COMMUNITY WILDFIRE PROTECTION PLAN

CIBOLA COUNTY, NM

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August 2006

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I. INTRODUCTION

This Community Wildfire Protection Plan for Cibola County New Mexico has been funded by a grant from the 2005 Wildfire Risk Reduction Program for Rural Communities, administered by the New Mexico Association of Counties through a partnership with the Bureau of Land Management.

This Community Wildfire Protection Plan (CWPP) meets the requirements of the Healthy Forest Restoration Act of 2003 by following the eight steps suggested in the handbook "Preparing a Community Wildfire Protection Plan" which was jointly developed by: Communities Committee of the Seventh American Forest Congress, National Association of Counties, National Association of State Foresters, Society of American Foresters, and Western Governor's Association. The eight steps are:1) convene decision makers, 2) involve federal agencies, 3) engage interested parties, 4) establish a community base map, 5) develop a community risk assessment, 6) establish community priorities and recommendations, 7) develop an action plan and assessment strategy, 8) finalize community wildfire protection plan.

The purpose of this Community Wildfire Protection Plan is to identify and prioritize, through analysis of hazard, risk and human values, areas for fuel reduction treatments and make recommendations on the types and methods of treatments to protect communities and infrastructure. Additionally, recommendations on measures to reduce the ignitability of structures within the areas of concern, and analysis of wildfire response and community preparedness are addressed within the CWPP.

II. LOCATION AND DEMOGRAPHICS

Cibola County is located in the west-central part of New Mexico containing approximately 2,900,000 acres ranging in elevation from 11,031 feet on Mt. Taylor to about 5,280 feet near the Rio San Jose River (figure 1). Average annual precipitation ranges from 7 to 25 inches depending on elevation. The rainy season is summer with about one-half of the annual precipitation falling during the period July to September. Nearly three-fourths of the annual precipitation falls between May and October.

The wide range in elevation and precipitation results in diverse vegetation ranging from grasslands to mixed conifer at the highest elevations (figure 2). Most of the country is in the 6,000 to 8,000 foot elevation range occupied by grassland and dry forest types (pinyon-juniper, ponderosa pine and dry site Douglas-fir). These are the vegetation types most outside the natural range of variability creating the wildfire hazard this CWPP will address.

Combined with this wildfire hazard is the increasing wildfire risk associated with a growing rural population on private land interspersed with federal and state ownerships. Population has been increasing with a 7.9 percent increase between 2000 and 2005

Figure 1: Vicinity Map

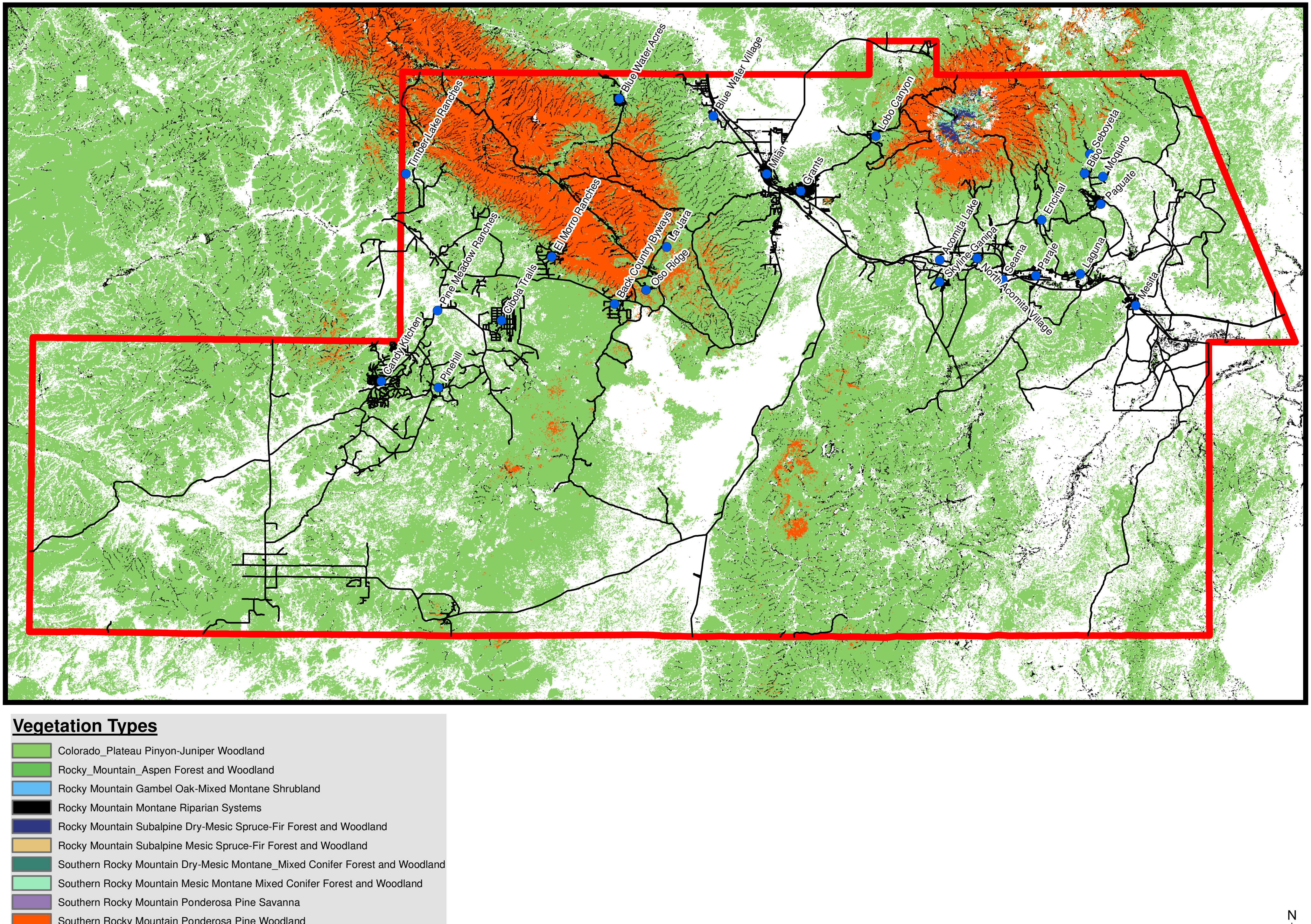

Figure 2: Existing Vegetation Types-Cibola County, New Mexico

compared to a 7.6 percent growth from 1990 to 2000. With only approximately 40 percent of the population in the Grants/Milan area, the majority of the population is in the rural areas with increased wildfire threat.

III. FIRE HISTORY

Prior to the 20th century, low severity fires burned regularly in most dry forest and grassland ecosystems, with ignitions caused by both lighting and humans. Low intensity fires controlled regeneration of fire-intolerant species (plants unable to physiologically withstand heat produced by fires), promoted fire-tolerant species (for example, ponderosa pine and Douglas-fir), maintained an open forest structure, reduced forest biomass, decreased the impacts of insects and diseases, and maintained wildlife habitats for many species that utilize open stand structures. In addition to the accumulation of fire intolerant vegetation, dense forest canopies with homogeneous and continuous horizontal and vertical stand structures (for example, dense trees with low crown base heights) developed resulting in an increased potential for crown fires in many forests of the western United States. These changes in structure and composition have dramatically altered how wildfires now burn in these forests from how they burned historically (USDA Forest Service Gen. Tech. Rep. RMRS-GTR-120.2004, page 3).

Large fires burning under extreme conditions of high winds and low humidity are difficult, if not impossible, to suppress. These extreme weather conditions are expected regularly during the fire seasons of the western United States. The prevalence of extreme fire behavior in low-elevation forests is, however, partly a consequence of effective fire suppression during the past century. Exclusion of historically frequent fire from these ecosystems has resulted in dramatic changes to vegetation structure and fuels compared to conditions in the 19th century. These alterations of the fuel structure, specifically the in-growth of trees and accumulation of dead woody fuels, tend to readily support extreme fire behavior (crown fire, spotting). This reduces the effectiveness of fire suppression and creates uncharacteristically severe effects in those ecosystems compared to pre-existing ecological disturbance regimes. Management of these fuels directly is, therefore, seen as a proactive means to change fire behavior and effects. The need for fuel management solutions has recently been made especially acute in these low-elevation areas because of human encroachment and development of areas formerly classified as wildlands (Finney, Mark A. and Jack D. Cohen. 2003. Expectation and evaluation of fuel management objectives. USDA Forest Service Proceedings RMRS-P-29: 353-354).

In recent years, as wildfires in the Southwest have begun to become larger and more destructive, both land managers and homeowners became increasingly concerned that conventional suppression methods were no longer effective in rapidly containing wildfires that ignited during severe conditions. This concern gave rise to a fear that everything downwind from a wildfire was vulnerable to destruction.

The changes in fire behavior as well as the increasing presence of structures in the rural areas were a cause for concern among those charged with fighting fires and managing for emergencies. In Cibola County, the Sedgwick fire in the Zuni Mountains in 2004 drove home that concern with an exclamation point. The fire behaved as no other fire in recent memory, moving rapidly through areas thought to be incapable of supporting a destructive wildfire (personal communication, Chuck Hagerdon, 2006). This fire, plus reports of numerous other large fires in the western United States, gave cause for the people who resided and recreated in and near the wildlands to express concern about the ever increasing danger and potential destruction they were facing. As information about wildland vegetation structure and its relationship to catastrophic wildfire became more commonly known, the by words began to be "not IF it burns, but rather WHEN it burns".

Because the protection of people, goods, and the environment is of paramount importance when dealing with wildfire, areas of accumulated fuels, risk of ignition, and potential loss of something of human value must be identified, and protection and mitigation strategies devised. It was for this purpose that a core group made up of fire chiefs, state and county emergency managers, tribal leaders and managers from federal agencies was convened at the request of the Cibola County Emergency Manager. The core group was charged with giving advice and lending expertise, but final decisions rested in the hands of the stakeholders and citizens of the county.

IV. COLLABORATION

Collaboration was achieved through the involvement of the core team in the complete process, and through a series of public meetings, that were designed to incorporate into the CWPP the ideas and opinions of the interested public and stakeholders. The first series of public meetings were held in March 2006 at Cubero, Grants, and at Tinaja Restaurant on Highway 53 South. The base map as well as a hazard map and a risk map were displayed and explained. Those attending the meeting expressed their concerns and suggested changes in area delineation and classification. The suggestions were incorporated into the maps, and updated maps were available at the second round of public meetings.

The second public meeting was held June 24, 2006 at Grants. At this meeting the threat level map and the priority map were displayed for the purpose of receiving suggestions, comments, and issues from the participants The threat level and priority maps were adjusted, after the meeting, to reflect needed changes identified during conversations and discussions with the meeting participants. The risk map was also available for those who wanted to see the adjustments resulting from the first series of meetings, and for those who were unable to attend the first series of meetings. Also available at the second meeting was the original hazard map which identifying fuel loading by high, medium, and low. The hazard map was used at the first public meetings, but was replaced by the Fire Regime Condition Class (FRCC) map when the Rapid Assessment component of Landfire was completed, for the geographical area that includes Cibola County, during the CWPP development process. The FRCC mapping is the latest technology available to identify the hazard that currently exists.

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V. RISK ASSESSMENT PROCESS

Initially the core group met several times to determine the scope and direction of the CWPP, and to develop base maps that could be used in the planning process and serve as visual aids for the stakeholders during the public meetings.

The factors of fuel load, risk of ignition, and potential loss can singly or in combination give cause for specific geographic areas of concern. These geographical areas of concern are usually called the Wildland Urban Interface (WUI), and are defined using a number of methods and techniques, ranging from vegetation type and fire history to population density. In general the WUI is defined as “The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels” (roadless.fs.fed.us/documents/feis/glossary.shtml).

Because of the rural nature of Cibola County along with its large contiguous blocks of wildland interlaced with low density subdivisions and scattered homes, the core group decided to designate the entire county as the Wildland Urban Interface.

One of the primary purposes of the CWPP was to identify areas, within the WUI, that had a high probability of experiencing a severe wildfire with possible loss of valuable human infrastructure. In this plan, the susceptible areas are identified through collaborative efforts using maps developed specifically for this CWPP, and direct input from the core group and participating public. The specific maps developed were a Base Map, Fire Regime Condition Class (FRCC), Risk, Values, Threat Level, and Risk Assessment.

