two or more zones to experience incidents requiring a major commitment of Area/National resources. High potential exists of fires becoming Class D or larger. Zones may be requesting resource priorities from SWCC.
IV	Class D and larger fires are common and have the potential to exhaust Southwest Area and National resources. Competition exists for Area/National resources.
V	Several zones are experiencing major fires, and National resources are exhausted. Military resources have been committed within the Southwest Area.

Fire Response Times

During Fire Season (March-November):

- Most of FMU 2 (natural fire unit) can only be reached via several hours of hiking, or by helicopter.
- Most of the FMU 1 (suppression unit) can be reached in less than an hour by graded road with engines.
- Hotshot or regular hand crews are typically no less than 4 hours away, if available.
- Helicopter(s) are typically one to several hours away.
- Air tanker turnaround time from area tanker bases is over 90 minutes.

During the off-season:

Times are usually longer due to lack of immediately available wheel or rotor resources. There are no air tankers available.

Restrictions and special concerns by management area

FMU 1 (Developments)

Improvements and structures
Tanks (propane, gasoline)
Reservoirs
Vehicles
Utility lines
Smoke on the highway
Hot, dry conditions
Flashy fuels

FMU 2 (Backcountry)

MSO PACs
Wilderness
Steep, inaccessible terrain
Loose rock
Hot, dry conditions
Limited use of retardant in McKittrick Canyon
Initial attack in backcountry can be delayed up to 48 hours
Spotting hazards with Douglas fir

Extended Attack and Large Fire Suppression

Determining extended attack needs. By definition, initial attack fires are handled by type 5 and type 4 incident management organizations. The key to both of these organizations (as can be found in the Complexity Analysis, see below) is that resources present to manage the fire are simple and of one kind (such as a squad or crew of firefighters, or two engines). The mixing of different types of resources such as engines, hand crews, and aircraft coupled with longer periods of time necessary to achieve control are typically the reasons for stepping up to an extended attack (i.e. type 3, type 2) incident management organization.

Implementation Plan Requirements – WFDSS development. By policy, the WFDSS process found on the webbased program is used to document strategic and tactical decisions regarding extended attack fires.

The park will intiate a WFDSS analysis prior to an arriving wildland fire incident management team.

WFDSS analysis must be reviewed and approved on a set timeframe designated by the superintendent until a wildland fire has been declared controlled. There is a requirement for WFDSS analysis to have regional or national review and approval if costs are to exceed $2,000,000, or $5,000,000 respectively. However, the Intermountain Regional Director will issue a memorandum certifying the WFDSS.

Complexity Decision Process from Initial Attack to Extended Attack. The Complexity Analysis process is designed to help guide a decision to step-up incident management to an extended attack or type 3 incident management organization. The key here is that complexity has increased due to mixing of types of resources and increased number of resources.

Organizational Needs Assessment. The Needs Assessment must also be completed.

Limited Delegation of Authority for Incident Commander. The Limited Delegation of Authority is the Superintendent's direction to an incident management team regarding management of a wildland fire. It is part of the briefing package presented to the team by the Superintendent. A sample Limited Delegation of Authority for Guadalupe Mountains National Park can be found as part of the Briefing Package for Incoming Incident Management Team, Appendix E.

Exceeding Existing WFDSS – Selecting a New Strategy

Should a wildland fire for resource benefit require placement into a full suppression strategy, the WFDSS will be revised and a new strategy documented. Likely reasons for this shift include threats to the park boundary, increased demand on area firefighting resources, increased impacts of smoke on air quality, and political concerns.

The Superintendent will then begin the procedures for an extended attack detailed above. This should minimally include selection of an Incident Commander and the completion of a complexity analysis, and needs assessment.

Minimum Impact Management

Park staff will manage wildland fire for resource benefits and suppression in ways that minimize unnecessary impacts to resources and wilderness and convey the importance of this strategy to all fire management forces. Minimum impact management strives to minimize landscape alteration and disturbance to natural and cultural resources while safeguarding human lives and property and accomplishing resource-related objectives. Without compromising safety, lines will be located where they do the least damage, and use natural firebreaks when possible. Staging areas and helispots will be placed with care. Agency resource advisors will be consulted prior to implementing management tactics. Minimum impact suppression tactics will always be deployed in any suppression action on any fire of any size.

Minimum impact suppression tactics guidelines for Guadalupe Mountains National Park can be found Appendix F. It is also listed as part of the Briefing Package for the Incoming Incident Management team.

Rehabilitation Guidelines

Despite the best intentions of minimum impact management, wildland fire actions often create the need for short-term or long-term rehabilitation. Staff will consult with specialists (archeologists,

hydrologists, plant ecologists, wildlife biologists) to determine short- and long-term needs and to write rehabilitation plans for each fire as needed, then will implement and monitor the plans. Common rehabilitation recommendations include flush cutting stumps, brushing in handlines, removing all trash, installing erosion control devices, and falling hazardous trees in human-use areas. Reseeding or revegetation after wildfires requires the prior written approval of the Regional Director.

The Resource Advisor will make recommendations to the FMO regarding rehabilitation actions that may be necessary after suppression actions. These recommendations will be made in the form of a Rehabilitation Plan, and, if an Incident Management Team (IMT) is present, will be made to allow the IMT sufficient time to implement them prior to team demobilization. Such actions would be limited-scale measures such as installation of water bars (but not reseeding). Completion of these recommended actions will then be the shared responsibility of the FMO and the IMT, if present.

See also Appendix G for additional rehabilitation guidelines.

Fire Reporting

Incident Status Summary (ICS-209) forms will be completed by the Incident Commander no later than 1800 each day for all Class D and larger wildfires. These will be faxed or e-mailed immediately to Pecos Zone Dispatch.

A master log of all wildfire suppression activities (other than those that involve an IMT) will be maintained in the office of the FMO. From this master record all wildfire-related forms and timekeeping records will be generated.

The centerpiece of the permanent record is the DI-1202, Individual Fire Report. The full record retained at the park (and staff responsible) will include:

- DI-1202 (FMO and Incident Commander)
- All narratives
- Daily and spot weather forecasts
- Smoke monitoring and permits
- Map showing daily acreage burned
- Total cost summary
- Monitoring data
- ICS
- Photos

Individual Fire Report (DI-1202) forms will be entered expeditiously by the FMO/Fire Program Management Assistant (FPMA) into the Fire Reporting Module of the Wildland Fire Management Information webbased program. All DI-1202s for a calendar year will be entered into this system no later than 5 days following the fire being declared out.

Wildland Fire For Resource Benefits

When a wildland fire meets the conditions of a predetermined prescription for fuel reduction or ecological improvement, it becomes a candidate fire for resource benefits. The Superintendent, based on consultation with key staff regarding the location and complexity of the fire, will make the decision whether to allow wildland fire for resource benefits.

Objectives of Wildland Fire For Resource Benefits
Wildland fire for resource benefits is a step toward restoring natural fire regimes in Guadalupe Mountains National Park. Fuel buildups that are the legacy of the full suppression era dictate that great caution is still required when considering letting natural ignitions burn. Wildland fire for resource benefits must be soundly based on management objectives—public and firefighter safety, natural and cultural resources benefits, interagency collaboration—and may include the full range of fire management strategies on a fire's entire perimeter.

Decision-making Criteria
Any natural (lightning) ignition occurring within FMU 2 and remaining within all prescription parameters listed here may be allowed to burn. The WFDSS process as documented on the webbased program will be the basis for all decision making and documentation regarding the certification of wildland fire for resource benefits.

Fuel Moisture/Fire Weather Information. The park regularly gathers fuel moisture and fire weather information that may be useful in wildland fire for resource benefits certification. Samples of fuel are either oven-dried or Computrac by Fire Effects Monitors and fuel moisture percent distributed through the Fire Management Office. The park also gathers and processes fire weather data daily from the Pinery (#417101—NFDRS fuel models L and T) and Bowl (#417103—NFDRS fuel models C and G) RAWS stations.

Specific Parameters. Some parameters specific to Guadalupe Mountains National Park's certification of wildland fire for resource benefits:

- Wildland fire for resource benefits is only allowed in FMU 2.
- When fires approach park boundaries, they must either be accepted for wildland fire for resource benefits by the park neighbor or placed under an appropriate management response.
- Wildland fire for resource benefits in Regional Preparedness Levels IV and V require regional approval.
- Wildland fire for resource benefits may be certified at any time of year but caution is required through the Risk Analysis during dry season months (generally April-June).

Table IV-6 is the Decision Criteria Checklist for wildland fire for resource benefits. **Remember, an answer of "NO" to any of the Decision Criteria Checklist questions results in a NO-GO decision resulting in initial attack/suppression action.**

The Initial Stage of the Wildland Fire Decision Support System (WFDSS)
The FMO or designee completes an Information and Fire Situation for all candidate wildland fire for resource benefits ignitions. It must be completed within 8 hours of discovery of the ignition.

The Initial Stage of WFDSS is the preliminary stage establishing the documentation framework for further decisions. It is both an information-gathering and decision-making stage considering various predetermined management objectives . This information provides location, fire cause, administrative information, fuel and weather conditions, and fire behavior information. It consists of the:

- Fire Situation – location, start,
- Management Objectives – pre-loaded
- Short-Term Wildfire projections
- Values at Risk – pre-loaded
- Recommended Response Action

The WFDSS aids agency administrators in making the initial decision to manage a fire for resource benefits or to suppress by providing location of the fire (suppression or wildland fire for resource benefits FMU), cause of fire (human or natural caused), and validation of the Wildland Fire For Resource Benefits (WFRB) decision.

Monitoring. All wildland fire for resource benefits will be monitored on a as needed basis based on the activity of the fire. The number of such fires in the park at any given time must not exceed the park's ability to monitor them. Consider ordering a Wildland Fire Module for monitoring. (See Chapter VI of this plan, Monitoring and Evaluation.)

Wildfire Short-Term Prediction and Fire Spread Probability (FSPRO) Analysis:
These fire prediction analysis provide managers and staff with information to initiate and continue managing wildland fire for resource benefits. It includes validation of short-term implementation actions as a decision. This stage will provide predictions of where the fire may go, how intense it may burn, how fast it may spread, necessary short-term actions, what the full complexity is, and if long-term management actions need to be addressed immediately.

Extended wildland fires for resource benefits should minimally include fire behavior predictions, a risk assessment, short-term implementation actions, a complexity analysis, and Organizational Needs Assessment.

The Course of Action supplements the FMP by providing the full long-term implementation actions necessary to manage the wildland fire to accomplish identified objectives. This stage will provide a definition of the ultimate acceptable geographic size of the fire (represented by the maximum manageable area or MMA). It will consider long-term fire behavior predictions and long term risk assessment. It will assess the likelihood of the fire reaching the MMA perimeter, and will document those operational Management Action Points (MAPs) necessary to manage long duration fires that will need mitigating measures to strengthen and defend the MMA.

Wildland Fire For Resource Benefits Approval Authority
The Superintendent has the ultimate responsibility for approving or for not approving continuation of wildland fire for resource benefits. The Strategic Operational Planner (SOPL) for each fire has the responsibility for monitoring smoke production and fire behavior and for making recommendations to the Superintendent and/or Incident Commander. He/she may be assisted by one or more Prescribed Fire Monitors (PFM) for each individual wildland fire for resource benefits.

Minimum Impact Management Tactics
Holding actions may be undertaken to confine wildland fire for resource benefits to certain areas. They must be fully described in the WFDSS and are subject to all of the constraints on suppression tactics (i.e., Minimum Impact Suppression Tactics described in Appendix F of this plan).

Table IV-6. Wildland Fire For Resource Benefits Decision Criteria (Must answer YES to all criteria to reach a GO decision. Any NO answers result in a NO-GO decision and declaration of a wildfire. Once declared, the fire cannot be reverted to wildland fire use.)

Decision Criteria	Questions
Ignition	Is it a natural source? Is the location within the wildland fire for resource benefits zone?
Management Objectives	Are resource objectives being met? Are potential effects on natural and cultural resources within the acceptable range of effects and variability?
Size	Is the current and expected size known? Is the potential for escape from the maximum management area acceptable?
Fuels	Are live fuel moistures within prescription?
Weather	Are drought indicators acceptable (1000-hr TLFM, Palmer drought index)?
Topography	Is the terrain in locations for potential holding actions along the maximum management area accessible and safe for crews to work in?
Resource Availability	Are local, regional or national resources available?
Safety of Life and Property	Can the threats to firefighters, staff, visitors, residents, neighbors, associated property and infrastructure be minimized?
Environmental Constraints	Is smoke dispersal and direction acceptable?
Political Constraints	Is managing this fire for wildland fire for resource benefits compliant with current policy, moratoriums, political constraints, funding and efficiency issues?

Air Quality

Clean air is a vital park resource, and 100-mile views are part of the draw for visitors. A burn permit must be obtained from the Texas Commission on Environmental Quality (TCEQ) for wildland fire for resource benefits that generates or is expected to generate a substantial amount of smoke. The TCEQ is legally embodied to deny or revoke burn permits for fires that produce unacceptable amounts of smoke. The park also makes a courtesy call to the New Mexico Environment Department, Air Quality Division regarding potential smoke production from wildland fire for resource benefits.

Converting to Suppression Strategy

Wildland fire for resource benefits that is declared unwanted fire cannot later be declared wildland fire for resource benefits a second time. It must continue to be managed in a suppression strategy.

Preplanned Wildland Fire For Resource Benefits Implementation Procedures

It is the responsibility of the FMO and the Chief of Resource Management and Visitor Protection to annually conduct an interdisciplinary meeting to update the park's wildland fire Pre-attack Plans (Appendix C of this plan). The Superintendent must sign any updates to the FMP to validate. A Pre-

attack Plan for wildland fire for resource benefits should minimally consist of reviewing previous WFDSS documentation from previous wildfires for typical scenarios of lightning ignitions in the wildland fire for resource benefits (FMU 2) portion of the park.

WFIPs from actual wildland fire use events also serve as Pre-attack Plans for future wildland fire for resource benefits and are included in Appendix C.

These preattack plans, if properly completed in WFDSS for representative scenarios, should serve well as templates for any subsequent ignitions. The primary consideration in all pre-attack plans will be firefighter and public safety.

Unplanned Wildland Fire For Resource Benefits Implementation Procedures
The most current version of the IPRG will be the basis for completion of WFDSS. Until declared out, any ongoing fire for resource benefits will be periodically assessed (daily or more frequently) and this assessment documented by the Superintendent on the Periodic Fire Assessment tab found in WFDSS. Given the likelihood of rewrites and additions to this guide and the forms it contains, the FMO/SOPL must be sure they are using the most current version and following the most current procedures.

Potential Impacts of Plan Implementation
The Environmental Assessment prepared for this plan addresses the impacts of wildland fire for resource benefits and mitigation measures. The strategy is justified by the need to return fire to fire-adapted systems (see Chapter III), but implementation requires acceptance of short-term losses in exchange for long-term ecological benefits. Criteria that allow wildland fire for resource benefits are strict, and at the time this plan was prepared, few fires had qualified as fire for resource benefits. The FMO or designee, in consultation with Resource Management staff, will use WFDS to determine potential impacts of wildland fire for resource benefits in the event that strategy is applied.

Staffing Requirements for Wildland Fire For Resource Benefits
It is recommended that if a wildland fire for resource benefits situation is anticipated to be long-term, a Wildland Fire Management Team be ordered.

Table IV-1 is the park Preparedness Staffing/Step-up Plan. Wildland fire for resource benefits is allowed in all 5 levels of park preparedness. It is likely, however, that in the higher levels either the WFDSS process or the Southwest Area Preparedness Level (see below) will preclude wildland fire for resource benefits. Staffing levels 4 and 5 dictate that regional and national approval, respectively, be sought before implementing a wildland fire for resource benefits scenario.

Table IV-5 is the Southwest Area Preparedness Levels which are important for the certification of wildland fire for resource benefits.

Public Information and Interpretation as it Relates to Wildland Fire For Resource Benefits
The Chief of Interpretation will work carefully with the FMO/SOPL to disseminate information regarding wildland fire for resource Benefits. The information officer will generate information and interpretation to communicate about wildland fire for resource benefits; this program will include "step-up" activities that address needs when fire activities escalate. The Visitor Center plays an integral part in the dissemination of information by presenting displays and talks as well as generating press releases. The Wildland Fire Management Team normally comes with a qualified Information

Officer; this person will coordinate with park interpretive staff to ensure accurate and timely dissemination of information.
Key agency, state, and local contacts for public information include:

- Lincoln National Forest, Fire Management Officer, Public Information Officer
- Pecos Zone Counterparts
- Pecos Dispatch
- Carlsbad Interagency Fire Organization (BLM and USFS) Fire Management Officers
- Culberson County Sheriff
- Texas Department of Public Safety
- Carlsbad Current-Argus and newspapers in Van Horn, Dell City, Midland-Odessa, and El Paso
- U.S. Fish and Wildlife Service (USFWS)
- National Park Service, Intermountain Region, Denver, CO, Information Officer

Standard Records to be Kept in Permanent Package for Wildland Fire For Resource Benefits
Planning Documents. The WFDSS and a DI-1202 Wildland Fire Report are required documentation for all wildland fire for resource benefits events. They will be filed in the Fire Management Office as part of the final project package. A hardcopy of the WFDSS, and National Fire Plan Operations and Reporting System (NFPORS) treatment entry should also be filed in this package.

Monitoring Reports. Monitoring requirements and reports are detailed in the Wildland and Prescribed Fire Monitoring Plan (Appendix H). While monitoring records are part of the permanent project record it is not necessary to store all of them physically with the final project package. They will remain filed with the Fire Effects Monitors or Fire Ecologist. A summary of monitoring actions taken for each wildland fire for resource benefits event should be filed with the final project package.

Funding and Financial Records. Funding codes are assigned by the Fire Management Office which is also where all financial records are stored. All funding issues and fiscal tracking are completed by the FMO and FPA. Costs related to wildland fire for resource benefits will be relayed to the regional FMO on a schedule agreed upon by the park. If wildland fire for resource benefits exceeds prescription and needs to be suppressed, a new fire cost accounting and charge number will not be assigned. Acres burned will be counted as wildland fire for resource benefits.

Permanent Project Record. Table IV-7 compiles the routine records and reports that the fire program must maintain, including those for wildland fire for resource benefits. The FMO is ultimately responsible for this collection of documents, but will delegate tasks as necessary.

Table IV-7. Fire Program Records, Reports and Plans

Record, Report, or Plan	Revision or Preparation Frequency	Responsibility	Distribution
DI-1202 with map	per incident	Incident Commander or Burn Boss	GUMO, NIFC (through Fire Web Reporting System)
WFDSS	per incident	Fire Committee	GUMO
Fire Atlas	annual	Fire Staff	GUMO
Fire Danger	daily (season)	Alamogordo Interagency Dispatch	GUMO, PEZ (through FireFamily +)
Fire Weather	daily (season)	AIDC	GUMO, WIMS
FIREPRO Submission	annual	FMO	IMRO, NIFC
FMP Revision	every 10 years	Chief RM & VP, FMO	GUMO
FMP Update	annual	FMO	GUMO, IMRO
Fuel Moisture	weekly (season)	Fire Effects Monitor	GUMO
Fuels Project Submissions	annual	Fire Staff	GUMO, NIFC, IMRO (through NFPORS)
Job Task Books	per training experience	Trainee	Trainee, IQCS
Wildland Fire For Resource Benefits Documentation	daily during fire	Superintendent	GUMO throught WFDSS web-based program
Prescribed Fire Plan, NPS Complexity Analysis	per fire	Prescribed Burn Boss, FMO, Fire Ecologist	GUMO
Readiness Reviews	annual	FMO	GUMO, IMRO
Red Card	annual	FMO	per firefighter, IQCS
Monitoring Report (level 1)	per incident	FMO	GUMO
Monitoring Report (level 2)	annual	FMO	GUMO, IMRO
Fire Preparedness Plan	annual	FMO	GUMO
Cost Accounting and Project Updates	per incident	FMO	GUMO, IMRO (through NFPORS)

IMRO = Intermountain Regional Office NIFC = National Interagency Fire Center
PEZ = Pecos Zone
IQCS=Incident Qualification Certification System
NFPORS = National Fire Plan Operations and Reporting System

Prescribed Fire

Prescribed burning allows meeting resource management and safety objectives on a predictable timetable. A general definition of prescribed fire (Rx burns) is:

> "the skillful application of fire to vegetation fuels under conditions of weather, fuel moisture, soil moisture, and suppression resources availability that will allow confinement of the fire to

a predetermined area while meeting certain burn objectives such as vegetation management, wildlife management, and hazard fuels reduction".

Program Scope

Guadalupe Mountains National Park has been conducting prescribed burns since 1976 (see Table IV-8 for records). The program is both a means and an end; prescribed burning pre-treats the landscape to prepare for the return of fire as a natural process, but it also becomes the process when lack of ignitions and restrictive conditions keep wildland fire for resource benefits from taking place. Prescribed fire compensates for ignitions outside the park that might naturally move into the park but are instead suppressed. An approved FMP is a prerequisite for prescribed fire for resource benefits in parks. All prescribed fire must meet the requirements of the interagency IPRG. The prescribed fire program aims to minimize risk of fire escape, cooperate with park neighbors where possible, and minimize damage to natural and cultural resources, while spending acceptable amounts of money.

Except in the lands below the escarpment and in the Bowl, park terrain is generally remote and extremely rugged, containing cliffs, ridges, and steep canyon walls. Most rock outcrops consist of exfoliating limestone and large pieces can readily be broken loose. In addition, poisonous spiders, insects, and reptiles are abundant. Since the risk of personal injury increases dramatically at night, the park will limit nighttime prescribed fire operations to passive monitoring activities in canyon and rugged areas.

Fuels management through either prescribed fire or non-fire means will be undertaken to:

- protect sensitive park resources and infrastructure from the effects of wildland fire.
- maintain defensible space to prevent or at least inhibit the escape of park wildland fires onto adjacent cooperator and private lands.

Burns to achieve certain resource management objectives may bring fire to areas where it is needed on either side of the peak fire season during cooler spring and fall "shoulder" periods, when risks of high-intensity fires are lower.

Table IV-8. Past Prescribed Burns at Guadalupe Mountains National Park

Year	Name	Date	Acres
1979	Salt I	08-10	0.13
1988	Tamarisk	07-27	0.4
1995	Signal Peak	4-13	2
1997	McKittrick RX	08-31	86
1997	Cherry Canyon	03-18	82
1997	Williams Ranch Complex	03-21	1231
1998	Pine Spring	03-25	60
1998	Indian Meadow	04-10	10
1998	Bowl Brush Piles 2	07-11	90
1998	Bowl Brush Piles 1	08-21	60
1998	Bowl	11-14	450
1999	Frijole Ridge	11-22	550
2002	D Boundary	08-08	100

Planning, Reporting, and Documentation

The FMO, Chief of Resource Management and Visitor Protection, Superintendent, Fire Ecologist, and others on the Resource Management Staff conduct the planning for fire at Guadalupe Mountains National Park. Prescribed fire accomplishments are reported to the Intermountain Region (IMRO) through NFPORS. Escaped fires are reported immediately to IMRO.

Annual Activities. In addition to making long-term plans, the FMO and Chief of Resource Management and Visitor Protection oversee the following annual planning activities:

- *At least 1 year out:* Verify that the proposed fire management actions are within the ESA/Section 7 Biological Opinion consultation Reasonable and Prudent Measure Terms and Conditions for the MSO, and the NHPA/ Section 106 consultation treatments recommendations contained in Chapter IX that follows.
- *1 year out:* Confirm budget is intact.
- *Monthly:* Submit prescribed fire/fuels reduction accomplishments to NFPORS within a week of completion or by the 23rd of the month.
- *April 1*: Set prescribed burn priorities and prepare NFPORS request for next fiscal year's prescribed burns. Initiate seasonal collaboration with partners.
- *August 1*: Respond to budget call for new projects.
- *November 1*: Receive notice of budget approval from IMRO.
- *Ongoing*: Collaborate with interagency contacts; conduct interagency planning; update multi-year prescribed fire schedule; update/draft burn plans; update monitoring plans.

Staff will work towards getting reusable burn plans on the shelf. At the time of preparation of this FMP, the Pratt Cabin burn plan can be reused with minimum modification.

Prescribed Fire Strategy by Fire Management Unit

The FMO, Chief of Resource Management and Visitor Protection, and Fire Ecologist have developed Table IV-9 (multi-year fuels treatment plan) and Figure IV-5 (treatment unit map). Table IV-9 identifies the FMU for each project area. Past treatments are entered into Table IV-8.

FMU 1 (suppression unit). Prescribed fire will be used moderately to frequently in these units to accomplish fuel reduction adjacent to park infrastructure and to maintain defensible space for unplanned wildland fires. As discussed in Chapter III, the FMU 1 landscape falls into condition class 3 (high departure from natural fire regime) at the time of plan preparation.

FMU 2 (wildland fire for resource benefits unit). Prescribed fire will be used in this unit to reduce fuels and ultimately accomplish the resource management objective of the reintroduction of fire to fire-dependent ecosystems. As discussed in Chapter III, the FMU 2 landscape falls mostly into condition class 3 (moderate departure from natural fire regime), with 2 units classified as condition class 4 at the time of plan preparation (see Table IV-9).

Staffing

Personnel qualifications and staffing organization for prescribed fire functions will follow current NPS policy as described in NPS RM-18, and regional policy as described in the Southwest Region Prescribed Fire Monitoring Guide. In order to have the minimum number of prescribed fire personnel necessary to carry out complex prescribed burns the park will endeavor to have park employees qualified in the following positions:

Number of Employees	Rating
1	Strategic Operation Planner (SOPL)
2	Prescribed Fire Burn Boss Type 2 (RXB2)
2	Holding Specialist (Single Resource Boss qualified)
2	Ignition Specialist Type 2 (RXI2)
2	Fire Effects Monitors (FEMO)
12	Prescribed Fire Crew Member (FFT2)

Specific employees will be identified and targeted for training opportunities in order to achieve the desired levels of expertise. Qualified seasonal employees will be trained and added to the teams each year.

