Draft Updated Central Navajo County Community Wildfire Protecton Plan

April 2016

Navajo County

Town of Snowflake

Town of Taylor

Taylor & Snowflake Fire & Medical Department

White Mountain Lake Fire District

Apache-Sitgreaves National Forests

Arizona State Forestry Division

Bureau of Land Management

Chevelon- Halter Cross ◆ Snowflake ◆ Silver Lake Estates

Taylor ◆ Shumway

White Mountain Lake ◆ Silver Lake Estates

SEAL OF NAVAJO COUNTY ARIZONA

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LIST OF ABBREVIATIONS

ASLD	Arizona State Land Department
ASFD	Arizona State Forestry Division
A-SNFs	Apache-Sitgreaves National Forests
BA	basal area
BLM	Bureau of Land Management
CWPP	community wildfire protection plan
drc	diameter at root collar
FRCC	fire regime condition class
GIS	geographic information system
GPS	Global Positioning System
HFRA	Healthy Forests Restoration Act of 2003
IGA	intergovernmental agreement
IMS	Federal Wildland Fire Occurrence Internet Mapping Service
ISO	Insurance Services Office
NCEM	Navajo County Emergency Management
PPE	personal protective equipment
SR	state route
SWReGAP	Southwest Regional Gap Analysis Project
TES	Threatened, endangered, and sensitive species
USDA	US Department of Agriculture
USDI	US Department of the Interior
USFS	US Forest Service
WUI	wildland-urban interface

EXECUTIVE SUMMARY: CENTRAL NAVAJO COUNTY COMMUNITY WILDFIRE PROTECTION PLAN

The existing Central Navajo County Wildfire Protection Plan (Central Navajo County CWPP) for at-risk communities in central Navajo County was developed in 2009 in response to the Healthy Forest Restoration Act (HFRA) of 2003, and due to the proximity of these communities to landscape scale fires. The 2009 Central Navajo County CWPP is compliant with HFRA and was designed to support the efforts of local land managers (both public and private) to identify and mitigate hazards to private property, community infrastructure and ecosystem health from wildfire in the wildland-urban interface (WUI). The Central Navajo County CWPP established goals and objectives to reduce wildland fire threat to at-risk communities, and also to "promote education of local citizens about wildfire issues and encourage each individual to make wildfire protection a personal responsibility"(Navajo County 2009). Since the approval of the 2009 Central Navajo County CWPP, residents, governments, and agencies have worked collaboratively to achieve the goals established in the 2009 Central Navajo County CWPP. However, the WUI continues to grow; new residents continue to arrive; the drought persists; and concepts, tools, and public attitudes related to wildland fire risk assessment and to wildland fuels and forest ecosystem management are evolving—all resulting in changing views from "protection from wildfire" to "preparation for wildfire."

Navajo County believes that the protection of life and property from wildland fire involves a comprehensive approach from a single home site to the entire community that abuts wildlands. Navajo County believes that a community-wide approach to creating fire-adapted communities (http://www.fireadapted.org/) is a new path forward, and a new way of thinking about wildland fire which reduces dependency on suppression. Such fire-adapted communities are composed of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire through preparation.

The 2009 Central Navajo CWPP was developed as a collaborative effort between the fire departments associated with the communities of Snowflake, Taylor, and White Mountain Lake Estates, as well as Navajo County Emergency Management (NCEM), Apache-Sitgreaves National Forests (A-SNFs), Bureau of Land Management (BLM) Gila District, the Arizona State Forestry Division (ASFD), and the University of Arizona.

Navajo County reinitiated the collaborative planning process in 2015 for this update and revision by soliciting participation in the Core Planning Team (Core Team) from the original 2009 collaborative process. In response, a Core Team composed of representatives from the NCEM, A-SNFs, BLM, local fire departments, communities, and interested parties has been re-formed to guide and provide direction for the 2016 Central Navajo CWPP. The Core Team followed essentially the same planning process in the revision and update of the 2009 Central Navajo CWPP.

Section I. Introduction

A primary objective of a CWPP is to help local governments, fire departments and districts, and residents identify at-risk public and private lands to better prepare those lands from severe wildfire threat. Additional functions of a CWPP are to improve fire prevention and suppression activities, as well as to identify funding needs and opportunities to reduce the risk of wildland fire and enhance public and firefighter safety. Identifying at-risk areas and improving fire protection capabilities helps the communities to prioritize high-risk projects and to expedite overall project planning. The 2009 Central Navajo County CWPP met all criteria of HFRA and was developed through a coordinated and collaborative performance-based framework of recommendations designed to meet its outlined goals.

The Core Team recommended additional goals to be considered for the 2016 Central Navajo County CWPP to reduce the risks to life and property from catastrophic wildland fire:

- Improve fire prevention and suppression, emphasizing firefighter and public safety
- Reduce hazardous fuels, emphasizing public and private property protection
- Restore forest, rangeland, and riparian health
- Promote community involvement and provide for community protection
- Recommend measures to reduce structural ignitability in the WUI
- Encourage economic development in the communities from vegetative treatments
- Use the CWPP in conjunction with surrounding community and agency fire management plans
- Encourage high-risk communities to become fire-adapted communities
- Reduce potential economic loss to communities from unwanted wildland fire
- Work with elected officials to develop opportunities for enhance funding through national, state and local sources for implementing the action recommendations of the Central Navajo County CWPP
- Work with local, state, and federal agencies to support the growth of forest industry and forest products to ensure infrastructure is in place to conduct landscape-level forest restoration and community wildfire preparedness objectives

Action recommendations for at-risk areas within the Central Navajo County CWPP WUI boundaries have been reviewed and updated where needed as part of the planning process. Treatments for wildland vegetative fuels and additional wildland fire mitigation measures are recommended to be implemented in specific time frames and with associated monitoring to determine and document measurable outcomes. Successful implementation of the Central Navajo County CWPP will require collaboration between fire departments and districts, governments, resource-management agencies, and private landowners. The cooperating agencies should develop processes and systems that allow recommended actions of the Central Navajo County CWPP to comply with applicable local, state, and federal environmental regulations.

Section II. Community Assessment

Section II covers the methods used in community wildfire risk assessments; the identification of the WUI; and the identification of communities with high, moderate, and low wildland fire risk within the WUI. The 2009 Central Navajo County CWPP working group identified specific WUI boundaries that were determined by proximity to population centers and with respect to identified values at risk. The 2009 WUI boundaries covered "248,486 acres, 29% of the planning area and were separated into four separate WUI sub areas: the Snowflake-Silver Lake WUI, the Chevelon-Halter Cross WUI, the Wood Products WUI and the East of Snowflake (EOS) WUI. Each sub area boundary was drawn around geographically grouped communities, key infrastructure or values at risk" (Navajo County 2009).

The 2009 and 2016 Central Navajo County CWPPs were developed through quantitative analyses of wildland fire risk within central Navajo County, designing mitigation measures and priority needs to implement mitigation measures, whether for wildland fire fuel manipulations, resource response, reduced structural ignitibility, or public education and outreach.

During the review and revision of the Central Navajo County CWPP, the Core Team has determined the community wildfire risk assessment would comprise the following assessments:

- *Wildland Fire Threat*—the probably and intensity of an area burning
- *Wildfire Effects*—the community values at risk from wildfire
- *Wildfire Risk*—an analysis of where the potential for catastrophic wildland fire occurs adjacent to or within areas of high community values that may be effected by wildfire within the central Navajo County community WUIs identified by the Core Team.

This risk analysis was developed to closely tie to the future Arizona Wildfire Risk Assessment Portal (AZ WRAP) (https://azsf.az.gov/fire/prevention/az-wrap). The 2016 Central Navajo County CWPP incorporates the current fire regime condition class, wildfire fuel hazards, risk of ignition, local preparedness and protection capabilities, and at-risk community values. The Core Team reviewed the Arizona State Forester's *Identifying Arizona's Wildland/Urban Interface Communities at Risk: A Guide for State and Federal Land Managers* (ASFD 2007) to allow the Central Navajo County CWPP to be compatible with and complementary to statewide CWPP planning efforts. The Core Team has included all risk factors required by the Arizona State Forester in the analysis and revision of this CWPP. The areas of concern for wildland fuel hazards, risk of ignition and wildfire occurrence, local preparedness and protection capabilities, and loss of community values were evaluated to determine areas of highest wildfire risk.

These elements were all identified and combined using spatial analysis within a geographic information system (GIS). As a result of the GIS analysis, a WUI and sub-WUI boundary map and a wildfire risk rating map were created. Sub-WUIs were divided into treatment management areas, according to high, moderate, and low wildfire risk. The Central Navajo County CWPP analysis consisted of 2,631,366 acres of federal, state, and private lands, of which approximately 252,021 acres were classified as the

WUI, slightly larger than the 248,486 acres of WUI identified in the 2009 Central Navajo County CWPP. Wildfire Risk levels across the Central Navajo County CWPP WUIs include 17 acres(<1 percent) of high wildland fire risk, 50,384 acres (20 percent) of moderate risk, and 201,619 acres (80 percent) of low risk.

Section III. Community Mitigation Plan

Section III prioritizes the areas in need of wildland fuel mitigation and recommends the types and methods of treatment and management necessary to mitigate the potential for wildland fire in the WUI. Also presented in this section are the Central Navajo County CWPP recommendations for enhanced wildland fire protection capabilities; public education, information, and outreach; and support for businesses and industries centered on local wood products, woody biomass, and wildland vegetative fuel management.

As part of the community mitigation plan, the Core Team identified the Central Navajo County CWPP administrators—central Navajo County fire chiefs, NCEM, ASFD, BLM, A-SNFs, community members, concurring agencies, county and local planning and zoning departments, and members of the Core Team —who will be mutually responsible for implementing and monitoring Central Navajo County CWPP action recommendations in coordination with the future-established countywide community CWPP working group. Central Navajo County CWPP administrators are responsible for ensuring implementation of the Central Navajo County CWPP, for preparing reports and work plans, and for developing community bulletins and public service announcements that inform residents of wildfire dangers and preventive measures. Additional tasks include assisting federal and state agencies and private landowners to identify appropriate funding sources to implement action recommendations of the Central Navajo County CWPP, as well as continued coordination with communities outside the analysis area. Central Navajo County CWPP administrators are also responsible for the monitoring and reporting of implementation actions that will allow for enhanced coordination of management programs and that will reduce inconsistencies among local, state, and federal agencies.

To prioritize treatments, the Core Team identified 10 wildland treatment management units within 4 WUI subareas. These treatment units were analyzed and categorized according to potential risk for wildfire. The Core Team ranked then provided a recommendation for each unit's preferred treatment type and method. Preferred treatments were recommended for treatment management units identified as high, moderate, and low risk. These treatments are designed to meet the fuel reduction and modification objectives of the Central Navajo County CWPP.

Section IV. Central Navajo County CWPP 2016 Priorities: Action Recommendations and Implementation

To achieve the goals outlined in the CWPP, the Core Team identified priority action recommendations, which are presented in Section IV. The first action recommendation was to identify priority treatment areas for fuel reduction projects. Treatment areas were identified within community WUIs to create survivable space through treatments within the home ignition zone, the use of strategically placed

fuelbreaks, and the modification of hazardous wildland fuels. The objective of a fuels reduction project is to create an acceptable vegetation condition class for community and infrastructure protection, as well as public and firefighter safety. Table 4.1 in Section IV lists the priority action recommendations for the reduction of hazardous fuels within the Central Navajo County CWPP area based on treatment areas identified in Section III. The second action recommendation identified by the Core Team was to reduce structural ignitability. Reduction of structural ignitability is achieved through evaluation; maintenance; and, at times, upgrades to community response facilities, capabilities, and equipment. The third action recommendation identified was to promote community involvement through education, information, and outreach.

Section V. Monitoring Plan

The monitoring plan, outlined in Section V, describes how monitoring the implementation of the revised Central Navajo County CWPP will occur. The Central Navajo County CWPP administrators are responsible for implementation and monitoring. Implementation begins by securing grants and other funding necessary to execute the action items.

The Central Navajo County CWPP administrators will report successful grant awards and projects implemented as a result of those awards to the CWPP signatories. The administrators will also update work plans based on projects completed in the previous years.

Acknowledgments

The following communities and agencies were involved in the collaborative process in preparation of and are assisting, as appropriate, in the revision and update of the Central Navajo County CWPP:

- Navajo County Office of Emergency Management
- Municipal fire departments and local fire districts and fire chiefs from the following communities:
  - Taylor and Snowflake Fire and Medical Department
  - White Mountain Lake Fire Department
- Arizona State Forestry Division
- US Department of the Interior, Bureau of Land Management
- US Forest Service, Apache-Sitgreaves National Forests

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I. INTRODUCTION

The existing Central Navajo County Wildfire Protection Plan (Central Navajo County CWPP) for at-risk communities in central Navajo County was developed in 2009 in response to the Healthy Forest Restoration Act (HFRA) of 2003 and due to the proximity of these communities to landscape-scale fires. The 2009 Central Navajo County CWPP is compliant with HFRA and was designed to support the efforts of local land managers (both public and private) to identify and mitigate hazards to private property, community infrastructure, and ecosystem health from wildfire in the wildland-urban interface (WUI). The Central Navajo County CWPP established goals and objectives to reduce wildland fire threat to at-risk communities and also to "promote education of local citizens about wildfire issues and encourage each individual to make wildfire protection a personal responsibility" (Navajo County 2009). Since the approval of the 2009 Central Navajo County CWPP, residents, governments, and agencies have worked collaboratively to achieve the goals established in that CWPP. However, the WUI continues to grow; new residents continue to arrive; the drought persists; and concepts, tools, and public attitudes related to wildland fire risk assessment and to wildland fuels and forest ecosystem management are evolving—all resulting in changing views from "protection from wildfire" to "preparation for wildfire." Therefore, Navajo County has determined that the 2009 Central Navajo County CWPP should be reviewed and, where necessary, revised to provide a higher level of community protection and preparation for unwanted wildland fire. Navajo County believes that the protection of life and property from wildland fire involves a comprehensive approach from a single home site to the entire community that abuts wildlands. Navajo County believes a community-wide approach to creating fire-adapted communities (http://www.fireadapted.org/) is a new path forward and a new way of thinking about wildland fire, which reduces dependency on suppression. Such fire-adapted communities are composed of informed and prepared citizens collaboratively planning, preparing, and taking action to safely coexist with wildland fire. Additionally, Navajo County supports a regional approach to preventing and preparing for unwanted wildlife to at-risk communities. Navajo County has agreed to mutually reestablish the Central Navajo County CWPP planning team and to identify and expand, where necessary, community wildfire protection and preparation on a regional level (Figure 1.1).

A. Background

Navajo County fully supports the tenants of the National Cohesive Strategy, which establishes a national vision for wildland fire management, defines national goals, describes the wildland fire challenges, identifies opportunities to reduce wildfire risks, and establishes national priorities focused on achieving the national goals. The National Cohesive Strategy explores four broad challenges:

1. Managing vegetation and fuels
2. Protecting homes, communities, and other values at risk
3. Managing human-caused ignitions
4. Effectively and efficiently responding to wildfire

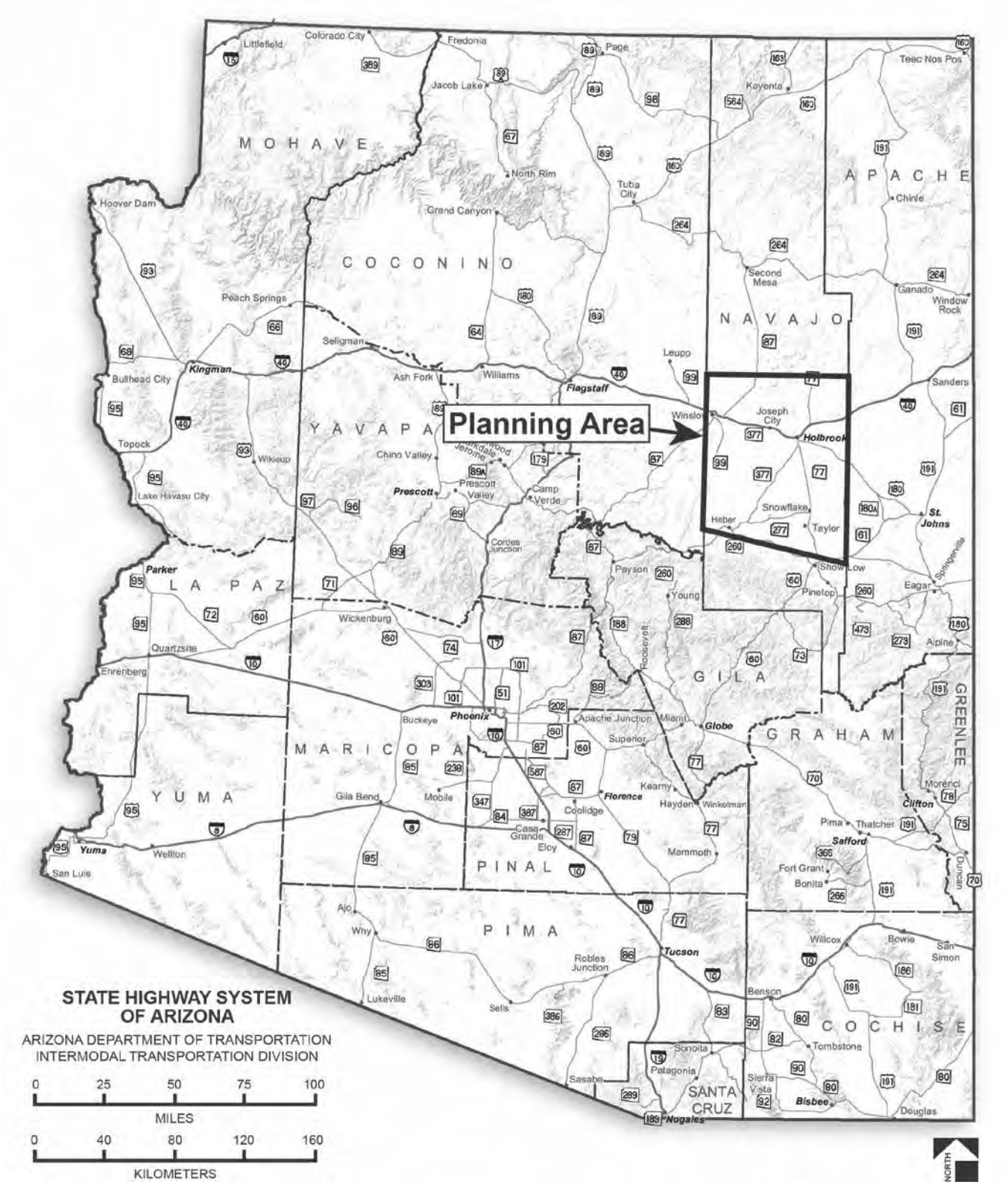

Figure 1.1. Location of 2016 Central Navajo CWPP Analysis Area

In particular, Navajo County supports the National Cohesive Strategy in providing general guidance for homes, communities, and values at-risk. The National Cohesive Strategy promotes community and homeowner involvement in planning and implementing actions to mitigate the risk posed by wildfire, stresses programs and activities that prevent human-caused ignitions, and emphasizes proactive wildfire risk mitigation actions. In order to provide central Navajo County residents with the most up-to-date information on community wildlife fire preparation, Navajo County Emergency Management (NCEM) is updating and, where appropriate, revising the 2009 Central Navajo CWPP to an inclusive regional approach to enhance fire-adapted communities.

The 2009 Central Navajo CWPP was developed as a collaborative effort between the fire departments associated with the communities of Snowflake, Taylor, and White Mountain Lake Estates and the NCEM, Apache-Sitgreaves National Forests (A-SNFs), Bureau of Land Management (BLM) Gila District, the Arizona State Forestry Division (ASFD), and the University of Arizona. The 2016 CWPP would be considered a HFRA-compliant CWPP for the at-risk communities of central Navajo County.

Navajo County has reinitiated the collaborative planning process for this update and revision by soliciting participation in the Core Planning Team (Core Team) from the original 2009 collaborative process. In response, a Core Team composed of representatives from the NCEM, A-SNFs, BLM, local fire departments, communities, and interested parties was re-formed to guide and provide direction for updates to the 2016 Central Navajo CWPP. The 2015 / 2016 Core Team has followed essentially the same planning process as used during development of the 2009 Central Navajo CWPP (Figure 1.2).

During analyses for the revision of the Central Navajo CWPP, the Core Team recognized that in addition to guidance documents used during development of the 2009 CWPP, advancements in wildlife fire risk assessments, responses, and public education have occurred. The Core Team reviewed the following documents:

- "Urban Wildland Interface Communities within the Vicinity of Federal Lands That Are at High Risk from Wildfire" (US Department of Agriculture and US Department of the Interior [USDA and USDI] 2001a, 2001b)
- *Field Guidance: Identifying and Prioritizing Communities at Risk* (National Association of State Foresters 2003)
- *Arizona Wildland Urban Interface Assessment* (ASFD 2004)
- *Identifying Arizona's Wildland/Urban Interface Communities at Risk: A Guide for State and Federal Land Managers* (ASFD 2007)
- *Arizona-Identified Communities at Risk* (ASFD 2009a)
- *Statewide Strategy for Restoring Arizona's Forests* (Governor's Forest Health Councils 2007)
- *Arizona Forest Resource Assessment* (ASFD 2010a)
- *Arizona Forest Resource Strategy* (ASFD 2010b)

- *Forest Health Landscape-Scale Restoration Recommendations* (Western Governors' Association 2010)
- *A National Cohesive Wildland Fire Management Strategy-Phase II National Report* (WFLC 2012)
- *Landscape Conservation and Restoration Strategic Action Plan* (USFS 2011)
- *Approved Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management and Decision Record* (BLM 2004a)
- *Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities* (Communities Committee et al. 2004)
- *Community Guide to Preparing and Implementing a Community Wildfire Protection Plan. A Supplemental Guide to Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities* (Communities Committee et al. 2008)
- *Guidance for Implementation of Federal Wildland Fire Management Policy* (USDA and USDI 2009)
- *Apache-Sitgreaves National Forest Plan* (USFS 1988)
- *Arizona BLM Gila District Fire Management Plan* (BLM 2013)
- *Fire Adapted Communities (FAC) Toolkit* (International Association of Fire Chiefs, http://www.iafc.org/facToolkit)
- Ready, Set, Go! (RSG) Program (International Association of Fire Chiefs, http://www.wildlandfirersg.org/)
- *Wildland Urban Interface Wildfire Mitigation Desk Reference* (National Wildfire Coordinating Group PMS 051 August 2014)
- *US Forest Service Southwest Region Wildfire Risk Assessment Initial Fire Hazard Results* (USFS October 2015)
- *National Fire Protection Association Firewise Communities* (http://www.firewise.org)
- *Fire Adapted Communities* (http://www.fireadapted.org/)
- *Fire Adapted Communities Learning Network* (http://www.wildlandfirersg.org/)