Each map has a detailed analysis section further in this document. A brief description of each map is as follows: 1) Base Map, a map of Cibola County showing human infrastructure, ownership and geopolitical boundaries, 2) Fire Regime Condition Class Map, displays the relative departure from natural fire occurrence, and rates the departure as low, medium, or high, 3) Wildfire Risk Map, quantifies the concentration of historical wildfire ignition sites as high, medium or low, 4) Values Map, identifies areas having value to humans, such as concentration of homes, communications sites, hydrologic features, watersheds, extraordinary wildlife habitat, etc, and quantifies them as high, medium, or low, 5) Threat Level Map, overlays and combines the fire regime condition class, and risk maps into one map identifying areas most likely to experience a severe wildfire, and 6) Risk Assessment Map, combines the values map with the threat level map to identify areas that are most urgently in need of treatment because of the combination of possible severe wildfire and potential loss of identified values.

The individual maps were generated using as many sources as could be readily found, and then were analyzed, and specific geographical areas were delineated and classified into zones of high, medium and low, relative to that map's specific function. A classification of high had the effect of tagging a specific area as one needing consideration for treatment, and the classification of low tagged an area as not needing additional consideration at this time. For example, each of the following; FRCC 3, numerous historical fires (both natural and man caused), and the presence of numerous residential structures was given the classification of high on their respective maps. A medium classification placed an area somewhere between needing and not needing additional consideration.

The cumulative results of map overlaying allowed for the visual identification of various threat levels and areas of priority. The core group used the risk assessment map, along with their specific knowledge of current projects, plans, and concerns to determine recommendations and priorities that would be the most effective, and to propose scheduling for treatment in the priority areas

A. Maps

Mapping for the CWPP is small scale because the scope of the plan covered the complete county, and was designed to identify areas that were a high priority for treatment when FRCC, wildfire risk, and value were considered. Consequently the CWPP maps can be used for general information and planning; however, large scale mapping will need to be employed once a specific area is proposed for treatment.

1. **Base Map** (figure 3): The base map contains geographic features of the county, and is the base on which the other maps are built. This map shows the county boundary, fire district boundaries, roads, property lines (private, National Park, USFS, BLM, tribal, and state), and residence locations.

2. **Fire Regime Condition Class** (figure 4): This map was obtained from the Landfire web site, under the Rapid Assessment component.

Landfire is a five-year, multi-partner wildland fire, ecosystem, and wildland fuel mapping project. The Landfire project objective is to provide consistent, nationwide data describing wildland fuel, existing vegetation composition and structure, historical vegetation conditions, and historical fire regimes to assist: 1) identification of areas at risk due to accumulation of hazardous fuels, 2) prioritization of hazardous fuel reduction projects, 3) improvement of coordination between agencies with regard to fire and other resource management, 4) modeling real-time fire behavior to support tactical decisions to ensure sufficient wildland firefighting capacity and safety, 5) modeling potential fire behavior and effects to strategically plan projects for hazardous fuel reduction and the restoration of ecosystem integrity on fore-adapted landscapes (www.landfire.gov, 04 April 2006).

Landfire generates consistent, comprehensive maps and data describing vegetative, fire, and fuel characteristics across the United States. One component of Landfire is Fire Regime Condition Class (FRCC), and it classifies the lands into three categories of departure from the natural fire regime. Fire Regime Condition Class is an interagency standardizing tool for determining the degree of departure from reference (historical) condition vegetation, fuels, and disturbance regimes. A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning. There are five natural fire regimes, and they are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation. There are three possible condition classes for each fire regime. The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historical) regime. The central tendency is a composite estimate of vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated natural disturbances. Low departure is considered to be within the natural (historical) range of variability, while moderate and high departures are outside. Characteristic vegetation and fuel conditions are considered to be those that occurred within the natural (historical) fire regime. Uncharacteristic conditions are considered to be those that did not occur within the natural (historical) fire regime, such as invasive species (e.g. weeds, insects, and diseases), “high graded” forest composition and structure (e.g. large trees removed in a frequent surface fire regime), or repeated annual grazing that maintains grassy fuels across relatively large areas at levels that will not carry a surface fire. Determination of amount of departure is based on comparison of a composite measure of fire regime attributes (vegetation characteristics; fuel composition; fire frequency, severity and pattern) to the central tendency of the natural (historical) fire regime. The amount of departure is then classified to determine the fire regime condition class (Hann, 2003).

El Malpais National Monument have completed a site-specific evaluation of the fire regime condition class for the Monument. This more detailed analysis was used in evaluating the threat level and risk assessment for the Monument.

3. Wildfire Risk (figure 5): The wildfire risk map reflects the history of fire starts during the past ten years, and was taken from fire occurrence information that included both natural and human caused ignition. The fire occurrence data from the New Mexico Forestry Department and from the USFS Mt. Taylor Ranger District were combined to determine fire ignition concentration. Areas on the risk map where fire ignitions were concentrated were delineated and were given a rating of high or medium, with the remainder of the county classified as low.

4. Threat Level (figure 6): The Threat Level map is the result of overlaying the FRCC map and the risk map to form a map showing the various combinations of high, medium and low ratings for both FRCC and risk of fire ignition. This map (threat level) identifies the areas that have a greater chance of experiencing a severe wildfire. A numerical score of 1, 2, or 3 was given to the low, medium, and high ratings respectively, for areas on the Risk map, and on the FRCC map. FRCC 3 scored a 3, a FRCC 2 scored a 2, and FRCC 1 scored a 1. The resulting cumulative score for a specific area was called Threat Level Map, and the scores could range from 2 to 6 with the combining of the two maps. Areas with scores of 6 were labeled Very High, a score of 5 was labeled High, a score of 4 was labeled Medium. The scores of 3 and 2 were labeled Low and Very Low, respectively.

5. Values At Risk (figure 7): Values are generally considered to be those of human infrastructure; however, values may include but are not limited to watersheds for clean water, stable soils, wildlife habitat, natural aesthetics, recreation opportunities, economic capital, protecting vegetation in healthy condition, privacy, protecting community infrastructure, health, human life, livestock in rural areas, financial assets and seclusion (i.e., narrow roads) (Southwest Community Wildfire Protection Plan Guide).

The values within the Cibola County WUI were determined by collaborative effort between the core group and the interested public through the public meetings. The core group members examined all the maps, combined the map information with their individual knowledge of specific areas, and incorporated the public input into identifying areas of value. The areas of value were drawn onto the map, and overlaid with the threat level map, resulting in a striking visual that identifies areas of concern pertaining to potential loss from wildfire.

Within the values for Cibola County are eight watersheds that are positioned on the landscape in such a way that heavy runoff could pose a threat to human infrastructure. Consequently, the eight watersheds have been included in the CWPP as values, and because of their size and number a separate map (figure 8) of watershed values was generated, and a separate section for watersheds developed.

6. **Risk Assessment** (figure 9): This map combined the value and threat level maps to create an overlay map showing the areas most likely to experience a wildfire resulting in a great loss of values. The core group used this map to compile a treatment area priority list, and to recommend treatment types and intensity, as well as recommending a treatment time schedule.

VI. PRIORITY AREA TREATMENT OBJECTIVES

The objective of treatments recommended in the Cibola County CWPP is to move the areas classified as FRCC 3 toward the classification of FRCC 1, and to create defensible space for structures. Creating defensible space for structures is addressed in the Community Preparedness section.

Moving an area FRCC classification requires that some sort of treatment be performed on the existing fuels in that area, and quite possibly the adjacent areas also. These treatments can be extensive and expensive, consequently it behooves all involved to plan and implement treatments that will be effective, coordinated and have a long-term benefit.

In order to change potential wildfire conditions and impact the associated fuels, it is necessary to understand the various types of wildfire and the conditions in which they exist. The following description of the various types of wildfire was taken from USDA Forest Service Research Paper RMRS-RP-29. 2001.

Fire scientists and managers recognize three general types of wildland fire, depending on the fuel stratum in which the fire is burning.

1) A ground fire is one that burns in the ground fuels such as duff, organic soils, roots, rotten buried logs, and so forth. Ground fuels are characterized by higher bulk density than surface and canopy fuels. Ground fires burn with very low spread rates but can be sustained at relatively high moisture contents. Fuel consumption through ground fire can be great, causing significant injury to trees and shrubs. Although ground fuels can be ignited directly, they are most commonly ignited by a passing surface fire.

2) A surface fire is one that burns in the surface fuel layer, which lies immediately above the ground fuels but below the canopy, or aerial fuels. Surface fuels consist of needles, leaves, grass, dead and down branch wood and logs, shrubs, low brush, and short trees. Surface fire behavior varies widely depending on the nature of the surface fuel complex.

