Santa Fe County
Community Wildfire Protection Plan

SANTA FE COUNTY, NEW MEXICO
COMMUNITY WILDFIRE PROTECTION PLAN

Prepared for

SANTA FE COUNTY
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Santa Fe, New Mexico 87508

Prepared by

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SWCA Project No. 13540
May 2008

SFC CLERK RECORDED 06/24/2008

SANTA FE COUNTY

RESOLUTION NO. 2008-92

A RESOLUTION ADOPTING THE SANTA FE COMMUNITY WILDFIRE PROTECTION PLAN

WHEREAS, in recent months Santa Fe County has partnered with State and Federal agencies and local citizens to develop a collaborative Community Wildfire Protection Plan (CWPP); and

WHEREAS, the goal of a CWPP is to enable local communities to better work with government agencies to identify areas at high risk for wildfire and prioritize areas for mitigation, fire suppression, and emergency preparedness; and

WHEREAS, this CWPP is designed to confront the increasing threat of wildfire to communities and watersheds in and adjacent to Santa Fe County; and

WHEREAS, conditions contributing to an increased threat of fire have been identified and include drought, increased tree density, insect infestation, and encroachment of developed areas into forested areas; and

WHEREAS, the CWPP provides a current inventory of existing wildland conditions, as well as recommendations to abate catastrophic wildfires and minimize the impact of wildfire on local communities; and

WHEREAS, the recommendations in this plan are specific to the Wildland Urban Interface areas in Santa Fe County and are intended to be used as guidelines to reduce the loss of life and infrastructure; and

WHEREAS, the plan provides a framework for fuel reduction project implementation when federal, state, or local funding opportunities become available; and

WHEREAS, communities with an established CWPP will be given priority for funding of hazardous fuels reduction projects carried out in accordance with the Healthy Forest Restoration Act of 2003.

NOW THEREFORE, the Board of County Commissioners of Santa Fe County hereby resolves as follows:

SFC CLERK RECORDED 06/24/2008

1. The Santa Fe County Community Wildfire Protection Plan has been a collaborative effort to address the threat of wildfire in Santa Fe County and to provide recommendations to abate wildfires and minimize their impact on communities.
2. Adopts the 2008 Santa Fe County Community Wildfire Protection Plan.

APPROVED, ADOPTED AND PASSED this 10TH day of June, 2008.

BOARD OF COUNTY COMMISSIONERS

Jack Sullivan, Chair

Approved as to form:

Stephen C. Ross,
Santa Fe County Attorney

Attest:

Valerie Espinoza,
Santa Fe County Clerk

COUNTY OF SANTA FE)
STATE OF NEW MEXICO) ss

BCC RESOLUTIONS
PAGES: 2

I Hereby Certify That This Instrument Was Filed for Record On The 24TH Day Of June, A.D., 2008 at 11:26 And Was Duly Recorded as Instrument # 1530068 Of The Records Of Santa Fe County

Witness My Hand And Seal Of Office
Valerie Espinoza
County Clerk, Santa Fe, NM

Deputy

SWCA
ENVIRONMENTAL CONSULTANTS

The entities listed below participated in the development of and/or reviewed and are in support of the Santa Fe County Community Wildfire Protection Plan:

Santa Fe County Fire Marshal

6-10-08

Dave Sperling **Date**

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The entities listed below participated in the development of and/or reviewed and are in support of the Santa Fe County Community Wildfire Protection Plan:

EMNRD, Forestry Division
District Forester

Todd Haines 5/23/08

Todd Haines **Date**

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The entities listed below participated in the development of and/or reviewed and are in support of the Santa Fe County Community Wildfire Protection Plan:

Santa Fe National Forest
Forest Supervisor

Daniel Jiron **Date** April 29, 2008

SWCA
ENVIRONMENTAL CONSULTANTS

The entities listed below participated in the development of and/or reviewed and are in support of the Santa Fe County Community Wildfire Protection Plan:

Santa Fe / Pojoaque Soil and Water Conservation District

4/18/08
Date

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List of Acronyms

°F	degrees Fahrenheit
BAER	Burned Area Emergency Rehabilitation
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
BTU/ft/sec	British Thermal Units per linear foot, per second
CAR	Community at Risk
CBD	Canopy Bulk Density
CBH	Canopy Base Height
CC	Forest Canopy Cover
CFRP	Collaborative Forest Restoration Program
CH	Forest Canopy Height
Ch/hr	Chains per hour
CIG	Conservation Innovation Grants
CRP	Conservation Reserve Program
CVAR	Community Values at Risk
CWA	Clean Water Act
CWPP	Community Wildfire Protection Plan
CWSF	Council of Western State Forecasters
DHS	Department of Homeland Security
DOE	Department of Energy
EAS	Emergency Alert System
EMS	Emergency Management System
EPA	Environmental Protection Agency
ESRI	Environmental Systems Research Institute
FBFM	fire behavior fuel model
FEMA	Federal Emergency Management Agency
FP&S	Fire Prevention and Safety
FRCC	Fire Regime Condition Class
FRI	fire-return interval
FSA	Farm Service Agency
GAID	Geographic Area Interagency Division
GIS	geographic information system
HFRA	Healthy Forest Restoration Act
HIZ	Home Ignition Zone
IC	Incident Command
ICC	International Code Council
m	meter
m^2	square meters
m^2/ha	square meters/hectares
MFI	Mean Fire Interval
NEPA	National Environmental Policy Act
NFFL	National Forest Fire Laboratory
NFP	National Fire Plan
NIFC	National Interagency Fire Center

NMCC	New Mexico Climate Center
NMFPTF	New Mexico Fire Planning Task Force
NMNG	New Mexico Natural Gas
NMSF	New Mexico State Forestry Division
NPS	National Park Service
NRCS	Natural Resources Conservation Service
PERI	Public Entity Risk Institute
PNM	Public Service Company of New Mexico
PPE	personal protective equipment
RAW	Remote Automated Weather
SAF	Society of American Foresters
SAFER	Staffing for Adequate Fire and Emergency Response
SFC CWPP	Santa Fe County Community Wildfire Prevention Plan
SWCD	Soil and Water Conservation District
t/ac	tons per acre
ULI	Urban Land Institute
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFS	U.S. Forest Service
WFA	Wildland Fire Associates
WFU	wildland fire use
WRCC	Western Regional Climate Center
WUI	Wildland Urban Interface
WUIWT	Wildland Urban Interface Working Team

Executive Summary

The Santa Fe County Community Wildfire Protection Plan (SFC CWPP) addresses hazards and risks of wildland fire throughout Santa Fe County (County) and makes recommendations for fuels reduction projects, public outreach and education, structural ignitability reduction, and fire response capabilities. Some of the recommendations for this plan include more than 55 fuels reduction projects; public education and outreach directed at homeowners to homeowners to help them prepare for wildland fire through events like pre-planned triages; strategies for fire responders to improve their capabilities through improved communication, professional training, and equipment; and the reduction of structural ignitability by providing public education on defensible space.

The plan highlights the need for increased preventive activities to reduce the negative impacts that wildland fire can have on communities and community members living in the Wildland Urban Interface. Approximately 54 career and 250 volunteer firefighters respond to fires in the County, and the demand for their services often exceeds the amount of available resources. The limitations of fire responders in the County are addressed to heighten citizens' awareness of the risks associated with the fire environment and the need for homeowners to contribute to preparing for wildland fire events by taking actions on private property. Also, it identifies a need for the County to engage in planning for publicly managed resources. Strategies and policies created at the County level serve to protect and preserve county-managed resources and communities from wildfire and affect change on a larger-scale.

The purpose of the SFC CWPP is to assist in protecting human life and reducing property loss due to wildfire throughout the County. The plan is the result of a community-wide wildland fire protection planning process and the compilation of documents, reports, and data developed by a wide array of contributors. This plan was compiled in 2008 in response to the federal Healthy Forest Restoration Act (HFRA) of 2003.

The SFC CWPP meets the requirements of the HFRA by:

1. Having been developed collaboratively by multiple agencies at the state and local level in consultation with federal agencies and other interested parties.

2. Prioritizing and identifying fuel reduction treatments and recommending the types and methods of treatments to protect at-risk communities and pertinent infrastructure.

3. Suggesting multi-party mitigation, monitoring, and outreach.

4. Recommending measures and action items that residents and communities can take to reduce the ignitability of structures.

5. Facilitating public information meetings to educate and involve the community to participate in and contribute to the development of the SFC CWPP.

A group of multi-jurisdictional agencies (federal, state, and local), organizations, and residents joined together as a Core Team to develop this plan. After the Core Team was assembled, public meetings were held to obtain vital information from stakeholders and homeowners in the County

regarding wildfire protection, community concerns, and opinions about the draft SFC CWPP. The public outreach process is critical to the SFC CWPP's effectiveness and community concerns and comments have been considered and addressed within.

The SFC CWPP provides background information, a risk assessment, and recommendations. Section 1 provides a general overview of Community Wildfire Protection Plans (CWPPs) and describes the County's need for a plan; Section 2 provides demographic and background information about the County; Section 3 presents an overview of the fire environment and specific information about the fuel types; Section 4 describes in detail the methodology and results of the risk assessment; and Section 5 provides recommendations that incorporate action plans and monitoring strategies for implementing fuels reduction projects, reducing structural ignitability, improving fire response capabilities, and initiating public outreach and education. The plan does not require implementation of any of the recommendations. However, the message throughout this document is that the greatest fire mitigation could be achieved through the joint actions of individual homeowners and local, state and federal governments. It is important to stress that this document is an initial step in raising public awareness and treating areas of concern, and should serve as a tool in doing so. The SFC CWPP should be treated as a living document to be updated every year.

1.0 INTRODUCTION

1.1 OVERVIEW OF SANTA FE COUNTY'S COMMUNITY WILDFIRE PROTECTION PLAN

Federal, state, county, and local governments and citizens have joined together to confront the threat of wildfire to communities and watersheds in and adjacent to Santa Fe County (hereafter referred to as the County) by developing a collaborative Community Wildfire Protection Plan (CWPP). SWCA Environmental Consultants were contracted by the County to produce the CWPP. Considering the landscape and local community values, this CWPP provides an inventory of existing conditions, as well as recommendations to abate catastrophic wildfires and minimize their impacts on communities. Wildfires have become increasingly severe over the past decades, threatening life, habitat, and property. Conditions contributing to the increased severity of fire include drought, insect infestation, increased tree density, encroachment of developed areas into forested areas, and overall declining forest health.

Santa Fe County is characterized by a mix of shortgrass prairie, shrubsteppe, dryland forest, mixed conifer, and riparian ecotypes. The County is divided into two distinct regions with the northern portion containing steeper slopes, higher elevations, and more forested ecosystems, while the southern portion consists primarily of grassland and shrubland communities on rolling topography. Approximately 25% of the land in the project area is managed by the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS), and 60% is privately owned. Consequently, collaboration among federal agencies and community members is necessary to successfully reduce the risk of wildfire and protect natural and human values. Santa Fe County contains 68 defined communities, 8 historical towns, and 142,407 residents (U.S. Census Bureau 2006) within 6 fire districts, all of which could be impacted by wildland fire. The recommendations in this plan are specific to Wildland Urban Interface (WUI) areas and are intended to reduce the loss of life and infrastructure. The recommendations for public lands adjacent to communities have been collaboratively planned with land management agencies.

The Santa Fe County CWPP (hereafter referred to as the SFC CWPP) provides background information, a risk assessment, and recommendations. Section 1 provides an overview of CWPPs and describes the County's need for a plan; Section 2 provides demographic and background information about the County; Section 3 presents an overview of the fire environment and specific information about the fuel types; Section 4 describes in detail the methodology and results of the risk assessment; and Section 5 provides recommendations that incorporate action plans and monitoring strategies for implementing fuels reduction projects, reducing structural ignitability, improving fire response capabilities, and initiating public outreach and education. The plan does not require implementation of any of the recommendations. A limitation of CWPPs is that they do not have any jurisdictional power to execute actions or recommendations outlined therein. Projects recommended for federally managed land need to adhere to National Environmental Policy Action (NEPA) standards.

The message throughout this document is that the greatest fire mitigation could be achieved through the joint actions of individual homeowners and local, state and federal governments. It is important to stress that this document is an initial step in raising public awareness and treating areas of concern, and should serve as a tool in doing so. The recommendations provided in this

planning document may be used as guidelines for implementation if funding opportunities become available. The recommendations for fuels reduction projects are general in nature; site-specific planning that addresses location, access, land ownership, topography, soils, and fuels would need to be developed upon implementation. Each site has unique needs and conditions, and specific prescriptions are not included in this plan. Detailed plans need to be produced for all fuels reduction projects that would be implemented in the County. For projects that require a formal NEPA process, public hearings would be facilitated to provide an opportunity for public comment. At this time, community members who may be opposed to the projects would have the ability to voice their opinions.

1.2 OVERVIEW OF COMMUNITY WILDFIRE PROTECTION PLANS

The SFC CWPP has been developed to address wildfire threat to communities in and adjacent to the project area. The plan provides recommendations to abate catastrophic wildfires and minimize their impacts on these communities.

The summer of 2000, particularly Cerro Grande fire, demonstrated how devastating severe wildfires could be in New Mexico. The Cerro Grande fire was the largest wildfire in New Mexico's history, burning approximately 48,000 acres, 235 homes, and 39 structures at Los Alamos National Laboratory, and leaving almost 400 families without homes (Los Alamos County Reports 2000). The Cerro Grande fire occurred in Santa Fe's neighboring County, Los Alamos, which is approximately 35 miles from the City of Santa Fe.

In response to that landmark season, the National Fire Plan (NFP) was established to develop a collaborative approach among various governmental agencies to actively respond to severe wildland fires and ensure sufficient firefighting capacity for the future. The NFP was followed in 2001, by the Western Governors' Association publication entitled *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: A 10-year Comprehensive Strategy*, and was updated in 2002 to include the *Implementation Plan*. This plan was again updated in 2006 and, like the previous plan, focuses on using a collaborative framework for restoring fire-adapted ecosystems, reducing hazardous fuels, mitigating risks to communities, and providing economic benefits, as well as improving fire prevention and suppression strategies. However, the updated *Implementation Plan* also emphasizes the importance of information sharing and monitoring of accomplishments and forest conditions; a long-term commitment to maintaining the essential resources for implementation; a landscape-level vision for restoration of fire adapted ecosystems; using fire as a management tool; and continued improvements to collaboration efforts (Western Governors' Association 2006).

In response to widespread declining forest health, in 2003 the U.S. Congress passed and President Bush signed into law the Healthy Forest Restoration Act (HFRA) (Public Law 108-148). The HFRA expedites the development and implementation of hazardous fuels reduction projects on federal land and emphasizes the need for federal agencies to work collaboratively with communities. A key component of the HFRA is the development of CWPPs, which facilitates the collaboration between federal agencies and communities in order to develop hazardous fuels reduction projects and place priority on treatment areas identified by communities. A CWPP also allows communities to establish their own definition of the WUI. In addition, communities with an established CWPP will be given priority for funding of hazardous fuels reduction projects carried out in accordance with the HFRA.

Although the HFRA and the specific guidelines are relatively new, the principles behind the CWPP program are not. The National and State Fire Plans, the Western Governors' 10-Year Comprehensive Strategy, and the Federal Emergency Management Agency Disaster Mitigation Act of 2000 all mandate community-based planning efforts with full stakeholder participation, coordination, project identification, prioritization, funding review, and multi-agency cooperation.

The New Mexico State Forestry Division (NMSF) has statutory responsibilities for cooperation with federal, state, and local agencies in the development of systems and methods for the prevention, control, and suppression of wildland fire and use of prescribed fires on rural lands and within rural communities on all non-federal and non-municipal lands in the state (NMSA 1978, Section 68-2-8). Therefore, the NMSF is involved in the CWPP planning process. The New Mexico Fire Planning Task Force (NMFPTF) was created in 2003 by New Mexico legislature to identify the WUI areas (Communities at Risk [CARs]) in the state that were most vulnerable to wildland fire danger. The NMFPTF updates its list of CARs annually and reviews completed CWPPs and approves those that are compliant with the HFRA. The *2007 Communities at Risk Plan* identified 300 CARs, surpassing the previous year's estimate of 234 CARs. CARs identified in the annual plan are also updated federally from the January 2001 Federal Register listing for CARs (NMSF 2007).

New Mexico CWPPs are a mix of county- and city-level plans with some CARs represented in more than one plan (Council of Western State Foresters [CWSF] 2006). The NMFPTF has adopted the International Code Council (ICC) WUI Code (NMSF 2007).

The risk assessment, an important part of a CWPP, has two components. The first involves individual community hazard and risk assessments that identify hazards that could put each community at risk in the event of a wildland fire. The second uses geographic information systems (GIS) and fire behavior modeling to identify areas that are at the greatest risk in the event of a wildland fire; this model is described here as a Composite Hazard/Risk Assessment and is discussed in detail in Section 4. Maps of the individual components of the risk assessment are used for visualizing the steps used in the model. Presenting the modeling components separately also allows the reader to see how the comprehensive model is created.

Implementation of recommendations for fuels treatment areas and public education and awareness is not required. However, if funding becomes available, the recommendations may be used as guidelines for the implementation process. The monitoring and assessment strategies for the SFC CWPP are addressed in Section 5.

1.3 GUIDING DOCUMENT FOR THE CWPP PLANNING PROCESS

In February 2001, the Santa Fe County Wildland Urban Interface Area Inventory Assessment (hereafter referred to as 2001 WUI Assessment) was completed for Santa Fe County; this document is used to guide the CWPP (Lightfoot et al. 2001). The Santa Fe County Fire Department identified 43 areas of WUI within the County. Each of the 43 identified areas have been visited, assessed, and assigned a hazard rating based on fuels conditions, access, building materials, quality of defensible space, water availability, terrain, proximity to the nearest fire department, extent of the area, housing density and potential for increase, and special hazards.

The assessment includes legal descriptions and explanations of all the rating factors for each individual area.

Of the 43 areas reviewed and assigned a hazard rating, 14 were rated as Moderate and accounted for 30,060 acres, 20 were rated as High and accounted for 35,600 acres, 8 were rated as Very High and accounted for 32,130 acres, and 1 area was rated as Extreme and accounted for 2,650 acres. The total acreage assessed for the WUI areas totaled 100,440 acres. The Santa Fe Watershed, which accounts for 17,520 acres and provides approximately 40% of the city of Santa Fe's water supply, was also included within the WUI. This critical water supply is threatened by wildland fire as the watershed is densely overpopulated with ponderosa pine, white fir, and douglas fir. A stand replacing fire in the watershed could have some of the following impacts: heavy flooding in Santa Fe; movement of soil, mud, and woody debris into the canyon bottom and reservoirs; damage to or loss of homes, habitats, and drinking water supply; spread of fire into residential and developed recreation areas; smoke infiltration into urban areas; and health problems. Wildfire would denude the slopes of vegetation, therefore creating conditions for sedimentation and erosion to fill the reservoirs, which would compromise the long- and short-term water supply of the city of Santa Fe (Steelman and Kunkel 2003).

1.4 GOAL OF CWPP

The goal of a CWPP is to enable local communities to improve their wildfire mitigation capacity while working with government agencies to identify areas at high risk for fire and prioritize areas for mitigation, fire suppression, and emergency preparedness. The minimum requirements for a CWPP, as stated in the HFRA, are as follows:

1. **Collaboration:** Local and state government representatives, in consultation with federal agencies or other interested groups, must collaboratively develop a CWPP (Society of American Foresters [SAF] 2004).
2. **Prioritized Fuel Reduction:** A CWPP must identify and prioritize areas for hazardous fuels reduction and treatments and recommend the types and methods of treatment that will protect one or more at-risk communities and their essential infrastructure (SAF 2004).
3. **Treatments of Structural Ignitability:** A CWPP must recommend measures that communities and homeowners can take to reduce the ignitability of structures throughout the area addressed by the plan (SAF 2004).

The SFC CWPP addresses all the completion requirements outlined in the HFRA, paying special attention to the desires and needs of the communities and multiple jurisdictions throughout the planning area.

1.5 PLANNING PROCESS

A CWPP requires a multi-party collaborative planning process. Representatives from various government agencies, along with members of fire departments and local communities, formed a Core Team (please see Section 1.6) and participated in decision-making activities that led to the

development of the SFC CWPP. Stakeholder involvement was important in producing a meaningful document that included all collaborators' diverse perspectives.

The Core Team discussed the importance of community involvement in the planning process and how it would be beneficial to have community members participate in various aspects of planning, particularly in designing community evacuation plans and fuels reduction plans. The SFC CWPP serves all of the communities in the County, including all tribal lands, and is designed to provide a model for other communities to use and contribute to. As communities design site-specific recommendations or plans, these sections should be inserted into the SFC CWPP. A CWPP is a living document and should be updated every year to reflect changes in community planning and the fire environment, as well as incorporate other local plans into the appendix. Also, the SFC CWPP can be used to observe and record how the levels of risk associated with communities that are recognized as Firewise (by meeting Firewise Communities/USA program standards) change or do not change.

The SAF (2004), in collaboration with the National Association of Counties, the National Association of State Foresters, the Western Governors' Association, and the Communities Committee developed a guide entitled "Preparing a Community Wildfire Protection Plan: A Handbook for Wildland–Urban Interface Communities" to provide communities with a clear process to use in developing a CWPP. The guide, which is available online at http://www.safnet.org/policyandpress/cwpphandbook.pdf, outlines eight steps for developing a CWPP and has been followed in preparing the SFC CWPP. The eight recommended steps include the following:

Step One: Convene Decision Makers: Form a Core Team consisting of representatives from the appropriate local governments, local fire authorities, and state agencies responsible for forest management.

Step Two: Involve Federal Agencies: Identify and engage local representatives of the USFS and the BLM. Contact and involve other land management agencies as appropriate.

Step Three: Engage Interested Parties: Contact and encourage active involvement in plan development from a broad range of interested organizations and stakeholders.

Step Four: Establish a Community Base Map(s): Work with partners to establish a baseline map (or maps) defining the community's WUI and illustrating inhabited areas at risk, forested areas that contain critical human infrastructure, and forest areas at risk for large-scale fire disturbance. (County base maps are provided in Appendix A of this document.)

Step Five: Develop a Community Risk Assessment: Work with partners to develop a community risk assessment that considers fuel hazards; risk of wildfire occurrence; homes, businesses, and essential infrastructure at risk; other community values at risk; and local preparedness. Rate the level of risk for each factor and incorporate this information into the base map(s) as appropriate.

Step Six: Establish Community Priorities and Recommendations: Use the base map(s) and community risk assessment to facilitate a collaborative community discussion that leads to identifying local priorities for fuels treatment, reducing structural ignitability, and other issues of interest, such as improving fire response capability. Clearly indicate whether priority projects are

directly related to protection of communities and essential infrastructure or to reducing wildfire risks to other community values.

Step Seven: Develop an Action Plan and Assessment Strategy: Consider developing a detailed implementation strategy to accompany the CWPP, as well as a monitoring plan that will ensure its long-term success.

Step Eight: Finalize Community Wildfire Protection Plan: Finalize the CWPP and communicate the results to the community and key partners.

1.6 CORE TEAM

The first task in the planning process is to bring together a broad group of stakeholders representing both agency and private interests to form a Core Team. The Core Team for the SFC CWPP includes approximately 15 to 20 people representing various agencies and levels of government, including Santa Fe County Fire Department, City of Santa Fe Fire Department, NMSF, Forest Guild, Edgewood Soil and Water Conservation District (SWCD), Santa Fe/Pojoaque SWCD, USFS Espanola Ranger District, USFS Santa Fe Ranger District, USFS Pecos Ranger District, Santa Fe County Open Space and Trails, New Mexico Environment Department, and Santa Fe City/County Emergency Management. Core team contact information can be found Appendix B. The first Core Team meeting was held on October 26, 2007, and the final meeting was held on April 17, 2008. Over the course of the project's schedule, from October 2007 until June 2008, the Core Team met four times.

1.7 PROJECT AREA

The project area includes all of Santa Fe County as delineated by its geographic and political boundaries (see Figure 1.1). The project area is in north-central New Mexico and encompasses a diverse range of topography and communities. Within the project area, land ownership is predominantly private, with some federally-managed and tribal lands (see Section 2.1).

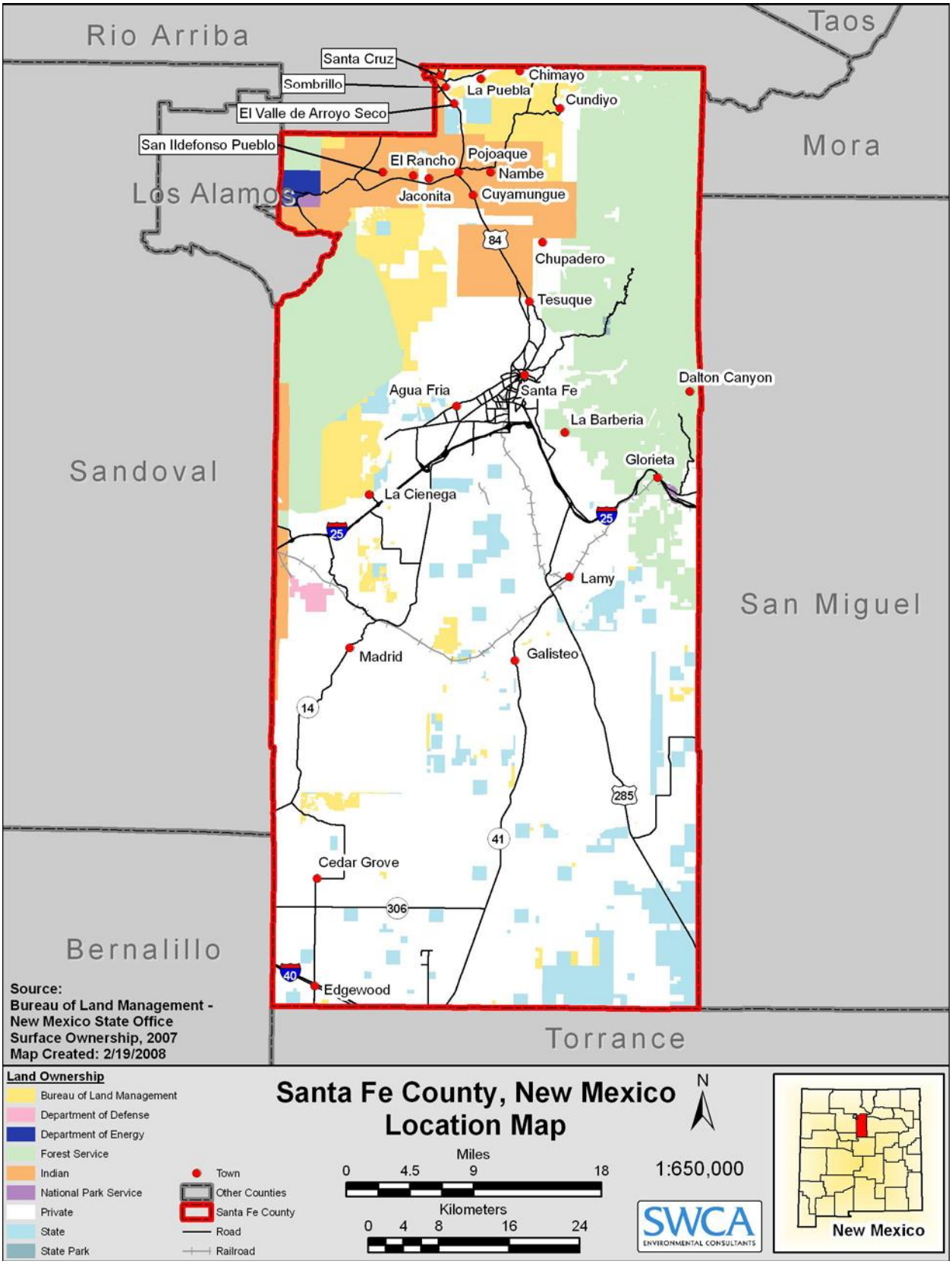

Figure 1.1. Project location map.

1.8 PUBLIC INVOLVEMENT

A key element in the CWPP process is the meaningful discussions it generates among community members regarding their priorities for local fire protection and forest management (SAF 2004). The public involvement process included two rounds of public meetings. In each round, four public meetings were hosted in the north, south, east, and west geographic regions of the County.

The meetings were announced using a variety of media, including newspapers, email communication, and flyers posted in commonly visited public places, such as bulletin boards. Press releases, an article in the *Santa Fe New Mexican* about the CWPP, and community calendars advertising the public meetings were published in local newspapers. Homeowner associations and other local organizations were contacted via distribution lists provided by the Santa Fe District Forest Service.

At the first round of public meetings, each meeting started with an open house period during which members of the public were invited to respond to surveys and informally discuss the plan. Next, a PowerPoint presentation outlined the goals and objectives of the SFC CWPP and provided details of the steps involved in the planning process. A facilitated discussion about values at risk and community needs generated a rich discussion. Educational information on defensible space was provided, maps were posted, and public comments were noted. Some addressed comments involved the need for more direct assistance for communities; pueblo and tribe collaboration; fuels reduction in critical riparian corridors; new development and expansion of WUI areas when planning; and watershed protection, particularly in watersheds that provide municipal water supply. A more complete list of comments from the surveys is provided in Appendix C.

A second round of public meetings was hosted after the draft CWPP was completed. These meetings were designed to provide an overview of the draft document and an opportunity for the public to share feedback on the plan. The facilitated discussions focused on recommendations for implementing fuels reduction, enhancing public outreach and education, reducing structural ignitability, and improving fire response capabilities stated in the plan.

At the public meetings, a group of community members provided comments stating why they do not support the plan. They are particularly concerned with the threat of clear cutting and would like to see greater retention of old growth trees during fuels reduction projects. These comments were listened to and discussed at the public meetings. Written comments provided by this group are available in Appendix C.

The Core Team has collaboratively and thoroughly discussed all components of the plan, including public opposition, and recommends various methods of thinning to reduce hazardous fuels. The Core Team does not agree with many of the comments provided by the community group opposed to the plan addressing fuels reduction, particularly because no recommendations for clear cutting are presented in this document. The Core Team does support the retention of old growth trees unless they pose a hazard to communities. The majority of the treatments recommended in this plan focus on the removal of small diameter trees and ladder fuels that contribute to crown fire risk. The majority of the comments received by community members at

public meetings were in support of the plan, particularly in regards to reducing the threat of wildfire in the WUI, where lives and property are at the greatest risk. The fuels reduction projects are primarily located in WUI areas. Recommendations for fuels reduction addressed in Section 5 remain unchanged. Additionally, the Core Team is required by the HFRA to make recommendations for hazardous fuels reduction and structural ignitability in the CWPP.

2.0 SANTA FE COUNTY BACKGROUND

2.1 LOCATION AND GEOGRAPHY

Santa Fe County is 1,910 square miles and is bordered by seven New Mexico counties: Rio Arriba to the north, Sandoval and Los Alamos to the west, Bernalillo at the southwest corner, Torrance to the south, and San Miguel and Mora to the east. Santa Fe County is between the Rio Grande to the west in Sandoval County and the Pecos River to the east in San Miguel County. The main transportation corridors include Interstate 25, which bisects the County at the city of Santa Fe, and Interstate 40, which runs east-west along the southern portion of the County. Other local transportation corridors include U.S. Route 285/84, which runs north-south through the southeast corner of the project area; New Mexico State Routes 14 and 41, which run north-south at the southwest and southern portions of the project area; and New Mexico State Routes 4, 502, 30, 74, 76, 399, and 68 in the northern section of the project area. Access to other County lands consists of narrow, winding roads, including maintained two-lane roads, some one-lane gravel roads, several 4 × 4 dirt roads, and multiple dead-end roads (Santa Fe County 2006).

Santa Fe County is primarily composed of privately owned lands. Other landowners include the USFS, the New Mexico State Land Office, the BLM, Department of Energy (DOE), U.S. Department of Defense, and the National Park Service (NPS), as well as private entities. The USFS manages the Santa Fe Watershed portion within the CWPP project area (Table 2.1).

Table 2.1. Breakdown of Land Ownership in Santa Fe County

Land Ownership	Square Miles	Percentage of the County
Private	1,141	59.73%
U.S. Forest Service	384	20.09%
Tribal Land	145	7.59%
State	119	6.22%
Bureau of Land Management	109	5.72%
Department of Energy	6	0.32%
Department of Defense	4	0.23%
National Park Service	2	0.10%

Santa Fe County contains two mountain ranges. The Ortiz Mountains are located in the southwest corner of the County, bordering the intersection of Sandoval and Bernalillo counties. The Sangre de Cristo Mountains, Spanish for "the blood of Christ", are the southernmost subrange of the Rocky Mountains, and extend into the northeastern portion of New Mexico and into Santa Fe County. The highest peak in this range within Santa Fe County is Santa Fe Baldy, standing at 12,622 feet and located in the Pecos Wilderness (Sangres 2007). The Pecos wilderness is within the Santa Fe National Forest, comprising 1.6 million acres (USFS 2007). The topography of Santa Fe County is discussed further below.

2.2 CLIMATE

Differences in topographical characteristics throughout the state of New Mexico and Santa Fe County contribute to the divergent climatic regimes within the planning area. The state generally

has a mild, arid to semiarid, continental climate characterized by abundant sunshine, light total precipitation, low relative humidity, and relatively large annual and diurnal temperature ranges. Across the state, the annual average number of hours of sunshine ranges from nearly 3,700 hours in the southwestern portions of the state to 2,800 hours in the north-central portions (New Mexico Climate Center [NMCC] 2008).

July is generally the warmest month of the year in New Mexico, with average monthly maximum temperatures ranging from 90 degrees Fahrenheit (ºF) at lower elevations to 75ºF to 80ºF at higher elevations. January is the coldest month, with average daytime temperatures ranging from 43ºF to 47ºF. Mean annual temperatures do not vary significantly across Santa Fe County, and from lower to higher elevations, mean annual temperatures only range from approximately 49ºF to 51ºF. Within the County, maximum mean annual temperatures range from 64.8ºF in the city of Santa Fe to 67.6ºF in Turquoise. Minimum annual temperatures range from 33.6ºF in Stanley to 36.1ºF in Santa Fe (Table 2.2) (Western Regional Climate Center [WRCC] 2008). Within the entire state, the freeze-free season ranges from more than 200 days in the southern valleys to fewer than 80 days in the northern mountains, where some high mountain valleys have freezes in the summer months (NMCC 2008).

Table 2.2. Mean Annual Temperature and Precipitation by Station in Santa Fe County

		Mean Annual Temperature (°F)		Annual Precipitation (inches)				
Station	**Elevation (feet)**	**Max**	**Min**	**Mean Annual**	**Max**	**Min**	**Mean Snowfall**	**Period of Record**
Glorieta	7,520	Insufficient Data	Insufficient Data	15.67	22.86	8.73	30.50	1915 - 2007
Santa Fe	6,720	64.80	36.10	13.81	20.09	7.23	19.10	1972 - 2007
Golden	6,700	Insufficient Data	Insufficient Data	14.11	23.44	4.07	23.00	1948 - 2007
Stanley	6,380	65.80	33.60	12.16	22.43	4.65	18.20	1914 - 2007
Turquoise	6,200	67.60	35.00	12.77	22.21	4.54	22.90	1954 - 1996

Source: WRCC 2008.

Throughout the entire state of New Mexico, average annual precipitation ranges from less than 10 inches over much of the southern desert and the Rio Grande and San Juan valleys to greater than 20 inches in the higher elevations. The mean annual precipitation within the County is typically light and ranges from as low as 14.11 inches in the town of Golden to 15.67 inches in Glorieta. The maximum annual rainfall within the planning area has been recorded as high as 23.44 inches in 1986 in Golden. Golden also had the lowest minimum average annual precipitation at 4.07 inches in 1956 (Table 2.2) (WRCC 2008). July and August mark the onset of the region's monsoonal weather patterns and are typically the hottest and wettest months of the year, accounting for 30% to 40% of the state's annual precipitation (Figure 2.1 and Figure 2.2) (NMCC 2008). These seasonal rains almost entirely take place as frequent and brief intense thunderstorms. The moisture associated with these storms originates in the Gulf of Mexico. These storms also generate intense lightning activity, which may result in multiple fire ignitions from one storm across a fire management district.

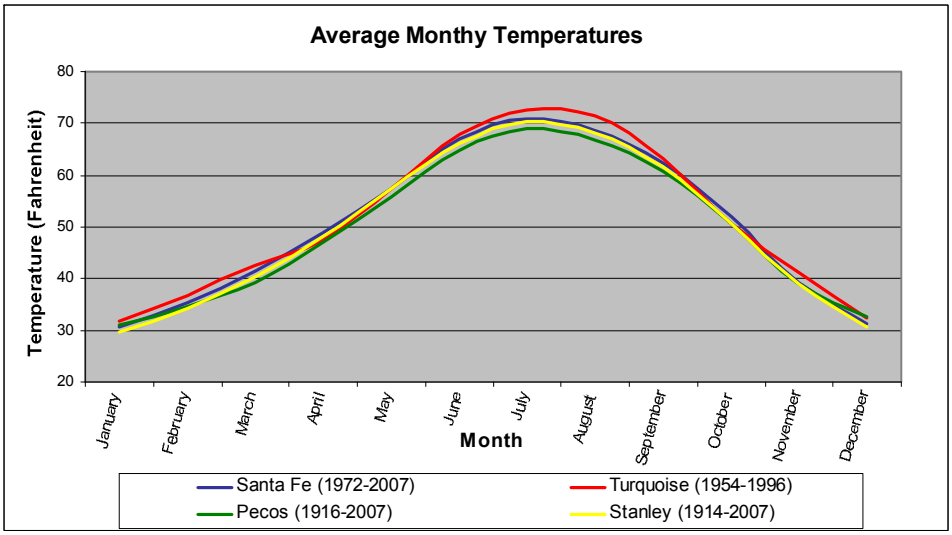

Figure 2.1. Average total monthly temperatures for each weather station's period of record (WRCC 2008).

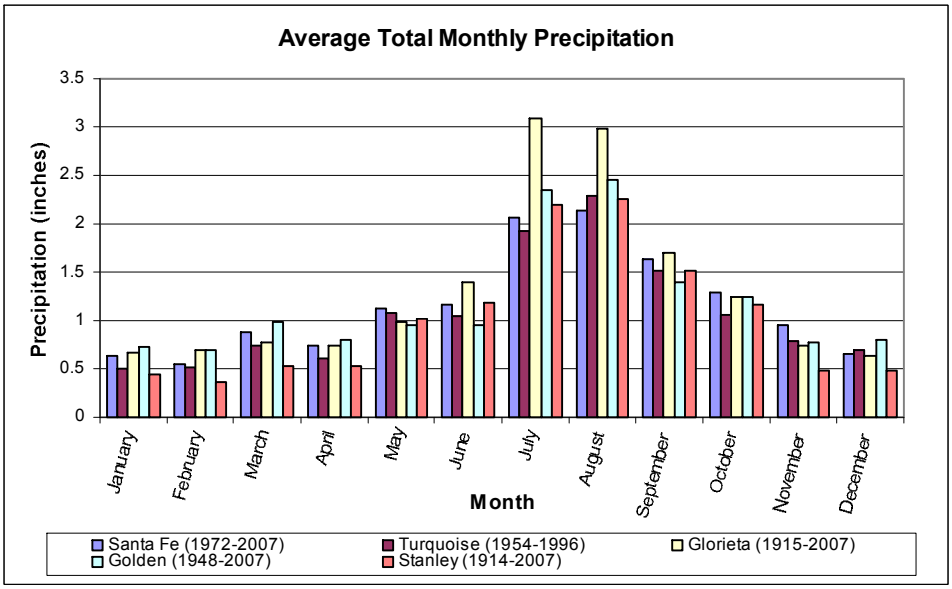

Figure 2.2. Average total monthly precipitation for each weather station's period of record (WRCC 2008).

Winter is the driest season in New Mexico, when precipitation is primarily a result of frontal activity associated with Pacific Ocean storms that move across the country from west to east. Much of this precipitation falls as snow in mountain areas. Wind speeds across New Mexico are usually moderate. However, relatively strong and unpredictable winds can accompany frontal activity during the late winter and spring. Wind direction is typically from the southwest (NMCC 2008).

Overall climate regimes in the state typically consist of cyclical drought/wet year patterns that are driven by El Niño-Southern Oscillation. Landscape scale drought and above-average precipitation have historically occurred at irregular intervals in the past as documented by tree-ring and other data with varying degrees of intensity (Swetnam and Betancourt 1998). Severe and prolonged droughts on record have occurred once every century on average (Gray et al. 2003).

2.3 VEGETATION

2.3.1 INTRODUCTION

Vegetation zones within Santa Fe County are primarily a function of elevation, slope, aspect, substrate, and associated climatic regimes. Since a broad range in elevation and topography exists across the County, characteristics in vegetative communities are quite variable from site to site.

Dominant vegetation types within the County are described based on a large spatial scale and represent the overall community structure that will play a general role in fire occurrence and behavior. Although the vegetation types are outlined and described for the entire County in this plan, site-specific evaluations of the vegetative composition and structure in each area of focus should be taken into consideration when planning fuels treatments.

The major vegetation types in Santa Fe County are listed below (Table 2.3) and are described in more detail using the NatureServe United States Ecological Systems categories (NatureServe 2007). Other types of land cover (e.g., agricultural and developed) also exist in a very small percentage of the County and are not described in more detail as they do not play a significant role in fire behavior.

Table 2.3. Percentage of Major Vegetation Types within Santa Fe County

Existing Vegetation Type	Acres	Percent
Overall Grassland Communities	*671,907*	*48%*
Western Great Plains Shortgrass Prairie	292,290	21%
Inter-mountain Basins Semi-desert Grassland	152,450	11%
Southern Rocky Mountain Juniper Woodland and Savanna	145,263	10%
Western Great Plains Foothill and Piedmont Grassland	23,292	2%
Inter-mountain Basins Montane Sagebrush Steppe	23,070	2%
Inter-mountain Basins Semi-desert Shrub-steppe	21,731	1%
Other Miscellaneous Grassland Types	13,811	1%
Overall Forested Communities	*625,845*	*46%*
Southern Rocky Mountain Piñon-juniper Woodland	409,101	29%
Southern Rocky Mountain Ponderosa Pine Woodland	102,485	8%
Rocky Mountain Dry-mesic and Mesic Montane Mixed Conifer Forest and Woodland	94,045	7%
Rocky Mountain Aspen Forest and Woodland	10,324	1%
Other Miscellaneous Forested Types	9,890	1%
Riparian Woodlands and Wetlands	*21,952*	*2%*
Other Types	*25,892*	*4%*

Source: (NatureServe 2007).

2.3.2 GRASSLAND COMMUNITIES

The majority of the vegetation in Santa Fe County consists primarily of grassland and evergreen forest communities. Grasslands within the County are composed almost entirely of shortgrass prairie, but also include areas of sagebrush steppe or juniper savanna type ecosystems. Graminoid species that are typical within grassland communities throughout the County include blue grama (*Bouteloua gracilis*) as the dominant graminoid mixed with a variety of different species that vary from site to site. Other associated graminoid species may include three-awn (*Aristida* spp.), needle and thread grass (*Hesperostipa comata*), prairie Junegrass (*Koeleria macrantha*), western wheatgrass (*Pascopyrum smithii*), James's galleta (*Pleuraphis jamesii*), sand dropseed (*Sporobolus* spp.), muhly grass (*Muhlenbergia* spp.), Indian ricegrass (*Achnatherum hymenoides*), fescue (*Festuca* spp.), and bluegrass (*Poa* spp.).

In some grasslands where shrubs or dwarf-shrubs are present, sand sagebrush (*Artemisia filifolia*), big sagebrush (*A. tridentata*), prairie sagewort (*A. frigida*), four-wing saltbrush (*Atriplex canescens*), spreading buckwheat (*Eriogonum effusum*), broom snakeweed (*Gutierrezia sarothrae*), winterfat (*Krascheninnikovia lanata*), and prickly pear (*Opuntia* spp.) may be present. Juniper savannas are best represented just below the lower elevational range of ponderosa pine (*Pinus ponderosa*) forests and contain widely spaced, mature, juniper trees (*Juniperus scopulorum* or *J. monosperma*) and occasionally piñon pine (*P. edulis*).

2.3.3 FORESTED COMMUNITIES

The most common forested community consists of piñon-juniper woodlands. This ecological system occurs on dry mountains and plateaus of north-central New Mexico and is represented in the elevational region between ponderosa pine and grassland communities. Piñon-pine and/or one-seed juniper (*J. monosperma*) dominate the tree canopy; however, Rocky Mountain juniper (*J. scopulorum*) may co-dominate or replace one-seed juniper in higher elevations. Understory layers are variable and may be dominated by shrubs or graminoids, or may be absent. Associated understory species may include blue grama, James's galleta, Arizona fescue (*F. arizonica*), Bigelow sage (*A. biglovii*), mountain mahogany (*Cercocarpus montanus*), and Gambel oak (*Quercus gambelii*).

Ponderosa pine forests exist in mountainous areas on all slopes and aspects within the County above an elevation of approximately 9,000 feet where the transition from piñon-juniper woodlands to ponderosa pine communities typically takes place. Ponderosa pine is the predominant conifer in these forests; however, Douglas-fir (*Pseudotsuga menziesii*), piñon pine, and Rocky Mountain juniper may also be present in the sub-canopy. The understory of this community is usually shrubby and includes species such as big sagebrush, mountain mahogany, wild rose (*Rosa* spp.), Gambel oak, and snowberry (*Symphoricarpos* sp.). Common graminoids are similar to those of other communities in the County including needle and thread grass, fescue, muhly, and grama species.

Mixed conifer forests also exist in the more mesic, higher elevations of the County above ponderosa pine and consist primarily of Douglas-fir, white fir (*Abies concolor*), and Engelmann spruce (*Picea engelmannii*); however, ponderosa pine may also be present in some areas. Associated understory species may include kinnikinnik, (*Arctostaphylos uvi-ursi*), creeping

barberry (*Mahonia repens*), Oregon boxleaf (*Pachystima myrsinites*), snowberry, fivepetal cliffbush (*Jamesia americana*), Gambel oak, and Rocky Mountain maple (*Acer glabrum*). Herbaceous species include sedge species (*Carex* spp.), muhly grass, Arizona fescue, strawberry (*Fragaria* sp.), and meadow rue (*Thalictrum* sp.).

A small amount of aspen (*Populus tremuloides*) woodlands exist in the County, but are not well represented. These deciduous forests are dominated by aspen, but may have some shade-tolerant coniferous species such as white fir and spruce developing in the understory in older stands. The understory may consist of shrub and herbaceous layers or may only have a simple herbaceous layer. Understory species may consist of snowberry, serviceberry *(Amelanchier spp.)*, kinnikinnick, and thimbleberry (*Rubus parviflorus*). This community type is typically created and maintained by stand-replacing disturbances, including fire.

2.3.4 Riparian Woodland Communities

Riparian woodlands exist in the County along the flood zones of river corridors and surrounding lakes. This vegetation type exists in a very small percentage of the County and consists primarily of cottonwood (*Populus* spp.), willow (*Salix* spp.), and a variety of other riparian species.

2.3.5 Other Types

Other types of land cover include a very small percentage of shrub communities, sparsely vegetated or barren areas, altered or disturbed areas, agricultural land, and developed areas.