Firefighter and prescribed fire crew member qualifications are essentially the same. Thus having 18 to 24 firefighters available is the same as having 18-24 prescribed fire crew members available.

Prescribed Fire Monitoring

Behavior and effects for all fires will be monitored in accordance with the Fire Monitoring Handbook (FMH) (see Chapter VI for more details); Appendix H is the Fire Monitoring Plan dictated by RM-18 Chapter 11 describing four monitoring levels—environmental planning, fire observations, immediate postfire effects, and long-term change. Along with the overall program, monitoring program components are also evaluated annually:

- Gathering and processing data
- Evaluating results
- Analyzing and interpreting data
- Responding to an identified trend
- Documenting results

During a prescribed fire, weather observations are recorded every half hour by a qualified fire effects monitor: temperature, relative humidity, wind direction, wind speed, cloud cover, and dew point. Fire behavior observations are collected hourly or more frequently if circumstances dictate: rate of spread, flame length, residence time, and flame zone depth. Fuel moisture (10-hour TLFM) is measured at least twice during a burn and more frequently if possible. Smoke data are collected every hour, and minimally include smoke column height and direction; more intense smoke monitoring occurs for burns in close proximity to heavy visitor use areas.

Monitoring objectives are measurable, and include short- and long-term analysis of program effectiveness. Monitoring type descriptions are on file in the Resources Management office and include monitoring objectives for each monitoring type. These descriptions are reviewed on an annual basis for validity and changed as needed. Concerns related to this FMH protocol include the time needed to evaluate program effectiveness and the appropriateness of these protocols to unique vegetation types.

Table IV-9. Multi-year Fuels Treatment Program

State	Region	Alpha	WUI or HF	Fiscal Year	Project Name	Treat Type	Fire Regime	Condition Class	NEPA	Target Acres	Notes
TX	IMR	GUMO	HF	FY05	Foothills/Lamar	Fire	I	2	Within FMP NEPA	7,200	
TX	IMR	GUMO	HF	FY06	Bowl 2nd Entry	Fire	I	3	Within FMP NEPA	407	
TX	IMR	GUMO	HF	FY06	Frijole Ridge	Fire	I	3	Within FMP NEPA	1,100	
TX	IMR	GUMO	HF	FY07	Bush Mountain	Fire	I	3	Requires Supplemental NEPA	1,814	
TX	IMR	GUMO	HF	FY08	Hunter	Fire	I	3	Within FMP NEPA	800	
TX	IMR	GUMO	HF	FY09	McKittrick VC	Fire	I	3	Within FMP NEPA	1,000	
TX	IMR	GUMO	HF	FY10	South McKittrick	Fire	I	3	Requires Supplemental NEPA	4,534	
TX	IMR	GUMO	HF	FY11	PX Flat	Fire	I	3	Within FMP NEPA	800	
TX	IMR	GUMO	HF	FY13	Dog Canyon	Fire	I	2	Within FMP NEPA	1,000	w/USFS
TX	IMR	GUMO	HF	FY14	North McKittrick	Fire	I	3	Requires Supplemental NEPA	2,000	w/USFS

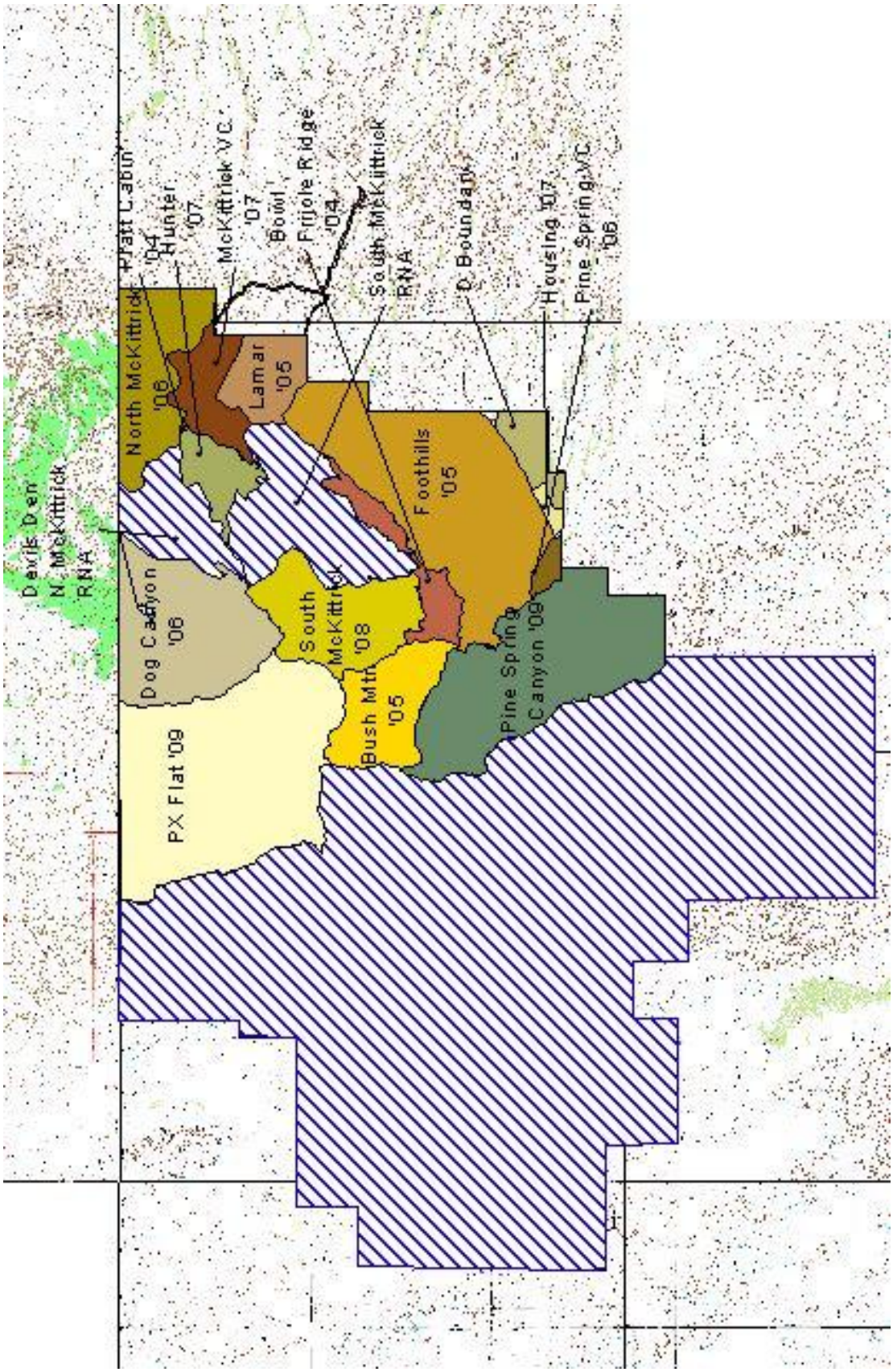


Figure IV-5. Multi-year Fuels Treatment Map (2004)

Prescribed Fire Critiques (see Chapter XII)
Prescribed Fire Project Critiques may be conducted as needed. Like wildland fires, prescribed fires have three levels of evaluation and review: park, regional, and national. The level of review depends on complexity and severity of the fire. In most cases, a park-level review is all that is warranted, and involves an in-park review that is sent to the Regional FMO. It is the Superintendent's responsibility to call for the review, request technical support if necessary, ensure the review's timely completion, and implement the recommended actions. RM-18 Chapter 13, Evaluation and Review, details all level reviews for prescribed wildland fire.

Documentation
Prescribed fire plan. The FMO or designee will prepare a prescribed fire plan preceding any burn. All prescribed fire plans will fully address contingency measures should a prescribed fire escape. The plan must be approved by the Superintendent prior to the ignition of prescribed fires and must conform to the NHPA (SHPO) and ESA conditions that were identified in the NEPA process for development of the FMP. A prescribed burn should not be proposed if it falls outside the scope of the existing NEPA documentation without additional consultation taking place. It also requires technical review by a qualified burn boss from outside the park. The Superintendent or burn boss may cancel an approved fire at any time. The burn boss must initial and date any modifications or amendments to an approved plan in advance of ignition. The format for Prescribed Fire Plans can be found in RM-18, Chapter 10. There is an electronic web link to a sample plan included in Appendix I.

Other documentation. The burn boss must report prescribed fires via the BLM fire reporting website using a DI-1202 Wildland Fire Report form. Table IV-10 lists documents to maintain in the files for each prescribed fire.

The prescribed burn boss or preparer of the prescribed burn plan analyzes risks and documents risk management procedures. The burn plan must include the Hazard Rating Guide, Prescribed Fire Risk Analysis Worksheet, Prescribed Fire Mitigation Table, and Prescribed Fire Complexity Rating Worksheet. A logical, continuous, five-step process guides prescribed fire risk management:

- Assess hazards to determine risks.
- Implement controls that eliminate or reduce hazards.
- Decide how to proceed and communicate decision clearly.
- Evaluate effectiveness of mitigations and controls.
- Communicate and document risk decisions.

Exceeding Existing Prescribed Fire Plan
If a prescribed fire exceeds prescriptions to the point where on-scene resources are incapable of controlling it, the fire will be declared a wildfire and staff will initate WFDSS. In these situations, staff will follow procedures as outlined in RM-18 Chapter 9, in addition to specific guidelines listed in the Prescribed Burn Plan. The process of declaring a prescribed fire "unsuccessful" is similar to the process of using the Decision Criteria Checklist in WFDSS for a WFRB.

A prescribed fire being declared "unsuccessful" or "exceeding existing prescribed fire plan" can result from a Superintendent's determination that the prescribed fire has:

- become a threat to firefighter or visitor life and safety or to property.
- had an undesirable effect on cultural or natural resources that cannot be mitigated.
- escaped predetermined target or secondary acreage i.e. escapes planned burn perimeter.

- clearly and continuously exceeded prescription parameters for prescribed fuel and weather conditions.
- persisted after ignition into a period of higher Regional Preparedness Levels.
- outstripped resources necessary and available for successful completion.

Agency administrator issues (above the Superintendent level) can also preclude continuation of prescribed fire.

Table IV-10. Required Prescribed Fire Documentation

Original signed prescribed fire plan	Agency administrator go/no-go approval
Checklist of pre-burn activities	Operational go/no-go checklist
All reviewer comments	Incident action plan(s)
All maps	Unit logs, daily validation, other unit leader documentation
Notification checklist	Press releases, public comments, complaints
All permits (burn, smoke, others)	Smoke dispersal information
Monitoring data	Post-fire analysis
Weather forecasts	DI-1202 (must also be reported in BLM Fire Reporting system and NFPORS)
Photographs	

Air Quality and Smoke Management

Guadalupe Mountains National Park was designated as a Class I airshed by the 1977 amendments to the Clean Air Act (Public Law 95-217). Air quality of the Guadalupe Mountains region is generally excellent; visibility at Guadalupe Mountains averages 80 miles and can exceed 155 miles on the clearest days. Dust, particularly during the spring windy season decreases visibility, and pollution from sources in the region's metropolitan areas, power plants, and smelters is increasing. Haze has reduced visibility at times to less than 50 miles and presently maximum visibility only occurs one percent of the time, with a fifty percent reduction fifty percent of the time. The net effect has been a measurable reduction in visibility, which is of paramount importance to visitor appreciation of the mountain and its environs. Smoke management is a factor in fire planning, but in general, smoke dispersion is excellent.

As specified by Section 118 of the Clean Air Act, (42 USC 7418), amended in 1992, NPS fire management activities that result in the discharge of air pollutants (e.g., smoke, carbon monoxide, and other pollutants from fires) are subject to, and must comply with, all applicable Federal, state, interstate, and local air pollution control requirements. Guadalupe Mountains National Park consults with the TCEQ on projects, complies with the National Ambient Air Quality Standards (NAAQS) both inside and outside unit boundaries, and protects visibility according to its congressionally mandated Class I area status. Air quality monitoring at Guadalupe Mountains has been ongoing since 1987 and currently the NPS operates a sampling station at Signal Peak, with 24-hour sampling analyzing particulate matter, sulfur dioxide, nitrogen oxide, ozone and heavy metals. There is currently no smoke permitting process in place for West Texas other then a courtesy call to TCEQ a week before the burn and a call the day of the burn.

Non-Fire Fuel Treatment Applications

Within the context of the fire program, mechanical, chemical, biological, and manual treatments are conducted only as pre-treatment for prescribed burns. As such, details for these projects appear in specific burn plans. Monitoring of non-fire treatments will be included as part of burn unit monitoring. Critiques, accounting, and reporting will be included with reporting for prescribed fires.

Minimum requirement analysis will be used to determine least intrusive pretreatment methods. Specific equipment and seasonal use restrictions include:

- No chainsaws in MSO PACs during breeding season (March 1-August 31)
- No chainsaws in designated wilderness

Emergency Rehabilitation and Restoration

Planning and implementation of post-fire emergency rehabilitation and restoration will follow guidelines set forth in the Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook as well as RM-18 Chapter 12 Burned Area Emergency Rehabilitation (BAER). "No-year" funding is available to allow parks to take immediate or short-term actions to prevent unacceptable resource damage and to minimize threats to life and property resulting from a wildland fire.

BAER plans and requests for funding must be submitted to the IMRO within five days of fire control. IMRO will review the plan and requests within seven days of receipt and may transfer these documents to the Fire Management Program Center for review, depending on cost.

Guadalupe Mountains National Park will use the least intrusive BAER actions to mitigate actual or potential damage caused by wildland fire. The preferred action will be natural recovery of native plant species, except in rare circumstances. BAER actions for fire for resource benefits and prescribed fires are inappropriate and will not be utilized.

Chapter V. Organizational and Budgetary Parameters

This chapter defines how park personnel act to carry out the fire program. Every employee in the park has a role to play in the fire management program—all members of the park staff are encouraged to join the Wildland Fire Team. Team members participate to the level of their training and qualifications. Guadalupe Mountains and Carlsbad Caverns national parks share fire staff.

Fire Organization

Figure V-1 (organization chart) shows the staffing structure for the park fire organization.

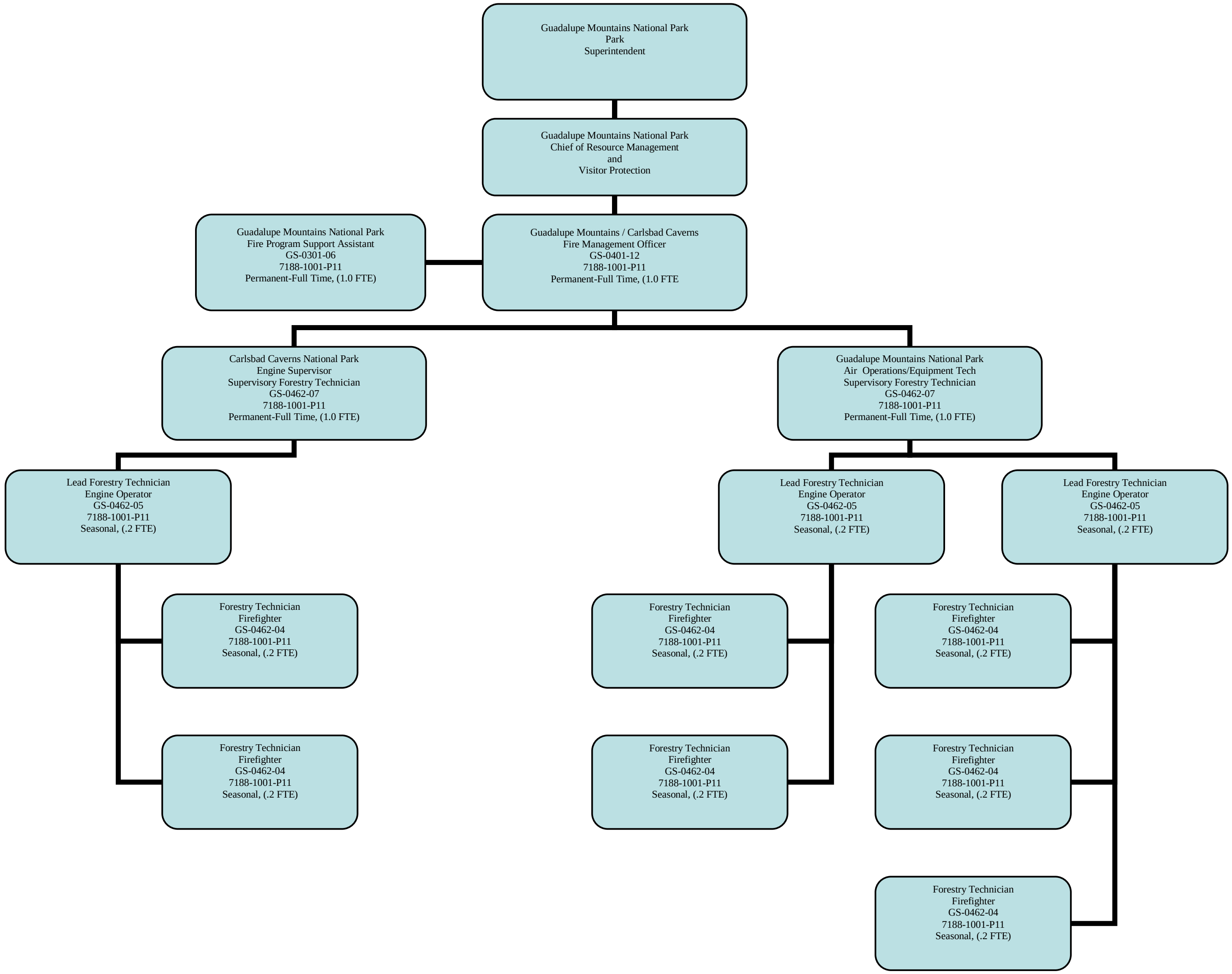
The *Superintendent* has ultimate authority and responsibility for all activities under this plan and will make final decisions regarding the fire program, based upon advice from appropriate staff. The Superintendent:

- Administers the overall fire program.
- The Superintendent is responsible for ensuring that compliance requirements have been meet for all fire management activities.
- Approves and terminates local and zone fire management agreements.
- Delegates authority to the Incident Commander to manage fire suppression operations and conducts briefing sessions for incoming and outgoing Incident Management Teams.
- Approves prescribed burn plans and ensures that projects comply with established procedures, FIREWISE standards, safe practices, agency direction and policy, and the FMP.
- Ensures that escaped prescribed fires that damage resources or property are reviewed and investigated in a timely manner.
- Chairs the fire committee.
- Serves as formal park representative in Pecos Zone matters and joint agreements.
- Approves an annual review and update of the FMP to ensure it continues to conform to laws, objectives, strategies, and procedures.
- Signs off on a periodic assessment that continued management of wildland fire for resource benefits is acceptable. This responsibility may be delegated to another organizational level.
- Authorizes annual verification of fuels treatment schedule.

The *Chief of Resource Management and Visitor Protection* has responsibility to plan, oversee, and implement the total fire management program. Included under this position is the coordination of all fire/resource management activities with all park divisions and with other agencies and neighbors. The Chief of Resources Management and Visitor Protection:

- Coordinates review and update of the FMP; monitors plan implementation.
- Coordinates NEPA compliance responsibilities through resource management and fire management staff.
- Serves as onsite program coordinator, overseeing prevention, pre-suppression, suppression, wildland fire for resource benefits, and prescribed fire operations.
- Coordinates inter-divisional Wildland Fire Team that provides in-park personnel, including Resource Management staff, for all facets of fire management.
- Appoints Prescribed Burn Boss (RXB1 or 2), Strategic Operational Planner (SOPL), or Incident Commander for park fires.
- Informs the Superintendent of fire situations in and around the park.

Table V-1. Fire Management Organization



- Maintains contact with neighboring landowners and public land managers during fire operations.
- Drafts Delegation of Authority to incoming Incident Commander's for the Superintendent's signature.
- Ensures that all activities and plans reflect a commitment to safety; recommends restrictions and closures during fires or periods of very high to extreme fire danger.

The Park *Fire Management Officer (FMO)* has responsibility for implementing fire and aviation management activities. The FMO manages day-to-day operations:

- Directs prevention, pre-suppression, suppression, wildland fire for resource benefits, and prescribed fire operations and prepares the annual work plan for fire program activities.
- Facilitates interagency cooperation with the BLM and USFS in regards to fire management activities covering all phases of wildland fire.
- Supervises fire staff and assigns tasks according to qualifications and demonstrated abilities.
- Seeks FIREPRO funding and manages budget (FPA).
- Coordinates and communicates fire danger ratings, fire weather data systems, and fire weather observations and forecasts.
- Assures readiness including training, equipment, and cache condition; administers annual refresher and pack testing for all participants.
- Plans, conducts, and coordinates all burn operations; oversees drafting and technical review of prescribed fire plans prior to plan approval; works with Fire Ecologist to develop prescriptions.
- Serves as the Park Aviation Officer for all flight activities and associated training.
- Ensures preparation of reports, filing of documentation, and updating of fire atlas.
- Ensures that all activities and plans reflect a commitment to safety.

The *Fire Ecologist*:

- Oversees fire effects monitoring.
- Works with the FMO to develop prescriptions for wildland fire use and prescribed burns.
- Coordinates fire research at the park.

The *Chief of Interpretation* (Public Information Officer) keeps the public informed about the fire program. The Chief of Interpretation:

- Provides for dissemination of fire prevention and fire danger information to staff and the public.
- Prepares new releases regarding prescribed burns, special fire danger situations, closures, and other actions.
- Serves as Information Officer during burn events and works closely with other Information Officers as appropriate.
- Supervises other staff in dissemination of information.

The *Resource Management Staff* will provide input to the Chief of Resources Management and Visitor Protection and Fire Management Staff toward the implementation of this FMP. Duties include:

- Provide assistance to the park on fire management planning and NEPA compliance, as well as ESA and NHPA.
- Provide baseline resource information in support of the fire management program, making this information available as needed and requested and as identified in the Dispatch Plan.
- Provide staff expertise and assistance in monitoring programs and fire research activities.

- Prepare compliance documents for the SHPO, as needed, for archeological and historical sites that may be impacted by fire management activities.
- Prepare section 7 consultation actions, as needed, for threatened and endangered species management.
- Serve as resource advisors to in-park fires, as requested.
- Make recommendations as necessary for post-fire rehabilitation of burn sites or damage caused by suppression or prescribed fire preparation activities.
- Participate in fire management assignments, as requested, to the level qualified.

The *Fire Program Management Assistant* is responsible for supporting all aspects of the fire management program. As the primary staff support to the branch, duties are many and varied. The support assistant often serves as the Park Dispatcher and performs the following duties:

- Carries out all fire-related clerical duties such as time and travel reporting, typing, and filing. Maintains the Fire Report files. Coordinates these activities with other division clerks, as necessary, to insure that all employees from all divisions are covered.
- Functions as the park dispatcher in the absence of the primary park dispatcher and as a second dispatcher during times of elevated activity.
- Maintains the annual Fire Log to (1) ensure fire names and numbers and account numbers are assigned in order and not duplicated and (2) keep current with the annual park fire situation.
- After approval and upon request, sets up fire accounts for emergency pre-suppression, fire suppression and special accounts and tracks and monitors expenditure in these accounts. Tracks expenditures in all fire accounts and keeps responsible person informed of the status of expenditures in accounts.
- During fire season submits the daily Fire Situation report to Alamogordo Interagency Dispatch in Alamogordo, New Mexico.
- Obtains Fire Situation reports and Fire Weather Information, on a daily basis during fire season and ensures proper posting.

The *Chief of Maintenance*, as a member of the park's management team, is responsible for coordinating support activities of the maintenance division in support of the fire management program. The Chief of Maintenance will:

- Provide information on utilities and other facilities that are potentially damaged by fire, or damaged or overused by suppression activities.
- Maintain water systems and electrical systems during emergency conditions.
- Provide emergency vehicle repairs, water system repairs, and other similar support to maintain emergency readiness.
- Help disseminate fire prevention information to park visitors.
- Provide vehicles and equipment and other logistical support required for fire operations.
- Provide division personnel for fire management assignments.

The *Administrative Officer* (AO), is responsible for coordinating support activities of the administrative division in support of the fire management program. AO duties include:

- Guides travel finance, emergency procurement, emergency employment, and other administrative matters.
- Supports establishment of in-park fire management accounts, including pre-suppression, emergency pre-suppression, suppression and any special accounts that may need to be established.

- Helps establish pre-season contracts for support services such as fuel, food and lodging, or other pre-identified needs. Maintains a copy of the Pecos Zone Supply Plan to assist the park in obtaining these items.
- Provides fire prevention information to subordinates, and provides that this information will be communicated to park visitors as appropriate.
- Provides division personnel for fire management assignments.

Normally Alamogordo Interagency Dispatch Center serves the needs of Guadalupe Mountains National Park. *Dispatchers* will be scheduled and dispatch coverage provided 24 hours/day whenever personnel are assigned on an in-park fire incident. When a Dispatcher is assigned to an extended shift at Alamogordo Dispatch that position generally monitors the radio, but may also:

- Implements the Park Dispatch Plan, initiating response and notifying proper parties, to provide for proper management of fire activities.
- Coordinates radio traffic and manages communications to provide for smooth transmission of information, minimize repeat radio traffic, minimize conflicts over use, assist in obtaining resources, documenting events, and to assist in providing for incident safety.
- Monitors status and availability of in-park fire resources during fire season.
- Maintains a status board of all fires burning in the park.
- Assists in the monitoring of the potential cumulative effects of smoke on visibility and on local communities, by maintaining logs and written "records" of all complaints regarding smoke and keeps the FMO advised.

FIREPRO Funding

The current (2005) Fire Programming analysis (FIREPRO), as described in NPS-18, Section III, Chapter 1, authorizes the park three seasonal Forestry Technician positions for 7 pay periods each. The seasonal positions are usually filled from late April until August for 7 pay periods (14 weeks) by 1 Lead Forestry Technician and 2 Forestry Technicians.