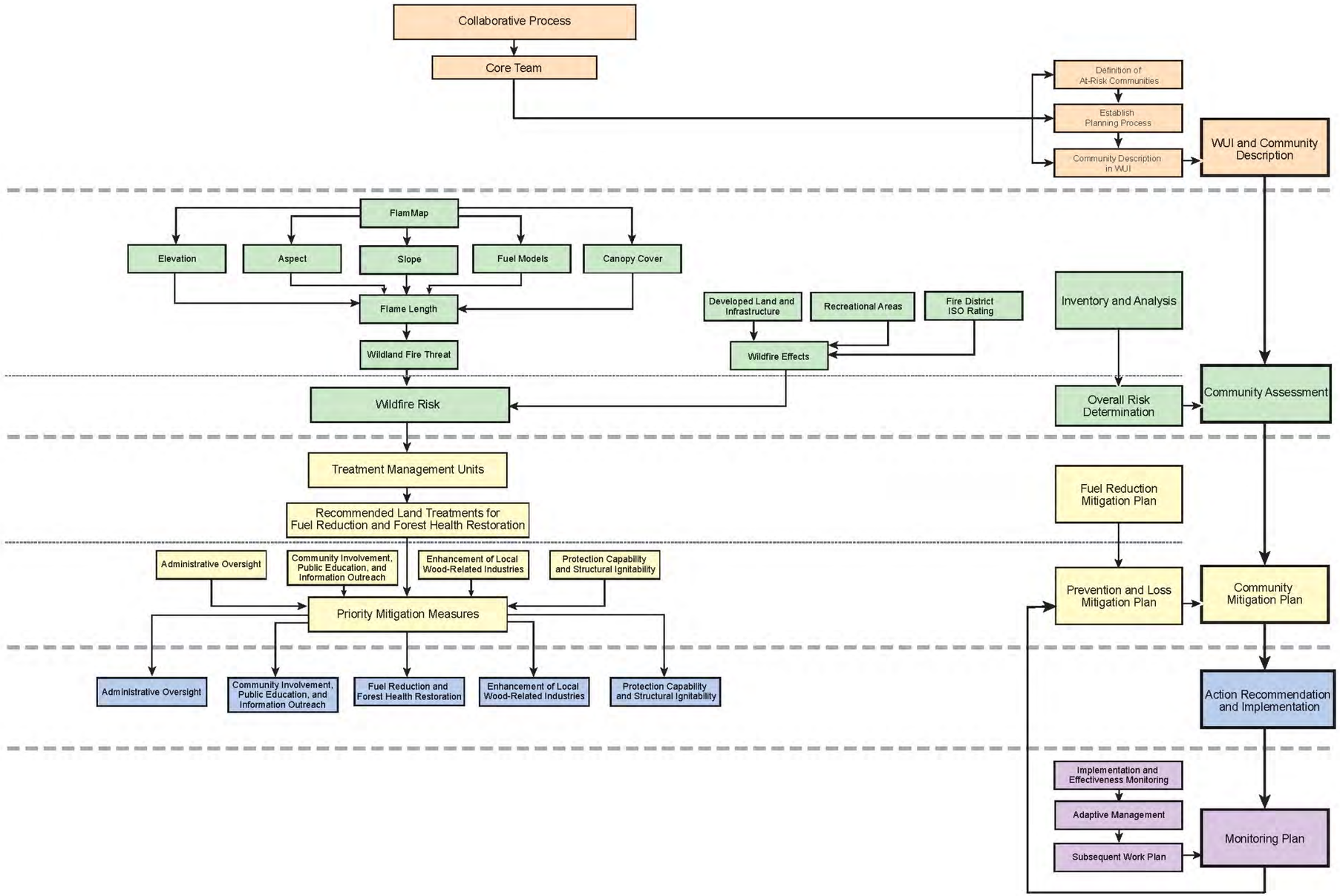

Figure 1.2. Central Navajo County CWPP Planning Process Chart

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B. WUI and Delineation Process

In January and August 2001 the USDI and USDA (2001a, 2001b) published the "Urban Wildland Interface Communities within the Vicinity of Federal Lands That Are at High Risk from Wildfire" in the *Federal Register*, but no central Navajo County communities were included in that 2001 list of at-risk communities. In 2004, the Arizona Interagency Coordination Group (AICG) prepared the *Arizona Wildland Urban Interface Assessment*, which included a list of Arizona communities at-risk. The 2004 communities list included a wildfire risk rating based on four main data layers composed of risk, topography, house/structure, and hazards. The rating ranged from 0 (no risk) to 14 (extreme risk). Central Navajo County communities were included in this 2004 list of at-risk communities and were rated as being at high or moderate risk to wildland fire (Table 1.1). The most recent communities' at-risk list published by the ASFD in 2009 did not include central Navajo communities (ASFD 2009). Navajo County and the Core Team have decided to reanalyze wildland fire risk to the central Navajo County communities using current data and methodologies. Evaluating risk with these techniques is consistent with recent state and federal agencies' approaches to analyzing wildland fire risk across Arizona. Additionally, Navajo County decided that it would be advantageous to local communities to simultaneously update and revise, where necessary, the Sitgreaves Community CWPP for Navajo and Apache County communities. Conducting concurrent wildfire risk analyses would allow for consistent fire behavior mapping and for sharing of concepts for fuel mitigation, enhanced fire protection, and public outreach across neighboring communities. Therefore, the Core Team for the Central Navajo CWPP meets concurrently with the Core Team for the Sitgreaves Communities CWPP.

Table 1.1. Navajo County CWPP Recommended At-Risk Communities

Community WUI	2004 WUI Risk Rating[a]	2009 WUI Risk Rating[b]	2016 WUI Risk Rating
Snowflake	10-High	3.1	
Taylor	10-High	2.9	
White Mountain Lakes	10-High	2.7	
Snowflake Area	9-Moderate	Moderate/High	Moderate
Taylor	9-Moderate	NA	
Shumway	9-Moderate	NA	
Chevelon–Halter Cross	NA	High	Moderate/Low
Wood Products	NA	High	Low
East of Snowflake	NA	NA	Moderate/Low

Note: CWPP =community wildfire protection plan; WUI = wildland-urban interface, NA = not applicable.

[a] 2004 Arizona Wildland Urban Interface Assessment.

[b] 2009 Central Navajo CWPP.

The at-risk communities within central Navajo County are adjacent to federal lands, including public lands administered by the ASLD, BLM, and A-SNFs, and are consistent with the Arizona State Forester's definition of an *intermix* or *interface community*:

> The Intermix Community exists where structures are scattered throughout a wildland area. There is no clear line of demarcation; wildland fuels are continuous outside of and

> within the developed area. The developed density within the intermixed community ranges from structures very close together to one structure per forty acres. Local fire departments and/or districts normally provide life and property fire protection and may also have wildland fire protection responsibilities.
>
> The Interface Community exists where structures directly abut wildland fuels. There is a clear line of demarcation between wildland fuels and residential, business, and public structures. Wildland fuels do not generally continue into the developed area. The development density for an interface community is usually three or more structures per acre, with shared municipal services. Fire protection is generally provided by a local fire department with the responsibility to protect the structure from both an interior fire and an advancing wildland fire. (ASFD 2007:1)

In addition to a community's listing status, the current condition of the wildland fuels within and adjacent to at-risk communities significantly contributes to the possibility of a catastrophic wildfire capable of damaging or destroying community values, such as houses, infrastructure, recreational sites, prehistoric and historic sites, and wildlife habitats. Revising where necessary the Central Navajo County CWPP to enhance the protection of community values and to minimize the potential loss of property while ensuring public and firefighter safety during a catastrophic wildfire remains the overriding priority recommendation of the Central Navajo County CWPP.

During the revised Central Navajo County CWPP planning process the Core Team identified the Community WUIs in accordance with the National Wildfire Coordinating Group Glossary of Wildfire Terminology (NWCG 2012), which defines the WUI as the "line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels." The Core Team also identified structures in accordance with the Arizona State Forester's definition of a *structure*:

> For the purposed of applying these categories and the subsequent criteria for evaluating risk to communities, a *structure* is understood to be either a residence or a business facility, including Federal, State and local government facilities. Structures do not include small improvements such as fences and wildlife watering devices. (ASFD 2007:1)

The Central Navajo County CWPP process of delineating WUI boundaries for at-risk communities involved collaboration among local, state, and federal government representatives, as well as interested individuals within the communities. The Core Team reviewed Section101.1.16 of HFRA for the definition of a WUI: "areas adjacent to an evacuation route for an at-risk community that the Secretary determines, in cooperation with the at-risk community, requires hazardous fuel reduction to provide safer evacuation from the at-risk community" (HFRA Sec.101.1.16.B.iii.). After review of HFRA and discussion with federal, state, and local wildland fire and resource specialists, the Core Team determined that the WUI boundaries for at-risk communities in the Central Navajo County CWPP analysis area have not significantly changed since 2009. Lands within the CWPP are composed of

private lands within defined community boundaries with a surrounding buffer determined by the Core Team; private lands not within a defined community boundary (described primarily as “occluded” communities) with a surrounding buffer determined by the Core Team, and significant federal lands included as A-SNFs and BLM WUI (ASFD 2007). The Core Team believes that the Central Navajo County CWPP community WUI boundaries are the minimum area needed to provide protection to each community and its surrounding community values. The 2016 identified WUI includes a total of 252,021 acres composed of a mix of private, county, state, and federal lands; the updated WUI is slightly larger than the 2009 WUI (248,486 acres) due to digitizing differences between the 2009 and 2015 GIS data sets. The WUI lands surrounding the communities are, or could be, under extraordinary weather events or in a condition conducive to large-scale wildland fire such that a wildfire could threaten human life and properties (Photo.1.1).

Photo 1.1. Wallow Fire 2014 (photo courtesy of Navajo County)

General elements used in creating the WUI boundaries for the 2016 Central Navajo County CWPP at-risk communities include the following:

- Vegetative fuel hazards, local topography, and fire behavior models
- Historical fire occurrence
- Community development characteristics
- Firefighting preparedness and response capabilities
- Infrastructure
- Recreational values

- Economic impacts on local economies from unwanted wildland fire
- Regional approach to promoting the forest industry and infrastructure necessary to conduct landscape-level forest restoration and wildland fuel mitigation

C. Desired Future Condition and Wildfire Mitigation in the WUI

The desired future condition of 2016 Central Navajo County CWPP lands have not significantly changed since 2009:

- WUI has adequate amount of created/maintained industrial/business/ home protection zones.
- Ecosystem components are all present and functioning properly. Fire is able to play its ecological role with overall positive effects on the local economy.
- Education and Awareness: community understands the importance of the role fire plays and the importance of fire prevention in the ignition zones.

The desired future condition of federal lands includes improving public and firefighter safety from wildland fire, using wildland fire as a management tool to achieve resource objectives, managing hazardous wildland fuels within and adjacent to the WUI, providing adaptive wildland fire response and suppression, and returning public lands to fire-resilient ecosystems through reintroducing fire into fire-adapted ecosystems where practicable. Once this condition is achieved, natural processes such as fire can be incorporated into long-term management practices to sustain habitat health. Current federal fire guidelines state that “initial action on human-caused wildfire will be to suppress the fire at the lowest costs with the fewest negative consequences with respect to firefighter and public safety” (USDA and USDI 2009:7). However, “a wildland fire may be concurrently managed for one or more objectives and objectives can change as the fire spreads across the landscape. Fire management objectives are affected by changes in fuels, weather, topography, varying social understanding and tolerance; and involvement of other government jurisdictions having different missions and objectives” (USDA and USDI 2009:7). The BLM and A-SNFs adhere to federal policy when managing all unplanned wildfire ignitions on public lands within the WUI. Federal policy for reducing wildfires on public lands (that is, BLM and USFS lands) is planned and administered locally through the BLM’s Tucson Field Office and the A-SNFs’ Black Mesa and Lakeside Ranger Districts.

The desired future condition of private lands in the community WUIs, as outlined in the 2009 Central Navajo communities CWPP, are as follows:

- Community has the capacity to effectively deal with wildfire within its boundaries, and communities/individuals take responsibility to participate in implementing wildfire protection.
- Existing and future building construction and landscaping effectively resist ignition.
- Education and Awareness: community understands the importance of the role fire plays and the importance of fire prevention in the ignition zones.

In addition, the desired future conditions for central Navajo County private landowners is to be in conformance with the National Firewise Communities program (http://www.firewise.org/) and the Fire Adapted Communities program (http://www.fireadapted.org/) or to meet home-ignition-zone landscaping or fire-safe landscaping recommended by the Central Navajo County CWPP fire departments and districts in compliance with local ordinances and in establishing fire-adapted communities. The Fire Adapted Communities program is a national effort to prepare fire-prone communities for the effects of wildland fire. Firewise is a national program that helps communities reduce wildfire risks and provides them with information about protecting themselves against catastrophic wildfires and mitigating losses from such fires. Within Arizona, the State Forester administers the Firewise certification program. The Core Team encourages homeowner associations through their conditions, covenants, and restrictions (CC&Rs) to become a Firewise community or adopt fire-safe standards in consultation with their local fire department. Fire departments and districts and local governments in central Navajo County would like to make this information available to their citizens and to encourage its application. Residential and other structures that comply with Firewise standards significantly reduce fire-ignition risks in a community, as well as the potential for fires to spread to surrounding habitats. Additionally, structures that comply with Firewise recommendations are more likely to survive wildland fires that do spread into a community (Cohen 2008). Navajo County recognizes the importance of a community and regional approach to wildfire preparedness and supports creating fire-adapted communities.

The Core Team is aware that wildland fuel accumulations primarily associated with the invasion of woody species, native and nonnative grasses, and decades of fire suppression, together with community growth in the WUI, have produced areas at risk from catastrophic wildfire. The Core Team aspires to achieve restored, self-sustaining, biologically diverse habitats of mixed open space and developed areas that contribute to a quality of life demanded by central Navajo County citizens. The Core Team recognizes that protection from catastrophic wildland fire requires collaboration and implementation through all levels of government and through an informed and motivated public. The Core Team considered ecosystem restoration or maintenance of fire-resilient ecosystems through reintroducing fire into fire-adapted ecosystems, community protection, and public and firefighter safety while developing this CWPP (see Photo1.1).

Financial commitments required to reduce the risk of catastrophic wildfire can be expensive for municipal, county, state, and federal governments; for fire districts; and for the small rural communities surrounded by public lands (Ingalsbee 2010, 2014). Since approval and concurrence of the 2009 Central Navajo County CWPP, the A-SNFs and BLM have implemented wildland fuel mitigation projects within or near the Central Navajo County community WUIs. Fire departments and districts have improved wildland fire suppression response and have continued with active public education and outreach programs concerning wildland fire threat and home-ignition-zone recommendations. Central Navajo County fire departments and districts have standing mutual-aid agreements to enhance initial and sustained wildland response**.** Additionally, the fire departments and districts have taken proactive measures to encourage willing property owners to reduce fire risk on private property (HFRA, Sec.

103.d.2.B). The Core Team, BLM, and A-SNFs collaborators are proposing additional wildland fuel treatments and wildland fire suppression enhancements and have been proactive in pursuing funding for wildland fire public outreach programs and fire-suppression training and equipment and will continue these activities in working toward meeting the goals and objectives of the 2016 Central Navajo County CWPP.

D. Goals for the 2016 Central Navajo County CWPP

The goals established in the 2009 Central Navajo County CWPP consisted of the following eight primary goals:

- Create/improve effective fire protection zones
- Restore/improve/maintain ecosystem health
- Restore forest health
- Promote education/awareness programs and community involvement
- Develop the community's capability to address wildfire issues
- Encourage fire-resistive building construction and landscaping standards
- Define wildfire risk
- Establish written mutual-aid agreements with regards to fire

The 2009 Central Navajo County CWPP met all criteria of HFRA and was developed through a coordinated and collaborative performance-based framework of recommendations designed to meet its outlined goals.

The Core Team is recommending additional goals to be considered for the 2016 Central Navajo County CWPP to reduce the risks to life and property from catastrophic wildland fire:

- Improve fire prevention and suppression, emphasizing firefighter and public safety
- Reduce hazardous fuels, emphasizing public and private property protection
- Restore forest, rangeland, and riparian health
- Promote community involvement and provide for community protection
- Recommend measures to reduce structural ignitability in the WUI
- Encourage economic development in the communities from vegetative treatments
- Use the CWPP in conjunction with surrounding community and agency fire management plans
- Encourage high-risk communities to become fire-adapted communities
- Reduce potential economic loss to communities from unwanted wildland fire

- Work with elected officials to develop opportunities for enhance funding through national, state, and local sources for implementing the action recommendations of the Central Navajo County CWPP
- Work with local, state, and federal agencies to support the growth of forest industry and forest products to ensure infrastructure is in place to conduct landscape-level forest restoration and community wildfire preparedness objectives

Action recommendations for at-risk areas within the Central Navajo County CWPP WUI boundaries have been reviewed and updated where needed as part of this planning process. Treatments for wildland vegetative fuels and additional wildland fire mitigation measures are recommended to be implemented in specific time frames and with associated monitoring to determine and document measurable outcomes. Successful implementation of the Central Navajo County CWPP will require collaboration between fire departments and districts, governments, resource-management agencies, and private landowners. The cooperating agencies should develop processes and systems that allow recommended actions of the Central Navajo County CWPP to comply with applicable local, state, and federal environmental regulations. The Core Team and collaborators encourage all agencies, groups, and individuals involved to develop any additional formal agreements necessary to work toward the Central Navajo County CWPP's timely implementation, monitoring, and reporting. The Core Team and CWPP planning process was reinitiated to meet collaborative requirements of HFRA and to report on achievements since adoption of the 2009 Central Navajo Community CWPP; to determine current wildfire risk assessment using up-to-date information and techniques; to be supportive of and complementary to current local, state, and federal land management direction; and to represent all central Navajo County communities and their interests, with all parties being involved in and supportive of the implementation of the 2016 Central Navajo County CWPP.

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II. CENTRAL NAVAJO COUNTY CWPP COMMUNITY ASSESSMENT AND ANALYSIS

The 2009 Central Navajo County CWPP Core Team identified specific WUI boundaries that were determined by proximity to population centers and with respect to identified values at risk. The 2009 WUI boundaries covered "248,486 acres, 29% of the planning area and were separated into four separate WUI sub areas: the Snowflake–Silver Lake WUI, the Chevelon–Halter Cross WUI, the Wood Products WUI and the East of Snowflake (EOS) WUI. Each sub area boundary was drawn around geographically grouped communities, key infrastructure or values at risk" (Navajo County 2009).

During the review and revision of the 2016 Central Navajo County CWPP, the Core Team determined that the community wildfire risk assessment would comprise the following assessments:

- *Wildland Fire Threat*—the probability and intensity of an area burning
- *Wildfire Effects*—the community values at risk from wildfire
- *Wildfire Risk*—an analysis of where the potential for catastrophic wildland fire occurs adjacent to or within areas of high community values that may be affected by wildfire within the central Navajo County community WUIs identified by the Core Team

This risk analysis was developed to closely tie to the future Arizona Wildfire Risk Assessment Portal (AZ WRAP) (https://azsf.az.gov/fire/prevention/az-wrap). The 2016 Central Navajo County CWPP incorporates the current fire regime condition class, wildfire fuel hazards, risk of ignition, local preparedness and protection capabilities, and at-risk community values. The Core Team reviewed the Arizona State Forester's *Identifying Arizona's Wildland/Urban Interface Communities at Risk: A Guide for State and Federal Land Managers* (ASFD 2007) to allow the Central Navajo County CWPP to be compatible with and complementary to statewide CWPP planning efforts. The Core Team included all risk factors required by the Arizona State Forester in the analysis and revision of this CWPP. The areas of concern for wildland fuel hazards, risk of ignition and wildfire occurrence, local preparedness and protection capabilities, and loss of community values were evaluated to determine areas of highest wildfire risk.

The Central Navajo County CWPP analysis area includes communities within central Navajo County comprising approximately 252,021 at-risk acres of WUI, which is slightly larger than the 248,486 at-risk acres of WUI identified in the 2009 Central Navajo County CWPP (Figure 2.1). During the review of the Central Navajo Communities CWPP, Navajo County agreed to mutually reestablish the Central Navajo County CWPP planning team and to identify and expand, where necessary, community wildfire protection and preparation on a regional level. During the revision of the Central Navajo County CWPP, the Core Team identified 252,021 acres of land considered at risk of wildland fire to be included in the 2016 revised community WUI (Table 2.1; Figure 2.1).

Primary landownership in the Central Navajo County CWPP planning area is a mosaic of privately owned lands; Arizona State Trust lands managed by the Arizona State Land Department (ASLD) ;and A-SNFs, BLM, and other lands (Table 2.1). Of the federal lands within the WUI, the A-SNFs manage 57,368 acres, or 23.0 percent, and the BLM manages 3,466 acres, or 1.0 percent, of lands within the WUI.

Table 2.1. Land Management within Community WUIs

Ownership Type	Total Acres	% of Total*
Private	148,608	59
BLM	3,466	1
A-SNFs	57,368	23
State Trust	41,758	17
Other	821	<1
Total	252,021	100

Note: BLM = Bureau of Land Management, A-SNFs = Apache-Sitgreaves National Forests; WUI = wildland-urban interface.

*Actual total may not add to 100% because of rounding.

Private land within the WUI composes 148,608 acres, or roughly 59 percent, of the WUI. Private lands are mostly clustered near communities, with some scattered private inholdings located throughout the WUI. The municipalities/unincorporated communities of Snowflake, Taylor, White Mountain Lakes, Silver Lake Estates, Chevelon–Halter Cross, and Shumay contain the majority of developed private land acreage within the WUI. Commercial structures are clustered along state and federal highways in community centers, and they are assumed to remain as the principal commercial corridors within the Navajo County at-risk communities.

State Trust lands were established in 1912 under the terms of the Arizona Enabling Act. With statehood, Arizona was granted ownership of four sections per township. ASLD manages State Trust lands to produce revenue for the Arizona State Trust beneficiaries, including the state's school system. Within the Navajo County CWPP WUI, 41,758 acres (17 percent) of State Trust lands are managed primarily for agriculture and livestock grazing.

The A-SNFs manage approximately 57,368 acres (23 percent) within the WUI consisting of lands within the Snowflake–Silver Lake WUI and the Chevelon–Halter Cross WUI. Of the remaining federal lands within the WUI, BLM manages approximately 3,466 acres (1 percent) of WUI lands. These federal lands provide extensive and popular hiking, hunting, and recreational areas within or adjacent to the WUI. The potential for escaped campfires or the need to evacuate camping areas during a wildfire warrants including these lands in the Central Navajo County CWPP.