2.4 Topography

The SFC CWPP project area rises from the point at which Interstate 25 crosses from Sandoval County in the west (at 5,436 feet) to the summit of Santa Fe Baldy to the northeast. The Sangre de Cristo Mountains were formed 27 million years ago when major fault lines running through the range pushed the bedrock skyward (Sangres 2007). Despite the dramatic elevations of Santa Fe County, the majority of the land area is relatively flat. The southern portion of the County exhibits only small hills and large spans of high desert plains (Santa Fe County 2006).

Although much of the County is relatively flat, the topography varies greatly throughout the CWPP project area. The percent of slope is an important factor in determining the types of treatments that should be implemented.

2.5 Population

The following information is drawn primarily from U.S. census data (U.S. Census Bureau 2006). In 2006, the population estimate of Santa Fe County was 142,407 persons, an increase of 10.1% over the 2000 census numbers of 129,292. In 1990, the population was at 98,928 and was only 53,756 in 1970. An estimated 53,277 households and 33,756 families were documented in 1990. The median income for households in 2006 was estimated at $50,437, and the median income for families was estimated at $61,355.

In 2006, 66% of the population was between 18 and 64 years old, nearly 62% of the population had been to college, and more than 43% of the total population had attained a college degree.

The percentage of families whose 2006 income was below the poverty level was 5.8%. This figure is much lower than either the 11.5% of neighboring Bernalillo County families or the 13.8% of New Mexico families who live below the poverty line.

The Social Capacity Index is another method of determining risk associated with wildfire based on socio-economic data, such as income, health conditions, age, serviceability from fire departments, and other factors. Forest Guild, a non-profit organization of field foresters and land stewards, provided a Social Capacity Index (Appendix D) based on communities' capacity to respond to and prevent wildfire.

2.6 CAPITAL CITY

After initial explorations, the Spanish established a permanent settlement in New Mexico in 1598, with a capital near Ohkay Owingeh Pueblo. Between 1609 and 1610, the capital shifted from this area to the depopulated but well-watered upper Santa Fe River, where it remains today. As time passed, much of the area was parceled into grants, confining pueblo land use and opening lands to Spanish colonists (Post 2001). San Gabriel served as the capital of New Mexico until the new villa of Santa Fe was established; the seat of government moved there in 1610 (Secretary of the State 2006). Established in 1952, Santa Fe was one of the nine original counties of New Mexico.

2.7 FIREFIGHTING CAPABILITY

Santa Fe County has approximately 54 career and 250 volunteer firefighters, which means there is approximately one fire fighter for every 560 square smiles in the County. Volunteer firefighters provide service throughout the County; however the demand for their services is heightened in rural or outlying areas, not only due to the limited number of career firefighters, but also because the career firefighters are based in the city of Santa Fe. Volunteers often have full-time jobs and need additional travel time to respond to fires, as they must first travel from an unspecified location to the fire station and then to a fire. Generally, approximately half of the volunteers are available to respond to fires when they occur. No reserve capacity of firefighters or equipment is available. Due to the limited number of resources, it would not be possible for the firefighters in the County to respond to two large-scale events simultaneously.

It is important that homeowners understand the limitations of fire responders in the County and the condition of the surrounding ecosystem. Homeowners need to be aware that many forested areas are in an unnaturally dense condition, due to decades of fire suppression. Trees are also weakened by climatic conditions and insect infestation. When building homes in proximity to forests, homeowners need to understand the risks associated with this choice. Fires occuring in these areas exhibit an increased risk of loss of life and property. Wildfires have the potential to become crown fires due to thick understory fuels, which act like ladders and allow surface fires to climb or transform into crown fires. Crown fires are very difficult to suppress and burn much hotter than surface fires.

In the event of a large fire, such as crown fire, and 100 or 200 homes are burning at the same time, the County would be able to provide services to respond to a maximum of two structures at a time. Fire responders choose to respond to the structures that will put them at the least risk.

Since fire responders will not be able to respond to every home that catches fire, it is imperative that homeowners are aware of the risks associated with wildfire and the actions they can take to reduce the risk. Section 5 and the Homeowner's Guide in Appendix E outline many actions that homeowners can take to help protect themselves from wildfire.

Risks are also increased when homes are located far from fire suppression resources and when only one ingress and egress route is available. Road conditions contribute to the level of risk due to the level of difficulty presented to fire responders trying to enter an area, particularly when residents are late to evacuate the scene and inadvertently obstruct oncoming fire responders. Fire departments often bring their own water supply, and travel to a fire becomes more difficult when grade and surface road conditions present challenges or when turnarounds are not large enough to turn a vehicle.

Santa Fe County could benefit from collaborative planning between the land use division and the fire departments to plan for appropriate locations to grant building permits and allow new construction, while considering fire response capabilities. Suppression efforts are much more difficult, or near impossible, when structures are located in areas that are inaccessible or in terrain that is conducive to rapid rates of fire spread, such as steep slopes.

For more information on the County's response capabilities, please see Appendix F which provides a detailed list of firefighting resources for the fire departments in Santa Fe County and a summary of emergency operation protocols. Additionally, the County produced an Emergency Operations Plan in April 2007, which included an Evacuation Plan as an annex. The County also has an E911 system.

3.0 FIRE ENVIRONMENT

3.1 WILDLAND URBAN INTERFACE

The WUI is comprised of both interface and intermix communities and is defined as areas where human habitation and development meet or intermix with wildland fuels (U.S. Department of Agriculture [USDA] and U.S. Department of Interior [USDI] 2001:752–753). Interface areas include housing developments that meet or are in the vicinity of continuous vegetation and consist of less than 50% vegetation. Intermix areas are those areas where structures are scattered throughout a wildland area of greater than 50% continuous vegetation and fuels and must meet or exceed a minimum of one house per 40 acres. Depending on the surrounding fuels conditions, topography, and present structures, wildland areas up to 1.5 miles from structures may be included in the WUI (Stewart et al. 2007).

The WUI creates an environment in which fire can move readily between structural and vegetative fuels, increasing the potential for wildland fire ignitions and the corresponding potential loss of life and property. Human encroachment into wildland ecosystems within recent decades is increasing the extent of the WUI and, therefore, is significantly influencing wildland fire management practices. The expansion of the WUI into areas with high fire risk combined with the collective effects of past fire management policies, resource management practices, land use patterns, climate change, and insect and disease infestations has created an urgent need to modify fire management practices and policies and to understand and manage fire risk effectively in the WUI (Pyne 2001; Stephens and Ruth 2005). Areas where fuels and fire management mitigation techniques have been strategically planned and implemented in WUI areas have proven to be effective; however, all WUI mitigation focus areas will be different and should be planned for accordingly.

A CWPP offers the opportunity for collaboration of land managers to establish a definition and a boundary for the local WUI; better understand the unique resources, fuels, topography, and climatic and structural characteristics of the area; and prioritize and plan fuels treatments to mitigate for fire risks. At least 50% of all funds appropriated for projects under the HFRA must be used within the WUI area.

The Core Team discussed the definition of WUI at length and considered the following topics: post-fire effects, such as increased runoff and flooding; sediment deposition; erosion; declining water quality; need to protect critical watersheds, particularly those providing municipal water supply; the inclusion of a mix of urban and less populated areas to provide a more holistic approach to preventative wildfire planning; and risk associated with the vegetation types in wilderness areas. Other topics included more publicly-managed land to gain opportunities for community members to become more involved in the decision-making process for federally-managed lands and for the federal land management agencies to consider community values in the management and protection of public lands.

The Core Team defined the WUI boundary by using the original areas identified by Santa Fe County's WUI base map from the 2001 WUI Assessment, then adding to these areas. Some existing areas were expanded, and other sparsely populated areas not covered by the 2001 base map were added. The McClure and Nichols reservoirs were also designated as part of the WUI, as they are located in the Santa Fe Watershed and provide municipal water to the residents of Santa Fe (Figure 3.1).

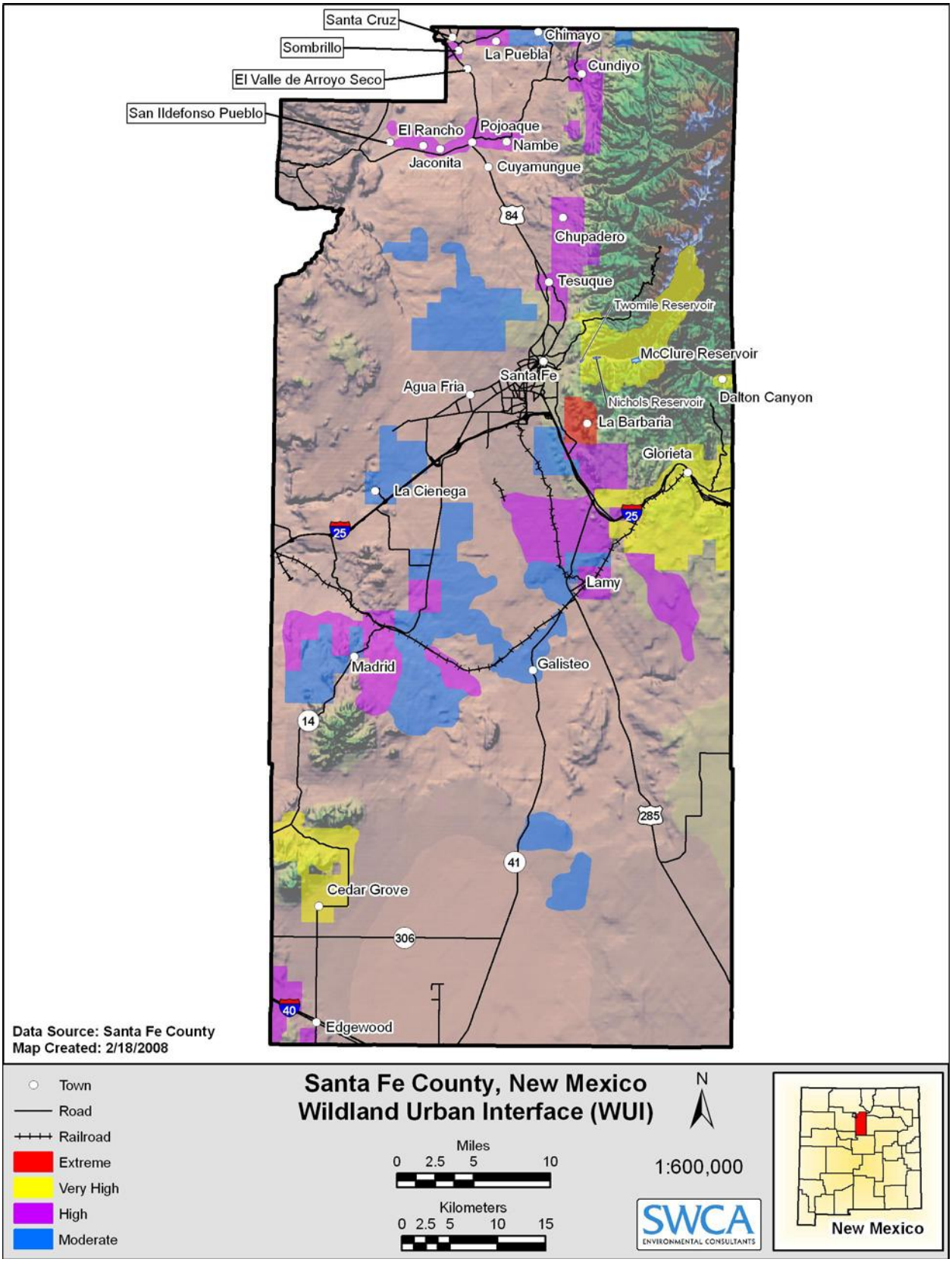

Figure 3.1. Santa Fe County Wildland Urban Interface.

3.2 FIRE HISTORY

3.2.1 LAND MANAGEMENT ACTIONS AND POLICIES

Native Americans modified the landscape in the United States before the arrival of European settlers by tilling land for crops, such as maize and squash; constructing houses of mud bricks or tree bark; building mounds and terraces; harvesting and gathering wild rice, nuts, and roots; hunting deer, rabbits, and other animals; and igniting fires in prairies, fields, and forests (Wuerthner 2006). In the past, tribes used fire as a tool to open land for agricultural use, hunting, or travel; to drive game for hunting; to promote desirable post-fire herbaceous vegetation; or to manage the land for habitat protection and resource use (Scurlock 1998). Although the specific influence that Native Americans had on historic fire regimes remains uncertain, human-caused fires can also be attributed to playing a role in influencing historical fire occurrences.

Prior to European settlement throughout the West in the 1800s, lightning- and human-ignited fires burned more frequently and less intensively. Following that time, a dramatic increase in livestock grazing, fire suppression, and other human-related activities tended to alter the landscape and the associated fire regimes. Some species of nonnative vegetation were also introduced during that time period and eventually invaded many native landscapes across the West and have altered natural fire disturbance processes.

Beginning in the early 1900s, the policy for handling wildland fire leaned heavily toward suppression and was initiated by the USFS. Over the years, other agencies, such as the BLM, the Bureau of Indian Affairs (BIA), and the NPS, followed the lead of the USFS and adopted fire suppression as the proper means for protecting the nation from wildfire. As a result, many areas currently have excessive fuel build-ups, dense and continuous vegetative cover, and tree and shrub encroachment into open grasslands.

3.2.2 HISTORICAL FIRE REGIMES AND PRESENT CHANGES

Fires are characterized by their intensity, the frequency with which they occur, the season in which they occur, their spatial pattern or extent, and their type. Combined, these attributes describe the fire regime. Fire regimes in the western U.S. have changed dramatically within the past several decades. Historically, frequent, low-intensity surface fires have burned throughout many areas within Santa Fe County, creating a mosaic of different stages of vegetative structure across the landscape. For the most part, these fires have helped to preserve an open vegetative community structure by consuming fuels on the ground surface, which has maintained open meadows and cleared the forest understory of encroaching vegetation. However, large areas of the Sangre de Cristos that adjoin Santa Fe County have not burned in more than 100 years. This departure from historical, low-intensity fire regimes has caused recent wildland fires to burn much more intensely and unpredictably in many areas of northern New Mexico. It is important to address here the common misconception that all southwestern forests have historically exhibited low intensity frequent surface fire regimes. This is not always the case, as many of the higher elevation spruce-fir as well as mid-elevation mixed conifer forests would have naturally experienced infrequent stand replacing fires as part of their natural regeneration cycle, so for these forest types restoration to more open stands is not always appropriate.

An additional factor contributing to the natural disturbance regime in southwestern forests are outbreaks of bark beetle (*Ips*, *Dendroctonus*, and *Scolytus* spp.) which have locally killed significant numbers of spruce, fir, Douglas-fir and pine trees throughout the planning area. The effect of bark beetle infestation is particularly evident within Santa Fe County in the area west of Glorieta Pass. Currently, many needles have dropped to the ground and have left only skeletons of trees where fire is less likely to be carried through the canopy due to the absence of light and flashy aerial fuels. In areas where the canopy is still maintaining dead needles, the risk of fire being carried through the canopy is much greater and should be mitigated for appropriately.

3.2.3 Fuels and Topography within the WUI in Santa Fe County

The southern half of the County is predominantly composed of grassland fuels, transitioning into shrubsteppe or shrubland dominated fuels to the north. Forested communities exist primarily in the higher elevations of the Sangre de Cristo Mountains in the northeastern portion of the County. Grassland communities are primarily characterized by shortgrass prairie, which is relatively sparse and usually occurs on flat to rolling topography at lower elevations. Grasslands may occur as pure herbaceous stands, as a shrubsteppe community, or as a juniper savanna.

Ponderosa Pine Forests

In general, studies have found that pre-1900 Mean Fire Intervals (MFIs)—the arithmetic average of all fire frequencies for a specific study site—ranged from 4 to 25 years across the Jemez Mountains and that fire frequencies and areas burned were the greatest in mid-elevation ponderosa pine forests (Allen 2001, Fulé et al. 1997; Grissino-Mayer et al. 2004; Swetnam and Dieterich 1985; Veblen et al. 2000). Ponderosa pine stands, which exist in the higher steeper elevations within the County, are fire-adapted ecosystems that are maintained by frequent, low-intensity fires. Throughout the Southwest, extensive fire history studies have documented historic fire frequencies in ponderosa pine using tree-ring data (Allen et al. 2002; Richardson 1998). Large variation in the spatial and temporal scales of fires in ponderosa pine was common and was usually based on forcing factors, such as seasonality, regional climate, elevation, aspect, and other site conditions (Brown et al. 2001). The effects of fire exclusion on forest structure are thought to be more profound in forests that previously sustained frequent, low-intensity surface fires (Westerling et al. 2006), and it is likely that fire exclusion was a primary cause of departure from historical conditions in ponderosa pine forests. Historically, frequent fire would have consumed fuels on the ground surface and culled young trees to maintain an uneven age distribution and mosaic pattern throughout the forest (Allen et al. 2002). Frequent fire disturbance maintained an open, park-like forest structure with canopy openings and an abundant herbaceous and shrubby understory (Biswell 1973; Cooper 1960; Weaver 1947, Covington and Moore 1994). In contrast to this historic structure, modern ponderosa stands are often overly dense with an understory of younger trees, increasing the likelihood for a fire to be lifted into the canopy. In areas where canopy spacing is less than 20 feet, there is increased crown fire hazard and potential for long-range spotting, especially in the presence of wind and steep slopes.

Mixed Conifer/Spruce-fir Forests

Often forest patches affected by low and high severity fire are closely juxtaposed in a transition zone made up of a forest type known as mixed conifer (Fulé et al. 2003). Fire histories in mixed conifer forests vary with forest composition, landscape characteristics, and human intervention,

but tend to exhibit mixed severity fire regimes with both low-intensity surface fires and patchy crown fires (Touchan et al. 1996). Mixed-severity fire regimes are the most complex fire regimes in the western United States (Agee 1998) because of their extreme variability (Agee 2004). A mixed-severity fire regime exists where the typical fire, or combination of fires over time, results in a complex mix of patches of different severity, including unburned, low-severity, moderate-severity and high-severity patches (Agee 2004).

Ponderosa pine was once co-dominant in many mixed-conifer forests with relatively open stand structures, but fire suppression has allowed the development of dense sapling understories, with regeneration dominated by the more fire-sensitive Douglas-fir, white fir, and Engelman spruce. Forest stand inventory data from Arizona and New Mexico show an 81% increase in the area of mixed-conifer forests between 1962 and 1986 (Fitzhugh et al. 1987; Johnson 1994). Herbaceous understories have been reduced by denser canopies and needle litter, and nutrient cycles have been disrupted. Heavy surface fuels and a vertically-continuous ladder of dead branches have developed, resulting in increased risks of crown fires (Touchan et al. 1996).

Spruce-fir forests that occur at higher elevations in the County exhibit high densities (782–1382 trees/acre), high basal areas (28–39 square meters per hectare [m²/ha]), continuous canopy cover (52%–61%) and increased woody debris (28–39 m²/ha). These forest characteristics naturally support high-intensity and severe stand replacing fires (Fulé et al. 2003) and an infrequent fire regime. Approximately 80% or more of the aboveground vegetation is either consumed or dies as a result of such fire.

Grasslands

Grassland fires have the potential to move quickly under dry, windy, and steep conditions and can easily spread at a surprisingly rapid rate, often reaching over 300 feet per minute. Many authors have suggested that the historical fire-return intervals (FRIs) for grasslands throughout the seventeenth to early nineteenth centuries are thought to have been every 5 to 10 years (Leopold 1924; McPherson 1995; Swetnam et al. 1992). Fire-suppression policies may have contributed to declining fire frequency in this cover type, but other interacting factors may have contributed as well. About the time of the Civil War, intensive livestock grazing is thought to have been responsible for a decline in grassland fires (Allen 1996; West 1984). Heavy grazing reduced the fuels available to propagate fire spread and also reduced competition with herbaceous plants, tipping the balance in favor of the woody species. Woodland encroachment, increased tree density, and altered fire behavior characterize many former grasslands of the Southwest. Once woody plants become dominant, their long life spans and their ability to extract both shallow and deep soil moisture can maintain a woodland condition indefinitely (Burgess 1995). Frequent fire plays a significant role in grassland nutrient cycling and successional processes, and long-term exclusion may produce irreversible changes in ecosystem structure and function (McPherson 1995).

Piñon-juniper Woodlands

One of most common vegetative communities in the County is piñon-juniper woodland. These woodlands are some of the most poorly understood ecosystems in terms of fire regimes, but recent research suggests that fire may have been a less-common and less-important disturbance agent in piñon-juniper woodlands as compared with adjacent ponderosa pine and grassland

ecosystems. In a recent review of piñon-juniper disturbance regimes, Romme et al. (2007) has subdivided the piñon-juniper cover type into three subtypes: areas of potential woodland expansion and contraction, piñon-juniper savannas, and persistent woodlands. These categories are helpful in separating the broad piñon-juniper cover type into distinct communities, which are subject to different climatic, topographic, and disturbance conditions.

Areas of potential expansion and contraction are those zones wherein the boundaries of the piñon-juniper ecotones have shifted. As mentioned previously, many grasslands in the Southwest have been colonized by trees as a result of a complex interplay of environmental factors. The issue of woodland encroachment into grasslands goes hand in hand with the assessment of historical conditions of the woodlands. These shifting boundaries have been widely documented (e.g., Gottfried 2004) but the historical condition of the ecosystem may be relative to the time scale of evaluation. Betancourt (1987) has suggested that the changing distribution patterns seen in the last century may be part of larger trends that have occurred over millennia and not the result of land use changes. Overall, it is believed that greater landscape heterogeneity existed previously in many of these areas that are now uniformly covered with relatively young trees (Romme et al. 2007).

Piñon-juniper savannas are found on lower elevation sites with deep soils where most precipitation comes during the summer monsoon season. Juniper savanna, the most common savanna in New Mexico, consists of widely scattered trees in a grass matrix (Dick-Peddie 1993). Similar to grasslands, the range of savannas has decreased as tree density has increased, but the mechanisms for tree expansion are complex as is the subject of current research. Significant scientific debate currently exists over the natural FRI for savannas, but most experts agree that fire was more frequent in savannas than in persistent woodlands.

Persistent woodlands, characteristic of rugged upland sites with shallow, coarse soils tend to have older and denser trees. Herbaceous vegetation within this community is typically sparse, even in the absence of heavy livestock grazing. Research from persistent woodlands provides strong evidence to support the theory that the natural fire regime of piñon-juniper woodlands was dominated by infrequent but high-severity fires and that FRIs may have been on the order of 400 years (Baker and Shinneman 2004; Romme et al. 2007). These findings are in stark contrast to previous estimates of piñon-juniper FRIs of 30 to 40 years (Schmidt et al. 2002; Smith 2000). The short FRI estimates are mostly inferred from FRIs of adjacent ponderosa pine ecosystems due to the scarcity of fire-scarred trees in these ecosystems.

In contrast to ponderosa pine, piñon pines and junipers produce relatively small volumes of litter. Understory fuels, either living or dead, must be sufficiently contiguous to carry a low-intensity surface fire. In the absence of fine surface fuels, fires that spread beyond individual trees are most likely wind-driven and spread from crown to crown (Romme et al. 2007). Fire extent is greatest in higher-density woodlands and is limited by both fuels and topography in sparse, low productivity stands on rocky terrain. Most scientists agree that fire has been more common in savannas and areas of expansion and contraction than in persistent woodlands, but debate remains on the exact range of fire frequency. Overall, frequent, low-intensity surface fires are not the predominant fire regime in piñon-juniper woodlands. Therefore, fire exclusion may not have altered forest structure as dramatically in this forest type. The degree of departure from historical

conditions and the causes of any observed changes remain uncertain; therefore, restoration treatments in woodlands should be approached with caution (Romme et al. 2007)

Riparian Communities

In some local ecosystems a more frequent fire regime has occurred as a result of changes in vegetation composition and structure. Fire-adapted invasive species, such as saltcedar (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*), have invaded many Southwestern riparian corridors, increasing both fuel volume and continuity. These species also sprout readily after fire. Although native cottonwoods and willows will also regenerate after fire, they typically have limited survival of resprouting individuals. Studies have found that the density of saltcedar foliage is higher at burned sites than unburned sites within riparian areas (Smith et al. 2006). Native riparian vegetation is not adapted to fire to the extent and severity it is currently experiencing. Fires within this ecological zone are typically of a smaller scale (e.g., single-tree fires with minimum surface spread). Once saltcedar has been established at a location, it increases the likelihood that the riparian area will burn and, as a result, alter the natural disturbance regime further. These altered fire regimes, rather than the natural hydrologic system, are now influencing the composition and structure of riparian ecosystems in the Southwest (Ellis 2001), as well as causing a threat to communities situated in or adjacent to the riparian zone.

3.2.4 Recent Fire Occurrence in the CWPP Planning Area

Ignition Sources in Santa Fe County

While prescribed burning accounts for a percentage of fire fires ignited, lightning and human ignitions are also common causes of fires within the County. Lightning ignitions are common throughout monsoon season, which typically takes place from July through August. Most of these fires are detected early and suppressed before they gain acreage; however, depending on environmental conditions and response time, they may spread rapidly across a sizable area, becoming difficult to suppress before they are effectively controlled. Another primary concern of residents in the interface is a growing number of human ignitions, particularly with the development and improvement of roads, residences, and recreational opportunities into wildland areas.

Recent Fire History

Most fires that are ignited within the region are usually less than 10 acres in size. However, records obtained from NMSF and USFS district offices show that 63 wildfires more than 10 acres and 13 wildfires more than 100 acres in size have occurred in the last 37 years (1970–2007) on County land. Five fires on record grew to greater than 1,000 acres: the Mosely, the Frijoles, the Quemado, the Capulin, and the Borrego fires. Table 3.1 lists the large fires (over 100 acres in size) that have occurred within the planning area during the period of record. Many of the fires for that time period occurred in grassland communities and were the result of human-caused ignitions such as debris burning, equipment use, arson, smoking, camping, children, and other sources of human ignitions.

Table 3.1. Fires over 100 Acres in Size on Record within Santa Fe County (1970 to 2007)

Fire Name	Start Date	Acres Burned
Unknown	May 10, 1988	122
Frijoles	June 15, 1993	2,626
Quemado	June 15, 1993	4,300
Lamy	May 3, 1996	220
Familia	May 31, 1996	300
Ramada	March 4, 1998	600
Windmill	March 10, 1998	100
Curvey	March 12, 1998	125
Turquoise	June 15, 2000	100
Borrego	May 22, 2002	12,995
Molina	June 3, 2003	900
Capulin	June 23, 2003	7,429
Mosely	June 15, 2006	1,250

Most of the fires within the County typically occur in June and July. However, increases in the number of human-caused ignitions have resulted in an increase in fire numbers throughout the year, especially in grassland and bosque ecosystems. Overall, fire occurrences have increased in numbers over recent years, which may be the result of fuel buildups, changes in climate, and forest disease outbreaks (Figure 3.2).

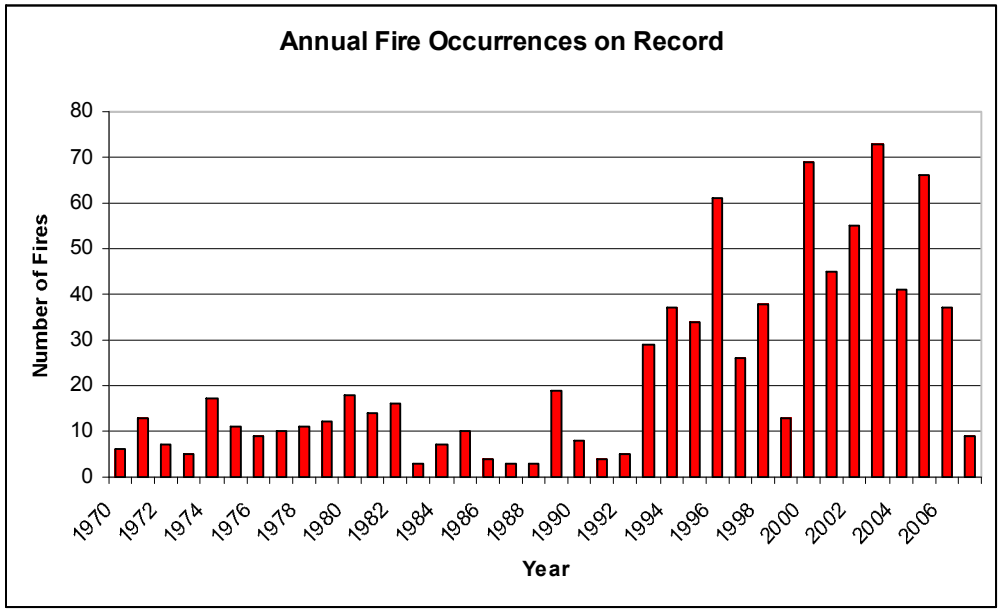

Figure 3.2. Fire occurrences on record from 1970 to 2007 (NMSF).

3.3 CHALLENGES TO FUTURE FIRE AND FUELS MANAGEMENT EFFORTS

3.3.1 SOCIAL

Some people involved in the CWPP process have raised concerns regarding fuels treatment projects throughout the County, particularly in the Santa Fe Watershed. It is important to note here that the CWPP makes recommendations primarily for reduction of hazardous fuels in WUI areas, and treatment of fuels in the watershed are included because of the need to protect this important source of municipal water for the city of Santa Fe. Public opposition to forest restoration efforts is a real concern, and land managers need to be sensitive to the views and values of the public. Increased public education and outreach is one way to disseminate information regarding the importance of forest restoration, particularly where current fire regimes are beyond their natural range of variability. It is also recommended that land managers adopt the New Mexico Forest Restoration Principles, provided as an appendix to this document (Appendix G), in order that restoration efforts are as sensitive as possible to all ecological and social concerns; this interagency document has been collaboratively developed and includes parameters such as retaining old growth trees, reducing the threat of unnatural crown fire, using low-impact techniques, and protecting sensitive communities.

It is important that land managers attempting forest restoration are guided by forest health principles. This message might help overcome some of the social opposition to thinning. For example thinning has been advocated by many forest research scientists as a means of improving forest health and promoting long-term viability of ponderosa pine forest (Allen et al. 2002; Hunter et al. 2007; Swetnam et al. 1999). In the Southwest, ponderosa pine landscapes were historically composed of a mosaic of meadows and savanna-like forests with low tree density interspersed and more dense forests with higher canopy cover (Savage 1991). This landscape helps to maintain diverse wildlife and plant habitat, more drought and insect resistant trees, and larger old-growth stands that thrive with lower competitive stress. These more open stands, as has been discussed previously, are also more resilient to high-severity wildfire as the potential for crown fire spread is reduced (Agee and Skinner 2005).

3.3.2 CLIMATIC

In addition to all of the anthropogenic impacts that have degraded natural fire regimes, climate change has also played an extensive role in altering fire occurrence and severity, influencing the vegetative cover and available burnable fuel across the western landscape. In the past few years, fires have grown to record sizes, are burning earlier and longer, and are burning hotter and more intensely than they have in the past (Westerling et al. 2006). According to the National Interagency Fire Center (NIFC), occurrence of catastrophic wildfires has greatly increased over the last 20 years. Westerling et al. (2006) claim that a study of large wildfires (approximately 988 acres) throughout the western United States from 1970 to 2003 saw a pronounced increase in frequency of fire since the mid 1980s. Fires from 1987 to 2003 have been four times more frequent than the 1970 to 1986 average. After 1987, the length of the fire season has also been observed to increase by 78 days. Within just the last seven years, a record number of acreages have burned, and numbers are continually getting larger (NIFC 2006).

Changes in relative humidity have been blamed for much of these changes as increased drying over much of the Southwest has led to an increase in days with high fire danger (Brown et al. 2004). Advanced computer models are now making national-scale simulations of ecosystems to provide predictions of how fire regimes will change in the twentieth century (Neilson 2004). Western grasslands are predicted to undergo increased expansion of woodier vegetation, such as piñon-juniper, associated with increased precipitation occurring during typical wet seasons. Summer months are predicted to be hotter and longer, which will also contribute to increased fire risk (Neilson 2004). Under greater climatic extremes widely predicted throughout the U.S., fire behavior is expected to become more erratic, with longer flame lengths, increased torching and crowning, and more rapid runs and blow-ups associated with extremely dry conditions (Brown et al. 2004).

In a Government Accountability Office (2007) report on climate change and federal lands, natural resource experts from numerous federal and state agencies as well as leading academic experts predict that climate change will cause forest fires to grow in size and severity. This in turn will impact the safety of communities located not just in WUIs but in even larger areas as a result of impaired air quality resulting from vast smoke production. Experts working under the auspices of the DOE's Accelerated Climate Prediction Initiative similarly warn of the increased risks. The costs of fire suppression as well as the expense of fire preparedness are likely to increase in parallel with increasingly larger fires. Experts warn that Southwest fire and fuels management strategies and policies need to address these risks now in order to prepare for these changing regimes, while also accommodating complex changing ecosystems subject to growing human stresses (Brown et al. 2004).

Although fire suppression is still aggressively practiced, fire management techniques are continually adapting and improving. Due to scattered human developments and values throughout the WUI, suppression will always have to be a priority in those areas. However, combining prescribed fire and wildland fire use (WFU) with effective fuels management and restoration techniques will help re-establish natural fire regimes and reduce the potential for catastrophic wildfires associated with our changing climate.

3.4 FIRE REGIMES AND FIRE REGIME CONDITION CLASSES

Methods to assess the condition of wildland areas have been developed to help classify, prioritize, and plan for fuels treatments across a fire management region.

3.4.1 FIRE REGIMES

A natural fire regime or historic fire regime is a general classification of the role fire would play throughout a landscape in the absence of modern human intervention, but includes the influence of aboriginal burning (Agee 1993; Brown 1995; Hann et al. 2003). Natural fire regime reference conditions have been developed for vegetation-fuel class composition, fire frequency, and fire severity for the biophysical settings at a landscape level for the Southwest and most other parts of the United States (Hann et al. 2003).

The following five fire regime classifications are based on average number of years between fires (fire frequency or MFI) combined with the severity (amount of vegetation replacement) of the fire and its effect on the dominant overstory vegetation (Hann et al. 2003).

I 0- to 35-year frequency and low (mostly surface fires) to mixed severity (less than 75% of the dominant overstory vegetation is replaced)

II 0- to 35-year frequency and high severity (more than 75% of the dominant overstory vegetation is replaced)

III 35- to 200-year or more fire frequency and mixed severity (less than 75% of the dominant overstory vegetation is replaced)

IV 35- to 200-year or more fire frequency and high severity (more than 75% of the dominant overstory vegetation is replaced)

V 200-year or more frequency and high severity (more than 75% of the dominant overstory vegetation is replaced)

3.4.2 Fire Regime Condition Class

The Fire Regime Condition Class (FRCC) is a measure of the degree of departure from reference conditions, possibly resulting in changes to key ecosystem components, such as vegetation characteristics (species composition, structural stage, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances, such as insect and disease mortality, grazing, and drought (Hann et al. 2003).

The three FRCC rankings are:

FRCC 1 No, or low departure from the central tendency of the reference conditions

FRCC 2 Moderate departure from the central tendency of the reference conditions

FRCC 3 High departure from the central tendency of the reference conditions

3.4.3 Fire Regime and Condition Classifications in Santa Fe County

Grasslands and shrublands within the planning area typically have a natural fire regime of class I, with an FRCC of 3 for the majority of the area. Piñon-juniper and juniper forests are variable in their natural fire regimes and FRCC classifications across the planning area. Juniper savanna communities most likely have a natural fire regime of class I with the fire severity ranging from low to moderate. Many of these stands have experienced extensive encroachment of trees and are FRCC 3. Based on stand age structures that have been observed in piñon-juniper landscapes, dense stands of piñon -juniper are likely to have natural fire regimes of I or II. These stands are potentially denser with a brushier understory than in the past and have an FRCC of 3. Ponderosa pine communities generally have a natural fire regime of class I and have an FRCC of either 2 or 3. An FRCC classification map of Santa Fe County is provided as Figure 3.3.

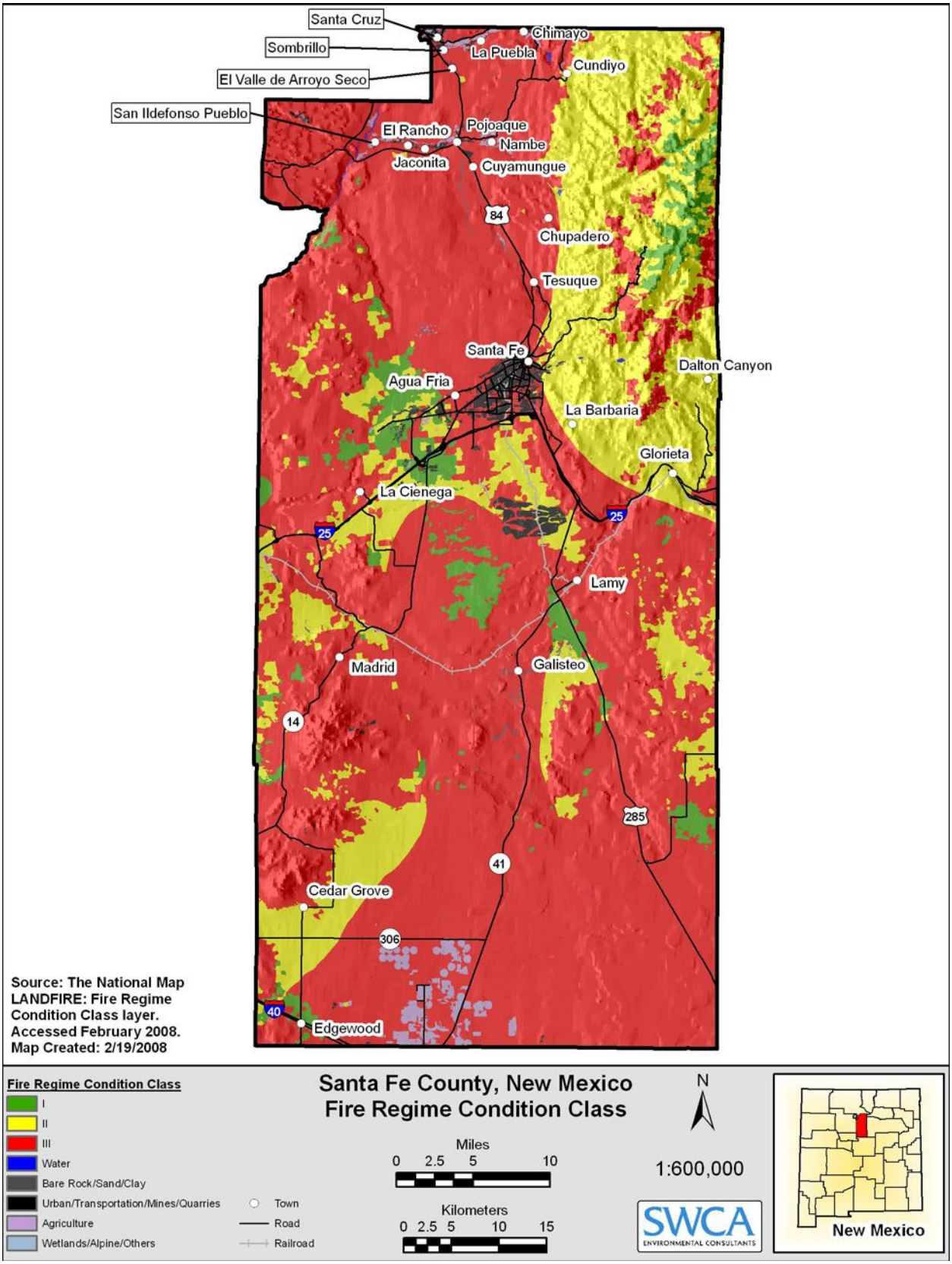

Figure 3.3. Santa Fe County FRCC.

Although the FRCC provides a useful concept, many authors have questioned the accuracy and appropriate application of the data (e.g., Della Sala et al. 2004; Schoennagel et al. 2004). The initial mapping project (Schmidt et al. 2002) was intended to provide national-level data and was not recommended for use at finer local scales. Unfortunately, despite the coarse nature of the data, it has been widely used to inform local management decisions. Another fundamental assumption is that the natural fire regime data that were used in the creation of the system were, in fact, accurate. This assumption may be critically flawed for piñon-juniper woodlands where recent research has indicated a natural FRI on the order of centuries (Baker and Shinneman 2004; Romme et al 2007) instead of the estimate of decadal disturbance used in the classification system (Schmidt et al. 2002). Based on this difference in the natural FRI, a piñon-juniper stand that was previously mapped as fire regime class I may be more accurately described as fire regime class V, at the opposite end of the spectrum; this would give it an averaged classification of FRCC 3. Improved data and local input may help to improve the applicability of the fire regime and FRCC systems for future decision-making processes, but the FRCC concept should be applied currently with great caution in designing and prioritizing fuels treatments.

3.5 WILDLAND FIRE BEHAVIOR OVERVIEW

An overview of fire behavior begins with a discussion of wildland fuels, defined here as any combustible vegetation. The term fuel refers to the live and dead vegetation available to burn that can carry a fire across the landscape. Determinants of fire behavior and combustibility include the horizontal and vertical continuity of the fuel bed, percent live versus dead, amount and distribution of fuels, dead fuel loading (amount in pounds or tons per acre), and fuel moistures of both live and dead vegetation.

3.5.1 BASIC WILDLAND FIRE TERMINOLOGY

Several different types of fires may take place in the County and are all referred to using different terms. Definitions for these fires are as follows:

- Wildland fire is a general term and is defined as any fire burning in wildland fuels and includes prescribed fire, wildland fire use, and wildfire.
- Prescribed fires are planned fires ignited by land managers to accomplish resource management objectives.
- Wildland fire use is when naturally occurring fires are allowed to burn under carefully prescribed conditions in order to accomplish resource management objectives.
- Wildfires are unwanted and unplanned fires that result from natural or human-caused ignitions.

3.5.2 TYPES OF FIRE BEHAVIOR

Wildland fire managers recognize three general types of wildland fire behavior, depending on the strata of fuel (i.e., ground, surface, aerial) in which the fire is burning.

A *ground fire* is one that burns in litter, duff, organic soils, roots, and rotten buried logs. Ground fires burn with very low spread rates but can be sustained at relatively high moisture contents.

Fuel consumption can be of concern due to significant injury to trees and shrubs. Although ground fuels can be ignited directly, they are most commonly ignited by a passing surface fire.

A *surface fire* is one that burns on the surface fuel layer, which lies immediately above ground fuels but below the canopy, or aerial, fuels. Surface fuels include needles, leaves, grass, dead and downed branch wood and logs, shrubs, low brush, and understory trees. Surface fire behavior varies widely depending on the type, continuity, loading, and arrangement of fuels.

A *crown fire* is one that burns in the elevated canopy (aerial) fuels. Aerial fuels normally consist of the live and dead foliage, lichen, and fine live and dead branch wood found in a forest canopy. Crown fires generally have higher moisture content than surface fuels. Three types of crown fire are generally recognized: passive, active, and independent.

- In a passive crown fire, also called torching or candling, individual or small groups of trees torch out, but solid flame is not consistently maintained in the canopy. Embers lofted during passive crowning can start new fires (spot fires) downwind, which makes containment more difficult and increases the overall rate of fire growth or spread.
- In an active crown fire, also called a running or continuous crown fire, surface and aerial fuels become involved. However, the crowning phase remains dependent on heat from the surface fuels for continued spread. Active crown fires are characterized by flame that extends from the fuel bed surface through the top of the canopy. Greatly increased radiation (i.e., preheating of unburned fuels) and short-range spotting (ignitions from blowing embers/fire brands ahead of the flaming front of the fire) lead to spread rates much higher than would occur if the fire remained on the surface. Medium- and long-range spotting associated with active crowning leads to even greater rates of fire growth.
- An independent crown fire is one that burns in aerial fuels without the aid of a supporting surface fire. Independent crown fires rarely occur and are commonly short lived. They require a combination of steep slope, high wind speed, closed vegetation canopy, and low foliar moisture content.

Assessing the potential for crown fire development and propagation is a matter of assessing the fire environment conditions on the ground.

A spot fire (spotting) is one that ignites outside and downwind or upslope of the main fire. Embers that lift from burning vegetation, normally consisting of tree bark, cone bracts, needle and leaf segments, and other materials that can carry heat, provide the ignition source. Another required condition is that of a receptive fuel bed for the ember to ignite. Punky (rotten) log material, dense grass, needle/leaf litter, and ignitable building materials (e.g., wood shake roofs) are examples. Long-range spotting can extend well over 1 mile, but normal spotting distances are within 0.5 mile from the main fire.

Fire behavior overall has changed during the last 10 to 20 years. Fire history studies in ponderosa pine illustrate that early wildland fires in this forest type were generally low-intensity surface fires in which surface fuels were lighter, and occasional torching and short duration crown fire runs occurred in dense thickets (Allen 2001). Today, however, extreme fire behavior with very high surface intensities, rates of spread, profuse spotting, and stand-replacement crown fires are

considered normal. Fire behavior and frequency in piñon-juniper woodlands and spruce-fir forests have been more difficult to categorize since many past fires were stand replacing and therefore not recorded in the tree ring records (Romme et al. 2007). However, it is believed that high elevation spruce-fir forests and some piñon-juniper cover types generally burn at higher intensity but with lower frequency than fires in ponderosa pine. Human encroachment into areas with these stand replacing regimes has exacerbated the WUI fire risk. A consequence of these changes is that firefighters are increasingly being injured and killed, and homes are torched in large numbers. The following section is a discussion of the factors that have contributed to this increasingly destructive fire behavior.

4.0 RISK ASSESSMENT

4.1 OVERVIEW AND PURPOSE OF HAZARD AND RISK ASSESSMENT

The risk assessment provides information regarding how fire moves through a landscape and where the greatest areas of risk are located based on the fire environment and community structure. The purpose of the risk assessment is to provide a quantitatively based wildland fire hazard ranking for communities in Santa Fe County and to highlight significant Community Values at Risk (CVAR).

From this assessment, land use managers, fire officials, planners, and others can begin to prepare strategies and methods for reducing the threat of wildfire, while working with community members to provide information about methods for reducing the damaging consequences of fire. The fuels reduction treatments can be implemented on both private and public land, so community members have the opportunity to actively apply the treatments on their properties, as well as recommend treatments for public land that they use or care about.

For purposes of this assessment, *risk* refers to the potential and frequency with which wildfire ignitions might occur; this is assessed by looking at historical ignitions over the past 10 years, both on the record and from local knowledge. Increasing encroachment of the built environment into the natural environment is another important consideration for the future, as the risk will increase with more development and growth. *Hazard* refers to those conditions of fuels, topography, and other environmental conditions, as well as the relative degree of defensibility that affect the behavior of fires within the interface.

Countless methods to perform wildfire risk assessments can be used and several have been applied to Santa Fe County. Different methods will highlight different factors, and it should be emphasized that these assessments illustrate relative risk for the purpose of prioritizing mitigation and planning efforts. Any WUI risk assessment is prone to some subjectivity and the significance of risk ratings must be kept in perspective. Once relative risk has been determined, components of the assessment can be used to guide mitigation efforts.

Hazard and risk must be evaluated according to the environment and values unique to the area. For Santa Fe County, elements of hazard and risk were analyzed using two risk assessments:

1. **Community Hazard and Risk Assessment:** Field assessments were performed for each WUI community in Santa Fe County. Fire Environment and Defensibility were evaluated using the Wildland Fire Associates (WFA) Hazard Assessment Form (Appendix H). Fuel hazard, slope, and special hazards and community characteristics contributing to defensibility were evaluated, and a numeric rating was assigned.
2. **Composite Risk Assessment:** A Fire Behavior Analysis showing fire behavior outputs such as fuel characteristics and weather conditions was processed in the GIS-based FlamMap 3.0 model to generate fire behavior predictions, such as flame length, rate of spread, fire line intensity, crown fire activity, and fire occurrence over the geographic area. The fire behavior outputs (hazard) were combined with the geographic fire occurrence data (risk) in a weighted overlay to produce a Composite Risk Assessment. This model illustrates the relative degree of wildfire risk throughout Santa Fe County.