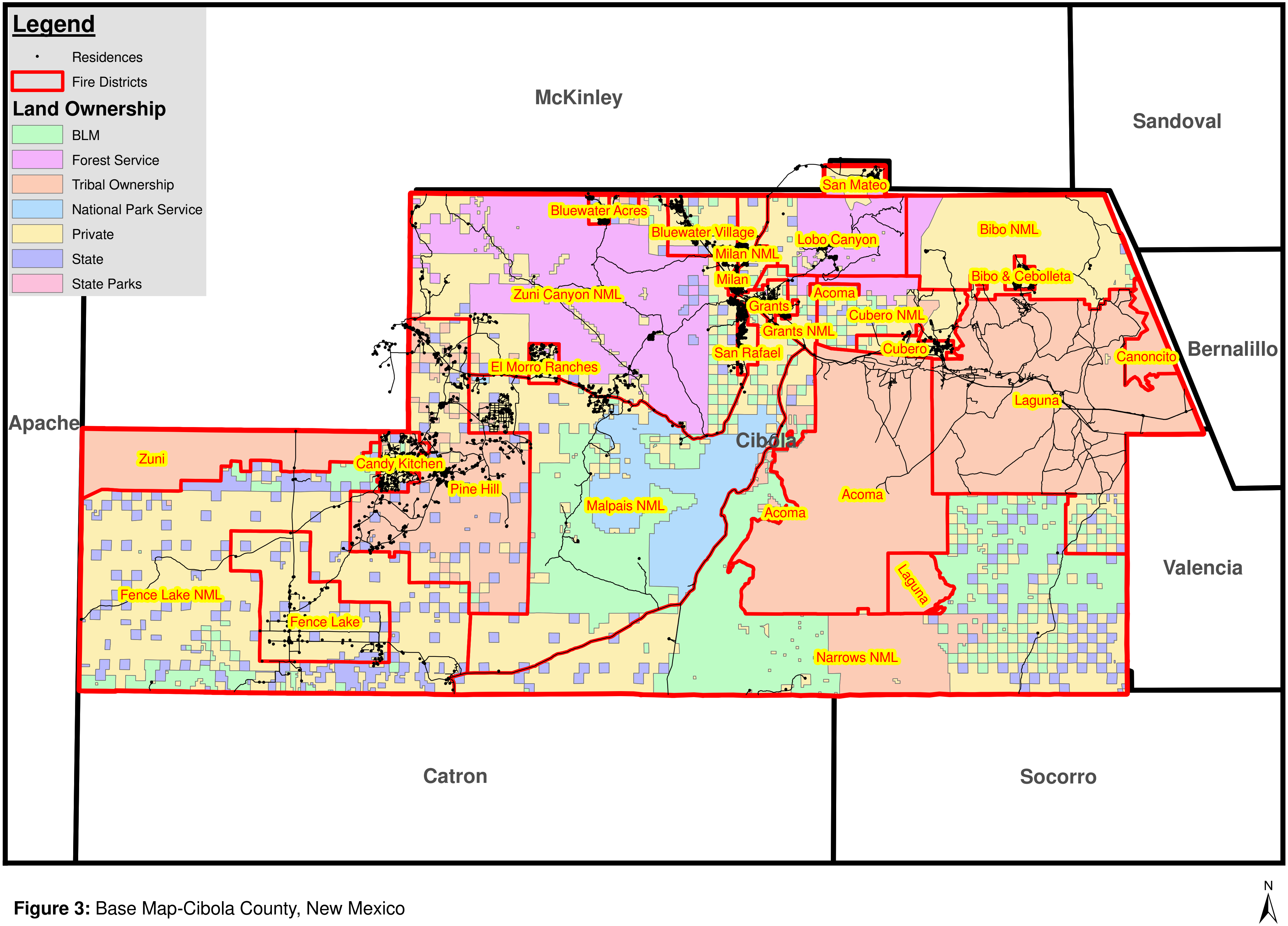

Figure 3: Base Map-Cibola County, New Mexico

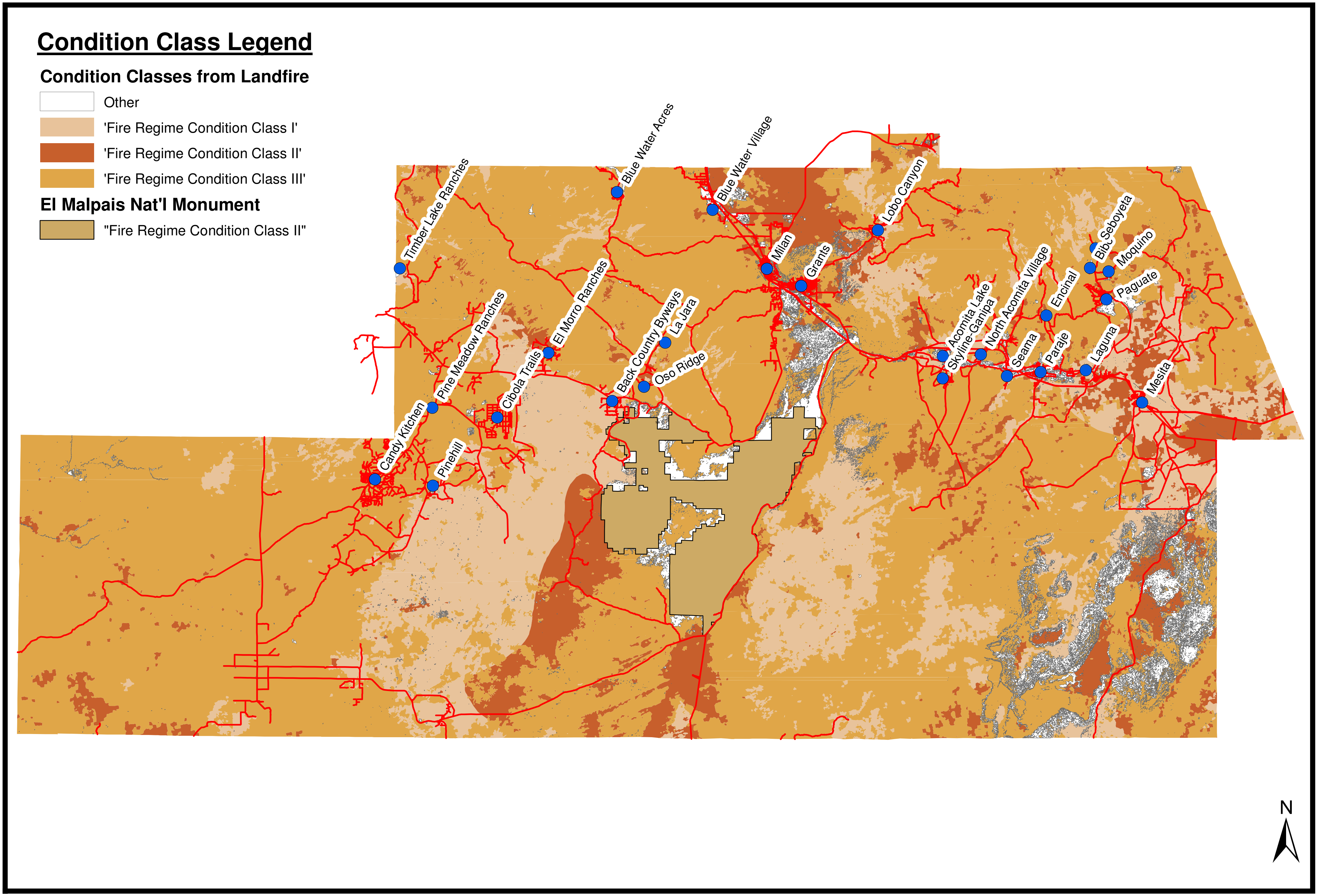

Figure 4: Fire Regime Condition Classes-Cibola County, New Mexico

Figure 5: Wildfire Risk

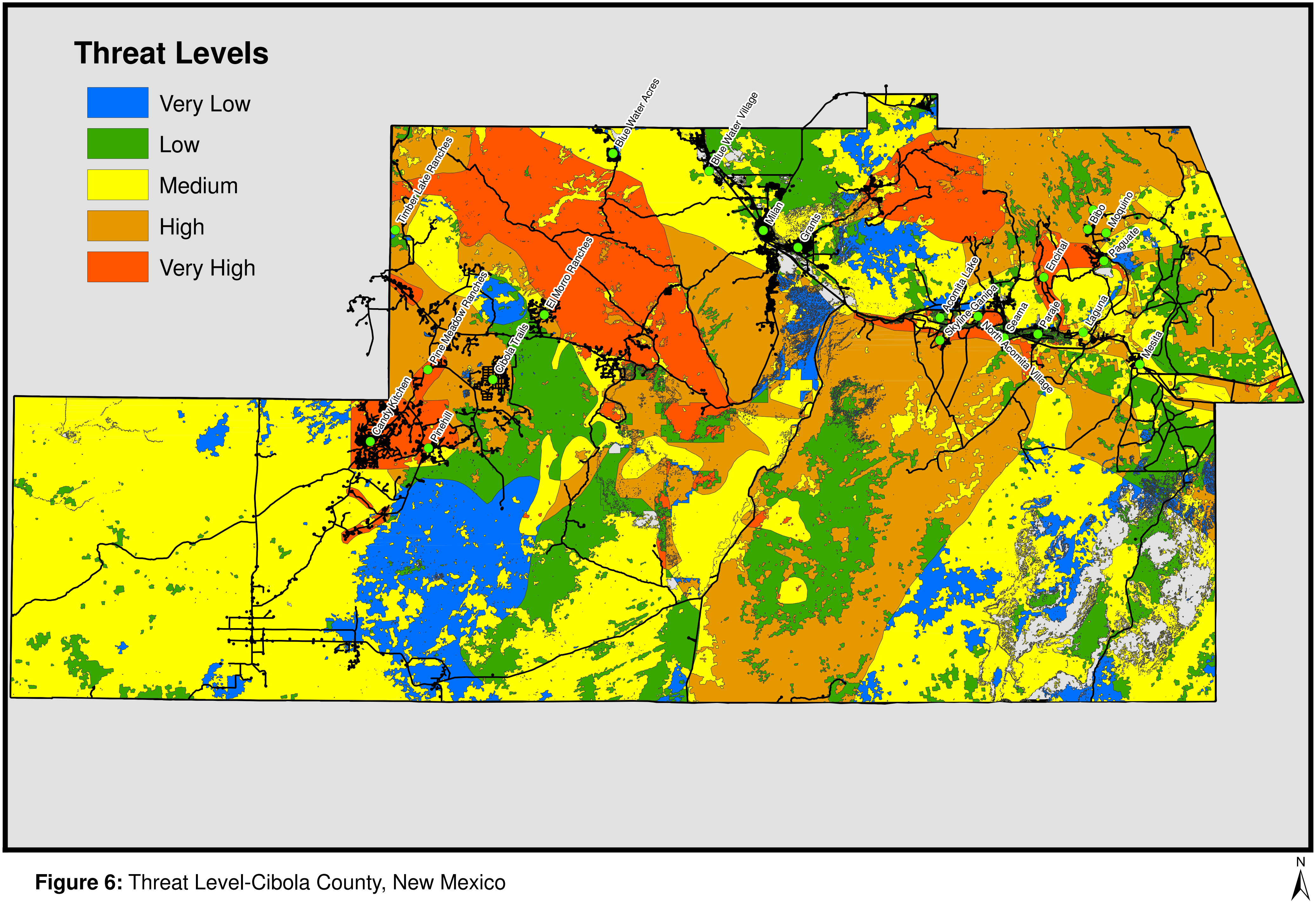

Figure 6: Threat Level-Cibola County, New Mexico

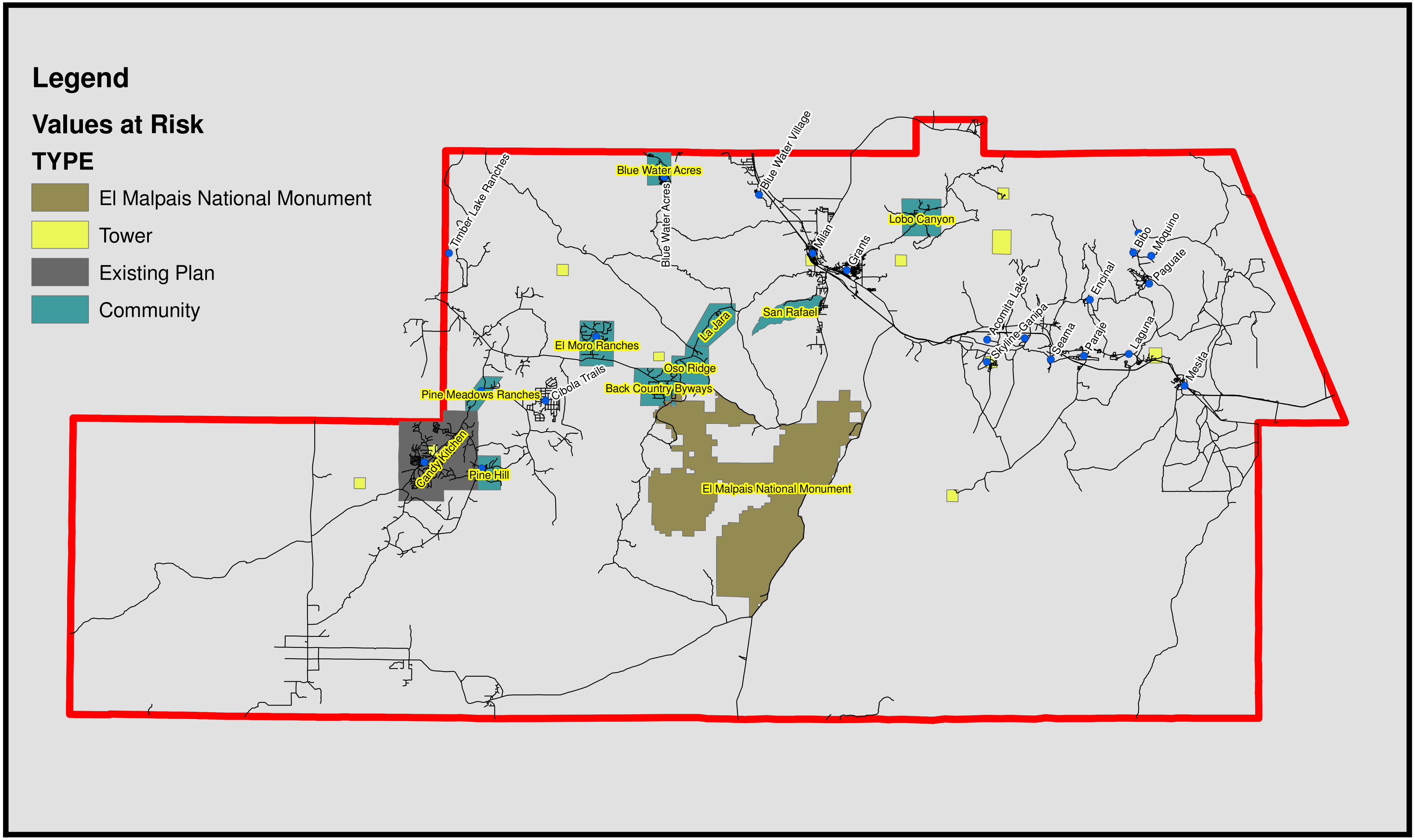

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Figure 7: Values at Risk-Cibola County, New Mexico