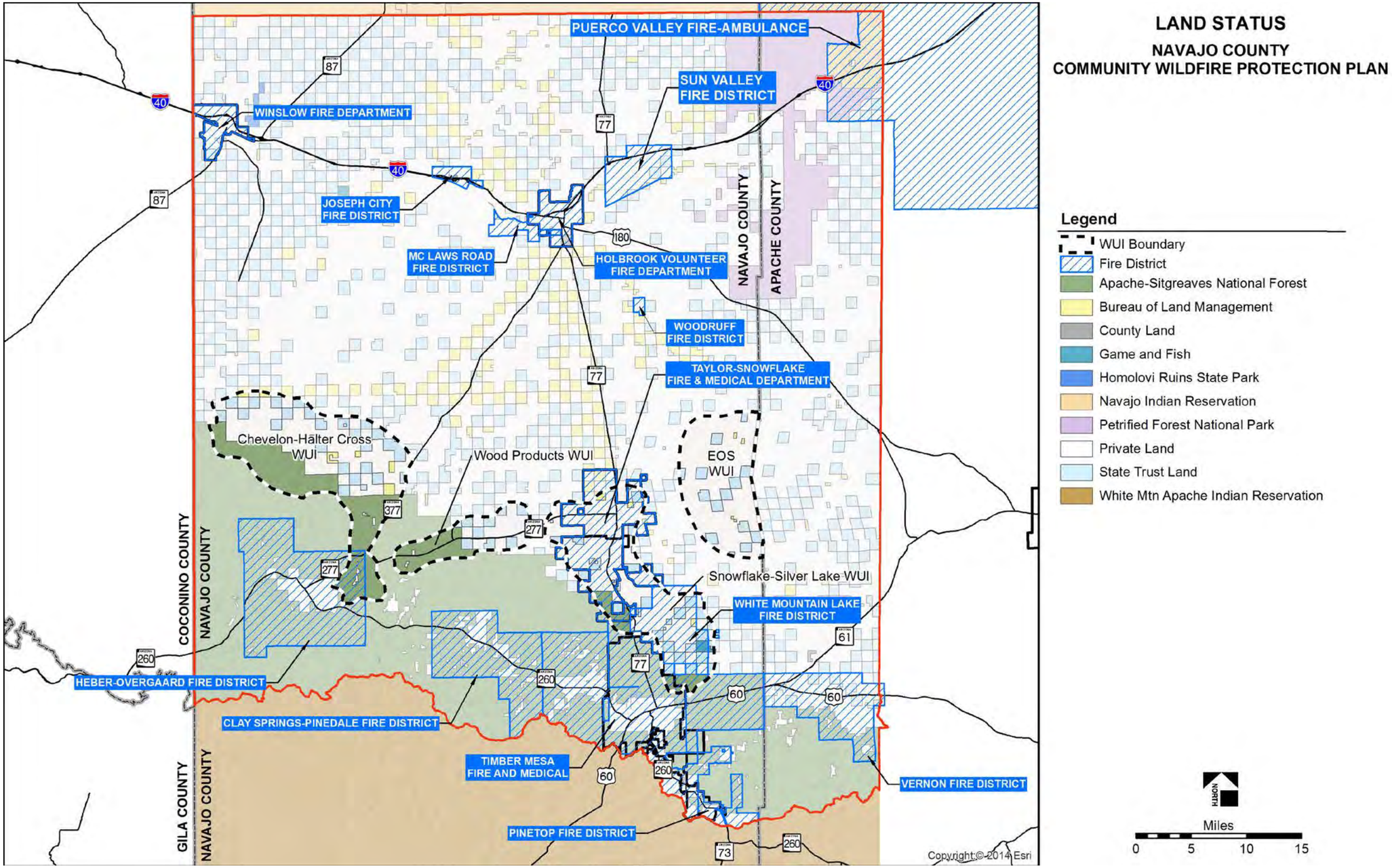

Figure 2.1. Central Navajo County CWPP WUI Area

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The diverse climate of Navajo County produces a varied landscape—from a mix of pinyon-juniper woodland to semi-desert shrub steepe, sagebrush shrublands, semi-desert grasslands with lower intensities of scrub oak and mixed conifer woodlands (Landfire.gov 2015). The central Navajo County communities within the CWPP analysis area occur in the Mexican Highland Section of the Basin and Range Province of the Intermontane Plateaus Major Land Resource Area (MLRA) 39 (NRCS 2011). This MLRA is characterized by volcanic fields and gently dipping sedimentary rocks eroded into plateaus, valleys, and deep canyons. Elevation ranges from 4,000 to 7,000 feet in the southern half of the area. North of the Mogollon Rim, it rises to more than 7,500 feet and includes the highest point in Arizona, Baldy Peak, at 11,403 feet (NRCS 2011). MLRA 39 falls within the Arizona-New Mexico Mountains Semi-Desert-Open Woodlands – Coniferous Forest Alpine Meadow Province (M313) of the Tropical/Subtropical Steppe Division of the Dry Domain Ecoregion of the United States (Bailey 1995).

The average annual precipitation is 15 to 30 inches in most of this area but may vary from 9 inches in lowest elevations to as much as 43 inches in the mountains. More than half of the precipitation occurs as high-intensity convective thunderstorms during July, August, and September. Because of Pacific frontal storms, a second rainy season occurs from December to March. The average annual air temperature is 36 to 55 degrees Fahrenheit. The freeze-free period averages 135 days and ranges from 60 to 205 days, decreasing in length with increasing elevation (NRCS 2011; Bailey 1995).

Cool-season vegetation growth normally begins in early spring and matures in early summer. Warm-season vegetation growth occurs after the summer rains and may remain green throughout the year in lower elevations (NRCS 2011). The potential plant community on lower elevations and gentler slopes is dominated by warm-season perennial grasses with a fair component of cool-season perennial grasses and small shrubs. Pinyon-juniper woodland normally occurs at an elevation below 6,800 feet. Below an elevation of about 6,000 feet, shrub oak woodlands, shrublands, and grasslands dominate.

A. Fire Regime and Condition Class

Before European settlement of North America, fire played a natural (historical) role in many of the Navajo County vegetated landscapes. Five historical fire regimes have been identified; these regimes are based on the average number of years between fires (fire frequency) combined with the severity (amount of overstory replacement) of fire on the dominant overstory vegetation (Fire Regime Condition Class [FRCC] Interagency Working Group 2005a, 2010) (Table 2.2).

The vegetation condition class (VCC) of wildland habitats describes the degree to which the current fire regime has been altered from its historical range, the risk of losing key ecosystem components, and the vegetative attribute changes from historical conditions. There are three VCCs, which are classified according to degree of departure from the historical fire regime: low departure (VCC 1), moderate departure (VCC 2), and high departure (VCC 3). VCC is calculated based on changes to vegetation composition, structural stage, and canopy closure using methods described in the *Interagency Fire Regime Condition Class Guidebook* (FRCC Interagency Working Group 2005b). LANDFIRE VCC is

based on departure of current vegetation conditions from reference vegetation conditions only, whereas the Fire Regime Guidebook approach includes departure of current fire regimes from those of the reference period. Data obtained from LANDFIRE.gov (http://www.landfire.gov/NationalProductDescriptions10.php, accessed November 2015) simulates historical vegetation reference conditions using the Vegetation Dynamics Development Tool, which is a vegetation and disturbance dynamics model. A current vegetation condition is then derived from a classification of existing vegetation type, cover, and height and is current to the vegetative land cover that existed on the landscape in 2008.

Table 2.2. Fire Regime Information

	Frequency	Severity[a]
Regime I	0–35 years	Low
Regime II	0–35 years	High
Regime III	35–100 years	Low
Regime IV	35–100 years	High
Regime V	200+ years	High

Source: Schmidt et al. 2002.

[a]Low = less than 75% of the dominant overstory vegetation replaced; High = greater than 75% of the dominant overstory vegetation replaced (stand replacement).

The following descriptions of condition classes are provided by the Arizona State Forester (ASFD 2007:3):

Condition Class 1:

Fire regimes are within a historical range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within the historical range.

Condition Class 2:

Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). Fire return interval is the time between fires in a defined area. This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.

Condition Class 3:

Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more

of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

The Central Navajo County WUI includes 3,404 acres of land classified as urban, water, and sparsely vegetated and barren landscapes (approximately 1.0 percent of WUI acres) and 654 acres of agricultural land (<1.0 percent of WUI acres). The WUI also includes 8,503 acres (approximately 3.0 percent of WUI acres) of VCC 1 lands; 153,472 acres (approximately 61.0 percent of WUI acres) of VCC 2 lands; and 85,977 acres (approximately 34.0 percent of WUI acres) of VCC 3 lands (http://www.landfire.gov/NationalProductDescriptions10.php, accessed November 2015). Therefore, over 95.0 percent of WUI acres are not considered to be within the natural range of variation of historical wildland fire regimes.

Most plant communities in Central Navajo County historically burned fairly frequently as part of historical fire regimes. Frequent fire occurrences reduced fuel loads and selected plant species that are adapted to fire. Maintaining or returning fire regimes to more natural conditions and using fire as a tool would return ecological systems to historical fire resiliency, thus reducing severity of wildland fire. The vegetation community associated with this CWPP is dominated by a mix of pinyon-juniper woodland, semi-desert shrub steepe, sagebrush shrublands, semi-desert grasslands with lower intensities of scrub oak, and mixed conifer woodlands. All of these plant communities have an associated understory of grasses and shrubs, and some are also composed of invasive grasses and woody species (Landfire.gov accessed 2015). In lower-elevation shrubland associations, wildland fire has played a very limited role in the development and maintenance of these vegetative communities. In these habitats wildfire has a long return interval, and fires could have negative effects on the ecosystem unless some form of mitigation is instituted. In these vegetative associations, mitigation practices could include biological (grazing), chemical, or mechanical means to manage invasive vegetation species and to reduce vegetative fuel loads in order to meet land management resource objectives and to minimize adverse effects of fire, protecting firefighter and public safety.

The Central Navajo County communities occur within the Arizona/New Mexico Mountains (ASFD 2010) in the White Mountain Forested landscape, which is a complex of forested mountain ranges in east-central Arizona, composed of desert grasslands at 3,000 feet above sea level (amsl) to coniferous forests of Mount Baldy at 11,400 amsl that typically support a high level of biodiversity (Governor's Forest Health Councils 2007). The Core Team intends the Central Navajo County CWPP to complement state, BLM, and A-SNFs objectives; the *Statewide Strategy for Restoring Arizona's Forests* (Governor's Forest Health Councils 2007); the *Arizona Forest Resource Strategy* (ASFD 2010); the *Approved Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management and Decision Record* (BLM 2004a); the *Arizona BLM Gila District Fire Management Plan* (BLM 2013); and the *Apache-Sitgreaves National Forest Plan* (USFS 1988). Federal wildfire reduction policy on public lands is planned and administered primarily by BLM and A-SNFs, which are the federal governing agencies for the public lands in the Central Navajo County CWPP WUI areas. BLM and A-SNFs manage wildland fire to help reduce unnaturally high wildland fuel loads that contribute to

catastrophic wildland fire and also to help encourage the return of fire to a more natural role in fire-adapted ecosystems, to achieve ecosystem benefits, to reduce economic impacts from wildland fire, and to enhance public and firefighter safety.

B. Fire Threat

The existing arrangement and flammability of vegetation associations largely determine wildland fire behavior. The Core Team and collaborators identified areas at risk from wildland fire by evaluating fire behavior models based on vegetative fuels and the arrangement of those fuels by slope and aspect as they occur on federal and nonfederal land in the WUI.

The arrangement of vegetative fuel, relative flammability, and potential of vegetation to support wildland fire varies throughout the WUI. Wildland fuel hazards depend on a specific composition, type, arrangement, or condition of vegetation such that if the fuel were ignited, an at-risk community or its infrastructure would be threatened. The Core team used the existing data through LANDFIRE.gov to determine the existing land cover and fire behavior models for the Central Navajo County WUIs. The Core Team reviewed vegetation associations within the WUI that were identified and mapped using the LANDFIRE.gov Existing Vegetation Type (EVT) data layer, which represents the species composition present at a given site up to 2008 (Landfire.gov, accessed November 2015).The LANDFIRE data sets use the 40 Scott and Burgan Fire Behavior Fuel Model (FBFM40) layer to represent distinct distributions of fuel loading found among surface fuel components (live and dead), size classes, and fuel types (LANDFIRE.gov accessed November 2015). These data sets allowed the Core Team to digitize vegetative landcover types (Figure 2.2) and display the distribution and abundance of vegetation associations and associated fire behavior models over the Central Navajo County WUIs (Figure 2.3). The Core Team used the FlamMap fire mapping and analysis system (Finney 2006; Stratton 2006) to depict potential fire behavior for constant environmental conditions (weather and fuel moisture), which produces an estimate of flame height as a surrogate for prediction of fire intensity over the landscape (Figure 2.3). These data sets provide the level of landscape description and vegetative landcover detail necessary for aligning wildland fuel flammability with existing vegetation. Each vegetation association consists of various fuel properties that produce differing wildfire behavior which is assigned to distinguishable fuel models.

The USFS Southwest Region is developing a Regional Wildfire Risk Assessment to quantify the probability of where fire is likely to occur, with what frequency, and with what intensity. The Core Team coordinated with the Southwest Region's fire ecologist to determine the consistency of fuel models between those in the LANDFIRE.gov database and those in the USFS Wildfire Risk Assessment across the CWPP landscape. Amendments were made to fire behavior models within the LANDFIRE.gov database for consistency with USFS fire behavior models. The revised fire behavior models were inserted into the FlamMap fire mapping and analysis system for predicting potential wildfire flame heights within the community WUIs. The normalized vegetative data and associated range of assigned fuel models for predicting wildfire behavior for each vegetation association is shown in Table 2.3. The predicted flame length from the FlamMap fire map model was used to determine the

high, moderate, or low wildland fire risk to communities (Table 2.4). The relationship of surface-fire flame length to suppression actions is the basis for assigning wildland fire risk. Wildland fire with flame lengths less than 4 feet can generally be attacked at the head of the fire using hand tools. Fuel models with a predicted flame length of fewer than 4 feet are assigned low risk. Flame lengths from 4 to 8 feet are too intense for direct attack and equipment such as fire trucks, and aircraft may be needed for suppression and control. Fuel models with a predicted flame length of 4 to 10 feet are assigned moderate risk. Flame lengths over 10 feet present serious control problems, including crown fires with fire spotting from fire brands, and major fire runs are possible. Fuel models with a predicted flame length of over 11 feet are assigned high risk (Heinsch and Andrews 2010). Table 2.5 lists the predicted flame height and associated wildfire risk rating.

The Arizona State Forester has established the following guidelines for evaluating risk (ASFD 2007:1):

> **Evaluate Risk to Communities:** Not all structures and/or communities that reside in an "interface" area are at significant risk from wildland fire. It is a combination of factors, including the composition and density of vegetative fuels, extreme weather conditions, topography, density of structures, and response capability that determines the relative risk to an interface community. The criteria listed below are intended to assist interagency teams at the state level in identifying the communities within their jurisdiction that are at significant risk from wildland fire. The application of these risk factors should allow for greater nationwide consistency in determining the need and priorities for Federal projects and funding.

The Core Team reviewed the fire behavior potential in the WUI and determined that the risk classification is consistent with Situations 1, 2, and 3 as described by the Arizona State Forester (ASFD 2007:1–2):

> <u>Risk Factor 1: Fire Behavior Potential</u>
>
> <u>Situation 1:</u> In these communities, continuous fuels are in close proximity to structures. The composition of surrounding fuels is conducive to crown fires or high intensity surface fires. Likely conditions include steep slopes, predominantly south aspects, dense fuels, heavy duff, prevailing wind exposure and/or ladder fuels that reduce fire fighting effectiveness. There is a history of large fire and/or high fire occurrence.
>
> <u>Situation 2:</u> In these communities, intermittent fuels are in proximity to structures. Likely conditions include moderate slopes and/or rolling terrain, broken moderate fuels, and some ladder fuels. The composition of surrounding fuels is conducive to torching, spotting, and/or moderate intensity surface fires. These conditions may lead to moderate fire fighting effectiveness. There is a history of some large fires and/or moderate fire occurrence.

Situation 3: In these communities, fine and/or sparse fuels surround structures. There is infrequent wind exposure and flat terrain to gently rolling terrain. The composition of surrounding fuels is conducive to low intensity surface fires. Fire fighting generally is highly effective. There is no large fire history and/or low fire occurrence.

The Central Navajo County community WUIs includes 4 major vegetative fuel types composed of 17 ecological system vegetation communities (not including agricultural lands), 3 mostly nonvegetated associations, and 2 open-space residential developed land covers (LANDFIRE.gov accessed November 2015). Each vegetative community is assigned to specific fuel models that predict the rate of spread, flame length, and fire intensity levels possible for each vegetation association during an average fire season under average weather conditions (Table 2.3). Additional fuel model descriptions are included in Appendix B.

The average historical fire return interval is highly variable among vegetation associations across the WUI. Habitat-replacement wildfires or wildfires resulting in a major loss of habitat components, in conjunction with drought, may increase fire frequency and intensity in woodland and forest habitats because of lower live fuel moisture in heavy wildland fuels (FRCC Interagency Working Group 2005a). Wet years that create abundant fine fuels such as grass and brush followed by drought years have in the past led to years with many large fires over fairly wide areas (Swetnam and Baisan 1996). Climate change may compound this and make fire behavior more intense and fire seasons longer (Stephens et al. 2013; Karl 2009; McDonald 2009).

Wildfire behavior as predicted by fuel models are influenced by topography features such as slope and aspect. Slope affects both the rate of spread and flame length, becoming greater as slope increases because the flame is tilted over the unburned fuel allowing it to ignite more quickly (Rothermel 1983). Aspect affects fire behavior by the amount of solar radiation creating the driest fuel moistures on slopes that face the afternoon sun, which would be the south and southwest aspects in the northern hemisphere. Additionally, during the summer months wind direction is primarily from the south-southeast during pre-monsoonal months. A southerly aspect will increase fire behavior by producing a greater effective wind speed if it is blowing up a slope rather than down it because the wind and slope are in alignment (Scott 2012) The Core Team recognizes the influencing factor of slope and aspect on wildfire behavior and included these influencing factors in determining wildfire risk.

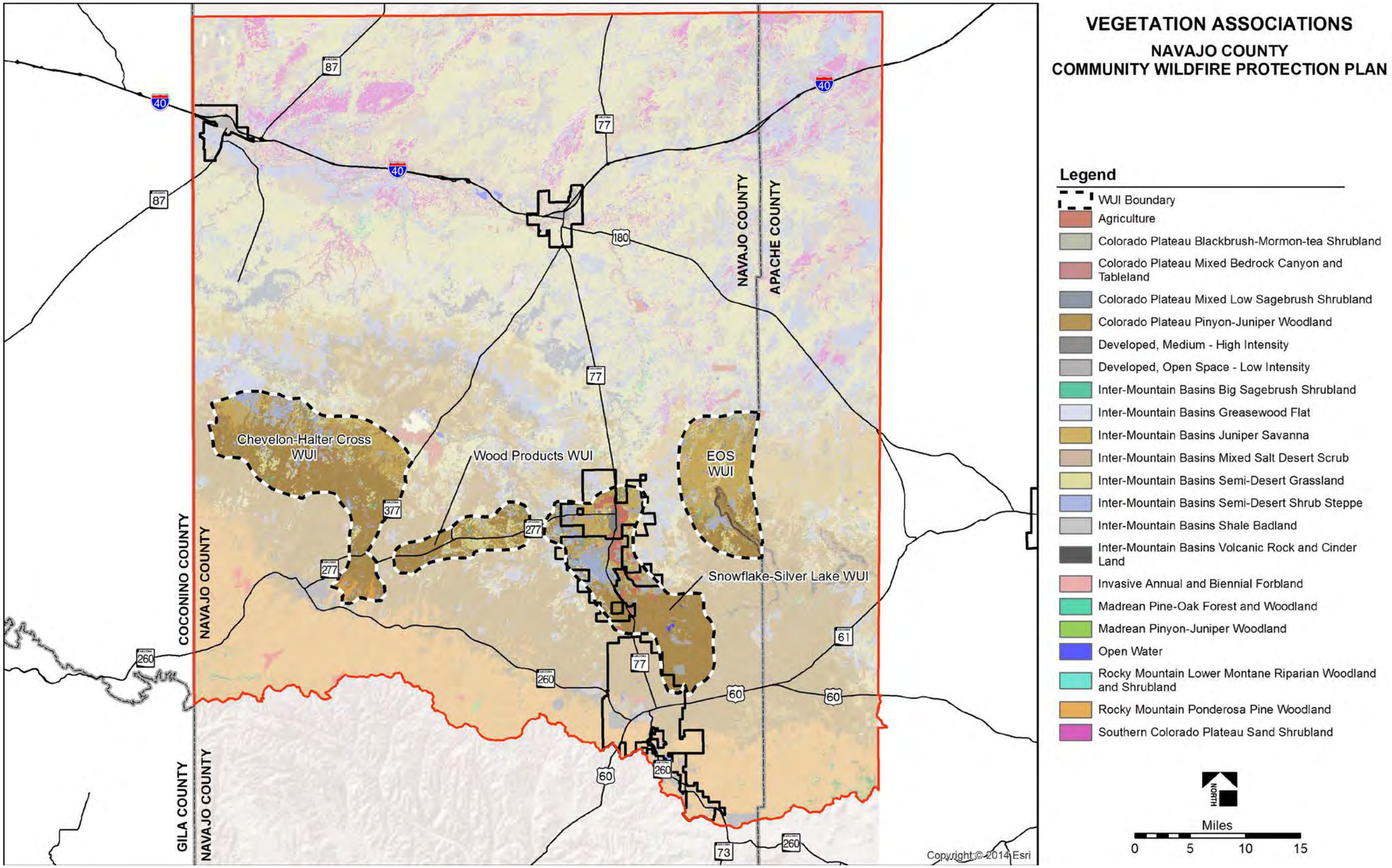

Figure 2.2. Central Navajo County CWPP Vegetation Association

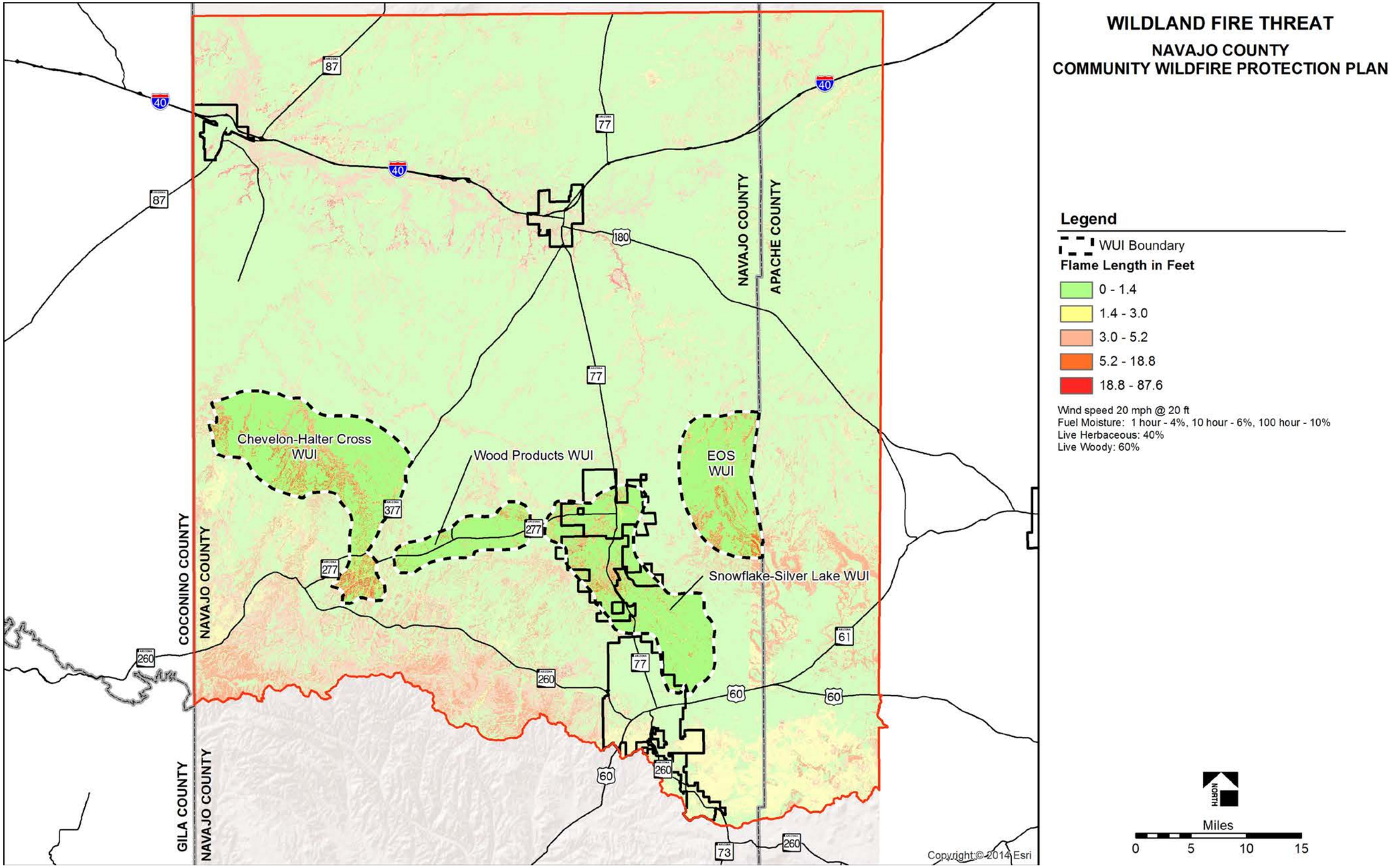

Figure 2.3. Central Navajo County CWPP Wildland Fire Threat

Table 2.3. Fuel Types and Vegetation Associations by WUI

Fuel Type	Vegetation Association	Chevelon-Halter Cross WUI Acres (%)[a, b]	East of Snowflake WUI Acres (%)[a, b]	Snowflake-Silver Lake WUI Acres (%)[b]	Wood Products WUI Acres (%)[a, b]	Total Acres (%)[b]
Shrublands	Blackbrush (*Coleogyne ramosissima*) Shrubland Alliance	327 (<1)	1 (<1)	45 (<1)	82 (<1)	455 (<1)
	Inter-Mountain Basins Big Sagebrush Shrubland	18,756 (19)	5,224 (10)	3964 (5)	1,942 (8)	29,886 (12)
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	34,469 (35)	22,549 (45)	23,229 (29)	9,060 (37)	89,306 (35)
	Inter-Mountain Basins Sparsely Vegetated Systems II	2,440 (3)	232 (<1)	266 (<1)	190 (<1)	3,129 (1)
	Western Cool Temperate Developed Ruderal Shrubland	36 (<1)	234 (<1)	3505 (4)	3 (<1)	3,777 (2)
	Western Cool Temperate Urban Shrubland	103 (<1)	NA	885 (1)	180 (<1)	1,168 (<1)
	Gambel's oak (*Quercus gambelii*) Shrubland Alliance	9,172 (9)	15 (<1)	143 (<1)	1,444 (6)	10,775 (4)
	Introduced Riparian Shrubland	570 (<1)	<1 (<1)	470 (<1)	797 (3)	1,838 (<1)
Grasslands	Apacherian-Chihuahuan Semi-Desert Grassland	236 (<1)	868 (1)	1136 (1)	393 (2)	2,633 (1)
	Inter-Mountain Basins Semi-Desert Grassland	11,600 (12)	10,491 (21)	9420 (12)	5,737 (23)	37,247 (15)
	Southern Rocky Mountain Montane-Subalpine Grassland	410 (<1)	NA	42 (<1)	<1 (<1)	453 (<1)
Woodlands	Colorado Plateau Pinyon-Juniper Woodland	16,080 (16)	10,886 (22)	28,218 (36)	4,189 (17)	59,374 (24)
	Inter-Mountain Basins Montane Riparian Forest and Woodland	552 (1	107 (<1)	905 (1)	151 (<1)	1,715 (<1)
	Madrean Pinyon-Juniper Woodland	472 (<1)	48 (<1)	11 (<1)	NA	531 (<1)
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	NA	NA	<1 (<1)	NA	<1 (<1)
	Southern Rocky Mountain Ponderosa Pine Woodland	2,654 (3)	NA	23 (<1)	1 (<1)	2,679 (1)
	Western Cool Temperate Urban Evergreen Forest	8 (<1)	NA	583 (<1)	2 (<1)	593 (<1)
Nonvegetated Lands	Barren	39 (<1)	NA	10 (<1%)	<1 (<1)	49 (<1)
	Developed-Low Intensity	NA	NA	590 (<1)	1 (<1)	591 (<1)
	Developed-Medium Intensity	<1 (<1)	NA	170 (<1)	2 (<1)	172 (<1)
	Developed-Roads	76 (<1)	NA	1,809 (2)	185 (<1)	2,070 (1)
	Open Water	4 (<1)	8 (<1)	968 (1)	<1 (<1)	981 (<1)
	Quarries-Strip Mines-Gravel Pits	NA	NA	261 (<1)	104 (<1)	364 (<1)
	Total	**98,005 (100)**	**50,666 (100)**	**78,884 (100)**	**24,466 (100)**	**252,021 (100)**

Source: LANDFIRE (November 2015).