4.2 COMMUNITY HAZARD AND RISK ASSESSMENT

The assessment analyzes the communities from the 2001 WUI Assessment, along with County open space, watershed, and other pertinent infrastructure, to assess how conditions in fire environment along with defensible space, have changed in the past six years. The methodologies and observations are presented below.

4.2.1 METHODOLOGY FOR COMMUNITY HAZARD AND RISK ASSESSMENT

The methodology developed for the 2007 Santa Fe County Community Hazard and Risk Assessment (hereafter referred to as the 2007 WUI Assessment) used the WFA Hazard Assessment Form (Appendix H) to determine hazard ratings for communities in the County (Figure 4.1). As discussed in Section 1.3, the baseline assessment used for this CWPP is the 2001 WUI Assessment. The 2007 WUI Assessment identifies and quantifies, where possible, changes that may have affected risk levels to communities during the past six years, and includes a qualitative assessment based on field observations of new housing developments since approval of the 2001 Santa Fe County Urban Wildland Interface Code, Ordinance No. 2001-11.

The 2007 WUI Assessment used a landscape approach and provided a coarse-scaled assessment, rather than a fine-scaled house-to-house approach. The field form (see Appendix H) was developed based on various factors, which, when considered together, yield an overall rating for a community. Numerical ratings were therefore based on averages observed for groups of houses in a community. The WFA Hazard Assessment Form's two components are Part 1: Fire Environment and Part 2: Defensibility.

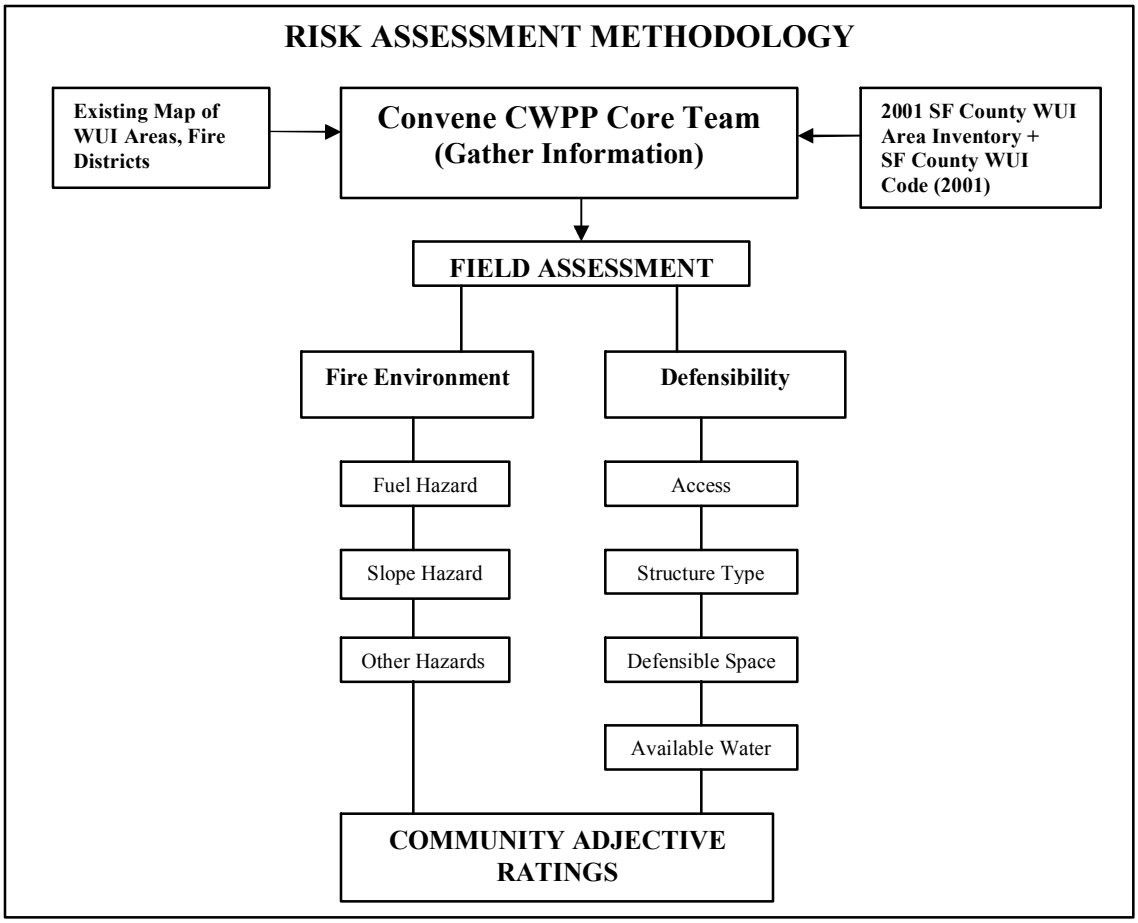

Figure 4.1. Risk assessment methodology.

4.3 WFA HAZARD ASSESSMENT FORM PART 1: FIRE ENVIRONMENT

The Fire Environment is defined as the interaction of fuels, weather, and topography. The weather component of the fire environment was not included in the assessment due to its wide variation and changing nature. However, the assumption used in the ratings was for average worst fire weather conditions in northern New Mexico: typically April, May, June, and July, prior to summer monsoons. WFA Hazard Assessment Form Part 1: Fire Environment considers the following three factors: fuel hazards, special hazards, and slope.

4.3.1 FUEL HAZARDS

Wildland fuels are considered the most critical variable to the fire hazard assessment process. Fuels are described using the 13 National Forest Fire Laboratory (NFFL) fire behavior fuel models. The assessment assumes these fuels burning under worst case conditions, which is defined as the highest negative impact to human safety and property resulting from a wildland fire. The models observed in the 2007 WUI Assessment are described in Table 4.1. Note that in the Composite Risk Assessment, the Scott and Burgan (2005) Fuel Model Classification was

used due to its finer scale resolution. Table 4.1 provides a comparison of the 13 and the 40 fuel models and shows the similarities among the fuel types in the two models.

Table 4.1. NFFL Fuel Type Descriptions

Fuel Group / NFFL Fuel Model	Description	Potential Fire Behavior	*NFFL to Scott and Burgan Fuel Model conversion*
Light—NFFL 1, 2, 5, 8	1=grass 2=timber/grass/litter understory (i.e., ponderosa pine) 5=low shrubs 8= short-needled conifer litter (i.e., open piñon-juniper stands)	Surface fire, low to moderate intensity depending on fuels characteristics (see Section 3.2); some spot fires under high wind conditions	1= GR1 2= GR2 5= SH1/SH2 8= TL3
Medium—NFFL 6, 9	9=long-needle conifer/needle litter (i.e., ponderosa pine) 6=dormant shrub (i.e., bosque)	Surface fire to intermittent crown fire (torching) to moderate to high intensity with spot fires and ember wash	6= SH1/SH2 9= TL8
Heavy—NFFL 4, 10	4=large dense brush; closed-canopy stands, dense bosque (high wind) or closed piñon-juniper (high wind, steep slope) 10=heavy dead-down woody material under conifer canopy (decadent ponderosa stands)	Low to high intensity surface fire to sustained crown fire with numerous spot fires and heavy ember wash with high winds	4= SH5/SH7 10= TU5/SH2

Source: Anderson 1982; Scott and Burgan 2005.

4.3.2 SPECIAL HAZARDS

Condition of the vegetation (e.g., drought, diseased, or insect-killed trees) was rated along with special topographical features affecting fire behavior such as steep canyons, chutes, and chimneys (i.e., very steep and narrow drainages). Insect-killed trees (piñon and ponderosa pine) have dropped needles and may represent a varying degree of decreased fuel hazard on the landscape. Note that in Table 4.1 "light" fuels generally represent a lower resistance to control than "heavy" fuels.

4.3.3 SLOPE

Wildland fires tend to spread faster uphill due to factors such as preheating of fuels upslope by bending flames. Therefore, steepness of slope, expressed in percent and described generally as flat to mild (0–9.9%), mild to medium (10–19.9%), medium to moderate (20–39.9%), and moderate to extreme (40+%), needs to be considered in site evaluations.

4.4 HAZARD ASSESSMENT FORM PART 2: DEFENSIBILITY

Defensibility is defined as the amount of difficulty that firefighters would encounter while attempting to defend a house or group of houses. WFA Hazard Assessment Form Part 2: Defensibility considers the four conditions listed below in determining the level of defensibility.

4.4.1 ACCESS

This criterion describes the relative length of dead-end roads encountered by responding fire agencies, ranging from less than 600 feet to greater than 1,320 feet, and incorporates such special factors as road width and slope, turnouts, turnarounds, bridge conditions, etc.

4.4.2 STRUCTURE TYPE

This criterion includes a general overview of roof and siding flammability, which is then averaged for a community. A large variation in types would be expected.

4.4.3 DEFENSIBLE SPACE

Defensible space is defined as an area around a structure in which fuels and vegetation are treated, cleared, or reduced to slow the spread of wildfire towards the structure and/or lower its intensity. Subjective ratings were assigned based on the following conditions: the amount of clearance between structures and flammable vegetation and the degree to which this space would reduce the potential for the flames of a crown fire to reach the structure; the probability for firebrands to ignite the house or set significant fires near the house; the chance of a structure fire moving from the building to the surrounding forest; and whether or not adequate space is present for firefighters to work.

4.4.4 WATER AVAILABILITY

This factor relates to types and amounts of water available to adequately defend a structure and suppress wildland fire in the WUI. Well water is generally not as efficient or plentiful as a community water system. Also, water tanks installed on private property can be used if the plumbing and drafting access for fire apparatus is sufficient.

4.5 RATING SYSTEM

Numerical hazard ratings were assigned for each of the criterion described above for all communities based on field observations. Multiple ratings were assigned to communities and the highest rating, or worst case, was selected to represent the community group. Extenuating circumstances were factored in with explanations to arrive at a total. Part 1 and Part 2 of the WFA Hazard Assessment Form were added together to assign a hazard class rating for each community. A range of numbers from 0 to 20 is used to indicate the level of risk, with the lowest numbers representing the least amount of risk, and the highest numbers representing the greatest amount of risk. The numerical and corresponding hazard class rating system is summarized in Table 4.2.

Table 4.2. Hazard Class Rating System

Adjective Rating	Part 1: Fire Environment	Part 2: Defensibility
Moderate	<9	≤4
High	9–12	5–8
Very High	13–15	9–11
Extreme	16–20	12–16
Total Points Possible	20	16

4.6 RESULTS OF COMMUNITY HAZARD AND RISK ASSESSMENT

After the ratings from the 2007 WUI Assessment were compiled, they were compared with the 2001 WUI Assessment. A comparison of the ratings is displayed in Table 4.3. The areas determined to be at Extreme and Very High risk using the 2007 WUI Assessment correlate strongly with the updated high priority locations identified by the Santa Fe County Fire Department (Figure 4.2). The 2001 and 2007 WUI assessments, along with input from the public and the Core Team, were used to compile a table of CARs (see Table 4.3). A second list of CARs using the terms *no risk, low, medium and high* as required by the NMFPTF is provided in Appendix I.

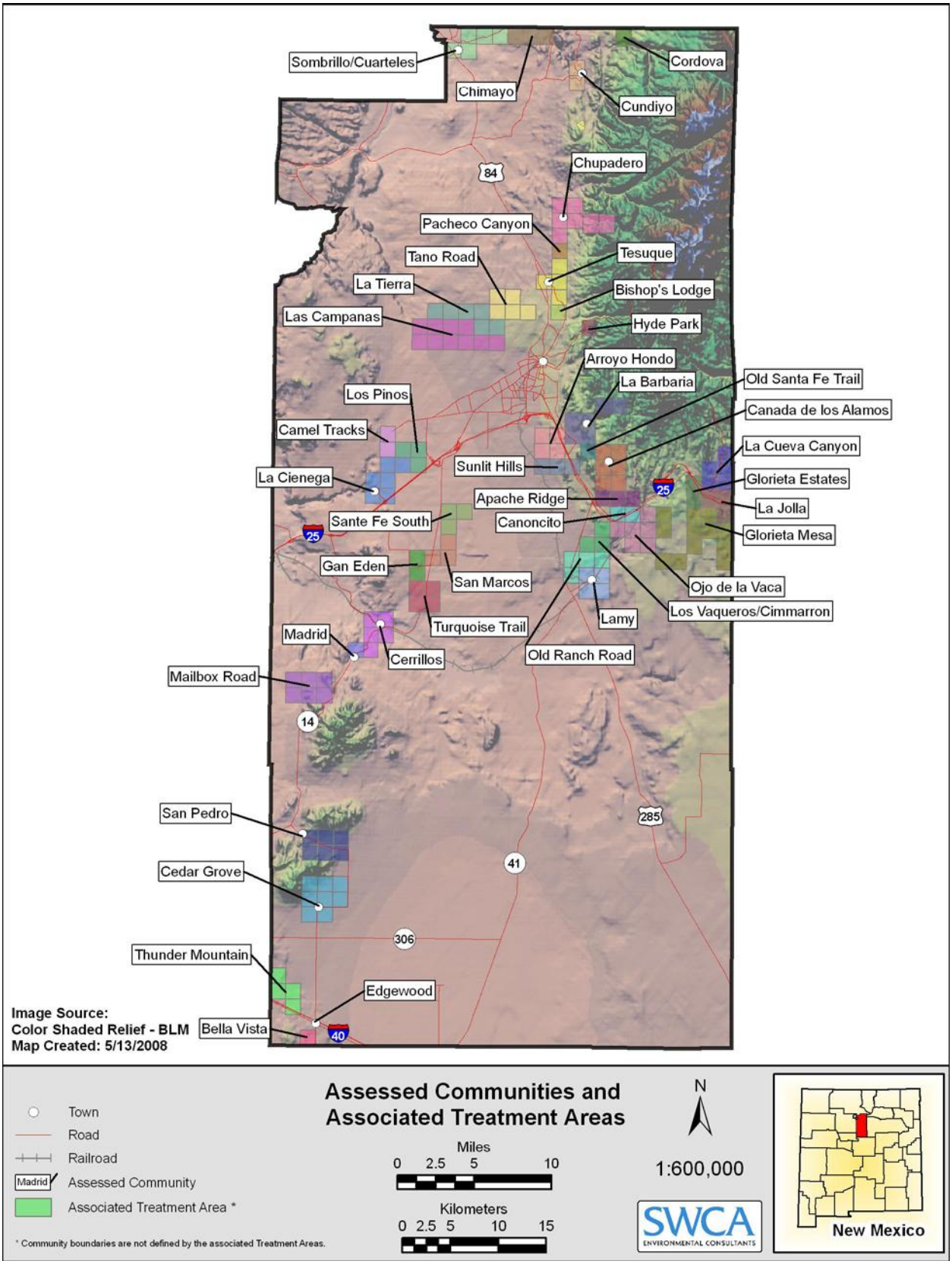

Figure 4.2. Assessed communities and associated treatment areas.

Table 4.3. Communities' Ratings Summary

Community	Numerical Rating (Parts 1 + 2)	Adjective Rating		Changes between 2001 and 2007 Assessments
		2001	2007	
La Barbaria	28	E	E	Added a 10K gallon water tank; otherwise same as 2001 WUI Assessment
Apache Ridge	24	VH	VH	Canopy broken by beetle mortality; may mitigate crown fire potential in some areas
Cedar Grove	23	VH	VH	Increased housing development into piñon-juniper woodland, variable structural ignitibility/defensibility
Glorieta Mesa	22	VH	VH	No change
Hyde Park	22	VH	VH	Aztec Springs included in rating; Firewise work continues; water system added since 2001
Mailbox Road	–	VH	H	Fuel loading has changed due to beetle kill (not rated 2007)
Ojo de la Vaca	22	VH	VH	Canopy broken by heavy beetle mortality; improved fuels hazard rating in some areas
San Pedro	26	VH	VH	Narrow access and limited turnarounds; wind funnel through saddle to west
Bella Vista	–	H	H	Same as 2001
Bishop's Lodge	–	H	H	Same as 2001 with several condo lots added east of Lodge
Canada de los Alamos	–	H	H	Same as 2001
Canoncito	–	H	H	Same as 2001
Cerrillos	–	H	H	Same as 2001
Chupadero	–	H	H	Same as 2001
Cundiyo	14	H	H	High hazard in bosque/arroyos primarily with continuous fuels
Edgewood, Thunder Mtn.	–	H	H	Same as 2001
Glorieta Estates	19	H	H	Firewise work continues around structures; pruning, raking
La Cueva Canyon	–	H	H	Same as 2001
La Jolla	–	H	H	Same as 2001
Lamy	–	H	H	Same as 2001
Los Vaqueros, Cimarron	–	H	H	Same as 2001
Old Santa Fe Trail	–	H	H	Same as 2001
Pacheco Canyon	–	H	H	Same as 2001
Sombrillo, Cuarteles	–	H	H	Same as 2001
Tano Road	14	VH	H	Canopy opened by beetle mortality; main roads paved with improved access
Tesuque	–	H	H	Same as 2001
Turquoise Trail	–	H	H	Same as 2001
Arroyo Hondo	–	M	M	Same as 2001
Camel Tracks	–	M	M	Same as 2001
Chimayo	–	M	M	Same as 2001

Table 4.3. Communities' Ratings Summary, continued

Community	Numerical Rating (Parts 1 + 2)	Adjective Rating		Changes between 2001 and 2007 Assessments
		2001	2007	
Cordova	–	M	M	Same as 2001
Gan Eden	–	M	M	Same as 2001
La Cienega	–	M	M	Same as 2001
La Tierra	–	M	M	Fuel loading has changed due to beetle kill
Las Campanas	–	M	M	Same as 2001
Los Pinos	–	M	M	Same as 2001
Madrid	–	M	M	Same as 2001
Old Ranch Road	–	M	M	Same as 2001
San Marcos	–	M	M	Same as 2001
Santa Fe South	–	M	M	Same as 2001
Sunlit Hills	–	M	M	Same as 2001

E = Extreme
H = High
VH = Very High
M = Moderate

In summary, the 2007 WUI Assessment identified one community rated as Extreme, six communities as Very High, 19 communities as High, and the remaining 15 as Moderate.

4.7 HAZARD ASSESSMENT NARRATIVES

The following narratives are from field forms for each rated community, noting vegetation, special conditions, fuels (including NFFL Fuel Model[s]), expected fire behavior, slope and other terrain features, and defensibility. The overall hazard rating is in parentheses. All of the assessments were performed in the fall of 2007. Narratives were arranged in descending order according to the adjective rating. Only the Extreme and Very High WUI areas are addressed in this document.

La Barbaria (E)
2007
Vegetation: Ponderosa pine/grass/litter understory in drainage bottoms; piñon-juniper mixed with ponderosa on lower slopes, grading into pure, closing canopy piñon-juniper with drainages moderate to heavily fueled (grasses, shrubs, hardwoods, conifers, and dead and down woody materials). *Fuels/Expected Fire Behavior*: Fuel Model 8 (low resistance to control) under open canopy; Fuel Model 4 (high resistance to control) in extreme fire weather conditions; Fuel Model 2, 9, or 10 (low to high resistance to control) under ponderosa canopy. Under primarily high-prevailing (west-southwest) wind conditions, the windward steeper slopes and drainages in alignment could produce intermittent to sustained and independent crown fire where canopy supports a continuous flaming front. Otherwise, expect low to moderately high intensity surface fire where supporting fuels exist (lower slopes, all aspects). Beetle mortality should have little effect on fire behavior in this area. *Slope/Aspect:* Slopes range from 5–40%; all aspects represented. *Defensibility:* Fair to poor; access can be difficult to impossible due to few turnouts, narrow surfaces, and no turnaround space; entrapment potential exists on driveways and roads leading to mid and upper slope structure locations; several structures may be passed up by fire crews under high severity conditions.

Apache Ridge (VH)
2007
Vegetation: Piñon-juniper on lower slopes, grading to ponderosa pine and Gambel oak woodland upper slopes. *Fuels/Expected Fire Behavior*: Fuel Model 8/9 (with ponderosa litter); low to high resistance to control depending on canopy closure; Fuel Model 5 in dormant closed oak brush (high resistance to control on steep slopes with high wind alignment; otherwise surface fire low resistance to control); Fuel Model 9/10 under pure ponderosa canopy (low to high resistance to control, depending on wind, slope, and aspect). Note: significant beetle mortality on slopes may interrupt a running crown fire in some locations. *Slope/Aspect:* 20–50% on all aspects. *Defensibility:* Variable; many dead-end, narrow steep roads, few turnarounds; water availability varies from none to sporadic; defensible space varies from none to some thinning in yards; several structures may be passed up by fire crews under high severity conditions.

Cedar Grove (VH)
2007
Vegetation: Closed or closing canopy piñon-juniper; open grasslands. *Fuels/Expected Fire Behavior*: Fuel Model 8 under low wind; Fuel Model 4 under high winds and slope alignment (high resistance to control; normally wind-driven fires with linear shape in one direction dictated by wind direction). *Slope/Aspect:* 5–40%; east-southeast-south. *Defensibility:* Access is poor to fair with steep, winding, narrow roads with few turnarounds; defensible space is nonexistent to sporadic; water availability is estimated at fair to poor; construction primarily mobile home/prefabricated/frame.

Glorieta Estates (VH)
2007
Vegetation: Piñon-juniper with short needle understory, sparse grasses, some shrubs in drainage bottoms; transitions into ponderosa pine on upper slopes and drainage bottoms. *Fuels/Expected Fire Behavior*: Fuel Model 8/4 in piñon-juniper; Fuel Model 9 in long needle litter or Fuel Model 10 with heavy downed woody materials. Fire behavior can range from creeping to running surface fire (resistance to control low to moderate), to torching or short-range crown fire runs in closed canopy on steep slopes with wind alignments (resistance to control very high). *Slope/Aspect:* 5–25%; all aspects. *Defensibility:* Access by County Road 51; relatively long response time/distance (Glorieta Fire Department station); water availability is poor to none.

Hyde Park (VH)
2007
Vegetation: Piñon-juniper, open and closed canopy; mixed piñon-juniper and ponderosa pine in drainages and upper slopes of the subdivision. *Fuels/Expected Fire Behavior*: Fuel Model 8 or extreme Fuel Model 4, depending on conditions of aspect/slope/wind alignments in closed canopy; spotting potential moderate (resistance to control moderate). *Slope/Aspect:* 20–40% slopes on all aspects, narrow drainages may cause "chimney" effect with winds carrying fire upslope. *Defensibility:* Tank placements since 2001 increased defensibility; closest stations Santa Fe City Fire Department #1 and Tesuque #1; Aztec Springs poorly defensible (narrow, steep access, poor turnarounds).

Mailbox Road (M)
2007
Vegetation: Juniper savanna, piñon-juniper woodland. *Fuels/Expected Fire Behavior*: (not available) *Slope/Aspect:* 5–50%; all aspects. *Defensibility:* Access is poor; terrain is steep, winding roads with washouts; no water is available; nearest station is Madrid #1. *Note: No Field Rating for 2007*

Ojo de la Vaca (VH)
2007
Vegetation: Canyon bottoms grass, shrubs, and open ponderosa and piñon-juniper stands; mid and upper elevations ponderosa pine and closing canopy piñon-juniper; several significant areas of beetle mortality primarily in piñon pine stands. *Fuels/Expected Fire Behavior*: Similar to Apache Ridge; Fuel Model 8/4 in piñon-juniper; Fuel Model 9 in long needle litter. Fire behavior can range from creeping to running surface fire (resistance to control low to moderate); to torching or short-range crown fire runs in closed canopy on steep slopes with wind alignments (resistance to control very high). *Slope/Aspect:* 5–50%, all aspects. *Defensibility:* Limited water; access is fair to poor; bridges are in fair condition; closest fire station is at Hondo with potentially long response times.

San Pedro (VH)
2007
Vegetation: Ponderosa stands on lower flats with mixed piñon-juniper on slopes; large areas of closing canopy piñon-juniper with moderate understory dead/down fuel accumulations. *Fuels/Expected Fire Behavior*: With topography acting to funnel winds from west to east, rates of spread vary from low (no wind) to very high with wind alignment; Fuel Model 9 under ponderosa canopy favors surface fire; under high winds and slope alignments, fire reaching closed canopy piñon-juniper may reach intermittent to short sustained crown fire runs with mid-range spotting. *Slope/Aspect:* 5–40%; mainly east, southeast, and southwest aspects. *Defensibility:* Poor where access is difficult for apparatus; driveways are narrow, winding, and/or steep; no water availability; defensible space varies by structure from poor to fair; closest station is Edgewood #3.

Monitoring and evaluation are tentatively scheduled on a basis of five-year intervals. Sites that were treated will be visited and evaluated for treatment effectiveness and any developing indicators of need for future treatment.

4.8 COMPOSITE RISK ASSESSMENT

4.8.1 FIRE BEHAVIOR MODEL COMPONENTS

For this plan, an assessment of fire behavior was based on well-established fire behavior models: FARSITE, FlamMap, BehavePlus, and FireFamilyPlus, as well as ESRI ArcGIS Desktop Spatial Analyst tools. Data used in the risk assessment were largely obtained from LANDFIRE.

LANDFIRE

LANDFIRE is a national remote sensing project that provides land managers a data source for all inputs needed for FARSITE, FlamMap, and other fire behavior models. The database is managed by the USFS and USDI and is widely used throughout the U.S. for land management planning. More information can be obtained from http://www.landfire.gov.

FARSITE

FARSITE is a computer model based on Rothermel's (1983) Spread Equations that also incorporates crown fire models and uses spatial data on fuels, canopy cover, crown bulk density, canopy base height, canopy height, aspect, slope, elevation, wind, and weather to model fire behavior across a landscape. In essence, FARSITE is a spatial and temporal fire behavior model. FARSITE was used to generate fuel moisture and landscape files as inputs for FlamMap. Information on fire behavior models is available online at http://www.fire.org.

Flammap

Like FARSITE, FlamMap uses a spatial component for its inputs but only provides fire behavior predictions for a single set of weather inputs. Essentially, it gives fire behavior predictions across a landscape for a snapshot of time, but it does not predict fire spread across the landscape. FlamMap was used in this project to predict fire behavior across the landscape under extreme (worst case) weather scenarios.

Behave Plus

Also using Rothermel (1983) equations, BehavePlus is a multifaceted fire behavior model and was used to determine fuel moisture in the modeling process.

4.8.2 FIRE BEHAVIOR MODEL INPUTS

Fuels

The fuels in the planning area are classified using Scott and Burgan's (2005) Standard Fire Behavior Fuel Model classification system. This classification system is based on the Rothermel (1983) surface fire spread equations, and each vegetation and litter type is broken down into 40 fuel models. This classification was selected because of the amount of herbaceous fuel in the planning area. These herbaceous fuels have a dynamic fuel moisture component that affects the

intensity to which they would burn based on the degree of pre-fire curing. The Scott and Burgan (2005) system acknowledges this feature of herbaceous fuels and classifies them accordingly.

The general classification of fuels is by fire-carrying fuel type (Scott and Burgan 2005):

- (NB) Nonburnable
- (GR) Grass
- (GS) Grass-Shrub
- (SH) Shrub
- (TU) Timber-Understory
- (TL) Timber Litter
- (SB) Slash-Blowdown

A more detailed breakdown of the fuel types present in the planning area is presented in Table 4.4, and Map 2 in Appendix A illustrates the fuels classification throughout the planning area. The dominant fuel types in the area are classified as GR2, GS1, and GS2. These fuels comprise the majority of the lowland areas of the County. GR2 is a moderately coarse, continuous grass fuel with a depth of approximately 1 foot. The spread rate in these fuels is high (20–50 chains per hour [ch/hr]), and flame lengths are moderate (4–8 feet). This fuel type makes up the majority of the southern portion of the County, grading into GS1 and GS2 in higher elevations. GS1 fuels are low load, dry climate grass-shrub and experience low flame lengths (1–4 feet) but moderate spread rates (5–20 ch/hr). GS2 fuels are made up of shrubs 1 to 3 feet high with a moderate grass understory. Spread rates and flame lengths are comparable to the GS2 fuels. In areas transitioning from grass-shrub to timber the fuels are classified as SH6 (low load, humid climate shrub) and SH7 (very high load, dry climate shrub). These taller shrubs (1–6 feet high) generate more intense fire behavior as rates of spread are often high (20–50 ch/hr) and flame lengths often exceed lengths that allow direct suppression by hand crews (12–25 feet).

The mountainous areas to the east consist of TL1, TL3, TL8, and TU5 fuels. TL1 and TL3 are Timber-Litter fuels with low load and moderate load (respectively) conifer litter, that both burn with low flame lengths (1–4 feet) and rates of spread (2–5 ch/hr). TL3 fuels are most prominent in the high elevations. TL8 fuels are timber-litter fuels with a long-needle pine litter and small amounts of herbaceous load beneath a forest canopy; spread rates are moderate (5–20 ch/hr) and flame lengths are low (1-4 feet). TL8 fuels grade into areas of TU5, which are timber-understory fuels where the fuel load is high-load conifer litter with shrub understory; these fuels burn with a moderate rate of spread (5–20 ch/hr) and moderate flame length (4–8 feet).

Nonburnable fuels are also present throughout the planning area, with urban fuels (NB1) dominant throughout communities, and some patches of agricultural fuels (cultivated crops and pasture) (NB3) in the south around Edgewood and in the northern areas around San Ildefonso Pueblo, Santa Cruz, and La Puebla. These fuel types are all considered noncombustible when input into the fire behavior model. This is important to note when determining risk in more rural areas where pasture land and cured crops could pose fire danger during certain times of the year, particularly prior to harvest. Land managers should pay close attention to these agricultural fuels in areas where crop burning is a common vegetation management practice.

Table 4.4. Fuel Model Classification for SFC CWPP Planning Area

1.	**Nearly pure grass and/or forb type (Grass)**
	GR1: Grass is short, patchy, and possibly heavily grazed. Spread rate is moderate (5–20 ch/hr); flame length low (1–4 feet); fine fuel load 0.40 ton per acre (t/ac).
	GR2: Moderately coarse continuous grass, average depth about 1 foot. Spread rate high (20–50 ch/hr), flame length moderate (4–8 feet); fine fuel load 1.10 t/ac.
	GR4: Moderately coarse continuous grass, average depth about 2 feet. Spread rate very high (50–150 ch/hr); flame length high (8–12 feet); fine fuel load 2.15 t/ac.
2.	**Mixture of grass and shrub, up to about 50% shrub cover (Grass-Shrub)**
	GS1: Shrubs are about 1 foot high, low grass load. Spread rate moderate (5–20 ch/hr); flame length low (1–4 feet); fine fuel load 1.35 t/ac.
	GS2: Shrubs are 1–3 feet high, moderate grass load. Spread rate high (20–50 ch/hr); flame length moderate (4–8 feet); fine fuel load 2.1 t/ac.
3.	**Shrubs cover at least 50% of the site; grass sparse to nonexistent (Shrub)**
	SH1: Low shrub fuel load, fuelbed depth about 1 foot; some grass may be present. Spread rate very low (0–2 ch/hr); flame length very low (0–1 foot); fine fuel load 1.7 t/ac.
	SH2: Moderate fuel load (higher than SH1), depth about 1 foot, no grass fuels present. Spread rate low (2–5 ch/hr); flame length low (1–4 feet); fine fuel load 5.2 t/ac.
	SH5: Heavy shrub load, depth 4–6 feet. Spread rate very high (50–150 ch/hr); flame length very high (12–25 feet); fine fuel load 6.5 t/ac.
	SH6: Dense shrubs, little or no herb fuel, depth about 2 feet. Spread rate high (20–50 ch/hr), flame lengths high (8–12 feet) (*only occurring in uplands beyond CWPP boundary*); fine fuel load 4.3 t/ac.
	SH7: Very heavy shrub load, depth 4–6 feet. Spread rate lower than SH5, but flame length similar. Spread rate high (20–50 ch/hr); flame length very high (12–25 feet); fine fuel load 6.9 t/ac.
4.	**Grass or shrubs mixed with litter from forest canopy (Timber-Understory)**
	TU5: Fuelbed is high load conifer litter with shrub understory. Spread rate is moderate (5–20 ch/hr); flame length moderate (4–8 feet); fine fuel load 7.0 t/ac.
5.	**Dead and down woody fuel (litter) beneath a forest canopy (Timber-Litter)**
	TL1: Light to moderate load, fuels 1–2 inches deep. Spread rate very slow (0–2 ch/hr); flame length very low (0–1 foot); fine fuel load 1.0 t/ac.
	TL3: Moderate load conifer litter. Spread rate very slow (0–2 ch/hr), flame length low (1–4 feet); fine fuel load 0.5 t/ac.
	TL8: Moderate load and compactness, may include small amount of herbaceous load. Spread rate moderate (5–20 ch/hr); flame length low (1–4 feet); fine fuel load 5.8 t/ac.
6.	**Insufficient wildland fuel to carry wildland fire under any condition (Nonburnable)**
	NB1: Urban or suburban development; insufficient wildland fuel to carry wildland fire.
	NB3: Agricultural field, maintained in nonburnable condition.
	NB8: Open water.
	NB9: Bare ground.

Notes:
Based on Scott and Burgan's (2005) 40 Fuel Model System.
Climate is arid to semiarid for all fuel types.
Only the categories present on the SFC CWPP fuel maps are presented above. For more information refer to Scott and Burgan 2005.

Topography

Topography is important in determining fire behavior. Steepness of slope, aspect, elevation, and landscape features can affect fuels, local weather, and rate of spread of wildfire. The topography in the planning area varies significantly from the flat open plains to steep mountainous areas of the Sangre de Cristos. Aspect and slope can assert significant influence on fire behavior, so where topography does fluctuate, flame lengths, rate of spread, and crowning potential could vary considerably. Other potentially significant topographic features are arroyos and tributaries that may funnel fire and intensify fire behavior. Narrow channel width and presence of vegetated islands are also topographic features that could influence fire spread in bosque areas.

Weather

Of the three fire-behavior components, weather is the most likely to fluctuate. Accurately predicting fire weather remains a challenge for forecasters, particularly during drought conditions. As spring and summer winds and rising temperatures dry fuels, particularly on south-facing slopes, conditions can deteriorate rapidly, creating an environment that is susceptible to wildland fire. Fine fuels (grass and timber litter) can cure rapidly, making them highly flammable in as little as one hour following light precipitation. Low live fuel moistures (typical in drought conditions throughout New Mexico) of shrubs and trees can significantly contribute to fire behavior in the form of crowning and torching. With a high wind, grass fires can spread rapidly, engulfing communities with often limited warning for evacuation. The creation of defensible space is of vital importance in protecting communities from this type of fire. For instance, a carefully constructed fuel break placed in an appropriate location could protect homes or possibly an entire community from fire. This type of defensible space can also provide safer conditions for firefighters by improving their ability to suppress the fire and protect life and property.

One of the critical inputs for FlamMap is fuel moisture files. For this purpose weather data was obtained from "FAMWEB" (http://fam.nwcg.gov/fam-web/famweb/index$.startup), a fire weather database maintained by the National Wildfire Coordinating Group. With guidance from the U.S. Fish and Wildlife Service meteorologist at the Southwest Area Coordination Center, a remote automated weather (RAW) station was selected, and data was downloaded from the website. The weather station was selected based on period of record, location within the planning area, reliability of the data, and how representative the data would be for weather in the planning area. As requested by the Core Team, wind speeds were based upon extreme conditions of 35 miles per hour.

Using an additional fire program (FireFamilyPlus) with the RAW station data, weather files that included prevailing wind direction and 20-foot wind speed were created; fuel moisture files were then developed for downed (1-hour, 10-hour, and 100-hour) and live herbaceous and live woody fuels. These files represent weather inputs in FlamMap.

4.8.3 FIRE BEHAVIOR MODEL OUTPUTS

The following is a discussion of the fire behavior outputs from FlamMap.

Flame Length

Map 3 in Appendix A illustrates the predicted flame length classifications for the County. Flame lengths are determined by fuels, weather, and topography. Flame length is a particularly important component of the risk assessment because it relates to potential crown fire and suppression tactics. Direct attack by hand lines is usually limited to flame lengths under 4 feet. For flame lengths in excess of 4 feet, indirect suppression is the preferred tactic. Using engines and heavy equipment, suppression will move from direct to indirect with flame lengths in excess of 8 feet.

The highest predicted flame lengths (>11 feet) are found in the northeastern portion of the County in the Sangre de Cristos, largely in the heavy shrub fuel types (SH5). However, a number of areas are classified as having potentially high flame lengths (>8 feet and >11 feet) particularly in areas of grass-shrub (GS2) and shrubland fuels (SH6 and SH5) scattered throughout the County. Another area of extreme flame lengths is predicted around Cedar Grove and along Highway 14 towards Madrid; again this occurs largely in the GS2 and shrubland fuel types. A large portion of the landscape is predicted to exhibit low flame lengths (up to 4 feet); this is especially evident in the short and moderate length grasslands (GR1 and GR2).

Rate of Spread

Map 4 in Appendix A illustrates the predicted rate of spread classifications for the planning area. The greatest rates of spread are predicted to occur in the grass-shrub fuels (GS1 and GS2) of the top two-thirds of the County, the shrubland fuels that occur in the transition zone between grass and timber (SH6 and SH7), and in the timber-understory fuels (TU5) in the Sangre de Cristos. Rates of spread in the remaining timber fuels are expected to be high under extreme wind conditions. Agricultural and urban areas are clearly delineated in this model by their low rate of spread.

Note: The spread rates in grassland may appear lower than would normally be expected. The reason for this is that the Core Team wanted to use a wind speed of 30 miles per hour in the model runs. In grasslands wind speeds can reach a certain threshold whereby an increase in wind speed actually reduces the fire spread because of the turbulence effect on the flame. This was acknowledged by the Core Team who chose to continue to adopt the 30-mile-per-hour wind speeds because these produced more realistic fire behavior in the timber fuels than model runs that used lower wind speed. It is important that this limitation is acknowledged by land managers responsible for fire in grassland ecosystems throughout the County.

Fireline Intensity

Map 5 in Appendix A illustrates the predicted fireline intensity throughout the planning area. Fireline intensity describes the rate of energy released by the flaming front and is measured in British Thermal Units per liner foot, per minute (BTU/ft/sec). Fireline intensity is a reliable measure, and suppression activities are planned according to it. The expected fireline intensity

throughout the County is similar in pattern to the predicted flame length as fireline intensity is a function of flame length.

Crown Fire

Crown fire activity in the County is confined to areas of timber-litter fuel (TL3 and TL8). These areas are primarily in the higher-elevation mountain areas in the northeast portion of the planning area. The remainder of the planning area is likely to witness surface fire.

Spot Fire Potential

The Flammap results indicate active crowning in some areas, which could generate spot fires. These new ignitions pose particular hazard in the mountainous terrain of the Sangre de Cristos, particularly where communities are located in this rugged terrain. Immediate suppression of spot fires is critical to prevent them from increasing the rate of spread and fire behavior; it also can prevent firefighters from becoming trapped while fighting the main fire.

Fire Occurrence Density

Map 6 in Appendix A illustrates the fire occurrence density throughout the planning area. Fire occurrence density was determined by performing a density analysis on fire start locations with ArcGIS Desktop Spatial Analyst. These locations were provided by the NMSF and the USFS as GIS points that showed the location of fire starts within the project area over the last 37years (1970 to 2007). The density analysis was performed over a 5-mile search radius. The density of previous fire starts is used to determine the risk of ignition of a fire. Map 6 (Appendix A) reveals a definite pattern of fires in the Sangre de Cristos, around communities such as Santa Fe, Glorieta, La Barberia, Cundiyo, Santa Cruz, and Edgewood, and along the main highways, particularly Interstate 25 and U.S. Highway 84.

It may be argued that areas that have burned previously are less likely to burn in the future due to lowered fuel loads, but post-burn regrowth and dead and downed fuels can contribute to increased fire risk in these previously burned areas. The fuels assessment used to determine the fuel models takes into account the fuel loading of recently burned areas as it is developed from 2006 imagery. Furthermore, the fire occurrence maps are used to provide information on areas where lightning- and human-ignited fires are prevalent, conditions that make an area more prone to fire in the future.

4.9 COMPOSITE RISK ASSESSMENT MODEL

4.9.1 GIS OVERLAY PROCESS

All data used in the risk assessment were processed using Environmental Systems Research Institute (ESRI) ArcGIS Desktop and the ESRI Spatial Analyst Extension. Information on these programs is available online at http://www.esri.com. Data were gathered from all relevant agencies, and the most current data were used.

All fire parameter data sets were converted raster format (a common GIS data format consisting of a grid of cells or pixels, with each pixel containing a single value). The cell size for the data is 30 × 30 meters (m) (900 square meters [m²]). Each of the original cell values was reclassified

with a new value between 1 and 4, based on the significance of the data (1=lowest, 4=highest). Prior to running the models on the reclassified data sets, each input parameter was weighted; meaning they were assigned a percentage value reflecting that parameter's importance in the model. The parameters were then placed into a Weighted Overlay Model, which "stacks" each geographically aligned data set and evaluates an output value derived from each cell value of the overlaid data set in combination with the weighted assessment. The resulting data set contains only values 1 through 4 (1=Low, 2=Medium, 3=High, 4=Extreme) to denote fire risk. This ranking demonstrates the relative fire risk of each cell based on the input parameters.

Table 4.5 lists the individual datasets, the classes assigned to the data, and the relative weights assigned within the modeling framework. Figure 4.3 illustrates how the various outputs were compiled in the Composite Risk Assessment.

Table 4.5. GIS Overlay Components

Layer	Source	Year	Weight (%)	Ranks
Flame Length (Map 3 Appendix A)	LANDFIRE: Elevation, Aspect, Slope, Scott and Burgan 40 Fuel Model, Forest Canopy Base Height (CBH), Forest Canopy Bulk Density (CBD), Forest Canopy Cover (CC), Forest Canopy Height (CH)	2007	15	1: 0–4 feet
				2: 4–8 feet
				3: 8–12 feet
				4: Greater than 12 feet
	RAW Stations (Weather)	1986–2006		
Rate of Spread (Map 4 Appendix A)	LANDFIRE: Elevation, Aspect, Slope, Scott and Burgan 40 Fuel Model, CBH, CBD, CC, CH	2007	15	1: 0–5 feet/minute
				2: 5–15 feet/minute
				3: 15–40 feet/minute
				4: Greater than 40 feet/minute
	RAW Stations (Weather)	1986–2006		
Fireline Intensity (Map 5 Appendix A)	LANDFIRE: Elevation, Aspect, Slope, Scott and Burgan 40 Fuel Model, CBH, CBD, CC, CH	2007 1992–2006	10	1: 0–100 BTU/ft/sec
	RAW Station (Weather)	1986–2006		
Crown Fire Activity	LANDFIRE: Elevation, Aspect, Slope, Scott and Burgan 40 Fuel Model, CBH, CBD, CC, CH	2007	15	1: No Data
	RAW Station (Weather)	1986–2006		2: Surface Fire
				3: Passive Crown Fire
				4: Active Crown Fire
				2:100–500 BTU/ft/sec
				3: 500–1,000 BTU/ft/sec
				4: >1,000 BTU/ft/sec
Fire Occurrence (Map 6 Appendix A)	NMSF	1970–2007	45	1: No Fires/square mile
				2: 0–0.2 Fire/square mile
				3: 0.2–1 Fire/square mile
				4: Greater than 1 Fire/square mile

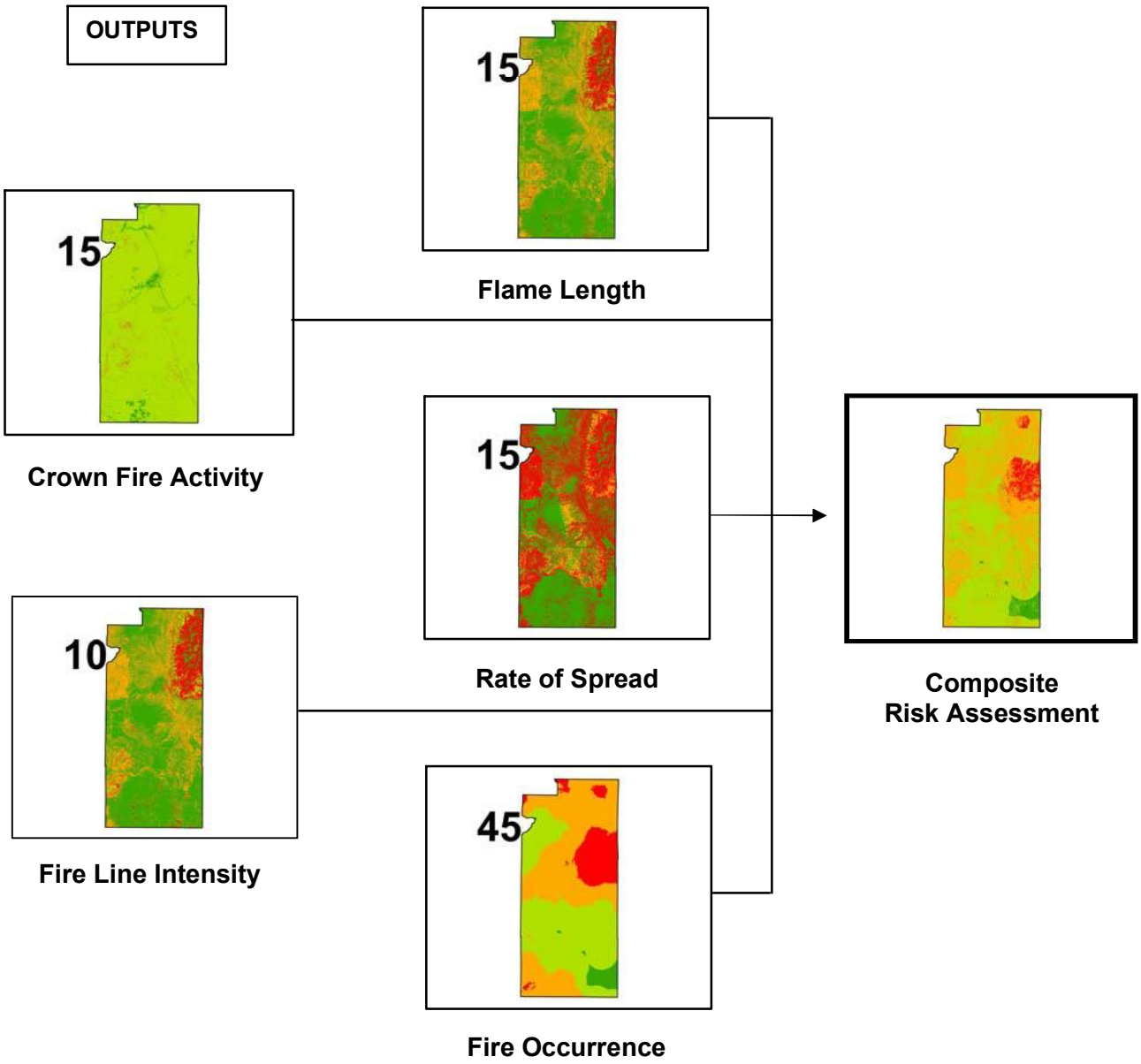

Figure 4.3. Composite Risk Assessment process.

4.9.2 RESULTS

Figure 4.4 illustrates the Composite Risk Assessment for the planning area that combines all the fire behavior parameters described above. The Composite Risk Assessment classifies the planning area into low, moderate, high, and extreme risk categories.