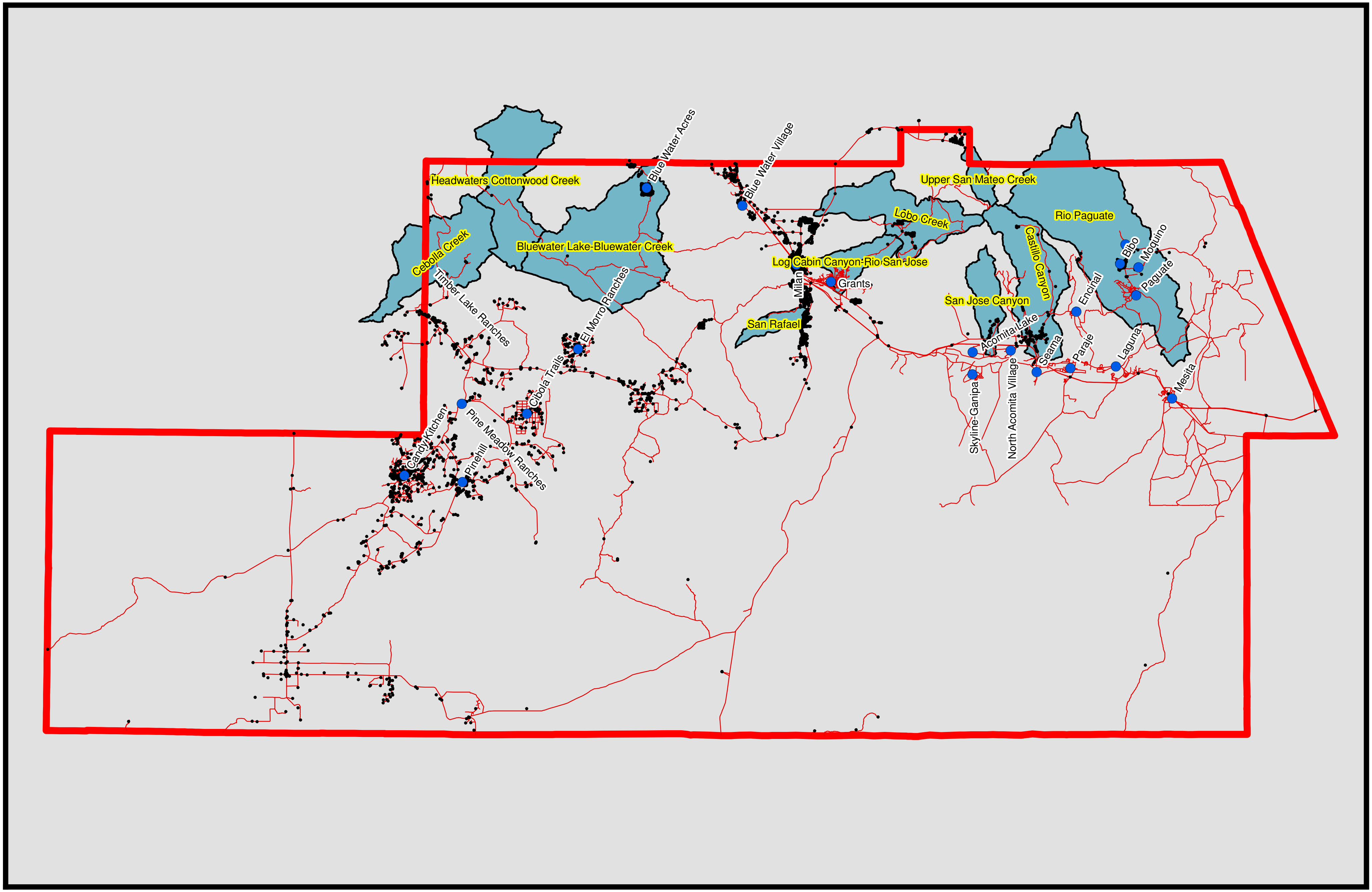

Figure 8: Watersheds-Cibola County, New Mexico

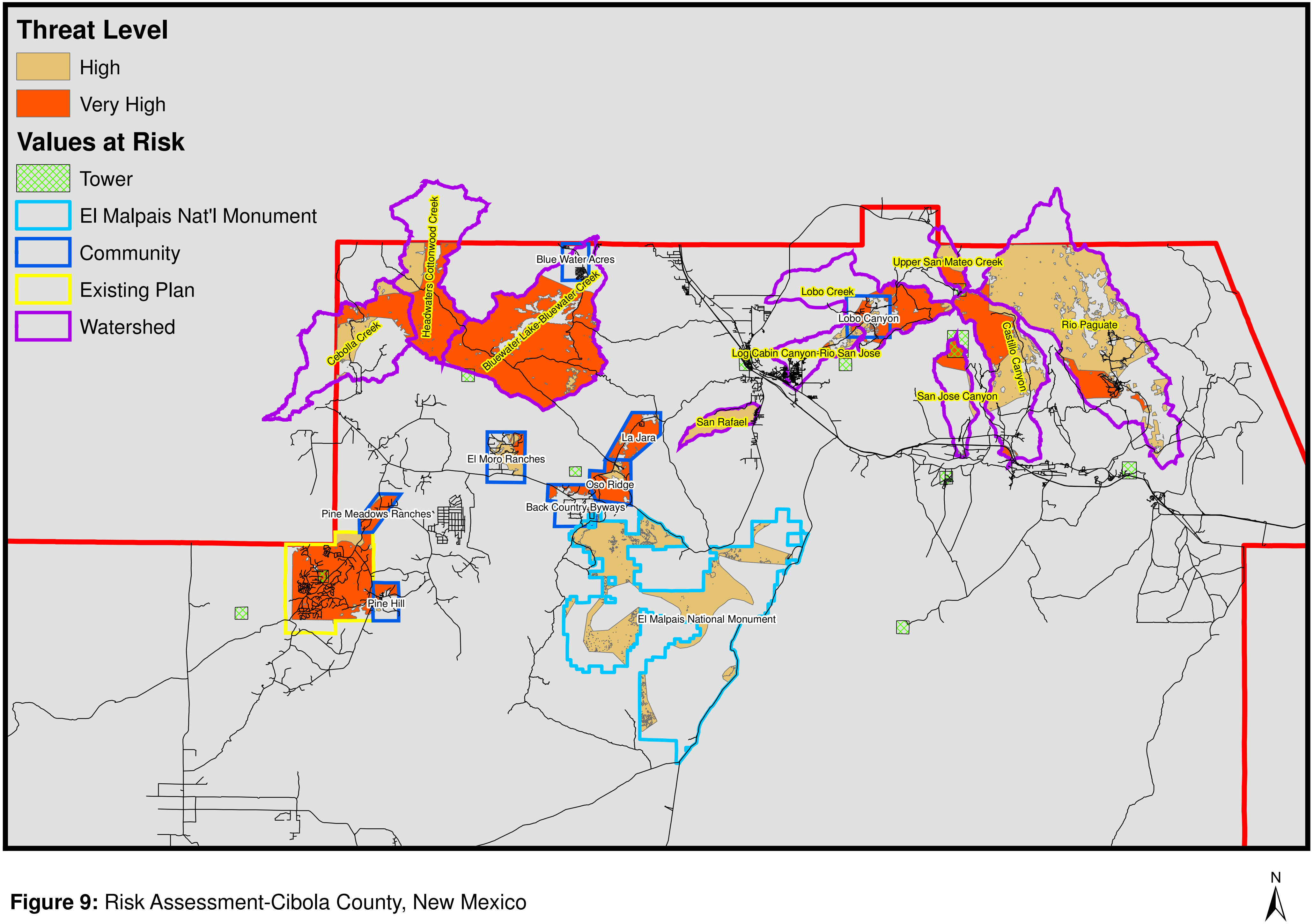

Figure 9: Risk Assessment-Cibola County, New Mexico

3) A crown fire is one that burns in the elevated canopy fuels. Canopy fuels normally consumed in crown fires consists of the live and dead foliage, lichen, and fine live and dead branchwood found in a forest canopy. They have higher moisture content and lower bulk density than surface fuels. We generally recognize three types of crown fire: passive, active, and independent.

A passive crown fire, also called torching or candling, is one in which individual or small groups of trees torch out, but solid flame is not consistently maintained in the canopy. Passive crowning encompasses a wide range of fire behavior, from the occasional tree torching out to a nearly active crown fire. The increased radiation to surface fuels from passive crowning increases flame front spread rate, especially at the upper end of the passive crown fire range. Embers lofted during passive crowning can start new fires downwind, which make containment more difficult and increases the overall rate of fire growth. Passive crowning is common in many forest types, especially those with an understory of shade-tolerant conifers.

An active crown fire, also called a running or continuous crown fire, is one in which the entire surface/canopy fuel complex becomes involved, but the crowning phase remains dependent on heat from the surface fuels for continued spread. Active crown fires are characterized by a solid wall of flame extending from the fuel bed surface through the top of the canopy. Greatly increased radiation and short-range spotting of active crown fires 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 grater rates of fire growth.

An independent crown fire is one that burns in canopy fuels without aid of a supporting surface fire. Independent crown fires occur rarely and are short loved, requiring an combination of steep slope, high windspeed, and low foliar moisture content. Many apparently independent crown fires may actually be active crown fires in which the canopy phase is momentarily pushed ahead of the surface phase under the influence of steep slope or strong wind (Scott, Joe H, Reinhardt, Elizabeth D. 2001. Assessing crown fire potential by linking models of surface and crown fire behavior. USDA Forest Service, Rocky Mountain Research Station, research paper RMRS-RP-29. 3-4).

Covington, while speaking about western forest conditions, stated that of particular concern is the occurrence in recent years of widespread crown fires that are dangerous to human lives, damaging to human communities, and ecologically harmful (Covington, W.W. 2000. Helping western forest heal. Nature 408(6809):135-163).

With that in mind and based on the collective ideas of the core group and stakeholders, the Cibola County CWPP is primarily directed at crown fire potential, and treatments that minimize crown fire occurrence, than with other types of wildfire. Dealing with crown fires requires knowledge of fuel conditions requisite for a crown fire to begin and sustain itself.

Fire behavior and severity depend on the properties of the various fuel (live and dead vegetation and detritus) strata and the continuity of those fuel strata horizontally and vertically. The fire hazard for any particular forest stand or landscape can be characterized by the potential for the fuels to cause specific types of fire behavior and effects. Understanding the structure of fuelbeds and their role in the initiation and propagation of fire is the key to developing effective fuel management strategies (Graham, Russell T, McCaffrey, Sarah, Jain, Theresa B. 2004. Science basis for changing forest structure to modify wildfire behavior and severity. USDA Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-120. 8).

Fuelbeds are classified in six strata: (1) tree canopy, (2) shrubs/small trees, (3) low vegetation, (4) woody fuels, (5) moss, lichens, and litter, and (6) ground fuels (duff). Each of these strata can be divided into separate categories based on physiognomic characteristics and relative abundance. Modification of any fuel stratum has implications for fire behavior, fire suppression, and fire severity (Graham. 2004).

The categories within the fuelbed strata that the Cibola County CWPP is concerned with are the surface fuels and the canopy fuels. Graham (2004) describes surface fuels as consisting of grasses, shrubs, litter, and woody material lying on, or in contact with the ground surface, and he describes crown fuels as those suspended above the ground in trees or vegetation (vines, mosses, needles, branches, and so forth). He further states that high surface fire intensity usually increases the likelihood for igniting overstory canopy fuels, but surface fuel types with longer residence times can contribute to drying aerial fuels in a forest canopy, which also leads to torching (when a tree's or group of trees' foliage ignites carrying the fire into the canopy).

Graham (2004) describes crown fuels as the biomass available for crown fire, which can be ignited from a surface fire via the understory shrubs and trees, or from crown to crown. The shrub/small tree stratum is also involved in crown fires by increasing surface fireline intensity and serving as "ladder fuels" that provide continuity from the surface fuels to canopy fuels, thereby facilitating crown fires. These essentially bridge the vertical gap between surface and crown strata. The size of this gap is critical to ignition of crown fire from a surface fire below.

Aerial fuels separated from surface fuels by large gaps are more difficult to ignite because of the distance above the surface fire, thus requiring higher intensity surface fires, surface fires of longer duration that dry the canopy before ignition, or mass ignition from spotting over a wide area. Once ignited, high density canopy fuels are more likely to result in a spreading crown fire (active crown fire) than low density canopies (Graham 2004).

The nature of crown fires--- intense, fast moving, and destructive---suggests that potential for damage is great whenever a crown fire occurs. Assessing the hazard posed by crown fire is therefore a matter of assessing the potential for their occurrence—of identifying the physical situations that lead to crown fire occurrence (Scott 2001).

The most effective strategy for reducing crown fire occurrence and severity is to (1) reduce surface fuels, (2) increase height to live crown, (3) reduce canopy bulk density, and (4) reduce continuity of the forest canopy (Graham, 2004).

The Cibola County CWPP has identified nine communities and their immediately adjacent wildlands that are susceptible to severe wildfire and property loss, and are in need of fuels treatment. These nine areas combined have almost 57,000 acres classified as either very high threat or high threat. The plan also identified approximately 176,000 acres of valuable watersheds that are classified as very high or high threat, and in need of fuel treatment.