The Guadalupe Mountains FMO is designated an Area FMO to serve the Permian Basin Group, which consists of White Sands NM, Chamizal NM, Gila Cliff Dwellings NM, Carlsbad Caverns NP, and Guadalupe Mountains NP. Annual work plans will help identify project needs and park support.

Fire Management Teams and Their Responsibilities

The *Interagency Southwestern Region Mobilization Guide* establishes policy for Southwestern parks fire management programs and states, "All qualified fire personnel shall immediately be made available to respond to a fire emergency should their services be requested by the Regional Fire Coordinator or designated dispatch centers." Guadalupe Mountains National Park personnel are encouraged to participate on incident management teams on three levels: (1) National Interagency Incident Management Teams (Type I), (2) Regional Interagency Incident Management Teams (Type I/II), and (3) Local Extended Attack Incident Management Teams (Type III).

Qualified park staff will normally be engaged as the parks primary Type III team for routine extended attack that does not require the ordering of a Type I or Type II team. This team will normally be comprised of qualified park staff, supplemented by individuals obtained by resource order, as necessary. The park fire call-out roster contains a list of all qualified staff and their qualifications.

Interagency Coordination

Specific authority for Guadalupe Mountains is contained in Section 6 of the Guadalupe Mountains Enlargement Act: "In the administration of the Guadalupe Mountains National Park, as enlarged by this act, the Secretary is authorized and encouraged to enter into cooperative agreements with other Federal, State and local public departments and agencies and with interested Indian tribes providing for the protection and interpretation of the Guadalupe Mountains in its entirety." The Fire Program Analysis system will facilitate cooperation among agencies in initial attack for FY08, with other programs (extended attack, large complex fires, prescribed fires, fire use) to follow in the future. The goal is to improve fire management on federal lands to minimize resource damage and reduce suppression costs.

Appendix D lists cooperative and mutual aid agreements in place that relate to fire management. Mutual Aid agreements for wildfire suppression to provide for the coordination of fire management activities have been established or are being established with all federal agencies adjacent to the park, local counties, private land owners adjacent to the park, and with the State of Texas. The agreements are maintained in office of the Chief of Resource Management and Visitor Protection at Park Headquarters.

Key Interagency Contacts

Table V-2 provides the key interagency contacts from the NPS, BLM and USFS, along with their functions and contact information.

Table V-2. Key Interagency Contacts

Title	Function	Office Location
Deputy Regional Fire Management Officer	Fire Management	Intermountain Support Office – Santa Fe
Regional Fuels Specialist – Fire Management	Fire Management	Intermountain Support Office – Santa Fe
Regional Fire Ecologist	Fire Management	Intermountain Regional Office - Denver
Superintendent	Park Management	Guadalupe Mountains National Park
Park Cluster Fire Management Officer	Fire and Fuels Management	Guadalupe Mountains National Park, TX
District Ranger, Guadalupe Ranger District	District Management	Guadalupe Ranger District - Lincoln National Forest Carlsbad Office
Fire Management Officer - USFS	Fire Management	Guadalupe Ranger District, Lincoln National Forest
Fire Management Officer - BLM	Fire Management	Pecos District - Carlsbad BLM Field Office
Wildlife Biologist	Biologist	Guadalupe Ranger District, Lincoln National Forest Carlsbad Office
Fire Staff Officer	Fire Management	Lincoln National Forest Supv Off., Alamogordo, NM

Chapter VI. Monitoring and Evaluation

Most of the monitoring at the park directly relates to the prescribed fire program. Vegetation monitoring is carried out according to NPS Fire Monitoring Handbook (FMH) protocols; USFWS dictates monitoring for Mexican spotted owl. park staff take daily weather and weekly air quality readings as described below.

FMH Vegetation Plots

Fire effects monitoring began in 1997 in two designated vegetation types. The FMH is the source document providing monitoring procedures that meet NPS needs. Plots have been installed up to two years prior to prescribed burns in Rocky Mountain (Petran) conifer forests and semi-desert grassland communities. Table VI-1 generally describes data collected on the plots; details are contained in the Monitoring Type Description Sheets. Figure VI-1 shows plot locations. Once plots are established and burned, staff read them annually. The analysis of these data yields fuel loads (tons/ac), species lists, species composition (percent each species by number of individual plants), and percent cover of grass and brush. The Fire Ecologist analyzes and interprets data and suggests changes to the prescriptions based on results, as well as determines whether specific objectives have been achieved. This monitoring has clarified relationships between relative humidity and fuel moisture in different vegetation types and helped optimize timing of prescribed burns. Analyses of these fire effects monitoring plots may be found in the Fire Management Office at the park; reports are submitted to the Intermountain Region Fire Ecologist on an annual basis. Appendix H is the Fire Monitoring Plan as required by RM-18 Chapter 11.

Routine Monitoring

Park staff collects daily weather and weekly air quality readings. The fire effects monitor collects live and dead fuel moisture readings on a monthly basis, and imports temperature and precipitation values from two park RAWS stations into a Fire Family Plus database. Precipitation and fuel moisture levels can then be correlated revealing time lags between precipitation events and moisture uptake in different vegetation types. This data is important in determining whether prescribed burns can proceed or wildland fire use is feasible. The fire effects monitor gathers the live moisture content of alligator juniper (*Juniperus deppeana*), one-seeded juniper (*Juniperus monosperma*), red berry juniper (*Juniperus pinchotii*), ponderosa pine (*Pinus ponderosa*), wavy leaf oak (*Quercus undulata*), and Douglas-fir (*Pseudotsuga menziesii*). Litter and duff moisture is collected on a monthly basis from April through October.

Monitoring of weather and fire behavior during prescribed burns is discussed in Chapter IV under Prescribed Fire.

Compliance Monitoring

The status of MSO PACS will be monitored on a 3-5 year basis while the owl is listed. If a planned fire will occur within 600 m of a known PAC, a survey will be conducted to determine if the habitat is occupied. If MSO's are not present or are not reproducing, the prescribed fire may proceed as appropriate.

After prescribed burning occurs in McKittrick Canyon, post-burn vegetative monitoring plots will be established to record presence of Guadalupe fescue (*Festuca ligulata*).

Table VI-1. FMH Monitoring Plot Data Collection. (Vegetation type abbreviations: P = Petran montane conifer, G = Semi-desert grasslands)

Feature	Plot Size	Data Collected	Vegetation Type
overstory	50x20 m	species ID, dbh, live/dead; canopy location, damage	P
pole-sized	25x10 m	species ID, dbh, live/dead, height	P
brush	50x2 m	species ID, seedling/mature/resprout, live/dead	P, G
herbs	50-m point intercept	species ID, height, live/dead	P, G
dead and down	4 50-m line intercept	tons/acre, litter/duff depths, all sizes of woody material: 1, 10, 100, 1000-TLFM classes	P
seedling	5x10 m	species ID, live/dead, height	P
Forest plot photos	8 photo points		P
Brush plot photos	2 photo points		G

Cultural Resources Monitoring

For prescribed burns archeological surveys will be conducted preburn on areas designated for line construction. A reconnaissance survey of the entire burn unit will also be conducted. Archeologists will discuss changes to line location with the Chief of Resource Management and Visitor Protection if cultural resources will be impacted by the current line location. Postburn surveys may be conducted as necessary.

For wildland fires, an archeologist may be requested to advise on line location and other operations that may impact cultural resources.

Air Quality and Smoke Management

Monitoring will be done, as a minimum, at the Level I and Level II monitoring levels for air quality and smoke, as identified in Chapter XIII of the Western Region FMH. A SASEM calculation will be calculated for prescribed fires.

Smoke characteristic monitoring for the purpose of this action plan will be accompanied by recommended thresholds that are not absolute but will serve as guidelines. All prescribed burn plans will contain specific and measurable smoke management objectives. Monitoring will be tailored to document the extent to which objectives are met. The minimum standard smoke monitoring variables will be reflected in burn plan objectives and will consist of:

1. Visibility
2. Particulates
3. Carbon Monoxide (CO)
4. Total smoke production
5. Mixing heights
6. Transport and surface wind speeds and direction
7. Documented complaints from downwind area

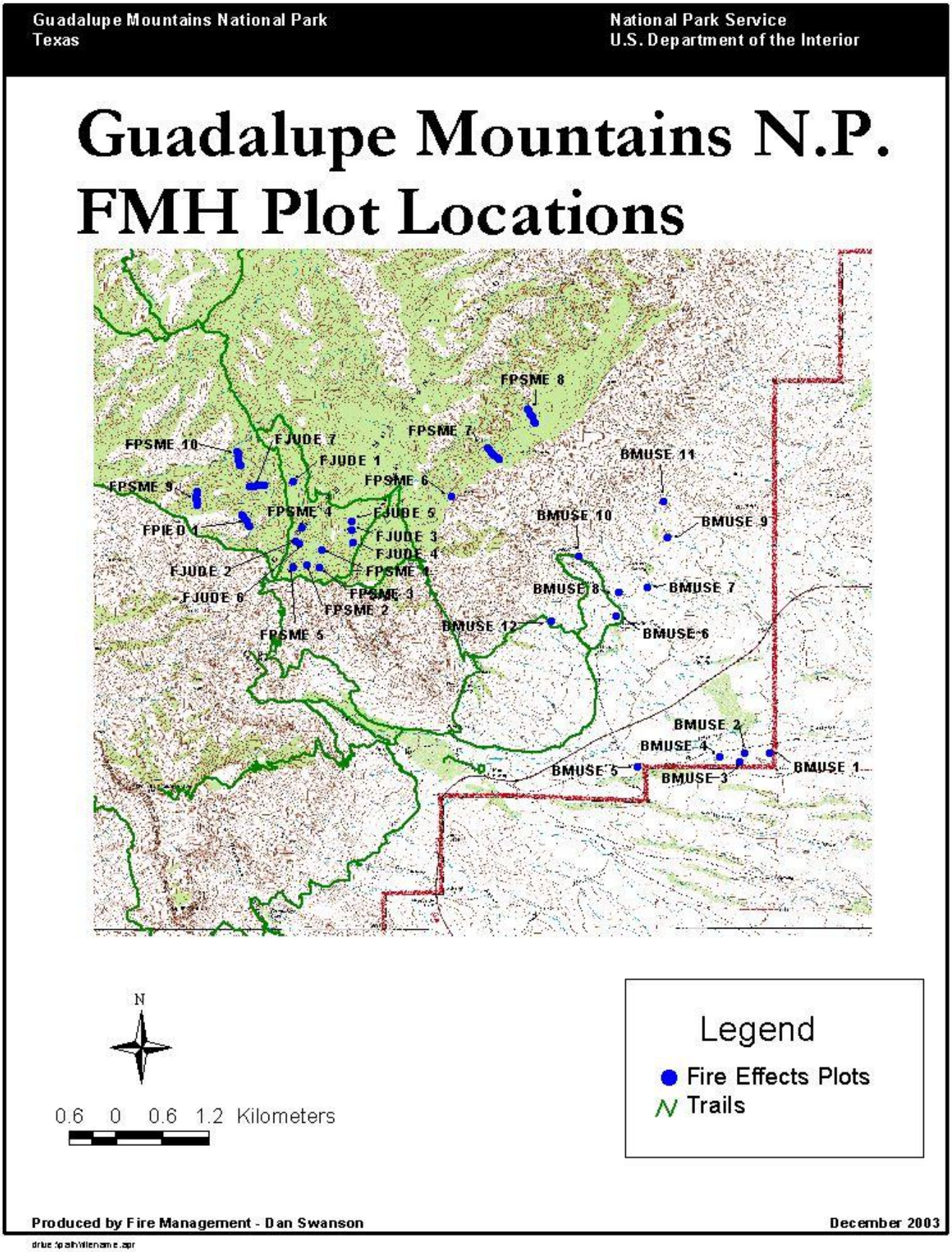


Figure VI-1. FMH Plot Locations

Smoke Monitoring Data Sheet (FMH-3). The smoke monitoring data sheet will be utilized on all management fires at Guadalupe Mountains. The minimum acceptable monitoring frequencies are displayed at the top of each line. Additional monitoring that may be required to meet specific objectives will be detailed in the burn plan. During burns monitors will record and report hourly observations of plume height, direction of smoke travel, and visibility every 15 to 30 minutes.

Guadalupe Mountains National Park is designated as a Class 1 airshed and will comply with all the requirements of the Clean Air Act. Identified smoke sensitive areas include the headquarters area and a portion of highway 62/180 that runs through the park. Adverse smoke events will generally be minimized by conducting small-scale ignitions to reduce particulate amounts during a burn period and ensuring favorable transport winds to disperse smoke away from sensitive areas.

Smoke is generally not a problem at Guadalupe Mountains National Park. Most of the burn units are at higher elevations and away from the identified smoke sensitive areas. The prevailing southwesterly winds allow for rapid smoke dispersal during most seasons of the year.

Chapter VII. Fire Research

Fire History Studies

NPS researcher Gary Ahlstrand (1981) conducted the first fire history studies at Guadalupe Mountains National Park. He collected historical information from the literature and old-timers (back to mid-19th century) then constructed a tree ring chronology (back to A.D.1668) from Douglas fir cores. A ponderosa pine chronology dating to 1515 from Cloudcroft, NM, was used on samples predating 1668. He noted, "The absence of fire in the recent past has permitted thickets of conifers to become established in the understory throughout the high country. It was not known if this represents a natural phase in the life cycle of the forest, or if it resulted from European man's activities in the area during the past century."

Ahlstrand's work addressed the main elements of the "relict mixed conifer forest" including *Pseudotsuga menziesii, Pinus strobiformis,* and *P. ponderosa*. Dry south-facing slopes support *P. ponderosa, Juniperus deppeana,* and *P. edulis.* He defined "fire year" as any year with ≥ one sample scarred by fire. A "major fire" scarred ≥ 20% of the samples, with at least 2 samples ≥ 2 km apart. He sampled 49 *P. strobiformis*. Seventy-one of the years between 1496 and 1980 were fire years. Small fires were more common before the mid-1800s. The mean interval between fires was 4.7 years during 1554–1842; the interval more than doubled 1842–1922. Sixty-three of the 71 fire years occurred before 1850. Fourteen large fires occurred between 1696–1922 (mean interval 17.4 years). Until the 20th century, 30 years was the maximum interval between large fires.

Decrease in fire frequency after mid-1800s is associated with increase in Europeans in area and fewer Apaches (who were likely responsible for some of the pre-European fires). Last large, high intensity fire was in 1922; after that grazing probably reduced the accumulation of cured grasses that helped carry fire. At the time of the study, the mixed conifer forest was overdue for another large, high intensity fire, and the perpetuation of the forest was "…dependent upon finding an effective means to reduce fuel loads while saving cost of the trees in the canopy."

Fire Research at Guadalupe Mountains National Park

The foundation of fire research at Guadalupe Mountains National Park can be attributed to Dr Gary Ahlstrand's work in the late 1970s and early 1980s (Ahlstrand 1979, 1981 abcd). His work focused primarily on the highland mixed confer forest of Guadalupe Mountains National Park and the Desert Mountain shrub communities in nearby Carlsbad Caverns National Park. Because of the highly discontinuous fuels found in the desert lowlands of the park, he viewed fire to be an insignificant factor in shaping the structure and function of the vegetation found there. Walter Kittams, Research Biologist at Carlsbad Caverns National Park also conducted fire research that is relevant to Guadalupe Mountain National Park's Desert Mountain Shrub Communities.

Forested Communities

From fire-scarred trees in the mixed conifer forest Ahlstrand (1979, 1981) determined that fire played a much more important role in the Guadalupe Mountains than in the desert below. He was able to document fires in the Guadalupe Mountains over a 500 year period from 1496 to 1980. The most notable findings from this record was a shift from an average fire free period of 5 years to 10 years in the mid-1800s at the onset Europeans arriving in the region. He found the average fire free period for large scale fires was 17 years. Prior to the Frijoles fire in 1990 the last large, high intensity fire was 1922, coincident with the establishment of the Hunter Ranch and when grazing of the high country

began in earnest. The establishment of the Hunter Ranch operation greatly reduced the availability of fine fuel and curtailed the potential for large scale low intensity surface fires that occurred with some regularity prior to 1922.

While Ahlstrand was able to describe changes in fire regime over time, he was unable to quantitatively describe changes in forest structure and composition. This is currently being addressed by Dr. Alan Taylor and his students of Penn State University who is developing reference conditions for forest and fire management in the Guadalupe Mountains forested highlands. This involves the reconstruction of forest conditions, including stand structure and overstory composition at the time of the last large, high intensity fire in 1922, prior to the suppression era. What has emerged is that the forest at the outset of the 21st century is much different than the one encountered some eighty years earlier. Tree densities and basal areas are much greater and species composition has shifted in general from open to savanna like stands of large southwestern white pine to dense stands of small diameter Douglas fir. Two factors appear to be at play to cause these changes. The first is suppression initially by grazing, a passive form of suppression, and then by active fire suppression both ultimately altering the fire regime. The second appears to be drought induced mortality in large overstory trees during the 1950s. The latter is still being analyzed for its contribution to compositional change. A complete analysis of the shifts in structure and composition of the forested highland with respect to drought and fire suppression will be made available in the fall of 2006.

Desert Mountain Shrublands and Grasslands

Work in this community type was generally short-term (3 yr) post-fire observational studies by Kittams (1972) from fires that occurred in the late 1960s and early 1970s. Finding from this centered primarily on vegetation recovery following wild fires. Recovery of grasses varied by landscape position over the three year period of the study. On steep upland south facing slopes, where shallow soils typically occur grass cover appeared to be thinned by fire. On flatter surfaces where deeper soils are found, grasses recovered within three years following the fire. Most shrubs that where lightly to moderately scorched during low intensity fires generally survived. When severely burned and damaged mortality is induced in agaves (lechuguilla and Parry), smooth sotol, desert ceanothus, and sacahuista. The remaining shrubs either resprout from basal buds or reestablish new plants from fleshy roots such as Datil yucca.

Lechuguilla is a primary component in the shrub-grass fuel matrix of this community and posses a significant hazard to those traversing the landscape of Guadalupe Mountains National Park and the nearby Carlsbad Caverns National Park. Its current dominance is thought to be a consequence of overgrazing. Because of lechuguilla's vulnerability to fire, fire frequency may be playing a important role in determining its dominance on the landscape. Further research will be needed to bare this out. Most of the smaller stature shrub species regain their pre-fire size within 3 to 5 years following a fire, however larger stature shrubs such as pinchotii juniper may take much longer; 15 to 20 years. Because the data that Kittam's examined on fire effects was observational, with no pretreatment data available for comparison, changes in species composition could only be made by comparing burned areas to adjacent unburned areas and assuming that species composition was equivalent prior to the fire. This is problematic due the difficulty of identifying to species or genus burned herbaceous plants as was well as their status as alive or dead prior to being burned. Consequently only very limited conclusions can be drawn from this study as to changes in species composition following a wildfire.

Gebow and Halverson (2001) in a report for Carlsbad Caverns National Park survey all of the research related to fire in the region, including Guadalupe Mountains National Park. This report annotates the

findings of all of research publish or found in reports on file at Carlsbad National Park and it also does so by plant species.

Fire Research Needs at Guadalupe Mountains National Park

Mixed Conifer Forests

One of the primary questions under the current fuels management program center around long-term implications of fuels reduction on current forest structure, While the immediate benefit of fuels reduction is a reduction in the potential for high severity fire, the longer-term implications are not so apparent. While a big reduction in dead and downed fuels by low-intensity prescribed fire is plausible the amount of mortality to be expected in the overstory trees is not well known, particularly in the smaller size classes where most of the mortality is desired. If greater mortality is required from more intense prescribed fire, then subsequent prescribed burns will have limited ability to alter forest structure and alternative treatments may be required to achieve desired forest conditions.

A visible change to the current forest structure may be needed to restore a forest where low intensity surface fire is the primary determinant of forest structure. To achieve the goal several strategies will need to be investigated including but not limited to the following:

Fuels/Restoration Treatments

- Low intensity prescribed fire. While it is believed that the dead and downed woody fuels can be reduced by prescribed fire, there is uncertainty as to what effect this may have on overstory trees. By monitoring currently scheduled projects long-term effects can be assessed. If mortality on small diameter overstory trees is minimal, removal of the dead and downed woody fuels alone will severely limit the subsequent use of prescribed fire to change forest structure. As previously noted other means may be need if it is desired to alter the current forest structure and restore pre-grazing conditions. During prescribed burning operations these factors need to be evaluated
    - Fire Types: backing, flanking and head fire on mortality across all tree size classes.
    - Evaluate soil moisture conditions on tree mortality under prescribed fire conditions and fire types.
- Mechanical thinning. This would involve the use of chainsaws to remove small diameter trees and leave old growth trees. This treatment may follow or precede initial prescribed fire treatments. Thinning prescription(s) would need to be developed that would effectively reduce the potential for high severity, stand replacing fires. These prescriptions could be developed from Taylor's (in progress) work for prescribed fire reference conditions. This research would need to be done initially at a small scale to determine landscape feasibility. Pile or broadcast burning would be follow-up treatments.
- Herbicide: Because mechanical treatment possesses a potential impact to Guadalupe Mountains National Park's back country wilderness. An alternative would be the use of herbicides to individual trees to thin the over stocked stands. This treatment would not result in the immediate fuel loading flux as with mechanical treatments. However subsequent prescribed or natural fire could incrementally reduce the increased dead and downed fuels over-time. This would initially need to be tried at a small scale to determine feasibility at the landscape level.

Desired conditions must be more fully defined for the mixed conifer forests of Guadalupe Mountains National Park. Fortunately the reference conditions for forest and fire management are current being identified by Taylor and his students at Penn State University which will provide a framework to more

fully develop desired conditions. The results of Taylor's work will be available in August of 2006. In developing desired conditions all of the above proposed treatments would need to be applied at a small scale to assess what is reasonably attainable with respect to desired conditions.

Mountain Desert Grasslands and Shrublands

One of the current management questions with respect to fire is the desired conditions of the desert mountain grassland and shrublands. A large portion of Guadalupe Mountains National Park was grazed until relatively recently. Grazing served as passive fire suppression that altered the natural fire regime and presumably vegetation structure. It is reasonable to assume that prior to livestock grazing many of the fires that burned within the park started beyond the park's boundary. Today, while there may be an adequate amount of fine fuel within the park to sustain large fires, these fire will need to originate within the park boundary. Grazing continues beyond the park boundary, thus minimizing the potential for fire starts on these lands to spread onto the park, in effect extending the fire free period between fires than what would otherwise occur naturally. In order to compensate for this grazing effect, prescribed fire will need to be utilized to maintain the current vegetation within the park. However there are several research questions that arise. First and foremost is that of desired conditions.

- *Desired Condition -Vegetation Structure and Composition:* During the ranching period vegetation change likely occurred, most plausibly being an increase in shrub density and cover, principally Pinchotii juniper and a corresponding reduction in grass cover. While recurrent prescribed fire may effectively serve to maintain current tree and shrub densities by reducing or eliminating seedlings, it will have limited effect on reducing the density of established shrubs and trees. Most of these species are merely top-killed by fire and return to pre-burn stature from basal buds that resprout following fire within 5 to 20 years post-fire, depending on the species and its pre-fire size. If the goal is to shift vegetation structure and composition back to pre-ranching conditions, where fire return intervals where conceivably shorter, shrub density lower and grass cover greater, treatments other than prescribed fire may be required. Chemical or mechanical treatments will be needed to remove trees and shrubs that established during the grazing era followed by recurrent prescribed fire to maintain the restored vegetation.
    - Prior to general landscape applications an assessment of prescribed fire and alternative treatments of mechanical and chemical as to their efficacy and feasibility needs to be made. The later two treatments will need to be conducted at a small-scale, prior to treating large areas. The effects of prescribed fire can be addresses largely through fire effects monitoring of currently planned projects.
- *Fire Return Intervals:* One of the problems of using recurrent prescribed fire to manage vegetation in desert grasslands and shrublands is that of an appropriate return interval, or how frequently should areas be burned. An analysis of fire history and annual precipitation at both Carlsbad Caverns and Big Bend National Parks suggest that the cumulative area burned is related to the amount of precipitation received in preceding years. Generally during dry periods the amount of area burned is small, and as precipitation increases the potential for more area to burn also increases. For both Carlsbad and Big Bend National Park a threshold is reached where in any given year there is a high probability of having large areas burn and a low probability of only a small area burning. The inverse is true of dry or drought years. As implementation of the prescribed burning proceeds there must be an analysis of timing of burns and their effect on vegetation in the context of varying precipitation patterns.

Table VII-1. Studies conducted at Guadalupe Mountains National Park. Reviews studies conducted in the park during the last 20 years that might be helpful to fire planning and operations, especially for resolving resource management issues related to fire.

Researcher	Affiliation	Date	Topic	Findings
Timothy Green	Texas A & M	1987-1993	Aquatic invertebrates in McKittrick	88-100 "taxonomic groups" (family or genus) present in large quantities.
Richard Henson	Appalachian State University	1989-1994	Scorpions in different life zones at GUMO	*Centruroides vittatus* is most common and widespread; 4 other major spp
Edward Knudson	private citizen	1989-1992	Lepidoptera of GUMO	Compiling checklist for park. In 1991 added 185 new species to list to total 1170. Describing about 15 species new to science. As of 2000, count was at 1300.
Michael Powell	Sul Ross	1988-1992	Vascular plant collection to determine T & E species	Described Guadalupe violet.
Kenneth Steward	University of North Texas	1991-1993	Caddisflies of TX and GUMO	Evaluating caddisfly biodiversity in GUMO; new species discovered.
Michael Burt	Horned Lizard Conservation Society	1992	Status survey of *Phrynosoma cornutum* in TX	Using mark recapture to survey threatened horned lizard populations. Found 1 individual at the Manzanita Springs trailhead at Frijole Ranch.
Philip and Susan McClinton	Sul Ross	1991-1992	Analysis of black bear ecology at GUMO by scat	Estimated 10,000-15,000 acres of suitable bear habitat; at least 1 bear in high country near Tejas campground.
Renee Rondeau and Rebecca VanDevender	Southwestern Field Biologists, Tucson	1992	Sneeds' pincushion cactus survey of the Guads	Document range, habitat type, estimated acreage, population sizes, and number of species.
Brent Wauer	NPS	1992	Expand park botanical database	Found 2 new orchids: *Corallorhiza wisteriana* and *Spiranthes parasitica*
Jon Gelhaus	Academy of Natural Sciences, Philadelphia	1993	Preliminary inventory of crane fly biodiversity at GUMO	Inventory focuses on aquatic species within larger context of study over the North American deserts. No crane flies recorded before this study, and preliminary results show at least 13 genera and many more species. Next year's results show 33 species, with 8 thought to be undescribed.
Charles Galt	Las Cruces, NM	1996	*Hexalectris* spp. in the Guads	Found *H. spicata* in July 1996 in Shumard Canyon. Recommends surveying n-facing slopes near springs or seeps in *Quercus* groves, when summer rainfall is abundant.