The Composite Risk Assessment illustrates the high risk associated with the Sangre de Cristos, particularly a large area east of Santa Fe and east of Cundiyo on National Forest lands. This pattern of extreme risk is a consequence of the fire occurrence density layer in the model as these two areas were highlighted as having experienced extreme fire densities. Because these fires were located close to communities and roads, they are likely to be predominantly human-caused; however, the elevation and dominance of timber means that possible lightning starts cannot be dismissed as the cause. The surrounding mountain portions are depicted as high and moderate risks as these areas are farther from roads and therefore farther from areas of frequent human ignition. Glorieta, La Barberia, and Dalton Canyon are three communities depicted as high and extreme risk due to adjacent dense shrub and timber fuels that generate extreme fire behavior. Extreme risk areas are primarily associated with timber-litter (TL3, TL8) and timber-understory (TU5) fuels. Some areas dominated by timber fuels, however, are classified as moderate as a result of the lower flame lengths and rates of spread in these fuel types. Crown fire behavior and spotting potential, however, raise the risk associated with these fuels. High risk areas are found throughout the County and are often associated with shrubland fuels (GS2). Areas of particular concern because of their proximity to communities include the area south of Madrid along Highway 14; the area northwest of Cedar Grove; the area southwest of Edgewood; the area east of Lamy and north of Galisteo; the area surrounding Santa Fe, Tesuque, Chupadero, and communities along Highway 84; and the northern communities of Cuyamungue, Pojaque, Cundiyo, La Puebla, El Valle de Arroyo Seco, Santa Cruz, and Sombrillo. Particular attention should be given to communities located northeast of areas of high risk as prevailing winds from the southwest could generate fire spread to these communities.

According to the Composite Risk Assessment, no communities identified in this plan are at low risk of wildfire. The majority of communities are depicted as either high or extreme risk and the remainder of the communities are classified as moderate risk since even areas of grassland fuels could exhibit rapid fire spread rates and significant ignition potential due to the road network through these grassland areas.

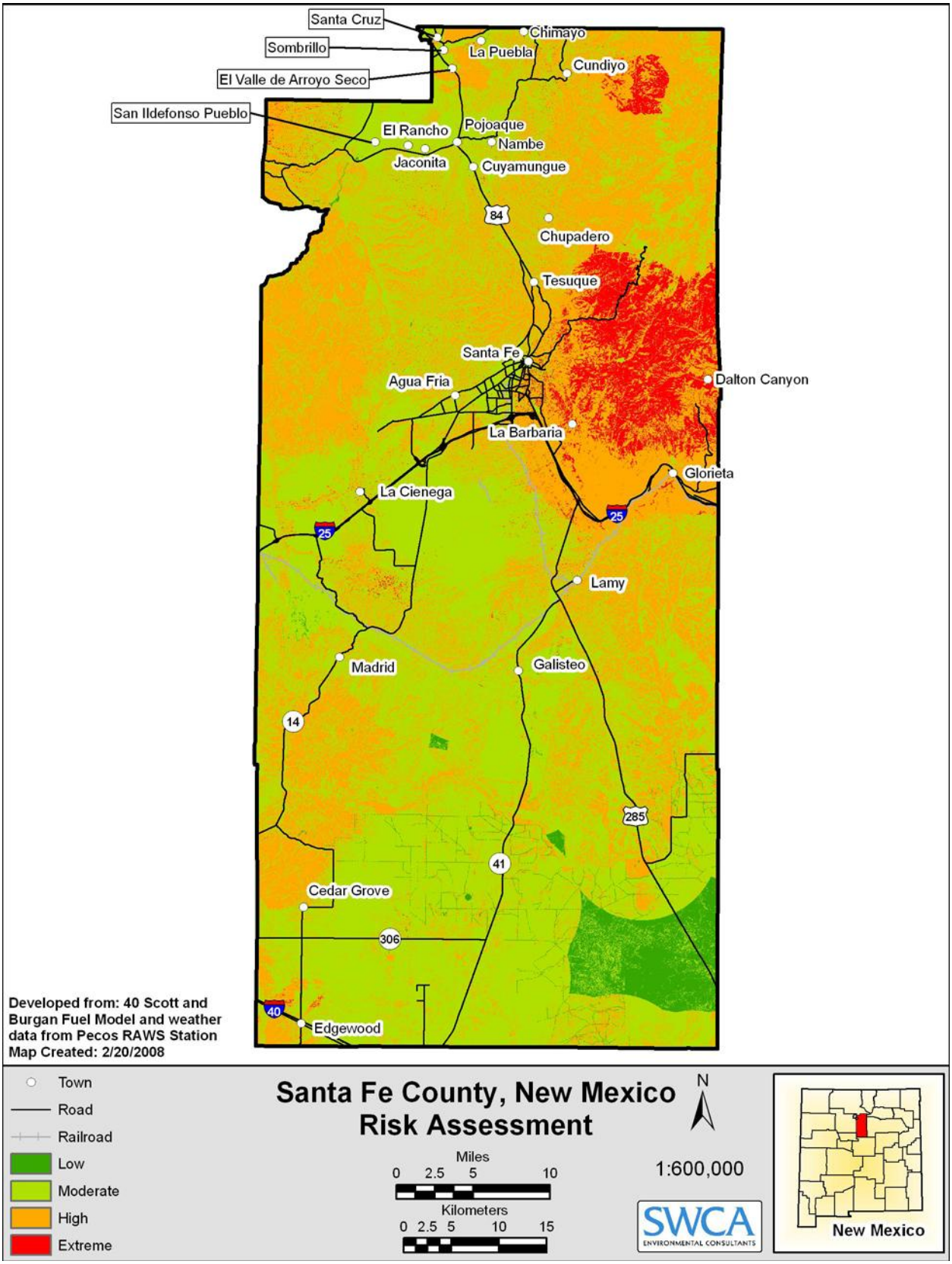

Figure 4.4. Composite Risk Assessment.

4.10 COMMUNITY VALUES AT RISK

CVAR provide a measure of people, property, and natural and other resources that could suffer losses in a wildfire. Examples of CVAR may include, but are not limited to, housing, businesses, infrastructure (including utilities, trails, roads), natural resources (including wildlife), cultural resources, tribal concerns, recreation areas and open space, scenic resources (including significant landscapes), and water resources. CVAR identified by community members strongly influence the recommendations in a CWPP.

Landowners' personal values will guide fuels treatments on private property. No one universal treatment can be applied to all hazardous fuels, and therefore, every treatment is unique. Values that drive fuels treatments may be based on aesthetics, restoring ecological or forest health, reducing the hazards that contribute to wildland fire, and a myriad of other values. Surrounding forest type will be another factor influencing landowners decisions about which type of treatment is most appropriate for their land.

The public meeting process and community surveys were used to compile information identifying values that the public deems to be at risk from wildland fire. These values fall into various categories, such as natural values and cultural values. Often these comments identify values that community members would like to see protected and or addressed. For example, community members have noted that there is a need for increased public education and awareness on how to create defensible space. This plan provides recommendations and information for homeowners to create defensible space and take other preventative actions to protect themselves, their homes, and property from wildfire.

Other values at risk that were considered and helped direct the recommendations for public education and awareness, improving fire response capabilities, and reducing structural ignitability include: community/fire department fire prevention partnerships and programs, water sources and continued fire protection resource development, firefighter training and readiness, safety zones, public education/training, and economic impacts.

This information helped to drive the treatment recommendations outlined in Section 5 (Appendix B is a compilation of all community comments). In addition, with Core Team collaboration, additional CVAR were identified; the WUI boundary encompasses the majority of these CVAR.

4.10.1 NATURAL CVAR

The feedback from the general public emphasized the importance of the watersheds, particularly those providing municipal water supply and ecological values to the general public. Treatment recommendations often target reduction of fuels at the headwaters of critical watersheds in an attempt to improve overall ecosystem health through prevention of intense wildfire. Examples of natural values identified by the public and the Core Team include the following:

- Headwaters
- Water resources
- Mature cottonwoods
- Riparian corridors along Rio Grande, Rio Pojoaque, and Rio Tesuque
- Native species
- Wildlife habitat/wildlife preserve
- Habitat for endangered species
- Wetlands
- Air quality
- Forest health
- San Pedro Mountains and groundwater recharge in the southern region of the County

4.10.2 SOCIAL CVAR

Social values include population, recreation, infrastructure, agriculture, and the built environment. Much of the built environment associated with the CVAR fell within the WUI. Examples included the following:

- Utilities (i.e., power and communication)
- Water supply and treatment sites
- Bridges
- Burlington Northern Santa Fe Railroad
- Recreational facilities
- River and trails
- Bosque/Riverine infrastructure
- Residential housing
- Community facilities
- Agricultural land
- Livestock
- Security and privacy
- La Cueva
- La Barberia
- Cañada
- Chysadero
- Tesuque
- Nambe
- Area along Interstate 25 between Santa Fe and El Dorado exit
- Cañoncito
- Hondo Hills
- San Sebastian
- Canada de Los Alamos
- El Dorado Wilderness Areas
- Glorieta Mesa

4.10.3 CULTURAL CVAR

Prehistoric resources within the planning area are abundant and several have not been surveyed, or information about the resources is not available. A large number of historic resources are located in the planning area, including historic adobe churches, plaza structures and adjoining houses, and many historic civic and private buildings along the Rio Grande river corridor. Many of these historic cultural resources maintain their use and purpose within the surrounding neighborhoods; they also may be recognized as critical social infrastructure.

The following cultural resources were identified by members of the public and the Core Team:

- Historic churches
- Historic plaza buildings
- Historic municipal buildings
- Historic buildings and houses (non-municipal) recognized on the National Register and New Mexico State Historic Registry
- Traditional irrigated agricultural lands and their corresponding acequia systems and acequia components and structures
- Pre-historic and historic pueblo sites
- Archaeological sites
- Historic communities along Highways 14 and 41

5.0 PRIORITIES, RECOMMENDATIONS, IMPLEMENTATION, AND MONITORING

This section addresses recommendations, action plans, and monitoring. The four different types of recommendations are: those for 1) fuels reduction projects, 2) public education and outreach, 3) reduction of structural ignitability, and 4) improved fire response capabilities. These recommendations are based on Core Team input, public outreach, and the GIS risk assessment. The recommendations are general in nature to provide maximum flexibility in implementation.

General action plans are incorporated into recommendation tables and address timeframes, contacts, and prioritization. However, securing funding, (please see Appendix J for a list of potential funding opportunities) developing a specific action plan and monitoring and assessment strategy that identifies roles and responsibilities, and timetables for completing highest-priority projects are important steps in organizing the implementation of any of the recommendations.

5.1 METHODS OF FUELS REDUCTION

Several treatment methods are commonly used for fuels reduction. This brief synopsis of treatment options is provided for general knowledge; specific projects will require further planning. Examples of previous treatments implemented in Santa Fe County, showing before and after conditions, can be seen in Figure 5.1 through Figure 5.4. The appropriate treatment method will vary depending on factors such as the following:

- Diameter of materials
- Acreage of project
- Steepness of slope
- Density of fuels
- Proximity to structures
- Fuel costs
- Area accessibility
- Project objectives

It is imperative that implementers plan for the long-term monitoring and maintenance of all treatments. Post-treatment rehabilitation such as seeding with native plants and erosion control may be necessary.

Figure 5.1. Arroyo Hondo Santa Fe County Open Space before treatment.
Note: This project was part of a forest demonstration site funded by the Collaborative Forest Restoration Program.

Figure 5.2. Arroyo Hondo Santa Fe County Open Space after treatment.

Figure 5.3. East Fork trail head, Cuba Ranger District, before treatment.

Figure 5.4. East Fork trail head, Cuba Ranger District, after treatment.

5.1.1 DEFENSIBLE SPACE

Defensible space and emergency access standards for new residential subdivisions are contained in the 2001 Santa Fe County Urban Wildland Interface Code. As existing communities begin to practice approaches to better prepare for wildland fire discussed in this code, it is anticipated that individual homeowners will begin to take more responsibility for protecting themselves and their neighbors.

Recommendations for creating defensible space are available online at www.firewise.com or can be acquired by contacting the Santa Fe County Fire Department. However, typical defensible space width will vary by slope steepness and fuel type. For example, grass fuels require approximately 30 feet of clearance from the eaves of a house. This clearance can increase to over 70 feet on slopes greater than 40%. Heavier fuels may require additional work to chunk and dispose of woody materials, periodic raking of leaf and needle litter, and pruning of selected trees in yards and along driveways. The local situation, where the property owner consults with a County Fire Department WUI specialist, will dictate the type and intensity of work required.

5.1.2 FUELBREAK RECOMMENDATIONS

It is important to note the distinction between the terms "fuelbreak" and "firebreak." A firebreak is a strip of land, 20 to several hundred feet wide (or more), in which all vegetation is removed down to bare, mineral soil each year prior to fire season. In contrast, a fuelbreak (or shaded fuelbreak) is an easily accessible strip of land of varying width (depending on fuel and terrain), in which fuel density and consequently wildfire intensity is reduced by removing some, but not all of the vegetation, thus improving fire suppression opportunities.

In fuelbreak construction, the stand is thinned (can be full or partial), and many remaining trees are pruned to remove ladder fuels. Here, it is important to retain a "patchiness" appearance horizontally across the landscape. This method prevents the "tree farm" look of equal tree spacing in rows, and promotes a more natural looking visual appearance.

Brush, heavy surface fuels, and dead trees (snags) are disposed of (see section 5.1.3), which creates a more open, park-like appearance. The intent is to keep a wildfire burning on the surface, not in the crowns of trees. Land owners are cautioned that under extreme fire behavior conditions fuelbreaks may become totally ineffective. Also note that fuelbreaks created without consideration of appearance can be visually undesirable. Thus, care must be taken with the property owner to plan and manage fuelbreak construction with this in mind.

Tree crown spacing is a key element in planning the fuelbreak. As with defensible space, crown spacing can vary. On slopes of <10%, a 10-foot minimum spacing is recommended; for slopes of <20%, a 15-foot spacing; for slopes <40%, a 20-foot spacing; and for >40% slopes, a 30-foot crown spacing should be considered. Also, trees can be felled so as to lay along the contour and help slow erosion, especially on steeper slopes.

Table 5.1 illustrates how typical fuelbreak widths above and below a value to be protected vary with changes in slope steepness. Note that these distances are only guidelines, and width may vary by local fuel type and terrain features.

Table 5.1. Fuel Break Guidelines

Percent Slope	Typical Minimum Width (feet) -- Uphill	Typical Minimum Width (feet)--Downhill	Total Width of Fuel Treatment (feet)
0–10%	150	150	300
10–20%	135	180	315
20–30%	120	200	320
30–40%	110	210	320
40–50%	100	230	330
50% & above	100	250+	350+

Under certain conditions of the HFRA a fuelbreak may extend out from the WUI boundary 0.5 to 1.5 miles. The USFS, the Santa Fe National Forest, and the BLM would determine actual buffer width, given conditions of fuels, terrain, and values at risk on the proposed project area.

Access routes and right-of-way clearances are also important to the overall fuels mitigation strategy. Here, the property owner or land management agency should consider how much clearance along roadways is adequate to allow for safe evacuation and to allow fire apparatus unimpeded movement, turnaround space, turnouts, and access to available water.

Re-treatment, or maintenance of fuelbreaks, is an essential component of long-term protection. In the absence of maintenance, fuelbreak effectiveness will decrease over time as in-growth increases. It is recommended that fuelbreak maintenance in this typically dry environment be considered every 7 to 15 years, depending on the individual site conditions and original treatment intensity. Monitoring strategies outlined in Section 5.1 along with the latest science, will support the decision-making process.

5.1.3 Debris Disposal

Thinning and/or pruning trees and shrubs without the removal or treatment of slash (debris) can often create greater fire hazard conditions than prior to treatment.

Three treatment methods are commonly used: hand or mechanical lopping/scattering and burning, piling and burning, and mastication or chipping. Lop and scatter redistributes the fuels rather than removing them, the technique is best applied in areas of lower fuel loading. This method calls for thinned trees to be limbed, bucked, and dispersed to prevent concentrating the slash. The area is then broadcast burned, or the slash is mechanically crushed to save intensive labor costs.

Mulching of small trees and slash using equipment with mulching heads (mastication) is becoming a popular method of treatment. Size, amount, and location of slash dictates the method used. Cost and the final desired appearance of the treatment area are also important considerations.

5.1.4 Prescribed Fire

As discussed in other sections of this plan, prescribed fire can become an important fuels/debris management tool. Aside from the pile-and-burn method already described, low-intensity

broadcast burns of small unit size (even a few acres at a time) can begin to locally restore ecosystem vigor and health. The consumption of woody and herbaceous debris with prescribed fire not only opens surface areas to sunlight, reduces plant competition, and prepares seedbed, but it can also recycle key organic chemicals that help to naturally fertilize nutrient-poor soils.

Again, the primary objectives of fuels treatment are to provide for both firefighter and public safety during wildfire suppression events, and to reduce the potential for a catastrophic crown fire. Finally, the forested areas that have been treated will better respond to natural disturbance events such as drought, insect epidemics, and wildfire.

5.1.5 Treatments for Saltcedar (Tamarix Spp.) Infestation

Many riparian areas throughout the County have become overrun by saltcedar. The eradication and control of saltcedar have challenges, however. Long-term commitment and multiple techniques are required to reduce its extent and minimize its spread. Techniques that are used for the management of saltcedar include mechanical, chemical, and biological methods.

Mechanical treatments, such as hand-pulling and cutting, can be used for smaller stands of young saltcedar saplings, but these treatments become expensive and ineffective within large stands of shrub-sized individuals. Root cutting and bulldozing can be effective, but the benefits may not outweigh the problems resulting from soil damage and the expense of this method. Fire has been used with some success, but because saltcedars are fire-adapted, they readily resprout. Resprouting is likely to occur after using any of these methods, so it is highly recommended to combine methods and follow-up treatments to continue control of this species.

Chemical control is typically the most effective method used for saltcedar; however, application of herbicides should be site specific. Aerial applications of imazapyr or an imazapyr and glyphosphate mixture should occur from late August through September. This method is slow-acting, and treated trees should not be removed for up to three years after the treatment to ensure root kill. It is important to only use herbicides that are approved for application near water. Biological control methods have also shown some success. One such method is the use of saltcedar leaf beetle (*Diorhabda elongate)* that asserts physiological stress on the tree through defoliation. This treatment coupled with burning in the summer months under intense prescribed fire prescription has been found to be successful in some saltcedar stands. Significant damage to the root crown is required for high mortality; this may require supplementing fuel loading, particularly around the root crown. The combination of cutting and/or chemical application to cut stumps or small-diameter whips is one of the most common management techniques used for saltcedar. The methods used will depend on the size of the saltcedar stand, the characteristics of the riparian area, and the distance to a community.

5.2 Recommendation for Fuels Reduction Projects

Recommendations for fuels reduction projects are illustrated in Figure 5.5 at the end of this section. These treatment recommendations are for areas deemed as high risk by the Community Hazard and Risk Assessment and Composite Risk Assessment, and by public and Core Team input. A description of treatment recommendations is provided in Table 5.2 at the end of this section. Also included on the fuels treatment map (see Figure 5.5) are projects that are being

implemented by other agencies, such as the BLM. One project that is not included on the map, but should be mentioned, is a thinning project organized by the Forest Guild, Chimayo Youth Conservation Core, and the Taos Field office of the BLM. This project will thin up to 100 acres of piñon-juniper near the Boyscout Camp Rand in the northeast corner of the County.

When implementing fuels reduction projects it is important to be clear of the goals and objectives of the treatment. Fuels treatments that are designed to reduce fire impact on communities and values at risk are often different from forest restoration treatments that are designed for restoration of large-scale forest health and consider stand structure, seral stage, density, insect infestations, disease, mortality, and wildlife habitat, among other issues. The number one priority and focus of the entire County fuels treatment program is the protection of life and property. Given the large-scale scope of forest restoration, the greatest emphasis in this plan will be on hazardous fuels reduction treatments that can occur on private lands and boundaries of public lands, and treatments that can be implemented by individual landowners and agencies.

Treatments to mitigate fuel accumulation and fire hazard have long been advocated (Martinson and Omi 2002). Crown fire initiation and spread depends on the vertical and horizontal continuity of fuels (Van Wagner 1977); the purpose of any fuels reduction project is to reduce this continuity with the intent of protecting life and property and restoring landscapes to a sustainable and healthy condition. Moderating extreme fire behavior, reducing structural ignitability, creating defensible space, providing safe evacuation routes, maintaining all roads for firefighting access, and minimizing resistance to control are methods of fuels reduction likely to be used by communities located in the WUI zone; using multiple methods often magnifies the benefits. Within and immediately around communities these goals may or may not be compatible with ecosystem restoration. Natural ecosystem form and function should always guide treatments but in interface areas, protecting life and property should be a primary objective.

In addition to ecological benefits of fuels reduction work, residents and visitors to the area will recognize positive changes in landscape appearance. For example, as thinning opens the dense and often stagnating forest canopy and allows sunlight to reach the surface, many native species of grasses, shrubs, and flowering plants will begin to appear. Thus, while fuels treatments provide for long-term protection of life and other values at risk, the added value of enhancing the appearance of forested communities will be instilled.

An important component of fuels treatment is monitoring and evaluating whether fuels treatments have accomplished their defined objectives and if any unexpected outcomes have occurred. In addition to monitoring mechanical treatments, it is important to carry out comprehensive monitoring of burned areas to establish the success of fuels reduction treatments on fire behavior, as well as monitoring for ecological impacts, repercussions of burning on wildlife, and effects on soil chemistry and physics. *Adaptive management* is a term that refers to adjusting future management based on the effects of past management. Monitoring is required to gather the information necessary to inform future management decisions, and can provide valuable educational opportunities for students. Economic and legal questions may also be addressed through monitoring.

The monitoring of each fuels reduction project would be site specific, and decisions regarding the timeline for monitoring and the type of monitoring to be used would be determined by project. Monitoring and reporting contribute to the long-term evaluation of changes in ecosystems, as well as the knowledge base about how natural resource management decisions affect both the environment and the people who live in it.

The most important part of choosing a monitoring program is selecting a method appropriate to the people, place, and available time. Several levels of monitoring activities meet different objectives, have different levels of time intensity, and are appropriate for different groups of people. They include the following:

Minimum—Level 1: Pre- and post-project photos

Appropriate for many individual homeowners who conduct fuels reduction projects on their properties.

Moderate—Level 2: Multiple permanent photo points

Permanent photo locations are established using rebar or wood posts, and photos are taken on a regular basis. Ideally, this process would continue over several years. This approach might be appropriate for more enthusiastic homeowners or for agencies conducting small-scale, general treatments.

High—Level 3: Basic vegetation plots

A series of plots can allow monitors to evaluate vegetation characteristics such as species composition, percent cover, and frequency; monitors then can record site characteristics such as slope, aspect, and elevation. Parameters would be assessed pre- and post-treatment. The monitoring agency should establish plot protocols based on the types of vegetation present and the level of detail needed to analyze the management objectives.

Intense—Level 4: Basic vegetation plus dead and downed fuels inventory

The protocol for this level would include the vegetation plots described above but would add more details regarding fuel loading. Crown height or canopy closure might be included for live fuels. Dead and downed fuels could be assessed using other methods, such as Brown's transects (Brown 1974), an appropriate photo series (Ottmar et al. 2000), or Fire Effects Monitoring and Inventory System plots.

Before implementing treatments, all appropriate compliance and permitting must be acquired. On federally-managed lands, NEPA regulations must be implemented before on-the-ground projects can begin.

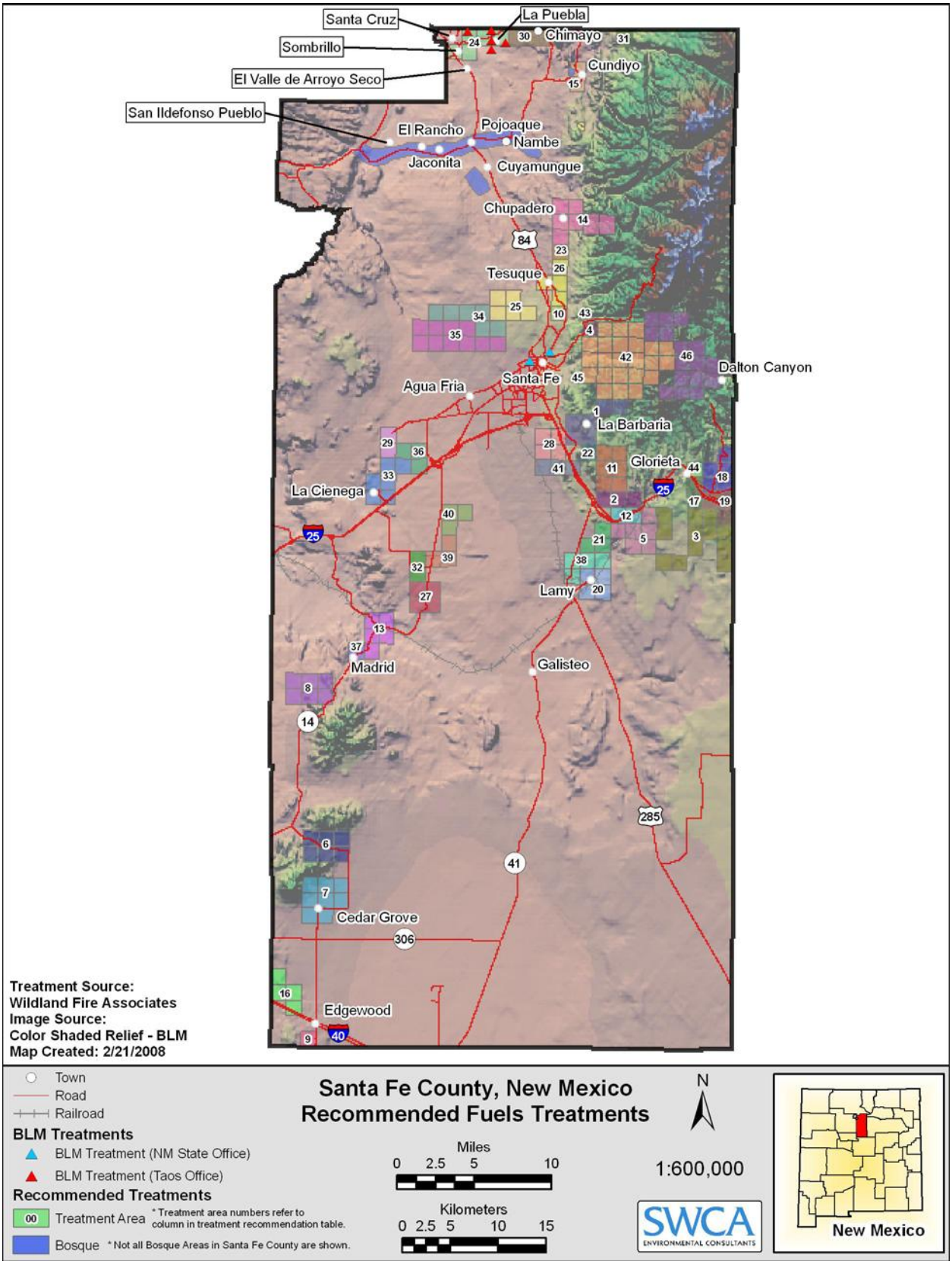

Figure 5.5. Recommended fuels treatments

Table 5.2. Action Plan for Fuels Treatments

Project (High or Medium Priority Rating) [1]	Location (Township, Range, Sections)	Size (acres)	Ownership/ Management [2]	Method [3]	Goal	Implementation	Monitoring [4]	BLM Methods	USFS Methods
La Barbaria /Dalton Can. **(H) #1**	T16N, R10E 2,3,8,9,16,17; T17N, R10E 35 USFS & Apache Ridge work)	4,000	Private (coordinate w/USFS)	T, P, B, M, or C - varies w/location & right-of-way fuel	Reduce crown fire potential; firefighter safety and access	Fall 2009	P, I; 5-year intervals	–	T, B Along private boundary to 0.5 mile ± width
Apache Ridge **(H) #2**	T15N, R10E 1,2,3	1,950	Private (coordinate with State Land Office)	T, P, R, B or C	(same as above)	Fall 2009	P, I; 5-year intervals	–	–
Glorieta Mesa **(H) #3**	T15N, R11E 8,10,11,13, 14,15,17,22,24,25,28,29 (coordinate w/ adjacent USFS & NPS)	5,735	Private, USFS, NPS	T, B/M, F along boundary	Reduce crown fire potential, FF safety	Summer/Fall 2010	Consider photo plots	–	F, B along boundary approx. 0.5 + mile wide
Hyde Park **(H) #4**	T17N, R10E 9 (coordinate work w/USFS Aztec Springs)	390	Private	T/PM/R	Defensible Space/buffer	Fall 2010	I, P; 5-year intervals	–	F, B along boundary approx. 0.5 + mile wide
Ojo de la Vaca **(H) #5**	T15N, R10E 13,14,24; T15N, R11E 7,18,19 (coordinate w/USFS along eastern boundary)	3,840	Private	T, P, B, M	Buffer, reduce crown fire potential	Fall 2010	I, P; 5-year intervals	–	F, B (one mile of boundary length); 0.5-mile-wide
San Pedro **(H) #6**	T12N, R7E 26,27,28,33,34,35	3,840	Private BLM	T (slopes), P, B, M, or C	Buffer along BLM boundary; defensible space	Winter 2009 or 2010	P, I; 5-year intervals	T, B, Fuelbreak Boundary approx. ½ mile wide	–
Cedar Grove **(M) #7**	T11N, R7E 9,10,11,14,15,16,21,22 (coordinate w/Pueblo)	5,100	Private, Pueblo	T slopes, R, B, or C	Keep fire on surface	Winter 2011	Same as above	–	–
Mailbox Road **(M) #8**	T13N, R7E 3,4,5,8,9,10	7,680	Private	T, P, B, C	See above	Winter 2011	Same as above	–	–
Bella Vista **(M) #9**	T10N, R7E, 33	640	Incorporated Municipality	Create defensible space	Provide firefighter safety	Winter 2011	–	–	–

Table 5.2. Action Plan for Fuels Treatments, continued

Project (High or Medium Priority Rating) [1]	Location (Township, Range, Sections)	Size (acres)	Ownership/ Management [2]	Method [3]	Goal	Implementation	Monitoring [4]	BLM Methods	USFS Methods
Bishop's Lodge **(M) #10**	T17N, R10E, 6 (coordinate w/USFS)	640	Private	Create defensible space	Firefighter safety, improve egress	Fall 2012	As needed	–	F, B, M or R Create 0.5 + mile buffer
Canada de los Alamos **(M) #11**	T16N, R10E 22,23,26,27,34,35 (coordinate work w/USFS)	3,328	Private	T, P, B, M, or C	Defensible space, reduce crown fire	Fall/Winter 2012	As needed	–	Create F along boundary; vary width with slope/fuels
Canoncito **(M) #12**	T15N, R10E 1,2,3 (coordinate w/NPS)	1,280	Private, NPS	T, B, or M, C use existing fuelbreaks	–	Fall 2011	I, P; consider photo sta.	–	–
Cerrillos **(M) #13**	T14N, R8E 17,18,19,20,30	2,560	Private	Create defensible space	–	Winter 2011	P, I	–	–
Chupadero **(M) #14**	T18N, R10E 3,4,5,6,7; T19N, R10E 31,32	1,882	Private, Pueblo	Create defensible space; T and B where needed	Improve forest health, firefighter safety	Fall 2012	P, I	–	F, B, R to create 0.5-mile buffer along boundary
Cundiyo **(M) #15**	T20N, R10E 17,20	300	Private BLM	Create defensible space; T and B where needed	Firefighter safety & improve egress	2010	P, I as needed	B and/or C/M in key locations	–
Thunder Mtn./Edgewood **(M) #16**	T10N, R7E 7,17,18,20	1,270	Private, Pueblo, New Mexico Natural Gas	T, P, M or C,	Firefighter safety & improve egress	2011	P, I	–	–
Glorieta Estates **(M) #17**	T15N, R11E 3 T16N, R11E 34 (coordinate work w/USFS, NPS)	717	Private, USFS, NPS	Continue FIREWISE work: T,P, M, C, or R	Improve escape routes, defensibility	2009 and ongoing	P, I	–	Consider F, T/B/M along boundary width adjusted for slope/fuels

Table 5.2. Action Plan for Fuels Treatments, continued

Project (High or Medium Priority Rating) [1]	Location (Township, Range, Sections)	Size (acres)	Ownership/ Management [2]	Method [3]	Goal	Implementation	Monitoring [4]	BLM Methods	USFS Methods
La Cueva Canyon **(M) #18**	T16N, R11E 24,25,26,35,36 (coordinate w/ USFS)	3,481	Private, USFS	T, P, B, M and/or C	Improve escape routes	2011	P, I	–	See above
La Jolla **(M) #19**	T15N, R11E 1,2,12 (coordinate w/adjacent owner	1,881	Private	T, P, B, M and/or C	Improve escape routes	2012 +	P, I	–	–
Lamy **(M) #20**	T15N, R10E 33,34; T14N, R10E 3,4	2,560	Private	T, P, B, M and/or C	Improve escape routes	2012 +	P, I	–	–
Los Vaqueros, Cimarron**(M) #21**	T15N, R10E 15,21,22	2,560	Private	T, P, B, M and/or C	Improve escape routes	2012 +	P, I	–	–
Old Santa Fe Trail **(M) #22**	T16N, R10E 17,21	1,280	Private, USFS, New Mexico Natural Gas	T, P, B, M and/or C	Improve escape routes	2012 +	P, I	–	Consider 0.5-mile buffer F, B or M on-site
Pacheco Canyon **(M) #23**	T18N, R10E 7,18	1,280	Private, Pueblo, USFS	T, P, B, M and/or C	Improve vigor, reduce crown fire	2012 +	P, I	–	Consider 0.5 ± mile-wide F, B or M on-site
Sombrillo, Cuarteles, La Puebla **(M) #24**	T20N, R8E 12; T20N, R9E 4,5,6	1,676	Private, BLM, Pueblo	T, P, B, M and/or C	Create defensible space	2013 +	P, I	Consider buffer along boundary	–
Tano Road **(M) #25**	T17N, R9E 2,3,4; T18N, R9E 33,34	3,840	Private	–	Public/firefighter safety	2013 +	P, I	–	–
Tesuque **(M) #26**	T18N, R9E 25; T18N, R10E 19,30,31	2,163	Private, USFS	T, P, B, M and/or C	Improve vigor, reduce crown fire	2013 +	P, I	–	Consider 0.5-mile ± buffer F, B or M on-site
Turquoise Trail **(M) #27**	T14N, R8E, 2,3,10,11	2,560	Private	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–
Arroyo Hondo **(M) #28**	T16N, R9E 13, 24; T16N, R10E 18,19	1,920	Private	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–
Camel Tracks **(M) #29**	T16N, R8E 17,20	1,036	Private, New Mexico Natural Gas	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–

Table 5.2. Action Plan for Fuels Treatments, continued

Project (High or Medium Priority Rating) [1]	Location (Township, Range, Sections)	Size (acres)	Ownership/ Management [2]	Method [3]	Goal	Implementation	Monitoring [4]	BLM Methods	USFS Methods
Chimayo **(M) #30**	T20N, R9E 1,2,3,7	640	Private, BLM	T, P, B, M and/or C	Public/Firefighter safety	2013 +	P, I	Consider F along high risk boundary	–
Cordova **(M) #31**	T20N, R10E 2	102	Private, USFS	T, P, B, M and/or C	Improve vigor, reduce crown fire	2013 +	P, I	–	Consider F of 0.5 mile ±
Gan Eden **(M) #32**	T15N, R8E 27,34	1,280	Private	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–
La Cienega **(M) #33**	T15N, R8E 5,6; T16N, R8E 28,29,31,32,33	4,480	Private, New Mexico Natural Gas	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–
La Tierra **(M) #34**	T17N, R8E 1,2; T17N, R9E 5,6,8,9	3,840	Private, BLM	Defensible space	Public/Firefighter safety	2013 +	P, I	Consider F along high risk boundary	–
Las Campanas **(M) #35**	T17N, R8E 10,11,12,13,14,15; T17N, R9E 7	5,760	Private, BLM	T, Defensible space	Public/Firefighter safety	2013 +	P, I	Consider F along high risk boundary	–
Los Pinos **(M) #36**	T16N, R8E 21,22,27	1,792	Private, New Mexico Natural Gas, Unincorporated	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–
Madrid **(M) #37**	T14N, R7E 25	640	Private	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–
Old Ranch Road **(M) #38**	T15N, R10E 27,28,29,32	2,560	Private	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–
San Marcos **(M) #39**	T15N, R8E 24,25,26	1,920	Private	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–
Santa Fe South **(M) #40**	T15N, R9E 7; T15N, R8E 12,13	1,920	Private	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–
Sunlit Hills **(M) #41**	T16N, R9E 25; T16N, R10E 29,30	1,523	Private	Defensible space	Public/Firefighter safety	2013 +	P, I	–	–

Note: The numbers beside the project correlate the numbers Treatment Map. The map shows the location of each project by number.

1 Fuels Treatment Rating combines adjective ratings (refer to hazard assessment table) of E&VH=H(High), and H&M=M (Moderate); priorities were also assigned to the first 7 projects based on hazard rating scores.
2 Note: Permits may be required to comply with agency or local authority
3 T=Thinning (10-ft spacing minimum & boundary adjusted for slope; hand or mechanical); P=Pruning (to break up laddering potential, about 25% of tree height); B=Burning (pile or broadcast); R= Removal (debris); M=Masticate debris (chop or crush); C=Chip (on site); F= Fuelbreak (width, thinning levels adjusted for slope, aspect, elevation, and HFRA criteria); all serve to improve tree health, vigor
All homeowners consider creating Defensible Space (rake, prune, dispose of debris to 30-ft from buildings adjusted for slope); new construction must meet Santa Fe County WUI Code
4 Monitoring strategies: P=photo documentation; I=Inspections (on-site w/owner; SF County Code & FIREWISE requirements being met)

5.2.1 Other Recommendations

Two areas in the County that were repeatedly addressed in Core Team and public meetings as being in need of wildfire prevention planning are the Santa Fe Watershed and County open space lands. While these geographic areas are not homes to residents, they represent areas that are of importance for community members for a host of reasons including: a source of municipal water, scenic vistas, forest health, emotional and spiritual attachments, wildlife habitat, cultural resources, recreational areas and corridors, public health, and citizen confidence in the capabilities of the fire services and in government.

5.2.2 Santa Fe Watershed

The Santa Fe River, which is located in the Santa Fe Watershed provides water supply to the McClure, Nichols, and Two Mile reservoirs. The estimated total area of the watershed area is 17,520 acres. The Santa Fe National Forest is responsible for 15,493 acres, of which half of is located in the Pecos Wilderness; the City of Santa Fe owns 1,124 acres; the Randall Davey Audubon Society owns 135 acres; the Nature Conservancy owns 290 acres; and the remaining 478 acres are privately owned (Steelman and Kunkel 2003).

Thinning work, primarily in ponderosa pine stands immediately upslope from the reservoirs, is a mitigation strategy intended to decrease crown fire potential. However, a wildfire on the upper slopes of the watershed or one that enters the watershed from adjacent drainages during a severe fire season could easily transition to a sustained crown fire. Resistance to control from this extreme fire behavior would be high, particularly where numerous spot fires could ignite more than a mile from the main fire and threaten numerous values (see Table 5.3).

Loss of structures in adjacent communities, threats to life and recreational and scenic values, severe soil erosion, and sedimentation are all possible. Damage to the city of Santa Fe's drinking water supply, of which 40% is provided by the Santa Fe Watershed (Steelman and Kunkel 2003), and potential flooding into parts of Santa Fe are realistic, undesirable outcomes from such a high-intensity wildfire. Resulting ecological damage, reminiscent of the 2000 Cerro Grande fire, would require decades to recover. Risk/hazard rating for the Santa Fe Watershed is *Very High*.

5.2.3 Santa Fe County Open Space

The County currently holds 19 properties that consist of approximately 3,385 acres and has received approval for an additional acquisition of approximately 1,300 acres. These open space lands are combined with approximately 19 parks and recreation properties to form the core of the County's open space inventory.

Parcels include Cerrillos Hills Historic Park, La Cieneguilla, Picacho Peak, Lamy Junction, Parker, Little Tesuque Creek, Arroyo Hondo, Rio En Medio, El Potrerro, Las Golondrinas, and the Thornton Ranch Open Space. Wildfires originating on or spreading to open space areas can damage habitat, cultural resources, scenic vistas, recreational values, and surrounding homes and infrastructure.

Grasslands mixed with a sagebrush shrub component and piñon-juniper woodlands comprise most of the vegetation in the open space. Fuels are estimated as moderate to light. Wildfires in

these areas would largely remain surface fires with low to moderate resistance to control, depending on wind conditions and fuel availability. Parcels including Parker, Little Tesuque Creek, and Rio En Medio are at higher elevations and the vegetation ranges are mixed ponderosa/piñon-juniper/conifer on all aspects with steep slopes leading to the Santa Fe Watershed.

Risk/hazard rating for Santa Fe County open space is High and in some cases (e.g., Little Tesuque Creek, Parker, and Rio En Medio Open Space parcels) the rating is Very High.

Table 5.3. Action Plan for Fuels Treatments for Community Values at Risk*

Other Values at Risk (Priority Rating)	Location	Acres	Recommended Methods and Implementation Timelines	Goal	Monitoring	Remarks
Wilderness Gate Community– City of Santa Fe **(H) #1**	–	282	Fall 2009 T,P, B, M, or C - varies w/location & right-of-way fuel	Reduce crown fire potential; FF safety and access	P, I 5-year intervals	Coordinate work with La Barbaria Community, County & USFS
Santa Fe Watershed (non wilderness) (see text above) **(H) #2**	T17N, R10E 9–16, 21–28, 34,35,36; T17N, R11E 17–20, 30	7,860 USFS; 1,880 Private	(See below)	(See below)	(See below)	(See below)
Santa Fe County Open Space: Little Tesuque **(H) #3** (see text above)	–	250	Consider partial fuel-break inside tract boundary – T, P, M or B Implementation: fall 2010	(Same as above)	Photos pre and post treatment	Coordinate work with USFS, City of Santa Fe, and Hyde Park Community
Glorietta Conference Center Housing Area **(H) #4**	T16N, R11E 27	40	T, P, M, B, or C Implementation: fall 2010	Create F adjustable width, with USFS & defensible space	Photo documentation and Inspections with property owner/manager	Private Ownership – USFS consider creating Fuelbreak along north parcel boundary, 0.5-mile buffer
Santa Fe County Open Space: Parker Parcel **(H) #5**	–	190	Consider partial fuel-break inside tract boundary – T, P, M or B Implementation: fall 2010	Provide protection for adjacent properties; reduce crown fire potential	Photos pre and post treatment	Coordinate work with City of Santa Fe and USFS
Upper Canyon Rd. WUI – City of Santa Fe **#6 (H)**	–	–	Santa Fe city fire departments coordinate work with the County and landowners	–	–	Santa Fe FD responsible for mitigation work
ONGOING: Apache Ridge Rd	T15N, R10E 2	–	Ongoing (see project workplan)	–	–	State Land Office project; updated WUI area
ONGOING: Edgewood, NM	T10N, R7E 32	–	Ongoing	–	–	State Land Office project: updated WUI area
Santa Fe National Forest Wilderness (Upper Santa Fe Watershed) **(H)**	T17N, R11E 4,5,6,7,8, 15,16,21,22,23, 26,27,28,32,33,34	6,680 (approx)	WFU only; Note: Constraints on mechanical equipment use and prescribed burning in wilderness in effect per agency policy	Reduced surface fuels; enhances ecosystem sustainability	Consider photo records of any WFU fires	Consider fuels reduction outside parcel boundary to reduce chances of unwanted wildfire entering the watershed. Tie work into natural barriers where feasible

* As noted above, any permit requirements shall be met to ensure compliance with laws and policies specific to the appropriate land management agency. Ongoing projects, such as State Land Office lands work, require close coordination with adjacent ownerships to ensure seamless continuity and that mutual protection objectives are met.

5.2.4 NORTHERN REGION OF SANTA FE COUNTY

At the second public meeting hosted in Pojoaque, an important concern arose about including additional projects in the northern region of the County. A site visit and additional meeting were facilitated to address these concerns. Recommendations for the northern region of the county are listed below.

Pojoaque Bosque, Multiple Land Owners

The Pojoaque Bosque from the Rio Grande to the Upper Village in Nambe transects all three fire districts in the area (Pojoaque, Nambe, and Chimayo) and three Pueblos (Pojoaque, Nambe, and San Ildefonso). Fuels reduction is needed along the entire Bosque, on both private and tribal lands. Coordination among the Pueblos and private land owners is needed to complete this project to ensure that projects are completed on at the landscape level.

Recommendations:

1) Removal of nonnative species along bosque area
2) Fuels reduction and thinning needed in bosque
3) Provide public education and outreach on fire hazards
4) Raise awareness of reducing structural ignitability through homeowner guides and Firewise workshops
5) Clear debris from irrigation ditches and provide regular maintenance

Figure 5.6. Pojoaque Bosque.

Cuyamungue Bosque, Pojoaque Pueblo

Densely forested areas and debris create a high risk fire environment in the Cuyamungue Bosque. The eastern end of Feather Road is residential and many homes are in this area, which could potentially be damaged by a wildfire. Brush is often illegally dumped on Feather Road, which is adjacent to riparian vegetation consisting of saltcedar with heavy underbrush, and therefore provides a constant continuity of fuels. Buffalo residing on the pueblo are at risk in the event of a wildfire, which is an important concern for Pojoaque Pueblo

Recommendations:

1) Increase public education and outreach regarding fire hazards related to dumping

2) Create a site where people can dump brush for free, and raise awareness about it. Work with the County to organize a time when the County can come to site and chip all of the accumulated brush at once. Make the chipped materials available for use by community members. Look to Glorietta Estates as a successful example of this type of project.

3) Fuels reduction thinning and maintenance in Bosque

4) Clear debris from irrigation ditches and provide regular maintenance

Figure 5.7. Cuyamungue Bosque

Santa Fe County Open Space

The County Open space area, located at 1812 NM 502, is dominated by debris and overgrown vegetation. The dense vegetation provides privacy and this area has become a hidden illegal dumping site.

Recommendations:

1) Use Collaborative Forest Restoration Program funding to clean this site and create a demonstration area to show the before and after conditions. Remove trash andnon-native vegetation. Provide education, a permanent sign, and photos of the conditions of the site. Possibly work with the Pojoaque campus of the Pojoaque School district, which is located across the street from this site, to implement an educational program focused on environmental stewardship.

2) Provide dumpster at site.

Figure 5.8. Santa Fe County Open Space.

Rio Nambe, Nambe Pueblo

Bosque vegetation along Rio Nambe is very dense along County road 106 and County Road 84F. Access for fire trucks is difficult due to overgrown vegetation and blocked entrance to the river bed. Only one road is available for ingress and egress.

At Nambe Pueblo, a planned fuels treatment to remove exotics from 56 acres of the riparian area along the Rio Nambe is scheduled for October 2008. This project will extend from the western boundary of the pueblo to the upper village. The site will be revisited and monitored annually.

Recommendations:

1) Fuels reduction, thinning and maintenance along County Road 106 and 84F.

2) Provide public education and outreach on fire hazards.

3) Improve access for fire response.