VII. TYPES AND IMPACTS OF TREATMENTS

Fire behavior responds to fuels, weather, and topography. Changes to fuels, for example from prescribed fire burning or thinning, are related to potential fire behavior at that site and have resulted in reduced severity of wildfires where fuel treatments have occurred. For many fuel management objectives, the goal is to limit surface fires from becoming crown fires (Finney. 2003).

The Cibola County CWPP has as one of its objectives, minimizing severe wildfire, and because crown fires are the main contributor to a wildfire being considered severe, fuel conditions that are conducive to crown fires must be modified in order to eliminate severe wildfire.

The three basic categories of tools available to forest managers for altering vegetative conditions are prescribed fire, mastication or mowing, and thinning. The effectiveness of each of these methods in altering the structure of or reducing the amount of ground and ladder fuels, and reducing crown bulk density is different. Consequently, each of these leaves residual stands with different vegetative characteristics and environmental effects. Each type of treatment also has a different set of financial costs, and in times of tight budgets the choice of which method to use is important in achieving the best combination of risk reduction and environmental effects within the available budget (Fight, Roger D, Barbour, James R. 2005. Financial analysis of fuel treatments. USDA Forest Service, Pacific Northwest research Station, General Technical Report PNW-GTR-662. 1-2).

Prescribed fire is generally used to remove ground fuels, understory vegetation, and small trees, and sometimes to kill larger trees. It is not a precise way of reducing stand density, and several prescribed fires spread over many years are often necessary to accomplish management objectives. Prescribed fire is, however, often seen as more environmentally benign than other methods for modifying vegetation.

Mastication or grinding is a special case of thinning without removal of the thinned materials. In the case of mastication, the thinned materials are ground and left on the site. This does not remove the biomass, but cuts it into smaller pieces leaving the material distributed on the ground, adding to the surface fuel load. If the masticated material exceeds 2 or 3 inches, there is a potential to alter the moisture regime adversely affecting tree growth and survival.

Thinning is also quite precise and, like prescribed fire, can include removal of biomass from the site, some of which may be in the form of merchantable trees. Thinning is not particularly useful at reducing understory plants or ground fuels, and it typically adds to the surface fuel load in the form of tops and limbs if not removed. In the Southwest it is generally recommended to pile and burn thinned trees, chip or remove from the site. Like mastication, the precision of thinning makes it useful for accomplishing large changes in vegetative structure and composition in one entry (Fight 2005).

There is no one-size-fits-all recommendation for how mechanical thinning or prescribed fire should be used at a given location in order to reduce wildfire risk, but thinning of both canopy and ladder fuels is generally needed to reduce crown fire potential (Lowe 2006).

In trying to determine how much to reduce canopy density and ladder fuels, land managers have available several fire behavior prediction software packages that can model fire behavior given a set of forest conditions, such as fuel load, fuel moisture, canopy bulk density, slope, elevation, and wind speed. The programs can then predict the speed and direction of the fire, flame length, rate of spread, fuel consumption, smoke production, and crown fire indices (Lowe 2006). By using several different scenarios in a fire behavior computer model, a plan for fuels reduction that best meets the needs of the areas values can be determined. Also, the cost of treatment and the treatments long-term effectiveness must be considered.

In 2003 a publication titled "Reducing Crown Fire Hazard in Fire-Adapted Forests of New Mexico" reported the results of an analysis of three different fuel reduction treatment prescriptions in the ponderosa pine and dry mixed conifer forest types to test the impact on fire behavior and long term effectiveness.

The three prescriptions were: (1) thin from below; remove all trees smaller than 9 inches in diameter at breast height (acronym of DBH and is 4.5 feet above ground level), (2) Diameter limit; reserve all trees greater than 16 inches DBH; however, if reserve basal area (acronym BA, and is defined as the square feet per acre of solid wood) is less than 50, reserve additional trees less than 16 inches DBH until the BA equals 50, and (3) Restoration; ecologically-based restoration of sustainable structure and composition, reserve a target BA of 40 to 50, primarily comprised of larger trees, although trees remain throughout the diameter distribution (Fiedler, Carl E, Keegan, Charles E. 2003. Reducing crown fire hazard in fire-adapted forests of New Mexico. USDA Forest Service Proceedings, RMRS-P-29. 39-48).

The three different prescriptions were put into a computer fire behavior computer model, and the analysis showed that hazard reduction treatments differ substantially in their potential to reduce crown fire potential. Of particular interest to this CWPP and severe wildfire potential were the treatment effects on the crowning index. The crowning index is defined as the windspeed, in miles per hour (mph), necessary to sustain a crown fire once a fire has reached the main canopy.

In a dense canopy, as one tree crown torches and burns, it will be close enough to other trees to pre-heat and ignite those crowns. In a less dense canopy (trees further apart) the trees will not be close enough together for a tree that is torching to pre-heat and ignite the neighboring trees without the aid of wind. In general the denser the canopy the lower the windspeed necessary to sustain the crown fire, and vice versa. The design of treatments that modify canopy density should consider anticipated wind speeds during fire seasons.

Fiedler reported that the pre-treatment crowning index for all three prescriptions was 16. The thin from below treatment moved the crowning index from 16 to 39. The diameter limit treatment resulted in a crowning index of 61, and the comprehensive treatment resulted in a crowning index of 66.

The study further used crowning index as the primary variable in quantifying forest hazard conditions into high, medium, or low. Fiedler defined high-hazard forest conditions as having a crowning index less than 25 mph, moderate hazard from 25 to 50 mph, and low hazard as greater than 50 mph.

Each prescription moved a percentage of the treatment area from high hazard into low hazard. The thin from below prescription moved 18 percent of the treated area into low hazard. The diameter limit and comprehensive prescriptions moved 72 percent and 79 percent of the treated area into the low hazard category, respectively.

Also of concern is the time period for which the treatment is effective in retaining an area in the low hazard category. Fiedler used a 30 year time frame, and the results were that the thin from below treatment was effective in retaining 13 percent of the area as low hazard. The results were much better for the other two treatments, with diameter limit retaining 62 percent and comprehensive retaining 62 percent of their respective areas in low hazard.

Table 1 shows the results of the treatments.

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In referring to the study, Fiedler concluded: Results of this study show that the fire hazard problem in New Mexico is best addressed by forest restoration approaches that recognize the broader ecological context within which hazard occurs. Whether degraded, fire-adapted forests are viewed from the standpoint of hazard reduction or ecological condition, an approach that centers on the density, structure, and species composition of the reserve stand is superior to prescriptions that focus only on the size of trees removed. The restoration prescription evaluated in this analysis achieves greater hazard reduction, and creates more sustainable conditions than alternative treatments. It is particularly superior when compared prescriptions with a singular focus on removal of small trees (Fiedler 2003).

Mastication modifies the form of ground fuels, understory plants of various sizes, and sometimes fairly large trees (15 to 20 inches in diameter). Mastication is more precise than prescribed fire because human judgment is used to target particular trees and shrubs. Accordingly, managers can use mastication to achieve specific stand density and vegetative composition goals in a single entry. Mastication changes fuel structure by grinding or chopping vegetation into smaller pieces that lay close to or on the ground, but it does not reduce fuel loads, it only rearranges the fuel (Fight 2005).

In ecosystems where high-intensity fire is not acceptable, the routine use of prescribed fire should change the wildfire regime such that it will be characterized by smaller and less severe fires from both the ecological and economic perspective. The best results of prescribed fire application are likely to be attained in heterogeneous landscapes and in climates where the likelihood of extreme weather conditions is low. Prescribed fire impacts the behavior and effects of large wildfires, but it is unlikely that the fuel effect will override extreme weather conditions to the extent of actually inhibiting fire spread (Fernandes, Paulo M, Botelho, Herminio S. 2003. A review of prescribed burning effectiveness in fire hazard reduction. International Journal of Wildland Fire. 117-124).

While managing fire-adapted forests with prescribed fire is often the least expensive option to reduce hazardous fuels when utilization opportunities are limited, there are many areas and times where prescribed fire cannot be used. High fuel loadings, air quality restrictions, short windows of appropriate weather, and risk of escaped fire in the wildland-urban interface are some of the factors that limit application of prescribed fire (USFS, Research and Development. 2003. A strategic assessment of forest biomass and fuel reduction treatments in western states).

Prescribed fire is likely to be effective in stands that have moderate or low tree densities, little encroachment of ladder fuels, moderate to steep slopes which preclude mechanical treatment, and expertise in personnel to plan and implement such large prescribed burns. (Pollet, Jolie, Omi, Philip N. Effect of thinning and prescribed burning on wildfire severity in ponderosa pine. The joint fire science conference workshop. 3). Depending on the site and vegetative conditions, the effectiveness of prescribed fire is generally 2 to 4 years.

In forests that have not experienced fire for many decades, multiple fuel treatments are often required to achieve the desired fuel conditions. Changing crown structure, while ignoring surface fuels, will only affect the likelihood of active crown fires---it will not necessarily reduce the likelihood of surface fires severe enough to damage soils or intense enough to ignite tree crowns. Therefore, it cannot be emphasized enough that all fuel strata need to be managed (over time and space) to minimize the unwanted consequences of wildfires (Graham, 2004).

Fire weather conditions in Cibola County coupled with a forest structure of dense stands place limitations on prescribed fire as a primary fuels treatment tool for preventing crown fires. These limitations indicate that prescribed fire should be used as a supplement to mechanical thinning wherever the treatment objective is prevention of crown fire.

VIII. PREVIOUS WUI

Cibola County has within its boundaries two previously identified Wildland Urban Interface (WUI) areas – the Zuni Mountain WUI and the Candy Kitchen WUI. The Zuni Mountain WUI has been incorporated into this CWPP. The Candy Kitchen WUI has a CWPP developed by the Bureau of Land Management (BLM) and has been retained as the primary WUI document for that community.

The Zuni Mountain WUI was identified and defined by the New Mexico Communities at Risk Assessment Plan, April 2004, EMNRD- Forestry Division. The boundary for this WUI does not include some important areas that were originally proposed to be within the boundary of the WUI, but are now a part of the Cibola County CWPP.

Within the Zuni Mountain WUI is the Bluewater Ecosystem Management Project being implemented by the United States Forest Service. The Bluewater Project deals with restoring the ponderosa pine forest and the pinyon-juniper forest to a desirable condition where fire can return to its previous role, one of frequent light fires that burn through the understory. The project will reduce the threat of destructive crown fires through substantial timber stand structural manipulation. (United States Forest Service, Cibola National Forest, FEIS, Bluewater Ecosystem Management Project).

Within the Cibola County CWPP are several watersheds that were classified as high priority areas. Two of these, the Bluewater Creek watershed, and most of Cottonwood Creek watershed are covered in the Bluewater Ecosystem Management Project, and any additional proposed treatments in the watersheds will incorporate that document.

The Candy Kitchen area was assessed, by the Bureau of Land Management in the summer and fall of 2005, with vegetative transects and visual observations. The data collected and analyzed included such information as tree spacing, tree height, tree diameter, trees per acre, percent crown cover, fire history, vegetative health, species diversity, and habitat orientation. This information made up the ecological factors that were used to develop a relationship to existing fire regime (Bastik, Robert. 2005. Candy kitchen community wildfire protection plan. Rio Puerco Field Office, Albuquerque District Bureau of Land Management. 4).

Bastic said the primary factor to be considered would be the FRCC and its relationship to the fire danger for homes and structures. The objective of the plan is to treat FRCC 2 and 3 sites with the goal of maximizing the sites in FRCC 1. The primary vegetative types are pinyon-juniper woodlands and grasslands, with ponderosa savannahs.

The plan identifies treatments for private properties in Candy Kitchen and adjacent BLM land. Thinning to reduce the spread of crown fires is recommended. Because of the amount of grassland within the plan area, surface fires are a risk and need to be treated with prescribed fire, mowing or livestock grazing.

The Candy Kitchen CWPP is made a part of this CWPP and located in appendix A. General recommendations made in the Cibola County CWPP, particularly related to defensible space, can be used as a supplement to the Candy Kitchen CWPP.

IX. INITIAL ATTACK AND FIRE DEPARTMENTS

All of Cibola County is divided into initial attack zones, with the responsibilities for initial attack on wildfires within a definite boundary assigned to one of the following organizations; Bureau of Land Management Rio Puerco District, Cibola National Forest, El Malpais National Monument, Laguna Agency, Ramah Navajo Agency, Southern Pueblos Agency, and the Zuni Agency (figure 10).