Researcher	Affiliation	Date	Topic	Findings
Ronald Coleman	Tucson, AZ	1997	Identify park orchids	Found one specimen of *Hexalectris nitida* in McKittrick Canyon. Earlier records indicate it may be widely scattered in this area. Surveyed suitable habitat after a March 1997 prescribed fire and didn't find *H. nitida*. *H. spicata* was found in the burned area, and it is reasonable to assume *H. nitida* also survived.
Kelly Gallagher and Brook Milligan	NMSU	1997-1999	Genetics of small *Aquilegia* populations	Looking at inbreeding in small McK populations. Have set up 15 plots and marked roughly 300 plants.
Juanita Ladyman	NM Natural Heritage Program	1997-1999	Study of *Lepidospartum burgessii*	Looked for plant on PX Flat where previously documented; not found. Looked in expansion areas and found 446 plants in 11 colonies. Park staff have found more.
Paul Miliotis	San Antonio	1997	Butterflies of GUMO	Initial survey identified 44 species; 4 more tentative species.
Stephen Moulton et al.	USGS, Arvada CO	1995-1998	Caddisflies of Texas	Document species at GUMO as part of study of diversity and distribution across Texas.
James Zech	Sul Ross	1997-1998	Population genetics of madrone	Looking at variation within and among populations.
Marc Baker and Robert Johnson	SW Botanical Research (now at ASU?)	1998-1999	Morphometric analysis of *Escobaria sneedii* var. *sneedii*, *E. s.* var. *leei*, *E. guadalupensis*.	Using 4 characteristics (# immature stems, mature stem diameter, # radial spines, length inner central spines), concluded that *E. s. s.* is restricted to Franklin Mtns of TX and NM; *E. s. l.* to the vicinity of Carlsbad Caverns NP; *E. g.* to the Guads in TX.
Jacqueline Bergdahl	UTEP	1995-1998	GUMO visitor survey	Mail back questionnaire was offered to visitors during different seasons. Spring, summer, and fall visitors have distinct profiles. (Was to be published as a journal article.)
Terry Griswold	ARS Bee Lab, Utah State	1990-2002	Bee fauna of GUMO	General survey to provide baseline species list, spatial/temporal diversity patterns, pollinator floral preferences, habitat restrictions, patterns of endemism.
David Stahle	U Arkansas Geosciences	1998	Tree-ring dating of Douglas-fir, Guad Peak	Cored 20 trees, preliminary data look like there are 400-500-year-old trees. Core samples archived at U Ark Tree-Ring lab under accession number 95-68. Located 300-400-year-old chinkapin oaks during 2001.

Researcher	Affiliation	Date	Topic	Findings
Eric Bergersen	CSU Coop unit	2000-2001	Ecology of fishes in McKittrick Creek	Provide comprehensive characterization of fauna; evaluate potential for bringing in suspected native Rio Grande cutthroat trout; determine pedigree of wild rainbow trout to see whether hybridization has occurred with RGCT.
Kathy Collins	EEB UA	2000-2003	Edge of range study of *Dipodomys merriami* and *Chaetodipus penicillatus*	Found densities in creosote flats twice as high as in center of range near Tucson.
Rolstan St. Hilaire	NMSU	2001-2002	Differences in seed germination, tissue culture, and development in bigtooth maple	Conducting ecophysiological studies.
Kim Blaxland	Radnor, PA	1990-2002	Viola of North America	Came to locate and photograph *Viola guadalupensis*. Found the only known colony.
James Mueller	Sul Ross	2001-2002	Veg survey and monitoring plot establishment for Salt Basin Dunes park addition	Made a preliminary veg map from landsat imagery; established 25 50-m vegetation transects and read them during summer 2001; 102 vouchers collected and deposited at GUMO and Sul Ross; seed collected and germinated to rear for road scar repair.
Charles Knisley	Randolph Macon College	2001-2002	Ecology and status of NM tiger beetles	Species are tied to limestone soils. Details in copy of report.
Justen Whittall	UCSB	2002-2004	Columbine speciation	Floral measurements suggest *A. chaplinei* from the park is most similar to *A. chaplinei* at Sitting Bull Falls, and slightly different from *A. crysantha* in 2 Arizona populations.

Chapter VIII. Public Safety and Information

Goals and Objectives Relating to Public Safety and Information

The primary objective of any fire management activity is to protect human life and property both within and adjacent to Guadalupe Mountains National Park. The safety of visitors, the general public, employees, and firefighters is a primary management concern and **takes priority over *all* other activities.**

Public and Employee Safety

Wildfires, prescribed fires and wildland fire for resource benefits will be managed so that assigned firefighters and the visiting public are protected. Consistent and accurate monitoring and evaluation of fire danger and fire behavior is the basis for contingency plans, contacts, and briefings that ensure public and personnel safety.

The steep and rugged terrain, limited surface water, limited access routes, frequent high winds causing extreme fire behavior, and confined canyon bottoms combine to create hazardous situations. Many of the more popular visitor use areas are locations with heavy accumulations of fuel and difficult access such as canyon bottoms. The park's most heavily visited area, McKittrick Canyon, has both a canyon-bottom trail and heavy accumulations of fuel. A fire could trap people in these locations. Early evacuation of the public, employees, and others from the canyon is of the utmost importance under conditions of extreme fire behavior.

Smoke is a potential hazard to visitors, both from prescribed and wildfire situations. The park will carefully monitor smoke from all fire types and inform drivers of possible road hazards.

All fires will be monitored and evaluated for safety as conditions change. If necessary, an area may be closed or evacuated because of hazardous conditions. The Superintendent and Chief of Resource Management and Visitor Protection will be notified immediately of any potential need to close or evacuate an area. The Superintendent authorizes, and the Chief of Resource Management and Visitor Protection enforces closures. Rangers will be responsible for implementing closures and evacuations. All Divisions are expected to inform visitors and employees of potential dangers, closures, and regulations in the course of daily contact. During fire use activities, the Prescribed Burn Boss and/or FMO are responsible for ensuring that closures and informational signs are properly posted.

Backcountry visitor safety during "high" to "extreme" fire danger is also a concern. The Wildland Fire Prevention Plan addresses these concerns and spells out specific steps, including signing and public notification, to alert hikers to potential hazardous situations. All backpackers receiving permits are advised by park staff of fire danger conditions and all staff are expected to contact visitors and alert them to "high to extreme" fire danger situations.

Safety is the responsibility of all personnel assigned to wildland fire incidents or fire management operations. Safety is an attitude which must be promoted at all operational levels. The safety of employees and visitors is the prime concern during all phases of fire management activities. All personnel engaged in fire management activities must be familiar with LCES (Lookouts, Communications, Escape Routes and Safety Zones), the 10 Standard Fire Orders, and the 18 Watch out Situations (Appendix J) and the safety procedures and practices for the job they are performing. All

red-carded fire personnel should be issued the National Wildfire Coordinating Group *Fireline Handbook* (NWCG 410-1).

Guidance and direction for safety operations can be found in various documents, but specifically related to park operations and wildland fire are: (1) National Wildfire Coordinating Group (NWCG 410-1) *Fireline Handbook*, (2) NPS-50 Loss Control Management Guideline, and (3) Forest Service Handbook 6079.11 *Health and Safety Code*, (4) Interagency Response Pocket Guide (IRPG).

Public Information and Education

Information dissemination is an important function of the Fire Management Program. Accurate information must be available to keep the public safe during fire operations, reduce the public's fear of wildland fire, and gain acceptance of a fire management program that promotes use of fire. Information activities are increased during periods of high to extreme fire behavior, as addressed in the "Step-Up Plan" found in Chapter IV (Table IV-1).

All fire related activity should be reported on Inside NPS on the following website: http://data2.itc.nps.gov/fire/admin/index/cfm. This report should cover mechanical treatments, prescribed burns, WFU, as well as wildland fire, and be updated until the event ends. At the end of the event, an entry will be made to close out that activity.

Target Groups

Three target groups with specific information needs have been identified:

- Park staff directly or indirectly involved in the implementation of the Fire Management Program
- Related agencies and park neighbors, especially those sharing mutual boundaries with the park
- Visitors and the general public

Staff

All park personnel, in all divisions, need to be able to effectively disseminate fire information to the general public. The entire park staff should be familiar with the FMP, fire operations, and the role of natural fire and prescribed fire in accomplishing resource management objectives, and each employee's role in fire management. An education program that includes training, general employee meetings and active participation by park staff in the fire program will provide staff the tools needed to communicate with the public about fire.

General Information

The FMO will be responsible for informing park staff of the fire situation in the park. When active fires are burning in the park, the FMO will insure that a daily fire situation report is made available to all park staff. If the situation requires such, the FMO or Public Information Officer (PIO) will prepare special flyers to disseminate to park staff.

Information on fire danger, closures, and fire activities will be disseminated to visitors through informal contact, bulletin board notices, signs, and information desk personnel. Backcountry visitors will be advised of fire danger, any restrictions, and on-going fires when they obtain their permits. Backcountry Patrol Rangers will keep backcountry users informed of fire danger, locations, and progress. Fire danger is broadcast daily to all park staff.

The Chief of Interpretation and Visitor Services with assistance from the fire management staff will prepare any handouts or other information to be disseminated to the public.

Press Releases
The Chief of Interpretation and Visitor Services serves as the PIO. The PIO will issue general press and public information releases from information provided by the Superintendent, Chief of Resource Management and Visitor Protection, FMO, and Incident Commander. The PIO will coordinate with the Fire Management Office to issue routine press releases on fire management issues and fire danger and as well as special press releases for fire activities.

Incident Management
During active fires, communications with other agencies and dissemination of information is the responsibility of the PIO working through the Incident Commander. Any special considerations for the management of this information will be provided to the Incident Commander when the delegation of authority is granted.

Interpretive Programs
Concepts of wildland fire for resource benefits, prescribed fire, and appropriate management response will be incorporated into the park's interpretive programs. Informational handouts detailing fire management programs will be prepared and updated by the Division of Interpretation and Visitor Services and the Fire Management Office. During periods when active management fires are burning, handouts will be distributed to visitors entering the park and areas of fire activity. The Division of Visitor Services and Interpretation will inform visitors, particularly in high-use areas, of active management fire locations and provide visitors with general information regarding fires, their size, management goals and objectives, and the role of fire in the park.

The park will actively communicate:

- The specific fire management goals and objectives of the NPS and Guadalupe Mountains National Park
- Information on the role of natural fire in the Guadalupe Mountains and the surrounding area
- Information on fire locations, behavior, and growth
- Information on the effects of fire
- Fire management actions taken on fires
- Fire impacts, on and off the park, on public and private facilities and services
- Restrictions and closures within the park
- Commitment of park personnel and equipment to fire management assignments within or outside the park and the effects upon visitor services of those support actions

Chapter IX. Protection of Sensitive Resources

Natural and cultural resources that may be particularly sensitive to fire program activities are either known to be directly affected by fire, or they are rare, have close ties with the identity of the park, or are controversial in nature such that the fire program must address potential impacts on them. Documents prepared along with this FMP that deal with these issues include (1) the Environmental Assessment; (2) a Biological Assessment prepared for USFWS that primarily addresses Mexican spotted owl and acknowledges possible association of yellow-billed cuckoo, black-tailed prairie dog, southwestern willow flycatcher, Guadalupe fescue, northern aplomado falcon, and black-footed ferret with areas affected by the fire program; and (3) a cultural resources analysis for NHPA/sec 106 compliance.

Resources discussed in this chapter also cover Forest Service concerns for the zone of cooperation. Western Archeological Conservation Center archeologists assisted with the cultural resources analysis and compliance procedures. The park informed affiliated tribes that it was developing this plan: Mescalero Apache Tribe, Ysleta Del Sur Pueblo (Texas), Hopi Tribe, Pueblo of Isleta (New Mexico), Jicarilla Apache Nation, Pueblo of Zia, Pawnee Nation, Commanche Nation, Kiowa Indian Tribe, San Carlos Apache Tribe, White Mountain Apache Tribe, Zuni Tribe, Apache Tribe of Oklahoma, and the Fort Sill Apache Tribe. Also consulted were relevant state and federal agencies, local governments, local businesses, non-government organizations, and private residents living adjacent to or near the park.

Cultural Resources

Chapter III summarizes cultural history relevant to the park and lists sensitive resources by fire management unit. Tables IX-1 through IX-4 itemize cultural resources at risk from fire activities and measures to minimize disturbance. The tables are organized by historic context—groups of resources characterized by specific time periods and people. These tables consider historical, archeological, architectural, engineering, and cultural values to define resources sensitive to fire program activities. The "matrix" also specifies the particular aspects at risk, reviews what fire program activities create the risk, defines protection objectives for these resources, and suggests methods to minimize or mitigate impacts in order to achieve the objectives. The matrix is a working summary of resources and how the fire program should relate to cultural resources. It is a useful guide, both for fire and cultural resources planning and operations in the park.

Definitions of Terms

Historic contexts are the historic and prehistoric themes under which various resources were created and used. Individual resources are best understood and evaluated by understanding the roles they played within specific historical frameworks. In the matrix, for example, ranching-mining-petroleum exploration context covers resources dating from the 1890s to 1970.

Resource types represent general function or morphology. The exact function may not be known, especially for prehistoric resources. In the matrix, historic districts are a specific resource type that are the setting for a number of different elements.

Elements are the specific physical characteristics of resource types. Identifying the elements allows us to define specific *elements or values at risk* from various fire management activities.

Risk conditions or activities are the specific environmental conditions and/or fire management activities that place particular resources at risk.

Fire management objectives guide actions in a way that protects the elements or values at risk. The matrix recommends reducing fuels and suppressing fires near historic structures.

Treatments or prescriptions are methods of attaining the objectives. In the matrix, pretreatment and line construction are necessary. Following are examples of other treatments or prescriptions:

- Reduce fuels in and around sites and artifacts using mechanical fuel reduction and/or prescribed fire, as appropriate.
- Manage the movement of fire into an identified sensitive cultural resource area only while taking safety and natural resource protection into consideration.
- Under certain circumstances, wildland fires and prescribed burns will be prevented from entering sensitive cultural resource areas.
- At fire-vulnerable sites such as corrals, other wooden structures or features, and hearths on archeological sites some form of documentation, sampling, or erecting protective barriers, etc. can mitigate adverse effects prior to fires.

List of Classified Structures

Guadalupe Mountains National Park has 34 entries on the List of Classified Structures (LCS, Table IX-5). These structures include buildings, partial ruins, stone walls, water impoundments, water tanks, windmills, well equipment and a historic trail.

Desired Conditions for Historic Properties

Desired Conditions for historic properties at Guadalupe Mountains National Park have been identified in previous plans or reports. Moreover, the List of Classified Structures (1998) specifies the condition of historic structures in the park. Fire program activities are intended to maintain present condition and minimize impacts to cultural resources. Given sufficient funding, the park plans to bring all structures and archeological resources into a standing of good condition. In some cases fire may be beneficial to historic landscapes and archeological site preservation. An example is the use of low-intensity fire to remove encroaching shrubs in order to restore grasslands or prevent woody vegetation encroachment around historic structures.

Table IX-1. Historic Context: Pre-ceramic period (paleo/archaic through AD 1000)

Resource Type	Elements	Elements or Values at Risk	Risk Conditions or Activities	Fire Management Objectives	Treatments or Prescriptions
camps and villages	hearths	feature integrity; radiocarbon date contamination	ground disturbance; carbon loading from fire; erosion	avoid disturbance; reduce fuels	pretreatment; line construction; use water where possible to suppress; photo documentation
	lithic scatter	radiocarbon date contamination; spatial arrangement	ground disturbance; loss of concealment; increased erosion	avoid disturbance; reduce fuels	pretreatment; use water where possible to suppress
	rock shelters	physical integrity	ground disturbance; rock flaking from heat; loss of concealment	avoid disturbance; reduce fuels; suppression	pretreatment; line construction
	rock art	radiocarbon date contamination; feature integrity; interpretive value	ground disturbance; loss of concealment; UV exposure; increased erosion; flaking from heat; retardant drop	avoid disturbance; suppression	line construction; pretreatment
	bedrock mortars	feature integrity	ground disturbance; up-gradient erosion (burial would also protect)	avoid disturbance	any suppression activities

Table IX-2. Historic Context: Ceramic period to European/American contact (AD 1000 to 1850)

Resource Type	Elements	Elements or Values at Risk	Risk Conditions or Activities	Fire Management Objectives	Treatments or Prescriptions
camps and villages	hearths	feature integrity; radiocarbon date contamination	ground disturbance; carbon loading from fire; erosion	avoid disturbance; reduce fuels	pretreatment; line construction; use water where possible to suppress; photo documentation
	ceramics	feature integrity; security	ground disturbance; loss of concealment; increased erosion	avoid disturbance; reduce fuels	pretreatment; use water where possible to suppress
	rock ring middens (agave roasting pits)	feature integrity and arrangement, radiocarbon date contamination	ground disturbance	avoid disturbance; reduce heavy fuels	pretreatment; use water where possible to suppress
	rock shelters	feature integrity	ground disturbance; rock flaking from heat; loss of concealment	avoid disturbance; reduce fuels; suppression	pretreatment; line construction
	rock art	pigments; security	ground disturbance; loss of concealment; UV exposure; flaking from heat; retardant drop	suppression	black line pretreatment
cultural landscapes	sacred sites	interpretive value; aesthetics	ground disturbance; loss of key features in fire; increased erosion	suppression; avoid disturbance	pretreatment; line construction
	landscape arrangements	feature integrity and arrangement (fire also maintains historic scene)	ground disturbance; loss of key features in fire; erosion	avoid disturbance; reduce fuels	pretreatment; revegetation
	bark peels	feature integrity	loss of individual trees by stand-replacing fire	reduce fuels; suppression	pretreatment; line construction
	agaves	individual plants, a local traditional food	plant mortality; loss or damage	reduce fuels	pretreatment; timing of prescribed burn

Table IX-3. Historic Context: Early Anglo-Military-Butterfield Stage (1850 to 1900.) (Note—most potentially flammable features are long gone)

Resource Type	Elements	Elements or Values at Risk	Risk Conditions or Activities	Fire Management Objectives	Treatments or Prescriptions
settlements; camps	houses	wooden features	loss or damage	divert fire from sites; suppression; minimize disturbance; maintain low intensity fuels	pretreatment; all suppression activities; photo documentation
	dugouts	wooden structural members	loss or damage; increased erosion	suppression; minimize disturbance	pretreatment; all suppression activities; photo documentation
	stone ruins	physical integrity	ground disturbance; increased erosion	avoid disturbance; reduce woody vegetation and root encroachment	any suppression activities
	military encampments	feature integrity and arrangement (fire also maintains historic scene)	ground disturbance; loss of landscape features; erosion	avoid disturbance	pretreatment; revegetation
roads	stage route/ emigrant trail	feature integrity	ground disturbance; erosion	minimize disturbance; maintain and stimulate grass cover	pretreatment; revegetation
historic sites	U.S. military-Indian engagement sites	feature integrity and arrangement (fire also maintains historic scene)	ground disturbance; loss of landscape features; erosion; fire could also help maintain cultural scene	minimize disturbance	pretreatment; revegetation
	signature trees	individual plants	plant mortality; loss or damage	suppression; avoid disturbance	pretreatment; any suppression activities

Table IX-4. Historic Context: Ranching-Mining-Petroleum Exploration (1890s to 1970)

Resource Type	Elements	Elements or Values at Risk	Risk Conditions or Activities	Fire Management Objectives	Treatments or Prescriptions
ranch sites	metal tanks	not at risk			
	stone tanks	physical integrity	ground disturbance; erosion	divert fire from sites; minimize disturbance; reduce woody fuels	pretreatment; line construction; use water where possible to suppress; photo documentation
	earthen tanks	physical integrity	ground disturbance; erosion	avoid disturbance; reduce woody fuels	pretreatment; line construction
	concrete dams	physical integrity	heat	suppression; reduce woody fuels	any suppression activities
	cabins and houses	wooden features	loss or damage	suppression; reduce woody fuels	any suppression activities
ranching cultural landscapes	Landscape arrangements	feature integrity and arrangement (fire also maintains historic scene)	ground disturbance; loss of landscape features; erosion	minimize disturbance	pretreatment; revegetation
mining/oil exploration sites	well derricks (water/oil)	physical integrity	ground disturbance	minimize disturbance; suppression	pretreatment; line construction
	Pipelines	physical integrity	ground disturbance	minimize disturbance; suppression	pretreatment; line construction

Table IX-5. List of Classified Structures

	Preferred Structure Name	Structure Number	LCS ID	Latest Condition	Latest Year Assessed
1.	Pinery	B-106	000520	Fair	1997
2.	Frijole Ranch House	B-200	005700	Good	1997
3.	Frijole Ranch Barn and Corral	B-205	005706	Good	1997
4.	Williams Ranch House	B-281	005707	Fair	1997
5.	Pratt Lodge	B-342	012077	Fair	1997
6.	Pratt Lodge Garage & Servant's Quarters	B-241	012078	Fair	1997
7.	Pratt Lodge Pumphouse	B-242	012079	Fair	1997
8.	Pratt Residence	B-341	012080	Fair	1997
9.	Pratt Residence Servant's Quarters	B-343	012081	Fair	1997
10.	Frijole Ranch Bunk House	B-207	012083	Good	1997
11.	Frijole Ranch Toilet and Shower	B-202	012084	Good	1997
12.	Frijole Ranch Pump House	B-204	012085	Good	1997
13.	Frijole Ranch Spring House	B-203	012086	Fair	1997
14.	Frijole Ranch Schoolhouse	B-201	012087	Fair	1997
15.	Grisham-Hunter Line Cabin	B-243	014400	Fair	1997
16.	Pratt Lodge Stone Fence	F-012	064390	Good	1997
17.	Frijole Ranch Water Tower	C-006	064394	Fair	1997
18.	Grisham-Hunter Tack Room	B-244	064401	Fair	1997
19.	Cabin in the Bowl	B-283	064402	Good	1997
20.	Cabin at Cox Tank	B-286	064403	Fair	1997
21.	Grisham-Hunter Line Cabin Stone Walls	B-246	064404	Fair	1997
22.	Metal Water Tanks	W-023-36	064405	Fair	1997
23.	Upper Pine Springs Pumping Operation	W-007	064406	Fair	1997
24.	Stone Water Tanks	W-023	064407	Good	1997
25.	Tack Building and Corral	B-142	064408	Fair	1997
26.	Stone Dam	D-001	064409	Good	1997
27.	Windmills with Metal Water Tanks	W-050-54	064410	Fair	1997
28.	Stone Dam	D-002	064411	Fair	1998
29.	Stone Dam	D-003	064412	Good	1998
30.	Stone Dam	D-004	064413	Good	1998
31.	Frijole Ranch Stone Fence	F-013	064414	Good	1997
32.	Butterfield Trail Segment	T-015	064415	Fair	1998
33.	Williams Ranch Corral	C-003	064416	Poor	1997
34.	Oil Well	W-201	064417	Fair	1997

Sensitive Plants

Table IX-6 lists the plants of concern to NPS, State of Texas, USFWS, and Lincoln National Forest relative to fire program activities. The park will manage for low-intensity fire in the vicinity of known populations of special status plants. For prescribed burns:

The park will:

- check for known populations
- conduct fuels assessments around known populations
- mechanically reduce fuels, if needed
- survey populations at 1, 2, 5, and 10 years post-burn

Sensitive plants, by vegetation type, are listed below:

- Rocky Mountain Coniferous Forest: biennial woolywhite, fiveflower rock daisy, Guadalupe pincushion cactus, Guadalupe rabbitbrush, Guadalupe valerian, Guadalupe violet, mat leastdaisy, McKittrick pennyroyal, and possibly McKittrick's snowberry
- Great Basin Conifer Woodland: Guadalupe mescal bean
- Madrean Evergreen Woodland: Chisos coralroot, Glass Mountain coralroot, Guadalupe milkwort, Guadalupe rabbitbrush, Guadalupe valerian, mat leastdaisy, and sparseflower jewelflower
- Interior Chaparral: Culberson County skullcap and possibly strong bladderpod
- Chihuahuan Semi-desert Grassland: Chisos agave, gypsum wild-buckwheat, paper spine, Payson's hiddenflower, and Trans Pecos beargrass
- Chihuahuan Desertscrub: Burgess' broomsage, gypsum milkvetch, Payson's hiddenflower, and Warnock's ragwort
- Interior Deciduous Forest and Woodland: cardinal penstemon, Chaplin's golden columbine, Guadalupe Mountains aster, and possibly Guadalupe fescue

Table IX-6. Sensitive Plants Associated with Guadalupe Mountains National Park or the Lincoln National Forest Zone of Cooperation