Note: WUI = wildland-urban interface.

[a] NA = not applicable.

[b] Actual percentages may not add to 100% because of rounding.

Table 2.4. Fuel Models, Fuel Descriptions, and Fire Behavior Models

Fuel Model	Fuel Description	Wildfire Risk Rating[a]	Anderson Fuel Model	Fire-Danger Rating Model[b]	Flame Length (ft)	Flame Length (ft) Low Dead Fuel Moisture	Fire Intensity Level from Fire Behavior Fuel Model[c]	Rate of Spread ft/hr (ch/hr)—Low Dead Fuel Moisture[d]	Acre (%)[e]
Shrub (SH)—Shrubs Cover at Least 50 Percent of the Site; Grass Sparse to Nonexistent (Shrub)		**L**	**5-6**	**L and T**	**1–5**				
SH1	Low shrub fuel load, fuelbed depth about 1 foot; some grass may be present. Spread rate very low; flame length very low.					0.2–0.7	SH1, 1	SH1, 7–132 (0–2)	97,600 (39)
SH2	Moderate fuel load (higher than SH1), depth about 1 foot; no grass fuel present. Spread rate low; flame length low.					1.5–>10.0	SH2, 1–3	SH2, 0-1188 (0–18)	1,937 (<1)
SH5	Heavy shrub load, depth 4 to 6 feet. Spread rate very high; flame length very high.					4.0–>25.0	SH5, 2–6	SH5, 0–16500 (0–250)	453 (<1)
SH7	Very heavy shrub load, depth 4 to 6 feet. Spread rate lower than SH5, but flame length similar. Spread rate high; flame length very high.					4.0–>25.0	SH7, 2–6	SH 7, 0–11889 (0–180)	73 (<1)
Grasslands (GR)—Nearly Pure Grass and/or Forb Type		**M**	**1,2**	**F and T**	**1-8**				
GR1	Grass is short, patchy, and possibly heavily grazed. Spread rate moderate; flame length low.					0.5–1.7	GR1, 1	GR1, 0–990 (0–15)	56,658 (22)
GR2	Moderately coarse continuous grass, average depth about 1 foot. Spread rate high; flame length moderate.					1.0–8.0	GR2, 4	GR2, 0–7920 (0–120)	40,264 (16)
Grass-Shrub (GS)—Mixture of Grass and Shrub, up to about 50 Percent Shrub Coverage (Grass-Shrub)		**M**	**1,2**	**A (B) and T**	**1–8**				
GS1	Shrubs are about 1 foot high, low grass load. Spread rate moderate flame length low.					1.0–6.0	GS1, 1–3	GS1, 0–3960 (0–60)	2,716 (1)
GS2	Shrubs are 1 to 3 feet high, moderate grass load. Spread rate high; flame length moderate					1.5–>10.0	GS2, 2–5	GS2, 0–>6600 (0–100)	1,060 (<1)
Timber-Understory (TU)—Grass or Shrubs Mixed with Litter from Forest Canopy (Timber-Understory)		**M**	**6-7**	**F and T**	**1-16**				
TU1	Fuelbed is low load of grass and/or shrub with litter. Spread rate low; flame length low					1.0–4.0	TU1, 1–3	TU1, 0–990 (0–15)	1,622 (<1)
TU2	Fuelbed is moderate litter load with shrub component. Spread rate; moderate; flame length low.					1.0–8.0	TU2, 1–5	TU2, 0–5,280 (0–80)	320 (<1)
Timber Litter (TL)—Dead and Down Woody Fuel (Litter) beneath a Forest Canopy (Timber Litter)		**H**	**4-5**	**B and T**	**4-25**				
TL1	Light to moderate load, fuels 1 to 2 inches deep. Spread rate very low; flame length very low.					0.0–0.5	TL1, 1	TL1, 0–66 (0–1)	6 (<1)
TL2	Low load, compact. Spread rate very low; flame length very low.					0.3–1.0	TL2, 1	TL2, 0–132 (0–2)	25 (<1)
TL3	Moderate-load conifer litter. Spread rate very low; flame length low.					0.4–1.3	TL3, 1	TL3, 0–198 (0–3)	41,251 (16)
TL4	Moderate load, includes small diameter downed logs.Spread rate low; flame length low.					1.5–2.0	TL4,1-3	TL4, 0–396 (0-6)	1 (<1)
TL5	High-load conifer litter; light slash or mortality fuel. Spread rate low; flame length low.					4.0–4.5	TL5. 1-3	TL5, 0- 1452 (0-22)	267 (<1)
TL8	Moderate load and compactness may include small amount of herbaceous load. Spread rate moderate; flame length low.					1.0–8.0	TL8, 1–5	TL1, 0–66 (0–1)	321 (<1)

Continued

Table 2.4. Fuel Models, Fuel Descriptions, and Fire Behavior Models

Fuel Model	Fuel Description	Wildfire Risk Rating[a]	Anderson Fuel Model	Fire-Danger Rating Model[b]	Flame Length (ft)	Flame Length (ft) Low Dead Fuel Moisture	Fire Intensity Level from Fire Behavior Fuel Model[c]	Rate of Spread ft/hr (ch/hr)—Low Dead Fuel Moisture[d]	Acre (%)[e]
Nonburnable (NB)—Insufficient Wildland Fuel to Carry Wildland Fire under Any Condition (Nonburnable)									
NB1	Urban or suburban development; insufficient wildland fuel to carry wildland fire.								2807 (1)
NB3	Agricultural field, maintained in nonburnable condition.								3 (<1)
NB8	Open water.								980 (<1)
NB9	Bare ground.								3656 (1)
								Total	**252,021 (100)**

Source: National Fire Danger Rating System (USFS 1983; Burgan 1988).

[a] L = low; M = moderate; H = high; NA = not applicable.

[b] National Fire Danger Rating System .

[c] Fire behavior fuel models are designed for wildland vegetation and do not accurately predict fire behavior when structures are involved. Fire intensity level (FIL) is an expression of fireline intensity based on flame length (in feet): FIL1 = 0–2 ft; FIL2 = 2.1–4 ft; FIL3 = 4.1–6 ft; FIL4 = 6.1–8 ft; FIL5 = 8.1–12 ft; FIL6 > 12 ft.

[d] Flame length predicted by FlamMap (LANDFIRE.gov).

[e] Actual percentages may not add to 100% because of rounding.

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Table 2.5. Wildland Fire Threat

Component	Influence
Vegetation type and density	
• Predicted flame length greater than 10 feet	High
• Predicted flame length of 2.5 to 10 feet	Moderate
• Predicted flame length of less than 2.5 feet	Low

Source: Logan Simpson.

C. Conditions of Ignition and Past Fire Occurrence

Past regional wildfire events are important for determining the potential occurrence of unwanted wildland fire in any area of the WUI. Because of the combination of recurring dry conditions and a regional history of fires, there will be wildland fire ignitions within the WUI that must be suppressed. The fire history of the planning area, including recent large wildfires that have occurred within or adjacent to the WUI, has been included in this analysis to determine the most likely areas for either natural or human-caused wildland fire ignition (Figure 2.4).

Table 2.6 details the high, moderate, and low positive-influence values assigned to fire-start incidents. These include concentrated areas of lightning strikes and human-caused ignitions with high-potential areas having the greatest number of fire starts per square mile. Wildland fire ignition data were obtained from the Federal Wildland Fire Occurrence Internet Mapping Service web site and database (http://wildfire.cr.usgs.gov/firehistory/) and from the Arizona State Forester's Office (ASFD 2015). Data sets were combined with redundant ignitions counted as a single ignition. The largest large wildfire boundary from all data sets for each mapped fire was used to depict fire boundaries. The data sets used in the Internet Mapping Service web site are based on official fire occurrence data collected from five federal and state agencies that have been merged into one fire-history point layer. According to these data, over 109 wildfire ignitions have been reported within the WUI from 1990 through 2014.

Table 2.6. Ignition History and Wildfire Occurrence

Wildfire Occurrence	Value
0–4 fire ignitions/square mile	Low
4–8 fire starts/square mile	Moderate
>8 fire starts/ square mile	High

A growing body of evidence shows that the climate has changed substantially since 1900, that this change is accelerating, and that even greater change is likely to occur in the next 100 years (USDA 2012); such climate change will alter natural ecosystems and affect their ability to provide goods and services (USDA 2012). Additionally, post-wildfire conditions and fire management activities can create ideal opportunities for invasions by nonnative plants that undermine the benefits of fire management actions (Brooks and Lusk 2008; Brooks 2008). The Core Team determined that the majority of wildfire ignitions within the WUIs have occurred within the Snowflake–Silver Lake WUI in the vicinity of Silver Creek and Silver Lake Road.

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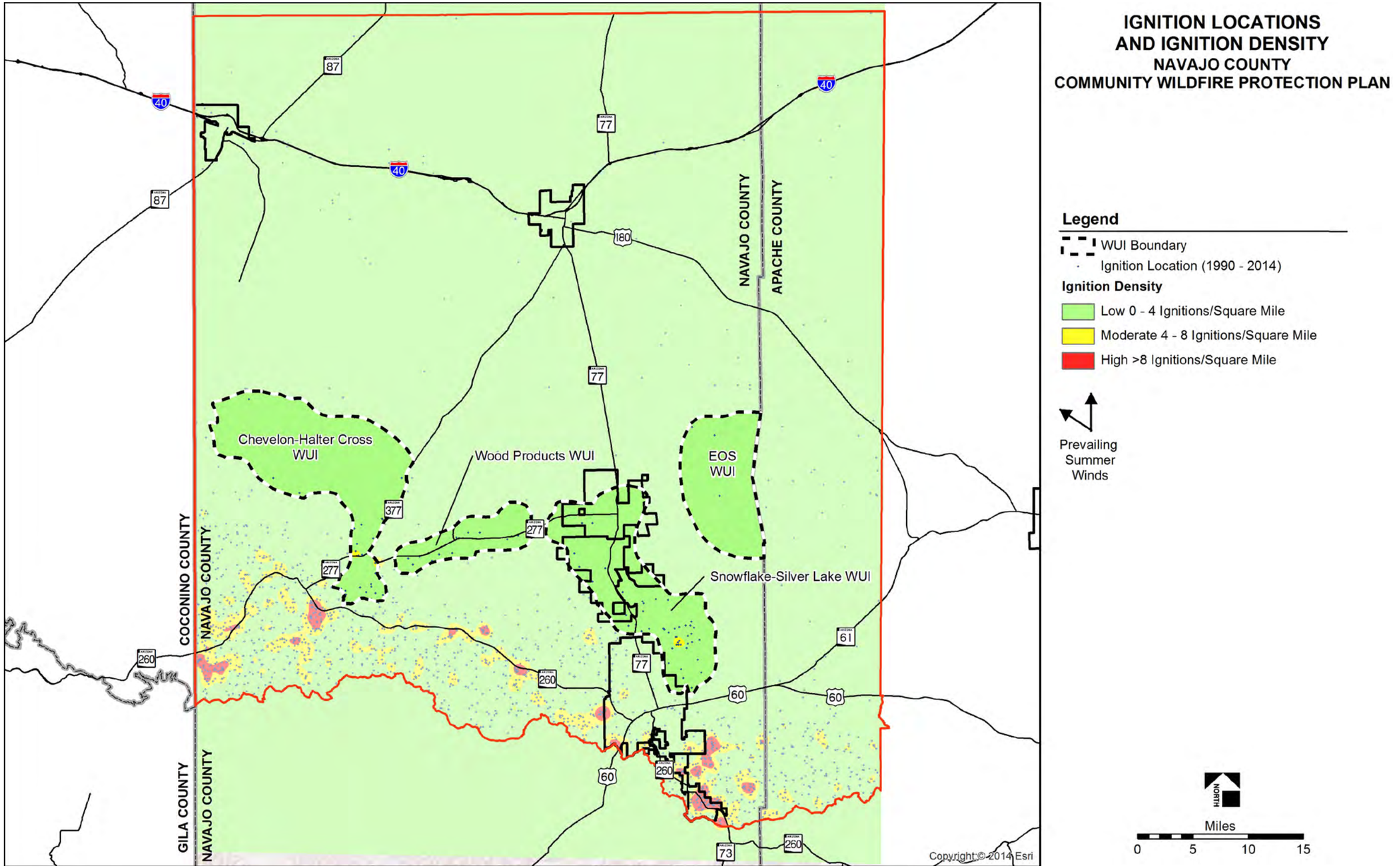

Figure 2.4. Central Navajo County CWPP WUI Ignition History

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D. Wildfire Effects

Valued at-risk community resources include private and community structures, communication facilities, local recreation areas, cultural and historic areas, sensitive wildlife habitat, watersheds, and natural resources. As agreed to by the Core Team, developed land and other infrastructures within the area of highest wildfire threat were given the highest influencing value of wildfire effects. In accordance with the risk to "Social, Cultural and Community Resources" identified by the Arizona State Forester (ASFD 2007:2), the Core Team has determined that the Central Navajo County WUI does include areas consistent with Risk Factor 2, Situations 1, 2, and 3, as follows:

> Risk Factor 2: Risk to Social, Cultural and Community Resources
>
> Situation 1: This situation most closely represents a community in an urban interface setting. The setting contains a high density of homes, businesses, and other facilities that continue across the interface. There is a lack of survivable space where personnel can safely work to provide protection. The community watershed for municipal water is at high risk of being burned to other watersheds within the geographic region. There is a high potential for economic loss to the community and likely loss of housing units and/or businesses. There are unique cultural, historical or natural heritage values at risk.
>
> Situation 2: This situation represents an intermix or occluded setting, with scattered areas of high-density homes, summer homes, youth camps, or campgrounds that are less than a mile apart. Efforts to create survivable space or otherwise improve the fire-resistance of a landscape are intermittent. This situation would cover the presence of lands at risk that are described under state designations such as impaired watersheds or scenic byways. There is a risk of erosion or flooding in the community of vegetation burns.
>
> Situation 3: This situation represents a generally occluded setting characterized by dispersed single homes and other structures that are more than a mile apart. This situation may also include areas where efforts to create a more fire-resistant landscape have been implemented on a large scale throughout a community or surrounding watershed.

1. Housing, Businesses, Essential Infrastructure, and Evacuation Routes

The Core Team identified high wildfire-effects areas—including the major community cores and portions of major highways and roadways within each community WUI. Residential community development is occurring throughout the WUI in a mix of high-density, single-family, and multi-acre parcels. The Core Team reviewed the most current structure data for each land parcel within each community WUI (Navajo County Assessor's Office 2015) to determine structure distribution and density within private lands to determine areas of low, moderate, and high structural density. This data was then portioned into wildfire-effects categories according to the density of structures and presence of

natural or developed landcover types. This includes areas of highly developed lands that lack significant open space or natural land covers, moderately developed private lands where an intermingling of public and private lands occur and where the major portion of the landscape is composed of natural landcover types, and lightly developed private lands where the majority of land cover is composed of natural land cover. Areas of highest development and areas lacking development are considered at lower wildfire-effects values; areas of moderate development where the majority of land cover is composed of natural land cover are considered as high wildfire effects; and areas of light development are considered areas as moderate wildfire effects (Table 2.7).

2. Recreation Areas/Wildlife Habitat

Recreational features within and adjacent to the WUI—including camping and recreation areas associated with designated camping and recreation areas in the A-SNFs and major USFS trailheads—are located throughout Navajo County. These parks and recreational areas provide camping and scenic vistas of deep canyons, distant mountain ranges, colorful fall foliage, and a mosaic of vegetation.

The WUI also includes known and potential habitat areas for several threatened, endangered, and sensitive plants and animals. The land management agencies use conservation strategies to mitigate risk to these species by implementing programs that meet goals and objectives of natural-resource management. The Core Team reviewed Section 102.a.5.B of HFRA and understands that site-specific evaluations of individual recommended projects will determine whether threatened, endangered, and sensitive species and habitats would benefit from wildland fire mitigation treatments that would reduce wildland fuels, and thereby lessen the threat of catastrophic wildland fire, while protecting the natural-resource and recreational values local residents and visitors associate with the communities.

3. Local Preparedness and Protection Capability

The Insurance Services Office (ISO) conducts assessments and rates communities on the basis of available fire protection. The rating process grades each community's fire protection on a scale from 1 to 10 (1 is ideal and 10 is poor) based on the ISO's Fire Suppression Rating Schedule. Five factors make up the ISO fire rating: water supply—the most important factor—accounts for 40 percent of the total rating, while type and availability of equipment, personnel, ongoing training, and the community's alarm and paging system account for the remaining 60 percent of the rating. Additionally, the Core Team determined the ISO rating for the fire protection services within each community WUI or, in many cases, the lack of any fire protection services. ISO ratings will vary within fire departments and districts depending on housing densities and the distance of structures that are isolated (usually 5 miles) from a fire station. The Core Team also recognized that some fire departments within the community WUIs must rely on private water companies, which can affect ISO ratings by not meeting fire flow requirements, inconsistencies in water delivery systems and not meeting the American Water Works Standards (American Water Works Association, http://www.awwa.org/). The Core Team determined that the many areas within the WUI include high ISO ratings. The Core Team also recognized that housing densities and ISO ratings tend to reflect compounding-influences factors. Where housing

density is high, ISO ratings are low—both essentially representing the same influence of risk to structures, infrastructures, subdivisions, and communities. The wildland and structural fire response within the WUI is provided by local fire departments and districts. The A-SNFs, ASFD, and local fire departments and districts provide support for initial wildland fire attack for areas within and adjacent to the Central Navajo County community WUIs. Structural protection for the USFS "involves the use of standard wildland fire suppression tactics and control methods; including the use of standard equipment, fire control lines, and the extinguishing of spot fires near or on the structure when safe and practical" (USFS 2009:1). Initial-attack response from local fire departments and districts can occur under the authority of mutual-aid agreements between individual departments or under the intergovernmental agreements that individual fire departments and districts have with the Arizona State Forester.

Land use in the community WUIs consists primarily of residences, livestock production, farming, community businesses, and community-based services and facilities. Surrounding areas are dominated by A-SNFs, BLM, and State Trust lands and private properties. Land uses within or close to the WUI include fuelwood cutting, hunting, and other recreational activities (for example, hiking, hunting, fishing, bird watching, nature study, photography, and off-road-vehicle use). Section II.E of this CWPP provides more detailed community assessments.

The Core Team recognizes that local populations and structure density within the Navajo County community WUIs will determine the extent of initial attack; sustained responses; structural protection; and public safety protection, including potential evacuation of a community. The Core Team used the most current structure density estimates for each WUI to provide the influence factor for wildfire-effects assessment of community values. The Core Team determined that housing density is the overriding influence factor for determining community values having the greatest wildfire effects.

Table 2.7 identifies the different influence-factor weightings given to these community value components; these components were also mapped and are depicted in Figure 2.5.

Table 2.7. Wildfire Effects

Component	Value
0.4 or more structures/acre	High
0.1–0.4 structure/acre	Moderate
0 - 0.1 structure/acre	Low

Source: Logan Simpson.