There are also sixteen organized fire districts within the county (figure 3), and each would respond to a wildfire within their respective boundaries. The base map shows the boundary for each of the fire districts, and the districts are: Acoma, Bluewater Acres, Bluewater Lake, Bluewater Village, Bibo & Cebolleta, Candy Kitchen, Canoncito, Cubero, El Morro Ranches, Fence Lake, Grants, Laguna, Lobo Canyon, Pine Hill, San Mateo, and San Rafael. Two of the fire districts are affiliated with other counties, the Canoncito fire district is affiliated with Bernalillo County and the San Mateo fire district is affiliated with McKinley County, and will not be addressed in this plan.

The initial attack organizations are well equipped and trained for fighting wildfire; however, the fire districts have very little equipment or training that would be appropriate for fighting a wildfire. Without appropriate wildfire fighting equipment, a fire district crew responding to a wildfire could place themselves and their equipment at risk.

The following list of training and equipment is required for a fire district to be minimally prepared for initial attack on wildland fire:

1) Initial and ongoing training for wildland fire fighting crew
2) Wildland Personal Protective Equipment (PPE) for each crew member
3) Hand tools, such as; chainsaw, shovels, axe, McLeod, etc.
4) Quick attack vehicle equipped with water tank, pump, reel hose, etc.
5) Water tanker, 2000 gallon
6) Means of communication with initial attack zone organizations
7) Global Positioning System (GPS) receiver

A. Recommendations

The detailed information developed by this plan, about threats, risks and hazards to communities in the county, indicates that each organized fire district needs to be at least minimally equipped and trained to perform initial attack on wildfire occurring within their fire district boundary.

Table 2 displays each fire district's current needs in order to become minimally prepared as an effective initial attack force.

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B. Priorities

With respect to wildfire initial attack capability, the goal of the CWPP is to move one fire district per year into the category "initial wildfire attack ready". Based on the threat level information generated through the CWPP, the following fire districts should have the higher priority for upgrade to "initial wildfire attack ready": Bluewater Acres, Candy Kitchen, El Moro Ranches, Lobo Canyon, and Pine Hill.

Serious consideration should be given to establishing organized fire districts for the areas of LaJara, Oso Ridge, and Backcountry Byways. Each of these areas has numerous homes in the vicinity, and much of the nearby wildlands are classified as very high or high threat level.

Figure 10: Initial Attack Zones

(Insert when latest version available)

X. COMMUNITY PREPARDNESS

A. Defensible Space

The traditional defensible space focuses on vegetation and the structure roof. Two factors have emerged as the primary determinants of a home's ability to survive wildfire. These are the home's roofing material and the quality of the "defensible space" surrounding it (Rogstad, Alix. 2002. University of Arizona, Cooperative Extension, College of Agriculture and Life Sciences, Creating wildfire-defensible space for your home and property).

Roofing Material: Use Uniform Building Code Class C or better rating fire-resistive materials, not wood or shake shingles, to roof homes in or near forests and grasslands (Rogstad, 2002).

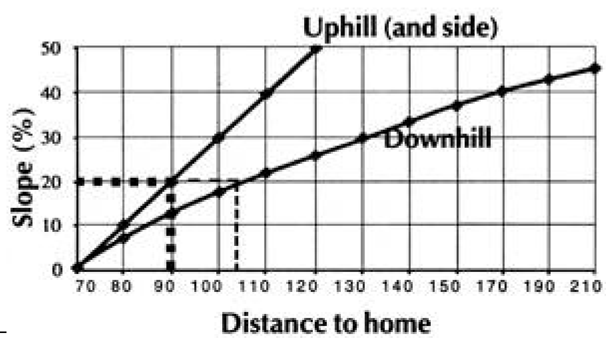
Defensible space: Defensible space is an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure. It also reduces the chance of a structure fire moving from the building to the surrounding forest. Defensible space also provides room for firefighters to do their jobs (Rogstad, 2002).

The design of defensible space depends on several factors: size and shape of buildings, materials used in their construction, the slope of the ground on which the structures are built, surrounding topography, and sizes and types of vegetation on the property (Rogstad, 2002).

Creating defensible space involves developing a series of management zones in which different treatments are used. Zone 1 is the area of maximum modification and treatment. It consists of an area of 15 feet around the structure in which all flammable vegetation is removed. The 15 feet is measured from the outside edge of the home's eaves and any attached structures, such as decks.

Zone 2 is an area of fuel reduction designed to reduce the intensity of any crown fire approaching structures. The size of Zone 2 depends on the slope of the ground where the structure is built. Typically, the defensible space should extend at least 75 to 125 feet from the structure. Table 3 can be used to determine the appropriate distance for the structure's defensible space where the structure is on sloping ground.

Table 3. Defensible Space by Slope Percent



Within this zone, the continuity and arrangement of vegetation is modified. Remove stressed, diseased, dead or dying trees and shrubs.

Zone 3 is an area of traditional forest management and is of no particular size, and extends from the edge of the defensible space to the property boundary. Tree spacing usually depends on the species involved and factors such as susceptibility to windthrow or damage from heavy snow loading. For most tree species a good rule of thumb for stem spacing is “diameter + 7”. Measure tree diameter in inches, substitute feet for the inches measured and add the 7. The resulting figure is the approximate desirable distance between trees. An example would be an 8 inch tree, add 7 to the 8 and the result is 15 foot spacing. (Rogstad, 2002). An objective for Zone 3 would be to thin the trees to the extent that the crowns are not touching.

A tool that can be used in determining the risk from wildfire to a specific structure is the Wildland Home Fire Risk Meter published by the National Wildfire Coordinating Group in 1990. With this simple meter a homeowner can quickly assess the home’s risk from wildfire. These meters are available to the fire chiefs through the Cibola County Emergency Coordinator.

Table 4 also can be used for determining defensible space. Although the zone distances and widths are different than those of Rogstad, the information is more detailed and will also help in preparing defensible space. Table 4 is from the Flagstaff Fire Department (Flagstaff, Arizona July 2002) and has been slightly modified to make it applicable to multiple communities.

Table 4. Defensible Space Fuel Management Standards

Fire ise Environment	Requirements	Recommendations	Comments
Zone 1			
0-10 feet from structure	• Remove all pine needles and flammable ground materials. • Remove all ladder fuels. • Min. 10 feet between crowns of native trees or "clumps" (max. 4 trees/clump). • Prune trees extending over eave of roof. • Remove branches within 15 feet of chimney. • Use only approved decking materials. • Use non-flammable landscape material (ex: no wooden fences, railroad ties, etc.). • Prune limbs to min. 8 feet from ground or 25% of tree height, whichever is less.	• Minimize flammable vegetation in this zone. • Maintain non-combustible ground material 2-3 feet around structure (planting beds, rock gardens, gravel or bare soil). • Keep roof and rain gutters clear of needles and leaves	Wildfire is the number 1 threat to many communities of the Southwest and Intermountain West. The goal in this zone is to reduce creeping ground fire. What is done now will greatly enhance structure survivability and firefighter safety.
Zone 2			
10-50 feet from structure	• Remove pine needles and flammable ground materials. • Remove all ladder fuels. • Min. 10 feet between stems of native trees or "clumps" (max. 5 trees/clump). • Crowns of stems or between "clumps" do not touch. • 10-15 feet between planting islands and groups of shrubs.	• Maintain low combustible ground covers. • Keep lawns watered (as conditions allow). • Consider planting beds, rock gardens, xeriscaping, and fire resistant plants. • Use bedding plants (less 18 inches high). • Consider non-flammable landscape material. • Prune native tree limbs min. 8 feet from ground or 25% of tree height, whichever is less.	The goal in this zone is to reduce radiant heat and short-range spotting.
Zone 3			
From 50 feet to property boundary	• Max. densities for native trees per local fire department, state forestry, or other "expert" (dependent upon site). • Remove all ladder fuels. • 15 feet between stems of native trees or "clumps" (max. 5 trees/clump). • 20 feet between planting islands.	• Consider coordination with neighboring properties. • Prune native tree limbs min. 8 feet from ground or 25% of tree height , whichever is less. • Store firewood and other combustibles in this zone.	Treatment in this zone will create conditions unfavorable to crown fire.

Although all communities in wooded areas are susceptible to damage and loss from wildfires, and the fact that some structures are more vulnerable than others, susceptibility to wildfire damage is not limited to wooded areas. Grass fires of short duration and low flame length can also ignite homes.

The Texas grass fires of early 2006 burned 1.6 million acres and destroyed 440 homes. Stone and brick homes with metal roofs burned, homes that at first glance would be classified as low risk. It was not a 50' wall of flames destroying the homes; it was flames from one or two inch tall grass (Weaver, Traci. 2006. A word to the firewise. Wildland Firefighter. July 2006, Volume 10, Number 7, 25-30).

Weaver said that the losses were truly an example of the home only being as strong as its weakest link. Primarily the weakest links were wood porches with no screening underneath, cedar posts and landscape timbers. Most of the losses occurred in areas with minimal amounts of vegetative fuels, and almost every loss was associated with conduction from firebrands entering open areas like attic vents, eaves and soffits, or radiant heat from short grass igniting combustible material, such as wooden decks or landscaping timbers, on or adjacent to the home (Weaver. 2006).

Of primary concern in community preparedness is an oncoming wildfire. Those in the path of a wildfire must take some kind of action, and knowing ahead of time what action to take is of great importance in protecting human life. The action can take several forms, and the two most commonly used are evacuation and safe haven or safety zones.

The traditional evacuation strategy is to remove all living beings, especially humans, from an area threatened by wildfire. This approach has been well documented to take a long time to implement and complete, and it requires tremendous human resources to be effective. In many cases, the human resources and equipment involved in these evacuations must be diverted from initial attack of the fire event, thus allowing the fire to grow beyond an early controllable size.

Contemporary evacuation strategies center on what is known as "sheltering in place". This practice relies on creating relatively safe havens for people (and animals) to go to until the main front of a fire passes. The idea is based on the theory that in many cases it is safer for evacuees to move to a safe place, such as a structure with defensible space, than it is for them to escape a fast-moving fire. There has been adequate research conducted most recently by Jack Cohen of the U.S. Forest Service that shows that the front of a passing wildfire is generally a relatively short-term event. Depending on slope and wind, the flaming front of a wildfire can pass a building within a 15-to-30 minute period. Cohen's research also shows that with a clearance of only 110 feet, a passing wildfire will not significantly ignite a structure (many of the structures lost in a wildfire are actually ignited by a creeping surface fire long after the catastrophic crown fire has passed by the area).

1. Recommendations

With availability of the latest defensible space information gleaned from the Texas grassfires, the Cibola County CWPP adds "weakest link" information to the defensible space dialogue. Homeowners should screen open areas (using 1/8 inch wire mesh) where firebrands can collect, such as wooden decks and open attic vents. Use non-flammable materials like river rock or pea gravel adjacent to any wooden aspects of the home, including decks and fences. Also cover the first few feet around the home with river rock or similar non-flammable material (Weaver. 2006).

Fire Chiefs should inventory defensible space within their jurisdiction, and periodically communicate the general conditions to the community, and specifically communicate with homeowners whose defensible space is sub-standard. Communications with private landowners should always stress that the responsibility for creating defensible space belongs to the landowner. Located in appendix B is the Firewise Communities Wildland Fire Risk and Hazard Severity Assessment form.

Accessibility for firefighters to homes is also an important factor when considering defensible space. Narrow, winding vegetation choked roads leading to a property may very well tag the home as non-defensible by a fire crew, and their reluctance to enter into an unusually dangerous situation may leave an otherwise defensible home defenseless, because firefighters could not safely get to the home.

Education is extremely important in any effort to reduce potential loss to wildfire. All landowners and homeowners need to be familiar with wildfire potential for their area, and understand what individuals can do to protect their property from loss to a wildfire. All of the needed information and materials about wildfires and property protection are available through the Firewise Communities program, and the New Mexico State Forestry Division is prepared and available to present Firewise to communities. The Cibola County Emergency Management Office should work with the State Forestry Division to set up and make Firewise presentations to the communities listed as having very high and high threat levels.

Also, because one homeowner's lack action to mitigate wildfire hazard can negatively affect the neighboring homeowner's opportunity to defend structures from wildfire, it would be beneficial to implement planning and zoning ordinances that require homeowner action with regards to defensible space. Road width for firefighting vehicles, water sources, and vegetation density are some defensible space issues that could be addressed in planning and zoning.