Common Name	**Scientific Name**	**Status**[a]	**Habitat**
Species occurring on rocky ledges or in other areas relatively protected from fire:			
Chaplin's golden columbine	*Aquilegia chrysantha* var. *chaplinei*	USFS, S1, SOC-NM	Wet, limestone crevices and gravel alluvium—areas where moisture causes fire to lay down
Gypsum milkvetch	*Astragalus gypsodes*	S2, SOC-NM	Gypseous soils in Chihuahuan desert scrub—sites where fire doesn't carry because of widely spaced vegetation
Payson's hiddenflower	*Cryptantha paysonii*	(regional endemic)	Rocky limestone slopes
Guadalupe rabbitbrush	*Ericameria nauseosa* var. *texensis**	SOC-F, USFS, S1	In crevices on faces of limestone cliffs and huge boulders; seen after 1990 Frijole and 1993 Pine fires around Smith Spring
Guadalupe pincushion cactus	*Escobaria guadalupensis*	SOC-F, USFS, S1	Limestone crevices and rocky soils in open woodland; park staff have seen similarly sized hedgehog cacti survive fires
McKittrick pennyroyal	*Hedeoma apiculatum*	SOC-F, USFS, S2 (DL), SOC-NM	Limestone cliff crevices, bottoms and slopes of several drainages; no changes to study plot population size observed after 1990 Frijole Fire.
Burgess' broomsage	*Lepidospartum burgessii*	SOC-F, S1, E-NM	Stabilized gypsum dunes—sites where fire doesn't carry because of widely spaced vegetation
Cardinal penstemon	*Penstemon cardinalis* ssp. *regalis*	USFS, S2, SOC-NM	Limestone ledges and gravel alluvium; plant observed in burned over gravel areas after 1993 Pine Fire

Common Name	Scientific Name	Status[a]	Habitat
Fiveflower rockdaisy	*Perityle quinqueflora*	SOC-NM	Limestone cliffs and canyon bottoms—sites where fire doesn't carry because of widely spaced vegetation
Guadalupe milkwort	*Polygala rimulicola* var. *rimulicola*	SOC-NM	Limestone cliffs and canyon bottoms
Warnock's ragwort	*Senecio warnockii*		Known from one location in the park; restricted to gypsum
Sparseflower jewelflower	*Streptanthus sparsiflorus*	SOC-F, S2, SOC-NM	Gravel alluvium and limestone ledges in canyon bottoms; regeneration observed after the 1993 Pine Fire in Pine Springs and Smith canyon draws
Guadalupe valerian	*Valeriana texana*		More mesic crevices in limestone cliffs and ledges above 6000 ft—sites where fire doesn't carry because of widely spaced vegetation
Mat leastdaisy	*Chaetopappa hersheyi*	SOC-F	Limestone cliff crevices where fire wouldn't carry on the surface, but where intense fire in overstory could shower down embers
Guadalupe Mountains aster	**Symphyotrichum laeve* var. *geyeri*	S1	Limestone soils along streams and wooded canyons above 5000 ft. Limited distribution.
Species whose entire known population might be affected by a high-intensity fire:			
Guadalupe mescal bean	*Sophora gypsophila* var. *guadalupensis*	USFS, S1, SOC-NM	Mostly restricted to a gypsum outcrop in a single drainage near the north edge of the park, west of Dog Canyon; population survived the 1994 Marcus Fire
Guadalupe violet	*Viola guadalupensis*	SOC-F, S1	Limestone crevice on east side of mountains; plants would be threatened directly by fire or indirectly by habitat change if two Douglas firs immediately adjacent burned
Likely fire-adapted species occurring in fire-prone habitats:			
Glass Mountain coralroot	*Hexalectris nitida*	SOC-F, USFS, E-NM	Oak humus in well-drained, gravelly areas.
Chisos coralroot	*Hexalectris revoluta*	S1	Humus in oak groves along rocky creekbeds in mountain canyons
Biennial woolywhite	*Hymenopappus biennis*	S2	Rocky soils in grasslands and open woodlands above 6000 ft; thrived after 1990 Frijole fire and not seen as dense since 2-3 years post-fire.
Strong bladderpod	*Lesquerella valida*	S1	Open slopes; hasn't been seen in recent years

Common Name	Scientific Name	Status[a]	Habitat
Trans Pecos beargrass	*Nolina arenicola*	SOC-F, S2	Sand dune areas and shrublands on steep limestone slopes; observed to resprout after moderate-intensity fire
Culberson County skullcap	*Scutellaria laevis*	SOC-F, S1	Mountain slopes and along arroyos, 3900 ft to 6000 ft
Rare species once found in the park but no longer known from the park:			
Guadalupe fescue	*Festuca ligulata*	C-F, S1	Pine-oak-juniper woodlands
McKittrick's snowberry	*Symphoricarpos guadalupensis*	SOC-F, SH	Understory component in Ponderosa pine-Douglas fir forests; collected once then never seen again
Rare species known from the region but not found at the park to date:			
Chisos agave	*Agave glomeruliflora*	SOC –F, S1, USFS	Chihuahuan desert grassland slopes in west Texas; hybrid origin—reported by Gentry (1982) in the Guadalupe Mountains; could be affected by high-intensity fire
Gypsum wild-buckwheat	*Eriogonum gypsophilum*	T-F	Known only from three locations in Eddy Co., New Mexico; restricted to soils that are almost pure gypsum
Paper spine	*Sclerocactus papyracanthus*	F-SOC, S1	Gypsum flats
Guadalupe Mountains aster	**Symphyotrichum laeve* var. *geyeri*	S1	Limestone soils along streams and wooded canyons above 5000 ft. Limited distribution.

*name *(Aster laevis* var. *guadalupensis)* updated according to National Plant Data Center (plants.usda.gov 2003)

Status:

T-F=Federal Threatened
SOC-F= Federal Species of Concern
E-NM= New Mexico Endangered
C-F=Candidate for listing as Federal Threatened or Endangered
USFS=U.S. Forest Service, Region 3 sensitive
T-NM= New Mexico Threatened

Rank (Texas):

S1=less than 6 occurrences known in Texas; critically imperiled in Texas; especially vulnerable to extirpation
S2=6-20 known occurrences in Texas; imperiled in the state because of rarity; very vulnerable to extirpation
SH= historical in Texas; not verified within the past 50 years but suspected to be extant

Sources:

- Agency Status of NM Rare Plants. New Mexico Rare Plant Technical Council. Nmrareplants.unm.edu/nmrptc/agency.htm (no date found).
- A List of the Rare Plants of Texas, January 2002 edition. Texas Parks and Wildlife Department.
- Federal Endangered, Proposed, and Candidate Species and Species of Concern in New Mexico. May 2003 revision.
- Federally Listed as Threatened and Endangered Species of Texas. June 24, 2003.
- Regional Forester's Sensitive Plant and Animal Species List dated July 21, 1999

Sensitive Animals

Table IX-7 is a list of sensitive animal species developed by NPS, State of Texas, USFWS, and Lincoln National Forest. Mexican spotted owl (MSO) is the species of greatest concern relative to fire at Guadalupe Mountains. The Biological Assessment (BA) and Biological Opinion (BO) contain background and guidelines for fire management. The following conservation measures are specified in the BA:

> The park will identify occupied owl breeding locations, prioritize areas for protection, and locate access points for suppression, wildland fire use, and prescribed burning activities. This information will be communicated in advance (when feasible) to fire management personnel. Guadalupe Mountains National Park is a Class I airshed, and smoke will be managed to prevent air quality degradation according to state and local requirements. Both volume and density of smoke is usually greater for wildfires than for prescribed burns or wildland fire use; smoke dispersal is a factor in the decision for wildland fire use. If aircraft flights over occupied protected activity centers (PACS) during the breeding season (March 1 through August 31) are needed during fire operations, Guadalupe Mountains National Park will maintain a vertical separation of at least 500 feet above ground level (AGL) over ridges and 2,000 feet AGL over canyon bottom MSO habitat. Aircraft overflights will likely only be used during emergency life-threatening situations, when it is tactically necessary, or when human structures are in danger.

Table IX-7. Special Status Wildlife Species Associated with Guadalupe Mountains National Park or the Lincoln National Forest Zone of Cooperation.

Common Name	Species Name	Status[a]	Habitat
Species that require special consideration relative to fire activities:			
Mexican spotted owl	*Strix occidentalis lucida*	T-F, T-T, USFS	Mixed conifer, ponderosa pine, and piñon-juniper; steep slopes and canyons with rocky cliffs between 5300' and 6500'; rare, breeder
Species that may require consideration relative to fire activities:			
Western burrowing owl	*Athene cunicularia hypugea*	SOC-F	Grasslands/shrublands, often use the burrows of prairie dogs and other burrowing animals; rare; occurs in only burnable part of the salt flat area (NW corner); more frequent fire would likely create more habitat
Yellow-billed cuckoo	*Coccyzus americanus*	C-F, USFS	Records from 1991 and 1996 in mouth of McKittrick Canyon
Townsend's big-eared bat	*Corynorhinus townsendii*	SOC-F	Roosts in caves and mine shafts where it may be sensitive to smoke
Black-tailed prairie dog	*Cynomys ludovicianus*	C-F	Historically present but currently absent from NW corner salt flat area; more frequent fire would likely create more habitat

Common Name	Species Name	Status[a]	Habitat
Black-footed ferret	*Mustela nigripes*	E-F, E-T	Associated with black-tailed prairie dog towns
Bell's vireo	*Vireo bellii*	USFS, T-NM	Prefers dense, low, shrubby vegetation in riparian areas
Species using fire-prone habitats:			
Limestone tiger beetle	*Cicindela politula petrophila*	SOC-F	Limestone outcrops and crevices
Ferruginous hawk	*Buteo regalis*	SOC, USFS	Low-lying areas in desertscrub and desert grassland; transient
American peregrine falcon	*Falco peregrinus anatum*	SOC-F, E-TX, USFS	Canyons and rocky terrain, nests in cliffs; rare, breeder; recently removed from endangered species list
Texas horned lizard	*Phrynosoma cornutum*	SOC-F, T-TX	Desertscrub and desert grassland, near populations of harvester ant; common
Mountain short-horned lizard	*Phrynosoma douglasi hernandesi*	T-TX	Forested areas and semiarid plains at higher elevations; common
Guadalupe southern pocket gopher	*Thomomys umbrinus guadalupensis*	SOC-F, T-NM, USFS	Montane and valley areas in shallow rocky soils, often associated with lechuguilla (*Agave lechuguilla*); uncommon
Black Bear	*Ursus americanus*	T-TX	Remote mountainous areas or thickets along watercourses; uncommon
Rare species known from the region but not found at the park to date:			
Northern goshawk	*Accipiter gentilis*	SOC-F, USFS	Inhabits mature forest; occasional spring or fall visitor to the park
Southwestern willow flycatcher	*Empidonax trailii extimus*	E-F, E-TX, E-NM	No valid records; likely prefers more densely vegetated riparian habitat than present at park
Northern aplomado falcon	*Falco femoralis septentriolnalis*	E-F, E-TX, E-NM	If species recovers, might use park's west-side grasslands

Status:

E-F = Federal Endangered
T-F = Federal Threatened
USFS = U.S. Forest Service, Region 3 sensitive
T-NM = New Mexico Threatened
C-F = Candidate for listing as Federal Threatened or Endangered
SOC-F = Federal Species of Concern
E-NM = New Mexico Endangered

Sources:

- Federal Endangered, Proposed, and Candidate Species and Species of Concern in New Mexico. May 2003 revision.
- Federally Listed as Threatened and Endangered Species of Texas. June 24, 2003.
- Texas Parks and Wildlife Department. www.tpwd.state.tx.us
- Threatened and Endangered Species of New Mexico: Biennial Review and Recommendations. New Mexico Department of Game and Fish. 2000.
- USDA Forest Service. Regional Forester's Sensitive Plant and Animal Species List dated July 21, 1999.

All vegetative manipulations in occupied habitat will follow guidelines in the MSO recovery plan. By conducting low-intensity prescribed fires, and managing naturally ignited fires to meet the low heat objectives in the burn plan, (including fitting appropriate fire prescriptions), Guadalupe Mountains National Park will minimize heat effects to known MSO. Resource advisors with knowledge of Mexican spotted owls must be onsite during burning operations and will participate in decisions relating to escaped prescribed fire and suppression actions. Additional minimization measures will be taken if fire enters a PAC, including, but not limited to:

- minimal line building
- restricted overflight of tankers
- restricted retardant drops on the perimeter and within the PAC
- thorough rehabilitation of any suppression actions occurring within and immediately adjacent to the PACs.

Unique Sites

In FMU 2, aspen groves, springs (Upper Pine, Smith, Manzanita, Choza, Guadalupe, and Bone springs), and Research Natural Areas require some protection from fire.

Sensitive Developments

Chapter III lists sensitive developments by FMU. In FMU 1, wildland fire use is not an option, and the park will apply the appropriate management response for wildland fires. Prescribed burning and non-fire treatments will be used to reduce fuels around developments. In FMU 2, where wildland fire is permitted, sensitive developments constitute special suppression zones: Dog Canyon developed area, McKittrick Canyon Visitor Center, Pinetop Cabin, 2 radio repeater stations, and the Bowl RAWS.

Chapter X. Fire Critiques and Annual Review

RM-18 Chapter 13 provides detailed instructions relative to fire critiques and the annual review of the FMP.

Incident Critiques

Table X-1 describes types of critiques. All fires will receive, at minimum, an after action review (AAR) by those involved to evaluate such topics as: the initial response, "hotline" (on-going fire incident) review, control methods used, safety concerns, and the need for new and replacement equipment. The Incident Commander, Prescribed Fire Burn Boss, Fire Management Officer, or official who has designated fire program responsibilities, will conduct the review using the Incident Response Pocket Guide PMS#461 guideline.

The Superintendent may call for reviews of wildland fires, fire-related incidents, and prescribed fires (as deemed appropriate) in order to:

- confirm or correct decisions
- identify improved procedures
- apply lessons learned to the fire management program
- understand anomalous incidents and deal with possible negligence

All situations resulting in human entrapment, fatalities, or serious injuries (or had the potential to do so) require reviews. It is the intent of reviews to resolve operational issues, not impose punitive actions.

Program Reviews

Program-level reviews fine tune the park's management of fire:

- to assure compliance with NPS standards (operations evaluations)
- after an unusual fire season (fire program review)
- for budgetary purposes (annual FIREPRO review)
- to assure continued preparedness (annual and periodic, in-depth preparedness reviews)

The Interagency Redbook, Chapter 18 addresses program reviews and preparedness reviews.
The park shall conduct its preparedness review annually, preferably before the peak fire season, and after fire personnel have received the annual refresher training.

Table X-1. Types of Fire Critiques. (See RM-18 Chapter 13 for more detailed instructions.)

Critique/Review	When Conducted	Who Conducts/Convenes
Hotline review	during on-going fire incident	Incident Commander, Prescribed Fire Burn Boss, Duty Officer, FMO or person with FMO responsibilities.
Incident management team (IMT) closeout and review	after fire incident before release of IMT	Superintendent
Park level review	after fire incident	Superintendent
Regional level review	after controversial fire incident	Regional FMO
National level review	after fatal or nationally significant fire	National FMO
Entrapment and fire shelter deployment review	after entrapments and fire shelter deployments	Regional FMO

Chapter XI. Consultation and Coordination

The preparation of this fire management team and associated compliance documents (Environmental Assessment, biological evaluation, and cultural resources component) involved much interaction among many parties. Members of the inter-disciplinary team, in particular Fred Armstrong, Richard Gatewood, Brooke Gebow, Jim McMahill, Kevin Parrish, Tim Stubbs, Dan Swanson, and Jan Wobbenhorst met frequently between March 2002 and August 2004.

Preparers

Fred Armstrong, *Natural Resource Program Manager, Guadalupe Mountains National Park*—BS in Natural Resources Management from California Polytechnic State University, San Luis Obispo; 23 years with the National Park Service, 11 years at Guadalupe Mountains NP. Contributed detailed information on the parks past fires and effects; helped with compliance for listed species and cultural resources; helped define burn units and project goals.

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Timothy C. Stubbs *(now retired NPS)*—BS in Botany from San Diego State University, 34 years with NPS; FMO for both Carlsbad Caverns and Guadalupe Mountains National Parks 1990 to March 2003. He also worked at Great Smokey Mountains and Sequoia National Park where he began his career as a seasonal employee in 1969. Drafted preliminary sections for the current FMP revision.

Dan Swanson, *Lead Fire Effects Monitor, Guadalupe Mountains and Carlsbad Caverns National Parks*—MS in Forest Resources from University of Idaho; BA in Environmental, Population, and Organismic Biology from University of Colorado; 2 ½ years at Guadalupe Mountains NP, 2 ½ years Assistant Nursery Manager at University of Idaho Research Nursery. Responsible for fire effects, burn unit delineation, and GIS maps.

Janice A. Wobbenhorst, *Chief, Resource Management and Visitor Protection, Guadalupe Mountains National Park*; MPA in Public and Environmental Affairs from Indiana University-NW, 34 years with the National Park Service. Responsible for overall review of fire operations, assisting with compliance, interagency coordination, and impact analysis review.

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Appendices

Appendix A
Fire Effects on Key Species by Vegetation Type for Guadalupe Mountains National Park

Table A-1. Rocky Mountain (Petran) Conifer Forest: Fire Ecology of Species. FEIS is the Fire Effects Information System maintained by the USDA Forest Service that contains literature reviews: http://www.fs.fed.us/database/feis/.

Species	Fire Ecology/Adaptations	Source
Acer grandidentatum	Bigtooth maple live in moist sites that tend to burn infrequently; following crown destruction by fire, some resprout from root crown, but not generally vigorously.	FEIS
Amalanchier utahensis	Utah serviceberry sprouts vigorously from root crowns after fire	Ahlstrand 1981x
Ostrya knowltonii	Little is known about fire and Knowlton hophornbeam, but it probably sprouts in limited fashion post-fire as do congeners; may colonize burned sites via seed.	FEIS
Pinus edulis	Colorado pinyon is generally very susceptible to fire damage depending on stand structure and understory; it is absent from post-fire early successional stages. Seedlings establish primarily via the postburn food caches of birds and rodents; successful establishment requires a nurse plant.	FEIS
Pinus ponderosa var. *scopulorum*	Interior ponderosa pine can survive considerable scorching. Fire adaptations include: open crowns; self-pruning branches; thick, insulative, relatively inflammable bark; thick bud scales; tight needle bunches that open into a loose arrangement that does not favor combustion; high foliar moisture; and a deep rooting habit	FEIS
Populus tremuloides	Much work on quaking aspen comes from the northern Rockies and eastern U.S.; the species is topkilled by fire, but sends up a "profusion" of stems for several years post-fire; new stands can develop within a decade; fire-scarred aspens in Utah showed 7- to 10-year fire frequency pre-1885; lack of young stands in the west may be due to absence of fire.	FEIS
Pseudotsuga menziesii	Mature Rocky Mountain Douglas-fir is generally more fire resistant than spruces and true firs and equally or slightly less fire resistant than ponderosa pine. Mature trees can survive moderately severe ground fires because thick, corky bark insulates the cambium from heat damage. Where fire is frequent young trees don't survive. Low growing branches and flammable foliage make trees susceptible to crowning.	FEIS
Quercus gambelii	Gambel oak generally resprouts vigorously the first season post-fire; repeated fires weaken trees; Gambel oak understory can serve as ladder fuels; trees produce large amounts of litter; in Utah, fires were more frequent in ponderosa pine stands with Gambel oak understory than in oak-dominated stands	FEIS
Q. muehlenbergii	Chinkapin oak often sprouts from stumps or rootcrowns after fire; reestablishment by seed is favored on mineral, post-fire seedbeds; sprouting ability appears to decrease as plants age	FEIS

Table A-2. Great Basin Conifer Woodland: Fire Ecology of Species. FEIS is the Fire Effects Information System maintained by the USDA Forest Service that contains literature reviews: http://www.fs.fed.us/database/feis/.

Species	Fire Ecology/Adaptations	Source
Bouteloua eriopoda	Black grama has the reputation of being fire-sensitive, recovering slowly after fire through vegetative growth; healthy stands recover more readily, given decent moisture; carries fire if cover dense and conditions windy.	FEIS
B. gracilis	Blue grama is topkilled by fire, but fire generally increases occurrence, production, and cover; seed and seedstalk production may also be stimulated by fire; wet years post-fire increase yield.	FEIS
B. hirsuta	Hairy grama cover was positively correlated with fire frequency in Minnesota; most studies conclude it is undamaged by fire following a season or two of depressed production.	FEIS
Dasylirion leiophyllum	Young sotol with green leaves touching the ground are usually only slightly scorched; mature sotol with trunks sheathed in dead leaves makes them especially susceptible to fire; stalks attract lightning; plant tops spread fire by falling off and rolling downhill; plants occasionally resprout if lightly or moderately burned.	FEIS
Juniperus deppeana	Alligator juniper canopies are often high enough so that fires scorch but do not severely damage the crown. Bark also provides protection from fire. It is generally capable of prolific sprouting after aboveground vegetation is consumed by fire, particularly if the resprouting zone is covered by soil.	FEIS
Juniperus scopulorum	Rocky Mountain junipers up to about 20 years old are highly susceptible to fire; older trees have thicker bark and a more open crown that help them survive fire, though severe fires will damage or kill; fire causes less damage in habitats with sparse undergrowth.	FEIS
Nolina microcarpa	Sacahuista resprouts from the woody, underground caudex after fire; cool fires result in little or no mortality; hot fires kill many young plants and some mature plants.	FEIS
Pinus edulis	Colorado pinyon is generally very susceptible to fire damage depending on stand structure and understory; it is absent from post-fire early successional stages. Seedlings establish primarily via the postburn food caches of birds and rodents; successful establishment requires a nurse plant.	FEIS
Quercus grisea	While the literature lacks fire data for Gray oak, oaks generally survive low-intensity, fast fires by resprouting after topkill.	FEIS
Sporobolus cryptandrus	Sand dropseed is usually killed or topkilled by fire; younger plants suffer less than older plants; postfire regeneration via seeds varies by site; water stress inhibits ability to withstand fire; conversely, wet conditions buffer effects of fire; positive responses to fire are associated with reduced competition.	FEIS

Table A-3. Madrean Evergreen Woodland: Fire Ecology of Species. FEIS is the Fire Effects Information System maintained by the USDA Forest Service that contains literature reviews: http://www.fs.fed.us/database/feis/.

Species	Fire Ecology/Adaptations	Source
Arbutus xalapensis [texana]	Observation of fire scars on Texas madrone suggests some survival of fire; moist habitats generally protect from fire; post-fire sprouting is not documented but not ruled out; bird-dispersed seed may establish on burns.	FEIS; GUMO staff observation
Bouteloua curtipendula	Sideoats grama response to fire depends on growth form, climatic conditions, season of burn, and severity of fire; reestablishment occurs through seed and/or rhizomes; recovery time is variable, but 2 to 3 years may be required.	FEIS
B. gracilis	Blue grama is topkilled by fire, but fire generally increases occurrence, production, and cover; seed and seedstalk production may also be stimulated by fire; wet years post-fire increase yield.	FEIS
B. hirsuta	Hairy grama cover was positively correlated with fire frequency in Minnesota; most studies conclude it is undamaged by fire following a season or two of depressed production.	FEIS
Juniperus deppeana	Alligator juniper canopies are often high enough so that fires scorch but do not severely damage the crown. Bark also provides protection from fire. It is generally capable of prolific sprouting after aboveground vegetation is consumed by fire, particularly if the resprouting zone is covered by soil.	FEIS
Mimosa aculeaticarpa var. *biuncifera [M. biuncifera]*	Fire topkills catclaw mimosa; plants are prolific post-fire sprouters; Ahlstrand's (1982) study showed greater frequency on burned versus unburned sites; plants themselves provide little fuel (open form and tiny leaves).	FEIS
Opuntia phaecantha	Response of Englemann prickly-pear to fire is extremely variable, depending presence of fuels and fire intensity.	Cable 1973
Quercus grisea	While the literature lacks fire data for Gray oak, oaks generally survive low-intensity, fast fires by resprouting after topkill.	FEIS
Q. muehlenbergii	Chinkapin oak often sprouts from stumps or rootcrowns after fire; reestablishment by seed is favored on mineral, post-fire seedbeds; sprouting ability appears to decrease as plants age	FEIS
Q. undulata [Q. pungens]	Fire topkills sandpaper oaks; surviving plants are stimulated to sprout; unburied acorns are probably killed by fire.	FEIS

Table A-4. Interior Chaparral: Fire Ecology of Species. FEIS is the Fire Effects Information System maintained by the USDA Forest Service that contains literature reviews: http://www.fs.fed.us/database/feis/.

Species	Fire Ecology/Adaptations	Source
B. gracilis	Blue grama is topkilled by fire, but fire generally increases occurrence, production, and cover; seed and seedstalk production may also be stimulated by fire; wet years post-fire increase yield.	FEIS
Ceanothus greggii	Fire generally kills desert ceanothus; seed remains viable for decades and is stimulated to germinate following fire; seedling abundance has been observed to increase with fire intensity; the plant is associated with stand-replacing fire frequencies of 20-30 years or more.	FEIS
Cercocarpus montanus	Fire generally topkills true mountain mahogany; plants resprout vigorously following fire; some seedlings may establish after fire.	FEIS; Ahlstrand 1981xx
Muhlenbergia porteri	Fire probably topkills bush muhly but the plant can probably resprout; recovery time probably depends on post-fire weather and competition; species is non-rhizomatous.	FEIS (probably)
Quercus grisea	While the literature lacks fire data for Gray oak, oaks generally survive low-intensity, fast fires by resprouting after topkill.	FEIS
Sporobolus cryptandrus	Sand dropseed is usually killed or topkilled by fire; younger plants suffer less than older plants; postfire regeneration via seeds varies by site; water stress inhibits ability to withstand fire; conversely, wet conditions buffer effects of fire; positive responses to fire are associated with reduced competition.	FEIS

Table A-5. Chihuahuan Semidesert Grassland: Fire Ecology of Species. FEIS is the Fire Effects Information System maintained by the USDA Forest Service that contains literature reviews: http://www.fs.fed.us/database/feis/.