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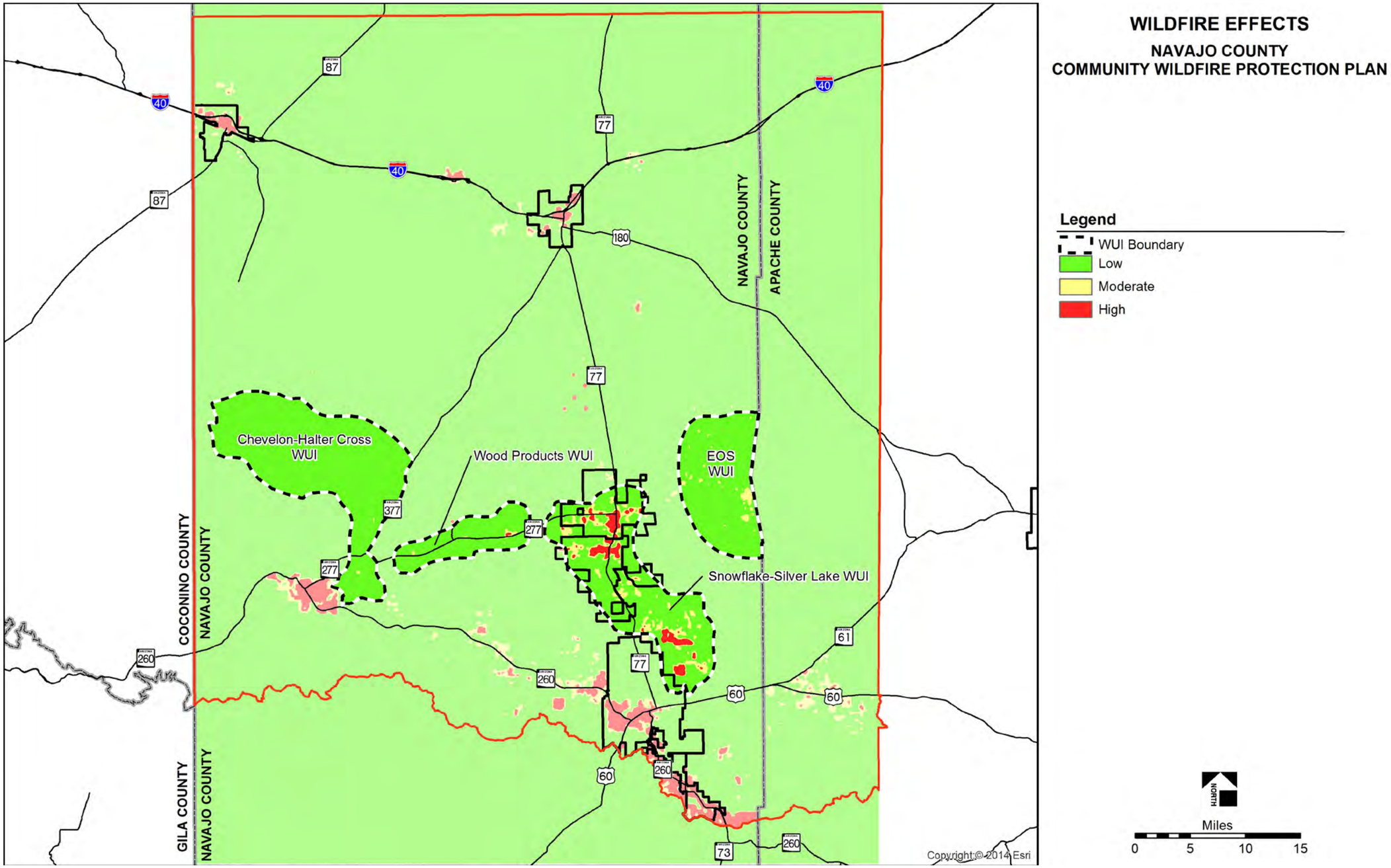

Figure 2.5. Central Navajo County CWPP Wildfire-Effects Assessment

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E. Summary of Community Assessment and Fire Risk Analysis

The major concerns identified by the Core Team during the revision of the Navajo County CWPP include (1) delayed response time by available mutual-aid fire departments; (2) obtainment of additional firefighting equipment and training; (3) insufficient dispatch and communication capabilities on initial response units; (4) structures, subdivisions, and communities that do not have fire protection because they are not within the jurisdiction of a fire department or district; and (5) inadequate firefighting water supplies. Additionally, many residences in the identified WUIs were not designed with adequate general or emergency vehicle access. Private structures without adequate access and readily available water supplies increase the risk of greater habitat and structural losses from large wildland fires.

The 10-year White Mountain Stewardship Project initiated in 2004 conducted forest restoration and thinning on over 75,000 acres mostly within or adjacent to community WUIs at the completion of the contract in 2014. Fuels treatments were conducted on 3,321 acres within the Central Navajo CWPP community WUIs from January 2008 through mid-June 2015. The Core Team recommends that the A-SNFs continue to conduct wildland fuel treatments in community areas with high wildfire effects through stewardship contracting which may become available through the Four Forest Restoration Initiative and other USFS means. The Core Team also supports fuel management and restoration actions by the BLM and ASFD within and adjacent to the community WUIs. Recommendations to landowners for wildfire risk mitigation are included in Section III of this CWPP. Additional recommendations for remote private lands include identifying properties by placing names or addresses on identification placards, road signs, and wells or surface-water sources that could be used to replenish water supplies for fire response equipment—both ground-based drafting and aerial bucketing.

The communities within each WUI subarea are described below in more detail. The community descriptions include data on population and housing units, major transportation routes, and major vegetation associations and a summary of where in the WUI subarea the highest risk of wildland fire occurs. Population and housing data was obtained from the US Census Bureau 2014 data unless noted otherwise.

1. Community WUI Descriptions and Risk Rating

Snowflake–Silver Lake WUI

As in 2009 the Snowflake–Silver Lake WUI is by far the most populated area within the planning area. It covers 78,884 acres and includes the communities of Snowflake, Taylor, Shumway, White Mountain Lake Estates, Silver Lake Estates, and the major roads connecting them. The Snowflake–Silver Lake WUI is composed of less than 1 percent of acres rated as high wildland fire risk, 30 percent of acres rated as moderate risk, and 70 percent of WUI acres rated as low risk. Therefore, the Snowflake–Silver Lake WUI is rated as moderate risk. Current Navajo County parcel data estimates that 9,121 structures are included within the WUI.

Snowflake

The Town of Snowflake is located within the Little Colorado River Basin of northeastern Arizona, 30 miles south of Interstate 40 in proximity to the Petrified Forest National Park and the Navajo and Hopi Reservations. Snowflake is located on a high desert plateau sitting at 5,640 feet amsl. The community enjoys a mild year-round climate with less than 10 inches of annual snowfall. One of the largest employers in the area is Catalyst, a paper recycling and manufacturing facility. Also located at this site is a biomass power plant that provides power to industry in the area. Various shops, schools, molding mills, a hydroponic tomato greenhouse, trucking facilities, pig farms, and sand-and-gravel operations employ the community residents. Some residents also travel to nearby electrical power generation facilities for employment, since there are several significant industrial complexes outside the urban area of Snowflake. Snowflake fire protection is provided by the municipal fire department supported by 25 firefighters. The fire department also protects the surrounding 450 square miles of unincorporated area, for a total estimated population of 9,500 residents. The fire department usually sees a response volume of 300 to 400 calls for service each year. Properties within the town have an ISO rating of 6. Major transportation routes into Snowflake are State Routes (SRs) 77 and 277. It is along these routes that both residential and commercial facilities exist and future growth is anticipated. It is expected that the community will experience significant infill, as well as growth to the west, along SR 277. The population of the outlying areas also continues to steadily increase. With a mild climate and affordable property, Snowflake continues to attract developers desirous to provide affordable and sustainable subdivisions with paved roads, sidewalks, utilities, and city services that are close to schools, medical centers, and recreational facilities. The majority of land in Snowflake is privately owned. However, there are 20,000 acres of state and federal land in and around the town of Snowflake. Some of the residents lease this land to graze cattle, while others merely enjoy the hiking, horseback riding, and scenic views. The population of the Town of Snowflake has increased from 3,680 in 1990 to an estimated 5,697 residents in 2014. Major employment in the town is composed of education and health care, service industry, and construction, which collectively provide more than 50 percent of the local employment share (Arizona Commerce Authority 2015).

Taylor-Shumway

Taylor was settled by James Pearce and named after John Taylor, an English-born president of the Church of Jesus Christ of Latter Day Saints in 1881. Taylor has several sites listed on the National Register of Historic Places. The town of Taylor is located immediately south of Snowflake along SR 77, approximately 13 miles north of Show Low. It is bordered on three sides by public land including the Apache-Sitgreaves National Forest and BLM administered lands. Located at 5,600 feet amsl, Taylor is set along the banks of cottonwood-lined Silver Creek. Wildland vegetation outside the urban area consists primarily of tall, seasonal grasslands with a mosaic of juniper stands of varying density. A majority of the Taylor economy is supported by Catalyst Paper Inc., Hormel Foods Inc., Renergy, molding mills, and other production-based industry. Landownership in Taylor is primarily private, about 80 percent, with 20 percent public (10 percent state, 10 percent federal). With the proximity of the A-SNFs, NOVO Power, a biomass energy generator, and Tri-Star Trucking have formed a partnership

and located a sawmill adjacent to the biomass plant just west of town. Also nearby, the Lumberjack Mill has been increasing production and jobs under the Four Forest Restoration Initiative. Taylor is home to the corporate offices of Pigs for Farmer John, Brimhall Sand and Rock, Hatch Construction and Paving, and Reidhead Sand and Rock. The Northeast Arizona Training Center is home to the Northern Arizona Law Enforcement Training Academy. It also houses fire-service classes offered through Northland Pioneer College. The facility's burn tower and driving track draw agencies from around the area. Taylor Municipal Airport boasts a 75- by 7,500-foot runway for corporate visitors, and ample land in the surrounding area makes it an attractive opportunity for businesses looking for a new location. Taylor Fire District encompasses 29 square miles of response area that includes the communities of Taylor and Shumway. The fire department employs 3 full-time professional firefighters and 28 volunteer firefighters. The resident population of Taylor is 4,300 with a seasonal increase of about one-third during the summer months. The ISO rating for Taylor is 6 in town, 9 out of town. The population of Taylor has grown from 2,420 residents in 1990 to an estimated 4,178 residents in 2014.

Silver Creek Area—White Mountain Lake and Silver Lake Estates

The Silver Creek area is located 7 miles northeast of Show Low and borders the northeastern portion of the Sitgreaves National Forest. The unincorporated communities of White Mountain Lake and Silver Lake Estates are included in this area. The Silver Creek Area is delineated by SR 77to the west, by Highway 60 to the south with the greatest threat of wildfire coming from the west and south. Landownership in the Silver Creek area is a mix of private and state lands, with the A-SNFs bordering these lands to the south. Current trends in land development and projected growth are a mix of low-density and higher-density residential developments around White Mountain Lake, along with isolated residences located east of Bourdon Ranch Road and extending to the Navajo/Apache County line. These homes are accessed by primitive roads. Recreation/open space mainly includes White Mountain Lake and state lands located through the area. The majority of state lands are located to the south and east of the White Mountain Lake community. The estimated year-round population of the Silver Creek area is over 2,500. However, due to the area's climate and recreational opportunities, this area experiences a seasonal population influx that more than doubles the resident population. Existing infrastructure includes paved roads, utilities, and communication centers. These resources are continually being enhanced by ongoing development. The White Mountain Lake Fire District protects an area of 42 square miles or more, with a seasonal population of 5,000 or more in the summer months. Properties in the White Mountain Lake Fire District have an ISO rating of7–8. Silver Lake Estates is a small community approximately 1 square mile in size with an estimated year-round population of 350. Silver Lake Estates' ISO rating is assumed to be 9–10. Primary ingress/egress to Silver Lake is Bordon Ranch Road. Both communities are currently served by the White Mountain Lake Fire District, which on July 1, 2008, went to a full-time career department staffed by three firefighters/EMS personnel per 48/96-hour shift. Due to the nature of wildland areas surrounding these communities, all fire district personnel are required to train to National Wildfire Coordinating Group (NWCG) standards of Basic Wildland Firefighter and to have, at a minimum, taken NWCG course work in wildland fire behavior. In May 2008, the residents of the districts approved implementation of both the 2006 International Fire

Code and the 2006 Wildland-Urban Interface Code. A Firewise education program has been initiated in a limited fashion. The chief and the company officers attend the monthly property owners' association meeting to inform and educate the public of the importance of defensible space. The community newsletter provides another opportunity to educate property owners on the need to apply Firewise standards to their property. Burn permits are now issued on a 30-day basis. Fire crews deliver the permit to the homeowner and inspect the area prior to issuing the permit. This provides yet another opportunity to educate the public on Firewise issues and defensible space. District personnel offer an assistance program for homeowners unable to participate in establishing defensible space on their property. On a donation basis, district personnel will go to the homeowners' property and provide services including, thinning, burning, and brush removal.

Chevelon–Halter Cross WUI

The Chevelon–Halter Cross WUI covers approximately 98,005 acres. Chevelon Retreat is the only established population center in the Chevelon–Halter Cross WUI. Chevelon Retreat is located in a remote portion of Navajo County. Access to this community is gained through USFS roads through ponderosa pine forests with higher fuel loads and greater potential for wildland fire. There is also a high-voltage power line that serves the entire planning area located near Chevelon Retreat. The WUI boundaries of this subarea have been defined in order to protect ingress/egress to Chevelon Retreat, as well as infrastructure key to all of Navajo County. Land designation in this WUI is evenly split between private and USFS-administered lands with checkerboard state lands mixed in with private land. The Chevelon–Halter Cross WUI's current Navajo County parcel data estimates that 199 structures are included within the WUI. The Chevelon–Halter Cross WUI has no acres rated as high wildland fire risk but has 17 percent rated as moderate risk and 83 percent rated as low risk. Therefore, the Chevelon–Halter Cross WUI is rated as moderate-low wildland fire risk.

Chevelon Retreat

Chevelon Retreat is an unincorporated community on the northern edge of the A-SNFs in the western portion of the Central Navajo County CWPP planning area. There is a wide range of developments ranging from low-income semi-permanent homes (homes occupied on a semi-permanent basis) to second-home/vacation cabins. There is no known economic development in the area. The precise year-round population is difficult to determine, but it is assumed to be less than 500. Values at risk include a high-voltage electrical transmission line that runs near the community and ingress/egress to individual homes. Access to Chevelon is primarily through unpaved forest roads. There is also a small airplane landing strip available for residents. This area was threatened by the Potato Fire in 2006 and is therefore determined to be at risk for future wildland fires. The vegetation of Chevelon Retreat is primarily pinyon/juniper of moderate density, with scattered grasslands not assumed capable of sustaining a crown fire. However, directly to the south are dense stands of pinyon/juniper with a component of ponderosa pine. These areas would carry a high-intensity wildland fire and, in the case of the Potato Fire, have done so in the past. For this reason, fuel treatments in this area are a priority for

the Black Mesa Ranger District of the A-SNFs to protect Chevelon Retreat. WUI boundaries for this subarea have been drawn to reflect this condition.

Wood Products WUI

There are no established communities within the Wood Products WUI. This WUI is defined by the economic significance to all central Navajo County WUI communities and covers approximately 24,466 acres. Many businesses, particularly in the wood-products industry, that sustain the local economy are located in this WUI. Land designation within this WUI is evenly split between private and USFS-administered lands. State Trust lands checkerboard much of the private land. The Taylor and Snowflake Fire and Medical Department responds to fires in this area. Current Navajo County parcel data estimates that 155 structures are included within this WUI. The Wood Products WUI has no acres rated as high wildland fire risk but has 8 percent rated as moderate risk and 92 percent rated as low risk. Therefore, the Wood Products WUI is rated as low- moderate wildland fire risk.

East of Snowflake WUI

The East of Snowflake (EOS) WUI covers approximately 50,666 acres. Little is known about the communities located northeast of Snowflake. The roads are unpaved and unmarked. Infrastructure is minimal; homes in this area are “off the grid”; no utilities (i.e., electricity, water, sewer) are provided by the city. The year-round resident population is unknown. ISO rating is assumed to be 10. Land designation in the EOS WUI is almost entirely private (84 percent), with some State Trust lands. This area falls within the Snowflake/Taylor response area; however, emergency assistance is often not requested nor desired by the residents. Fortunately, overall wildfire risk is low. A wildland fire in the EOS WUI would most likely not carry far and would have limited fire effects. The 2009 Core Team designated a WUI subarea here so that in the future, as local conditions change, these communities may be reevaluated for WUI considerations. The Core Team carried this WUI forward for these reasons. Current Navajo County parcel data estimates that 1,166 structures are included within this WUI. The EOS WUI has no acres rated as high wildland fire risk but has 17 percent rated as moderate risk and 83 percent rated as low risk. Therefore, the EOS WUI is rated as moderate-low wildland fire risk.

F. Wildfire Risk Analysis

The wildfire risk analysis synthesizes the risk associated with fuel hazards, wildfire ignitions, wildfire occurrence, and community values as determined by wildfire-threat analyses composed of potential wildfire behavior and wildfire ignition history and by wildfire-effects analyses composed of structure density within the WUI in consideration of fire suppression resources. These components were analyzed spatially and combined to determine the wildfire risk for each community WUI. Figures 2.6a and 2.6b and Table 2.8 display the results of the wildfire risk, identifying the areas and relative percentages of WUI areas of high, moderate, and low wildfire risk.

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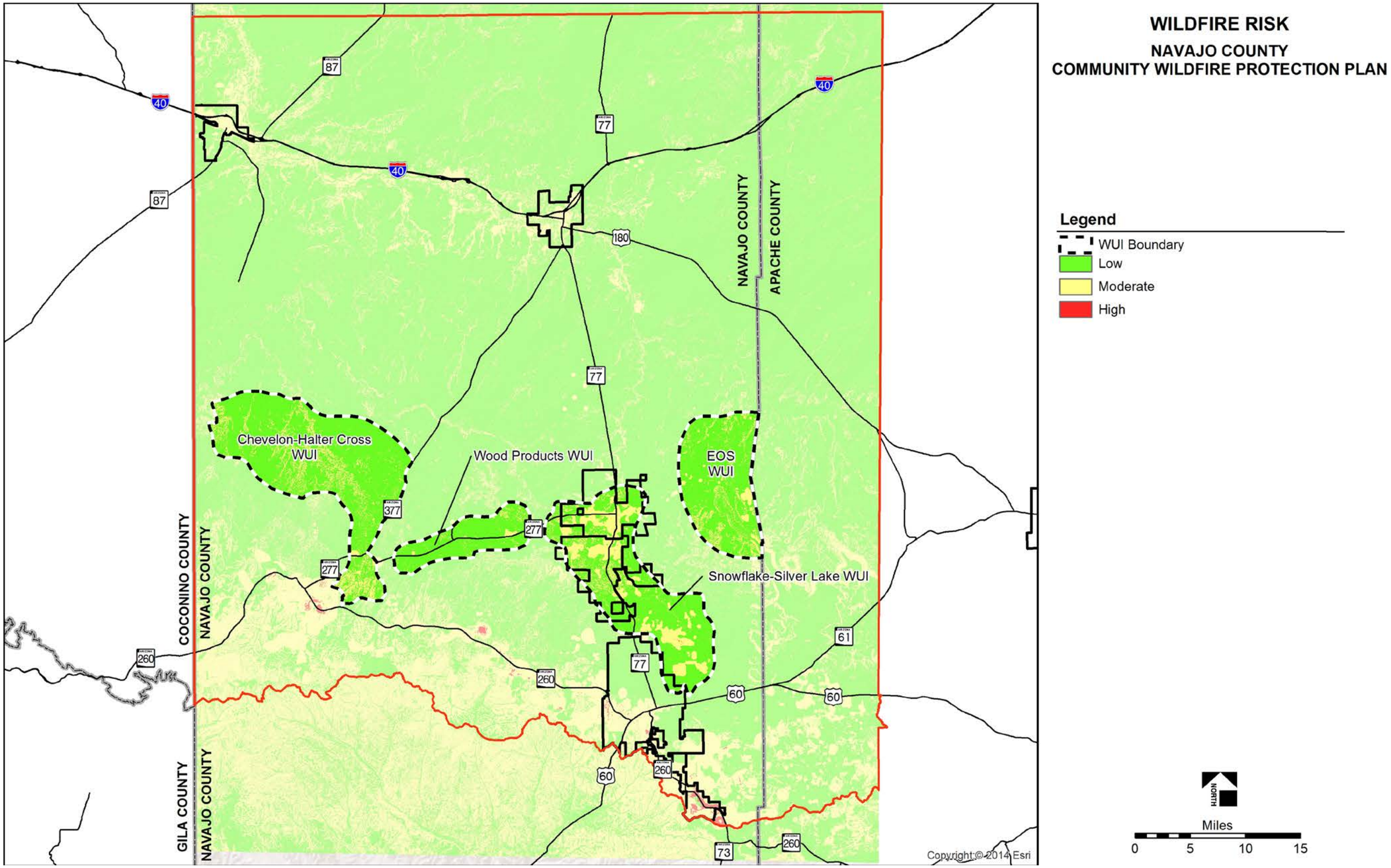

Figure 2.6a. Central Navajo County CWPP Wildfire Risk Analysis

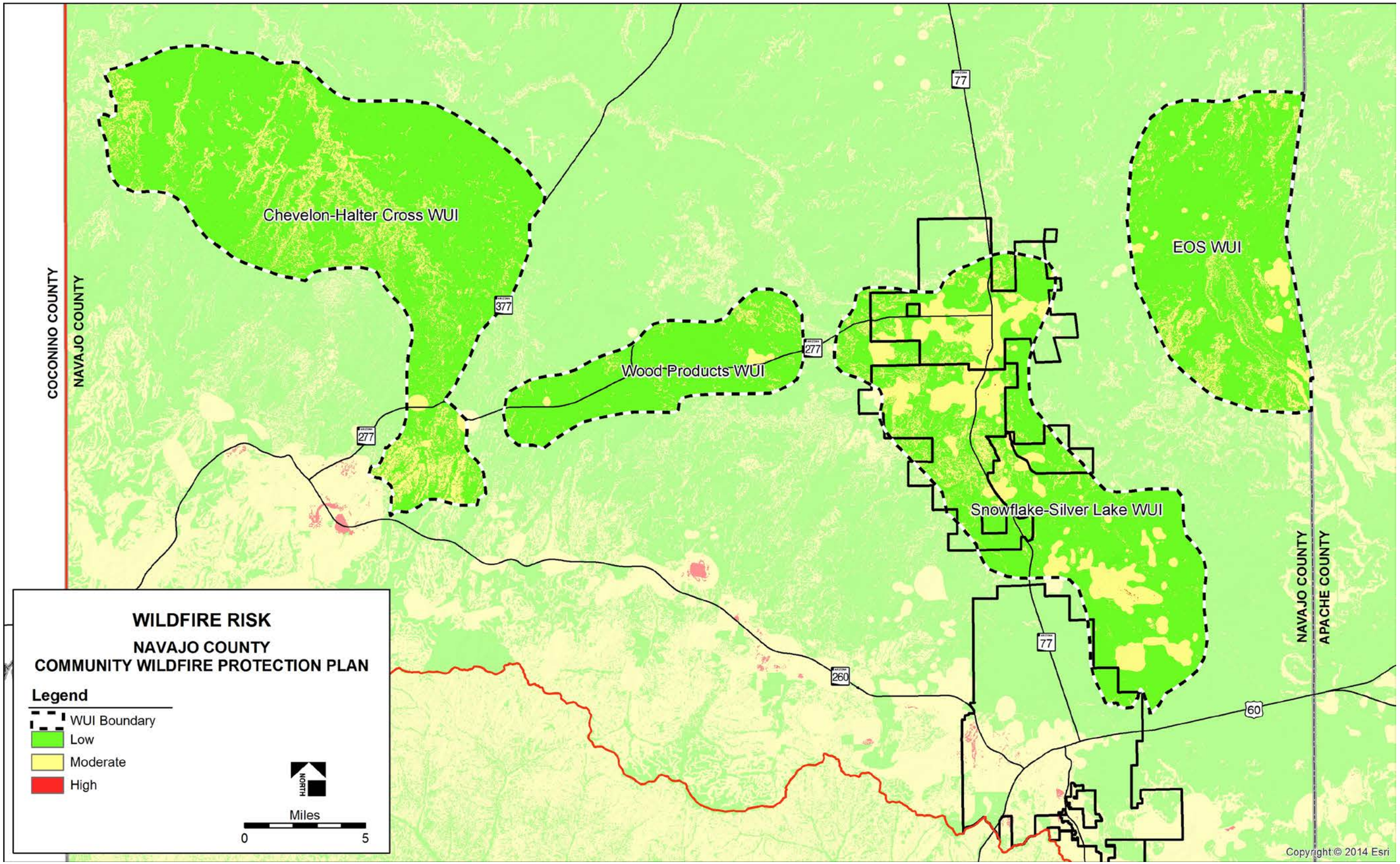

Figure 2.6b. Central Navajo County CWPP Wildfire Risk Analysis—Detail View

Table 2.8. Wildfire Threat Assessment by Percentage and Acreage of the WUI

Central Navajo County Community WUI	High Risk		Moderate Risk		Low Risk		Total Acres
	%	Acres	%	Acres	%	Acres	
Chevelon–Halter Cross	0	0	17	16,390	83	81,615	98,005
East of Snowflake	0	0	17	8,546	83	42,120	50,666
Snowflake–Silver Lake	<1	17	30	23,583	70	55,284	78,884
Wood Products	0	0	8	1,865	92	22,601	24,466
Total		17		50,384		201,619	252,021

Source: Logan Simpson.