The covenants, conditions and restrictions (CC & R's) of a community often contain restrictions on the cutting of trees. Restrictions such as these hamper the efforts to create defensible space, and county wide zoning and planning ordinances should be implemented to address the issues involved in creating defensible space.

Future planned communities should also have CC & R's that allow for creation and maintaining defensible space as well as requiring road standards and access necessary for fighting wildland fires.

2. Priorities

This plan recommends that the fire chiefs, who have communities at risk within their jurisdiction, evaluate each community and decide upon an appropriate emergency action. The chiefs should then communicate with the public about those decisions and how to implement them.

Within the community polygons, the plan objectives for defensible space are: (1) inventory the homes and structures to determine the total number present, (2) evaluate each home and structure for defensible space and determine the number with adequate defensible space, (3) inventory and evaluation to be completed by year end 2006, and (4) goal of having 100% of homes and structures with adequate defensible space by year end 2007.

The plan objectives for homes and structures outside the community polygons but within the fire district boundary are: (1) inventory the homes and structures to determine the total number present, (2) evaluate each home and structure for defensible space and determine the number with adequate defensible space, (3) inventory and evaluation to be completed by year end 2007, (4) goal of having100% of homes and structures with adequate defensible space by year end 2008.

Gathering data for the home, structure, and defensible space inventory should be the responsibility of the fire chiefs, and could be contracted if funding is available.

The communities of Backcountry Byways, Bluewater Acres, Candy Kitchen, El Moro Ranches, LaJara, Lobo Canyon, Oso Ridge, Pine Hill, and Pine Meadow Ranches, all were identified through the planning process as communities located in areas of very high or high threat level.

For mapping purposes each community was enclosed in a polygon that generally included most of the homes in the general area, and some additional area in the direction of the prevailing winds.

The terminology for specific areas in and around a community polygon can be confusing; therefore, the following terminology will be used to identify specific areas in and around communities, homes, and structures. Zone 1 will be the term used to identify the area up to 15 feet from a structure or home. Zone 2 will be the term used to identify the area between 15 feet and 125 feet from a structure or home. Zone 3 will be the term used to identify the area inside the community polygon that is further than 125 feet from a structure or home. Zone 3 can extend beyond the community polygon when conditions warrant.

The area within each community polygon was analyzed for the amount of very high and high threat level. Table 5 shows acres by threat level for each community.

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The community of Candy Kitchen was included in the table for the purpose of comparison, and has appropriate planning in the Candy Kitchen CWPP.

Any attempt to rank the communities in an order of priority for treatment would be inappropriate because it is not possible to say one person's home is more expendable than another's. However, those communities with limited and/or constricted travel routes that create for difficult or dangerous evacuation in the event of a wildfire should receive extra consideration. Early fuels treatment in these communities and their surrounding area may prevent a dangerous evacuation necessity. The communities with limited and/or constricted travel routes are: LaJara, Lobo Canyon, and Oso Ridge, and they should be given the highest priority for fuels treatment.

Simply listing the number of very high and high threat level acres demonstrates the magnitude of the need for fuels treatment. The communities combined have 19,425 acres in the very high threat level and 10,851 acres in the high threat level.

The wildland areas in and adjacent to these communities should be treated for fuels reduction as quickly as resources allow. In a fuels treatment prescription that uses prescribed burn as the primary tool, a reasonable time schedule should be approximately the same as the time period of effectives for a prescribed burn (2-to-4 years).

This plan has an expectation for a restoration type fuels treatment, within the very high and high threat level areas of the at risk community polygons, to be completed within a five year period. To achieve the CWPP time frame, the average number of acres treated each year will be approximately 6,055.

There are also many homes and structures that were not included in the community polygons because they were not situated in a group or cluster of homes. Some of these homes and structures are located in areas identified and mapped as very high or high threat level. The Zone terminology used for the communities within map polygons will also apply to these individual homes and structures, but with a modification to the Zone 3 definition. For those structures and homes outside community polygons: Zone 3 will be the area further than 125 feet from a structure or home and will extend into the surrounding area. The distance Zone 3 extends into the surrounding area will vary with geographic features, prevailing winds, vegetation type, vegetation density, fuel load, etc. The intend is for Zone 3 to be a sufficiently large area, with a high crowning index, so as to prevent a crown fire from entering Zone 2. Generally an active crown fire will cease spreading after traveling about 300 feet through an area with low canopy density, high crowning index, and an absence of ladder fuels. With the cumulative distances of the zones in mind, the outer edge of Zone 3 will be approximately 440 feet from a structure or home, but extreme conditions could require that Zone 3 be ½ mile or more wide.

A fuels treatment prescription that is comprehensive and includes thinning, restoration, and prescribed burn and/or mastication would still have the urgency of treating the acres as quickly as possible. The return interval for comprehensive treatment would be much longer than prescribed burn only, as the effective time period of a comprehensive treatment is longer than for prescribed burn only.

XI. COMMUNICATION SITES

Functioning communication sites are essential during day to day activities, and become critical during an emergency. Wildfire can damage the structures on a communication site to the extent that the communication equipment can become inoperable. One often overlooked consideration is the guy lines attached to towers. Heat from a wildfire can affect the strength of guy lines, and high winds normally associated with a wildfire exacerbate the concerns of tower safety.

Eleven communication sites were identified during the planning process, and they should be treated with the same consideration as defensible space near homes and structures. Guy line anchor points should also be treated as structures.

XII. EL MALPAIS NATIONAL MONUMENT

The El Malapis National Monument is a unique area with numerous cultural sites scattered throughout and warrants separate consideration within this plan. The threat level acres for the monument are 43,434 in the high threat category and 54,026 in the medium threat level. The entire monument is a value at risk, and the combination of threat level analysis and values at risk results in the 43,434 acres of high priority area being classified as a high priority for fuels reduction.

The monument has developed a Fire Management Plan that is comprehensive and detailed, and should be the primary source for procedures and planning on the monument.

XIII. WATERSHEDS

Many of the unique features of forest soils, and consequently watersheds, such as the forest floor, decaying debris, and cycling of nutrients, can be dramatically altered by severe wildfire. When soils and vegetation change within a watershed, the very nature of that watershed also changes. Abrupt and large scale changes within a watershed can so alter the characteristics of the watershed that the outputs that were so valued now become a liability.

Wildfire is the forest disturbance that has the greatest potential to change watershed conditions. It is not fire per se, but the intensity and duration of burning that influences the severity of soil and hydrologic effects (Ice, George G., Daniel G. Neary, and Paul W. Adams. 2004. Effects of wildfire on soils and watershed processes. Journal of Forestry (September): 18-20.

Ice et al. (2004) stated that several key watershed processes can be significantly altered by wildfire, such as dry ravel, infiltration and runoff, surface erosion, slope failure and debris torrents, and stream sediment. Of particular importance to the Cibola CWPP are infiltration and runoff, and surface erosion, because these are integral with flooding and sedimentation, especially with the occurrence of high intensity thunderstorms after the fire.

The impact of a wildfire in a watershed can be described as changing the 100-year flood interval from a pre-fire 100 years to a post-fire 5 year interval. In other words, a watershed suffering a severe wildfire will probably experience a 100-year flood within five years after the wildfire (Kuyumjian, Greg. 2006. U.S.D.A., Forest Service, Los Alamos, NM. Personal conversation May 9).

Studies have shown that after a wildfire the sedimentation rate increases considerably. An example is the report on New Mexico's Cerro Grande Fire of 2000, where, during the first year after the fire, sediment was deposited into the Los Alamos Reservoir at a rate 450 times greater than the pre-fire sedimentation rate (Lavine, Alexis, G.A. Kuyumjian, S.L. Reneau, D. Katzman, and D.V. Malmon. A five-year record of sedimentation in the Los Alamos Reservoir, New Mexico, following the Cerro Grande Fire. Los Alamos National Laboratory and U.S. Forest Service. Paper presented at the joint eighth federal interagency sedimentation conference and third federal interagency hydrologic modeling conference. April 2-6, 2006. Reno, Nevada).

Such flooding and sedimentation can reduce the storage capacity of a reservoir quickly and dramatically as experienced by the approximately 33% capacity reduction in the Strontia Springs Reservoir in Colorado after the 1996 Buffalo Creek Fire, (Benavides-Solorio, Juan and Lee H. MacDonald. 2001. Post-fire runoff and erosion from simulated rainfall on small plots, Colorado front range. Hydrological Processes. 15: 2931-2932).

Because of the effect an intense long burning wildfire can have on the soil and the potential losses from an unusually severe flood, protecting critical watersheds from intense wildfire is important to downstream resource users and residents. Considering that wildfires do occur regardless of efforts to prevent them, protection of the critical watersheds is best accomplished by creating and maintaining conditions that minimize the duration and intensity of a wildfire.

An evaluation of a watershed in relation to potential loss from severe wildfire must consider at the very least: 1) presence of human structures, 2) reservoirs and uses of water, 3) total area of the watershed, 4) area of the various threat levels, 5) percentage of watershed in the various threat levels, 6) topography and soils, 7) potential natural vegetation, and 8) potential downstream impacts from flooding.

A. Recommendations

The CWPP identifies ten watersheds (Acomita Reservoir, Bluewater Creek, Cottonwood Creek, Grants Canyon, Laguna, Lobo Canyon, Ramah Reservoir, San Mateo Canyon, San Rafael, and Water Canyon at Cubero) that are considered as values, and consequently received evaluation as to threat level and priority of treatment.

The watersheds were mapped and evaluated, and then combined with the threat level map. The result was a map showing the location and extent of the various threat level categories (figure 9).

Table 6 shows the number of acres in each threat level as well as the percentage of the total watershed represented by that threat level.

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A scoring system that rated the watersheds relative to one another was developed and those scores were used to produce a fuel treatment priority list.

First the watersheds were ranked (1 to 10) based on number of acres in the very high threat level. A score of ten was given to the watershed with the largest number of very high threat level acres, and a score of one given for the least number of acres in the very high threat level, with the rest of the watersheds falling in between. Next the procedure was repeated for the high threat level. The relative size of the very high and high threat level areas was also used in the scoring. The procedure calculated the percentages of a particular watershed's acres that were classified as very high threat level and high threat level, and the same 1 to 10 relative scoring system used to rank the watersheds in those two categories.

An additional 10 points were granted to a watershed if it had a community within its boundary, and another 10 points if the watershed had either a significant reservoir or flooding potential to damage or destroy a large number of structures.

B. Priorities

The scores were accumulated and the watersheds ranked by score. The higher the combined score the more urgent is the need for fuels treatment. Table 7 shows the scoring and suggested treatment priority order.

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The Bluewater Creek and Cottonwood Creek watersheds scored the highest and received a priority ranking of 1 and 2 respectively, and treatments within those watersheds are covered in the Bluewater Restoration Project.

Lobo Canyon and Ramah watersheds are the next highest ranking watersheds and their 23,255 acres (rated as very high and high threat levels) should be treated for fuels reduction as soon as is practical.

Grants Canyon and Water Canyon at Cubero are the next watersheds on the priority list, and their 21,557 acres of very high and high threat level should be treated with at least a prescribed burn as soon as practical.

A comprehensive treatment on the watersheds should have a treatment return interval of about 25 years, and a prescribed burn only treatment would have a treatment return interval of about 5 years.

Plan expectation for implementing fuel treatment in the very high and high threat areas of the watersheds is for the treatment to be completed within 10 years. The treatment scheduling will generally follow the Fuels Treatment Priority list, and will average about 17,600 acres per year.

Historically, funding to treat watersheds for fuels reduction has not been available; however, there is a need for fuels reduction, and land managers and owners should seek funding that will result in protection of the watershed resource.

The county emergency management office will convene the core group yearly to review and monitor the watershed treatment acres, and recommend adjustments to the CWPP.

Compiling the information about treatment acres will be the responsibility of the county emergency management office.

XIV. MONITORING

The monitoring section of this plan addresses how results will be measured against the plan; however, monitoring efforts can be made so complex that the actual monitoring could become cost prohibitive. The core group decided to make the monitoring as simple as possible and still yield useful data.

The Cibola County CWPP addresses three different sets of conditions that need monitoring; (1) Zone 3, (2) watersheds, and (3) Zones 1 & 2. Each of these conditions requires different monitoring methods and standards.