Species	Fire Ecology/Adaptations	Source
Agave lechuguilla	Lechuguilla occurs in dense stands that can readily carry hot fire; mortality tends to be high; some plants survive and produce offsets; plants can escape fire by living in rocky microhabitats.	FEIS
Bouteloua eriopoda	Black grama has the reputation of being fire-sensitive, recovering slowly after fire through vegetative growth; healthy stands recover more readily, given decent moisture; carries fire if cover dense and conditions windy.	FEIS
B. gracilis	Blue grama is topkilled by fire, but fire generally increases occurrence, production, and cover; seed and seedstalk production may also be stimulated by fire; wet years post-fire increase yield.	FEIS
B. hirsuta	Hairy grama cover was positively correlated with fire frequency in Minnesota; most studies conclude it is undamaged by fire following a season or two of depressed production.	FEIS
Dasylirion leiophyllum	Young sotol with green leaves touching the ground are usually only slightly scorched; mature sotol with trunks sheathed in dead leaves makes them especially susceptible to fire; stalks attract lightning; plant tops spread fire by falling off and rolling downhill; plants occasionally resprout if lightly or moderately burned.	FEIS
Digitaria californica	Arizona cottontop probably recovers completely from fire during the first growing season if it is a wet summer; a dry summer following fire extends recovery to two years; fire tolerance is due to growing points at or below the ground line.	FEIS
Ephedra spp.	Ephedras sprout post-fire; some seeding of disturbed sites has been observed.	FEIS
Fouqueria splendens	Waxy, resinous ocotillo bark burns readily; plants sprout after some fires; most ocotillo habitat carries fire only with sufficient grassy fuel buildup	FEIS
Juniperus pinchottii	Frequent fire kills young Pinchot juniper seedlings and saplings; where grasses are present, germination is suppressed; lack of fire and grazing have allowed encroachment into former grassland areas; trees sprout after fire; very hot fires under very dry conditions will kill plants.	FEIS
Prosopis glandulosa	Honey mesquite is an invader in some desert grassland communities; grazing reduced fuels and fire frequencies that kept plants in check; even very small plants survive fire by resprouting; frequent fire (7-10 yr intervals) may prevent honey mesquite establishment.	FEIS
Sporobolus airoides	Alkali sacaton is thought to be tolerant but not resistant to fire; recovery following fire has been reported as 2-4 years; fire is associated with this plant when its habitat has dried out or been invaded by mesquite or acacia.	FEIS
Yucca elata	Soaptree yucca can sprout from the stem after fire, even when some of the leaves are burnt; damage to apical meristem can lead to branching or death of above-ground plant and sprouting from rhizomes and root crown; the plant has been observed to increase in numbers in the absence of fire.	FEIS

Table A-6. Chihuahuan Desertscrub: Fire Ecology of Species. FEIS is the Fire Effects Information System maintained by the USDA Forest Service that contains literature reviews: http://www.fs.fed.us/database/feis/.

Species	Fire Ecology/Adaptations	Source
Bouteloua eriopoda	Black grama has the reputation of being fire-sensitive, recovering slowly after fire through vegetative growth; healthy stands recover more readily, given decent moisture; carries fire if cover dense and conditions windy.	FEIS
Flourensia cernua	Tarbush habitat generally does not carry fire; it is thought to colonize [burned areas] through seed from offsite.	FEIS
Fouqueria splendens	Waxy, resinous ocotillo bark burns readily; plants sprout after some fires; most ocotillo habitat carries fire only with sufficient grassy fuel buildup	FEIS
Muhlenbergia porteri	Fire probably topkills bush muhly but the plant can probably resprout; recovery time probably depends on post-fire weather and competition; species is non-rhizomatous.	FEIS (probably)
Opuntia spp.	Prickly-pear and chollas survive fires depending of fuel buildup nearby; more fuel tends to accumulate under chollas; after cool fires, undamaged cholla joints on the ground may resprout.	Cable 1973
Prosopis glandulosa	Honey mesquite is an invader in some desert grassland communities; grazing reduced fuels and fire frequencies that kept plants in check; even very small plants survive fire by resprouting; frequent fire (7-10 yr intervals) may prevent honey mesquite establishment.	FEIS
Sporobolus airoides	Alkali sacaton is thought to be tolerant but not resistant to fire; recovery following fire has been reported as 2-4 years; fire is associated with this plant when its habitat has dried out or been invaded by mesquite or acacia.	FEIS

Table A-7. Interior Deciduous Forest and Woodland (riparian): Fire Ecology of Species. FEIS is the Fire Effects Information System maintained by the USDA Forest Service that contains literature reviews: http://www.fs.fed.us/database/feis/.

Species	Fire Ecology/Adaptations	Source
Acer grandidentatum	Bigtooth maple live in moist sites that tend to burn infrequently; following crown destruction by fire, some resprout from root crown, but not generally vigorously.	FEIS
Arbutus xalapensis [texana]	Observation of fire scars on Texas madrone suggests some survival of fire; moist habitats generally protect from fire; post-fire sprouting is not documented but not ruled out; bird-dispersed seed may establish on burns.	FEIS; GUMO staff observation
Juglans microcarpa	Little walnut exhibits few adaptations for fire; presumably reestablishes through seed from offsite.	FEIS
Juniperus deppeana	Alligator juniper canopies are often high enough so that fires scorch but do not severely damage the crown. Bark also provides protection from fire. It is generally capable of prolific sprouting after aboveground vegetation is consumed by fire, particularly if the resprouting zone is covered by soil.	FEIS
Ostrya knowltonii	Little is known about fire and Knowlton hophornbeam, but it probably sprouts in limited fashion post-fire as do congeners; may colonize burned sites via seed.	FEIS
Pinus ponderosa var. *scopulorum*	Interior ponderosa pine can survive considerable scorching. Fire adaptations include: open crowns; self-pruning branches; thick, insulative, relatively inflammable bark; thick bud scales; tight needle bunches that open into a loose arrangement that does not favor combustion; high foliar moisture; and a deep rooting habit.	FEIS
Populus deltoides var. *wislizenii*	*Populus deltoides* is a weak sprouter and generally killed by fire.	FEIS
Q. muehlenbergii	Chinkapin oak often sprouts from stumps or rootcrowns after fire; reestablishment by seed is favored on mineral, post-fire seedbeds; sprouting ability appears to decrease as plants age.	FEIS
Sapindus saponaria	Specific adaptations to fire have not been identified in western soapberry; plants may reoccupy a site through seed transported from adjacent unburned areas by birds; postfire sprouting from underground rhizomes is possible but has not been documented.	FEIS

Appendix B

Guadalupe Mountains National Park
Fire Prevention Analysis and Action Plan

General Action Items

The following general action items have been identified as elements in the park's overall Fire Prevention Program. Many of the action items are issues that overlap between zones and are therefore presented here together. These items apply to all or most fire prevention zones in the park.

1. Fire prevention messages are delivered by staff at time of issuance of backcountry permits.

Responsibility:	*Target date:*
All staff issuing permits	On-going

2. The Backcountry Handout and the Backcountry Permit will be reviewed and revised if necessary, each year, to ensure that an adequate fire prevention message is included.

Responsibility:	*Target date:*
Chief of Interpretation	March 1, each year

3. Continue the prohibition of all open fires in the entire park, both wood and charcoal, post this notice at all campgrounds, and enforce this restriction.

Responsibility:	*Target date:*
Frijole Area Rangers Dog Canyon Area Ranger Entire park staff, to inform public	On-going

4. All trailhead waysides will be posted with Special Fire Restrictions whenever they are placed in effect in accordance with the park's Step up Plan.

Responsibility:	*Target date:*
Frijole Area Rangers Dog Canyon Area Ranger	Whenever special fire restrictions are implemented.

5. Seasonal training will include fire prevention training and will emphasis the need for fire prevention education and enforcement.

Responsibility:	*Target date:*
Chief Ranger Fire Management Officer (FMO)	June 1, each year

6. Education/enforcement through normal backcountry patrols.

Responsibility:	*Target date:*
Chief Ranger and RM & VP Staff	On-going

7. A fire prevention message will be developed to include in the visitor message on the TIS (Radio) Information System.

Responsibility:	*Target date:*
Chief Interpreter	June 1, annually.

8. The Park Step-Up Plan for Wildland Fire will call for increased fire prevention patrols, special restrictions and the broadcast of public service announcements during periods of High to Extreme Fire Danger in the park.

Responsibility:	*Target date:*
Chief Ranger Fire Management Officer Chief Interpreter (PIO)	Completed and On-going

Fire Prevention Analysis and Fire Prevention Zones

An analysis of the park was accomplished by developing a series of overlays of the park base map, attached as exhibits to this action plan, which defined and assigned relative values to specific Risk Areas, Value Areas and Hazard areas for the park. This was done using the NPS Fire Prevention Analysis Guideline. From this analysis, Guadalupe Mountains NP established seven Fire Prevention Zones and assigned values of High, Moderate or Low to the specific Risk Areas, Value Areas and Hazard areas. A summary of these Fire Prevention Zones and their associated ratings follows. These ratings were then utilized to develop the specific fire prevention actions described in this action plan.

Guadalupe Mountains National Park Fire Prevention Zones

Zone 1 – West Side
Hazard -- Low
Value -- Low
Risk -- Low

Zone 2 – Pine Springs Area
Hazard -- Low
Value -- High
Risk -- High

Zone 3 – Eastern Escarpment
Hazard -- Moderate
Value -- Low
Risk -- Low

Zone 4 – McKittrick Canyon Area
Hazard -- High
Value -- High
Risk -- Moderate

Zone 5 – High Country/Bowl Area
Hazard -- High
Value -- Moderate
Risk -- Moderate

Zone 6 – Dog Canyon
Hazard -- High
Value -- High
Risk -- High

Zone 7 – Ship on the Desert/McKittrick Access Corridor
Hazard -- Low
Value -- High
Risk -- High

Specific Fire Prevention Zone Ratings/Action Items

Fire Prevention Zone 1 – West Side

Hazard – Low
Value – Low
Risk – Low

Hazard – Low

This zone includes the lower elevations of the west side and the south side, including the near vertical wall that forms the western escarpment. Characterized by low rainfall and sparse, patchy vegetation. Vegetation is primarily Chihuahuan desert/grassland communities.

Value – Low

Some threatened and endangered plant and animal species, some archeological resources. No pending threat from fire.

*One high value in the Williams Ranch Historic Site.

Risk – Low

Overall limited risk due to inaccessibility, steep and rugged terrain, lack of water, accessed mainly only along Williams Ranch Road and Bone Springs by four-wheel drive operators and geologists.

- One high risk corridor along the 7-mile Williams Ranch four-wheel-drive road.
- One high risk area at the Shumard Campsite.
- One moderate risk corridor along the 12.2 miles of hiker trail going through the zone.

Specific Prevention Actions Required

1. Trailhead wayside will contain fire prevention message and any fire restrictions.

Responsibility:	*Target date:*
Message Development and Signs:	
Chief Ranger and Chief Interpreter	May 1, annually
Implementation:	
Frijole Area Rangers	Done when fire restrictions are in effect.

2. Conduct special patrols of Williams Ranch Road and the Shumard campsite during periods of High and Extreme Fire Danger, especially when use is high.

Responsibility:	*Target date:*
Frijole Area Rangers	Ongoing

3. Mechanical reduction of fuels around the Williams Ranch house when necessary to protect structure and in accordance with Cultural Landscape Report and Management Plan.

Responsibility:	*Target date:*
Fire Management Officer	Ongoing
FIREPRO Seasonals	Ongoing

Fire Prevention Zone 2 – Pine Springs/Frijole Area

Hazard – Low
Value – High
Risk – High

Hazard – Low

This zone includes the mouth of Pine Canyon and the lower elevations at the base of the Eastern escarpment from Pine Springs to Smith Canyon. Fairly level topography with several large drainages crossing the zone. Vegetation includes grass-shrub and sotol-grass communities with some hardwood and hardwood/conifer stands in drainages or at springs. A large stand of shrub oak is in the mouth of the canyon.

Value – High

This zone includes the major developments in the park, including the parks Visitor Center/headquarters complex, the park's maintenance facility, Pine Springs Housing complex, and the Pine Springs Campground. The zone also includes the Frijole Ranch Historic District. Important local springs, a significant stand of shrub oak and small meadows are also present.

Risk – High

Park's primary use area with concentrated visitor use. Primary Visitor Center, campground and major backcountry trailhead.

Specific Prevention Actions Required

1. Trailhead waysides at Pine Springs Campground, Frijole Ranch and Frijole Horse Corrals will contain fire prevention messages and any fire restrictions.

Responsibility:	*Target date:*
Message Development and Signs:	
Chief Ranger and Chief Interpreter	Ongoing
Implementation:	
Frijole Area Rangers	Done when fire restrictions are in effect.

2. Post special signs in the Pine Springs campground when fire restrictions are in effect.

Responsibility:	*Target date:*
Frijole Area Rangers	Done when fire restrictions are in effect.

3. Patrol trails and campground making visitor contacts regarding fire danger and special restrictions that are in effect.

Responsibility:	*Target date:*
Frijole Area Rangers And Campground Host /VIPs	Done when fire restrictions are in effect.

4. All visitors receiving backcountry permits are informed of the fire danger and any special fire restrictions that are in effect.

Responsibility:	*Target date:*
Chief Interpreter Interpretative Staff	Done when fire restrictions are in effect.

5. Hazard Fuel Reduction, through both Mechanical and Prescribed Fire methods.

Responsibility:	*Target date:*
Fire Management Officer	On-going.

6. Hazard Fuel Reduction by mechanical means around buildings and campground.

Responsibility:	*Target date:*
Roads and Trails Foreman Buildings and Utilities Foreman	Monthly during growing season

Fire Prevention Zone 3 – Eastern Escarpment

Hazard – Moderate
Value – Low
Risk – Low

Hazard – Moderate

This zone is comprised of steep and rugged slopes leading from the lower elevations on the eastern side of the park to the escarpment ridgeline. Numerous steep watersheds intersect the escarpment. Vegetation is primarily grass and grass-shrub communities with some sparse conifers in the drainages. Some powerlines cross the zone.

Value – Low

No structural, cultural or natural resources which would be significantly threatened by fire.

Risk – Low

Limited risk due to no trails or other access to the zone. Little or no visitor use.

Specific Prevention Actions Required

No specific fire prevention actions required for this zone.

Fire Prevention Zone 4 – McKittrick Canyon Area

Hazard – High
Value – High
Risk – Moderate

Hazard – High

This zone is comprised primarily of the McKittrick Canyon drainage. It is characterized by steep canyon walls, rugged terrain and inaccessibility to the upper canyon reaches. Vegetation

includes hardwood stands in the canyon bottom, brush covered (chaparral-like) slopes, and conifer forests in the upper reaches. Fuel loads on the canyon slopes are extremely high.

Value – High

This zone contains the only riparian area in the park, a significant and rare natural resource. Numerous threatened and endangered plant and animal species are present, including the Peregrine Falcon. The Pratt Cabin, a National Register property, and the Historic Hunter Line Shack both are found in this zone.

Risk – Moderate

Overall use is moderate because much of the zone is inaccessible, steep rugged terrain. Upper reaches of canyon have little use due to lack of trails and inaccessibility.

Very high use area in canyon bottom. One of the most popular and heavily used day hiking trails in the park. A significant backcountry trail entry point. Risk is limited somewhat in canyon bottom by restriction to day use only.

Specific Prevention Actions Required

1. Hazard Fuel Reduction, through both Mechanical and Prescribed Fire methods.

Responsibility:	*Target date:*
Fire Management Officer (FMO)	On-going.

2. Hazard Fuel Reduction by mechanical means from around the structures of Pratt Cabin and the structures at Hunter Line Cabin to protect the structures, as needed.

Responsibility:	*Target date:*
Fire Management Officer (FMO)	On-going.

3. Special patrols in the canyon to contact visitors that are day hiking in the area to insure that they know about the fire danger and any special fire restrictions and for patrol.

Responsibility:	*Target date:*
Frijole Area Rangers	Done when fire restrictions are in effect.

Fire Prevention Zone 5 – High Country/Bowl Area

Hazard – High
Value – Moderate
Risk – Moderate

Hazard – High

This zone is located primarily in the park's high country, which is accessible only by a 2,500 ft. + climb. Vegetation ranges from grass-shrub and sotol grass communities in the lower elevations to hardwoods and a hardwood/conifer forest in the high country. The northwest portion of this zone includes a significant pinyon-juniper/grassland, which includes concentrations of flashy grass fuels near the Marcus campground. The forest on top is characterized by a closed canopy and extremely heavy fuel accumulations.

Value – Moderate

This zone contains numerous threatened and endangered species and a relict coniferous forest in the high country. Politically it is important for this relict forest community.

Risk – Moderate

Use is primarily serious hikers and backcountry users. Risk is limited due to prohibition on all backcountry fires, steep and rugged terrain, and lack of water.

Risk is high along the Tejas Trail corridor where most use occurs and where also most horse use occurs.

Risk is high at the numerous backcountry campgrounds located in this zone.

Specific Prevention Actions Required

1. Hazard Fuel Reduction, through both Mechanical and Prescribed Fire methods.

Responsibility:	*Target date:*
Fire Management Officer (FMO)	On-going.

2. Patrol the main Tejas trail corridor and the backcountry campsites (based on use) to insure that all visitors know about the fire danger and any special restrictions.

Responsibility:	*Target date:*
Frijole Area Rangers Dog Canyon Area Ranger	Done when fire restrictions are in effect.

3. Hazard Fuel Reduction by mechanical means around the backcountry cabin and the Bowl cabin to protect those buildings, as needed.

Responsibility:	*Target date:*
Frijole Area Rangers	Ongoing

Fire Prevention Zone 6 – Dog Canyon

Hazard – High
Value – High
Risk – High

Hazard – High

This zone is characterized by a canyon bottom with steep canyon walls located in a remote portion of the park (110 miles from Headquarters, 70 miles from town). Staffing is extremely limited with one person the usual staffing. Vegetation Pinyon-juniper/grassland with a significant conifers component in the drainages. Fuel accumulations are high with heavy accumulations of flashy grass fuels in the canyon bottom.

Value – High

This zone includes the Dog Canyon developed area, which includes a barn, visitor contact station, campground, housing, etc.

Risk – High

Visitor use is significant with a contact station and campground providing visitor services. Is a major backcountry entry point.

Specific Prevention Actions Required

1. Trailhead wayside will contain fire prevention message and any fire restrictions.

Responsibility:	*Target date:*
Message Development and Signs:	
Chief Ranger and Chief Interpreter	May 1, annually
Implementation:	
Dog Canyon Area Ranger	Done when fire restrictions are in effect.

2. Post special signs in the Dog Canyon campground when fire restrictions are in effect.

Responsibility:	*Target date:*
Dog Canyon Area Ranger	Done when fire restrictions are in effect.

3. Patrol trails and campground making visitor contacts regarding fire danger and special restrictions that are in effect.

Responsibility:	*Target date:*
Dog Canyon Area Ranger	Done when fire restrictions are in effect.

4. All visitors receiving backcountry permits are informed of the fire danger and any special fire restrictions that are in effect.

Responsibility:	*Target date:*
Dog Canyon Area Ranger	Done when fire restrictions are in effect.

5. Hazard Fuel Reduction, through both Mechanical and Prescribed Fire methods.

Responsibility:	*Target date:*
Fire Management Officer	On-going

6. Hazard Fuel Reduction by mechanical means around buildings and in campground.

Responsibility:	*Target date:*
Dog Canyon Area Ranger	Done during growing season.

Fire Prevention Zone 7 – Ship on the Desert/McKittrick Access Corridor

Hazard – Low
Value – High
Risk – High

Hazard – Low

This zone is located in fairly level terrain with easy access provided by roads in the area. Vegetation is desert shrub/grassland.

Value – High

This zone contains one of the major access points to the park. The McKittrick Canyon Visitor Center, picnic area is a focal point for visitor access for McKittrick Canyon. This zone also includes the Ship-On-The-Desert Historic District.

Risk – High

This zone is a major focal point for visitor access, and the primary access point into McKittrick Canyon, one of the most popular and heavily used visitor use areas in the park. Also serves as a backcountry trail use access point.

Specific Prevention Actions Required

1. Post a sign on the entrance road when fire danger is high or extreme informing the incoming visitor traffic of the fire danger.

Responsibility:	*Target date:*
Frijole Area Rangers	Done when fire restrictions are in effect.

2. Trailhead wayside at McKittrick trailhead will contain fire prevention messages and any fire restrictions.

Responsibility:	*Target date:*
Message Development and Signs:	
Chief Ranger and Chief Interpreter	May 1, annually
Implementation:	
Frijole Area Rangers	Done when fire restrictions are in effect.

3. Post special signs at the McKittrick Visitor Center when special fire restrictions are in effect and make personal contact with visitors about special fire danger.

Responsibility:	*Target date:*
Frijole Area Rangers	Done when fire restrictions are in effect.
Interpretative Staff	

4. Hazard Fuel Reduction by mechanical methods around the McKittrick Visitor Center to protect the structure.

Responsibility:	*Target date:*
B & U Foreman	Done during growing season.
R & T Foreman	

5. Hazard Fuel Reduction by mechanical methods around the Ship-On-the-Desert when necessary to protect structure and in accordance with the Cultural Landscape Report and Management Plan.

Responsibility:	*Target date:*
Fire Management Officer (FMO) Frijole Area Rangers	On-going

Appendix C
Wildland Fire Pre-Attack Plan Checklist

This pre-attack checklist is to be completed by April 1st of each year. Initial and date each item to indicate that it meets full readiness criteria.

1. Fire Organization

- Fire Management Plan is current.
- Adequate maps of the park are available:
  - Base Map
  - Topo Map
  - Vegetation Map
  - FMU Map
  - Recent Burn History Map
  - Hazard Map
- Interagency Agreements
- IC capabilities
- Draft Delegation of Authority
- Closure Procedures
- Evacuation Procedures
- Park fire organization chart is completed.
- Presuppression supervision is adequate and qualified.

2. Administration

- Physicals and pack tests completed.
- Fire qualification cards up to date as well as IQCS.
- Physical fitness program for firefighters is established.
- Appropriate training needs are identified and planned.
- Firefighter quarters are up to safety codes.
- Interagency agreements are current.
- Accident reporting procedures are in place.
- Presuppression Staffing (Step-up) plan is current.
- Property accountability procedures are in place.
- AMD/OAS approved fixed wing aircraft are available.
- Park management is familiar with the park's approved Fire Management Plan.
- ICP Location in the event of large fire
- Utility Company Contact Information
- Medical Facilities
- Equipment Rental Availability

3. Facilities and Equipment

- Weather stations are maintained and fully operational.
- Fire Cache tools are maintained.
- Saw and pump kits are maintained and fully operational.
- Personal protective equipment is ready.

- Vehicle operators trained in defensive driving.
- Hose testing is completed.
- Engines and Water tenders are fully operational and equipped.
- Prevention message signs posted at trailheads.
- Fire Cache is clean and organized.

4. Fire Operations

- Readiness Review done by cooperators using interagency checklists.
- Pre-season risk analysis has been conducted.
- Radios are correctly programmed and repeaters are fully operational.
- Communication Plan completed for:
  - Initial Attack
  - Extended Attack
- Fire weather procedures have been established.
- Park Run Cards are current.
- Wildfire Prevention Analysis and Action Plan is current.
- Wildfire Pre-attack Plan is current.
- Park detection procedures are understood by patrollers.
- Park aircraft procedures are current and understood:
  - Aviation Management Plan is current.
  - Helipads are organized, painted, unobstructed.
  - Fugitive retardant is available.
  - Flight Safety/Hazards Map is current.
  - Aircraft dispatching procedures are understood by dispatchers.
- Interagency operation procedures are understood.
- Wildfire investigation procedures are established.
- Structural Protection Needs
- Safety Zones
- Staging Locations

5. **Fire For Resource Benefits / Prescribed Fire Considerations**

- Superintendent has been briefed on:
  - Daily certification procedures.
  - Fire For Resource Benefits conversion or prescribed fire escape procedures.
- Neighbor agencies have been contacted regarding possibility of Fire For Resource Benefits.
- Prescribed Burn Bosses or Strategic Operation Planner are available.
- Fire Monitors are available. Dispatchers have been briefed on Fire For Resource Benefits and NPS prescribed fire procedures.

Appendix D
Cooperative Agreement Summaries

The following is an annotated list of the cooperative agreements, memorandums of understanding and similar documents in effect to support the Fire Management Program at Guadalupe Mountains National Park. Complete documents are all on file in the Chief Ranger's Office at Guadalupe Mountains and can be reviewed there.

Interagency Agreement between the NPS and BLM for RAWS Operation and Maintenance

This agreement provides for the operation and maintenance of RAWS stations in the National Park Service with the Bureau of Land Management. It provides the satellite uplink for RAWS stations and depot maintenance. This agreement provides this service for the RAWS stations that Guadalupe Mountains maintains.The Bowl, Pinery, PX WELL, McKittrick, Dog Canyon.

Interpark Agreement between Carlsbad Caverns NP, Chamizal NM, Gila Cliff Dwellings NM and Guadalupe Mountains National Park

This agreement is between the five respective national park units to provide Fire Management staff support, expertise, and assistance from Guadalupe Mountains / Carlsbad Caverns NP's to the other three units. By way of this agreement, the FMO at Guadalupe Mountains / Carlsbad Caverns provides assistance and fire management expertise to the other three units. In addition, it provides for sharing of resources by all five parks to accomplish fire management activities.

Joint Powers Operating Plan (JPOP)

This agreement is between the State of New Mexico and all of the agencies in Southeast New Mexico and West Texas; it includes all agencies in the Pecos Zone. It provides for interagency coordination of fire activities and provides for the coordination and operation of the Alamogordo Interagency Dispatch Center in support of interagency fire management activities.