4) Collaboratively work with Santa Fe County to choose a location, (possibly near the transfer station) where community members can dispose of slash. Raise awareness about the location and the intent to place all waste in one place. The County is available to provide a chipper and remove slash, when the pile reaches a certain size.

Chimayo #1

County Road 98, also known as Juan Medina Road, is adjacent to a thick bosque, approximately 200 × 200 square feet, with about six homes located within the area.

County Road 94 B, also known as Camino de Los Ranchos, is very narrow and provides only one way in and out, making it inaccessible to fire trucks. The bosque along the Santa Cruz River is thick and sparsely populated with homes.

The only area that has been treated for hazardous fuels in this region is the Santa Fe County Open Space located on County Road 98.

Recommendations:

1) Fuels reduction, thinning, and maintenance along County Road 98 and 94 B.

2) Provide public education and outreach on fire hazards.

Figure 5.9. Chimayo Bosque.

La Puebla

On Highway 76, from mile marker 1.5 to 8, the vegetation in the bosque is very dense. Houses located along the river are difficult to access. Also, it is common for people in this area to burn fields. The Santa Cruz River provides a dependable water source for fire suppression.

Recommendations:

1) La Puebla, Pojoaque, and Chimayo fire districts need funding to purchase portable pumps to pump water from the Santa Cruz River when responding to fires in the vicinity.

2) Fuels reduction, thinning, and maintenance along Highway 76 from mile marker 1.5 to 8.

3) Provide public education and outreach on fire hazards, particularly about burning fields.

Figure 5.10. La Puebla Bosque.

Chimayo #2

From Santa Cruz Lake to Espanola the Bosque is very thick. Only one area, the Santa Fe County Open Space located at 280 Juan Media Rd, has been treated in this region. A concern in the Santa Cruz Watershed is that there is a critical need for water conservation, particularly to serve the Santa Cruz Irrigation District. Invasive species have been consuming large quantities of water and therefore lowering the water table. Removal of invasive species serves to reduce hazardous fuels and raise the water table.

Recommendations:

1) Practice more water saving techniques in the Santa Cruz Watershed.

2) Fuels reduction, thinning, and maintenance along the Rio Pojoaque from the confluence of Rios Nambe and Tesuque to Cuyamungue.

3) Fuels reduction, thinning, and maintenance along the Rio Nambe from the confluence of the Rio Nambe and Pojoaque to the Nambe Reservoir.

4) Fuels reduction, thinning, and maintenance along the Santa Cruz River from the Rio Grande to the Santa Cruz Reservoir.

Figure 5.11. La Puebla Bosque.

5.3 RECOMMENDATIONS FOR PUBLIC EDUCATION AND OUTREACH

The need for public education and outreach has been emphasized throughout the SFC CWPP process by all participating parties. The Core Team has repeatedly discussed the need for improved fire education for the public in order to raise awareness of fire risk. Discussions with community members at public meetings have indicated that most people would be interested in gaining more information from agencies and the County to improve their preparedness in the event of a wildfire. Table 5.4 lists recommendations for improving public education and outreach.

The biggest challenge in increasing public understanding of wildfire issues in this area is reaching community members, particularly those that reside in unincorporated areas. It is difficult to communicate with a large but diffuse population that is generally not organized into units such as townships or even neighborhood associations. The local SWCDs and fire departments are arguably the most effective conduits for reaching the diverse population. Community groups, churches, and schools may be other possible targets to help reach out to community members. The recruitment of volunteer neighborhood leaders to participate in planning efforts or attend workshops on fire behavior and defensible space may provide another option to disseminate the available information. Although various programs exist and efforts have been made to increase public awareness, recent emergency management research concludes that widespread complacency remains even when significant emergency preparedness is provided. A "not going to happen to me" attitude exists which impedes the process of taking responsibility for private property. (International Association of Emergency Managers Conference 2007).

The need for public education and outreach has always been clear. This CWPP recommends support for ongoing community outreach. This support might include funding to hire a facilitator to conduct public outreach meetings at local fire stations. The support might also include funding to hire outreach coordinators as part of a sustained educational effort at selected communities or watersheds. Providing continuous outreach through an outreach coordinator is recommended. Hiring an outreach coordinator who is available to work in a community may benefit the community greatly as this person can continuously be engaged with community members.

Table 5.4. Action Plan Recommendations for Public Outreach and Education

Project	Project Description	Presented by	Target Date	Resources Needed	Goal
Fuelbreaks and Trails Projects	Use fuelbreaks as part of integrated trail plan in Pojoaque Valley. Potential for educational events to be planned on trails.	Multiple land owners in Pojoaque Valley	2009	Funding for fuels break, community planning, tools to implement.	Reduce fuel loads and provide recreational and educational opportunities for community members
Fire department services more accessible to communities	Fire departments currently offer some services, such as home visits, to discuss hazards present on property, which would benefit communities. This info needs to be accessible to communities.	Fire departments	2008	Improved communication among fire departments and communities.	Raise awareness in communities and reduce the risk of loss of property and life
Fire in the media	Coordinate and fund monthly ads in local media that maintain consistent and seasonally relevant fire information.	Community fire representative or agency outreach personnel	2009	Funding for ad space, research, and writing of monthly column addressing wildfire issues.	Maintain fire awareness and relay a consistent message regardless of fuel conditions and short-term changes in fire risk.
Pre-planned triage	Pre-plan triage by fire departments: let community know who will be responded to based on accessibility and fuels.	Fire departments	2008	Firefighters, public advertising, training for homeowners.	Raise awareness among homeowners about expectations of fire responders, as well as actions homeowners need to take to reduce risk.
Homeowner's guide	Develop a handbook with locally relevant and detailed information to help residents be more prepared for wildfire, including a defensible space checklist specific to local structural and wildland fuel considerations.	SWCDs, local fire departments, State Cooperative Extension agents	2009	Funding to develop and print copies of the handbook. Volunteers to help distribute and explain the document.	Give residents detailed and locally specific tools that they can use to improve preparedness.
Fireworks curriculum	Provide support to local teachers to implement and customize curriculum developed by Missoula Fire Science Lab.	Local schools	Fall 2008, ongoing	Fireworks teacher training including purchase of Fireworks box.	Educate children in grades 1–10 about fire ecology and fire management.
Emergency preparedness meetings	Utilize Red Cross volunteers and other preparedness experts. Attend community functions and hold special meetings to provide guidance for creating household emergency plans.	Red Cross, County personnel	Summer 2008, ongoing	Written materials.	Improve preparedness by facilitating the communication between family members and neighbors about what procedures to follow in the event of a wildfire.
Defensible space workshops	Attend all possible community meetings and hold additional workshops to educate homeowners about why and how to create effective defensible space.	Community fire representative or agency outreach personnel	Summer 2008, ongoing	Written materials, trained personnel.	Empower homeowners to make affordable and effective changes to reduce the vulnerability of individual homes.

Table 5.4. Action Plan Recommendations for Public Outreach and Education, continued

Project	Project Description	Presented by	Target Date	Resources Needed	Goal
Targeted wildfire info sessions	Fund development of materials and presentations to highlight how a fire might affect particular groups within the community, such as realtors, ranchers, acequia communities, and real estate developers.	Community fire representative or agency outreach personnel	2009	Funding for research, writing, and presentation of detailed information on how large-scale wildfire would affect the target audience and the measures that could be taken to reduce the threat.	Deliver a clear and consistent message that impacts of wildfire are far-reaching and that it is in the best interest of a diverse set of stakeholders to become involved in planning and preparing for fire.
Homeowner's insurance task force	Convene a group of insurance company representatives and local and state officials to discuss current limitations and possible solutions to expand insurance coverage for losses from wildfire across the CWPP area.	Insurance agencies, State Public Regulation Commission, County fire departments, and community representatives	2008	Agency personnel.	Explore possibilities of improving the currently limited insurance coverage for fire.
Neighbors for defensible space	Organize a community group comprised of residents and agency personnel to develop materials and communicate relevant defensible space messages.	SWCDs, USFS, BLM, NMSF, local residents	2009	Funding to help cover costs of materials and participation.	Engage diverse stakeholders in reaching out to community members, and encourage defensible space practices.

5.4 RECOMMENDATIONS FOR ACTIONS TO REDUCE STRUCTURAL IGNITABILITY

Table 5.5 provides a list of community-based recommendations to reduce structural ignitability that should be implemented throughout the SFC CWPP planning area. Reduction of structural ignitability depends largely on public education that provides homeowners the information they need to take responsibility for protecting their own property. Section 5.3.1 provides a list of action items that individual homeowners can follow. Conducting fuels reduction treatments on public lands may only be effective in reducing fire risk to some communities; however, if homeowners have failed to provide mitigation efforts on their own land, the risk of home ignition remains high and firefighters' lives are put at risk when they provide structural defense. Firefighting resources in rural areas are minimal, and during a widespread wildfire they are likely to be stretched thin across the County—a situation that highlights the importance of educating homeowners on mitigation efforts they can take to protect themselves and their property.

Preparing for wildland fire by creating defensible space around the home is an effective strategy for reducing structural ignitability. Studies have shown that burning vegetation beyond 120 feet of a structure is unlikely to ignite that property through radiant heat (Cohen and Butler 1996), but fire brands that travel independently of the flaming front have been known to destroy houses that had not been impacted by direct flame impingement. Education about managing the landscape around a structure, such as removing weeds and debris within a 30-foot radius and keeping the roof and gutters of a home clean are two methods for creating defensible space. Educating community members about the benefits of cutting trees and using Firewise landscaping methods on their property is also essential for successful household protection.

It is important to note that no two properties are the same. Homeowners and communities are encouraged to research treatments that would have the most effect for their properties. Owners of properties on steep slopes, for example, should be aware that when constructing defensible space they have to factor in slope and topography, which would require extensions to the conventional 30-foot recommendations. A number of educational programs are now available to homeowners and are available through local fire departments or the NMSF; Firewise Communities/USA is one example of such a program (www.firewise.org). More detailed information on structural ignitability is provided in Appendix E (Homeowner's Guide).

Another reason to prepare a home and property for wildfire is to ensure homeowners' insurance coverage. Many insurance companies are not covering people who are not prepared for wildfire and are located in areas that are at high risk for wildfire.

Table 5.5. Plan to Reduce Structural Ignitability

Project	Private Lands / Homeowner	Programs Available	Description	Contact	Priority
Strengthen building codes	Countywide	International WUI Code	ICC code enforces building codes and ordinances for new development in the WUI.	State Fire Marshall	Moderate
Construct defensible space	All residents would be encouraged to participate	Firewise Communities USA; NMSF; local fire department liaison	Educate homeowners in defensible space practices; remove all but scattered trees within 30 feet of structure; keep grass mown and green within 100 feet of structure; keep flammable materials at least 30 feet from structure; surround foundations with rocks or gravel to a width of 1 foot.	www.firewise.org or local State Forestry Firewise trained personnel	High
Create Defensible Space around second or vacation homes	Countywide	Neighborhood associations	Stay active in preparing for wildland fire when absent; plan to have someone maintain property when absent; speak with neighbors to develop an action plan in the event of a fire.	Neighbors	Moderate
Defensible space cost-sharing programs	All private land within CWPP area would be eligible	SWCDs already offer these programs	This project would provide additional funding to SWCDs to expand existing program and target new participants.	SWCDs	High
Community chipper days	All residents would be encouraged to participate	SWCDs already offer similar programs	A chipper and operator would be provided free of charge in a central location for residents to bring small trees and brush. Chips could remain at chipper location or be utilized by participants.	SWCDs	High
Fire protection workshops	All residents would be encouraged to participate	Community fire liaison, agency outreach personnel	Offer hands-on workshops to highlight individual home vulnerabilities and how-to techniques to reduce ignitability of common structural elements. Examples include installing metal flashing between house and fence or deck and installing wire mesh over eaves, vents, and under decks.	State Firewise personnel	High
Assess and improve accessibility to property	All residents would be encouraged to participate	Fire departments code enforcement officers	Inform homeowners about the importance of keeping driveways accessible to fire engines and emergency responders.	Local fire department	Moderate
Rural addressing	All residents would be encouraged to participate	County rural addressing department	Inform homeowners about the availability of rural addressing signs.	County	Moderate
Provide a list of mitigation measures to homeowners with different scales of actions	All residents would be encouraged to participate	Fire departments; Firewise Communities USA; NMSF literature; USFS literature; academic and peer-reviewed literature	See Section 5.3.1.	SWCDs, NMSF, fire departments	High
Install screens	All residents would be encouraged to participate	Firewise Communities/USA, local fire department services	Inform homeowners about the importance of installing metal screens on all openings and around decks to prevent embers entering/collecting.	Fire departments	High

Table 5.5. Plan to Reduce Structural Ignitability, continued

Project	Private Lands / Homeowner	Programs Available	Description	Contact	Priority
Replace roofs with fire resistant materials	All residents would be encouraged to participate	Firewise Communities/USA, local fire department services	It may be costly, but replacement of old roof construction to roofing made of inflammable material can lower ignitability.	Fire departments	High
Propane tanks	All residents would be encouraged to participate	Firewise Communities/USA, local fire department services	Inform homeowners about the importance of relocating propane tanks underground or removing surrounding flammable materials to distance of 10 feet.	Fire departments	Moderate
Improved communication in the event of a fire	Countywide	local fire department services	Have local people involved with fire departments to assist with communication between agencies and community members in the event of a fire; train firefighters in triage.	Fire departments	Moderate

5.4.1 Action Items for Homeowners to Reduce Structural Ignitability

Low or No Cost Investment (<$50)

- Regularly check fire extinguishers and have a 100-foot hose available to wet perimeter.
- Maintain defensible space for 30 feet around home. Work with neighbors to provide adequate fuels mitigation in the event of overlapping property boundaries.
- Make every effort to keep lawn mowed and green during fire season.
- Screen vents with noncombustible meshing with mesh opening not to exceed nominal 1/4-inch size.
- Ensure that house numbers are easily viewed from the street.
- Keep wooden fence perimeters free of dry leaves and combustible materials. If possible, noncombustible material should link the house and the fence.
- Keep gutters free of vegetative litter. Gutters can act as collecting points for fire brands and ashes.
- Store combustible materials away from the house; maybe in a shed, if available.
- Clear out materials from under decks and/or stacked against the structure. Stack firewood at least 30 feet from the home, if possible.
- Reduce your workload by considering local weather patterns. Since the prevailing winds in the area are often from the southwest, consider mitigating hazards on the southwest corner of your property first, and then work around to cover the entire area.
- Seal any gaps in roofing material and enclose gaps that could allow fire brands to enter under the roof tiles or shingles.
- Remove flammable materials from around propane tanks.

Minimal Investment (< $250)

- When landscaping in the Home Ignition Zone (HIZ) (approximately 30 feet around the property) select noncombustible plants, lawn furniture, and landscaping material. Combustible plant material like junipers and ornamental conifers should be pruned and kept away from siding. If possible, trees should be planted in islands and no closer than 10 feet to the house. Tree crowns should have a spacing of at least 18 feet when within the HIZ. Vegetation at the greatest distance from the structure and closest to wildland fuels should be carefully trimmed and pruned to reduce ladder fuels, and density should be reduced with approximately 6-foot spacing between trees crowns.
- Box in eaves, attic ventilation, and crawl spaces with noncombustible material.
- Work on mitigating hazards on adjoining structures. Sheds, garages, barns, etc. can act as ignition points to your home.
- Enclose open space underneath permanently located manufactured homes using noncombustible skirting.

- Clear and thin vegetation along driveways and access roads so they can act as a safe evacuation route and allow emergency responders to access the home.
- Purchase or use a National Oceanic and Atmospheric Administration weather alert radio to hear fire weather announcements.

Moderate to High Investment (> $250)

- Construct a noncombustible wall or barrier between your property and wildland fuels. This could be particularly effective at mitigating the effect of radiant heat and fire spread where 30 feet of defensible space is not available around the structure.
- Construct or retrofit overhanging projections with heavy timber or noncombustible material.
- Replace exterior windows and skylights with tempered glass or multilayered glazed panels.
- Invest in updating your roof to noncombustible construction. Look for materials that have been treated and given a fire-resistant roof classification of Class A. Wood materials are highly combustible unless they have gone through a pressure-impregnation fire-retardant process.
- Construct a gravel turn-around in your driveway to improve access and mobilization of fire responders.
- Treat construction materials with fire-retardant chemicals.
- Install a roof irrigation system.
- Replace wood or vinyl siding with nonflammable materials.
- Install an independent water supply that can be run for 24 hours or more.
- Relocate propane tanks underground.

5.4.2 Community by Adoption All/Part/or None of ICC WUI Codes

While individual actions are necessary to reduce structural ignitability, actions taken at a countywide level affect change on a larger-scale. The ICC's International Wildland Urban Interface Code provides minimum regulations for land use and the built environment in the designated WUI areas. The standards for the codes are based on data collected from tests and incidents, technical reports, and mitigation strategies from various countries around the world. These codes address the mitigation of fire in the WUI (ICC 2006). The County recommends adopting the Wildland Urban Interface Code, particularly in high risk areas. When the County approaches this task, they will determine if they will adopt it in its entirety or adopt certain aspects of the ICC International Wildland Urban Interface Code as most appropriate for the County. This code can be used to develop standards for improved public safety and community driven protection and prevention measures.

5.5 RECOMMENDATIONS FOR IMPROVED FIRE RESPONSE CAPABILITY

Firefighters play a critical role in protecting people, property, and natural resources from wildland fire. Individuals and communities alike have come to rely on firefighters to take a leadership role in suppressing fires. Firefighters' involvement in fire response, community planning, landscape/home evaluation, and safety is largely a volunteer service. These voluntary services, particularly in rural areas, are essential to reducing the negative consequences of fire and to maintaining the health, welfare, and safety of citizens and communities. Firefighters face circumstantial dangers in each case they respond to and need to have the proper equipment and training to successfully suppress fires. The following recommendations support local fire departments and aim to improve fire response capabilities.

5.5.1 LOCAL RESPONDERS

Volunteer and career firefighters at the County and community level have similar capabilities throughout the entire year, while state and federal responders are affected by fire season. In spite of the continuous level of capabilities, ebbs and flows occur within the volunteer service. Recruiting and retaining volunteers is challenging due to peoples' lifestyles and the training requirements one must follow to be a volunteer firefighter. Although several volunteer firefighters are present in the County, not all are available to respond to every fire.

5.5.2 STATE AND FEDERAL RESPONDERS

The availability of resources is dictated by the state and federal wildland fire season. From approximately April 15 through July 15, resources are plentiful around the region. This time period is considered the Southwest fire season, so multiple crews, engines, helicopters, and air tankers are available. However, from July 15 to October 31 firefighting focus often changes to other regions such as to the Northwest and California. During this period, the timeframe to obtain resources is extended, sometimes taking up to 48 hours. During the winter months, obtaining resources is difficult as many firefighters are employed seasonally from April through October. Given the changing fire regimes, wildfires now occur throughout the entire year, extending beyond the state and federal designated wildland fire season. Resources are limited for fires that occur outside of this timeframe.

Table 5.6 provides recommendations for improving firefighting capabilities.

Table 5.6. Action Plan for Improving Fire Response Capabilities

Project	Fire Department	Possible Solution	Target Date	Contact
Increase knowledge and skills	All districts in County	Develop interagency mutual aid agreements	Ongoing	County, all fire departments, NMSF, USFS
		Provide trainer training		
		Provide practical training		
		Provide online training		
		Provide cross training for communication and equipment		
		National Wildfire Coordinating Group training		
		Offer community college classes		
		Provide on-the-job training		
		Reimburse volunteers		
		Conduct conferences & workshops		
		Mentor fire personnel		
		Cross training for communication and equipment		
Increase fuels reduction planning and funding	All districts in County	Continue and add to ongoing hazard fuels reduction projects	Summer 2008	County, all fire departments, NMSF, USFS
		Make chippers and facilities to dispose materials available		
		Develop service to remove materials		
		Develop a specialized fuels reduction / suppression crew with stand alone funding		
Improve fire suppression coordination	All districts in County	Improve communication between fire suppression crews	Ongoing	Fire departments, USFS
		Provide better incident briefing for crews to establish clear understanding of situation and tasks		
Target funding for equipment personal protective equipment (PPE), tools, and vehicles	All districts in County	Obtain equipment PPE, tools, and vehicles	Ongoing	County, City of Santa Fe, all fire departments, NMSFS, USFS, BLM
	City of Santa Fe	Need map showing thread boundaries		
		Obtain additional thread adapters		
Better prepare ancillary emergency responders	All districts in County	Obtain funding for training, PPE	Ongoing	County, City of Santa Fe, all fire departments, NMSF, USFS, BLM

Table 5.6. Action Plan for Improving Fire Response Capabilities, continued

Project	Fire Department	Possible Solution	Target Date	Contact
Improve response times	All districts in County	Update maps for responders	Ongoing	County
		Identify right of way on maps		
Implement code enforcement	All districts in County	Update Santa Fe WUI code to list new boundaries	Winter 2008	County, City of Santa Fe, NMSF
		Adopt a code in the city of Santa Fe		
Implement inspection and accountability	All districts in County	Obtain funding to evaluate all programs	Winter 2008	County, City of Santa Fe, NMSF
Increase and improve water suppression	All districts in County	Develop additional water resources	Ongoing	County, City of Santa Fe, NMSF
		Create map showing number and location of fire hydrants		
Strengthen emergency management capabilities	All districts in County	Use multiple layers of warning	Winter 2008	County, City of Santa Fe, all fire departments, NMSF
		Improve community warning, use weather alert radios		
		Obtain funding to get warning sirens		
		Continue public education in personal awareness		
		Create evacuation routes and publicize		
		Streamline info and say it the same way repeatedly		
		Encourage pre-planning		
		Create local evacuation plan and publicize		
		Conduct regular review of emergency operations plan and evacuation routes		
Increase involvement of locals in volunteer fire departments	All districts in County	Conduct recruitment drive to increase number of volunteers	Ongoing	All fire departments
		Increase awareness in schools and colleges		

5.6 IDENTIFY TIMELINE AND PROCESS FOR UPDATING THE CWPP

As the needs of community members shift or environmental conditions change, the SFC CWPP will need to be modified. Santa Fe County is constantly undergoing development, particularly in the WUI zone, and as a result more communities are likely to become part of the fire-human matrix in the County. The plan should be updated annually and the Core Team should continue to communicate after the plan is completed to discuss the best method for making revisions to reflect changing conditions. The HFRA allows for maximum flexibility in the CWPP-planning process, permitting the Core Team to update the CWPP as necessary. In the future, one topic of discussion for the County may be how to incorporate the expanded WUI areas identified in the CWPP into the 2001 Santa Fe County Urban Wildland Interface Code, Ordinance No. 2001-11.

5.7 CONCLUSION

The SFC CWPP is a collaboratively developed plan that addresses wildfire concerns and wildfire prevention strategies throughout the entire County. It identifies areas at high risk of wildfire and provides recommendations for reducing the risk of wildfire and the negative impacts of wildfire on communities. The planning process emphasizes public participation and collaborative planning among federal, state, county, and local governments and other contributing agencies. Wildland fire is a concern to all residents of the County and the goal of the CWPP is to reduce the risk for catastrophic wildfire by providing specific information regarding what is most at risk and how to protect these places and community values.

The SFC CWPP identifies areas most at risk and provides recommendations for fuels reduction treatments, educational outreach activities, reduction of structural ignitability, and improved fire response capabilities to reduce risk. The purpose of making recommendations is to raise awareness about the various strategies that can be implemented to reduce the risk of losing life, property, and community and natural values.

The recommendations are based on the 2007 WUI Assessment, the Composite Risk Assessment, identification of CVARs, and comments from community members and the Core Team, and are general in nature to provide high levels of flexibility in the implementation phase. The recommendations range from simple tasks that an individual can accomplish at no cost to costly large landscape treatments that require multi-party collaboration. The implementation of these recommendations should reduce the risk of catastrophic wildland fire and provide protection for communities in Santa Fe County.

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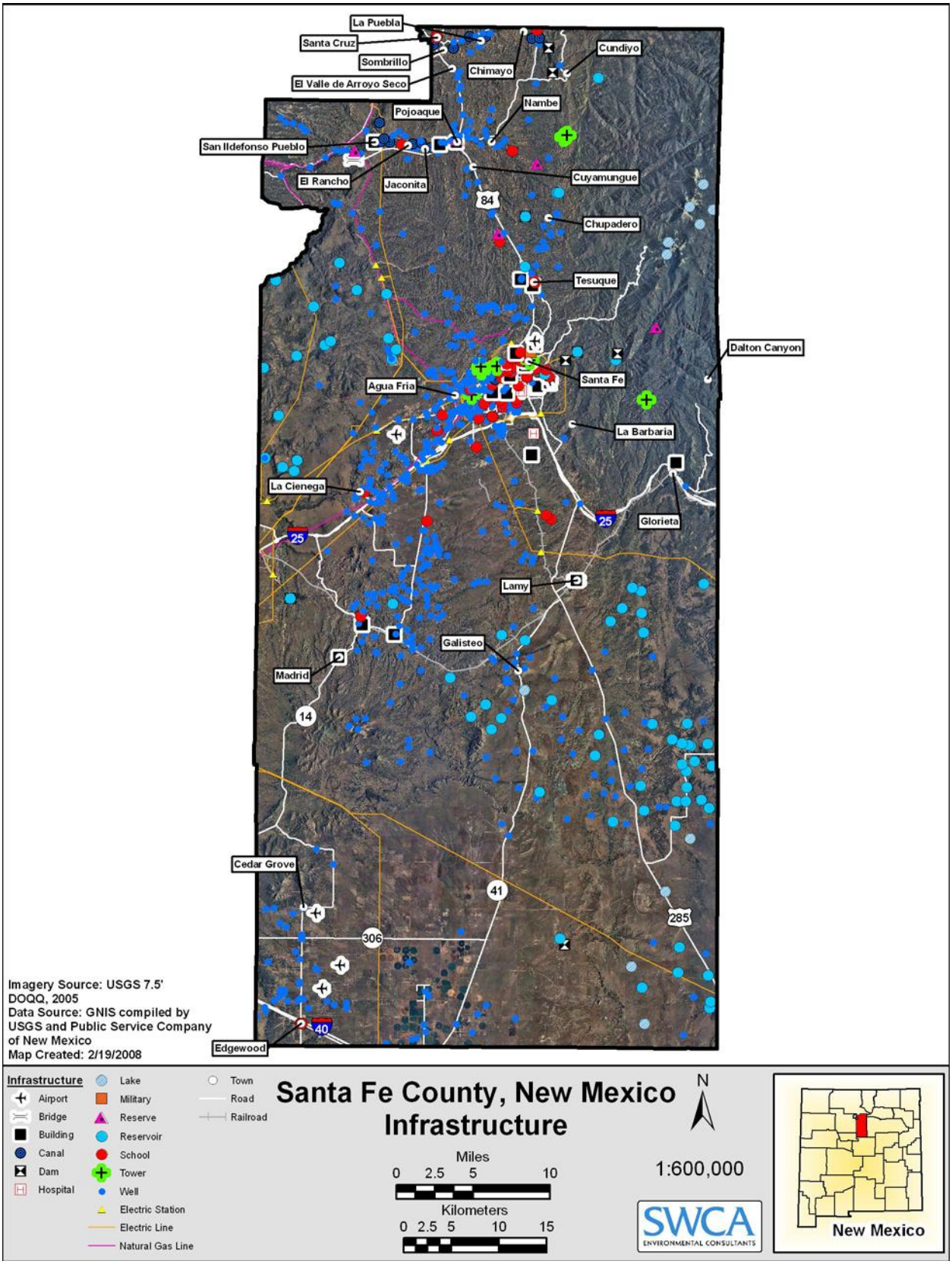
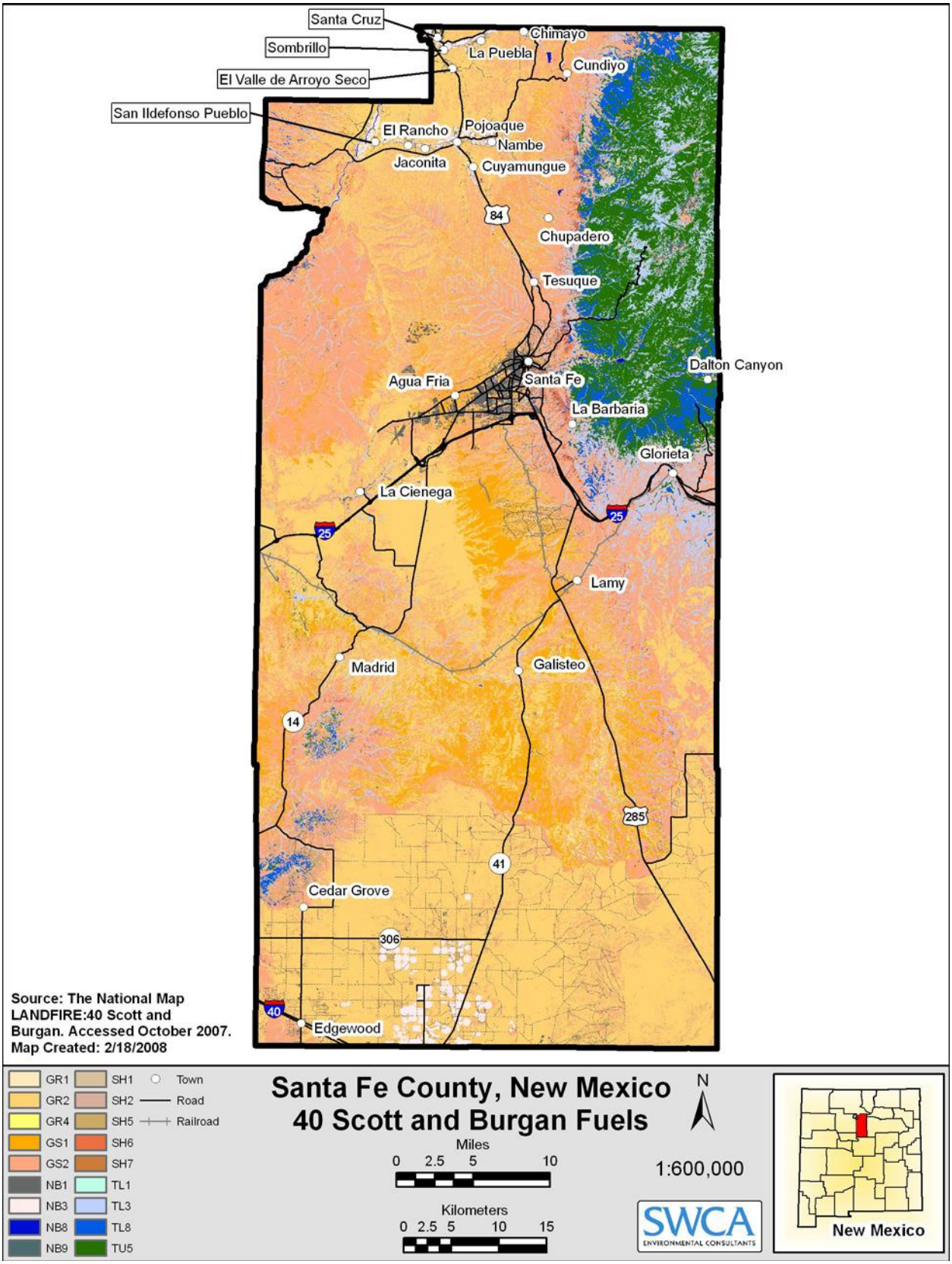
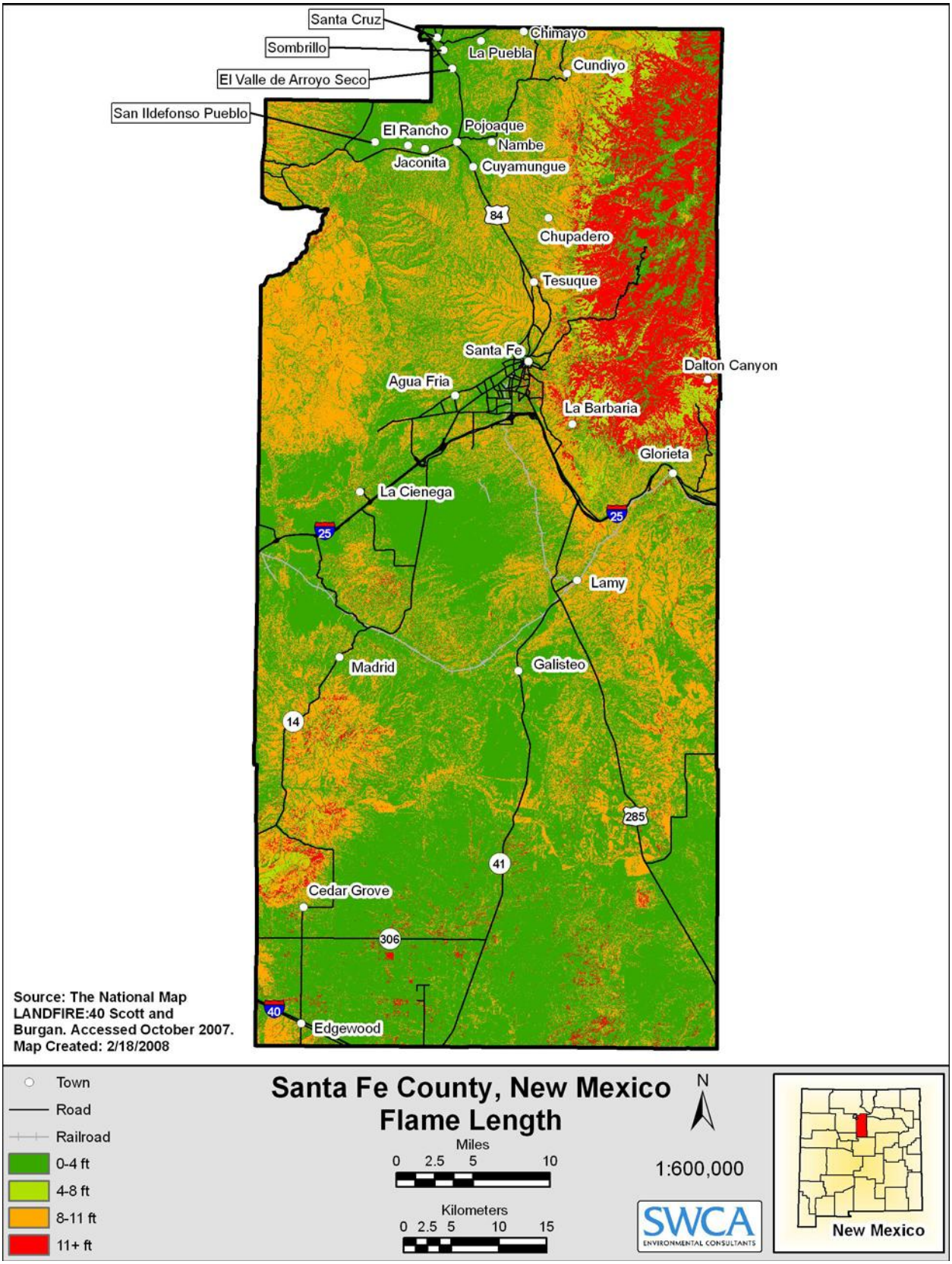
APPENDIX A
BASE MAPS



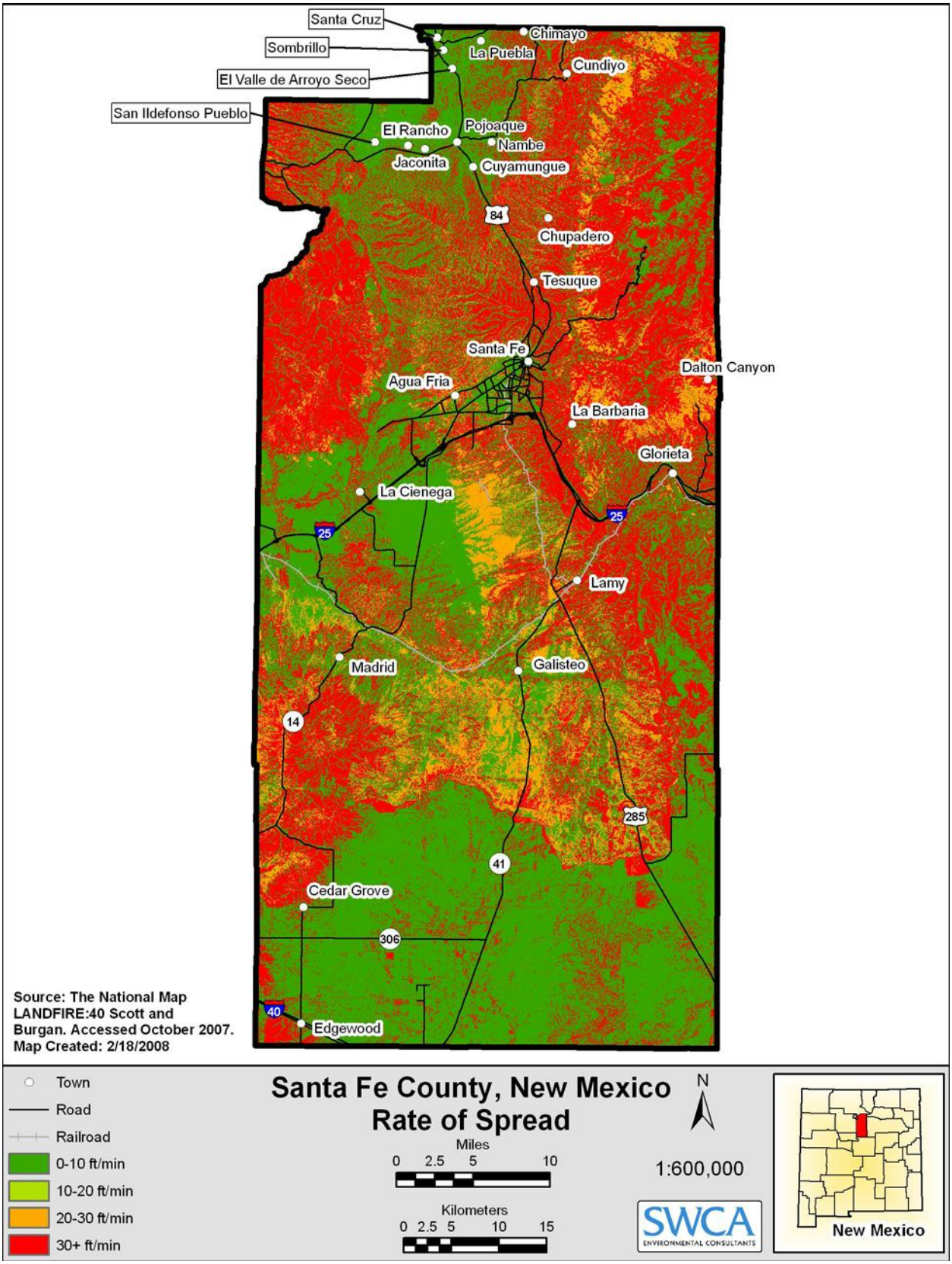
Map 1. Santa Fe County critical infrastructure.



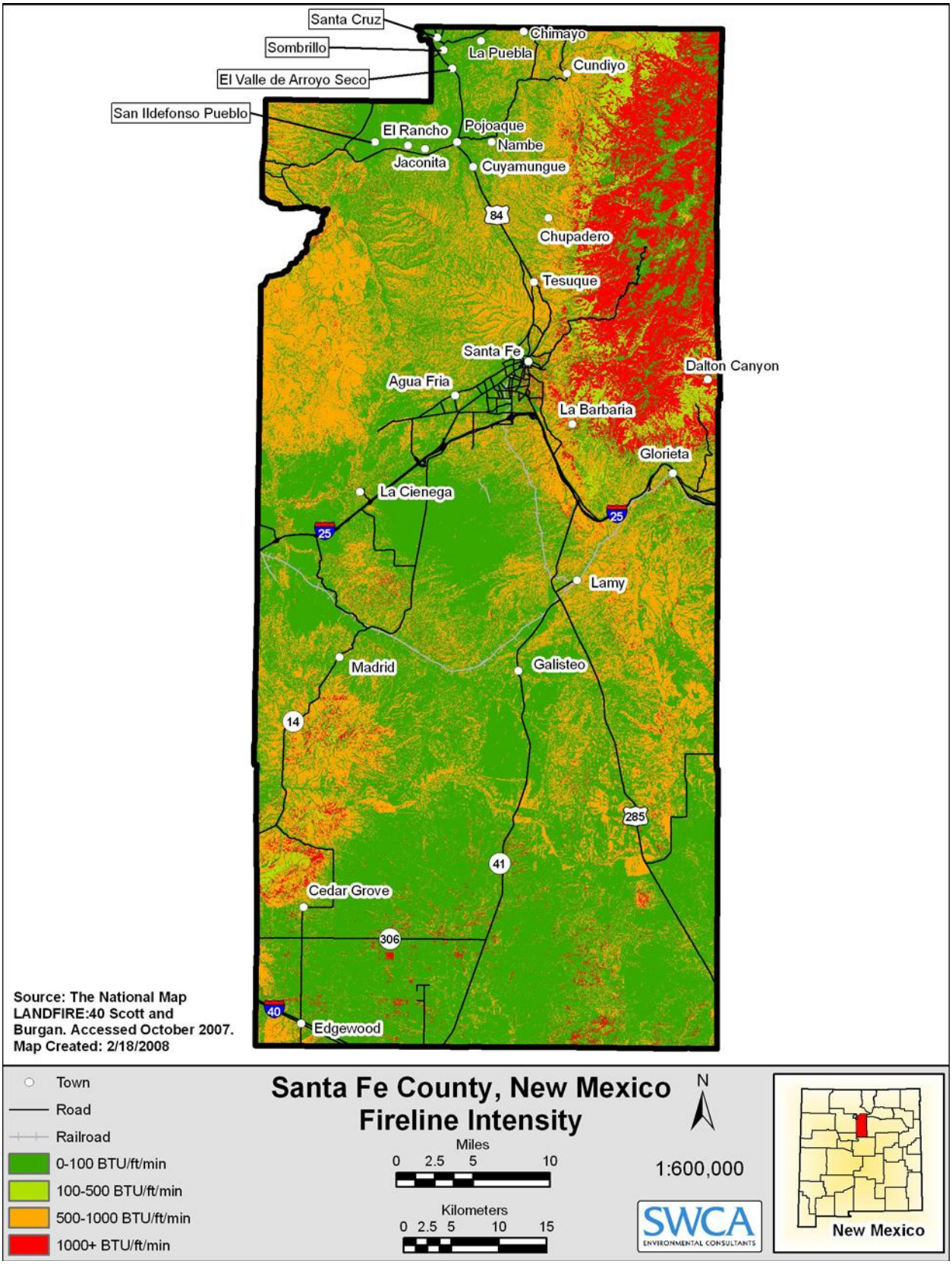
Map 2. Santa Fe County fuels map.



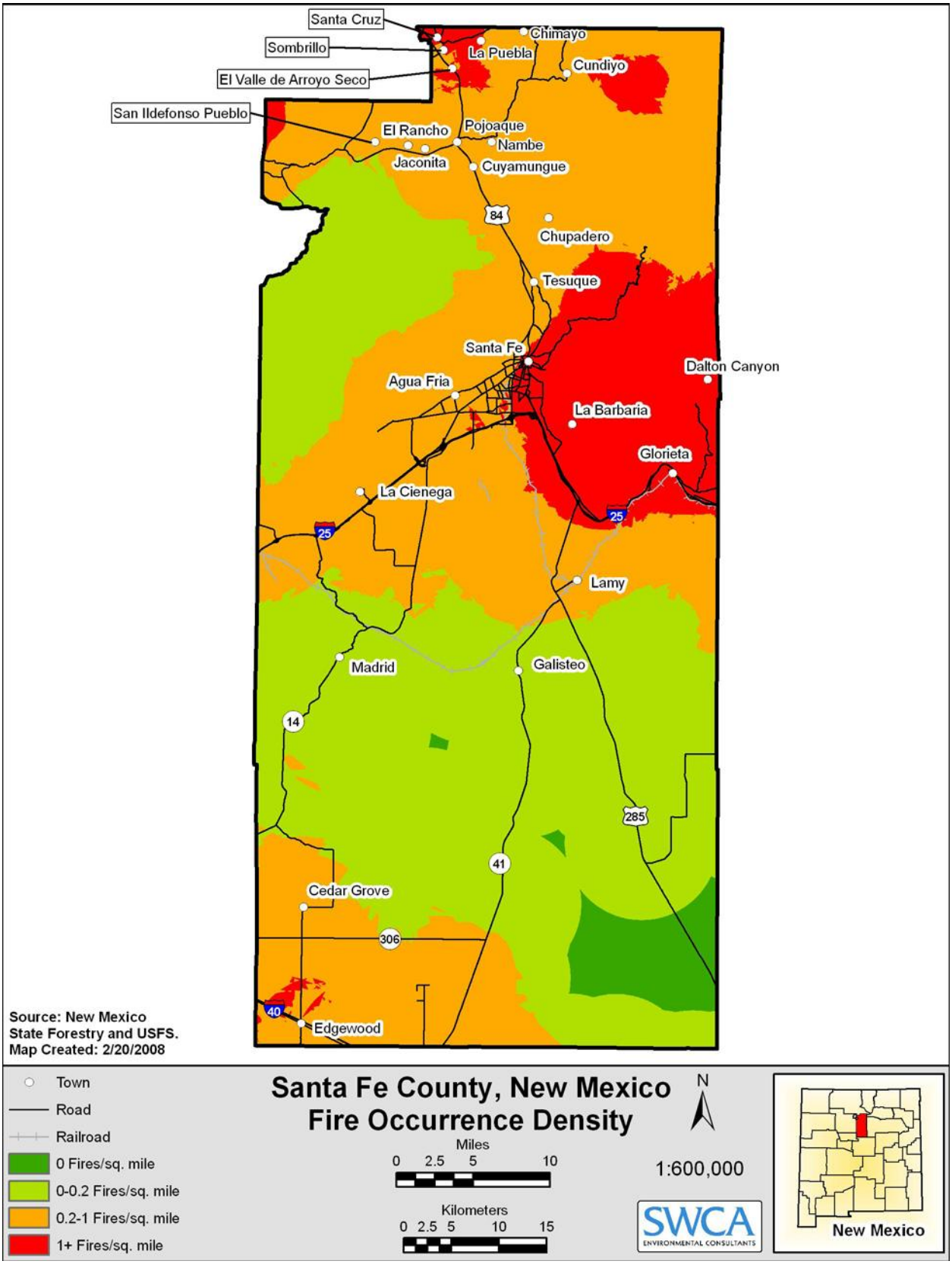
Map 3. Santa Fe County flame length.



Map 4. Santa Fe County rate of spread.



Map 5. Santa Fe County fireline intensity.



Map 6. Santa Fe County fire occurrence density.