A. Zone 3

For Zone 3, the number of acres treated each year compared to the total number of very high and high threat level acres (in the communities at risk polygons) will be the measure tracked by the monitoring process. The number of acres treated each year on government managed lands will be readily available from the various land managers. Tracking acres treated on private property will require additional effort, but any treatment will probably be part of a larger cooperative effort and results should be readily available.

The Cibola County Emergency Coordinator will monitor the number of acres treated, and compare that to the total of 30,336 acres of very high and high threat level needing treatment in Zone 3 of the communities. The plan target is for an average of 6,067 acres to be treated each year. Also to be monitored in the Zone 3 category is the 25,407 acres at Candy Kitchen in the very high and high threat level. Table 8 can be used as a form for tracking results in Zone 3 of the communities.

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B. Watersheds

The watershed acres of very high and high threat level are almost all on national forest on Mt. Taylor or in the Zuni Mountains. There are 175,925 watershed acres that are in need of fuels treatment, and the plan time frame of 10 years will result in an average of 17,600 acres per year treated. The Cibola County Emergency Coordinator will track the number of watershed acres treated annually, and compare that to the total in need of treatment. Table 9 can be used to track fuels treatment in the watersheds.

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C. Defensible Space

Monitoring for the defensible space category (Zones 1 & 2) will be the percent of homes and structures that have completed an acceptable defensible space program. The baseline will be established by Fire Chiefs, and will be the total number of homes and structures within the community polygons, and the number of homes and structures that have adequate defensible space.

Each year the fire chiefs will assess the change in the number of homes and structures, and the status of the defensible space within the community polygons. The percentage of structures with adequate defensible space will be the measure used to determine plan success and to compare community preparedness one year to the next.

The fire chiefs will report home and structure inventory results to the county emergency management office on a yearly basis. Table 10 could be used as part of the defensible monitoring process.

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Homes and structures outside the community polygons also must be inventoried and rated for defensible space. Collection of this information should begin when the inventory of the community polygons is complete. Each fire district will inventory the homes and structures within their district boundary, and report the information to the county emergency management office.

APPENDIX A

- NO ELECTRONIC COPY -

HARD COPY ONLY -

APPENDIX B

Wildfire Hazard Severity
Form Checklist

Subdivision Quarter Quad Name

Street Fire District

Examiner Date

WILDFIRE HAZARD SEVERITY FORM CHECKLIST

(Check off the most appropriate element in each category and add the point totals)

Element **A. Means of Access**	**Points**	**SEC/House #**	**SEC/House #**	**SEC/House #**	**SEC/House #**
1. Ingress and egress					
a. Two or more roads in/out	**0**				
b. One road in/out	**7**				
2. Road width					
a. ≥ 6.1m (24 ft.)	**0**				
b. ≥ 6.1m (20 ft.) and <7.3m (24 ft.)	**2**				
c. < 6.1m (20 ft.)	**4**				
3. All-season road condition					
a. Surfaced road, grade < 5%	**0**				
b. Surfaced road, grade > 5%	**2**				
c. Non-surfaced road, grade < 5%	**2**				
d. Non-surfaced road, grade > 5%	**5**				
e. Other than all-season	**7**				
4. Fire Service Access					
a. ≤ 91.4m (300 feet) with turnaround	**0**				
b. > 91.4m (300 feet) with turnaround	**2**				
c. < 91.4m (300 feet) with no turnaround	**4**				
d. ≥ 91.4m (300 feet) with no turnaround	**5**				
5. Street signs					
a. Present [10.2cm (4 in.) in size & reflectorized]	**0**				
b. Not present	**5**				
B. Vegetation (Fuel Models)					
1. Characteristics of predominate vegetation within 91.4m (300 ft.)					
a. Light (e.g., grasses, forbs, sawgrasses, and tundra) NFDRS Fuel models A, C, L, N, S, and T	**5**				
b. Medium (e.g., light brush and small trees) NFDRS Fuel models D, E, F, H, P, Q, and U	**10**				
c. Heavy (e.g., dense brush, timber, and hardwoods) NFDRS Fuel models B, G, and O	**20**				
d. Slash (e.g., timber harvesting residue) NFDRS Fuel models J, K, and L	**25**				
2. Defensible space					
a. > 30.48 m (100 ft.) of vegetation treatment from the structure(s)	**1**				
b. 21.6 - 30.48m (71-100 Ft.) of vegetation treatment from the structure(s)	**3**				
c. 9.1-21.3m (30-70 Ft.) of vegetation treatment from the structure(s)	**10**				
d. <9.1m (30 ft.) of vegetation treatment from the structure(s)	**25**				

Element **C. Topography within 91.4m (300 ft.) of structure(s)**	**Points**	**SEC/House #**	**SEC/House #**	**SEC/House #**	**SEC/House #**
1. Slope < 9%	**1**				
2. Slope 10% to 20%	**4**				
3. Slope 21% to 30%	**7**				
4. Slope 31% to 40%	**8**				
5. Slope >41%	**10**				
D. Additional Rating Factors (rate all that apply)					
1. Topography features that adversely affect wildland fire behavior	**0-5**				
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations (e.g., heavy lightning, railroads, escaped debris burning, arson)	**0-5**				
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	**0-5**				
4. Separation of adjacent structures that may contribute to fire spread	**0-5**				
E. Roofing Assembly					
1. Class A roof	**0**				
2. Class B roof	**3**				
3. Class C roof	**15**				
4. Non-rated	**25**				
F. Building Construction					
1. Materials (predominate)					
a. Noncombustible/fire resistive siding, eaves & deck	**0**				
b. Noncombustible/fire resistive siding, combustible deck	**5**				
c. Combustible siding and deck	**10**				
2. Building setback relative to slopes of 30% or more					
a. ≥ 9.1m (30 ft.) to slope	**1**				
b. < 9.1m (30 ft.) to slope	**5**				
G. Available Fire Protection					
1. Water source availability					
a. Pressurized water source availability					
1892.7 lpm (500 gpm) hydrants ≤ 304.8m (1000 ft.) apart	**0**				
946.4 lpm (250 gpm) hydrants ≤ 304.8m (1000 ft.) apart	**1**				
b. Non-pressurized water source availability (off site)					
≥ 946.4 lpm (250 gpm) continuous for 2 hours	**3**				
< 946.4 lpm (250 gpm) continuous for 2 hours	**5**				
c. Water unavailable	**10**				
2. Organized Response Resources					
a. Station ≤ 8 km (5 mi.) from structure	**1**				
b. Station > 8 km (5 mi.) from structure	**3**				
3. Fixed Fire Protection					
a. NFPA 13, 13R, 13D sprinkler system	**0**				
b. None	**5**				
H. Placement of Gas and Electric Utilities					
1. Both utilities underground	**0**				
2. One underground, one above ground	**3**				
3. Both above ground	**5**				
I. Totals for Home or Subdivision (Total for all above points)					
1. Low Hazard: < 40 points 2. Moderate Hazard: 40-69 points 3. High Hazard: 70-112 points 4. Extreme Hazard: >112 points					

GLOSSARY

Basal Area (BA): The area of the cross-section of a tree trunk near its base, usually 4½ feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective basal area of trees per acre.

Biodiversity (biological diversity): The variety of life and its process, including the variety in genes, species, ecosystems, and the ecological processes that connect everything in the ecosystem.

Coarse-filter analysis: An analysis of aggregates of elements such as cover type or plant community.

Community protection: Actions or programs undertaken for the purpose of protecting human lives, property, and infrastructure.

Conservation: The careful protection, utilization and planned management of living organisms and their vital processes to prevent their depletion, exploitation, destruction, or waste.

Critical habitat: According to Federal Law, the ecosystem upon which endangered and threatened species depend.

Cro n fire: This is a fire that travels from one crown (or tree top) to another in dense stands of trees, killing most trees in its path. However, even in intense crown fires, unburned strips may be left due to powerful, downward air currents. A passive (or dependent) crown fire relies upon heat transfer from a surface fire burning below crowns. An active (or independent) crown fire does not require transfer of heat from below the crowns.

Defensible space: This is the area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure. It also reduces the chance of a structure fire moving from the building to the surrounding forest. Defensible space provides room for the firefighters to do their jobs. Many communities are taking a more holistic approach of creating defensible neighborhoods rather than just individual properties.

Disturbance: A discrete event, either natural or human induced, that causes a change in the existing condition of an ecological system.

Ecosystem: Living organisms interacting with each other and with their physical environment, usually described as an area for which it is meaningful to address these interrelationships.

Ecological restoration: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Fire Behavior: As utilized throughout this plan –

> *Active Fire Behavior* = Fires readily transition into tree crowns, with large group tree torching common: associated long-range (.5 mile) spotting is common
>
> *Passive Fire Behavior* Fires will transition into tree crowns, but only small-group or individual tree torching common: associated long-range spotting (.5 miles) can occur
>
> *Surface Fire Behavior* Fires stay on the ground, with little tendency to transition into tree crowns except in isolated cases: short-range spotting (mile) can occur

Fire Frequency (Fire Return Interval): How often fire burns a given area; often expressed in terms of fire return intervals (e.g., fire returns to a site every 5-15 years). (see also Fire Regime Group).

Forest ecosystem health: A condition where the parts and functions of an ecosystem are sustained over time and where the system's capacity for self-repair is maintained, allowing goals for uses, values, and services of the ecosystem to be met.

Forest ecosystem restoration: Holistic actions taken to modify an ecosystem to achieve desired, healthy, and functioning conditions and processes. Generally refers to the process of enabling the system to resume acting, or continue to act, following the effects of a disturbance. Restoration management activities can be active (such as control of invasive species, thinning of over-dense tree stands, or redistributing roads) or more passive (more restrictive, hands-off management direction that is primarily conservation oriented). Frequently, a combination or number of actions is used sequentially to achieve restoration goals.

Hazard: To place something of value in a risky or dangerous situation

Hazardous fuel: Excessive live and dead trees and other vegetation and organic debris that increase the potential for uncharacteristically intense wildland fire and decrease the capability to protect life, property, and natural resources.

Healthy ecosystem: An ecosystem in which structure and functions allow the maintenance of the desired condition of biological diversity, biotic integrity, and ecological processes over time.

Old gro th tree: This is an old tree, one that exhibits the complex structural characteristics associated with the oldest age class of trees in a group, clump or stand. In today's forests, an old growth tree is one that has been present since before the onset of commercial logging and fire exclusion. These trees are sometimes referred to as pre-settlement trees. These trees typically have orange or yellow platy bark.

Prescribed fire: A management fire ignited to meet specific fuel reduction or other resource objectives. All prescribed fires are conducted in accordance with prescribed fire plans.

Risk to communities: The risk associated with adverse impacts to communities resulting from unwanted wildfire.

Reference conditions: Conditions characterizing ecosystems composition, structure, and their variability.

Restoration: Actions taken to modify an ecosystem in whole or in part to achieve a desired condition.

Surface fire: A fire that burns over the forest floor, consuming litter, killing aboveground parts of herbaceous plants and shrubs, and typically scorching the bases and crowns of trees.

Sustainability: The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

Threat: An indication that an undesirable event or catastrophe may occur. For this plan, a Threat matrix, using three items, was developed to permit focus upon the Interface Zone.

> *Value* – The measure of how strongly something is desired, expressed in terms of effort, money, etc. one is willing to expend to attain or preserve it. Two issues (Communities and Infrastructure, and Municipal Watersheds) were identified in this plan.
>
> *Risk* – The possibility of danger, injury, or loss. Two issues (Predicted Fire Behavior and Post-Fire Flooding) were identified in this plan.
>
> *Other* – Further or additional issues. One item (Areas upwind from at-risk communities permitting fire spread into at-risk communities) was identified in this plan.

Treatment Types (potential): These are general descriptor terms only, not silvilcultural terms.

Thinning Intensity:

Low	Simple thinning, with prescribed fire
Intermediate	Moderate thinning, with prescribed fire
High	Heavy thinning with prescribed fire

Prescribed Fire only (Rx):

Light	No mechanical thinning: maintenance burn (one goal is lower tree mortality) or sites with light fuels (less intense fire)
Heavy	No mechanical thinning (required or practical): thin with fire (one goal is higher tree mortality) or sites with heavy fuels (more intense fire)

Watershed: An area of land with a characteristic drainage network that contributes surface or groundwater to the flow at that point; a basin or a major subdivision of a drainage basin.

Wildland fire use: The management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in pre-defined geographic areas outlined in Fire Management Plans.

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