Memorandum of Understanding between the National Park Service: Big Bend NP, Carlsbad Caverns NP, Guadalupe Mountains NP, Ft. Davis NHS and White Sands NM; Bureau of Land Management--Roswell District; United States Forest Service–Lincoln National Forest; and United States Fish and Wildlife Service–Bitter Lake Wildlife Refuge

This agreement provides a governing guideline for the Carlsbad Interagency Wildland Fire Crew. It established procedures and guidelines for the organization, dispatch, preparedness, training, transportation and management of this Interagency Crew.

Interagency Memorandum of Understanding between Carlsbad Caverns National Park, Guadalupe Mountains National Park, Pecos District of the Bureau of Land Management, and the Guadalupe Ranger District of the Lincoln National Forest

This agreement provides for cooperation between the signatory agencies of the Guadalupe Mountains on the planning and execution of management ignited prescribed fires (MIPF) and allows for the mutual management of prescribed natural fires (PNF) across jurisdictional boundaries within the project area.

Cooperative agreement with Culberson County

This is an agreement between Culberson County and Guadalupe Mountains National Park to provide mutual aid between the two agencies.

Cooperative agreement with Hudspeth County

This is an agreement between Hudspeth County and Guadalupe Mountains National Park to provide mutual aid between the two agencies.

Mutual Agreement with BIA Mescalero Agency

This is an agreement with the BIA Mescalero Agency (previously included Lincoln N.F.) to fund an interagency exclusive-use contract helicopter and personnel to respond to wildfires within Pecos Zone. The aircraft also supported other aviation related project needs of Pecos Zone cooperators.

Cooperative Agreement with Texas DPS

This agreement defines operational aircraft and pilots approved for use by Guadalupe Mountains N.P. for Law Enforcement, evacuations, or other support needs.

Appendix E
Briefing Package for Incoming Incident Management Team

An Agency Administrator's Briefing Packet is used to brief incoming Incident Commanders and Incident Management Teams. An outline is available in the Redbook, Appendix D. It will contain the following items:

- **Delegation of Authority signed by the Superintendent (draft copy attached)**
- **Delegation of Authority addendum with specifics on the particular fire (draft copy attached)**
- **Minimum Impact Suppression Tactics (Appendix F)**
- **Rehabilitation Guidelines (Appendix G)**
- **Safety Considerations**
- **WFDSS that has been initiated / completed for that incident**
- **Fire Complexity Analysis for the incident**
- **Maps of Fire location**
- **Specific Resource Information on that Fire—to be determined for each fire**

_____, 20__

LIMITED DELEGATION OF AUTHORITY

_____, Incident Commander:

As Superintendent of Guadalupe Mountains National Park, I have the ultimate responsibility for the protection of the Park's resources and the lives of Park visitors and employees. Your expertise in the area of fire management will assist me in fulfilling that responsibility during the present crisis. By means of this memorandum on this ___ day of ____, 20__, at _____ hours, I am delegating to you the authority to carry out the task of suppressing the _____ Fire, Fire #TX-GUP-_____, in accordance with the attached Agency Administrator's Briefing Packet.

The package will provide you with my priorities in fire suppression, specific restraints which are necessary to protect the Park's cultural and natural resources, and other guidelines for carrying out your overall task of fire suppression within this Park. In addition, the Agency Administrator's Briefing Packet will provide you with a list of Park officers who have been assigned to assist you in carrying out your duties and a list of facilities which are available to you under the conditions stated.

Upon your arrival, I will conduct an on-site briefing for you and your Incident Management Team. A fireline briefing will also be conducted for you and your team by the current incident commander.

John Lujan
Superintendent

Delegation of Authority, _____ Fire

As of ____ hours, _____, 20__, I have delegated authority to manage the _____ Fire, Number _____ to Incident Manager _____ and his/her Incident Management Team.

This fire originated _____. It was first discovered _____hours when _____ _____. It was apparently caused by _____ _____.

The fire is entirely inside National Park Service lands and is primarily in or threatening a section of prime wilderness that is of high environmental quality. It is threatening structures, some historical structures and threatened and endangered species.

My considerations are as follows:

1. Personal safety of fire suppression personnel and park visitors in the backcountry is of prime importance and a high priority.

2. I would like the fire managed under a confinement/containment strategy since the fire is primarily in wilderness and to reduce impact on the park resources. All suppression actions should be done with as little environmental damage as possible.

3. Helicopters are the only means of access into the wilderness high country, (except for walking) and may be used within the wilderness.

4. Minimum tools for use in the wilderness are helicopters. No chainsaws are to be used in the wilderness.

5. Helispot construction should be limited as much as possible to only those sites necessary. Open sites that are accessible and require minimum removal of trees are preferred.

6. You may use the _____ area as your base camp.

7. You may spike crews in the high country if needed.

8. The McKittrick Canyon drainage is a fragile riparian environment with many endemic and threatened and endangered species. In addition, it has the only flowing water in the park. Efforts should be made to keep the fire out of McKittrick Canyon and to preserve these resources.

9. There is _____ developed area and _____ historic structures in the fire area, including _____
_____.

10. Several small springs are located throughout the area and are fragile ecosystems. Efforts should be made to minimize impact on these areas if at all possible.

11. Fire suppression scars should be kept to a minimum.

12. Air Tanker drops are permitted and may be used as necessary. Fugitive retardant should be used if at all possible and consideration for water only in the McKittrick Drainage, if possible. However, I realize that this may not be possible or practical.

13. The Bowl is a relict forest. Efforts should be made to keep the fire out of the Bowl and preserve this special resource.

14. Trails in the high country and McKittrick Canyon have been closed to the public as of _____. In addition, _____ has been closed since the fire began. Other closures can be made, if necessary.

15. Emergency funds are available for suppression but must be fully justified.

16. Use of the park gas pumps is available for refueling of vehicles.

17. Policy for aircraft use in this park is that which has been developed by the Aviation Management Directorate (AMD). Please adhere to it.

18. ** _____, the park's _____ and/or the park FMO will serve as the park's representative to your team. **

19. Providing training opportunities for the local park and zone personnel is requested to strengthen our organizational capabilities.

20. Base all actions with incident cost containment a consideration.

John Lujan
Superintendent

**Items to be adjusted by incident.

Appendix F
Minimum Impact Suppression Guidelines

The intent of the following guide is to provide a checklist for fire managers and suppression personnel to consider:

Command and General Staff

1. Evaluate suppression tactics during planning and strategy sessions to see that they meet Park objectives and minimum suppression impact guidelines.
2. Include Park resource advisor in planning and strategy.
3. Discuss minimum impact suppression in briefings.
4. Ensure minimum impact suppression tactics are implemented.

Planning Section

1. Use resource advisor/s to ensure that suppression tactics are commensurate with land/resource and incident objectives.
2. Ensure that instructions for minimum impact suppression tactics are listed in the Incident Action Plan.
3. Anticipate fire behavior and ensure all instructions can be implemented safely.
4. Detail objectives for extent of necessary mop-up.
5. Adjust line production rates to reflect the minimum suppression tactics.
6. Utilize an assessment team and or outside publics to get different perspectives.

Operations Section

1. Emphasize minimum impact suppression tactics during each operational period briefing.
2. Explain expectations for instructions detailed in the Incident Action Plan.
3. Consider showing minimum impact suppression slide-tape or video to arriving crews.
4. Monitor suppression tactics/conditions.
5. Distribute field guide to appropriate supervisory operations personnel.

Logistics Section

1. Ensure actions performed in areas other than Incident Base i.e. dump sites, camps, staging areas, helibase, etc. result in minimum impact on the environment.

Division/Group Supervisors and Task Force/Strike Team Leaders

1. Ensure crew superintendents and single resource bosses understand what is expected.
2. Discuss minimum impact tactics with crews.
3. Ensure Dozer and Falling Bosses understand expectations.
4. Monitor suppression tactics/conditions.

Crew Superintendents

1. Ensure/monitor results expected.
2. Discuss minimum suppression tactics with crews.
3. Provide feedback on implementation and success or failure of tactics.
4. Look for opportunities to further minimize impact to land and resources during suppression and mop-up phases.

Minimum Suppression Impact Implementation Guidelines for various activities are as follows:

Safety

1. Safety is of the utmost importance.
2. Constantly review and apply the Watch out Situations and Fire Orders.
3. be constantly aware of the surroundings, of expected fire behavior and potential.
4. Observe caution in:
    -Burning snags you allow to burn down.
    -Burning or partially burning live and dead trees.
    -Unburned fuel between you and the fire.
    -Identify hazard trees with observers, flagging or glow sticks.

Fire Line

1. Select procedures, tools, equipment that least impacts the environment.
2. Utilize natural barriers to the extent feasible.
3. Use cold trailing if conditions allow.
4. If constructed fireline is necessary use minimum width and depth required to check fire spread.
5. Bulldozers may only be utilized with specific consent of the Superintendent, use minimum blade width or brush blade.
6. Leave some trees randomly in fireline.
7. Consider use of helibuckets and water/foam vs. airtanker/retardant.
8. Minimize bucking by line establishment around logs.
9. Cut brush and small trees flush to ground.
10. Limb only enough to prevent fire spread.
11. Minimize cutting of trees, burned trees and snags.
12. Live trees will not be cut unless determined they will cause fire spread across lines or endanger personnel. Scrape around tree bases, if trees are cut, then cut stump to within 3".
13. Cut only those snags that would reach fireline should they fall.

Mop-up

1. Use heat detection devices vs. total area mop-up.
2. Cold trail.
3. Restrict spading to hot areas.
4. Allow larger logs to burn-out vs. bucking.
5. Extinguish burning trees and snags, fell as a last resort.

Camp Sites and Personal Conduct

1. Use existing campsites if available, select those unlikely to be seen by visitors/users. Avoid meadows; consider changing location if impacts become apparent.
2. Do minimal disturbance in preparing bedding and campfire sites, do not clear vegetation or trench area.
3. Select alternative travel routes between camp and fire if trailing becomes excessive.
4. Evaluate coyote camps versus fixed camps in sensitive areas.

Appendix G
Rehabilitation Plan and Guidelines

Rehabilitation is the process of stabilizing the landscape and mitigating the effects of fire suppression activities. As a general rule, burned areas will not be revegetated. However, if special conditions exist that warrant such action Resource Management personnel will be employed to develop the plan and Field Director approval is required. The Fire Management Officer, working with the Resource Management Staff, will be responsible for rehabilitation planning and work. Rehabilitation needs should be considered for each wildfire and a rehab plan developed for each. All acreage impacted by suppression efforts will be rehabilitated in accordance with the Western Region Revegetation and Rehabilitation Handbook (in preparation) and the established funding guidelines .

Incident emergency rehabilitation is an integral part of the overall suppression process and is financed under FIREPRO, Emergency Rehabilitation funding, which covers emergency actions necessary to rehabilitate a burned area by preventing land degradation and resource loss or to protect public safety. Appropriate use of funds include erosion control, rehab of firelines, emergency stabilization of fire damaged structures, short term control of feral plants and animals, removal of hazard trees created by wildfire, emergency trail repair, emergency mitigation of damage to archeological sites and mitigation of other immediate safety hazards.

The following standards will be used as a minimum for rehabilitation efforts:

1. Firelines

- After fire spread is secured, fill in deep and wide firelines, and cup trenches.
- Waterbar, or dam as necessary, to prevent erosion.
- Ensure stumps from trees and brush are flush cut with ground.
- Camouflage cut stumps.
- Lop and scatter cut trees and brush or pile for burning.

2. Camps

- Restore campsites to natural conditions to extent possible.
- There should be no campfires, but if they are approved for emergency reasons, then scatter campfire rocks, charcoal and cover fire area with dirt and blend in with natural cover.
- Pack out all garbage and unburnables.

3. General

- Remove all signs of human activity (flagging, litter etc.)
- Restore helicopter landing zones.

Rehabilitation Plan

Spacing for Waterbars on Firelines

Fireline Gradient (perpendicular to slope)	Erodibility of Soil on Fireline	
	Medium (M)	High (H)
Less than 15%	200'	150'
15 to 30%	100	75
30 to 45%	65	50
Steeper than 45%	30	25

Waterbars shall be put in by hand—no bulldozers.

These are minimum standards and are not intended to restrict the implementation of more if the need is indicated.

Appendix H
Fire Monitoring Plan

Introduction

This plan is in compliance with RM-18 Chapter 11 Wildland and Prescribed Fire Monitoring, which states that "All NPS units applying wildland fire use and/or prescribed fire to accomplish resource benefits must prepare a Fire Monitoring Plan." This plan is appended to the 2003 Fire Management Plan. Monitoring is considered a critical component of fire management; "In order to evaluate resource management and fire management objectives, units must monitor the effects of fire." (RM-18 Ch. 11) Four monitoring levels are recognized and are cumulative—environmental planning, fire observations, immediate postfire effects, and long-term change. This document will identify monitoring rationale as well as specific monitoring protocols for Guadalupe Park National Park.

Descriptions of vegetation communities and their relationship to fire can be found in the main body of this FMP, Chapter III. Natural resource-related conflicts include plots that experienced severe flooding events, plots experiencing high pine mortality rates from bark beetle infestation, and plots with blow down.

Description of Ecological Models

Seven dominant plant communities have been identified for fire effects monitoring at Guadalupe Mountains National Park: Rocky Mountain (Petran) conifer forests, Great Basin conifer woodland, Madrean evergreen woodland, interior chaparral, Chihuahuan semi-desert grassland, Chihuahuan desert scrub, and interior deciduous forest and woodland. Major species found in each vegetation community and fire history studies are reviewed in the description of vegetative communities of the FMP, Chapter III. Fire effects on these species are reviewed in Appendix B of the FMP. Guadalupe Mountains National Park is extremely diverse, with over 1200 species of plants found within its boundary; other species and their associated fire effects may be obtained in the Fire Effects Information System (FEIS), http://www.fs.fed.us/database/feis, from FMH evaluation of prescribed burns and their associated fire effects, and from individual prescribed burn documentation and monitoring reports.

Management Objectives

The Guadalupe Mountains were inhabited for many centuries up until around 1880 by the Nde' (Mescalero Apache). Many of the fires in the high country can be attributed to Indians from 1550 to 1879. Following this period the area was used for ranchland and was heavily grazed by sheep and cattle. Prior to the Guadalupe Mountains being used for ranch land, the area experienced a range of fire regimes among the vegetation communities. Chapter III of the FMP reviews the fire history literature in detail. Fire history studies and results of past prescribed burns aided in the determination of management objectives for prescribed burning. Rocky Mountain (Petran) conifer forests likely experienced a low to moderate intensity fire every 3 – 20 years with a mean fire return interval of 4.7 years (Ahlstrand) The semi-desert grassland communities in the lower elevations of the park likely experienced moderate intensity fires with a fire return interval of 10 – 12 years.

Prescribed fire goals and objectives exist for the two monitoring types and are found in their respective monitoring type descriptions. Prescribed goals for the remaining five monitoring types will be

addressed in FY04 as analysis from the current fire history research from Penn State University becomes available. This research may necessitate changes in the prescribed fire goals and objectives that are addressed in this paper. Management objectives are described in terms of percent change from the current condition instead of target population size. Until further study is conducted on pre-suppression era structure and composition, target population size will not be used as a basis for management objectives. The following lists these goals and objectives by monitoring type:

Petran Montane Conifer (FPSME1G10 and FJUDE1G10):

Goals:

- Produce a less dense mixed conifer forest with minimal pole-sized trees and understory brush
- Reduce dead and down fuel loading and ladder fuels to reduce threat of a stand-replacing wildland fire
- Protect Mexican spotted owl habitat by retaining large overstory trees and opening up the subcanopy

Objectives:

- Reduce shade tolerant pole trees by at least 20%, five years postburn
- Limit mortality of all overstory trees greater than 12" DBH to 20% or less, five years postburn
- Reduce dead and down fuel loads in the 1 TLFM size class by at least 60%, immediate postburn
- Reduce dead and down fuel loads in the 10 and 100 TLFM size classes by 50 – 90%, immediate postburn
- Reduce dead and down fuel loads in the 1000 TLFM size class by 30 – 90%, immediate postburn

Semi-desert Grassland (BMUSE1G02):

Goals:

- Reduce red berry juniper encroachment and increase native grass richness
- Reduce dead and down fuel loadings

Objectives:

- Limit mortality of overstory coniferous trees > 16" DBH to < 20%, five years postburn
- Reduce dead and down fuel loadings of 1 and 10 TLFM size classes by 50-90%, immediate postburn
- Reduce dead and down fuel loadings of 100 TLFM size class by 40 – 90%, five years postburn
- Reduce dead and down fuel loadings of 1000 TLFM size classes by 30 – 90%, five years postburn

Monitoring Design

The Fire Monitoring Handbook monitoring design will be used for existing fire effects plots in the Petran conifer forests and Chihuahuan semi-desert grassland monitoring types. See the Fire Monitoring Handbook for a description of specific protocols for forest, brush, and grass plots. Additional plots will be established using a 200 m by 5 m belt transect to capture greater spatial variability across the landscape. These plots capture the same information as the traditional FMH plots but in a timelier manner.

Monitoring Objectives

At the present time we are confident of what the historical species composition was in the high country of Guadalupe Mountains National Park. We presently have the same species that occurred there for hundreds of years before park was grazed. We do know that the species richness, density, and structure has changed though, and an ongoing research project is determining the degree of condition class change. Currently, a graduate student from Penn State University is conducting a two year study looking at the fire history in the high country of the park. He is collecting fire scar samples, increment boring trees, and assessing the species diversity, species richness, and stand structure in approximately 200 plots. The plots are located in all the vegetative communities in the high country and this information will be used to see how the forests have changed with the exclusion of fire. Prescribed burn objectives and monitoring objectives have been created that address our current knowledge and understanding of fire frequency and intensity and as more research knowledge is gained the objectives will be adjusted accordingly. Since additional comparative study is warranted, the monitoring objectives listed below are broadly stated and the level of accuracy to substantiate these objectives relatively low.

Petran Conifer Community:

- Measure total fuel loading with a sufficient sample size to be 90% confident that the sample mean will be within 25% of the population mean.
- Measure the pole tree density with a sufficient sample size to be 90% confident that the sample mean will be within 25% of the population mean.
- Measure overstory tree density with a sufficient sample size to be 90% confident that the sample mean will be within 25% of the population mean.
- Measure shrub density or percent cover with a sufficient sample size to be 90% confident that the sample mean will be within 25% of the population mean.
- Measure cover of native grasses and forbs with a sufficient sample size to be 90% confident that the sample mean will be within 25% of the population mean.

Chihuahuan Semi-Desert Grassland Community:

- Measure shrub density with a sufficient sample size to be 80% confident that the sample mean will be within 25% of the population mean.

Sampling Design

Monitoring type descriptions are reviewed annually and updated as needed. Sampling unit size and field placement protocols are in the Fire Monitoring Handbook. Rejection criteria are listed in the monitoring type description sheets. Five plots per monitoring type will minimally be installed to run minimum sample size calculations. Additional plots will be installed in accordance with those calculations.

Field Measurements

The field methods as detailed in the Fire Monitoring Handbook will be used as well as non-fmh protocols for the 200 m by 5 m plots.

Timing of Monitoring

Plots will be monitored according to the Fire Monitoring Handbook protocols (preburn, postburn, 1 year, 2 year, 5 year, 10 year, 20 year intervals). Plots will be monitored during summer / fall green-up phonological stage.

Monitoring Plot Location

Each plot has a written description to navigate to the plot, as well as a map with azimuth and pacing directions. These are found in the individual plot file in the Fire Management office, as well as on the FMH database (written instructions only). In addition, each plot has a GPS location (in UTMs) listed in the plot file and on an ArcView map of plot locations. GPS locations have, on average, 2 m accuracy. A 2003 plot map is attached.

Prescribed Fire Monitoring Parameters

The four monitoring levels, designed to provide a minimum acceptable standard (MAS) of conformance with RM-18, are: reconnaissance, fire conditions, immediate postfire effects, and long-term change; these levels are cumulative. Level 1 and 2 fire monitoring contain the following:

Level 1: Reconnaissance MAS

- Fire cause, location, and size
- Fuel and vegetation type
- Relative fire activity
- Potential for further spread
- Current and forecasted weather
- Resource or safety threats and constraints
- Smoke volume and movement

Level 2: Fire Conditions MAS

- Fire Monitoring Period
    - Fire number and name
    - Observation date and time
    - Monitor's name
- Ambient Conditions
    - Topographic Variables
        - Percent slope
        - Aspect of terrain
- Fire Weather Variables
    - Air temperature
    - Relative humidity
    - Wind speed
    - Wind direction
    - Percent shading
    - 1, 10, 100, 1000-hr time lag fuel moisture
    - Live fuel moisture
    - Drought index by fuel model
- Fuel Model
    - 13 Fire Behavior Prediction System fuel models or customized model
- Fire Characteristics
    - Linear rate of spread
    - Perimeter and area growth
    - Flame length
    - Fire spread direction
- Smoke Characteristics

  - Visibility
  - Particulates
  - Carbon monoxide
  - Total smoke production
  - Mixing heights
  - Transport and surface wind speeds and direction
  - Documented complaints from downwind areas
- Fire Conditions
  - Duff moisture
  - Flame zone depth

Intended Data Analysis Approach

Data analysis was traditionally done through the FMH software for the Fire Effects Annual Report; these reports are on file in the Fire Management office and encompass the dates 1997-2001. Minimum sample size calculations will be run until the minimum plot numbers are met for each variable. For all variables related to condition or change objectives, minimum sample size calculations will be run again once all the plots burned within a monitoring type reach one year postburn and again when the timeframe mentioned in the management objective has been reached.

The new Fire Effects Assessment Tool (FEAT) will be the new data analysis tool used for the fire effects dataset. More information regarding this program will be added when it is distributed to individual parks.

Monitoring Implementation Schedule

See Chapter IV Table IV-7 for a list of the Fuels Treatment schedule. Plots will be established according to the FMH protocols and in numbers deemed reasonable for the fuel treatment unit size, plant communities, and topography. Plots will be installed in each fuel treatment unit on the schedule and will be sampled up to 2 years prior to burning and no later than 2 months after burning the unit.

Data Sheet Examples

See the Fire Monitoring Handbook for examples of data sheets used in sampling.

Management Implications and Potential Results

Monitoring results will be analyzed and reviewed by the Ecologist, Fire Effects Monitor, and Natural Resource Manager on a yearly basis; determination of acceptable results will be completed, and changes to prescriptions, burn objectives, monitoring objectives, burn unit boundaries, and research needs will be suggested and documented at that time. Minor changes to the program will be implemented in the next prescribed fire season. Major changes will be sent to the Regional Fire Ecologist for review and validation.

Monitoring data will be reported to other NPS personnel and in publications, as needed.

Consultation and Coordination

The Regional Fire Ecologist will be consulted in matters of major monitoring or prescribed fire program changes. Major changes to the program may necessitate a new NEPA document should the new program objectives and implementation be outside the scope of the original NEPA document.

Non-FMH Fire Effects Protocols

Plot location: Plots are randomly located throughout the burn units with the 0P rebar approximately 25 m from the top of the ridge. The transect runs directly down hill for 200 m unless the bottom of the slope is reached and at that point the transect stops.

Overstory trees: Overstory trees (>= 5.9" dbh) will be recorded the entire 200 m transect length and within 2.5 m of the transect.

Pole trees: Pole trees (>= 1" and < 5.9" dbh) will be recorded at transect intervals of 25 - 50, 75 - 100, 125 - 150, and 175 – 200 m. These trees need to be within 1.5 m of the transect.

Seedlings: Seedlings (< 1" dbh) will be recorded at transect intervals of 20 – 25, 60 – 65, 100 – 105, 140 – 145, 180 – 185 m. Seedlings need to be within 1 m of the transect.

Veg. transect: Same procedures as FMH except plant species recorded every meter for 200 m.

Brush transect: Same procedures as FMH except brush species recorded at transect intervals 25 – 50, 75 – 100, 125 – 150, 175 – 200 and a width of 1.5 m of the transect.

Fuels transect: Same procedures as FMH but sampling locations on transect are 25, 75, 125, 175 m.

Photo points: Pictures taken at 0P, 25P, 75P, 125P, 175P, and 200P. Two photos are taken at each rebar, except 0P and 200P where the photo is taken down and up the transect respectively. At the remaining photo points a picture is first taken down the slope and then up the slope.

Rebar location: Rebar are installed at 0P, 25P, 75P, 100P, 125P, 175P, and 200P. Four additional rebar are installed 50 feet from the 25, 75, 125, and 175 m locations to complete the fuels transects.

Appendix I
Sample Burn Plan

Prescribed Fire Plan Format from RM-18, Chapter 10

http://www.nps.gov/fire/fire/fir_wil_pla_reference18.html

Appendix J
Safety Considerations for Employees Involved in Wildland Fire Operations

Safety is a priority in all fire management activities. Safety is everyone's responsibility. All fire management activities have the potential to be extremely dangerous on the fireline and all employees should exercise extreme caution and care when engaged in fire management activities.

Universal Safety factors and Safety Practices are noted here, as follows:

Common Denominators of Fire Behavior on Tragedy Fires

1. Most incidents happen on smaller fires or on isolated sections of larger fires.
2. Flare-ups generally occur in deceptively light fuels, such as grass, herbs and light brush.
3. Most fires are innocent in appearance before unexpected shifts in wind direction and/or speed result in flare-ups. In some cases, tragedies occur in the mop-up stage.
4. Fires respond to large and small scale topographic conditions, running uphill surprisingly fast in chimneys, gullies and on steep slopes.

Critical Fuel and Weather Factors to Consider

1. Extreme weather conditions consisting of high temperatures and low relative humidity.
2. Low dead fuel moisture and extremely low live fuel moisture.
3. Strong wind events. Pay attention to ***Red Flag Warnings***.

Fire behavior can be so extreme that the timeframes for decision-making are very short.