APPENDIX B
CORE TEAM CONTACT INFORMATION

Santa Fe County CWPP Core Team

Agency or Organization	Name	Position	Email	Office Phone	Cell Phone
Local Fire / Emergency Authorities					
Santa Fe County Emergency Management	Martin Vigil	Director	mvigil@sfcfire.org	992-3072	
Santa Fe County Fire Department	Buster Patty	Captain Fire Prevention	bpatty@sfcfire.org	505-660-0607	
Santa Fe County Fire Department	Tom Chilton	Deputy Chief Hondo Volunteer fire district	tom@discoveryexhibits.com	505-690-7423	
Santa Fe County Fire Department	Greg Gallegos	Wildland Cordinator	ggallegos@sfefire.org	231-8845	
Santa Fe County Fire Department	Dave Sperling	Deputy Chief	dsperling@co.santa-fe.nm.us	505 -992-3076	
Santa Fe Fire Department	Porfirio Chavarria	Wildland Specialist	pnchavarria@santafenm.gov	505-995-3119	
Local Government Agencies					
Santa Fe County Open Space & Trails	Scott Rivers	Field Coordinator	srivers@santafecounty.org	505-992-9867	
State Government Agencies					
EMNRD, Forestry Division	Todd Haines	District Forester	todd.haines@state.nm.us	867-2334	
EMNRD, Forestry Division	Dave Bervin	Fire Management Officer	david.bervin@state.nm.us	505-867-2334	
EMNRD, Forestry Division	Terrell Treat	WUI Specialist	terrell.treat@state.nm.us	505-345-2200	
New Mexico Environment Department	Neal Schaeffer	Surface Water Bureau	neal.schaeffer@state.nm.us]		
Federal Agencies					
Bureau of Land Management	Donna Hummel, Dave Borland			505-827-7911	
Forest Service, Pecos Ranger District	Dwayne Archuleta	Fire Management Officer		438-7853	660-3295
Forest Service, Pecos Ranger District	Bill Armstrong	District Forester	warmstrong@fs.fed.us		920-8106
Forest Service, Santa Fe Ranger District	Robert Morales	Fire staff	rmmorales@fs.fed.us		
Forest Service, Espanola Ranger District	Lawrence Garcia	Fire Management Officer	lrgarcia@fs.fed.us	505 753 7331	
Santa Fe / Pojoaque Soil and Water Conservation District	Alfredo Roybal		aoroybal@aol.com	505-455-7211	
Edgewood Soil and Water Conservation District	Kelly Archuleta		kelly@swcd.org	505-832-1111	
Conservation Groups					
Forest Guild	Eytan Krasilovsky	Community Forestry Coordinator	eytan@forestguild.org	505-983-8992 ext. 16	505-470-0185 cell
Contractors					
SWCA Environmental Consultants	Emily Geery		egeery@swca.com	505-254-1115	
Wildland Fire Associates	John Lissoway		jlissoway@cybermesa.com	670-6437	

APPENDIX C
COMMUNITY COMMENTS

SANTA FE COUNTY COMMUNITY WILDFIRE PROTECTION PLAN
Public Wildfire Questionnaire

1. I live in:
2. What communities do you think are at the greatest risk of wildfire in Santa Fe County?
3. I would rate the chances of losing my home to wildfire as: Low/Moderate/High.
4. My home is vulnerable to wildfire because of: Building Materials / Distance to fire station/ lack of water supplies for fighting fire/inaccessible area/ flammable trees and shrubs.
5. How Prepared is your community for a large wildfire? Poorly prepared 1 2 3 4 5 Well prepared.
6. Rate the following actions in their importance to making the community better prepared for wildfire. No. 1-5.
   1. Thinning or clean-up by individual property owners,
   2. Better firefighting equipment,
   3. Improved water supplies,
   4. Thinning and fuel treatments on public land,
   5. Community education and communication
7. My biggest challenge to making my home more fire-safe is: Time, Money, Don't know what to do, I think my home is already safe.
8. I would be most interested in funding to help me and my community with: Green-waste disposal, Home hazard assessments, Education, Thinning on private land, Water supply development
9. What areas are most important to protect from wildfire (please write a brief description for each) Natural areas: Cultural Historic Areas
10. Other Questions and Comments

1	Glorieta	Lowes Canoncito Santa Fe Co		Canada de Los Alamos	Glorieta Mesa and Santa Fe	Lower Canoncito	
2	La Cueva & La Barbaria outrageous fuel loading and poor access	La Cueva, Canada, Chysadero, Tesuque, Nambe			Rural communities	The area along 1-25 between SF and the El Dorado exit….which touches many, many communities located nearly…especially up into the hills as they touch so many outlying communities… ie, Canoncito, Hondo Hills, San Sebastian, Canada de los Alamos…etc and El Dorado Wilderness Areas. I'm also concerned about Glorieta Mesa. Especially if the OHV park is passed.	Communities near National Forests lands, they are remote, often difficult to monitor and therefore vulnerable areas. This is especially so given the variety of recreation that they can support.
3	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate

4	Building Materials, Distance to fire station, Lack of water supplies for fighting the fire		Flammable trees and shrubs - grass	Building materials, Lack of water supplies for fighting fire, Flammable trees and shrubs	Distance to fire station, Lack of water supplies for fighting fire, Inaccessible area, Flammable trees and shrubs	Lack of water supplies for fighting the fire	Lack of water supplies for fighting the fire, Flammable trees and shrubs
5	4	2	2	1	1	2 I live in a valley that you used to be able to exit from either end. A homeowner at one end of the valley on Sibley Road blocked off (what I think is public access) and put up a locked gate. If our community needed to evacuate to the north…we could be trapped by this locked gate. This man does not live in the valley, he gave a key to his immediate neighbor, but that might not help others if the neighbor that travels a lot is not around. In addition…there are numerous locked gates on the Glorieta Mesa…which might be problematic	
6	1,5,2,4,3	1,---5	1,4,3,5,2	5,4,3,2,1	1 Enforcement on Santa Fe National forest - illegal fires	2,4,3,1,5	5,3,4,5,5

7	I think my home is already safe	I think my home is already safe	Don't know what to do		Time, Money	Time, Money My home is located on flat land that back ups to a hill covered with 16 acres of trees. I have cleaned the flat land around my home and the dead pinions on the edge of the hill which is closest to my home. I have had my home evaluated and been told my home is defensible, because of the work I have had done. HOWEVER there is no way I can clear further up the hill or further down the road….which would be crucial in the event of a big fire. As a 61 year old woman…the physical aspect is overwhelming. I spent $5,000 to clear around the house and was only able to tackle but a small part of my land. I am still concerned as my property butts up to El Dorado Wilderness area, which is also covered in dead trees.	Education
8	Water supply development	Home hazard assessments, Thinning on private land		Education	Green-waste disposal, Education	Thinning on private land	Natural Areas are important to protect. They require maintenance such as thinning as well as protection from overuse, misuse and enforcement of regulations. This also requires adequate staffing to monitor public lands

9	None. Natural areas should have fire.		The Santa Fe National Forest on Glorieta Mesa consists of miles of grassland with juniper & pinyon stands as well as some ponderosa		Santa Fe National Forest		Cultural Historic Areas are also a vital part of our community. They are also often located in public lands, places that were held as important, even sacred to those who came before us.
10		Private properties	I am concerned that our local forest service ranger, Joe Redden claims that fire is extremely unlikely, almost impossible in the Gloried Mesa National Forest. I would like to see someone do an independent study of the mesas forest to assess fire risk particularly as related to the up and coming travel management plan which would probably allow an inappropriate amount of ATV/OHV traffic w/camping on the mesa.		Current forest service proposals for OHV trails under the travel management rule do not take into account fire rises. Core team should include representatives of the main stakeholders, including communities. This was a nice meeting. Thanks.		

ONCEAFOREST.ORG
And Supporters

April 7, 2008

Santa Fe County Officials involved in the Wildfire Protection Plan
Dear Sirs,

The purpose of this letter is to critique Community Wildlife Protection Plan ("CWPP") and offer a citizen's plan (presented below) that provides technical support and funding to private landowners for hazardous fuels reduction and recommends conservation measures they can take to protect fragile soils, wildlife and other resources. Most importantly, the citizen's plan preserves public open-space where fire hazard is low and extensive clearing unnecessary. We also suggest regulations and incentives encouraging environmentally responsible development in fire-adapted landscapes.

We support the county's effort to prepare a CWPP because it provides the opportunity to engage key constituencies (Pueblos, businesses, hikers, bird watchers, neighborhood associations, environmental and watershed groups etc.) in a community-based fire planning process. The county is also more likely to receive future funding with a broadly supported CWPP.[1]

Unfortunately, this CWPP was not developed collaboratively[2] and has not yet achieved community consensus. Federal funding will be more difficult in the future if the community is divided on key questions of fire safety and environmental protection. Therefore, we urge you to ensure that the CWPP is prepared with meaningful public participation.[3]

Below are detailed comments to the draft CWPP.

1. The fire plan lacks meaningful public participation.

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[1] The Healthy Forest Restoration Act ("HFRA") that authorizes federal funding to reduce hazardous fuels on non-federal lands and funds this project says "The Secretary should, to the maximum extent practicable, give priority to communities that have adopted a community wildfire protection plan . . ." HFRA 1904, Section 103(d)(2)(B).

[2] The attempt last fall to remove trees in the Hyde Park area did not involve the public. A Fire Department spokesperson said in a September 22, 2006 letter to concerned citizens "I do apologize . . . for our poor public involvement . . . we did rush forward and not involve the public as we should have."

[3] HFRA encourages "meaningful public participation" including "participation of interested persons" in planning federally funded hazardous fuels reduction projects. HFRA Section 104(f).

The CWPP implementation handbook states, "as early as possible, core team members should contact and seek active involvement from key stakeholders and constituencies." [4] The Fire Department's four page "final draft" CWPP was developed without any public participation.[5] In particular: 1) the wildland/urban interface boundaries were developed without key partners, contrary to the CWPP handbook that says, "the core team and key partners should develop a base map" and; [6] 2) the community risk assessment was developed without stakeholder involvement, contrary to the CWPP handbook that says, "engaging key stakeholders in the (community risk assessment) rating process will be essential to a successful outcome."

2. The fire plan did not consider the influence of the large-scale piñon mortality.

As you know, an outbreak of bark beetles has killed many of Santa Fe's piñons, including extensive mortality in areas proposed for vegetation clearing.[7] It is often incorrectly assumed that fire risk will increase as a result.[8]

It is true that the risk of a crown fire may increase for the brief time when dead needles are still on the trees. However, after needles drop the likelihood of a crown fire is greatly reduced. This is because beetle-killed trees create gaps in the canopy that slows the spread of fire (much like the mechanical clearing proposed by the Fire Department) and the needles and twigs that fuel fast moving, wind-driven crown fires are largely gone. Several decades later, the risk of crown fire may again increase, fueled by the fallen trees and re-growth of vegetation. The upshot is that in most cases bark beetles have little or no effect on fire occurrence and severity[9] and may significantly decrease the risk of crown fire.[10]

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[4] See "*Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities*", March 2004, p. 5. The core team includes local government, local fire department and State Forestry. http://www.safnet.org/policyandpress/cwpphandbook.pdf

[5] According to the "Collaboration" section of the Fire Department's CWPP, "members of the public (are) to be specified after meetings held in November 2006." It is not stated how these members will be identified and selected. No members of the public have yet been selected. See *Final Draft Community Wildfire Protection Plan, Santa Fe, New Mexico, November 9. 2006,* p. 1.

[6] CWPPs have broad discretion to define WUI boundaries. HFRA establishes one and a half mile default boundaries for communities without CWPPs. HFRA Section 101(16).

[7] For example, see proposed Cerro Gordo project area. http://www.onceaforest.com/images/UploadFiles/CerroGordoCutLG(1).jpg

[8] See p. 8 in http://www.cfri.colostate.edu/docs/cfri_insect.pdf

[9] See p. 10 in http://www.cfri.colostate.edu/docs/cfri_insect.pdf

[10] See http://www.onceaforest.com/index.asp?sPG=75

The Fire Department contracted with consultants to identify high-risk areas and analyze potential fire behavior.[11] Unfortunately, your consultants did not consider the effects of the current bark beetle outbreak on fire behavior, using the same fuel model to evaluate fire risk in both beetle-killed and live piñon/juniper stands.[12] As a result, the risk of a damaging crown fire has been exaggerated and the benefit of beetle-created gaps and reduced canopy fuels not evaluated.

3. Please consider the citizen's plan below to reduce fire hazard with minimal environmental impacts.

As you know, the National Environmental Policy Act ("NEPA") is our national charter for protection of the environment.[13] Federally funded hazardous fuel reduction projects on non-federal lands must comply with NEPA's requirements of full disclosure, analysis and citizen participation.[14] At the heart of NEPA is the requirement to "rigorously explore and objectively evaluate all reasonable alternatives." [15]

In this spirit we offer for your consideration a carefully considered citizen's plan guided by the ecological Hippocratic Oath of "first, do no harm." [16] This plan uses proven practices to reduce the risk of homes igniting during wildfires, encourages conservation of private lands targeted for hazardous fuels removal and preserves fragile public open-space as a safe haven for wildlife and high quality recreation. Zoning changes are also suggested to live more sustainably in fire-adapted landscapes.

Home ignitability is the principle cause of home loss during wildland fires (Cohen, 1999). Intensive fuels reduction far removed from homes and communities will have little effect on home ignitability and consequently will not significantly reduce home fire losses (Cohen, 1995). Even high-intensity crown fires will not directly ignite homes at distances beyond approximately 200 feet (Cohen 2000).

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[11] The report makes many excellent recommendations, including reducing fuels adjacent to homes, installing cisterns and suggesting that people who have taken reasonable precautions remain in their homes during a fire.

[13] 40 C.F.R. 40 § 1500.1(a).

[14] See 40 C.F.R. § 1508.18(a). Federal actions subject to NEPA include "projects and programs entirely or partly financed . . . by federal agencies." In addition, the Forest Service *Interim Field Guide* instructs managers to comply with not only "the appropriate procedures and consultation requirements" of NEPA but also with the Endangered Species Act and the National Historic Preservation Act. See p. 36 http://www.fs.fed.us/projects/hfi/field-guide/

[15] 40 C.F.R. § 1502.14(a).

[16] "Do no harm" means designing fuels reduction programs in deference to the unknowable complexity of natural systems and the inherently uncertain impacts of management (DellaSala et al. 2004:984). For example, it is unknown whether restoration objectives that call for aggressive thinning will be sustainable or even desirable in current or future climates.

However, highly ignitable homes can suffer fire loss when firebrands are lofted downwind from distant wildfires and collect on and ignite wood shake roofs, adjacent vegetation or other flammable home materials. If homeowners have not taken actions to reduce home ignitability within approximate 130 feet of the structure's flammable materials, they are at risk of ignition by firebrands (Cohen and Butler, 1998).

This risk can be significantly reduced by using fire resistant construction materials (especially roofs), removing flammable materials like firewood from around the house, cleaning flammable debris from roofs and gutters, pruning the lower branches of trees, raking needles and leaves and mowing grass adjacent to the house and thinning dense groups of trees (Cohen, 2000a). Since complete elimination of firebrands is not a reasonable goal (Cohen, 1995) and fuel breaks may be ineffective in decreasing fire behavior under severe fire-weather conditions (Stephens 1998; Graham et al. 2004:23), reducing home ignitability is the preferred strategy.

The principle elements of the citizen's plan are:

- Provide support and objective information to private landowners on methods for reducing hazardous fuels immediately surrounding homes on private lands;

- Provide timely funding to home owners for approved fuels reduction plans on private property through federally funded cost-share agreements and;

- Establish a Citizen's Advisory Committee to review hazardous fuels reduction plans on private property and recommend measures to mitigate the environmental effects of thinning, pruning and other treatments.

- At a minimum, measures to mitigate environmental impacts include:

    - ✓ Retain all nut-bearing piñons (trees of significant size and age) that have survived drought and bark beetles to seed future woodlands;
    - ✓ Maintain a thin layer of duff and fine woody plant material (less than 1 inch in diameter) over 90 percent or more of the treated area to minimize soil erosion;
    - ✓ Where feasible retain standing dead trees (snags) equal to or greater than 8 inches in diameter for cavity nesting birds and other wildlife;
    - ✓ Lop and scatter activity fuels (flammable twigs and branches from thinning and pruning). Leave felled tree trunks on ground to reduce erosion and hold soil.[17]

[17] This restoration technique, known as contour felling, places felled tree trucks, limbed flush with the bole, perpendicular to slopes and arranged in a shingle pattern. On steep terrain limbed logs are set into the soil and staked on the downhill side to prevent movement.

- ✓ Conduct vegetation clearing, pruning and other ground disturbing activities outside the breeding season for birds and other wildlife that utilize the treated area; also consider limiting these activities to late summer and fall to avoid attracting egg-laying beetles that breed in woody debris and threaten surrounding drought-stressed trees;
- ✓ Limit road building and use of heavy equipment (i.e. masticators, off-road vehicles) that cause soil compaction and erosion;
- ✓ Monitor invasive plants and mechanically remove if found and;
- ✓ Inventory archeological sites and survey for sensitive plants and wildlife prior to treatment; protect these sites and habitats using the best available science.

No treatment is proposed for the persistent piñon-juniper woodlands on steep, rocky terrain of public open-space. Natural processes (periodic drought, bark-beetle outbreaks and infrequent high-intensity fire) would continue to shape these woodlands, a low-risk and ecologically responsible approach[18] based on the following rational:

The bark beetle outbreak has significantly *decreased* the chance of a high-intensity fire and there is no ecological need to aggressively thin persistent woodlands.

- ❖ Bark beetle caused mortality has thinned the woodlands, creating gaps in the canopy and reduced canopy fuels, significantly reducing the likelihood of crown fire initiation and spread;[19]

- ❖ The likelihood of crown fire initiation and spread is significantly less because the dead needles have fallen from beetle-killed trees reducing the mass and continuity of live canopy fuels;[20]

- ❖ Dead trees are less of a crown fire hazard than live trees because moisture-stressed green needles contain highly flammable compounds that fuel fast moving crown fires unlike the bare stems and branches of dead trees;

- ❖ Dead piñons are breaking apart and falling to the ground. This may result in locally intense burning but these patchy ground fuels will not carry severe fire over large areas and are easier to control.[21]

- ❖ Aggressive thinning to restore pre-settlement conditions is not needed. Unlike southwestern ponderosa pine ecosystems, persistent woodlands with little

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[18] See p. 21 in http://www.cfri.colostate.edu/docs/cfri_insect.pdf

[19] See p. 9 in http://www.cfri.colostate.edu/docs/cfri_insect.pdf

[20] See p. 9 in http://www.cfri.colostate.edu/docs/cfri_insect.pdf

[21] See p. 3 in http://www.onceaforest.com/index.asp?sPG=75

understory vegetation growing on steep, rocky terrain with shallow soils are not unnaturally dense as the result of fire suppression and livestock grazing.[22]

- The interval between large fires in the piñon-juniper woodlands surrounding Santa Fe is generally centuries. These persistent woodlands show little evidence of past fire, other than small fires that produced no significant change in stand structure (Romme 2006:1);

Hikers and other recreation users will not be exposed to Hantavirus carrying mice.

- Preserving open-space will prevent short-term increases in ground-dwelling deer mice (*Peromyscus maniculatus*) that prefer cleared areas, build nests in logging debris and are the principle vector spreading Hantavirus, a potential deadly pulmonary disease that may pose a threat to hikers and other recreational users of open-space.[23] Dry years followed by unusually wet years, a pattern increasingly common in New Mexico,[24] results in dramatic upsurges in deer mice populations (Agency Technical Work Group 2005:33).

Reduces temporary fire hazard resulting from slash build-up on private lands.

- An increase in flammable twigs and branches (logging slash or activity fuels) from aggressive thinning and pruning on private lands will increase short-term fire hazard. If these fuels are not chipped, hauled away or burned, they will become a long-term fire hazard.[25]

- Maintaining vegetative cover on public open-space will reduce short-term fire hazard by preventing excessively large cleared areas from drying due to increased insolation and wind; [26]

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[22] Increasing density and canopy cover during the 20th century was primarily a function of favorable climate and part of the normal dynamics of these ecosystems (Romme 2006:2). Density reduction may be warranted in areas where woodlands have expanded into grassy meadows with fine textured soils that were formerly subject to low-intensity, frequent fires. In such cases, research at Bandelier National Monument suggests that thinning and scattering slash may protect archeological resources from erosion. See http://www.santafenm.gov/fire/PajaritoPlateau.pdf.

[23] See p. 5 in http://www.santafenm.gov/fire/RestoringBiodiversity.pdf

[24] Precipitation variability in central New Mexico was greater in the 20th century than any period in the last 1,370 years (Grissino-Mayer et al. 2002).

[25] See p. 1297 in http://www.santafenm.gov/fire/RapidlyErodingPinon.pdf

[26] Clearing vegetation simultaneously on both public and private land could increase the flammability of forest fuels, lower humidity and cause fires to burn hotter and faster over large areas. A dense forest canopy shades the ground and surface fuels from elevated temperatures,

Preserves wildlife habitat, protects fragile soils on steep terrain and lessens opportunities for establishment of invasive plants.

- Undisturbed open-space provides valuable hiding, escape and winter thermal cover for mammals and nesting sites for birds that may not be available on intensively managed private lands; the region-wide pinon die-off has stressed woodland-dependent wildlife;

- Clearing vegetation interferes with piñon seed-planting Scrub and Piñon Jays and Clark's Nutcrackers that rely on landmarks to recover cached seeds during the winter; [27]

- Tree-removing machinery damages cryptogrammic soil crusts that bind soil, hold nutrients and water and fix atmospheric nitrogen; cool season grasses[28] and piñon seedlings growing beneath protective tree canopies are also easily damaged; public open-space is at greater risk of erosion because of generally steeper terrain; and

- There is less opportunity for establishment of cheat grass, broom snakeweed and other invasive plants;[29]

Recently many states and local governments have acted to hold homeowners more responsible for making their homes resistant to wildfire. The regulations and incentives adopted are similar to those commonly used to restrict development in floodplains, coastal zones and earthquake-prone areas. Below are some ideas to provide incentives for homeowners to make their properties fire safe and direct development away from high-hazard areas:

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radiates away heat and provides increased moisture through plant transpiration. (Schroeder and Buck, 1977).

[27] Buried piñon seeds not dug up for winter sustenance germinate to become future pinon woodlands. According to statewide surveys, there has been a 75 percent decline in the Pinon Jay population since the late 1960s. See Sauer et al. 2005 at http://www.mbr-pwrc.usgs.gov/cgi-bin/tf05.pl The regional piñon die-off may be further depleting the jay population, threatening reestablishment of "bird-pine" woodlands following the bark beetle outbreak.

[28] Cool season grasses include mutton grass, June grass, littleseed ricegrass and galleta. See p. 9 http://www.santafenm.gov/fire/PairedWatershedStudy.pdf. These important soil-binding grasses are uncommon in the project area because of depleted seed banks and predation by harvester ants.

[29] Sites with little initial vegetative cover, such as bare soils between tree canopies, may be particularly susceptible to cheat grass. See p. 115 in http://www.santafenm.gov/fire/Chapter6.pdf. Broom snakeweed increased every year following Bandelier's restoration treatments. See p. 41 http://www.santafenm.gov/fire/PairedWatershedStudy.pdf. Increased temperatures and summer rainfall associated with global warming likely favor the spread of snakeweed.

- Expand City/County open-space by purchasing development rights from willing sellers in identified high-hazard areas;

- Enact a firewise zoning ordinance for high hazard areas that requires building with fire resistant materials, providing cisterns for fire fighting and ensuring a minimum level of fuels reduction based on recommendations by the City Fire Department. Homeowners that fail to comply would be subject to fines;

- Provide density bonuses[30] to developers for clustering development away from highly combustible areas (i.e. steep slopes); and

- Allow private parties to purchase conservation easements in high-hazard areas in which landowners give up development rights in exchange for tax benefits.

At your convenience, we want to discuss our concerns and explain the citizen's plan in more detail.

Respectfully submitted,

Jan Boyer, Onceaforest.org
And Supporters (see attached)

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[30] This would allow developers to build more houses than existing zoning allows in fire safe areas in exchange for avoiding hazardous areas.

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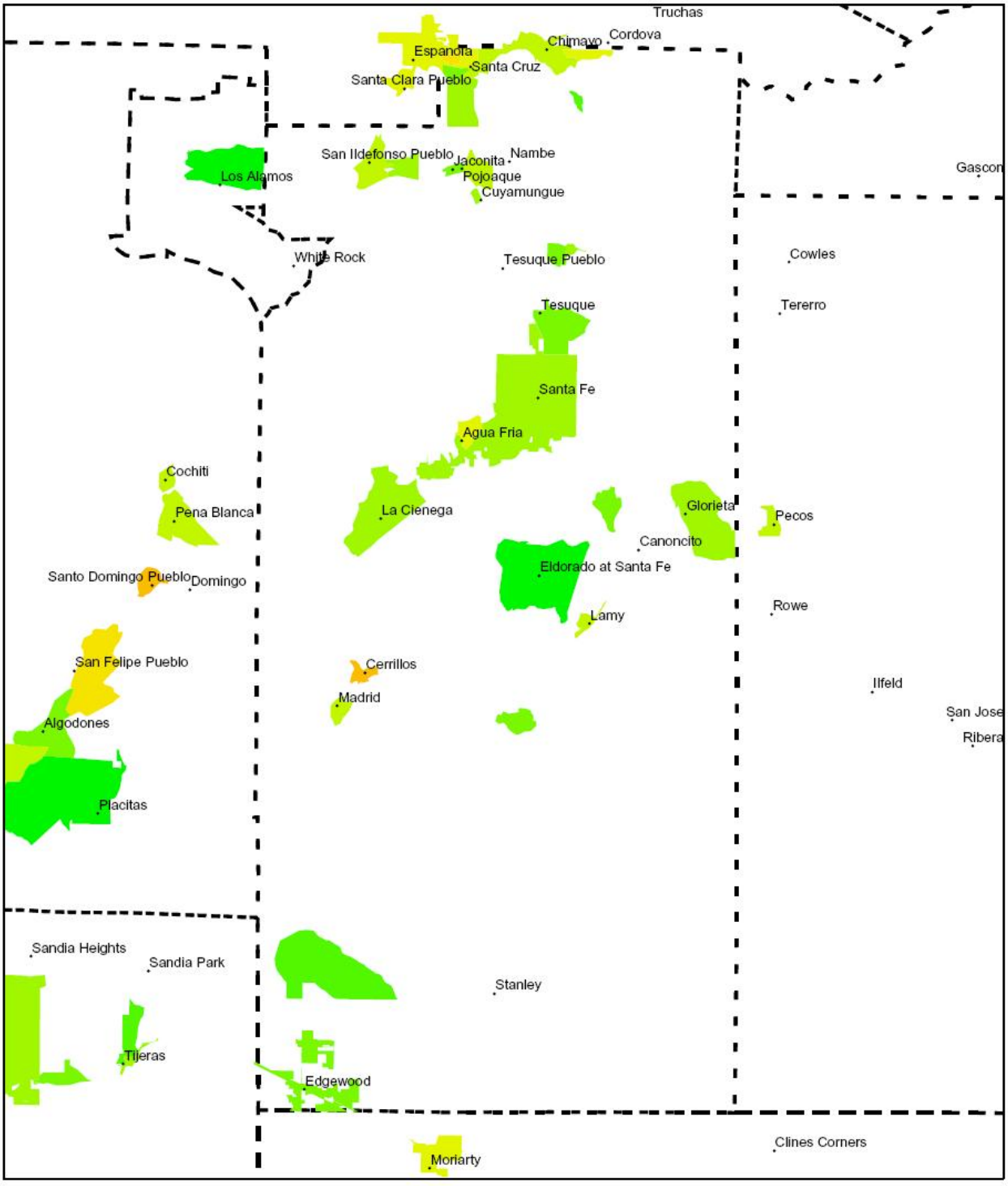
APPENDIX D
SOCIAL CAPACITY INDEX



Community Capacity for Wildfire Protection

Scaled Values	
1	5
2	6
3	7
4	8
	9
	10

for more information on community capacity for protection from wildfires
please see: http://www.forestguild.org/publications/ICCPW_07.pdf

0 3 6 12 18 Miles

forest GUILD

forest GUILD

Community Capacity in Santa Fe County, New Mexico

The Forest Guild applied the "community capacity index" (CCI) to US Census designated places within Santa Fe County to provide additional socioeconomic data to the county for their Community Wildfire Protection Plan (CWPP) efforts. All census designated places were ranked between 1 (low) and 10 (high) based on the results of the CCI which was drawn from 9 indicators listed below. Communities within the county (see map) received values ranging from 3 (Espanola, Agua Fria, and Cerrillos) to 10 (Eldorado and the Sandia Park area). When combined with ecological conditions and wildfire risk, the CCI map for Santa Fe County provides an additional tool for natural resource managers to reduce wildfire risk to communities, increase awareness of wildfire risk, to strategically prioritize limited funds, and to select appropriate funding mechanisms (cost-share programs etc.) for each of the varied communities within Santa Fe County. For further information, questions, or technical assistance using and applying the CCI, please contact the Forest Guild at 505-983-8992 ext. 16.

Measuring community capacity to resist and respond to wildfires in New Mexico

Wildfires have a disproportionately negative impact on those households and communities lacking adequate resources to prepare for, respond to, and recover from catastrophic events. While all communities risk tremendous losses in the face of wildfires, some communities have lower capacity to cope with fire-related disruptions of economic activity and social services, and risk loosing more of their assets when their homes or their communities burn.

Community capacity in the context of wildfire is the ability to respond to wildfire threat through fuel reduction efforts, creating defensible space around structures, improving fire suppression facilities, and restoring forest ecosystems- community capacity is the collective ability to prepare for, respond to, and recover from disasters.

The Forest Guild developed a "community capacity index" as a quantitative measure to rank communities according to their ability to prepare for, respond to, and recover from wildfire events. The community capacity index (CCI) is designed to integrate social, human, financial, and political capital indicators into a single measure. The following 9 indicators are combined to create the CCI.

- Social Capital
    - Vulnerable populations (Age Dependency Ratio)
    - Vulnerable populations (Percent without disabilities)
    - Vulnerability of minorities (Female only headed households)
- Human Capital
    - Education (Percent with high school diploma)
    - Employment (Percent employed)
    - Cultural diversity (Percent of population employed)
- Financial Capital

  - Income (median income)
  - Poverty (percent of community below the poverty line)
- Political Capital
  - Political participation (voter turn out)

The community capacity index coupled with biotic and abiotic measures of fire risk can be a valuable tool in identifying communities most at risk to wildfire and the highest priority uses for available financial and human resources. As no index of community capacity can exactly measure all facets of a community's strengths or weaknesses, it is critical to balance all assessments and quantitative measures against local knowledge and qualitative information.

Measuring community capacity to resist and respond to wildfires in New Mexico

Questions and Answers

Why is community capacity relevant to wildfire protection plans?

A key element of community wildfire protection planning is the development of a community risk assessment. Fuel hazards, risk of wildfire occurrence, homes, businesses, and essential infrastructure at risk, local preparedness and fire fighting capacity, are all standard elements of risk assessments. Nevertheless, social and economic characteristics of community capacity also contribute to a communities' vulnerability to wildfire. Community capacity indicators coupled with biotic and abiotic measures of fire risk can be a valuable tool in identifying communities most at risk to wildfire and the highest priority uses for available financial and human resources.

Are communities most at risk from wildfire able to access and benefit from federal programs established to serve these communities? In other words, are the dollars, assistance, and fuels-reduction projects hitting the ground in the areas that are most at risk?

The answer to this question is unclear as agencies currently lack adequate monitoring systems and performance measures to gauge the benefits of Forest Service programs in low-income and low capacity communities. In fact, in some cases, assistance has been given to wealthier communities to the detriment of less well off communities. During the fiscal years 2001 and 2002 in New Mexico, all of the $685,000 awarded for private land went to reduce fuels in wealthier, bedroom communities of Albuquerque rather than the predominantly economically distressed and forest-dependent communities of the Manzano Mountains (Morton 2003).

A 2005 study by Resource Innovations and the National Network for Forest Practitioners, *Mapping the Relationship between Wildfire and Poverty*, (Lynn and Gerlitz 2005) examined the relationship between wildfire and poverty. Results from the *Wildfire and Poverty* study indicate that, in general, there are more households in poverty in inhabited wildland areas than there are in the WUI or in areas outside of the vegetated

wildlands. The federally defined WUI is one example of a well meaning policy and program that can exclude low income communities.

To further examine the capacity of communities who actively participate in the creation of CWPPs, the guild compared the ICCPW values for those Census county subdivisions that included communities with CWPPs in place to those without CWPPs. The results showed that, for New Mexico counties, areas that have CWPPs have a higher community capacity for protection from wildfire than those areas lack such plans. The ICCPW score for county subdivisions with CWPPs was 8 while those without had an average score of 7 and the 95% confidence interval of the difference was from 0.02 to 1.7 on the 10 point ICCPW scale.

Why aren't some communities included on the map? Why are there no data for certain communities?

Some communities may not be on the map or may not have detailed information because the US Census did not recognize them as a "Census Designated Place". We attempted to locate these other communities but still may have failed to capture every community. Please provide any additional information for your community that you want included in the analysis.

Are 9 indicators really needed to measure community capacity?

While one indicator, say income, may be an adequate measure of poverty, it is not sufficient in the context of understanding the relationship between community capacity and wildfire. The nine indicators combined in one index give a more robust assessment of community capacity than one indicator alone. For example, a family may have an income above the poverty level, but still may not be able to garner resources to protect themselves and their property against wildfire.

Should a designation for low-capacity communities be developed that will increase the ability of federal agencies and congress to identify, assist, and monitor impacts in communities that need the most help?

Indicators to identify low capacity communities that agencies could use include poverty, population size (to ensure that rural communities are targeted), governance, and special needs (RVCC 2007, Evans et al. 2007). Creating a low-capacity designation will assist agencies in directing reduced cost-shares, set-asides in grants, technical assistance, training, or other types of help to communities that require the most assistance to protect themselves from wildfire.

The low capacity designation should be used in 1) assessing low capacity communities to target financial and technical assistance, 2) wildfire risk assessments at a state and local level, and 3) monitoring outcomes and performance measures for a range of federal land management agency programs. The agencies should engage in a collaborative process with community-based forestry organizations to develop the designation and a strategy for its use.

APPENDIX E
HOMEOWNER'S GUIDE

Introduction

This guide has been developed to address site-specific information on wildfire for the County. In public meetings and written comments, residents expressed a need for better information on reducing wildfire risk and what to do in the event of a wildfire. This document was developed to meet these expressed community needs, as well as to fulfill requirements for the CWPP. This guide suggests specific measures that can be taken by homeowners to reduce structure ignitability, and enhances overall preparedness in the planning area by consolidating preparedness information from several local agencies and departments.

BEFORE THE FIRE—PROTECTION AND PREVENTION

REDUCING STRUCTURE IGNITABILITY

Structural Materials

Roofing—The more fire-resistant the roofing material, the better. The roof is the portion of the house that is most vulnerable to ignition by falling embers, known as firebrands. Metal roofs afford the best protection against ignition from falling embers. Slate or tile roofs are also noncombustible, and Class-A asphalt shingles are recommended as well. The most dangerous type of roofing material is wood shingles. Removing debris from roof gutters and downspouts at least twice a year will help to prevent fire, along with keeping them functioning properly.

Siding—Noncombustible materials are ideal for the home exterior. Preferred materials include stucco, cement, block, brick, and masonry.

Windows—Double-pane windows are most resistant to heat and flames. Smaller windows tend to hold up better within their frames than larger windows. Tempered glass is best, particularly for skylights, because it will not melt as plastic will.

Fencing and trellises—Any structure attached to the house should be considered part of the house. A wood fence or trellis can carry fire to your home siding or roof. Consider using nonflammable materials or use a protective barrier such as metal or masonry between the fence and the house.

If you are designing a new home or remodeling your existing one, do it with fire safety as a primary concern. Use nonflammable or fire resistant materials and have the exterior wood treated with UL-approved fire-retardant chemicals. More information on fire-resistant construction can be found at http://www.firewise.org.

SCREEN OFF THE AREA BENEATH DECKS AND PORCHES

The area below an aboveground deck or porch can become a trap for burning embers or debris, increasing the chances of the fire transferring to your home. Screen off the area using screening with openings no larger than one-half inch. Keep the area behind the screen free of all leaves and debris.

FIREWOOD, KINDLING, AND OTHER FLAMMABLES

Although convenient, stacked firewood on or below a wooden deck adds fuel that can feed a fire close to your home. Be sure to move all wood away from the home during fire season. Stack all firewood uphill, at least 30 feet and preferably 100 feet from your home.

When storing flammable materials such as paint, solvents, or gasoline, always store them in approved safety containers away from any sources of ignition such as hot water tanks or furnaces. The fumes from highly volatile liquids can travel a great distance after they turn into a gas. If possible, store the containers in a safe, separate location away from the main house.

The Public Service Company of New Mexico (PNM) does not have sufficient crews for frequent inspection of all its high-voltage power lines. If you have high-voltage lines running near your property, take a moment to walk underneath them and ensure that no tree branches are close to the towers or lines. If there is any situation that could be a fire hazard, contact a customer service representative from PNM.

CHIMNEYS AND FIREPLACE FLUES

Inspect your chimney and damper at least twice a year and have the chimney cleaned every year before first use. Have the spark arrestor inspected and confirm that it meets the latest safety code. Your local fire department will have the latest edition of National Fire Prevention Code 211 covering spark arrestors. Make sure to clear away dead limbs from within 15 feet of chimneys and stovepipes

FIREPLACE AND WOODSTOVE ASHES

Never take ashes from the fireplace and put them into the garbage or dump them on the ground. Even in winter, one hot ember can quickly start a grass fire. Instead, place ashes in a metal container, and as an extra precaution, soak them with water. Cover the container with its metal cover and place it in a safe location for a couple of days. Then either dispose of the cold ash with other garbage or bury the ash residue in the earth and cover it with at least 6 inches of mineral soil.

PROPANE TANKS

Your propane tank has many hundreds of gallons of highly flammable liquid that could become an explosive incendiary source in the event of a fire. The propane tank should be located at least 30 feet from any structure. Keep all flammables at least 10 feet from your tank. Learn how to turn the tank off and on. In the event of a fire, you should turn the gas off at the tank before evacuating, if safety and time allow.

SMOKE ALARMS

A functioning smoke alarm can help warn you of a fire in or around your home. Install smoke alarms on every level of your residence. Test and clean smoke alarms once a month and replace batteries at least once a year. Replace smoke alarms once every 10 years.

FIRE-SAFE BEHAVIOR

- If you smoke, always use an ashtray in your car and at home.
- Store and use flammable liquids properly.
- Keep doors and windows clear as escape routes in each room.

DEFENSIBLE SPACE

The removal of dense, flammable foliage from the area immediately surrounding the house reduces the risk of structure ignition and allows firefighters access to protect the home. A 100-foot safety zone, free of all trees and shrubs, is recommended by the fire department; the minimum distance is 30 feet. Steep slopes require increased defensible space because fire can travel quickly uphill.

Within the minimum 30-foot safety zone, plants should be limited to fire-resistant trees and shrubs. Focus on fuel breaks such as concrete patios, walkways, rock gardens, and irrigated garden or grass areas within this zone. Use mulch sparingly within the safety zone, and focus use in areas that will be watered regularly. In areas such as turnarounds and driveways, nonflammable materials such as gravel are much better than wood chips or pine needles.

Vegetative debris such as dead grasses or leaves provide important erosion protection for soil but also may carry a surface fire. It is simply not feasible to remove all the vegetative debris from around your property. However, it is a good idea to remove any accumulations within the safety zone and extending out as far as possible. This is particularly important if leaves tend to build up alongside your house or outbuildings. Removing dead vegetation and leaves and exposing bare mineral soil are recommended in a 2-foot-wide perimeter along the foundation of the house. Also, be sure to regularly remove all dead vegetative matter including grasses, flowers, and leaf litter surrounding your home and any debris from gutters, especially during summer months. Mow the lawn regularly and promptly dispose of the cuttings properly. If possible, maintain a green lawn for 30 feet around your home.

All trees within the safety zone should have lower limbs removed to a height of 6–10 feet. Remove any branches within 15 feet of your chimney or overhanging any part of your roof. Ladder fuels are short shrubs or trees growing under the eaves of the house or under larger trees. Ladder fuels carry fire from the ground level onto the house or into the tree canopy. Be sure to remove all ladder fuels within the safety zone first. The removal of ladder fuels within about 100 feet of the house will help to limit the risk of crown fire around your home. More information about defensible space is provided at http://www.firewise.org.

FIRE RETARDANTS

For homeowners who would like home protection beyond defensible space and fire-resistant structural materials, fire-retardant gels and foams are available. These materials are sold with

various types of equipment for applying the material to the home. They are similar to the substances applied by firefighters in advance of wildfire to prevent ignition of homes. Different products have different timelines for application and effectiveness. The amount of product needed is based on the size of the home, and prices may vary based on the application tools. Prices range from a few hundred to a few thousand dollars. An online search for "fire blocking gel" or "home firefighting" will provide a list of product vendors.

ADDRESS POSTING

Locating individual homes is one of the most difficult tasks facing emergency responders. Every home should have the address clearly posted with numbers at least three inches high. The colors of the address posting should be contrasting or reflective. The address should be posted so that it is visible to cars approaching from either direction.

ACCESS

Unfortunately, limited access may prevent firefighters from reaching many homes in the County. Many of the access problems occur at the property line and can be improved by homeowners. First, make sure that emergency responders can get in your gate. This may be important not only during a fire but also to allow access during any other type of emergency response. If you will be gone for long periods during fire season, make sure a neighbor has access, and ask them to leave your gate open in the event of a wildfire in the area.

Ideally, gates should swing inward. A chain or padlock can be easily cut with large bolt cutters, but large automatic gates can prevent entry. Special emergency access red boxes with keys are sold by many gate companies but are actually not recommended by emergency services. The keys are difficult to keep track of and may not be available to the specific personnel that arrive at your home. An alternative offered by some manufacturers is a device that opens the gate in response to sirens. This option is preferred by firefighters but may be difficult or expensive to obtain.

Beyond your gate, make sure your driveway is uncluttered and at least 12 feet wide. The slope should be less than 10%. Trim any overhanging branches to allow at least 13.5 feet of overhead clearance. Also make sure that any overhead lines are at least 14 feet above the ground. If any lines are hanging too low, contact the appropriate phone, cable, or power company to find out how to address the situation.

If possible, consider a turnaround within your property at least 45 feet wide. This is especially important if your driveway is more than 300 feet in length. Even small fire engines have a hard time turning around and cannot safely enter areas where the only means of escape is by backing out. Any bridges must be designed with the capacity to hold the weight of a fire engine.

NEIGHBORHOOD COMMUNICATION

It is important to talk to your neighbors about the possibility of wildfire in your community. Assume that you will not be able to return home when a fire breaks out and may have to rely on your neighbors for information and assistance. Unfortunately, it sometimes takes tragedy to get

people talking to each other. Don't wait for disaster to strike. Strong communication can improve the response and safety of every member of the community.

PHONE TREES

Many neighborhoods use phone trees to keep each other informed of emergencies within and around the community. The primary criticism is that the failure to reach one person high on the tree can cause a breakdown of the system. However, if you have willing and able neighbors, particularly those that are at home during the day, the creation of a well-planned phone tree can often alert residents to the occurrence of a wildfire more quickly than media channels. Talk to your neighborhood association about the possibility of designing an effective phone tree.

NEIGHBORS IN NEED OF ASSISTANCE

Ask mobility-impaired neighbors if they have notified emergency responders of their specific needs. It is also a good idea for willing neighbors to commit to evacuating a mobility-impaired resident in the event of an emergency. Make sure that a line of communication is in place to verify the evacuation.

ABSENTEE OWNERS

Absentee owners are often not in communication with their neighbors. If a home near you is unoccupied for large portions of the year, try to get contact information for the owners from other neighbors or your neighborhood association. Your neighbors would probably appreciate notification in the event of an emergency. Also, you may want to contact them to suggest that they move their woodpile or make sure that the propane line to the house is turned off.

HOUSEHOLD EMERGENCY PLAN

A household emergency plan does not take much time to develop and will be invaluable in helping your family deal with an emergency safely and calmly. One of the fundamental issues in the event of any type of emergency is communication. Be sure to keep the phone numbers of neighbors with you rather than at home.

It is a good idea to have an out of state contact, such as a family member. When disaster strikes locally, it is often easier to make outgoing calls to a different area code than local calls. Make sure everyone in the family has the contact phone number and understands why they need to check in with that person in the event of an emergency. Also, designate a meeting place for your family. Having an established meeting site helps to ensure that family members know where to go, even if they can't communicate by phone.

CHILDREN

Local schools have policies for evacuation of students during school hours. Contact the school to get information on how the process would take place and where the children would likely go.

The time between when the children arrive home from school and when you return home from work is the most important timeframe that you must address. Fire officials must clear residential areas of occupants to protect lives and to allow access for fire engines and water drops from

airplanes or helicopters. If your area is evacuated, blockades may prevent you from returning home to collect your children. It is crucial to have a plan with a neighbor for them to pick up your children if evacuation is necessary.

PETS AND LIVESTOCK

Some basic questions about pets and livestock involve whether you have the ability to evacuate the animals yourself and where you would take them. Planning for the worst-case scenario may save your animals. An estimated 90% of pets left behind in an emergency do not survive. Don't expect emergency service personnel to prioritize your pets in an emergency. Put plans in place to protect your furry family members.

PETS

Assemble a pet disaster supply kit and keep it handy. The kit should contain a three-day supply of food and water, bowls, a litter box for cats, and a manual can opener if necessary. It is also important to have extra medication and medical records for each pet. The kit should contain a leash for each dog and a carrier for each cat. Carriers of some kind should be ready for birds and exotic pets. In case your pet must be left at a kennel or with a friend, also include an information packet that describes medical conditions, feeding instructions, and behavioral problems. A photo of each pet will help to put the right instructions with the right pet.

In the event of a wildfire you may be prevented from returning home for your animals. Talk to your neighbors and develop a buddy system in case you or your neighbors are not home when fire threatens. Make sure your neighbor has a key and understands what to do with your pets should they need to be evacuated.

If you and your pets were evacuated, where would you go? Contact friends and family in advance to ask whether they would be willing to care for your pets. Contact hotels and motels in the area to find out which ones accept pets. Boarding kennels may also be an option. Make sure your pets' vaccinations are up-to-date if you plan to board them.

Once you have evacuated your pets, continue to provide for their safety by keeping them cool and hydrated. Try to get your pets to an indoor location rather than leaving them in the car. Do not leave your pets in your vehicle without providing shade and water. It is not necessary to give your pets water while you are driving, but be sure to offer water as soon as you reach your destination.

LIVESTOCK

Getting livestock out of harm's way during a wildfire is not easy. You may not be able or allowed to return home to rescue your stock during a wildfire evacuation. Talk to your neighbors about how you intend to deal with an evacuation. If livestock are encountered by emergency responders, they will be released and allowed to escape the fire on their own. Make sure your livestock have some sort of identification. Ideally, your contact information should be included on a halter tag or ear tag so that you could be reached if your animal is encountered.

If you plan to evacuate your livestock, have a plan in place for a destination. Talk to other livestock owners in the area to find out whether they would be willing to board your stock in the event of an emergency. Often in large-scale emergencies, special accommodations can be made at fair and rodeo grounds, but personal arrangements may allow you to respond more quickly and efficiently.

If you do not own a trailer for your horses or other livestock, talk to a neighbor who does. Find out whether they would be willing to assist in the evacuation of your animals. If you do own a trailer, make sure it is in working condition with good, inflated tires and functioning signal lights. Keep in mind that even horses that are accustomed to a trailer may be difficult to load during an emergency. Practicing may be a good idea to make sure your animals are as comfortable as possible when being loaded into the trailer.

HOUSE AND PROPERTY

Insurance companies suggest that you make a video that scans each room of your house to help document and recall all items within your home. This video can make replacement of your property much easier in the unfortunate event of a large insurance claim. See more information on insurance claims in the "After the Fire" section below.

PERSONAL ITEMS

During fire season, items you would want to take with you during an evacuation should be kept in one readily accessible location. As an extra precaution, it may be a good idea to store irreplaceable mementos or heirlooms away from your home during fire season.