Note: WUI = wildland-urban interface.

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III. COMMUNITY MITIGATION PLAN

This section outlines the Central Navajo County CWPP revised priorities for wildland fuels treatments, as well as the recommended methods of treatment and management strategies for mitigating the potential spread of catastrophic wildland fire throughout the WUI. The central Navajo County communities, BLM, and the A-SNFs have conducted wildland fuel mitigation and forest restoration projects within and adjacent to community WUIs subsequent to approval of the 2009 Central Navajo County CWPP. The Core Team reviewed these treated areas and determined current priority areas for future fuels mitigation and restoration treatments that are included in this revised Central Navajo County CWPP. This section also presents revised recommendations for enhanced wildland fire protection capabilities and public education, information, and outreach to further community preparation for wildland fire within and adjacent to the communities.

A. Fuel Reduction Priorities

After determining areas currently at greatest risk for wildland fire (Section II of this CWPP), the Core Team reviewed and amended, as necessary, the 2009 proposed wildland fire mitigation recommendations for residential treatments, fuel breaks appropriate for the wildland fuel types, and fuel mitigation treatments for undeveloped landscapes (Table 3.1). Within the Central Navajo County CWPP area, approximately 3,321 acres of wildland fuel reduction and restoration treatments in or proximate to community WUIs associated with A-SNFs have occurred from 2008 to the first half of June 2015. The Core Team has proposed wildland fire mitigation projects for at-risk federal, public, and private lands that have not had recent (prior to 2008) fuel reduction or forest restoration treatments. These revised proposed actions are recommended to prevent wildfire spread from public lands onto private land and, conversely, to reduce the risk of fires spreading from private land onto public lands by reducing wildland fuels and creating survivable space within fire-adapted communities. A “survivable space” is the area around a structure where the vegetation has been managed to reduce fire intensity as a wildfire nears and to reduce the chance of fire from reaching and burning the structure. A primary goal of the revised Central Navajo County CWPP is for proposed treatments to be continuous across property boundaries, allowing for the most effective protection from wildfires and to complement those fuel mitigation and forest restoration treatment conducted after approval of the 2009 Central Navajo County CWPP.

Hazardous fuels reduction recommendations on federal and private lands vary by implementing single fuel breaks to broader land treatment applications for wildland fuel reduction and forest restoration within or adjacent to the WUI. Additional fuel breaks or hazardous fuels reduction projects since those implemented beginning in 2009 are recommended and conform to the types of treatment recommendations developed by the 2009 Core Team. The current recommendations for fuel mitigation and restoration treatments are complementary to previous actions and conform to current land management plans. The Core Team recognizes the responsibility of private landowners in creating and maintaining survivable wildland fire space on their lands and within fire-adapted communities to enhance protection of values within their properties and communities. The Core Team supports and encourages private landowners to become involved with wildland fire protection and the creation of

survivable space in fire-adapted communities. NCEM, ASFD, A-SNFs, BLM, municipalities, local fire departments and districts, and the Core Team's participating resource specialists developed wildland fuel reduction recommendations designed to restore wildland fire to its natural role appropriate for the landscape and to provide for community preparedness. The recommended land treatments and fuel breaks will enhance public and firefighter safety, community value protection, restoration of native vegetation, and provide for wildlife habitat needs. In this plan, *fuel break* means a strip of land where vegetation has been modified so that fires burning into it can be more readily controlled.

These revised wildland vegetative fuel and fuelbreak recommended treatments meet the revised Central Navajo County CWPP goals of enhancing firefighter and public safety; reducing hazardous wildland fuels on public and private lands; improving fire prevention and suppression; restoring riparian, forest, and rangeland health; involving the community; and expediting project implementation. To prioritize wildland fuel mitigation projects, the Core Team analyzed wildland fire risk through analyzing fire threat and fire effects. The Core team analyzed fire effects through determination of proximity of community values and structure density to high wildfire threat. Fire threat and fire effects were combined to produce the wildland fire risk assessment that is compiled in a single community base map depicting areas of low, moderate, and high wildland fire risk (see Figures 2.6a and 2.6b). The 2009 Central Navajo County CWPP identified and categorized a total of 87 fuel management units (FMUs) within four WUI subareas, with an overall risk value determined for each treatment management unit (see Navajo County 2009:Table 13). The Core team has reviewed the 2009 FMUs and has revised these in accordance with the current risk assessment. In contrast with the 2009 Central Navajo CWPP where FMUs were not intended to be boundaries for treatment units, the Core Team identified specific treatment management units based on wildfire risk across all landownerships. The Core Team has identified 10 treatment management units (Figure 3.1; Table 3.2) based on similar risk values and fuel reduction treatments necessary to meet fire-adapted community goals identified by the Core Team. Additionally, the Core Team has developed a series of fuel reduction and restoration recommendations that meet agency and community wildfire preparedness goals (Table 3.1).

Table3.1. Fuel Modification and Treatment Plans

Treatment No.	1 Developed Parcels <2 Acres				2 Undeveloped private parcels or single-structure parcels >2 acres		3 Grassland Fuelbreaks		4 Oak/Pinyon/Juniper and Shrublands within the WUI	
Treatment Category	**Zone 1 (0–10 feet from structures)**	**Zone 2 (10–30 feet from structures)**	**Zone 3 (30–100 feet from structures)**	**Zone 4 (100–600 feet around home)**	**Slopes <20%**	**Streambeds, Channels, and Slopes ≥20%**	**Slopes <20%**	**Slopes ≥20%**	**Landscape Treatment outside Fuelbreaks**	**Fuelbreaks**
Vegetation	Remove ladder fuels by pruning the lower third of trees or shrubs up to a maximum of 10 feet to reduce flammable vegetation. Remove and destroy insect-infested, diseased, and dead trees and shrubs. Grasses and forbs may be cut with a mower to a 4-inch stubble. Remove dead plant material from ground; prune tree limbs overhanging roofs; remove branches within 10 feet of chimneys; remove flammable debris from gutters and roof surfaces.	Remove ladder fuels by pruning the lower third of trees or shrubs up to a maximum of 10 feet; remove and destroy insect-infested, diseased, and dead trees. Create separation between trees, tree crowns, and other plants according to fuel type, density, slope, and other topographical features. Reduce continuity of fuels by creating a clear space around brush or planting groups. Grasses and forbs may be cut with a mower to a 4-inch stubble. All snags and vegetation that may grow into overhead electrical lines, other ground fuels, ladder fuels, dead trees, and thinning from live trees must be removed. Control soil erosion from small waterflow channels by using rock or noncombustible velocity-reducing structures.	Remove ladder fuels by pruning the lower third of trees or shrubs up to a maximum of 10 feet; remove and destroy insect-infested, diseased, and dead trees. Maximum density of trees (whichever is greater: 60 basal area[a]. The maximum number of conifer trees per acre is recommended to not exceed 60 per acres Grasses and forbs may be cut with a mower to a 4-inch stubble.	For natural areas, thin selectively and remove highly flammable vegetation. Carefully space trees; choose Firewise plants (see online list: http://www.firewise.org/usa/fw_plantlists.htm).	Remove ladder fuels by pruning the lower third of trees or shrubs up to a maximum of 8 feet; remove and destroy insect-infested, diseased, and dead trees. Maximum density of trees should reflect fire resiliency status appropriate for the fire-adapted vegetation community See the Fuel Modification Plan (this section) developed to promote riparian health, to prevent spread of fire to adjacent property, and to create survivable space with considerations for wildlife and groundwater protection. Single structure or structures on parcels exceeding 2 acres should include Treatment 1 in proximity to structures and Treatment 2 for remaining acres.	Remove ladder fuels by pruning the lower third of trees or shrubs up to a maximum of 12 feet Remove dead, diseased, and dying trees. Fell dead trees away from stream channels with defined bed and banks. Areas should be hand-thinned and hand-piled; inaccessible areas may be treated with periodic prescribed fire. Develop a fuel modification plan (this section) for treatments.	Grassland types may be mechanically treated, including mowing, baling, chopping, or mastication, to reduce or remove vegetation or may be grazed to a suitable stubble height. Ensure that treatment of vegetation within a designed fuelbreak of >1 chain (66 feet) in width and length is necessary to enhance protection of federal, state, or private land values. Fuel reduction treatments within grassland vegetation types may include multiple-entry burns to maintain stand structure and reduce fine fuels. Trees and shrubs should be thinned to a variable distance to reflect fire resiliency status appropriate for the fire-adapted vegetation community. Mechanical/chemical or grazing treatment may be used to maintain fuelbreaks on private lands. See the Fuel Modification Plan (this section) developed to prevent spread of fire to adjacent property and to create defensible space with considerations for wildlife and groundwater protection.	Same as for slopes <20%. Fuel treatments may require hand-thinning and hand-piling or grazing in steep slopes. Prescribed fire may be used to reduce high fire potential (see Treatment 5). Designated fuelbreaks may be increased to more than 2 chains in steep slopes where herbaceous (fine fuels) and subshrub species fuel loads increase to pretreatment levels within 3 years. See the Fuel Modification Plan (this section) developed to promote forest health, to prevent spread of fire to adjacent property, and to create defensible space with considerations for wildlife and groundwater protection.	Spacing may be variable to promote (1) wildlife habitat while breaking horizontal fuel loading, which allows for patches of closely spaced trees for adequate cover, and (2) other habitat components while incorporating openings to increase herbaceous forage production, to maximize edge effect, and to promote fire-resilient stands. Mechanical thinning, mastication, and prescribed fire (see Treatment 5) can be used to reduce fuels by removing dead standing oaks and junipers to move stands toward potential natural vegetation groups as described in the *FRCC Interagency Handbook* (FRCC Interagency Working Group 2005b) or grazed to like conditions. All trees >10 inches diameter should be targeted as "leave trees" unless treatment is necessary to reflect fire resiliency status appropriate for the fire-adapted vegetation community	Woodland and shrub trees should be thinned to reflect fire resiliency status appropriate for the fire-adapted vegetation community, or prescribed fire should be applied to achieve like conditions. Shrub and tree trunks should be severed <4 inches from the ground. Mechanical treatments, such as crushing, chipping, mastication, and prescribed fire, may be used to create open stands to minimize crown-fire potential and to produce fuel conditions conducive to suppression action. Herbaceous and subshrub understory may be mechanically treated, including mowing, chopping, and masticating, or may be grazed to limit fine-fuel loading while protecting soil integrity. Herbicide application may be used to prevent resprouting/regrowth of trees, and broad-scale invasions of woody species.
Slash	Remove or reduce natural flammable material 2–4 feet above the ground around improvements. Remove vegetation that may grow into overhead electrical lines, ladder fuels, and dead trees; thinning from live trees must be removed (chipped, etc.). Remove all leaf litter to a depth of 1 inch.	Remove all leaf litter to a depth of 1 inch.	Same as Zones 1 and 2.	Slash may be burned, piled and burned, or chipped and removed. Slash from grassland treatments may be burned, removed, masticated, turned, or grazed for like treatment.	All slash, snags, and vegetation that may grow into overhead electrical lines; other ground fuels; ladder fuels; dead trees; and thinning from live trees must be removed, mechanically treated (chipped, etc.), or piled and burned along with existing fuels.	Clean dead and down debris in channels where debris may be mobilized in floods and thus create downstream jams. Some slash and debris can be scattered and retained in small, ephemeral streambeds in which slash can help retain runoff and sediment and provide headcut stabilization.	Slash from grassland treatments may be burned, removed, masticated, or turned (disked).	Same as for slopes <20%; however, slash may be hand-piled and ignited with prescribed fire as the primary slash reduction treatment.	Slash may be burned, piled and burned, or chipped and removed. Slash from grassland treatments may be burned, removed, masticated, or turned.	Slash may be burned, piled and burned, or chipped and removed. Slash from grassland treatments may be burned, removed, masticated, or turned.

Continued

Table3.1. Fuel Modification and Treatment Plans

Treatment No.	5 Prescribed Fire	6 Riparian Areas (federal, nonfederal, and private lands)		7 Saltcedar Removal for Restoration Purposes (federal and nonfederal lands)	8 Forest Types (federal and nonfederal lands)	
Treatment category	**Federal, State, or Private Lands**	**Federal or State Lands**	**Fuelbreaks on Private Lands**	**Federal, State, or Private Lands**	**Thinning**	**Shaded Fuelbreaks**
Vegetation	Prescribed fire should be used as a tool to accomplish specific resource management objectives in accordance with standards and guidelines from ASLD, ASFD, A-SNFs, BLM, or all of the above. Prescribed fire on federal land is authorized if part of an approved prescribed-fire plan. As additional areas within the WUI are identified, prescribed fire may be used as a treatment tool provided that a prescribed fire plan has been approved and that all conditions set forth have been met. Prescribed fire can occur at low, moderate, and/or high intensity depending on the vegetation type and treatment objectives.	Riparian treatments should be limited in scope. The majority of riparian areas that fall within the WUI boundary will be avoided unless deemed a fuel hazard. Clearing or cutting of any material by mechanized equipment adjacent to any stream on federal land may be prohibited to prevent the risk of accelerating erosion. Treatments may include some overstory removal of deciduous riparian trees and shrubs in areas where encroachment has increased heavy woody fuels (emphasizing removal and control of saltcedar and other invasive trees). Treatments will emphasize nonnative species. Snags may be retained in accordance with agency guidelines. Presettlement trees, including snags, will be targeted for retention.	Private land treatment should use hand tools, chain saws, or mowers. Dead vegetation and slash should be removed. Ladder fuels, including limbs and branches, should be removed up to a maximum of 8 feet aboveground. All mechanized equipment must meet state and local fire-department/district standards. Perform treatments October–March annually to avoid nesting season.	Areas of monotypic saltcedar, or saltcedar in mix with other riparian tree species, may be treated mechanically or chemically or by controlled burning and reburning to reduce stem density, canopy, and excessive fuel loading. Mechanical removal for saltcedar by cutting below the root collar during November–January is preferred. Mechanical whole-tree extraction has achieved as high as 90% mortality on initial treatments and may be considered a preferred treatment. Low-volume oil-based herbicide applications in late spring through early fall would be considered for controlling small plants (<2 inch-diameter at root collar). Low-volume cut-stump herbicide applications should be considered in combination with mechanical treatment. Preferred phenological stage for burning is peak summer months and after bird nesting season. Black lines and appropriate headfires should be initiated depending on site-specific vegetative and burning conditions (Zouhar 2003). Maintenance, revegetation, restoration, and monitoring should follow as needed for each treatment area.	Lands may be thinned from below to reduce understory vegetation. Residual stocking levels for sites of predominantly pine, or juniper overstory would be reduced to reflect fire resiliency status appropriate for the fire-adapted vegetation community. All trees larger than agency diameter limits stated would not be cut even if the desired stocking level is not being met. In those cases, all tress smaller may be cut, but with some vegetation retained to provide a mosaic pattern.	Shaded fuelbreaks would only be planned around residential areas. A shaded fuelbreak is a type of fuelbreak within forested lands in which a band of larger mature trees (that are more fire resistant) are left in place with a relatively open understory. Enough mature trees are left to provide shade to keep the understory from redeveloping. The fuelbreak is designed to significantly slow the speed of a wildfire, All dead standing trees, of any size, would be removed. A shaded fuelbreak width of approximately 330 feet is necessary to reduce fire crowning.
Slash	Slash, piles of small-diameter dead trees or tree limbs (jackpots), and down logs may be burned as appropriate in consideration of local conditions and distance from private property. Pile or prescribed fire can be used to remove fuel from private land as designated. Snags and down woody material may be retained in areas where fire resilience is not compromised.	After removal of heavy woody fuels, fine fuels may be maintained by cool-season low-intensity prescribed fire that moves slowly downslope or into prevailing winds to midslope. Large down woody material and snags (≥12 inches) may be retained in riparian areas.	Fuel treatments and woody material removal should occur on existing roads. Cool-season low-intensity prescribed fire may be used for maintenance of fine fuels. Pile burning or burning stands of small diameter trees (jackpot burning) should not occur in ephemeral, intermittent, or perennial stream channels.	Created slash should be made available for woody biomass use. If not used for wood-related products, slash should be piled with preexisting fuels and burned. Disturbed areas should be immediately revegetated with a native plant community that contains no invasive species and meets other land use objectives, such as wildlife habitat enhancements or recreational-use benefits.	Slash may be lopped and scattered to a thickness of no more than 2 feet deep, then treated later as part of a broadcast burn. Slash may also be piled by hand or machine, and later burned.	Slash would be piled and burned.

Note: ASFD = Arizona State Forestry Division; ASLD = Arizona State Land Department; BLM = Bureau of Land Management; A-SNFs = Apache-Sitgreaves National Forests;

[a] Basal area is the common term used to describe the average amount of an area (usually an acre) occupied by tree stems.

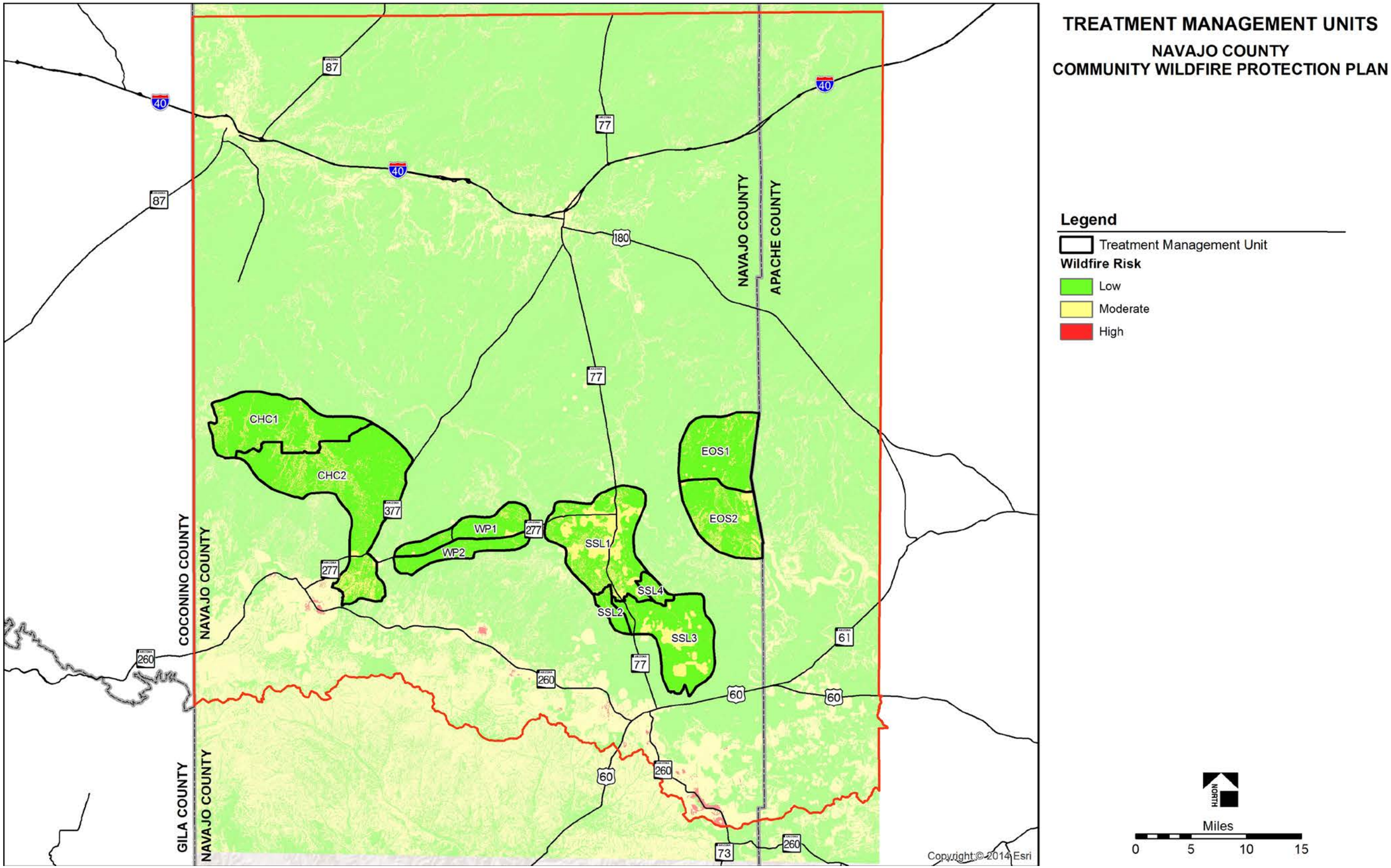

Figure 3.1. Central Navajo County CWPP Treatment Management Units

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Table 3.2. Identified Treatment Management Units

Treatment Management Unit	Map ID	Risk Value	Fuel Model(s)	Recommended Treatment[a]	Total Acres	Federal Acres	State Trust Acres	Nonfederal/ Other Acres
Chevelon–Halter Cross	CHC1	M	GR1,GR2,GS1,NB8,NB9, SH1,SH2,SH5,SH7,TL1, TL3,TL8,TU1	1,2,3,4,5,8	35,087	5,253	7,830	22,005
	CHC2	L	GR1,GR2,GS1,NB1,NB8, NB9,SH1,SH2,SH7,TL1, TL3,TL4,TL8,TU1	1,2,3,4,5,8	62,918	36,658	7,948	18,312
Wood Products	WP1	L	GR1,GR2,GS1,NB1,NB8, NB9,SH1,SH2,TL3,TL8, TU1,TU2,	1,2,3,4,5,8	14,032	4,537	2,885	6,610
	WP2	M	GR1,GR2,GS1,NB1,NB9, SH1,SH2,SH5,SH7,TL3, TL8,TU1	1,2,3,4,5,8	10,434	6,021	1,851	2,562
Snowflake–Silver Lake	SSL1	M	GR1,GR2,GS1,GS2,NB1, NB3,NB8,NB9,SH1,SH2, SH5,SH7,TL2,TL3,TL5, TL8,TU1	1,2,3,4,5,8	40,968	624	4,460	35,885
	SSL2	M	GR1,GR2,GS1,NB8,NB9, SH1,SH2,SH5,TL3,TL8, TU1	1,2,3,4,5,8	3,782	3,270	310	202
	SSL3	M	GR1,GR2,GS1,NB1,NB3, NB8,NB9,SH1,SH2,SH5, TL2,TL3,TL5,TL8,TU1,TU2	1,2,3,4,5,8	31,083	4,228	8,764	18,090
	SSL4	M	GR1,GR2,NB1,NB3,NB8, NB9,SH1,SH2,SH5,TL3, TL5,TL8,TU1	1,2,3,4,5,8	3,052	3,047	5	0
East of Snowflake (EOS)	EOS1	M	GR1,GR2,GS1,GS2,NB1, NB8,NB9,SH1,SH2,SH5, TL3,TL5,TU1	1,2,3,4,5,8	26,149	173	3,272	22,704
	EOS2	L	GR1,GR2,GS1,GS2,NB8, NB9,SH1,SH2,TL3,TU1	1,2,3,4,5,8	24,517	70	4,434	20,012
				Total Acres	252,021	60,835	41,758	149,428

Note: CHC = Chevelon–Halter Cross WUI; WP = Wood Products WUI; SSL = Snowflake–Silver Lake WUI; EOS = East of Snowflake WUI; L = low; M = moderate; H = high.

[a] See Table 3.1 for recommended treatments.

The Core Team described the location of each treatment management unit in the WUI and then assigned recommended treatments for each treatment management unit (Table 3.2). The management units listed in Table 3.2 do not always coincide with fire department or district boundaries. Some management units are not located within a fire department or district and therefore have no structural fire protection. For example, the Chevelon Retreat community is not included within a fire district and the Snowflake–Silver Lake WUI is much larger than the fire district boundary.

Treatment of wildland fuels within the WUI is expected to generate considerable slash and vegetative waste material. Private individual use of wood products from fuel reduction treatments within the WUI is primarily for fuelwood. Commercial use of the woody material from fuel reduction treatments has been generated through the A-SNFs' 2004 White Mountain Stewardship Project whose goals were to reduce the impact of wildfires to communities at risk, to improve wildlife habitat, and to restore forest health, while helping rural communities stimulate employment in the wood-products industry.