Strategy and Tactical Considerations

- Remember the basics, establish a secure anchor and flank your fire from your anchor.
- If you can't clearly see the fire edge, assign a lookout who can see all areas of the fire.
- Communications are critical. You must be able to talk with your crew and adjacent crews. Each crew must have access to operational and fire weather information.
- Designating your fireline as an escape route is not enough. Factor your travel time into escape situations. Steep slopes and loose soil on many firelines slows your escape. Be sure your escape route will get you out of potential trouble in time.
- The safety zone you select must offer protection from direct flames and high levels of radiant heat. Be sure it is big enough for everyone who intends to use it. Medium-sized heliports are often not adequate.
- Consider the potential for reburn in areas that appear black and safe. If an area doesn't have a good safety zone, either build one or don't go in.

No wildland fire, even those that threaten structures or improvements, is worth risking death or injury.

Review and Implement:

- 10 Standard Fire Orders1
- 18 Situations that Shout "Watch Out"
- LCES = Lookout, Communications, Escape route, Safety Zones
- Work/Rest and Length of Assignment Guidelines
- Personnel, Nutrition and Weather Requirements

Everyone should know the 10 Fire Orders and the 18 Watch Out Situations. They are included on the following two pages.

Standard Fire Orders

1. Know what your fire is doing at all times.

2. Keep informed on FIRE WEATHER conditions and obtain forecasts.

3. Base all actions on current and expected fire behavior.

4. Give clear INSTRUCTIONS and be sure they are understood.

5. Post lookouts in potentially hazardous situations.

6. Establish safety zones and escape routes for everyone and make sure they are known.

7. Be Alert, Keep Calm, Think Clearly, Act Decisively.

8. Maintain control at all times.

9. Remain in communication with your crewmembers, supervisors, and adjoining forces.

10. Fight fire aggressively but provide for SAFETY first.

This model should be viewed as dynamic and continuous through time and space.

Develop Situational Awareness

Make a Plan

Communicate the Plan

Work the Plan

1. Know what your fire is doing at all times.

2. Keep informed on FIRE WEATHER conditions and obtain forecasts.

3. Base all actions on current and expected fire behavior.

4. Post lookouts in potentially hazardous situations.

5. Establish safety zones and escape routes for everyone and make sure they are known.

6. Give clear INSTRUCTIONS and be sure they are understood.

7. Be Alert, Keep Calm, Think Clearly, Act Decisively.

8. Maintain control at all times.

9. Remain in communication with your crewmembers, supervisors, and adjoining forces.

10. Fight fire aggressively but provide for SAFETY first

As the fire environment changes over time

Maintain Situational Awareness

Make Necessary Adjustments to the Plan

Communicate Adjustments to the Plan

Work the New Plan

1. Know what your fire is doing at all times.

2. Keep informed on FIRE WEATHER conditions and obtain forecasts.

3. Base all actions on current and expected fire behavior.

4. Post lookouts in potentially hazardous situations.

5. Establish safety zones and escape routes for everyone and make sure they are known.

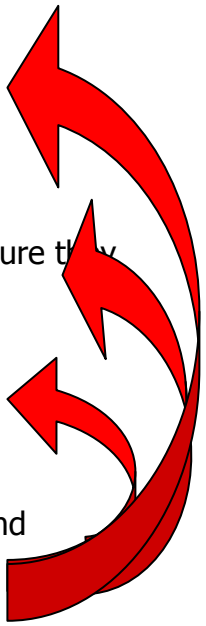
6. Give clear INSTRUCTIONS and be sure they are understood.

7. Be Alert, Keep Calm, Think Clearly, Act Decisively.

8. Maintain control at all times.

9. Remain in communication with your crewmembers, supervisors, and adjoining forces.

10. Fight fire aggressively but provide for SAFETY first



Watch Out Situations
(Survival Checklist)

1. **FIRE NOT SCOUTED AND SIZED UP**

2. **IN COUNTRY NOT SEEN IN DAYLIGHT**

3. **SAFETY ZONES AND ESCAPE ROUTES NOT IDENTIFIED**

4. **UNFAMILIAR WITH WEATHER AND LOCAL FACTORS INFLUENCING**
1. **FIRE BEHAVIOR**

5. **UNINFORMED ON STRATEGY, TACTICS AND HAZARDS**

6. **INSTRUCTIONS AND ASSIGNMENTS NOT CLEAR**

7. **NO COMMUNICATION LINK WITH CREW MEMBERS/SUPERVISOR**

8. **CONSTRUCTING FIRELINE WITHOUT SAFE ANCHOR POINT**

9. **BUILDING FIRELINE DOWNHILL WITH FIRE BELOW**

10. **ATTEMPTING FRONTAL ASSAULT ON FIRE**

11. **UNBURNED FUEL BETWEEN YOU AND THE FIRE**

12. **CANNOT SEE MAIN FIRE, NOT IN CONTACT WITH ANYONE WHO CAN**

13. **ON A HILLSIDE WHERE ROLLING MATERIAL CAN IGNITE FUEL BELOW**

14. **WEATHER IS GETTING HOTTER AND DRIER**

15. **WIND INCREASES AND/OR CHANGES DIRECTION**

16. **GETTING FREQUENT SPOT FIRES ACROSS LINE**

17. **TERRAIN AND FUELS MAKE ESCAPE TO SAFETY ZONES DIFFICULT**

18. **TAKING A NAP NEAR THE FIRELINE**

Appendix K
Glossary of Fire Terms

Activity Fuel - Forest fuel created by timber management practices; slash.

Aerial Fuel - All live and dead vegetation located in the forest canopy or above the surface fuel, including tree branches and crowns, snags, moss, and high brush.

AFFIRMS - Administrative and Forest Fire Information Retrieval and Management System is a user-oriented, interactive computer program. That permits entry of fire weather observations and forecasts, and which performs the computation of fire danger indices, both observed and predicted. Additional information and services are available, including data storage.

Ambient Air - That portion of the atmosphere, external to buildings, to which the general public has access.

Appropriate Management Action – Specific actions taken to implement a management strategy.

Appropriate Management Response – Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Appropriate Management Strategy – A plan or direction selected by an agency administrator, which guide wildland fire management actions intended to meet protection and fire use objectives.

Available Fuel - Those fuels which will burn during a passage of a flaming front under specific burning and fuel conditions.

Backfiring - When attack is indirect, intentional setting fire to fuel inside the control line to slow, knock down, or contain a rapidly spreading fire. Backfiring provides a wide defense perimeter and may be further employed to change the force of the convection column. Backfiring makes possible a strategy of locating control lines at places where the fire can be fought on the firefighter's terms. Except for rare circumstances meeting specified criteria, backfiring is executed on a command decision made through line channels of authority.

Best Available Control Technologies (BACT) -Practices related to an emission source or activity which results in the maximum level of emission reduction practicable, considering effects on public health, safety, environmental and economic impacts and cost. BACT are the minimum measures required for serious non-attainment areas a prescribed in the Clean Air Act. For management-ignited prescribed fires, BACT includes a smoke management program which reflects the specific conditions and requirements of a local area. Elements of a smoke management program that reflects BACT include (1) smoke dispersion evaluation, (2) prescribed fire planning authorization and administration, (3) requirements for ensuring prescribed fire qualifications, (4) public education and awareness, (5) surveillance and enforcement, (6) emission inventories and emission reduction efforts, (7) appropriate governing authority oversight.

Blowup - Sudden increase in fire intensity or rate of spread sufficient to prevent direct control or to upset existing control plans. Often accompanied by violent convection, it may also have other characteristics of a fire storm.

Burned Area Emergency Rehabilitation (BAER) - Emergency actions taken during or after wildland fire to stabilize and prevent unacceptable resource degradation or to minimize threats to life or property resulting from the fire. The scope of BAER projects are unplanned and unpredictable requiring funding on short notice.

Burning Out - Used when attack is direct, or parallel, and the control line touches points of the fire. Burning out is intentional setting fire to fuel inside the control line to strengthen the line. Burning out is almost always done by the crew boss as a part of line construction. The control line is considered incomplete unless there is no available fuel between the fire and the line.

Canopy - The stratum containing the crowns of the tallest vegetation present, (living or dead) usually above 20 feet in height.

Class I Air - An area set aside under the Clean Air Act to receive the most stringent protection of air quality from degradation. Mandatory federal Class I Areas are (1) international parks, (2) national wilderness areas which exceed 5,000 acres in size, (3) national memorial parks which exceed 5,000 acres in size, and (4) national parks which exceed 6,000 acres and were in existence prior to the 1977 Clean Air Act Amendments.

Climate - The prevalent or characteristic meteorological conditions of any place or region, and their extremes.

Cold Front - The leading edge of a relatively cold air mass that displaces warmer air. The heavier cold air may cause some of the warm air to be lifted. If the lifted air contains enough moisture, cloudiness, precipitation, and even thunderstorms may result. In case both air masses are dry, there may be no cloud formation. Following a cold front passage (in the Northern Hemisphere), often westerly or northwesterly winds of 10 to 20 MPH, or more, continue for 12 to 24 hours.

Cold Trailing - A method of controlling a partly dead fire edge by carefully inspecting and feeling with the hand to detect any fire, digging out every live spot, and trenching any live edge. No trench is built where the fire edge is dead out.

Combustion - The rapid oxidation of combustible materials that produces heat energy.

Compactness - The spacing between fuel particles. This can be especially important in the surface layer of fuel, where the amount of air circulation affects rate of drying, rate of combustion, etc.

Contingency Plan - A back-up plan of action for implementation when actions described in the primary plan are no longer appropriate. On management-ignited prescribed fires, these are the action to be taken if the fire is declared out of prescription and designated a wildland fire.

Continuity - The proximity of fuel to each other that governs the fire's capacity to sustain itself. This applies to aerial fuel as well as surface fuel.

Control Line - An inclusive term for all constructed or natural fire barriers and treated fire edges used to control a fire.

Convection - Vertical air movements resulting in the transport of atmospheric properties. In meteorology, atmospheric motions that are predominately vertical, i.e., usually upwards.

Convection Column - The thermally-produced, ascending column of gases, smoke, and debris produced by a fire.

Crown Fire - A fire that advances from top to top of trees or shrubs more or less independently of the surface fire. Sometimes crown fires are classed as either running or dependent to distinguish the degree of independence from the surface fire.

Cultural Resources - Archeological features, recent person-made features, and select natural resources important in understanding social activities or religious beliefs of Native Americans and European Settlers on a specific site.

Direct Attack - A method of suppression that treats the fire as a whole, or all its burning edge, by wetting, cooling, smothering, or by chemically quenching it or mechanically separating it from unburned fuel.

Duff - A mat of partially decomposed organic matter immediately above the mineral soil, consisting primarily of fallen foliage, herbaceous vegetation and decaying wood (twigs and small limbs).

Equilibrium Moisture Content (EMC) - The level at which dead fuel neither gain nor lose moisture with time, under specific constant temperature and humidity. The water vapor pressure in the air is equal to the vapor pressure in the fuel. A fuel particle, at EMC, will have no net exchange of moisture with its environment.

Escaped Fire - A fire which has exceeded the first calculation of initial attack resources and reasonable reinforcements necessary for prompt control or that exceeds fire prescription.

Evaporation - The transformation of a liquid to the gaseous state. Heat is lost by the liquid during this process.

Extreme Fire Behavior - Implies a level of wildland fire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: High rates-of-spread; prolific crowning and/or spotting; presence of fire whirls; a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment, behaving erratically and sometimes dangerously.

Fine Fuel - Fuel such as grass, leaves, draped pine needles, fern. Tree moss and some kinds of slash which, when dry, ignite readily and are consumed rapidly. Also called flash fuel.

Firebrand - Any source of heat, natural or manmade, capable of igniting wildland fuel. Flaming or glowing fuel particles that can be carried naturally by wind, convection currents, or by gravity into unburned fuel.

Fire Danger - A general term used to express an assessment of fixed and variable factors such as fire risk, fuel, weather, and topography, which influence whether fires ill start, spread, and do damage; also the degree of control difficulty to be expected.

Fire Danger Rating - The process of evaluating fire danger by using a system of numerical scales.

Fire Dependent Ecosystem - A community of plants and animals that must experience recurring disturbance by fire, in order to sustain its natural plant succession, structure and composition of vegetation and maintain appropriate fuel loading and nutrient cycling to ensure proper ecosystem function.

Fire Environment - The surrounding conditions, influences, and modifying forces that determines the behavior of fires.

Fire Flank - The parts of a fire's perimeter that are roughly parallel to the main direction of spread.

Fire Frequency - The historical return interval of fire to a defined environment.

Fire Intensity - The rate of heat release for an entire fire at a specific point in time (Also see fireline intensity level).

Fireline - The part of a control line that is scraped or dug to mineral soil. Sometimes called a fire trail.

Fireline Intensity Level (FIL) - A planning level for fire management practices which incorporates flame length, fireline intensity, and BI into a system which is both measurable (flame length) and calculable (fireline intensity and BI).

Fire Management - An extension of the concept of wildland fire decision making which takes into account resource values, role of fire in the environment, the level of protection required, opportunities for management-ignited prescribed use of fire, consideration of fire effects, and the efficiency of the fire control operation.

Fire Management Unit (FMU) - A term used to denote the division of an area for fire planning purposes based on common fire management objectives.

Fire Management Zone (FMZ) - An area of land with similar vegetation, fuel, and fire history in which wildland fire is managed by a predetermined method defined in the Wildland Fire Management Plan. A subdivision of a Fire Management Unit.

Fire Occurrence - The number of wildland fires started in a given area over a given period of time.

Fire Perimeter - The entire outer edge or boundary of a fire.

Fire Prevention - Activities directed at reducing fire occurrence; includes public education, law enforcement, personal contact, and reduction of fire hazard risks.

Fire Regime - Systematic interaction of fire with the biotic and physical environment within a specified land area.

Fire Risk - The probability that a wildland fire will start as determined by the presence and activities of causative agents.

Fire Season - One or more wildland fires (types 11 and 15) in ten day period (10% occurrence rule), as recorded in the Shared Applications Computer System (SACS) for a statistically representative planning period (e.g. 10 years), Supported by fire danger indices such as designated weather observations and calculated NFDRS codes for the primary fuel model. The period or periods of the year during which wildland fires are likely to occur, spread, and do sufficient damage to warrant organized fire control; a period of the year with beginning and ending dates as established by some fire control agencies.

Fire Storm - Violent convection caused by a large continuous area of intense fire. It's often characterized by destructively violent surface indrafts near and beyond the perimeter, and sometimes by tornado-like whirls.

Fire Weather - Weather conditions which influence fire ignition, behavior, and suppression.

Flame Length - The distance measured from the tip of the flame to the middle of the flaming zone at the base of the fire. It is measured on a slant when flames are tilted due to effects of wind or slope.

Flaming Front - That zone of a moving fire within which the combustion is primarily flaming. Behind this flaming zone, combustion is primarily glowing. Light fuel typically having a shallow, flaming front, whereas heavy fuel has a deeper front.

Fog - A cloud at or near the earth's surface. Fog consists of numerous droplets of water which individually are so small that they cannot readily be distinguished by the naked eye.

Front - A transitional zone between two air masses of differing densities.

Fuel Break - A wide strip or block of land on which the native or pre-existing vegetation has been permanently modified so that fires burning into it can be more readily extinguished. It may or may not have fire lines constructed in it prior to fire occurrence.

Fuel Loading - The weight of fuel in a given area, usually expressed in tons per acre. Fuel loading may be referenced to fuel size or timelag categories; and may include surface fuel or total fuel.

Fuel Model - A simulated fuel complex for which all fuel descriptors required by the mathematical fire spread model have been specified.

Fuel Type - An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics. General fuel types are grass, brush, timber, and slash.

Ground Fire - Fire that consumes the organic material beneath the surface litter of the forest floor, such as a peat fire.

Ground Fuel - All combustible materials lying beneath the ground surface including deep duff, roots, rotten buried logs, peat and other woody fuel.

Hazard -A fuel complex defined by kind, arrangement, volume, condition, and location that forms a special threat of ignition or of suppression difficulty.

Head Fire - A fire spreading or set to spread with the wind. (See backing fire.)

Humidity - The measure of water vapor content in the air.

Ignition - The initiation of combustion.

Indirect Attack - A method of suppression in which the control line is mostly located along natural fire breaks, favorable breaks in topography, or at considerable distance from the fire, and all intervening fuel is backfired or burned out. The strip to be backfired is wider than in the parallel method and usually allows a choice of the time when burnout or backfiring will be done.

Inversion - A layer in the atmosphere where the temperature increases with altitude.

Initial Actions – Action taken by the first resources to arrive at a wildland fire to meet protection and fire use objectives.

Initial Attack – The prompt, pre-planned, aggressive suppression response consistent with firefighter, public safety, and values to be protected.

Jet Stream - A narrow meandering stream of high speed winds embedded in the normal prevailing westerly wind flow aloft.

Ladder Fuel - Fuel which provide vertical continuity between strata. Fire is able to carry from surface fuel by convection into the crowns with relative ease.

Litter - The upper most layer of loose debris composed of freshly fallen or slightly decomposed organic materials such as dead sticks, br4anches, twigs, and leaves and needles.

Long-range Spotting - Large glowing firebrands are carried high into the convection column and then fall out downwind beyond the man fire starting new fires. Such spotting can easily occur ¼ mile or more from the firebrand's source.

Mesic - Relating to moist habitat.

Meteorology - The science and art of dealing with the phenomena of the atmosphere, especially weather and weather conditions.

Microclimate - A small site or habitat with essentially uniform climate, fuel modifying characteristics, and burning conditions.

Minimum Impact Suppression - The application of strategy and tactics which effectively meet suppression and resource management objectives with the least cultural, environmental, and social impacts.

Moisture of Extinction - The fuel moisture content at which the fire will not spread or spreads only sporadically and in a non-predictable manner.

National Ambient Air Quality Standards (NAAQS) - Standards for maximum acceptable concentrations of pollutants in the ambient air to protect public health with an adequate margin of safety, and to protect public welfare from any known or anticipated adverse effects of such pollutants (e.g., visibility impairment, soiling, materials damage, etc.) in the ambient air.

National Environmental Policy Act (NEPA) - Establishes procedure that Federal agencies must follow in making decisions on Federal actions which may impact the environment. Procedures include evaluation of environmental effects of proposed actions, and alternatives to proposed actions; involvement of the public and cooperating agencies.

NFDRS - National Fire Danger Rating System.

NFFL - Northern Forest Fire Laboratory (renamed the Intermountain Fire Sciences Laboratory) located in Missoula, Montana.

Nuisance Smoke - Amounts of smoke in the ambient air which interferes with a right or privilege common to members of the public, including the use or enjoyment of public or private resources.

NWCG - National Wildfire Coordinating Group.

Particulate Matter - 1. Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog found in air or emissions. 2. Very small solid suspended in water. They vary in size, shape, density, and electric charge, can be gathered together by coagulation and flocculation. Any liquid or solid matter except uncombined water, which exists as a liquid or solid at standard conditions.

Patrol - 1. To travel a given route to prevent, detect, and suppress fires. 2. To go back and forth watchfully over a length of control line during or after its construction to prevent breakovers, control spot fires, or extinguish overlooked hotspots.

Perennial - Present at all seasons of the year and continuing from year to year.

Physiographic Regions - Broad descriptions of geographic areas with similar physical and climatic features.

Precipitation - The collective name for moisture in either liquid or solid form large enough to fall from the atmosphere and reach the earth's surface.

Prescription – Measurable criteria which guide selection of appropriate management response and actions. Prescription criteria may include safety, public health, environmental, geographic, and administrative, social, or legal considerations.

Prescribed Fire – Any fire ignited by management actions to meet specific resource management objectives and ignited in accordance with established prescription criteria in a predetermined area. A written, approved Prescribed Fire Plan must exist and NEPA requirements must be met prior to ignition. NEPA requirements can be met at the land use or fire management planning level.

Preparedness – Activities that lead to a safe, efficient and cost effective fire management program in support of land and resource management objectives through appropriate planning coordination.

Preparedness Analysis – Required interagency analysis used to determine budget for initial attack resources and oversight requirements. The BIA's Fire Management Preparedness Analysis (FMPA) utilizes either the Alternative Analysis or the Interagency Initial Attack Analysis.

Rate of Spread - The relative activity of a fire extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire; or as rate of forward spread of the fire front; or as rate of increase in area, depending on the intended use of the information. Usually its (forward) rate of spread is expressed in chains or acres per hour.

Relative Humidity - The ratio of the amount of moisture in the air to the amount which the air could hold at the same temperature and pressure if it were saturated; usually expressed in percent.

Running - Behavior of a fire that is spreading rapidly, usually with a well-defined head.

Savannah - Grassland containing scattered trees and drought resistant undergrowth.

Sensitive Receptor Sites - Population centers such as towns and villages, camp grounds and trails, hospitals, nursing homes, schools, roads, airports, Federal Class I Areas, etc. where smoke and air pollutants can adversely affect public health, safety, and welfare.

Seral - Of, relating to, or constituting an ecological stage in succession.

Severity Funding – Funds provided to increase wildland fire suppression response capability necessitated by abnormal weather patterns, extended drought, or other events causing abnormal increase in the fire potential and/or danger.

Size Class - An alpha character used in documentation of wildland fire that represents a size of the fire area:

Class A	less than 0.25 acres
Class B	0.26 - 9 acres
Class C	10 - 99 acres
Class D	100 - 299 acres
Class E	300 - 999 acres
Class F	1,000 - 4,999 acres
Class G	over 4,999 acres

Slash - Debris left after logging, pruning, thinning, or brush cutting; also debris resulting from thinning, wind or fire. It may include logs, chunks, bark, branches, stumps, and broken understory trees or brush.

Smoke Management Program (SMP) - Establishes a basic framework of procedures and requirements for managing smoke from prescribed fire and fire use projects. The purposes of SMP's are to mitigate the nuisance and public safety hazards (e.g., on roadways and at airports) posed by smoke intrusions into populated areas; to avoid significant deterioration of air quality and potential NAAQS violations; and to mitigate visibility impacts in Class I Areas.

Smoldering - Behavior of a fire burning without flame and barely spreading.

Snag - A standing dead tree or part of a dead tree from which at least the leaves and smaller branches have fallen.

Spot Fire - Fire set outside the perimeter of the main fire by flying (or rolling) sparks or embers.

Spotting - Behavior of a fire producing sparks or embers that are carried by convection columns and/or the wind and which start new fires beyond the zone of direct ignition by the main fire.

Stability - A state of atmosphere in which the vertical distribution of temperature is such that an air particle will resist vertical displacement from its level (Stable air).

Stand Replacing Fire - Fire which kills all or most living overstory trees in a forest and initiates secondary succession or regrowth.

State Implementation Plan (SIP) - A Clean Air Act required document in which States adopt emission reduction measures necessary to attain and maintain National Ambient Air Quality Standards, and meet other requirements of the Act.

Subsidence - An extensive sinking motion of air in the atmosphere, most frequently occurring in polar highs. The subsiding air is warmed by compression and becomes more stable. Of particular importance due to the heating and drying of the air. It is often the cause of very rapid drying of fuel in the smaller size classes.

Suppression - A management action intended to protect identified values from a fire, extinguish a fire or alter a fire's direction of spread.

Surface Fire - A fire that burns surface litter, debris, and small vegetation.

Surface Fuel - All materials lying on, or immediately above, the ground, including needles or leaves, duff, grass, small dead wood, downed logs, stumps, large limbs, low brush and reproduction.

Temperature - A measure of the degree of hotness or coldness of a substance.

Timelag - An indication of the rate a dead fuel gains or loses moisture due to changes in its environment. The time necessary for a fuel particle to lose approximately 63 percent of the difference between its initial moisture content and its equilibrium moisture content.

Topography - The configuration of the earth's surface, including its relief and the position of its natural and manmade features.

Torching - Fire burning principally as a surface fire that intermittently ignites the crowns of trees or shrubs as it advances.

Visibility - The greatest distance that prominent objects can be seen and identified by unaided, normal eyes. (Usually expressed in miles, or fractions of a mile.)

Volatile Organic Compounds (VOC) - Any organic compound which participates in atmospheric photochemical reactions, which are measured by a referenced method, an equivalent method, or an alternative method. Some compounds are specifically listed as accepted due to their having negligible photochemical reactivity.

Weather - The short-term variations of the atmosphere in terms of temperature, pressure, wind, moisture, cloudiness, precipitation, and visibility.

Wet Line - A fire control line, usually temporary, prepared by treating the fuel with water and/or chemicals which will halt the spread of the fire.

Wildland - Uncultivated lands where development is essentially nonexistent except for transportation facilities, structures, and are widely scattered.

Wildland Fire Agreements - Agreements between agencies for wildland fire protection. Includes mutual aid agreements, cooperative fire protection agreements, direct protection agreements.

1. **Mutual Aid Agreement** - Written agreement between agencies and/or jurisdictions in which they agree to assist one another upon request, by furnishing personnel and equipment.
2. **Direct Protection Agreement** - Agreement with a single organization for attacking wildland fires and for directing suppression action.
3. **Cooperative Agreement** - Agreements between agencies that share wildland fire resources and costs related to incidents.

Wildland Fire - 1. An unplanned wildland fire requiring suppression actions, or other action according to policy, as contrasted with a management-ignited prescribed fire burning within prepared lines enclosing a designated area, under prescribed conditions. 2. A free burning wildland fire unaffected by fire suppression measures. 3. Any non-structure, free burning and unwanted fire, other than prescribed fire, that occurs in the wildland. The term “Wildfire” is being replaced by “Wildland Fire” within the Federal government lexicon.

Wildland Fire Management Plan - 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 procedures such as Preparedness Plans, Pre-planned Dispatch Plans, Prescribed Fire Plans, Hazard Fuel Reduction Plans, and Prevention Plans.

Wildland Fire Decision Support System (WFDSS) - A real time web-based decision making process that documents and evaluates alternative management strategies/objectives against selected safety, environmental, social, economical, political, and resource management objectives as selection criteria. Replaces the Wildland Fire Implementation Plan (WFIP) and Wildland Fire Situational Assessment (WFSA).

Wildland/Urban Interface (WUI) - The line, area, or zone where structures and other human development meet or intermingle with the wildland.

Wind - The horizontal movement of air relate to the surface of the earth.

Xeric - Relating to dry habitat.