It is important to make copies of all important paperwork, such as birth certificates, titles, and so forth, and store them somewhere away from your home, such as in a safe deposit box. Important documents can also be protected in a designated firesafe storage box within your home.

IN THE EVENT OF A FIRE

NOTIFICATION

In the event of a wildfire, announcements from the local Emergency Management office will be broadcast over local radio and television stations. Media notification may be in the form of news reports or the Emergency Alert System (EAS). On the radio, the AM station 770 KOB generally provides frequent updates. On television, the emergency management message will scroll across the top of the screen on local channels. The notice is not broadcast on non-local satellite and cable channels.

One good way to stay informed about wildfire is to use a National Oceanic and Atmospheric Administration (NOAA) weather alert radio. The radios can be purchased at most stores that carry small appliances, such as Target, Sears, or Radio Shack. The radio comes with instructions for the required programming to tune the radio to your local frequency. The programming also determines the types of events for which you want to be alerted. The weather alert radio can be used for any type of large incident (weather, wildfire, hazardous materials, etc.), depending on how it is programmed. Local fire personnel can assist with programming if needed.

WHEN FIRE THREATENS

Before an evacuation order is given for your community, there are several steps you can take to make your escape easier and to provide for protection of your home. When evaluating what to do as fire threatens, the most important guideline is: DO NOT JEOPARDIZE YOUR LIFE.

Back your car into the garage or park it in an open space facing the direction of escape. Shut the car doors and roll up the windows. Place all valuables that you want to take with you in the vehicle. Leave the keys in the ignition or in another easily accessible location. Open your gate.

Close all windows, doors, and vents, including your garage door. Disconnect automatic garage openers and leave exterior doors unlocked. Close all interior doors as well.

Move furniture away from windows and sliding glass doors. If you have lightweight curtains, remove them. Heavy curtains, drapes, and blinds should be closed. Leave a light on in each room.

Turn off the propane tank or shut off gas at the meter. Turn off pilot lights on appliances and furnaces.

Move firewood and flammable patio furniture away from the house or into the garage.

Connect garden hoses to all available outdoor faucets and make sure they are in a conspicuous place. Turn the water on to "charge," or fill your hoses and then shut off the water. Place a ladder up against the side of the home, opposite the direction of the approaching fire, to allow firefighters easy access to your roof.

EVACUATION

When evacuation is ordered, you need to go ***immediately***. Evacuation not only protects lives, it also helps to protect property. Some roads in the County are too narrow for two-way traffic, especially with fire engines. Fire trucks often can't get into an area until the residents are out. Also, arguably the most important tool in the WUI toolbox is aerial attack. Airplanes and helicopters can be used to drop water or retardant to help limit the spread of the fire, but these resources cannot be used until the area has been cleared of civilians.

Expect emergency managers to designate a check-out location for evacuees. This process helps to ensure that everyone is accounted for and informs emergency personnel as to who may be remaining in the community. Every resident should check out at the designated location before proceeding to any established family meeting spot.

A light-colored sheet closed in the front door serves as a signal to emergency responders that your family has safely left. This signal saves firefighters precious time, as it takes 12–15 minutes per house to knock on each door and inform residents of the evacuation.

AFTER THE FIRE

RETURNING HOME

First and foremost, follow the advice and recommendations of emergency management agencies, fire departments, utility companies, and local aid organizations regarding activities following the wildfire. Do not attempt to return to your home until fire personnel have deemed it safe to do so.

Even if the fire did not damage your house, do not expect to return to business as usual immediately. Expect that utility infrastructure may have been damaged and repairs may be necessary. When you return to your home, check for hazards, such as gas or water leaks and electrical shorts. Turn off damaged utilities if you did not do so previously. Have the fire department or utility companies turn the utilities back on once the area is secured.

INSURANCE CLAIMS

Your insurance agent is your best source of information as to the actions you must take in order to submit a claim. Here are some things to keep in mind. Your insurance claim process will be much easier if you photographed your home and valuable possessions before the fire and kept the photographs in a safe place away from your home. Most if not all of the expenses incurred during the time you are forced to live outside your home could be reimbursable. These could include, for instance, mileage driven, lodging, and meals. Keep all records and receipts. Don't start any repairs or rebuilding without the approval of your claims adjuster. Beware of predatory contractors looking to take advantage of anxious homeowners wanting to rebuild as quickly as possible. Consider all contracts very carefully, take your time to decide, and contact your insurance agent with any questions.

POST-FIRE REHABILITATION

Homes that may have been saved in the fire may still be at risk from flooding and debris flows. Burned Area Emergency Rehabilitation (BAER) teams are inter-disciplinary teams of professionals who work to mitigate the effects of post-fire flooding and erosion. These teams often work with limited budgets and manpower. Homeowners can assist the process by implementing treatments on their own properties as well as volunteering on burned public lands to help reduce the threat to valuable resources. Volunteers were instrumental in implementing many of the BAER treatments following the Cerro Grande fire. Volunteers can assist BAER team members by planting seeds or trees, hand mulching, or helping to construct straw-bale check dams in small drainages.

Volunteers can help protect roads and culverts by conducting storm patrols during storm events. These efforts dramatically reduce the costs of such work as installing trash racks, removing culverts, and re-routing roads.

Community volunteers can also help scientists to better understand the dynamics of the burned area by monitoring rain gauges and monitoring the efficacy of the installed BAER treatments.

APPENDIX F
FIREFIGHTING RESOURCES

APPARATUS	DESCRIPTION
SANTA FE COUNTY Number of ▪ Personal Vehicles 11 ▪ Specialty Vehicles 16 ▪ Trailers 8	
Truck	Command; 4-crew capacity; BLS gear; bunker gear; wildland gear; hand tools; fire extinguisher; gasoline; 4WD
Truck	Command; 6-crew capacity; BLS gear; wildland gear; fire extinguisher; diesel; 4WD
Truck	Command; 6-crew capacity; BLS gear; bunker gear; wildland gear; SCBA; fire extinguisher; diesel; 4WD
Truck	Command; 6-crew capacity; ALS Thomas Pack; Lifepack 10; oxygen; SCBA; Technical Rescue equipment; bunker gear; wildland gear; fire extinguisher; diesel; 4WD
Truck	Command; ICS vests; ICS forms; management board; MCI management kit; WMD detection equipment; CBRNE technical reference material; Communications: 50-channel VHF load, wildland communications plan load, EMSCOM radio, 800 mHz City Fire and City Police frequencies, VHF aircraft, 1 dual-band ham radio, satellite phone; diesel; 4WD
Truck	Command; 5-crew capacity; GPS; ALS gear; SCBA; ICS vests; landing zone vest; Technical Rescue equipment; triage gear; Lifepack 12; hand tools; fire extinguisher; rehab supplies; diesel; 4WD
Truck	Snow removal; 3-crew capacity; 7 ft snowplow; diesel; 4WD
Truck	Primary use - wildland fires; Secondary use - transporting the Chipper; basic wildland tools; diesel; 4WD
Truck	Fleet maintenance; 4-crew capacity; arc welder/10,000W electric generator; plasma cutter; torch; 3200 lb crane; air compressor; hand tools; air tools; jack stands; extra fuel (both diesel and gasoline); tow chains; misc.emergency apparatus parts; diesel; road cones
Truck	Fleet maintenance; 2-crew capacity; arc welder/8,000W electric generator; torch; air compressor; hand tools; air tools; jack stands; extra fuel (both diesel and gasoline); misc. emergency apparatus parts; diesel; road cones
Truck	Fleet maintenance; 2-crew capacity; torch; air compressor; hand tools; air tools; 20-ton jack; jack stands; battery tester; misc. emergency apparatus parts; diesel; road cones
Mobile Command Unit	Mobile communications center; command/communications; 2-crew capacity; ACU 1000; 8 radios; command light; light tower; weather station; on-board video recording; ICS forms; restroom facility; diesel
Command Bus	Mobile communications unit; Primary use - communications; Secondary use - MCI transport; 25-crew capacity; radios; phones; 4000W electric generator; ICS forms; maps; rehab supplies; gasoline
PMS Van	Electric generator; restroom facility; diesel
Warthog	Wildland fire support; 2-crew capacity; 40,000 lb PTO winch; 250 gpm pump; 1200 gal water; basic wildland hand tools; diesel; gasoline-powered pump; 6x6 *Housed at Turquoise Trail Station 2

APPARATUS	DESCRIPTION
Wildland 1	Wildland fire support; wildland hand tools; pumpkin; wildland PPE; diesel; 4WD *Housed at Pojoaque Station 2
Wildland 2	Wildland fire support; wildland hand tools; 4WD; diesel *Housed at Turquoise Trail Station 2
Air 1	Structure fire support; compressor with a cascade; 4 bottles - can run 2 at a time; 8 spare air bottles; rehab supplies *Housed at Hondo Station 2 (Med 80)
Air 2	Structure fire support; compressor with a cascade; 4 bottles - can run 2 at a time; 8 spare air bottles *Housed at Edgewood Station 2
Air 3	Primary use - air supply for structure fires (cascade); Secondary use - lighting support; 10 kW diesel generator, retractable light towers with 2 lamps each; road cones *Housed at Pojoaque Station 1 (Med 50)
Snorkel; Aerial Fire Truck	Primary use - high angle rescue; Secondary use - fire suppression; 3-crew capacity; 85 ft reach; articulating platform with waterway; **Supply hose**: 1000 ft 3"; 6 SCBA; 2 gas vent fans; confined space ventilator (gas); salvage covers; harness; forcible entry tools; road cones *Housed at Agua Fria Station 1
ATV (3)	EMS first response equipment, trauma kit, airway kit, oxygen, backboards *Housed at State Pen storage units
ATV Trailers (3)	2 5/16 hitch
Welding Trailer	10,000W electric generator
Swiftwater Trailer (also listed on p. 89)	Its complement is Turquoise Trail's Rescue 3 (housed at Turquoise Trail Station 1); 2 inflatable boats; PFDs; paddles; throw bags; electric generator; scene lights
MCI Trailers (2)	North and South - Admin and Edgewood; 2500W electric generator; 50-patient capability; 20 BLS patient treatment packs; spine boards; trauma supplies; VHF/UHF radio; quartz floodlights; blankets; clipboards; PPE
WMD Trailers (4)	North, West, South, and East - currently at Admin; WMD detection equipment; CBRNE PPE; CBRNE technical reference materials

NORTHERN REGION (Chimayo, La Puebla, Pojoaque, Tesuque)

Services Provided

- ALS
- Structural fire suppression
- Wildland fire suppression
- Light extrication/rescue
- Swiftwater rescue at awareness level
- Number of Ambulances 1

APPARATUS	DESCRIPTION
Med 50	ALS; 30 gal foam extinguisher; light extrication equipment; capable of 2 patient transport; 4-gas meter; TIC; 2 SCBA; SKED; rope rescue equipment; swiftwater PPE; wildland PPE
CHIMAYO FIRE DISTRICT Number of ▪ Stations 2 ▪ Fire Suppression 5 ▪ Rescue Trucks 1 ▪ *Float pump 1	
Chimayo Station 1	
Engine 1; Type 1 Engine (Class A)	Primary use - structure fires; Secondary use - wildland fires, MVAs; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 1200 gal dump tank; 15 gal Class A foam; Attack hose: 250 ft 3" and 250 ft 2.5"; Supply hose: 1000 ft 3"; 5 SCBA and 5 masks; 4 spare air bottles; 1 chainsaw; 1 vent saw; 1 gas vent fan; deck gun; Propak; hose clamps; spot chains; piercing nozzle; road cones
Mini-pumper; Type 6 Engine (Brush Truck)	Primary use - structure fires; Secondary use - wildland fires; 3-crew capacity; 750 gpm side panel pump; 400 gal water; Supply hose: 1000 ft 3"; 4 SCBA; 1 chainsaw; Holmatro; PPV generator; Propak; brush hand tools; 4WD; road cones
Tanker 1; Tender (Tanker)	Wildland fires; 3-crew capacity; 500 gpm side panel pump; 1800 gal water; 1500 gal dump tank; Supply hose: 1200 ft 3"; 1 chainsaw; pump and roll; 250 ft hydraulic rollback; ladder; spot chains; road cones
Rescue 1; Light Rescue Truck	Rescue, MVAs, and EMS; 1 Stokes litter with 1 wheel; 1 combitool; 2 portable light towers with 2 halogen lights each; Holmatro; medical supplies; vacuum splints; stiffnecks; BVMs; 4WD; road cones
Chimayo Station 2	
Tanker 2; Tender (Tanker)	Water supply; 3-crew capacity; <250 gpm rear independent, motorized pump; 1500 gal water; 1500 gal dump tank; Attack hose: 100 ft 2.5"; Supply hose: 1000 ft 3"; hand tools; road cones

APPARATUS	DESCRIPTION
LA PUEBLA FIRE DISTRICT 1 Number of ▪ Stations 2 ▪ Fire Suppression 5 ▪ Rescue Trucks 1 ▪ Specialty Vehicles 1 ▪ *30,000 gal water 1	
La Puebla Station 1 (Main Station)	
Engine 1; Type 1 Engine (Class A)	3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 20 gal CAFS; Attack hose: 150 ft 2.5" and 600 ft 1.75"; Supply hose: 1250 ft 3"; TIC; 4 SCBA; 8 spare air bottles; 1 chainsaw; 1 vent saw; 1 gas vent fan; Propak; road cones
Tanker 8; Tender (Tanker)	2-crew capacity; 500 gpm side panel pump; 1800 gal water; 1800 gal dump tank; Attack hose: 100 ft 2.5" and 600 ft 1.75"; 1 SCBA; Propak; road cones
Rescue 7; Light Rescue Truck	MVAs, EMS, and technical rescue; high angle rescue apparatus; 1 combitool; 1 Sawzall; 1 spreader; 1 small ram; 3 low pressure airbags; 2 SCBA; 2 spare air bottles; GPS; medical supplies; cribbing; rehab supplies; 4WD; road cones
La Puebla Command	Chief's Vehicle; GPS; spare handheld radios; 2 SCBA; rope; medical supplies
La Puebla Fire Station 2	
Engine 3; Type 1 Engine (Class A)	Primary use - second out engine; Secondary use - tanker; 3-crew capacity; 1250 gpm side panel pump; 1000 gal water; 1000 gal dump tank; Attack hose: 1200 ft 2.5" and 900 ft 1.75"; Supply hose: 200 ft 5"; 4 SCBA; 4 spare air bottles; 1 chainsaw; 1 vent saw; 1 gas vent fan; proportioner; road cones
Brush 2; Type 6 Engine (Brush Truck)	Primary use - wildland fires; Secondary use - EMS; 3-crew capacity; <250 gpm rear panel pump; 200 gal water; 10 gal Class A foam; Attack hose: 100 ft 2.5" and 400 ft 1.75"; GPS; 2 SCBA; 4 spare air bottles; 1 chainsaw; Propak; medical supplies; basic extrication tools; hand tools; winch; 4WD; road cones
Tanker 4; Tender (Tanker)	Primary use - second out tanker; Secondary use - mutual aid; 3-crew capacity; <250 gpm rear panel pump; 1500 gal water; 1500 gal dump tank; Attack hose: 200 ft 1.75"; 1 SCBA; 1 spare air bottle; pump and roll; transfer device; road cones

APPARATUS	DESCRIPTION
POJOAQUE FIRE DISTRICT Number of ▪ Stations 2 ▪ Fire Suppression 7 ▪ Rescue Trucks 1 ▪ Medical Vehicles 1	
Pojoaque Station 1 (Main Station)	
Engine 7; Type 1 Engine (Class A)	First out for structural firefighting; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 2000 gal dump tank; 30 gal Class A foam; Attack hose: 200 ft 2.5" and 500 ft 1.75"; Supply hose: 1200 ft 3"; TIC; GPS; 8 SCBA; 1 chainsaw; 1 vent saw; 1 gas vent fan; road cones
Brush 1; Type 6 Engine (Brush Truck)	Primary use - first out for brush fires; Secondary use - illegal burns; 3-crew capacity; 250 gpm rear panel pump; 250 gal water; 20 gal Class A foam; Attack hose: 50 ft 1.75" and 400 ft 1.5", and 800 ft 1"; GPS; 2 chainsaws; 4WD; road cones
Tanker 4; Tender (Tanker)	Primary use - first out for structure fires; Secondary use - brush fires and dumpster fires; 3-crew capacity; 250 gpm side panel pump; 1800 gal water; 2200 gal dump tank; 20 gal Class A foam; Attack hose: 100 ft 1.75" and 100 ft 1"; 2 SCBA; road cones
Rescue 2; Light Rescue Truck	Primary use - first out for MVAs; Secondary use - EMS first response; Rope rescue equipment; basic Hazmat PPE; AED; oxygen/EMS response kit; radiation detector; 2 retractable single-pole towers with 2 lamps each; 1 Stokes litter with a wheel; GPS; 1 cutter; 1 spreader; 1 small ram; 1 large ram; 1 PPU; 3 low pressure airbags; 1 SCBA; 4WD; road cones
Med 3; Ambulance	Primary use - first out for EMS; Secondary use - EMS standbys; ILS medications/ ALS airway; Holmatro SCRT combitool; GPS; capable of 2 patient transport; road cones
Pojoaque Station 2 (Substation)	
Engine 6; Type 1 Engine (Class A)	Backup for structural firefighting - automatic and mutual aid; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 30 gal Class A foam; Attack hose: 400 ft 1.75"; Supply hose: 1200 ft 3"; 4 SCBA; 1 chainsaw; 1 vent saw; 1 gas vent fan; road cones
Engine 5; Type 1 Engine (Class A)	Primary use - reserve for mutual aid; Secondary use - wildland (RMP); 3-crew capacity; 1000 gpm front panel pump; 1000 gal water; 2000 gal dump tank; 30 gal Class A foam; Attack hose: 600 ft 1.75"; Supply hose: 1200 ft 3"; 2 SCBA; 2 chainsaws; road cones
Brush 2; Type 6 Engine (Brush Truck)	Primary use - backup for brush fires - automatic or mutual aid; Secondary use - backup for illegal burns and wildland incidents (RMP); 5-crew capacity; 250 gpm rear panel pump; 250 gal water; 20 gal Class A foam; Attack hose: 600 ft 1.5" and 800 ft 1"; GPS; 2 chainsaws; 4WD; road cones
Tanker 8; Tender (Tanker)	Primary use - backup for automatic and mutual aid; Secondary use - brush fires and dumpster fires; 3-crew capacity; 250 gpm side panel pump; 1800 gal water; 2200 gal dump tank; 20 gal Class A foam; Attack hose: 100 ft 1.75" and 100 ft 1"; 2 SCBA; road cones

APPARATUS	DESCRIPTION
TESUQUE FIRE DISTRICT Number of ▪ Stations 3 ▪ Fire Suppression 8 ▪ Rescue Trucks 1 ▪ Specialty Vehicles1	
Tesuque Station 1 (Main Station)	
Engine 2; Type 1 Engine (Class A)	Primary use - first out pumper; Secondary use - MVAs; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 1000 gal dump tank; 20 gal Class A foam; Attack hose: 250 ft 3" and 600 ft 1.75"; Supply hose: 500 ft 3" and 1200 ft 5"; 8 SCBA; 4 spare air bottles; 1 chainsaw; 1 vent saw; 1 gas vent fan; med bag; rehab supplies; road cones
Attack 1; Type 6 Engine (Brush Truck)	Fire attack in 4WD locations; 2-crew capacity; 500 gpm side panel pump; 400 gal water; 10 gal Class A foam; Attack hose: 450 ft 1.75"; 4 SCBA; 1 chainsaw; 1 gas vent fan; light tower; Holmatro; cribbing; basic hand tools; binoculars; carbon monoxide detector; 4 spare handheld radios; med bag; rehab supplies; flashlights; MCI vests; management board; accident scene sign; 4WD; road cones
Rescue 1; Medium Rescue Truck	Fire attack in 4WD locations; 2-crew capacity; 250 ft hydraulic lines; 1 Stihl 460 chainsaw; 1 Sawzahl cutter; 1 mini-cutter; 1 spreader; 1 small ram; 1 large ram; 1 Stokes litter with a wheel; 1 jack; 1 SCBA; 1 hacksaw; brake pedal cutter; portable Holmatro; emergency scene lights; ropes for swiftwater rescues; Lifepack 12; 3 spare oxygen bottles; 6 longboards; bullhorn; binoculars; cribbing; 6 spare handheld radios; KED; vacuum splint; MCI vests; management board; med bag; rehab supplies; flashlights; flares; TIC; carbon monoxide detector; accident scene sign; basic hand tools; 1 winch; blankets; 4WD; road cones
Tesuque Command	Chief's Vehicle; 1-ton 4WD; light tower; MCI vests; binoculars; bullhorn; hydrant wrenches; axes; vehicle entry kit; 3 SCBA; shovels; bolt cutters; ILS gear; suction unit; Lifepack 500; 1 UHF and 2 VHF radios; blankets; winch; fire extinguishers; rehab supplies
Tesuque Station 2 (Chupadero)	
Engine 4; Type 1 Engine (Class A)	Second out pumper; Non-synchro 7-speed; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 15 gal Class A foam; Attack hose: 900 ft 1.75"; Supply hose: 2000 ft 3"; 8 SCBA; 4 spare oxygen bottles; 1 gas vent fan; scene lights; ladder; 4WD; road cones
Tanker 2; Tender (Tanker)	Second out tanker; 3-crew capacity; 1000 gal dump tank; fire extinguishers; road cones
Tesuque Station 2 (Tesuque Pueblo)	
Engine 3; Type 1 Engine (Class A)	Third out pumper; 3-crew capacity; 1000 gpm side panel pump; 1000 gal water; 1000 gal dump tank; Attack hose: 650 ft 1.75"; Supply hose: 800 ft 3"; 1 gas vent fan; 2 fire extinguishers; flashlights
Brush 1; Type 6 Engine (Brush Truck)	Fire attack in 4WD locations; 2-crew capacity; 500 gpm rear panel pump; 250 gal water; Attack hose: 900 ft 1.75" and 700 ft 1"; 150 ft hose reel; 1 chainsaw; basic wildland hand tools; rehab supplies; 4WD
Brush 2; Type 6 Engine (Brush Truck)	Fire attack in 4WD locations; 2-crew capacity; 500 gpm rear panel pump; 250 gal water; Attack hose: 900 ft 1.75" and 800 ft 1"; 150 ft hose reel; 1 chainsaw; basic hand tools; 4WD
Tanker 1; Tender (Tanker)	First out tanker; 3-crew capacity; 500 gpm side panel pump; 1200 gal water; 1000 gal dump tank; 2 SCBA; transfer device; hand tools; road cones

WESTERN REGION (Agua Fria Fire District, La Cienega Fire District, Madrid Fire District, State Pen Fire District, Turquoise Trail Fire District,)

Services Provided

- ALS
- Structural fire suppression
- Wildland fire suppression
- Light extrication/rescue
- Swiftwater rescue at awareness level

Number of

- Ambulances 1
- Backup ambulances 1

APPARATUS	DESCRIPTION
Med 60	ALS; 30 gal foam extinguisher; light extrication equipment; capable of 2 patient transport; 4-gas meter; TIC; 2 SCBA; SKED; rope rescue equipment; swiftwater PPE; wildland PPE
Med52	Backup if Med 60 is out of service; ALS; light extrication equipment; capable of 2 patient transport; 4-gas meter; TIC; 2 SCBA; SKED; rope rescue equipment; swiftwater PPE; wildland PPE
AGUA FRIA FIRE DISTRICT Number of ▪ Stations 2 ▪ Fire Suppression 6 ▪ Rescue Trucks 1 ▪ Specialty Vehicles1	
Agua Fria Station 1 (Main Station)	
Engine 1; Type 1 Engine (Class A)	Primary use - structural firefighting; Secondary use - traffic accidents; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 1800 gal dump tank; 12 gal Class A foam; Attack hose: 300 ft 3" and 500 ft 1.75"; Supply hose: 1000 ft 3"; TIC; 6 SCBA; 1 chainsaw; 1 vent saw; 1 gas vent fan; on-spots; portable highway sign; Propak; 1 gal micro-blaze; piercing nozzle; transfer device; road cones
Brush 1; Type 6 Engine (Brush truck)	Primary use - brushfire suppression; Secondary use - EMS; 3-crew capacity; 500 gpm side panel pump; 400 gal water; 20 gal Class A foam; Attack hose: 250 ft 1.75"; Supply hose: 600 ft 3"; 2 SCBA; 1 chainsaw; 200 ft 1" hose reel; Propak; 4WD; road cones
Tanker 1; Tender (Tanker)	Primary use - structural fire suppression; Secondary use – brushfire suppression; 3-crew capacity; 500 gpm side panel pump; 1800 gal water; 2 SCBA; 200 ft 1" hose reel; Propak; transfer device; portable highway sign; 2WD; road cones
Rescue 1; Light Rescue Truck	Primary use - EMS; Secondary use - rehab or light for fire scenes; 2-crew capacity; 1 combitool; 1 Stokes litter with 1 wheel; 1 cutter; 1 spreader; 1 small ram; 1 medium ram; 1 PPU; 3 jacks; hydraulic hose reels - 150 ft + 50 ft spare; command light tower with 6 lights; swiftwater PPE - throw bags, helmets, and vests; 110/AC extension cord; 2 reciprocal saws (1 battery); blood carbon monoxide monitor; hand extrication tools; gas and electric fans; pneumatic pillows; few hundred chains of different lengths; cribbing; 2 rescue come-alongs (up to 6000 lbs); air chisel; AED; suction unit; 2 spare air bottles; 1 spare oxygen bottle; 2 backboards; oxygen kit; 2nd-in bag; 4WD; road cones
Agua Fria Command	Chief's Vehicle; PPU; combitool; air pack; 1st-in bag; fire extinguisher; 4WD

APPARATUS	DESCRIPTION
	Agua Fria Station 2
Engine 2; Type 1 Engine (Class A) Brush 2; Type 6 Engine (Brush Truck)	Primary use - structural fire suppression; Secondary use - traffic accidents; non-synchro 7-speed; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 30 gal Class A foam; Attack hose: 250 ft 3" and 650 ft 1.75"; Supply hose: 1000 ft 3"; 1 PPU with combitool; 8 airpacks; Propak; road cones Primary use - brushfire suppression; Secondary use - EMS; 5-crew capacity; <250 gpm rear panel pump; 250 gal water; 20 gal Class A foam; Attack hose: 150 ft 1.75" and 1000 ft 1"; Supply hose: 300 ft 3"; 1 chainsaw; Propak; 4WD; road cones
Tanker 2; Tender (Tanker)	Primary use - structural fire suppression; Secondary use – brushfire suppression; 3-crew capacity; 1800 gal water; 2000 gal dump tank; 2 SCBA; on-spots; 2WD; road cones
LA CIENEGA FIRE DISTRICT Number of ▪ Stations 2 ▪ Fire Suppression 7 ▪ Rescue Trucks 1 ▪ Specialty Vehicles1	
	La Cienega Station 1 (Main Station)
Engine 1; Type 1 Engine (Class A)	Structural fire suppression; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 500 gal dump tank; 10 gal Class A foam; Attack hose: 400 ft 2.5" and 600 ft 1.75"; Supply hose: 700 ft 5"; TIC; 6 SCBA; 1 chainsaw; 1 vent saw; 1 gas vent fan; Holmatro; medical supplies; road cones
Brush 1; Type 6 Engine (Brush Truck)	Primary use - EMS; Secondary use - wildland fires; 3-crew capacity; 250 gpm rear panel pump; 300 gal water; 20 gal CAFS; Attack hose: 300 ft 1.5"; Supply hose: 50 ft 3"; 1 chainsaw; Firefox front nozzle; portable pump; medical supplies; 4WD; road cones
Brush 2; Type 6 Engine (Brush Truck)	Primary use - wildland fires; Secondary use - EMS; 3-crew capacity; <250 gpm rear panel pump; 250 gal water; 10 gal Class A foam; Attack hose: 300 ft 1.5"; Supply hose: 50 ft 3"; 1 chainsaw; Firefox front nozzle; portable pump; medical supplies; 4WD; road cones
Tanker 2; Tender (Tanker)	Primary use - water tender; Secondary use - wildland fires; 3-crew capacity; 500 gpm side panel pump; 1800 gal water; 500 gal dump tank; 10 gal Class A foam; Attack hose: 300 ft 1.5"; Supply hose: 700 ft 3"; 2 SCBA; Firefox front nozzle; road cones
Rescue 1; Heavy Rescue Truck	Primary use - MVAs; Secondary use - EMS; 6-crew capacity; 2 Stokes litters with 1 wheel; 3 combitools; 1 chainsaw; 1 rooksaw; 3 Sawzalls; 5 cutters; 1 spreader; 2 small rams; 1 large ram; 2 PPU; 1 set of highlight tools; 6 SCBA; 1 electrical hose reels; 2 air systems; light tower; 25,000W electric generator; high/low angle bag; Technical Rescue Team equipment: 2 sets of PPE; 30 gal CAFS; heavy extrication equipment; stabilizing bars; hand tools; medical supplies; TIC; road cones
La Cienega Command	Chief's Vehicle; light tower; SCBA; swiftwater gear; high/low angle gear; medical supplies; TIC
	La Cienega Station 2
Engine 2; Type 1 Engine (Class A)	Structural fire suppression; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 500 gal dump tank; 10 gal CAFS; Attack hose: 400 ft 3" and 600 ft 1.75"; Supply hose: 700 ft 5"; TIC; 6 SCBA; 1 chainsaw; 1 vent saw; 1 gas vent fan; Holmatro; medical supplies; road cones
Tanker 1; Tender (Tanker)	Primary use - water tender; Secondary use - wildland fires; 3-crew capacity; 1500 gal water; 500 gal dump tank; 10 gal Class A foam; Attack hose: 300 ft 1.5"; Supply hose: 700 ft 3"; 2 SCBA; Firefox front nozzle; road cones

APPARATUS	DESCRIPTION
Ladder 1; Aerial Fire Truck	75 ft reach; ladder with waterway
MADRID FIRE DISTRICT Number of ▪ Stations 1 ▪ Fire Suppression 3 ▪ Rescue Trucks 1	
Madrid Station 1 (Main Station)	
Engine 5; Type 1 Engine (Class A)	Primary use - fire suppression; Secondary use - MVAs; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 1500 gal dump tank; 25 gal Class A foam; Attack hose: 1000 ft 1.75"; Supply hose: 600 ft 6", 400 ft 3", and 100 ft 2.5"; 4 SCBA; 1 chainsaw; 1 vent saw; 1 gas vent fan; GPS; monitor and portable base; Propak; piercing nozzle; road cones
Brush; Type 6 Engine (Brush Truck)	Primary use - wildland fire suppression; Secondary use - access to 4WD locations; 3-crew capacity; <250 gpm rear panel pump; 200 gal water; 5 gal Class A foam; Attack hose: 400 ft 1" and 600 ft 1.75"; Supply hose: 200 ft 1.5"; GPS; 1 chainsaw; Propak; BLS backpack; rehab supplies; 4WD; road cones
Tanker 6; Tender (Tanker)	Primary use - water tender; Secondary use - attack engine; 3-crew capacity; 1000 gpm side panel pump; 1500 gal water; 1500 gal dump tank; 25 gal Class A foam; Attack hose: 200 ft 2.5", 600 ft 2", and 400 ft 1.75"; Supply hose: 800 ft 3" and 800 ft 5"; 4 SCBA; GPS; Propak; mini-monitor; road cones
Rescue; Light Rescue Truck	Primary use - EMS; Secondary use - rescue; 1 Stokes litter; 1 combitool; 1 small ram; 1 large ram; 1 PPU; 2 highlift tools (1 jack); 1 high pressure airbag; two 500W portable, dismountable lights; one 500W tabletop light; 2500W electric generator; cribbing; 2 air bottles; harness; BLS equipment; AED; winch; complete cordless tool set; GPS; 4WD; road cones
STATE PEN FIRE DISTRICT Number of ▪ Stations 1 ▪ Fire Suppression 2 ▪ Specialty Vehicles 1	
State Pen Station 1 (Main Station	
Engine; Type 1 Engine (Class A)	1000 gpm side panel pump; 750 gal water
Brush 1; Type 6 Engine (Brush Truck)	<250 gpm rear panel pump; 200 gal water; 4WD
State Pen Command	Chief's Vehicle; 4WD

APPARATUS	DESCRIPTION
TURQUOISE TRAIL FIRE DISTRICT Number of ▪ Stations 3 ▪ Fire Suppression 6 ▪ Rescue Trucks 2 ▪ Medical Vehicles 2	
Turquoise Trail Station 3 (Main Station)	
Engine 1; Type 1 Engine (Class A)	Primary use - structure fires; Secondary use - wildland fires; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 1000 gal dump tank; 40 gal Class A foam; Attack hose: 150 ft 2.5" and 800 ft 1.75"; Supply hose: 1400 ft 3"; TIC; 6 SCBA; 1 chainsaw; 1 vent saw; 1 gas vent fan; gas meter
Tanker 3; Tender (Tanker)	Primary use - structure fires; Secondary use - wildland fires; 3-crew capacity; 500 gpm side panel pump; 1500 gal water; 1800 gal dump tank; Attack hose: 400 ft 1.75"; Supply hose: 500 ft 3"; 2 SCBA; 1 chainsaw; wildland hand tools
Tanker 6; Tender (Tanker)	Primary use - structure fires; Secondary use - wildland fires; stainless steel tank allows it to carry potable water; 2-crew capacity; 750 gpm side panel pump; 2500 gal water; 2500 gal dump tank; Attack hose: 300 ft 1.75"; Supply hose: 200 ft 3"; 2 SCBA
Rescue 1; Heavy Rescue Truck	Primary use - heavy extrication; Secondary use - search and rescue; 1 Stokes litter with 1 wheel; 1 combitool; 1 16" Stihl chainsaw; 2 cordless Sawzalls; 1 1/10 Sawzall; 1 cutter; 1 small cutter; 1 spreader; 1 small ram; 1 medium ram; 2 PPU; 2 rescue jacks; 1 set of complete jacks; 3 high pressure airbags; 200 ft and 2 50ft hydraulic hose reels; 1 light tower; 2 portable, dismountable light stands; 20,000W electric generator; basic swiftwater PPE; TIC; gas detector; 1 front-mount and 1 portable winch; pigs; air tools; traffic control equipment; command vests; 6 spare radios; cribbing; BLS Thomas Pack
Rescue 3; Light Rescue Truck (also listed on p. 89)	Primary use - Technical Rescue Truck; Secondary use - traffic control; complement to Swiftwater Trailer; 2 Stokes litters with 1 wheel; 1 combitool; 1 PPU; 2 portable tripod lights; 5500W electric generator; 2 dry suits; confined space equipment; 6 spare waterproof radios; swiftwater PPE: 10 helmets, 10 PFDs, 10 throw bags; rope rescue equipment; SKED line crossing gun; hand-powered rescue Windlas; 2 tripods; 200yd wired communications system
Med 5; Ambulance	Capable of 2-patient transport; ALS airway/ ILS medications; 4WD
Turquoise Trail Station 1 (Substation)	
Engine 2; Type 1 Engine (Class A)	Primary use - structure fires; Secondary use - wildland fires; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 1000 gal dump tank; 40 gal Class A foam; Attack hose: 150 ft 2.5" and 800 ft 1.75"; Supply hose: 1400 ft 3"; TIC; 6 SCBA; 1 chainsaw; 1 vent saw; 1 gas vent fan
Med 7; Ambulance	Capable of 2-patient transport; ALS airway/ ILS medications; 4WD
Turquoise Trail Station 2 (Substation)	
Engine 4; Type 1 Engine (Class A)	Primary use - structure fires; Secondary use - wildland fires; 3-crew capacity; 750 gpm front panel pump; 750 gal water; 10 gal Class A foam; Attack hose: 400 ft 1.75"; Supply hose: 1000 ft 3"; 4 SCBA; 1 gas vent fan
Tanker 8; Tanker (Tender)	Primary use - wildland fires; Secondary use - structure fires; used as a brush truck; 2-crew capacity; <250 gpm rear panel pump; 1500 gal water; brush hand tools

SOUTHERN REGION (Edgewood Fire District, Stanley Fire District,)

Services Provided

- ALS
- Structural fire suppression
- Wildland fire suppression
- Light extrication/rescue
- Swiftwater rescue at awareness level

Number of

- Ambulances 1

APPARATUS	DESCRIPTION
EDGEWOOD FIRE DISTRICT Number of ▪ Stations 4 ▪ Fire Suppression 10 ▪ Medical Vehicles 2 ▪ 10,000 gal water (at station 3) 1	
Edgewood Station 1 (Main Station)	
Engine 1; Type 1 Engine (Class A)	Structure fires; can be used as a tanker; 2-crew capacity; 1250 gpm top panel pump; 1000 gal water; dump tank; 25 gal Class A foam; Attack hose: 50 ft 2.5" and 100 ft 1.75"; Supply hose: 15 ft 5", 1200 ft 4.5", and 50 ft 3"; 4 SCBA; 4 spare air bottles; 1 chainsaw; 1 vent saw; 1 gas vent fan; TIC; GPS; BLS bag; 4-gas meter; deck gun; rehab supplies; 4WD; road cones
Brush 1;Type 6 Engine (Brush Truck)	Wildland fires; 2-crew capacity; <250 gpm rear panel pump; 200 gal water; Attack hose: 100 ft 2.5" and 50 ft 1.75"; 1 SCBA; 1 chainsaw; GPS; Kestrel weather instrument; hose reel; Propak; BLS bag; rehab supplies; 4WD; road cones
Tanker 1; Tender (Tanker)	Primary use - water tender; Secondary use - extrication; 500 gpm side panel pump; 1800 gal water; dump tank; 5 gal Class A foam; Attack hose: 200 ft 2.5" and 150 ft 1.75"; 2 SCBA; 1 spare air bottle; TIC; GPS; wildland gear; generator; Holmatro; cutters; BLS bag; rehab supplies; 4WD; road cones
Med 34; Ambulance	ILS rescue; second-out med unit; GPS; rehab supplies; 4WD; road cones
Med 35; Ambulance	ALS rescue; first out med unit; light extrication equipment; generator; Holmatro; combitool; cutters; GPS; rehab supplies; 4WD; road cones
Dodge Ram Charger; Specialty	6 ft snowplow
Edgewood Station 2 (Cedar Grove)	
Engine 2; Type 1 Engine (Class A)	Structure fires; can be used as a tanker; 1250 gpm top panel pump; 1000 gal water; dump tank; 5 gal Class A foam; Attack hose: 150 ft 2.5" and 450 ft 1.75"; Supply hose: 1000 ft 4" and 150 ft 3"; 4 SCBA; 4 spare air bottles; 1 chainsaw; 1 vent saw; 1 gas vent fan; deck gun; bolt cutters; hand tools; GPS; 4-gas meter; BLS bag; rehab supplies; 4WD; road cones
Brush 2; Type 6 Engine (Brush Truck)	Wildland fires; 2-crew capacity; <250 gpm rear panel pump; 300 gal water; 5 gal Class A foam; Attack hose: 100 ft 1.75" and 50 ft 1"; 2 SCBA; 1 chainsaw; 2 wildland packs; GPS; Kestrel weather instrument; Propack; Lifepack; automatic breathing unit; BLS bag; rehab supplies; 4WD; road cones

APPARATUS	DESCRIPTION
Tanker 2; Tender (Tanker)	Primary use - water tender; Secondary use - rescue; 500 gpm side panel pump; 1800 gal water; dump tank; 5 gal Class A foam; Attack hose: 200 ft 2.5" and 100 ft 1.75"; 2 SCBA; 1 Stokes litter with a wheel; BLS bag; wildland tools; wildland pack; 30,000 lb continuous weight toe strap; rehab supplies; road cones
Engine 3; Type 1 Engine (Class A)	Structure fires; 2-crew capacity; 1250 gpm top panel pump; 1000 gal water; dump tank; Attack hose: 100 ft 2.5", 300 ft 1.75", 100 ft 1.5", and 300 ft .5"; Supply hose: 1000 ft 3"; 4 SCBA; 4 spare air bottles; 1 chainsaw; 1 gas vent fan; GPS; generator; basic rescue gear; airbags; jacks; ropes; BLS bag; rehab supplies; road cones
Brush 3; Type 6 Engine (Brush Truck)	Wildland fires; 2-crew capacity; <250 gpm rear panel pump; 300 gal water; 5 gal Class A foam; Attack hose: 100 ft 1.75"; 2 SCBA; 1 chainsaw; GPS; Kestrel weather instrument; hose reel; Propak; Lifepack 500; automatic breathing unit; BLS bag; rehab supplies; 4WD; road cones
Tanker 3; Tender (Tanker)	Water tender; dump tank; 500 gpm side panel pump; 1300 gal water; dump tank; pump and roll capable; wildland tools; road cones
Edgewood Station 3 (San Pedro)	
Engine 3; Type 1 Engine (Class A)	Structure fires; 2-crew capacity; 1250 gpm top panel pump; 1000 gal water; dump tank; Attack hose: 100 ft 2.5", 300 ft 1.75", 100 ft 1.5", and 300 ft 5"; Supply hose: 1000 ft 3"; 4 SCBA; 4 spare air bottles; 1 chainsaw; 1 gas vent fan; GPS; generator; basic rescue gear; airbags; jacks; ropes; BLS bag; rehab supplies; road cones
Brush 3; Type 6 Engine (Brush Truck)	Wildland fires; 2-crew capacity; <250 gpm rear panel pump; 300 gal water; 5 gal Class A foam; Attack hose: 100 ft 1.75"; 2 SCBA; 1 chainsaw; GPS; Kestrel weather instrument; hose reel; Propak; Lifepack 500; automatic breathing unit; BLS bag; rehab supplies; 4WD; road cones
Tanker 3; Tender (Tanker)	Water tender; dump tank; 500 gpm side panel pump; 1300 gal water; dump tank; pump and roll capable; wildland tools; road cones
Edgewood Station 4 (Thunder Mountain)	
Engine 4; Type 1 Engine (Class A)	1250 gpm side panel pump; 1000 gal water; Supply hose: 1000 ft 4" and 150 ft 3"; 2 SCBA; 4 spare air bottles; deck gun; hose reel; GPS; bolt cutters; BLS bag; rehab supplies; road cones
STANLEY FIRE DISTRICT Number of ▪ Stations 2 ▪ Fire Suppression 6 ▪ Rescue Trucks 1 ▪ Specialty Vehicles 1	
Stanley Station 1 (Main Station)	
Engine 1; Type 1 Engine (Class A)	Structure fires; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 1500 gal dump tank; 10 gal Class A foam; Attack hose: 800 ft 1.75" and 200 ft 1"; Supply hose: 800 ft 3"; 4 SCBA; 6 spare air bottles; 1 chainsaw; 1 gas vent fan; portable light; monitor; hose clamps; piercing nozzle; fire extinguishers; road cones
Brush 2; Type 6 Engine (Brush Truck)	Primary use - wildland fires; Secondary use - rescue; 3-crew capacity; <250 gpm rear panel pump; 200 gal water; 10 gal Class A foam; Attack hose: 100 ft 1.75" and 300 ft 1"; 2 SCBA; 1 chainsaw; 2 high pressue airbags; highlift jack; combitool; cutter; spreader; cribbing; defibrillator; 4WD; road cones

APPARATUS	DESCRIPTION
Brush 3; Type 6 Engine (Brush Truck)	Wildland fires; 5-crew capacity; <250 gpm rear panel pump; 300 gal water; Attack hose: 300 ft 1.75” and 300 ft 1”; 2 chainsaws; front winch; 4WD; road cones
Tanker 2; Tender/ Tanker	First out tanker; 3-crew capacity; <250 gpm side panel pump; 1800 gal water; 1500 gal dump tank; 10 gal Class A foam; Attack hose: 100 ft 1.75”; Supply hose: 20 ft 2.5” suction hose; 2 SCBA; transfer device; hand tools; 20 ft 2.5” suction hose; road cones
Rescue 1; Light Rescue Truck	EMS non-transport; 4WD; road cones
Stanley Command	Chief’s Vehicle; TIC; LED light tower; emergency scene lights; SCBA; 3 spare radios; computer; wildland tools; front winch; 4WD; road cones
Stanley Station 2	
Engine 2; Type 1 Engine (Class A)	Structure fires; 3-crew capacity; 1250 gpm side panel pump; 1000 gal water; 1200 gal dump tank; Attack hose: 800 ft 2.5” and 450 ft 1.75”; 4 SCBA; 4 spare air bottles; 1 vent saw; 1 gas vent fan; 4000W electric generator; telescoping lights; top deluge monitor; rehab supplies; road cones
Tanker 3; Tender (Tanker)	Second out tanker; 2-crew capacity; <250 gpm rear panel pump; 3000 gal water; 5 gal Class A foam; Supply hose: 20 ft 5” and 20 ft 3”; road cones

EASTERN REGION (El Dorado Fire District, Galisteo Fire District, Glorieta Pass Fire District, Hondo Fire District,Wildland Strike Team, Technical Rescue Team)

Services Provided

- ALS
- Structural fire suppression
- Wildland fire suppression
- Light extrication/rescue
- Swiftwater rescue at awareness level

Number of

- Ambulances 1

APPARATUS	DESCRIPTION
Med 80	ALS; 30 gal foam extinguisher; light extrication equipment; capable of 2 patient transport; 4-gas meter; TIC; 2 SCBA; SKED; rope rescue equipment; swiftwater PPE; wildland PPE
EL DORADO FIRE DISTRICT Number of ▪ Stations 3 ▪ Fire Suppression 9 ▪ Rescue Trucks 1 ▪ Medical Vehicles 2	
El Dorado Station 1 (Main Station)	
Engine 5; Type 1 Engine (Class A)	Primary use - structure fires; Secondary use - MVAs, rescue, wildland fire; 2-crew capacity; 1750 gpm top panel pump; 1500 gal water; 20 gal Class A foam; Attack hose: 800 ft 2.5" and 800 ft 1.75"; Supply hose: 2000 ft 5"; TIC; 8 SCBA; 1 gas vent fan; road cones
Engine 12; Type 3 Engine	Primary use - wildland fires; Secondary use - structure fires; 5-crew capacity; 2 pumps - 500 gpm and 250 gpm; 850 gal water; pumpkin; road cones
Tower 1; Aerial Fire Truck	Quint; 70 ft reach with platform and waterway; 115 ft ground ladders; Primary use - structure fires; Secondary use - rescue; 6-crew capacity; 2000 gpm side panel pump; 500 gal water; 25 gal Class A foam; Attack hose: 600 ft 2.5" and 600 ft 1.75"; Supply hose: 1200 ft 5"; 7 SCBA; 1 gas vent fan; AC generator
Rescue 3; Heavy Rescue Truck	Primary use - MVAs; Secondary use - structure fires; 1 Stokes litter; 1 combitool; 14" and 16" gas rotary saws; 1 chainsaw; 1 cutter; 1 spreader; 1 small ram; 1 large ram; 2 PPU; 1 jack; 1 large airbag; 2 medium airbags; 2 small airbags; 2 SCBA; 2 hydraulic hose reels; portable halogen lights; 2500W AC generator (PTO driven); support rescue struts; winch on the front bumper; electric smoke ejector fan; carbon monoxide detectors; explosimeter; hand tools; pneumatic tools; electric saws and drills; air compressor; road cones
Med 2; ALS Ambulance	Capable of 2 patient transport; 4WD; road cones
Med 3; ALS Ambulance	Capable of 2 patient transport; 4WD; road cones