Recent costs of fuels mitigation treatment on USFS lands within the WUI are estimated to be $100.00 per acre for mowing and $200.00 per acre for mastication. Recent costs of fuels mitigation treatment on A-SNFs lands consistent with the White Mountain Stewardship contract costs for thinning within the WUI include $525.00 per acre and $250.00 to $350.00 per acre for forest treatments conducted by the A-SNFs. If wildland fuel modification prescriptions require follow-up pile burning or herbicide application after vegetation treatment, the total cost per acre could include $50.00–$100.00 for burning and $400.00 for foliar herbicide application (A-SNFs, pers. comm. 2015).

Private land treatments in the WUI typically occur on small land parcels near power lines, structures, and other obstacles. In many cases, cut trees and slash cannot be piled and burned on small private land parcels, or it is not the preferred slash treatment by the owner of a small residential lot or by the local fire departments. Therefore, the Core Team recommends that slash from wildland fuel reduction treatments on small residential parcels be removed, whole or chipped, and transported to a disposal site. The Core Team does not oppose alternative vegetative treatments, such as an experimental grazing program using primary grazers within the WUI, to achieve wildland fuel mitigation objectives adjacent to state or federal lands. The Core Team also recommends that fuelbreaks constructed on public and private lands to restrict wildland fire movement be maintained on a rotating 2- or 3-year interval, or as deemed necessary, to ensure the integrity of the fuelbreak through removal of fine and light vegetative fuels.

The Core Team recommends that when available, wildland fuel modification projects be contracted to ASFD through the use of the Department of Correction fire and fuels management crews to ensure that treatments are conducted in a timely fashion and at a reasonable cost. The estimates of daily costs, which include a 20-person labor crew and a chipper for a 100-mile roundtrip to the project site by an ASFD crew carrier as of December 2015 are as follows:

- 10-hour day—$1,400.00
- 12-hour day—$1,580.00

Cost estimates for treatments in the WUI are based on the estimates provided by the ASFD for the Fire and Fuels Crew costs for both federal and nonfederal land treatments (Table 3.3). The ASFD Fire and Fuels Crew does not remove hazard trees or provide “climbers” for pruning or segmented tree removal that is sometimes required on private lands. The Core Team does support and encourage local business development that will complement wildland fuel mitigation needs within federal and nonfederal lands of the WUI. Vegetative fuel mitigation costs for this CWPP are estimated to be $350.00 per acre, which is comparable to the estimated cost of the ASFD Fire and Fuels Crew and estimated fuel mitigation costs on adjacent federal lands. However, the availability of federal, state, and local funding for mitigation of wildland fire risk, enhanced response, and public education will drive the ability of the Core Team to meet the goals of the revised Central Navajo County CWPP.

Table 3.3. Acres of Wildland Fuels Mitigation Treatment Conducted by ASFD Fire and Fuels Crew during a 10-Hour On-Site Workday

Vegetation Association	Average Acres per Day Treated
Ponderosa pine/mixed conifer	0.5 to 1 acre per day
Pinyon/juniper	1 to 2 acres per day
Mesquite woodland	3 to 4 acres per day
Oak woodland	3 to 4 acres per day
Riparian	1 to 2 acres per day (depending on fuel loading)
Grassland	2 to 4 acres per day (depending on grass type and fuel loading)

The Core Team recommends that private landowners who wish to adopt fuel modification plans other than those described in Table 3.1 have the plan prepared or certified by a professional forester, by a certified arborist, by other qualified individuals, or in conjunction with recommendations from local fire departments or fire districts that reference Firewise or fire-safe guidelines. Fuel modification plans for federal and state lands within 0.5 mile of private lands may be prepared for wildlife and watershed benefits—including the retention of large snags or vegetative patches of high wildlife value in areas more than 600 feet from private lands in which fire resiliency is not impaired and will not compromise public or firefighter safety. A fuel modification plan should identify the actions necessary to promote rangeland, wildlife, or watershed health and to help prevent the spread of fire to adjacent properties by establishing and maintaining survivable space. The action identified by the fuel modification plan should be completed before development of the property or identified during project initiation on federal and state lands.

Alternate Federal, State, or Private Land Wildland Fuel Modification Plan

A fuel modification plan for federal and state lands will follow agency procedures, standards, and guidelines. Fuel modification treatment plans for private land parcels should at least include the following information:

- A copy of the site plan
- Methods and timetables for controlling, changing, or modifying fuels on the properties in a timely and effective manner
- Elements for removal of slash, snags, and vegetation that may grow into overhead electrical lines; removal of other ground fuels, ladder fuels, and diseased, dying, and dead trees; and thinning of live trees
- Methods and timetables for controlling and eliminating diseased or insect-infested vegetation
- A plan for the ongoing maintenance of the proposed fuel reduction and control measures for disease and insect infestations
- A proposed vegetation management plan for groupings of parcels under multiple ownership that has been accepted by all individual owners (subject to compliance with this section)

HFRA was designed to expedite administrative procedures for conducting hazardous wildland fuel reduction and restoration projects on federal lands. Regardless of priority treatments selected for federal lands, an environmental assessment must be conducted for fuel reduction projects. Although HFRA creates a streamlined and improved process for reviewing fuel reduction and restoration treatments, it still requires that appropriate environmental assessments be conducted and that collaboration is maintained (USDA and USDI 2004).

The recommended treatments within the Central Navajo County CWPP have been developed to be consistent with state and federal land-management action alternatives and are intended to comply with and facilitate efficient planning and decision making concerning fuels mitigation treatments or habitat restoration of public and private lands in order to reduce risks to communities caused by severe fires and to restore fire-adapted ecosystems (USFS 2000).

B. Prevention and Loss Mitigation

The 2016 Central Navajo County CWPP Core Team prepared the revised Central Navajo County CWPP to be used as a resource to help coordinate long-term interagency mitigation of potential catastrophic wildfire events in at-risk communities within central Navajo County. The Central Navajo County CWPP Core Team established specific revised goals for wildland fire prevention and loss mitigation as follows:

- Improve fire prevention and suppression for firefighter and public safety and to protect private property
- Promote community collaboration, involvement, and education
- Recommend measures to reduce structural ignitability in the Central Navajo County CWPP WUI
- Restore forest and rangelands to pre-European settlement conditions which supports native plant and wildlife values

- Identify funding needs and opportunities
- Expedite project planning through partnerships with ASFD, BLM, ASNFs, and private and public entities in managing wildfire risk within the WUI
- Reduce economic impacts to local communities as a result of unwanted wildland fire
- Ensure a viable and sustainable forest industry necessary to conduct fuel mitigation recommendations, enhance local economies, and traditional community values

The Central Navajo County CWPP will be reviewed annually and updated every 5 years, or as needed. Successful implementation of this CWPP will require collaboration among numerous government entities and community interests.

The Core Team and collaborators have revised the "Action Recommendations and Implementation" from the 2009 Central Navajo County CWPP and proposed the following revised action recommendations to meet the goals of the revised Central Navajo County CWPP.

1. Administer and Implement the Central Navajo County CWPP

The Core Team recommends establishing a Central Navajo County CWPP working group—composed of central Navajo County fire chiefs, NCEM, ASFD, BLM, A-SNFs, community members, concurring agencies, County and local planning and zoning departments and members of the Core Team to organize individual agency implementation of the recommendations for fuel modification, public outreach, protection capability, and structural ignitability within the Central Navajo County CWPP WUI, including fuel hazards removal on private lands within the WUI.

2. Improve Protection Capability and Reduction in Structural Ignitability

The 2016 Central Navajo County CWPP Core Team considers the risks of wildland fire igniting and spreading throughout the WUI a serious threat. The Core Team and collaborators believe that actions to reduce risk and promote effective responses to wildland fires must be undertaken. The following are revised recommendations prepared by the Core Team to enhance protection capabilities for at-risk communities within central Navajo County:

- Obtain a medium-size water tender for use by local fire departments and districts
- Improve additional water-storage tanks, wells, or other water sources for tender filling throughout the fire departments and districts
- Improve water supply capacity within private water districts that support local fire departments
- Maintain helicopter landing sites; and update mapping capabilities of local fire departments and districts.
- Establish a countywide public emergency mass notification system.

- Encourage fire departments and districts to participate in annual multiagency wildfire safety training before the fire season.
- Encourage subdivisions and communities that are not within a fire department or district to take actions necessary to be annexed by an existing fire district to provide viable fire protection services.
- Obtain one multipurpose utility vehicle with attachments for chipping, brush cutting, and mini-water tending, such as the Bobcat Toolcat.
- Acquire GIS and GPS (Global Positioning System) software and laptops to update mapping capabilities of local fire departments and districts.
- Arrange for the acquisition, operation, and maintenance of a green-waste disposal site within reasonable proximity to the central Navajo County communities and encourage the use of the disposal site for all vegetative material removed during wildland fuel treatments on private lands within the WUI.
- Provide enhanced and coordinated firefighting training and equipment, such as personal protective equipment (PPE) and second-generation fire shelters, for newly certified wildland firefighters and volunteer firefighters.
- Develop and maintain mutual-aid agreements with neighboring fire departments or districts for wildland and structural fire response support and other emergency response.
- Develop a pre-suppression plan with BLM and ASNFs along the community WUI boundaries.
- Develop additional wildland fire preplans for all high-hazard locations across central Navajo County where they have not been adopted.
- Meet annually, immediately before the fire season, to coordinate early suppression deployment and to determine training and equipment needs.

3. Promote Community Involvement and Improved Public Education, Information, and Outreach

Navajo County and the Core Team should continue developing and implementing public outreach programs to help create an informed citizenry. The goal is to have residents support concepts of fire-adapted communities, survivable space, and naturally functioning wildland systems through restoration management and rapid response to wildland fire. The 2016 Central Navajo County CWPP is intended to be a long-term strategic plan containing prescriptive recommendations to address hazardous fuels, enhance wildfire preparedness, and create fire-adapted communities. A grassroots collaborative structure of individual citizens, supported by local governments as full partners, will provide the most effective long-term means to achieve these goals and to maintain community momentum. The components of such a structure include the following recommendations:

- Assist in implementing the Firewise Communities/USA Recognition program and the Fire Adapted Communities program in communities where the programs are supported by the local fire departments and districts. The Firewise and Fire Adapted Communities approach emphasizes community and individual responsibility for safer home construction and design, landscaping, and maintenance. The Core Team will also help identify high-priority communities that would most benefit from a Firewise and Fire Adapted Communities program.
- Expand the use of current public information tools for fire-safe residential treatments as an immediate action step. This will be accomplished through information mailers to homeowners, presentations by the NCEM, ASFD, BLM, A-SNFs, and local fire departments and districts and through the development of specific promotional materials by the Core Team.
- Place fire-danger information signs on major access roads throughout the WUI. Community bulletins and other public service announcements concerning wildfire threat and preparedness should be developed with assistance from ASFD, BLM, A-SNFs, and Central Navajo County fire departments.
- Place and maintain bilingual wildfire caution signs within camping areas and access routes in some areas of the WUI.
- Complete wildfire home assessments through the use of Redzone software, or an equivalent software system, and submit wildfire hazard mitigation strategies to landowners for each private property assessed within highest-risk communities.
- Replace and maintain fencing adjacent to high-use and illegal off-road-vehicle use areas within or adjacent to the WUI.

4. Encourage Use of Woody Material from WUI Fuel Mitigation Programs

The Core Team and its collaborators should continue to support and promote private contractors who perform Firewise or fire-safe mitigation work necessary to provide for survivable space and create fire-adapted communities. Navajo County should continue to support and promote new businesses involved in the wood-products market. Navajo County, A-SNFs, BLM, and local fire departments and districts are committed to encouraging, as appropriate, the use of vegetative by-products from the WUI fuel management program for use by commercial entities or community service organizations. Navajo County encourages the A-SNFs to continue with long-term stewardship contracting through the pending Four Forest Restoration Initiative to enhance local community economies through a sustained forest products industry, which would allow wildland fire to return to its historical role in forest and rangeland management and would help forest communities with wildfire preparation.

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IV. CENTRAL NAVAJO COUNTY CWPP 2016 PRIORITIES: ACTION RECOMMENDATIONS AND IMPLEMENTATION

The Core Team reviewed the "CWPP Priorities: Action Recommendations and Implementation" developed by the 2009 Core Team. The action recommendations developed by the 2015 / 2016 Core Team (see Section III of this CWPP) are necessary to meet the revised Central Navajo County CWPP objectives. The updated Central Navajo County CWPP is composed of a series of recommendations that may reduce structural ignitability, improve fire prevention and suppression, and enhance public outreach that is based on the wildfire threat, wildfire effects, and wildfire risk assessment conducted by the Core Team.

The Core Team recommends that projects implemented from these action recommendations be monitored for effectiveness in meeting Central Navajo County CWPP objectives. For the life of the Central Navajo County CWPP, recommendations for additional projects or wildland fuel mitigation treatments can be made on the basis of project performance from previous implemented projects.

A. Administrative Oversight

The 2009 Central Navajo County CWPP established a Central Navajo County CWPP working group and an administrator to monitor implementation of the CWPP. Generally, the most efficient way to manage the mitigation of wildland fire risk in the WUI is through identifying, delegating, implementing, and monitoring the action recommendations of the Central Navajo County CWPP. Establishing a unified effort to collaboratively implement the Central Navajo County CWPP embraces adaptive management principles that enhance decision making and reduces inconsistency at all levels of government.

The Core Team recommends that the working group, administrator, and concurring agencies work toward accomplishing the recommendations for outreach and structural ignitability within the Central Navajo County CWPP WUI area, which include fuel hazards removal on private lands within the WUI. The CWPP working group should consist of representatives from local fire departments and districts and, as needed, representatives from NCEM, ASFD, ASLD, A-SNFs, BLM, county and local municipalities, and other concurring agencies. The Core Team may solicit communities that are not serviced by a fire department or district, as well as other interested individuals or agencies, to participate in the working group. NCEM would be the lead agency in coordinating the working group and producing monitoring reports and any updates to the CWPP.

As established in the 2009 Central Navajo County CWPP, the working group would prioritize wildland fuel modification, structural ignitability, protection capability, and public outreach projects listed in the Central Navajo County CWPP and would review these priority recommendations for possible reprioritization. Fuel modification and community planning and outreach would be prioritized by the working group as a whole; other projects involving firefighter training, equipment, communications,

facilities, and apparatus would be recommended by the fire chiefs from Central Navajo County or their representatives in the CWPP Working Group.

The working group is expected to be an advocate for and provide support to fire departments and districts or other agencies in the submittal of grant applications and the solicitation of other funding opportunities to implement wildland fuel modification, structural ignitability, protection capability, and public outreach projects established as priorities by the working group. Additionally, individual agencies and fire departments and districts would be able to seek letters of support from the working group or partner agencies in applying for funding to implement projects identified in the revised Central Navajo County CWPP.

The working group would also compile monitoring and reporting documents from cooperating agencies to provide information on additional measures necessary to meet Central Navajo County CWPP goals, including additional future recommendations from fire departments and districts and other agencies for inclusion in the priorities list. The working group may also act as an advisory group to the Navajo County Planning and Zoning Department and to developers in outlying areas to ensure adequate public safety access and to provide vegetation mitigation and landscaping recommendations, water supplies for emergency services, and recommendations for establishing and funding fire services and equipment in residential and commercial developments.

The following general criteria would be used for prioritizing proposed projects and action items:

1. Geographic/fuel-load/residential density:
    a. In any given year, the working group would evaluate countywide weather, vegetation, and fuel-load conditions and projections, as well as current residential and commercial densities, to determine short-term priority adjustments for projects in all WUI areas of the counties for that year.
    b. In any given year, the working group would evaluate the progress of new developments and increasing residential and commercial densities to determine potential needs and priorities within the WUI for the next 3 years following that given year.
2. Categorical/functional criteria—priorities would generally be established as listed below; these priorities are subject to review and change by the working group on an ongoing basis:
    a. Fuel modification projects (those in the WUIs listed in Table 4.1 that are within the jurisdictions of fire departments and districts, A-SNFs, BLM, or ASFD would have first priority)
    b. Enhanced wildland firefighter training and acquisition of personal protective equipment (PPE)
    c. Wildland-fire suppression equipment and tools, including brush engines and tenders

d. Water-storage sites and supply facilities

e. Community planning and outreach activities, including warning signs/systems and identification and improvement of evacuation routes

f. Helicopter landing pads for firefighter deployment or evacuation

g. Fire stations in areas with sufficiently high threat and population densities as determined annually by the working group

The agencies involved in the formation of this plan support local community efforts are encouraged to work with the communities toward accomplishing action items. BLM, A-SNFs, ASFD, NCEM, and fire departments and districts, in coordination with the established working group, would collaborate on fuel mitigation projects within the WUI on lands managed by local, state, and federal government agencies, as well as those on private lands. The Core Team and the proposed working group encourage and support agencies, municipalities, and local fire departments and districts in obtaining grants and soliciting opportunities to implement wildland fuel mitigation projects on private lands and to support public information, education, and outreach within the WUI. Successful award of grant funds is necessary to implement the action recommendations for private land treatments, mitigation projects for reduced structural ignitability, firefighting response, and public outreach. BLM, A-SNFs, ASFD, NCEM, fire departments and districts, and the Core Team also encourage soliciting grants and other funding to construct and maintain fuelbreaks as well as broader applications of wildland fuel mitigation projects within and adjacent to the WUI. Monitoring and reporting compiled by the working group would provide information on additional measures necessary to meet Central Navajo County CWPP goals.

B. Priorities for Mitigation of Hazardous Wildland Fuels

Table 4.1 displays the priorities for wildland fuel treatments within the WUIs as recommended by the Core Team. These action recommendations would assist in reducing wildfire potential. The Core Team recognizes that not all acres within a high-risk landscape can be treated. Site-specific analysis would determine treatment acres and methods that meet forest and rangeland restoration objectives and enhances community preparedness for wildland fire.

Table 4.1. Action Recommendations for Wildland Fuel Modification

Management Area	Description	Project Partner	Estimated Treatment Cost[a]
CHC1	Chevelon Retreat from FR 153	NCEM, A-SNFs, and ASFD	3,740 moderate-risk acres, 1,247 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $436,432.00/year
CHC2	Halter Cross Road south of SR 277	NCEM, A-SNFs, and ASFD	3,113 moderate-risk acres, 1,038 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $363,188.00/year
WP1	North of SR 277	NCEM, A-SNFs, and ASFD	530 moderate-risk acres, 176 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $61,693.00/year
WP2	South of SR 277	NCEM, A-SNFs, and ASFD	205 moderate-risk acres, 68 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $23,912.00/year
SSL1	Snowflake, Taylor Shumay north of Black Mesa Road	NCEM, Taylor and Snowflake Fire and Medical Department, ASFD	12,290 moderate-risk acres, 4,096 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $1,433,600.00/year
SSl2	Snowflake Taylor west of SR 77 south of Black Mesa Road north of Lone Pine Dam Road	NCEM, Snowflake Fire District, Taylor Fire District, ASFD	1,162 moderate-risk acres, 387 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $135,520.00/year
SSL3	Shumay, White Mountain Lakes, Silver Lakes Estates	NCEM, Taylor and Snowflake Fire and Medical Department, White Mountain Lakes Fire District, ASFD	9,325 moderate-risk acres, 3,108 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $1,087,905.00/year
SSL4	North of Shumway Road, east of Deeker Valley Road	NCEM, Taylor and Snowflake Fire and Medical Department, ASFD	915 moderate-risk acres, 305 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $106,820.00/year
EOS1	North of Old Concho Highway	NCEM, ASFD	4,445 moderate-risk acres, 1,482 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $518,621.00/year
EOS2	South of Old Concho Highway	NCEM, ASFD	4,167 moderate-risk acres, 1,389 acres of lands to be treated over 3 years estimated to begin in FY 2016–2017 at $350.00/acre = $486,253.00/year
Fuelbreak maintenance	1- to 3-year rotating maintenance of fine and light fuels in fuelbreaks	ASLD, ASFD, A-SNFs, NCEM, and participating fire departments and districts	600 acres/year of light understory fuel treatments in excess of 4 acres treated/10-hour day at $1,400.00/day costs = $210,000.00/year

Table 4.1. Action Recommendations for Wildland Fuel Modification

Management Area	Description	Project Partner	Estimated Treatment Cost[a]

Note: ASFD = Arizona State Forestry Division; ASLD = Arizona State Land Department; NCEM = Navajo County Emergency Management; A-SNFs = Apache-Sitgreaves National Forests; BLM = Bureau of Land Management; FY = fiscal year; CHC = Chevelon–Halter Cross, SSL= Snowflake–Silver Lake, WP = Wood Products, EOS = East of Snowflake.

[a] Total acres to be treated during the life of the plan; 30% of acres estimated to be treated based on site-specific analysis, which would determine actual acres available for treatment in each area.

C. Identified Action Items for Protection Capability and Reduced Structural Ignitability

The Core Team has developed action recommendations to enhance community wildfire preparation and response facilities, capabilities, and equipment necessary to meet fire adapted community goals. Table 4.2 lists the identified action items proposed by the Core Team for consideration by individual fire departments and districts for reduced structural ignitability and public outreach within their respective jurisdictions. Table 4.3 lists the future recommendations for wildland fire protection and reduced ignitability.

After the ASFD's final approval of the Central Navajo County CWPP, the working group would meet to review projects for the upcoming year and, thereafter, would meet annually or as necessary to reevaluate projects and revise priorities as needed. Such prioritization by the working group would not impinge on or interfere with the fire departments' and districts' opportunities to independently seek funding for projects within their jurisdictions.

Table 4.2. Action Recommendations for Structural Ignitability and Public Outreach

Project Partner	Project[a]	Specific Recommendation	Estimated Cost	Timeline
NCEM, and Central Navajo County fire departments and districts	**E1**—Wildland Fire Protection and Reduced Ignitability	Purchase one Type 3 fire engine.	New acquisition with standard equipment: $382,000.00	Begin grant applications in FY 2016; purchase in FY 2017.
NCEM, and Central Navajo County fire departments and districts	**E1**—Wildland Fire Protection and Reduced Ignitability	Purchase one Type 6 fire engine.	New acquisition with standard equipment: $143,000.00	Begin grant applications in 2016/2017; purchase in 2016/2017
NCEM, and Central Navajo County fire departments and districts	**A1**—Wildland Fire Protection and Reduced Ignitability	Construct a series of 5,000-gallon water-storage facilities located strategically throughout residential areas.	Install water-storage facilities/year: $6,500.00/facility	Locate and install one water-storage facility in FY 2016.

Table 4.2. Action Recommendations for Structural Ignitability and Public Outreach

Project Partner	Project[a]	Specific Recommendation	Estimated Cost	Timeline
NCEM, and Central Navajo County fire departments and districts	**A2**—Enhanced Public Education, Information, and Outreach	Develop wildfire public education brochures (e.g., Arizona 7 Steps brochure, and "Living with Wildfire" booklet).	Produce and publish community-specific wildfire informational brochures	Begin grant applications in 2016; continue on an ongoing basis starting in 2017.
NCEM, and Central Navajo County fire departments and districts	**A2**—Enhanced Public Education, Information, and Outreach	Work with land-management agencies for the acquisition, operation, and maintenance of a green-waste disposal site within reasonable proximity to community.	Locate and coordinate with land-management agency; excavate pit and fence: $20,000.00	Begin planning with agencies in FY 2016/2017; implement in FY 2016/2017.
NCEM, and Central Navajo County fire departments and districts	**A3**—Enhanced Public Education, Information, and Outreach	Create fire-safety and fire-awareness posters for public places.	Development, printing, and distribution costs: $5,000.00	Solicit funds for production and printing in FY 2016; publish and post in FY 2017.
NCEM, and Central Navajo County fire departments and districts	**A4—**Enhanced Public Education, Information, and Outreach	Include links to relevant Firewise websites on project-partner websites. CWPP Working Group should check links annually for validity and notify partners of changes.	Staff time to add links. $1,000 per participating agency.	Implement with roll-out of CWPP. Update annually if needed.
Fire departments	**A6—**Enhanced Public Education, Information, and Outreach; Structural Ignitability	Conduct hazard assessments for homeowners. Use Firewise or similar door tags.	Solicit funds for acquisition of door tags and for volunteer staff time for distribution	Acquire door tags in2016; distribute in 2016/2017.
NCEM and Central Navajo County fire departments and districts	**A7—**Enhanced Public Education, Information, and Outreach	Establish and maintain roadside fire-danger warning signs and other informational and directional road signs along major roads as determined by the Navajo County Fire Chiefs Association	Construction and placement: $5,000.00	Install in FY 2016; start with roads with highest fire incidence/risk. Solicit grants from Federal Highway Administration
NCEM, A-SNFs, ASFD, ASLD, associated fire and police departments, and Central Navajo County Sheriff's Office	**A8—**Enhanced Public Education, Information, and Outreach	Issue PSAs, do media spots, use social media about safe use of fireworks and open burning and reporting illegal use.	Staff time. $3,000 per participating agency annually.	Begin in FY 2016. Around July 4 and January 1.