APPARATUS	DESCRIPTION
	El Dorado Station 2
Engine 2; Type 1 Engine (Class A)	Reserve engine; 3-crew capacity; 1000 gpm side panel pump; 750 gal water; 1000 gal dump tank; 15 gal Class A foam; Attack hose: 250 ft 2.5", 650 ft 1.75", and 200 ft 1"; Supply hose: 20 ft 6" suction, 1500 ft 5", and 400 ft 3"; 8 SCBA; 1 gas vent fan; custom hard suction to draft from swimming pools; road cones
Engine 4; Type 1 Engine (Class A)	Primary use - structure fires; Secondary use - MVAs, rescue, and wildland fire; 2-crew capacity; 1750 gpm top panel pump; 1500 gal water; 20 gal Class A foam; Attack hose: 700 ft 2.5" and 800 ft 1.75"; Supply hose: 20 ft 6" suction and 2000 ft 5"; TIC; 8 SCBA; 1 gas vent fan; road cones
Tender 1; Tender (Tanker)	Primary use - structure fires; Secondary use - wildland fires; 3-crew capacity; <250 gpm rear panel pump; 1500 gal water; 1000 gal dump tank; 5 gal Class A foam; Attack hose: 100 ft 1.75" and 200 ft 1"; Supply hose: 1000 ft 5" and 50 ft 3"; hose ramps; road cones
	El Dorado Station 3
Engine 3; Type 1 Engine (Class A)	Primary use - structure fires; Secondary use - MVAs, rescue, wildland fire; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 1500 gal dump tank; 25 gal Class A foam; Attack hose: 400 ft 2.5" and 800 ft 1.75"; Supply hose: 20 ft 6" suction, 2000 ft 5", and 50 ft 3"; 7 SCBA; 1 gas vent fan; 4WD; road cones
Brush 2; Type 6 Engine (Brush Truck)	Primary use - wildland fires; Secondary use - MVAs; 3-crew capacity; 350 gpm rear panel pump; 250 gal water; 30 gal Class A foam; Attack hose: 600 ft 1.75", and 1400 ft 1", and 400 ft .75"; Supply hose: 20 ft 6" suction and 50 ft 3"; 2000 lb winch; AC generator; 4WD
Tender 3; Tender (Tanker)	Primary use - structure fires; Secondary use - wildland fires; 3-crew capacity; <250 gpm side panel pump; 1500 gal water; 1500 gal dump tank; 5 gal Class A foam; Attack hose: 100 ft 1.75" and 2000 ft 1"; Supply hose: 50 ft 3"; road cones
GALISTEO FIRE DISTRICT Number of ▪ Stations 1 ▪ Fire Suppression 3 ▪ Medical Vehicles 1 ▪ Specialty Vehicles 1	
	Galisteo Station 1 (Main Station)
Engine 1; Type 1 Engine (Class A)	Primary use - structure fires; Secondary use - MVAs; 3-crew capacity; 1250 gpm top panel pump; 1250 gal water; 1500 gal dump tank; 15 gal Class A foam; Attack hose: 450 ft 1.75"; Supply hose: 1000 ft 3"; TIC; 6 SCBA; 1 chainsaw with venting attachment; 1 gas vent fan; 4WD; road cones Brush 1; Type 6 Engine (Brush Truck)
Brush 1; Type 6 Engine (Brush Truck)	Primary use - wildland fires; Secondary use - MVAs; 6-crew capacity; <250 gpm side panel pump; 350 gal water; 12 gal Class A foam; 10 ft hose reel; 2 chainsaws; 4WD; road cones
Tanker 1; Tender (Tanker)	Primary use - water tender for structure fires, wildland fires, and MVAs; Secondary use - mutual aid; can also be used as a rescue; 3-crew capacity; 500 gpm side panel pump; 1800 gal water; 1500 gal dump tank; Attack hose: 100 ft 1.75" and 75 ft 1"; Supply hose: 50 ft 3"; 3 SCBA; Propak; light extrication equipment; combitool; cutter; small ram; large ram; Sawzall; PPU; DeWalt battery; electric generator; road cones

APPARATUS	DESCRIPTION
Rescue 2; Medical Rescue	Primary use - EMS, MVAs; Secondary use - rehab; transport capable - can intercept with Med 80 or Lifeguard; also licensed to transport in MCI events; capable of 3 patient transport; ILS-equipped (with the meds); Lifepack 3; Technical Rescue Team equipment: ropes; 4WD; road cones
Galisteo Command;	Chief's vehicle; 4WD; road cones
GLORIETA PASS FIRE DISTRICT Number of ▪ Stations 1 ▪ Fire Suppression 5 ▪ Rescue Trucks 1	
Glorieta Station 1 (Main Station)	
Engine 2; Type 1 Engine (Class A)	Primary use - second out tanker; Secondary use - traffic control; 5-crew capacity; 1250 gpm top panel pump; 1200 gal water; 1500 gal dump tank; 10 gal Class A foam; Attack hose: 450 ft 2"; Supply hose: 200 ft 6", 20 ft 5", and 525 ft 3"; 4 SCBA; 4 spare air bottles; 1 gas vent fan; Bendex King; BLS gear; scene lights; emergency traffic signs; rehab supplies; road cones
Engine 3; Type 1 Engine (Class A)	First out tanker; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 1000 gal dump tank; 5 gal Class A foam; Attack hose: 550 ft 2"; Supply hose: 20 ft 6", 220 ft 5", and 425 ft 3"; 4 SCBA; 4 spare air bottles; 1 vent saw; 1 gas vent fan; BLS gear; rope; gated Y; Bendex King; carbon monoxide detector; road cones
Brush 1; Type 6 Engine (Brush Truck)	Wildland fires; 3-crew capacity; 250 gpm rear panel pump; 300 gal water; 10 gal Class A foam; Attack hose: 25 ft 2.5", 100 ft 1.75", and 100 ft 1"; 1 vent saw; Bendex King; 50 ft hose reel; suction; GPS; rehab supplies; 4WD
Tanker 3; Tender (Tanker)	Primary use - structure fire/ mutual aid; Secondary use - wildland fires; 3-crew capacity; 500 gpm side panel pump; 1800 gal water; 1500 gal dump tank; 2 SCBA; pump and roll; transfer device; 25 ft hose reel; suction hoses; rehab supplies; road cones
Tanker 4; Tender (Tanker);	350 gpm side panel pump; 1500 gal water; hose reel
Rescue 6; Light Rescue Truck	Primary use - rescue; Secondary use - traffic control; 1 Stokes litter; 1 combitool; 2 battery-operated Sawzalls; 2 electric Sawzalls; 1 cutter; 1 PPU; 1 large pneumatic jack; 1 small pneumatic jack; 2 highrise packs; 3 low pressure airbags; 1 high pressure airbag; scene lights; spotlights; Technical Rescue Team equipment: rope, throw bags, high and low angle rescue gear, swiftwater gear; GPS; MCI vests; emergency traffic signs; 4WD; road cones

APPARATUS	DESCRIPTION
HONDO FIRE DISTRICT Number of ▪ Stations 2 ▪ Fire Suppression 6 ▪ Rescue Trucks 1 ▪ Medical Vehicles ` ▪ Specialty Vehicles 1 ▪ *Pumpkin – 500 gal 1 ▪ *Float pump 1	
Hondo Station 1 (Main Station)	
Engine 1; Type 1 Engine (Class A)	Primary use - fire suppression; Secondary use - traffic control; 3-crew capacity; 1250 gpm top panel pump; 1000 gal water; 20 gal CAFS; Attack hose: 200 ft 2.5" and 400 ft 1.75"; Supply hose: 1200 ft 3"; TIC; 6 SCBA; 4 spare air bottles; 3 vent saws (2 circular); 1 gas vent fan; suction unit; piercing nozzle; portable monitor (1000 gpm); hand tools; salvage covers; hot stick; 2 gas detectors; heat seekers; laser thermometer; 2 radios; rehab supplies; ladders; pipe holes; snail food; BLS bag; water can with foam; 2 fire extinguishers; 2WD; road cones
Tanker 1; Pumper/Tanker	Primary use - fire suppression; Secondary use - traffic control; 3-crew capacity; 1000 gpm side panel pump; 1500 gal water; 2250 gal dump tank; 20 gal Class A foam; pump and roll capable Attack hose: 200 ft 2.5" and 500 ft 1.75"; Supply hose: 600 ft 3"; 4 SCBA; 4 spare air bottles; 1 chainsaw; 2 vent saws (1 circular); 1 gas vent fan; TIC; brushfire equipment; piercing nozzle; heat seeker; gas detectors; 1 Holmatro PPU; 1 combitool; transfer device; portable ground-mounted monitor; BLS kit; 2 radios; remote-controlled front-mounded monitor; highrise pack; transfer device; road cones
Rescue 1; Medium Rescue Truck	Primary use - extrication; Secondary use - traffic control; 1 chainsaw; 2 Sawzalls (1 electric, 1 battery); 2 hacksaws; 1 glass saw; 4 cutters (1 pedal, 1 steering wheel); 3 bolt cutters; 1 spreader; 1 small ram; 1 medium ram; 1 large ram; 2 PPU; 2 combitools; 1 Stokes litter with 1 wheel; 1 jack; 10 pneumatic Paratech struts (strutting and lifting); 6 adjustable, Rescue 42 struts (2 long, 2 short, 2 fiberglass); 5 low pressure airbags; 200 ft hydraulic hose reels; 15.000W command light tower; 30KW PTO electric generator; low angle rescue ropes and rigging; 3 radios; Holmatro rescue equipment; 6 spare air bottles; cribbing; traffic control equipment; 2 air chisel sets; small grinding wheel; circular saw; battery-powered drill; working rope; wood plugs and wedges; exothermic oxygen torch; hand tools; roof flapper; air hose; 4 wire slings (2 with loops, 2 with hooks); 2 backboards; tents and chairs for MCI scenes; 2 portable scene lights; accessory foot pump; road cones
Med 1; ALS Ambulance	Primary use - ALS care and transport; Secondary use - traffic control; capable of 3 patient transport; MCI bag; 4WD; road cones
Hondo Command	Chief's Vehicle; 1 spare handheld radio; 3000W light tower with HID lights; command board; maps; binoculars; traffic vests; highway signs; AED; BLS bag; fire extinguishers; rehab supplies; various fire scene supplies; 4WD; road cones
Hondo Station 2 (Med 80)	
Engine 2; Type 1 Engine (Class A)	Primary use - fire suppression; Secondary use - traffic control; 3-crew capacity; 1000 gpm top panel pump; 750 gal water; 1000 gal dump tank; 10 gal Class A foam; Attack hose: 200 ft 2.5" and 400 ft 1.75"; Supply hose: 1200 ft 3"; TIC; 6 SCBA; 2 spare air bottles; 2 vent saws; 1 gas vent fan; suction unit; highrise pack; road cones
Engine 6; Type 6 Engine (Brush Truck)	Primary use - wildland fires; Secondary use - structure fires with wildland exposure; 4-crew capacity; 250 gpm side panel pump; 300 gal water; 6 gal Class A foam; Attack hose: 200 ft 1.75"; GPS; 2 chainsaws; 100 ft rear hose reel; drip torch; suction unit; hand tools; BLS kit; binoculars; fire finder; Propak; rehab

APPARATUS	DESCRIPTION
	supplies; 4WD
Engine 7; Type 6 Engine (Brush Truck)	Primary use - wildland fires; Secondary use - structure fires with wildland exposure; 3-crew capacity; 500 gpm rear panel pump; 400 gal water; 6 gal Class A foam; Attack hose: 200 ft 1.75"; Supply hose: 300 ft 3"; 1 chainsaw; 200 ft top hose reel; suction unit; hand tools; BLS kit; 4WD
Tanker 2; Pumper/Tanker	Primary use - fire suppression; Secondary use - traffic control; 3-crew capacity; 750 gpm side panel pump; 1500 gal water; 2250 gal dump tank; 10 gal Class A foam; pump and roll capable; Attack hose: 500 ft 1.75"; Supply hose: 600 ft 3"; TIC; 4 SCBA; 1 chainsaw; 1 vent saw; 1 gas vent fan; spill kit; hand-powered cutter; snail foot; hand tools; ladders; brushfire equipment; piercing nozzle; portable ground monitor; highrise pack; foam tube; road cones
WILDLAND STRIKE TEAM Number of ▪ Wildland vehicles 2	
Wildland 1 (also listed on p. 10)	Wildland fire support; wildland hand tools; pumpkin; wildland PPE; diesel; 4WD *Housed at Pojoaque Station 2
Wildland 2 (also listed on p. 10	Wildland fire support; wildland hand tools; 4WD; diesel *Housed at Turquoise Trail Station 2
TECHNICAL RESCUE TEAM 10 personnel trained in ▪ Swiftwater rescue ▪ High and low angle rescue ▪ Confined space rescue ▪ Trench rescue	
Swiftwater Trailer (also listed on p. 11)	Its complement is Turquoise Trail's Rescue 3 (housed at Turquoise Trail Station 1); 2 inflatable boats; Stokes litter; PFDs; paddles; throw bags; electric generator; scene lights
Rescue 3; Light Rescue Truck (also listed on p. 49)	Primary use - Technical Rescue Truck; Secondary use - traffic control; complement to Swiftwater Trailer; 2 Stokes litters with 1 wheel; 1 combitool; 1 PPU; 2 portable tripod lights; 5500W electric generator; 2 dry suits; confined space equipment; 6 spare waterproof radios; swiftwater PPE: 10 helmets, 10 PFDs, 10 throw bags; rope rescue equipment; SKED line crossing gun; hand-powered rescue Windlas; 2 tripods; 200yd wired communications system

Incident Management Protocol

This is a summary of a document entitled *Interagency Emergency Operations in Wildland Fire with NM State Forestry Division: Planning Projects and Incident Management*. This unpublished document was developed by New Mexico State Forestry Division to provide guidelines for emergency responders.

Three factors are always present in any emergency incident, and all jurisdictions responding to a fire in the Santa Fe County Community Wildfire Protection Plan (SFC CWPP) planning area follow these three basic parameters.

- Life safety
- Incident stabilization
- Resource protection

There are a number of tiers to emergency management and emergency management planning. A Geographic Area Operations Plan is the overarching document that defines roles and responsibilities for the responders to an incident by jurisdiction and activity. The three levels of this plan are:

- State–Federal Geographic Area Operations Plan
- A local area operations plan
- Mutual aid plans

General Incident Operations

The following outlines the general set of procedures for wildland fire response:

1. Local resources (i.e., municipal, County, or volunteer fire department) are often the first to be called and dispatched when there is a report of a fire. The dispatch office that has jurisdictional authority will activate the initial attack.
2. The initial attack Incident Command (IC) provides dispatch with a size up for the fire in order to determine the need for additional resources.
3. An IC post is established and staging areas set up.
4. Dispatched resources from all jurisdictions check in at staging area.
5. If the IC level changes (higher or lower), the IC holds a briefing to inform all concerned about any change of status or tactic.

For initial attack responders:

- No notification to the New Mexico State Forestry Division (NMSF) is necessary for fires controlled at initial attack using municipal resources.
- For an initial attack on fires in a county response area, notification to NMSF is necessary.
- For an initial attack response by federal agencies responders or the Bureau of Indian Affairs (BIA), notification must be made to the Geographic Area Interagency Dispatch (GAID)

- For federal jurisdiction fires, notification must be made to NMSF about who will contact the GAID to confirm resource needs and act as liaison.

For fires that activate Mutual Aid Agreements (e.g., spread potential, red flag warnings, values at risk):

- Municipal fire departments must notify NMSF if they respond.
- All requests for additional resources must be made through NMSF.
- For federal jurisdictions, NMSF will respond to all resource requests.
- For additional requests from federal jurisdictions, all additional requests must pass through GAID.

If the fire goes to extended attack, additional operation procedures are implemented:

- Dispatch responsibilities are transferred to GAID.
- Request activation of Type 3 Team.
- Establish IC post and unified command.
- Identify and establish a large staging area.
- Request activation of New Mexico resource mobilization plan.
- Request implementation of Emergency Preparedness Network.
- Notify Red Cross to set up rehab units.
- Begin collecting information for complexity analysis and wildland situation analysis.
- Notify Office of Emergency Management.
- Notify NMSF:
    - Type 3 Management Team
    - New Mexico resources mobilization plan
    - Air Attack Operations

APPENDIX G
NEW MEXICO FOREST RESTORATION PRINCIPLES

New Mexico Forest Restoration Principles

Preamble

These principles were collaboratively developed by a team of dedicated professionals representing industry, conservation organizations, land management agencies, and independent scientists. These principles for restoration should be used as guidelines for project development and they represent the "zone of agreement" where controversy, delays, appeals, and litigation are significantly reduced. They may be appropriate for application to specific restoration projects in New Mexico. These principles were developed for use in designing and implementing projects with a primary objective of ecological restoration while promoting economic and social benefits.

Participants

The Nature Conservancy in New Mexico
Natural Resources Conservation Service
Bureau of Land Management
Sierra Club, Rio Grande Chapter
Forest Guardians
New Mexico State Forestry Office
U.S. Forest Service
Bureau of Indian Affairs
New Mexico State Land Office
Forest Guild
Center for Biological Diversity
Restoration Solutions
Public Service of New Mexico

Principles

1. **Collaborate**. Landscape scale assessment, and project design, analysis, implementation and monitoring should be carried out collaboratively by actively engaging a balanced and diverse group of stakeholders.

2. **Reduce the threat of unnatural crown fire.** A key restoration priority must be moving stands toward a more natural restored condition and the reduction of the risk of unnatural crown fires both within stands and across landscapes. Specific restoration strategies should vary based upon forest vegetation type, fire regime, local conditions, and local management objectives. Forests and woodlands characterized by infrequent and mixed-severity fire should be managed toward a stand structure consistent with their historical ranges of variation—including, in some cases, high-density, continuous stands. Discontinuous stand structure may be appropriate to meet community protection objectives in areas such as the wildland urban interface for these forest and woodland types.

3. **Prioritize and strategically target treatment areas**. Key considerations for prioritizing restoration treatment areas are: degree of unnatural crown fire risk, proximity to human developments and important watersheds, protection of old-growth forests and habitats of federally threatened, endangered, or listed sensitive species, and strategic positioning to break up landscape-scale continuity of hazardous fuels. Treatments should be done at a landscape scale to decrease forest vulnerability to unnatural stand-replacing fire. This priority-setting should take place during fire management planning, land management planning, and community wildfire protection planning.

4. **Develop site-specific reference conditions.** Site-specific historical ecological data can provide information on the natural range of variability for key forest attributes, such as tree age structure and fire regimes that furnish local "reference conditions" for restoration design. A variety of constraints, however, prevent the development of historical information on every hectare of land needing restoration. General goals should be to restore ecological integrity and function.

5. **Use low-impact techniques.** Restoration treatments should strive to use the least disruptive techniques, and balance intensity and extensiveness of treatments. In many areas, conservative initial treatments would be the minimum necessary to adequately reduce the threat of unnatural crown fire. Wildland fire use or management ignited fires may be sufficient to reestablish natural conditions in many locations. In the extensive areas where fire alone cannot safely reduce tree densities and hazardous ladder fuels, mechanical thinning of trees may be needed before the introduction of prescribed fire. Patient, effective treatments will provide more options for the future than aggressive attempts to restore 120 years of change at once. In certain areas, however, such as some urban-wildland interfaces, trade-offs with imminent crown fire risks require considerations of rapid, heavy thinning of mostly small diameter trees.

6. **Utilize existing forest structure.** Restoration efforts should incorporate and build upon valuable existing forest structures, such as large trees, and groups of trees of any size with interlocking crowns excluding aspen. These features are important for some wildlife species, such as Abert's squirrels and goshawks, and should not be removed completely just to recreate specific historical tree locations. Since evidence of long-term stability of precise tree locations is lacking, especially for piñon and juniper, the selection of "leave" trees and tree clusters in restoration treatments can be based on the contemporary spatial distribution of trees, rather than pre-1900 tree positions. Maximizing use of existing forest structure can restore historical forest structure conditions more quickly. Leaving some relatively dense within-stand patches of trees need not compromise efforts to reduce landscape-scale crown fire risk.

   The underlying successional processes of natural tree regeneration and mortality should be incorporated into restoration design. Southwestern conifer regeneration occurs in episodic, often region-wide pulses, linked to wet-warm climate conditions and reduced fire occurrence. Periods with major regeneration pulses in the Southwest occurred in the 1910s–1920 and in 1978–1998. Some of this regeneration would have survived under natural conditions. Restoration efforts should retain a proportion of these cohorts.

7. **Restore ecosystem composition.** Missing or diminished compositional elements, such as herbaceous understories, or extirpated species also require restoration attention. The forest understory, including shrubs, grasses, forbs, snags, and down logs, is an important ecosystem

component that directly affects tree regeneration patterns, fire behavior, watershed functioning, wildlife habitat, and overall patterns of biodiversity. Similarly, soil organisms, such as mycorrhizal fungi, are vital elements that can influence community composition and dynamics. A robust understory provides a restraint on tree regeneration and is essential for carrying surface fires. The establishment and maintenance of more natural patterns of understory vegetation diversity and abundance are integral to ecological restoration.

Restoration planning should include the conservation of habitats for diminished or extirpated wildlife species. Comprehensive forest ecosystem restoration requires balancing fire risk reduction with retention of forest structures necessary for canopy dependent species.

Recovery plans and conservation plans for threatened, endangered, and sensitive species should be incorporated to the fullest extent possible in planning for comprehensive forest restoration.

8. **Protect and maintain watershed and soil integrity.** Low impact treatments will minimize sedimentation, disruption of surface runoff, and other detrimental ecosystem effects. Equipment and techniques should be managed according to soil and water conservation "best management practices" applicable to site-specific soil types, physiography and hydrological functions.

   Reconstruction, maintenance, or decommissioning of existing roads to correct for poor hydrologic alignment and drainage condition can greatly reduce soil loss and sedimentation rates. Projects should strive for no net increase in road density.

   Managing forest density and fuels to avoid uncharacteristically intense wildfire events will reduce the likelihood of catastrophic post-fire soil erosion and nutrient depletion from forested landscapes. Soil productivity should be protected and maintained by avoiding soil loss and compaction, and managing for on-site nutrient retention. Avoid repeated whole tree biomass removal from the forest to maximize nutrient retention. Whenever feasible, green foliage should be recycled by scattering on site; followed by prescribed burning to release stored nutrients.

9. **Preserve old or large trees while maintaining structural diversity and resilience.** Large and old trees, especially those established before ecosystem disruption by Euro-American settlement, are important forest components and critical to functionality of ecosystem processes. Their size and structural complexity provide critical wildlife habitat by broadly contributing crown cover, influencing understory vegetation patterns, and providing future snags. Ecological restoration should manage to ensure the continuing presence of large and old trees, both at the stand and landscape levels. This includes preserving the largest and oldest trees from cutting and crown fires, focusing treatments on excess numbers of small young trees.

   Develop "desired" forest condition objectives that favor the presence of both abundant large diameter trees and an appropriate distribution of age classes on the landscape, with a wide distribution of older trees. It is generally advisable to maintain ponderosa pines larger than 41 cm (16 inches) diameter at breast height (dbh) and other trees with old-growth morphology regardless of size (e.g. yellow-barked ponderosa pine or any species with large drooping limbs, twisted trunks or flattened tops).

   Treatments should also focus on achievement of spatial forest diversity by managing for variable densities. Overall, forest densities should be managed to maintain tree vigor and

stand resiliency to natural disturbances. Disease conditions are managed to retain some presence of native forest pathogens on the landscape, but constrained so that forest sustainability is not jeopardized. Guidelines must provide opportunities to apply differing site-specific management strategies to work towards attainment of these goals, and recognize that achievement may sometimes require more than one entry.

Stand level even-aged management may be appropriate for some objectives, including disease management, post wildfire tree regeneration, accelerating development of old growth characteristics, or for, forest types for which even-aged stands are characteristic, such as spruce or aspen. Treatments should be identified through collaboration with key stakeholders.

Some ponderosa pine forests contain extremely old trees and dead wood remnants that may be small but are important because they contain unique and rare scientific information in their growth rings. Such trees have become increasingly rare in the late 20th century, and the initial reintroduction of fire often consumes these tree-ring resources. Restoration programs should preserve them where possible.

10. **Manage to restore historic tree species composition.** Forest density levels and the presence of fire in the ecosystem are key regulators of tree species composition. Where fire suppression has allowed fire-sensitive trees like junipers or shade-tolerant white fir or spruce to become abundant in historical ponderosa pine forests, treatments should restore dominance of more fire-resistant ponderosa pines. However, fire intolerant species sometimes make up the only remaining large tree component in a stand. Retention of these large trees is important to canopy dependent wildlife species. In mixed conifer forests, landscapes should be managed for composition and structure that approximates the natural range of variability.

11. **Integrate process and structure**. Ecological sustainability requires the restoration of process as well as structure. Natural disturbance processes, including fire, insect outbreaks, and droughts, are irreplaceable shapers of the forest. In particular, fire regimes and stand structures interact and must be restored in an integrated way; mechanical thinning alone will not reestablish necessary natural disturbance regimes. At the same time, fire alone may be too imprecise or unsafe in many settings, so a combination of treatments may often be the safest and most certain restoration approach.

    The single best indicator of whether a proposed approach should be considered as "ecological restoration" is to evaluate if the treatment would help successfully restore the fire regime that is natural for that forest type. Approaches that do not restore natural fire regimes will not achieve full ecological restoration.

12. **Control and avoid using exotic species.** Seeding of exotic grasses and forbs should be prohibited as ecologically incompatible with good restoration. Once established, exotic species can be extremely difficult or impossible to remove. Seeding should be conducted with certified or weed free seeds to reduce the risk of contamination by non-native species or varieties.

    In general, it is ecologically desirable to allow native herbaceous vegetation to recover incrementally unless there is potential for serious soil erosion or the potential for establishment of non-native invasive plants. If enhancement of herbaceous vegetation is needed, especially for road closures and recovery, using locally sourced native seeds or transplanting individuals from nearby areas into treatments is ecologically desirable.

Restoration treatments should also routinely incorporate early actions to control the establishment and spread of aggressive exotics that can be expected from restoration-related site disturbance.

13. **Foster regional heterogeneity**. Biological communities vary at local, landscape, and regional scales, and so should restoration efforts. Ecological restoration should also incorporate the natural variability of disturbance regimes across heterogeneous landscapes. Heterogeneity should be fostered in planning and implementing ecological restoration and all spatial scales, including within and between stands, and across landscape and regional scales.

14. **Protect sensitive communities**. Certain ecological communities embedded within ponderosa pine or other types of forests and some riparian areas, could be adversely affected by on-site prescribed burning or mechanical thinning. Restoration efforts should protect these and other rare or sensitive habitats, which are often hotspots of biological diversity, particularly those that are declining in abundance and quality in the region.

15. **Plan for restoration using a landscape perspective that recognizes cumulative effects**. Forest restoration projects should be linked to landscape assessments that identify historical range of variation (reference condition), current condition, restoration targets, and cumulative effects of management. Ecosystems are hierarchical; changing conditions at one level arise from processes occurring at lower levels, and are constrained, in turn, by higher levels. The landscape perspective captures these complex relationships by linking resources and processes to the larger forest ecosystem. Forest restoration projects should incorporate plans for long-term maintenance of ecological processes.

16. **Manage grazing**. Grass, forbs, and shrub understories are essential to plant and animal diversity and soil stability. Robust understories are also necessary to restore natural fire regimes and to limit excessive tree seedling establishment. Where possible, defer livestock grazing after treatment until the herbaceous layer has established its current potential structure, composition, and function.

17. **Establish monitoring and research programs and implement adaptive management**. Well-designed monitoring, research, and documentation are essential to evaluate and adapt ongoing restoration efforts. Monitoring programs must be in place prior to treatment, and must evaluate responses of key ecosystem components and processes at multiple scales. Use research and monitoring results from a variety of sources to adjust and develop future restoration treatments.

    When possible, restoration projects should be set up as experiments with replicates and controls to test alternative hypotheses. The locations and prescriptions for all restoration treatments should be archived in a geographic information system, so that land managers and researchers have access to site-specific records of restoration treatments.

18. **Exercise caution and use site-specific knowledge in restoring or managing piñon-juniper ecosystems and other woodlands and savannas**. These systems are diverse and complex. Knowledge of local reference structure, composition, processes and disturbance regimes is lacking or uncertain for many piñon–juniper ecosystem types. Given the diversity, variability, and complexity of piñon–juniper systems, identification of local reference conditions is critical to the development of restoration objectives. Exercise caution and use best available science and site-specific knowledge in planning and implementing ecological restoration projects. Use the Grassland and Woodland Restoration and Management

Framework for development and implementation of specific projects (The Framework is currently under development).

Active management may be appropriate to mitigate soil erosion, community wildland fire hazard, or degraded hydrologic function in cases where historical ecological dynamics are insufficiently understood to justify ecological restoration. Piñon–juniper sites may be particularly susceptible to ecological damage from treatments, for example, soil erosion and invasion by non-native plants.

APPENDIX H
COMMUNITY RISK ASSESSMENT FORM

HAZARD ASSESSMENT FORM
WILDLAND FIRE ASSOCIATES

COMMUNITY/AREA_____
DATE_____

1. FIRE ENVIRONMENT

A. FUEL HAZARD (NFPA 299) – (Averaged)	**POINTS**
No Fuels = 0	
Light fuels (Grass, Low Shrubs) - NFFL 1,2,5,8 = 1	
Medium Fuels (Brush, Large Shrubs, Small Trees) – NFFL 9 = 3	
Heavy Fuels (Timber, slash, Large Brush, Bosque) NFFL 4,10 = 5	
B. SLOPE HAZARD (NFPA 299, FEMA) – (Averaged)	
Flat to Mild Slope (0-9.9%) = 1	
Mild to Medium Slope (10-19.9%) = 2	
Medium to Moderate Slope (20-39.9%) = 3	
Moderate to Extreme Slope (40% +) = 5	
ASPECT (N & E = 1; S & W = 2)	
C. SPECIAL HAZARDS (Averaged)	
Insect kill (Piñon, ponderosa pine), mistletoe = 0–2	
Chimney, Steep Canyon, Saddles = 3–6	
Other (describe)	
Total	

2. DEFENSIBILITY

A. ACCESS - Length of Dead-End Road (consider bridges, turnouts, bordering fuels, turnaround space, etc.)	**POINTS**
Less than 600 feet 0 Points	
600 to 1,000 feet 1 Point	
1,000 to 1,320 feet 3 Points	
Greater than 1,320 feet 5 Points	
B. STRUCTURE TYPE – (Averaged)	
Flame-resistant roofing/siding = 0	
Flammable roofing/siding = 1–3	
C. CLEARANCE/DEFENSIBLE SPACE (Averaged)	
Fuel Break > 30 ft. (trees pruned 6 ft., firewood >10 ft. away) = 0–3	
Fuel Break < 30 ft. (defensibility marginal) = 4–6	
D. WATER AVAILABILITY (Averaged)	
Well Water only – limited water source = 2	
Community Water – uninterruptible water source = 0–1	
Total	

APPENDIX I
COMMUNITIES AT RISK LIST

Community at Risk List

This Community at Risk (CAR) list is developed for the New Mexico Fire Planning Task Force. The communities listed are based upon Core Team input and the Risk Assessment carried out as part of this CWPP.

The Communities are rated as High, Moderate, Low, or No Risk. Because this is a countywide plan, it is recommended that more detailed analysis be conducted to identify to a subdivision level communities to be added to this CAR list in the future.

Community	Risk Rating
Apache Ridge	High
Arroyo Hondo	Low
Bella Vista	Medium
Bishop's Lodge	Medium
Camel Tracks	Low
Canada de los Alamos	Medium
Cañoncito	Medium
Cedar Grove	High
Cerrillos	Medium
Chimayo	Low
Chupadero	Medium
Cordova	Low
Cundiyo	Medium
Gan Eden	Low
Glorieta Conference Center	Medium
Glorieta Estates	Medium
Glorieta Mesa	High
Hyde Park	High
La Barberia	High
La Cienega	Low
La Cueva Canyon	Medium
La Jolla	Medium
La Tierra	Low
Lamy	Medium
Las Campanas	Low
Los Pinos	Low
Los Vaqueros, Cimarron	Medium
Lower Pacheco Canyon	Medium
Madrid	Low
Mailbox Road	High
Ojo de la Vaca	High
Old Ranch Road	Low
Old Santa Fe Trail	Medium
Pacheco Canyon	Medium
San Marcos	Low
San Pedro	High
Santa Fe South	Low

Community	Risk Rating
Sombrillo, Cuarteles	Medium
Sunlit Hills	Low
Tano Road	High
Tesuque	Medium
Thunder Mountain	Medium
Turquoise Trail	Medium

APPENDIX J
FUNDING OPPORTUNITIES

The following section provides information on federal, state, and private funding opportunities for conducting wildfire mitigation projects.

I. Federal Funding Information

Source: Pre-Disaster Mitigation Grant Program
Agency: Department of Homeland Security Federal Emergency Management Agency (DHS FEMA)
Contact: David L. R. Freeborn, CFM
State Hazard Mitigation Officer
New Mexico Dept. of Homeland Security & Emergency Management
P.O. Box 27111
Santa Fe, NM 87502
505-476-9600
Website: http://www.fema.gov/government/grant/pdm/index.shtm
Description: The DHS includes FEMA and the U.S. Fire Administration. FEMA's Federal Mitigation and Insurance Administration is responsible for promoting pre-disaster activities that can reduce the likelihood or magnitude of loss of life and property from multiple hazards, including wildfire. The Disaster Mitigation Act of 2000 created a requirement for states and communities to develop pre-disaster mitigation plans, and established funding to support the development of the plans and to implement actions identified in the plans. This competitive grant program, known as PDM, has funds available to state entities, tribes, and local governments to help develop multi-hazard mitigation plans and to implement projects identified in those plans.

Source: Section 319 Base Grant to State Entities and Indian Tribes
Agency: Environmental Protection Agency
New Mexico State 319 Coordinator
David Hogge
New Mexico Environment Department
P.O. Box 26110
Santa Fe, NM 87502
Phone: (505) 827-2981
Fax: (505) 827-0160
david_hogge@nmenv.state.nm.us
Website: http://www.epa.gov
Description: Funding under this program is often used for reduction of nonpoint-source pollution; however, one community successfully used the grant to obtain funding to reduce hazardous fuels to protect the municipal watershed. For additional information on this success story, visit http://www.santafewatershed.com. To learn about obtaining this type of funding for your community, contact New Mexico's 319 Grant Coordinator, Dave Hogge, New Mexico Environmental Dept. (505) 827-2981.

This funding opportunity is a Request for Proposals from state entities and Indian tribes for competitive grants under section 319 of the Clean Water Act (CWA). The purpose of this

grant program is to provide funding to implement nonpoint-source management programs developed pursuant to CWA section 319(b). The primary goal of this management program is to control nonpoint-source pollution. This is done through implementation of management measures and practices to reduce pollutant loadings resulting from each category or subcategory of nonpoint-source identified in the grant recipient's nonpoint-source assessment report, which should be developed pursuant to CWA section 319(a). The Environmental Protection Agency (EPA) has set aside a portion of section 319 funds appropriated by Congress for competitive grant awards to Tribes for the purpose of funding the development and implementation of watershed-based plans and other on-the-ground watershed projects that result in a significant step toward solving nonpoint-source impairments on a watershed-wide basis. Please note that the funding opportunity described here is found in section B of the full announcement. (Section A includes the EPA's national guidelines, which govern the process for awarding non-competitive base grants to all eligible Tribes.)

Source: Funding for Fire Departments and First Responders
Agency: DHS, U.S. Fire Administration
Website: http://www.usfa.dhs.gov/fireservice/grants/
Description: Includes grants and general information on financial assistance for fire departments and first responders. Programs include the Assistance to Firefighters Grant Program, Reimbursement for Firefighting on Federal Property, State Fire Training Systems Grants, and National Fire Academy Training Assistance.

Source: Conservation Innovation Grants (CIG)
Agency: National Resource Conservation Service
Website: http://www.nm.nrcs.usda.gov/programs/cig/cig.html
Description: CIG is a voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging federal investment in environmental enhancement and protection, in conjunction with agricultural production. Under CIG, Environmental Quality Incentives Program funds are used to award competitive grants to non-federal governmental or non-governmental organizations, Tribes, or individuals. CIG enables the Natural Resources Conservation Service (NRCS) to work with other public and private entities to accelerate technology transfer and adoption of promising technologies and approaches to address some of the nation's most pressing natural resource concerns. CIG will benefit agricultural producers by providing more options for environmental enhancement and compliance with federal, state, and local regulations. The NRCS administers the CIG program. The CIG requires a 50–50 match between the agency and the applicant. The CIG has two funding components: national and state. Funding sources are available for water resources, soil resources, atmospheric resources, and grazing land and forest health.

Source: Volunteer Fire Assistance
Agency: U.S. Department of Agriculture (USDA) Forest Service
Website: http://www.fs.fed.us/fire/partners/vfa/
Description: USDA Forest Service funding will provide assistance, through the states, to volunteer fire departments to improve communication capabilities, increase wildland fire management training, and purchase protective fire clothing and firefighting equipment. For more information, contact your state representative; contact information can be found on the National Association of State Foresters web site.

Source: Economic Action Programs
Agency: USDA Forest Service
Website: http://www.fs.fed.us/spf/coop/programs/eap/index.shtml
Description: USDA Forest Service funding will provide for Economic Action Programs that work with local communities to identify, develop, and expand economic opportunities related to traditionally under-utilized wood products and to expand the utilization of wood removed through hazardous fuel-reduction treatments. Information, demonstrations, application development, and training will be made available to participating communities. For more information, contact a Forest Service Regional Representative.

Source: Collaborative Forest Restoration Program (CFRP)
Agency: USDA Forest Service
Website: http://www.fs.fed.us/r3/spf/cfrp/index.shtml
Description: The Community Forest Restoration Act of 2000 (Title VI, Public Law 106-393) established a cooperative forest restoration program in New Mexico to provide cost-share grants to stakeholders for forest restoration projects on public land to be designed through a collaborative process (the CFRP). Projects must include a diversity of stakeholders in their design and implementation, and should address specified objectives including: wildfire threat reduction; ecosystem restoration, including nonnative tree species reduction; re-establishment of historical fire regimes; reforestation; preservation of old and large trees; increased utilization of small-diameter trees; and the creation of forest-related local employment. The act limits projects to four years, and sets forth cost limits and provisions respecting collaborative project review and selection, joint monitoring and evaluation, and reporting. The act authorizes appropriations of up to $5 million annually, and directs the Secretary to convene a technical advisory panel to evaluate proposals that may receive funding through the CFRP.

Source: Catalog of Federal Funding Sources for Watershed Protection
Agency: N/A
Website: http://cfpub.epa.gov/fedfund/
Examples of the types of grants found at this site are:

- Native Plant Conservation Initiative, http://www.nfwf.org/AM/Template.cfm?Section=Browse_All_Programs&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=3966
- Targeted Watershed Grants Program, http://www.epa.gov/owow/watershed/initiative/

- Pre-Disaster Mitigation Program, http://www.fema.gov/government/grant/pdm/index.shtm
- Environmental Education Grants, http://www.epa.gov/enviroed/grants_contacts.html

Source: Firewise
Agency: Multiple
Website: http://www.firewise.org
Description: The Wildland Urban Interface Working Team (WUIWT) of the National Wildfire Coordinating Group, is a consortium of wildland fire organizations and federal agencies responsible for wildland fire management in the United States. The WUIWT includes the USDA Forest Service, U.S. Department of the Interior (USDI) Bureau of Indian Affairs, USDI Bureau of Land Management, USDI Fish and Wildlife Service, USDI National Park Service, FEMA, U.S. Fire Administration, International Association of Fire Chiefs, National Association of State Fire Marshals, National Association of State Foresters, National Emergency Management Association, and National Fire Protection Association. There are many different Firewise activities that can help homes and whole neighborhoods become safer from wildfire without significant expense. Community clean-up days, awareness events, and other cooperative activities can often be successfully accomplished through partnerships among neighbors, local businesses, and local fire departments, at little or no cost. The Firewise Communities/USA recognition program page (http://www.firewise.org/usa) provides a number of excellent examples of these kinds of projects and programs.

The kind of help you need will depend on who you are, where you are, and what you want to do. Among the different activities individuals and neighborhoods can undertake, the following actions often benefit from some kind of seed funding or additional assistance from an outside source:

- Thinning/pruning/tree removal/clearing on private property—particularly on very large, densely wooded properties
- Retrofit of home roofing or siding to noncombustible materials
- Managing private forest
- Community slash pickup or chipping
- Creation or improvement of access/egress roads
- Improvement of water supply for firefighting
- Public education activities throughout the community or region

Some additional examples of what communities, counties, and states have done can be found in the National Database of State and Local Wildfire Hazard Mitigation Programs at http://www.wildfireprograms.usda.gov. You can search this database by keyword, state, jurisdiction, or program type to find information about wildfire mitigation education programs, grant programs, ordinances, and more. The database includes links to local web sites and e-mail contacts.

Source: The National Fire Plan
Website: http://www.forestsandrangelands.gov/
Description: Many states are using funds from the National Fire Plan to provide funds through a cost-share with residents to help them reduce the wildfire risk to their private property. These actions are usually in the form of thinning or pruning trees, shrubs, and other vegetation and/or clearing the slash and debris from this kind of work. Opportunities are available for rural, state, and volunteer fire assistance.

Source: Staffing for Adequate Fire and Emergency Response (SAFER)
Agency: DHS
Website: http://www.firegrantsupport.com/safer/
Description: The purpose of SAFER grants is to help fire departments increase the number of frontline firefighters. The goal is for fire departments to increase their staffing and deployment capabilities and ultimately attain 24-hour staffing, thus ensuring that their communities have adequate protection from fire and fire-related hazards. The SAFER grants support two specific activities: (1) hiring of firefighters and (2) recruitment and retention of volunteer firefighters. The hiring of firefighters activity provides grants to pay for part of the salaries of newly hired firefighters over the five-year program. SAFER is part of the Assistance to Firefighters Grants and is under the purview of the Office of Grants and Training of the DHS.

Source: The Fire Prevention and Safety (FP&S) Grants
Agency: DHS
Website: http://www.firegrantsupport.com/fps/
Description: The FP&S are part of the Assistance to Firefighters Grants and are under the purview of the Office of Grants and Training in the DHS. FP&S grants support to projects that enhance the safety of the public and firefighters who may be exposed to fire and related hazards. The primary goal is to target high-risk populations and mitigate high incidences of death and injury. Examples of the types of projects supported by FP&S include fire prevention and public safety education campaigns, juvenile fire-setter interventions, media campaigns, and arson prevention and awareness programs. In fiscal year 2005, Congress reauthorized funding for FP&S and expanded the eligible uses of funds to include firefighter safety research and development.

II. State Funding Information

Source: State and Private Forestry Programs
Agency: National Association of State Foresters
Website: http://www.stateforesters.org/S&PF/coop_fire.html
Description : The National Association of State Foresters recommends that funds become available through a competitive grant process on Wildland-Urban Interface hazard mitigation projects. State fire managers see opportunities to use both the State Fire Assistance Program and the Volunteer Fire Assistance Program to improve the safety and effectiveness of firefighters in the interface, as well as in other wildland fire situations. To ensure firefighter safety, minimize property and resource loss, and reduce suppression costs, land management agencies, property owners, local leaders, and fire protection agencies must work cooperatively to mitigate interface fire risks, as well as to ensure that wildland firefighters receive the training, information, and equipment necessary to safely carry out their responsibilities.

The 2007 Western WUI Grant Program is a specific grant available under the State Fire Assistance Program. It includes opportunities for hazardous fuels reduction, education, and community and homeowner actions. An application and instructions can be found at: http://www.firesafecouncil.org/news/attachments/2007_CDF_application-proccess_final168.pdf

Source: New Mexico Association of Counties 2007–2008 Wildfire Risk Reduction Program
Agency: New Mexico Association of Counties
Website: http://www.nmcounties.org/wildfire.html
Description: This program targets at-risk communities by offering seed money to help defray the costs of community wildfire protection projects. During the past two years, the Wildfire Risk Reduction Grant Program has primarily funded projects for the development of Community Wildfire Protection Plans (CWPP), a pre-requisite to all other activities. In 2007, priority was given to projects that requested funding for hazardous fuel reduction, wildfire prevention, and community outreach activities that were identified in completed CWPPs.

III. Private Funding Information

Source: The Urban Land Institute (ULI)
Website: http://www.uli.org
Description: ULI is a 501(c)(3) nonprofit research and education organization supported by its members. The institute has more than 22,000 members worldwide, representing the entire spectrum of land use and real estate development disciplines, working in private enterprise and public service. The mission of the ULI is to provide responsible leadership in the use of land to enhance the total environment. ULI and the ULI Foundation have instituted Community Action Grants (http://www.uli.org/Content/NavigationMenu/MyCommunity/CommunityActionGrants/Community_Action_Gr.htm) that could be used for Firewise activities. Applicants must be ULI members or part of a ULI District Council. Contact actiongrants@uli.org or review the web page to find your District Council and the application information.

Source: Environmental Systems Research Institute (ESRI)
Website: http://www.esri.com/grants
Description: ESRI is a privately held firm and the world's largest research and development organization dedicated to geographic information systems. ESRI provides free software, hardware, and training bundles under ESRI-sponsored Grants that include such activities as conservation, education, and sustainable development, and posts related non-ESRI grant opportunities under such categories as agriculture, education, environment, fire, public safety, and more. You can register on the website to receive updates on grant opportunities.

Source: StEPP Foundation
Website: http://www.steppfoundation.org/default.htm
Description: StEPP is a 501(c)(3) organization dedicated to helping organizations realize their vision of a clean and safe environment by matching projects with funders nationwide. The StEPP Foundation provides project oversight to enhance the success of projects, increasing the number of energy efficiency, clean energy, and pollution prevention projects implemented at the local, state, and national levels for the benefit of the public. The web site includes an online project submittal system and a Request for Proposals page.

Source: The Public Entity Risk Institute (PERI)
Website: http://www.riskinstitute.org
Description: PERI is a not for profit, tax-exempt organization. Its mission is to serve public, private, and nonprofit organizations as a dynamic, forward-thinking resource for the practical enhancement of risk management. With its growing array of programs and projects, along with its grant funding, PERI's focus includes supporting the development and delivery of education and training on all aspects of risk management for public, nonprofit, and small business entities, and serving as a resource center and clearinghouse for all areas of risk management.

IV. Other Funding information

The following resources may also provide helpful information for funding opportunities:

- National Agricultural Library Rural Information Center: http://www.nal.usda.gov/ric/ricpubs/fire_department_resources.htm
- Forest Service Fire Management web site: http://www.fs.fed.us/fire/
- Insurance Services Office Mitigation Online (town fire ratings): http://www.isomitigation.com/
- National Fire Protection Association: http://www.nfpa.org
- National Interagency Fire Center, Wildland Fire Prevention/Education: http://www.nifc.gov/preved/rams.htm
- U.S. Department of Agriculture "How to Get Information" (contacts): http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB/.cmd/ad/.ar/sa.retrievecontent/.c/6_2_1UH/.ce/7_2_5JN/.p/5_2_4TR/.d/0/_th/J_2_9D/_s.7_0_A/7_0_1OB?PC_7_2_5JN_navid=NEW_NOTEWORTHY&PC_7_2_5JN_navtype=RT&PC_7_2_5JN_parentnav=NEWSROOM#7_2_5JN
- Department of Homeland Security U.S. Fire Administration: http://www.usfa.dhs.gov/fireservice/grants/rfff/