Table 4.2. Action Recommendations for Structural Ignitability and Public Outreach

Project Partner	Project[a]	Specific Recommendation	Estimated Cost	Timeline
NCEM, A-SNFs, ASFD, ASLD, and associated fire departments	**A10—**Enhanced Public Education, Information, and Outreach	Establish and promote countywide public emergency mass notification system.	Annual operational cost of approximately $20,000.00.	Begin planning with agencies in FY 2016; implement in FY 2017.

Note: ASFD = Arizona State Forestry Division; ASLD = Arizona State Land Department; NCEM = Navajo County Emergency Management; A-SNFs = Apache Sitgreaves National Forest; DOT = department of transportation; FY = fiscal year; PSA = public service announcement.

[a] Projects are designated by project type (E = equipment; A = administrative) but not ranked in order of importance.

Table 4.3. Future Recommendations for Wildland Fire Protection and Reduced Ignitability

Project Partner	Project[a]	Equipment/Expense	Timeline
NCEM, A-SNFs, ASFD, ASLD, and associated fire departments	**E5**—Obtain a medium-size water tender to better traverse rural landscape than larger units	1,500-gallon water tenders, 4-wheel drive: $191,000.00	Acquire tender in FY 2016/17; assess additional tender needs in FY 2017/18
NCEM, A-SNFs, ASFD, ASLD, and associated fire departments	**A5**—Work with Central Navajo County to develop a notification and evacuation plan for the community	Staff time, coordination efforts, research, and meetings: $5,000.00	Begin planning in FY 2016/15; implement in FY 2016
NCEM, A-SNFs, ASFD, ASLD, and associated fire departments	**A6**—Work with utility and transportation agencies on vegetative management treatments within and adjacent to utility corridors where opportunities exist on private lands	Staff time, coordination efforts, research, and meetings: $5,000.00	Begin planning in FY 2016/15; implement in FY 2016

Note: ASFD = Arizona State Forestry Division; ASLD = Arizona State Land Department; NCEM = Navajo County Emergency Management; A-SNFs = Apache-Sitgreaves National Forests; DOT = department of transportation; FY = fiscal year; PSA = public service announcement.

[a] Projects are designated by project type (E = equipment; A = administrative) but not ranked in order of importance.

D. Priorities for Promoting Community Involvement through Education, Information, and Outreach

NCEM and the working group would collaborate on implementation of public outreach and education programs for residents to heighten awareness and understanding of the threat that wildland fire poses to the communities and to further fire-adapted community and survivable space goals of the 2016 Central Navajo County CWPP

Table 4.4 lists the Core Team's priority recommendations for promoting community involvement. Additional programs that could be used or developed to enhance community outreach and education may be implemented in the future. The working group would use the resources of the ASFD, A-SNFs,

and BLM for additional public education programs and community outreach. Community bulletins and other public service announcements concerning wildfire threat and preparedness should be developed with assistance from local fire departments and districts, ASFD, A-SNFs, and BLM.

Table 4.4. Future Recommendations for Enhanced Public Education, Information, and Outreach

Project Partner	Project[a]	Equipment/Expense	Timeline
NCEM, A-SNFs, ASFD, ASLD, and associated fire departments	**I2**—Acquire Redzone software, or equivalent software, and field data recorders or PDAs to complete home fire assessments and implement fire-safe recommendations	Software and data recorder: $1,300.00 Assessment completion: $2,000.00	Acquire software and complete assessments in FY 2016/2017; implement recommendations in FY 2016
NCEM, A-SNFs, ASFD, ASLD, and associated fire departments	**I3**—Encourage private businesses that perform Firewise land treatments; encourage market development of WUI by-products from vegetative fuel mitigation programs	Marketing plan to be developed	Initiate community marketing planning meetings in FY 2017
NCEM, A-SNFs, ASFD, ASLD, and associated fire departments	**I4**—Replace and maintain fencing adjacent to high OHV use areas	Assess in 2016; initial plan for 1 mile of new or repaired fencing	Estimate $6,000.00m per mile of standard 4-wire fencing

Note: ASFD = Arizona State Forestry Division; ASLD = Arizona State Land Department; NCEM = Navajo County Emergency Management: A-SNFs = Apache-Sitgreaves National Forests; DOT = department of transportation; FY = fiscal year; PSA = public service announcement.

[a] Projects are designated by project type (I = infrastructure) but not ranked in order of importance.

V. MONITORING PLAN

Monitoring is essential to ensure that the revised goals of the 2016 Central Navajo County CWPP are met. The Core Team, local fire departments and districts, NCEM, ASFD, A-SNFs, and BLM would monitor the progress of the revised CWPP action recommendations to determine the effectiveness of ongoing and completed projects in meeting the revised Central Navajo County objectives, as well as to recommend future projects necessary to meet the 2016 Central Navajo County CWPP revised goals.

In accordance with Section 102.g.5 of HFRA, the Central Navajo County CWPP communities would like to participate in any multiparty monitoring program established by state and federal agencies, or other interested parties, to assess progress toward meeting the 2016 Central Navajo County CWPP objectives. The Core Team believes that participation in multiparty monitoring would provide effective and meaningful ecological and socioeconomic feedback on landscape and site-specific fuel reduction projects and watershed enhancements and would also help BLM, A-SNFs, ASFD, ASLD, NCEM, Navajo County municipalities, and fire departments and districts with future land-management planning.

This section details the performance measures that would be used to assess the effectiveness of implementing the 2016 Central Navajo County CWPP action recommendations. Monitoring would include assessing and evaluating the implementation of individual Central Navajo County CWPP projects and a given project's effectiveness in furthering the 2016 Central Navajo County CWPP objectives.

A. Administrative Oversight, Monitoring, and Central Navajo County CWPP Reporting

The CWPP Core Team—composed of Central Navajo County fire chiefs, NCEM, A-SNFs, ASFD, ASLD, and BLM—would mutually assist in furthering and monitoring Central Navajo County CWPP action recommendations. The CWPP Core Team should identify appropriate grant and other funding mechanisms necessary to implement the action recommendations of the 2016 Central Navajo County CWPP. Grant information should be routinely searched to identify updated grant application cycles.

As a product of the CWPP plan review, the NCEM, in coordination with the future-established Core Team, would report on the success of the 2016 Central Navajo County CWPP project implementation and overall progress toward meeting Central Navajo County CWPP goals. The Core Team should report successful grant awards received for implementing the Central Navajo County CWPP action recommendations to the revised CWPP signatories. The Core Team report should include recommendations to the revised CWPP signatories for updating the Community Mitigation Plan and the Prevention and Loss Mitigation Plan portions of the revised Central Navajo County CWPP. The Core Team report should support timely decision making for all levels of government and would provide input necessary for developing future work plans and for prioritizing project recommendations over the life of the 2016 Central Navajo County CWPP. Appendix A provides information on the data used in the analysis of the 2016 Central Navajo County CWPP and the appropriate contacts for updating the

CWPP. Once the CWPP is updated, it should be submitted to the Central Navajo County fire chiefs, NCEM, Navajo County Board of Supervisors, A-SNFs, ASFD, ASLD, and BLM for their concurrence or approval.

B. Effectiveness Monitoring

Table 5.1 outlines the performance measures that the Core Team should monitor and use to assess status in meeting current CWPP performance goals. The CWPP administrators should assess the current status of wildland fuel hazards and look for any new or developing issues not covered by the 2016 Central Navajo County CWPP. As new issues arise, such as new invasive-species infestations, further risks and recommendations for treatment should be identified, and the 2016 Central Navajo County CWPP should be updated or amended as necessary to meet revised CWPP goals. To help track fuel treatments being planned and completed through local, state, and federal programs, the CWPP administrators should cooperatively provide detailed mapping information to the Arizona State Forester's office.

Table 5.1. Performance Measures to Assess Central Navajo County CWPP Progress

Goal	Performance measure

Improve fire prevention and suppression	Reduction of wildland fire occurrence and acres burned (unplanned) in the WUI:
	• Type 3 fire engine acquired.
	• Type 6 brush truck acquired.
	• Effectiveness monitoring of fire prevention and suppression would include the following:
	  • Acres burned and degree of severity of wildland fire
	  • Percentage of wildland fire controlled on initial attack
	  • Number of homes and structures lost to wildland fire
	• New water sources developed in key areas.

Reduce hazardous vegetative fuels	Effective treatment of high-risk areas by acre: • Number of treated acres of nonfederal WUI lands in Condition Class 2 or 3 identified as high priorities by the Central Navajo County CWPP and moved to Condition Class 1 or another acceptable level of wildland fuel loading and continuity. • Acres treated to acceptable fuel levels within priority treatment management areas. • Total acres treated through any fuel-reduction measures, including prescribed fire, that are conducted in, or adjacent to, the WUI. The change of vegetation condition class should be determined for small projects or treatment areas through the use of the LANDFIRE database.
Restore watershed health	Acres of fuel reduction or watershed enhancement treatments that meet restoration treatment guidelines for riparian habitats: • Coordination with and support of NCEM, ASFD, ASLD, A-SNFs, and BLM in implementing and determining social, economic, and environmental effects of riparian restoration treatments (Treatments 6 and 7; see Table 3.1 in the Community Mitigation Plan section).
Promote community involvement	Initiation of public outreach programs: • Community CWPP Core Team initiated. • Public outreach programs and promotions implemented to enhance volunteer efforts to reduce hazardous fuels. • Number and areas (community or dispersed residences) of private landowners supporting and implementing fuel reduction projects. • NCEM and local fire departments and districts developed and implemented evacuation plans for identified high-risk areas. • Roadside fire-danger warning signs in English and Spanish installed at strategic points within the WUI. • Homeowner assessments initiated. • Fire-safety awareness program, posters, and information available in public places.
Encourage economic development	Wood-products industry growth and diversification to use all sizes of material removed by fuel reduction treatments (wood-product examples: furniture, fence posts, charcoal, grilling chips, mulch, compost): • Number of value-added wood products developed by the community. • Number of new markets (local firewood sales) for local products created. • Stewardship contract for fuel and forest treatment implemented through the Four Forest Restoration Initiative

Note: ASFD = Arizona State Forestry Division; ASLD = Arizona State Land Department; BLM = Bureau of Land Management; NCEM = Navajo County Emergency Management; A-SNFs = Apache-Sitgreaves National Forests; CWPP = community wildfire protection plan; PPE = personal protective equipment; WUI = wildland-urban interface.

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VII. DECLARATION OF AGREEMENT AND CONCURRENCE

The following cooperators in the revision of the 2009 Central Navajo County Community Wildfire Protection Plan for Navajo County communities have reviewed and do mutually agree or concur with its contents:

Agreement

Chairman, Navajo County Board of Supervisors	Date
Mayor, Town of Snowflake	Date
Mayor, Town of Taylor	Date
Chief, Taylor and Snowflake Fire and Medical Department	Date
Chief, White Mountain Lake Fire District	Date

CONCURRENCE

Forest Supervisor, Apache-Sitgreaves National Forests	Date
Arizona State Forester Arizona State Forestry Division	Date
Gila District Manager Bureau of Land Management	Date

APPENDIX A. INFORMATION DATA SHEET AND CONTACTS

A.1. CWPP Base Information Data Source

Name	Type	Source	Contact / Web address
Wildland Fuel Hazards	Shapefile	Logan Simpson Design Inc.	Roy Baker (480) 967-1343; rbaker@logansimpson.com
Wildland-Urban Interface (WUI)	Shapefile	Logan Simpson Design Inc.	Roy Baker (480) 967-1343; rbaker@ logansimpson.com
Vegetation Zones	Raster	Southwest Regional Gap Analysis Project (USGS 2005)	USGS GAP Analysis Program http://earth.gis.usu.edu/swgap/
Landownership	Shapefile	Arizona State Land Department	Arizona Land Resources Information System, published October 17, 2014 (602) 542-2606
Land Parcel Data	Shapefile	Navajo County Assessor's	Ryan Taylor GIS & ES Manager Navajo County (928) 524-4116
LANDFIRE Existing Vegetation Type	Raster	USGS Wildland Fire Science, Earth Resources Observation and Science Center	http://www.landfire.gov
Vegetation Condition Class	Raster	USGS Wildland Fire Science, Earth Resources Observation and Science Center	http://www.landfire.gov
Ignition History	Shapefile	USGS and Arizona State Forestry Division	http://rmgsc.cr.usgs.gov/outgoing/GeoMAC/historic_fire_data/ Arizona State Forestry Division
Treatment Activities	Shapefile	Apache-Sitgreaves National Forests (2004–2015)	Mark R. Empey Forest Fire Chief Apache-Sitgreaves National Forests Supervisor's Office (928) 333-6315
FlamMap Elevation, Slope, Aspect, Fuel Models, and Canopy Cover	Raster	USGS LANDFIRE Data Distribution Site	http://landfire.cr.usgs.gov/viewer/

All final-analysis GIS data—including flammability analysis, fuel hazards analysis, ignition history and density, community values analysis, cumulative risk analysis, and treatment management units—are located at the Navajo County Office of Emergency Services and at Logan Simpson.

A.2. Central Navajo County CWPP Contacts

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APPENDIX B. FUEL MODEL DESCRIPTIONS

B.1. Fuel Model Selection

The Core Team determined the appropriate fuel models for the Central Navajo CWPP by reviewing the vegetation associations within the WUI that were identified and mapped using the LANDFIRE.gov Existing Vegetation Type (EVT) data layer which represents the vegetation composition present at a given site up to 2008 (Landfire.gov, accessed November 2015). The Core Team used the EVT data to determine the general fire-carrying fuel type: grass, grass-shrub, shrub, timber litter, timber with (grass or shrub) understory, or slash or blowdown fuels. The core team then reviewed the LANDFIRE data sets which utilize the 40 Scott and Burgan Fire Behavior Fuel Model (FBFM40) layer to represent distinct distributions of fuel loading found among surface fuel components (live and dead), size classes, and fuel types (LANDFIRE.gov, accessed November 2015).The core team using the current US Forest Service Regional Wildfire Risk Assessment modified where appropriate the FBFM40 by estimating which stratum of surface fuels is most likely to carry the fire. For example, the fire may be in a forested area, but if the forest canopy is open, grass, not needle litter, might carry the fire. In this case a grass model was considered.

The Core Team is aware that moisture content of live vegetation significantly affects fire behavior because vegetative fuel load shifts between live and dead, and dead fuel usually has much lower moisture content than live. The fuel moisture weighed over all the fuel classes, at which a fire will not spread, is called the extinction moisture content. The dead fuel extinction moisture assigned to the fuel model defines the moisture content of dead fuels at which the fire will no longer spread. This fuel parameter is generally associated with climate (humid versus dry). The extinction moisture content is divided into very low, low, moderate, and high values over all fuel classes to provide a relative assessment of fuel moisture within a fuel bed that will carry wildland fire.

The Core Team emphasizes that homeowners manage the fuels that are the primary carrier of wildland fire. In some vegetation associations, with proper spacing, the overstory of ponderosa pine may not carry fire but an understory of needle litter or shrubs will transport fire with high rates of spread and flame lengths.

Table B.2 describes the fire-behavior models that were determined to be within the 2015 Central Navajo CWPP community WUIs.

Table B.1. Standard Fire Behavior Fuel Models (Scott and Burgan 2005)

Fuel Model Name	Primary Carrier Fuel Type of Fire	Extinction Moisture Content (percent)	Fire Behavior
Non-burnable (NB1) Urban/Developed	Urban suburban development	Does not support wildland fire spread	Areas mapped as NB1 may experience structural fire losses during a wildland fire incident; however, structure ignition in those cases is either house-to-house or by firebrands, neither of which is directly modeled using fire behavior fuel models. If sufficient fuel vegetation surrounds structures such that wildland fire spread is possible, then a fuel model appropriate for the wildland vegetation is entered rather than NB1.
Agriculture (NB3)	Croplands	Agricultural lands maintained in a non-burnable condition.	There are many agricultural areas that are not kept in a non-burnable condition, grass is often allowed to grow beneath orchard trees, and wheat or similar crops are allowed to cure before harvest; in those cases you can insert a fuel model other than NB3.
Grasslands	Grass	Generally 15 percent in short grass fuel types	Grass (GR) fuels vary from heavily grazed grass stubble or sparse natural grass to dense grass more than 6 feet tall. Fire behavior varies from moderate spread rate and low flame length in the sparse grass to extreme spread rate and flame length in the tall grass models. All GR fuel models are dynamic, live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong.
Short sparse dry climate grass (GR1)	Grass	15 percent in sparse grass fuel type	The primary carrier of fire in GR1 is sparse grass, with small amounts of fine dead fuel present. The grass in GR1 is generally short, either naturally or by grazing, and may be sparse or discontinuous. GR1 is indicative of a dry climate fuelbed, but GR1 may also be applied in high-extinction moisture fuelbeds because in both cases predicted spread rate and flame length are low compared to other GR models.
Low load dry climate grass (GR2)	Grass	15 percent in short grass fuel type	The primary carrier of fire in GR2 is grass, though small amounts of fine dead fuel may be present. Grass fuel load is greater than GR1, and fuelbed may be more continuous. Shrubs, if present, do not affect fire behavior.

Continued

Table B.1. Standard Fire Behavior Fuel Models (Scott and Burgan 2005)

Fuel Model Name	Primary Carrier Fuel Type of Fire	Extinction Moisture Content (percent)	Fire Behavior
Grass-Shrub	Grass-Shrub combined	Generally less than 20 percent in short shrub and grass fuel type	The primary carrier of fire in the grass-shrub (GS) fuel models is grass and shrubs combined; both components are important in determining fire behavior. All GS fuel models are dynamic, live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model.
Low load, dry climate, grass shrub (GS1)	Grass-Shrub combined	15 percent in short shrub and grass fuel type	The primary carrier of fire in GS1 is grass and shrubs combined. Shrubs are about 1 foot high, grass load is low. Spread rate is moderate; flame length low. Moisture of extinction is low.
Moderate load, dry climate grass-shrub (GS2)	Grass-Shrub combined	15 percent in short shrub and grass fuel type	The primary carrier of fire in GS2 is grass and shrubs combined. Shrubs are 1 to 3 feet high, grass load is moderate. Spread rate is high; flame length moderate. Moisture of extinction is low.
Shrub	Live and dead shrubs	The effect of live herbaceous moisture content on spread rate and flame length can be strong in those dynamic SH models	The primary carrier of fire in the SH fuel models is live and dead shrub twigs and foliage in combination with dead and down shrub litter. A small amount of herbaceous fuel may be present, especially in SH1 and SH9, which are dynamic models (their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content).
Low Load Dry Climate Shrub (SH1)	Short woody live and dead shrubs and litter	Generally 20 percent in short woody shrub litter fuel type	The primary carrier of fire in SH1 is woody shrubs and shrub litter. Low shrub fuel load, fuelbed depth about 1 foot; some grass may be present. Spread rate is very low; flame length very low.
Moderate Load Dry Climate Shrub (SH2)	Short woody live and dead shrubs and litter	Generally 20 percent in short woody shrub litter fuel type	The primary carrier of fire in SH2 is woody shrubs and shrub litter. Moderate fuel load (higher than SH1), depth about 1 foot, no grass fuel present. Spread rate is low; flame length low.
High Load Dry Climate Shrub (SH5)	Taller woody shrubs and litter	Moisture of extinction is high, generally 20 percent in chaparral up to 6 feet	The primary carrier of fire in SH5 is woody shrubs and shrub litter. Heavy shrub load, depth 4-6 feet. Spread rate very high; flame length very high..

Continued

Table B.1. Standard Fire Behavior Fuel Models (Scott and Burgan 2005)

Fuel Model Name	Primary Carrier Fuel Type of Fire	Extinction Moisture Content (percent)	Fire Behavior
Very high load dry climate shrub (SH7)	Taller woody shrubs and litter	Moisture of extinction is 15 percent in short dense shrub and litter fuel type.	Usually shrubs are short and may nearly cover the area such as regeneration shrublands after fire. The primary carrier of fire in SH5 is woody shrubs and shrub litter. Heavy shrub load, depth 4-6 feet. Spread rate very high; flame length very high.
Timber Understory (TU)	Forest litter, herbaceous and shrub fuels	Moisture of extinction is generally 25 percent in timber and litter fuel type	The primary carrier of fire in the TU fuel models is forest litter in combination with herbaceous or shrub fuels. TU1 and TU3 contain live herbaceous load and are dynamic, meaning that their live herbaceous fuel load is allocated between live and dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model.
Low load dry climate timber-grass-shrub (TU1)	Grass, shrub and litter component	Moisture of extinction is 20 percent in grass, shrub and litter understory fuel type	The primary carrier of fire in TU1 is low load of grass and/or shrub with litter. Spread rate is low; flame length low.
Moderate load humid climate timber shrub (TU2)	Litter and shrub component	Moisture of extinction is high at 30 percent in grass, shrub and litter understory fuel type	The primary carrier of fire in TU2 is moderate litter load with shrub component. Spread rate is moderate; flame length low.
Timber litter	Dead and down woody fuel	Moisture of extinction is generally 30 in closed timber litter fuel types	The primary carrier of fire in the TL fuel models is dead and down woody fuel. Live fuel, if present, has little effect on fire behavior. Flame lengths can vary from over 10 feet to under 2 feet
Low load compact conifer litter (TL1)	Compact Forest litter	Moisture of extinction is high at 30 percent in compact litter	The primary carrier of fire in TL1 is compact forest litter. Light to moderate load, fuels 1 to 2 inches deep. May be used to represent a recently burned forest. Spread rate is very low; flame length very low.
Low load broadleaf litter (TL2)	Hardwood litter	Moisture of extinction is 25 percent in hardwood litter	The primary carrier of fire in TL2 is broadleaf (hardwood) litter. Low load, compact broadleaf litter. Spread rate is very low; flame length very low.

Continued

Table B.1. Standard Fire Behavior Fuel Models (Scott and Burgan 2005)

Fuel Model Name	Primary Carrier Fuel Type of Fire	Extinction Moisture Content (percent)	Fire Behavior
Moderate load conifer litter (TL3)	Conifer litter	Moisture of extinction is 20 percent in conifer litter	The primary carrier of fire in TL3 is moderate load conifer litter, light load of coarse fuels. Spread rate is very low; flame length low. Litter layer is composed of needles, leaves and twigs because little undergrowth is present in the stand
Small downed log(TL4)	Fine litter and course woody fuels	Moisture of extinction is 25 percent in litter and down logs	The primary carrier of fire in TL4 is moderate load of fine litter and coarse fuels. Includes small diameter downed logs. Spread rate is low; flame length low.
High load conifer litter (TL5)	Conifer litter, light slash, activity or mortality fuels	Moisture of extinction is 25 percent in conifer litter, and mortality fuels	The primary carrier of fire in TL5 is high load conifer litter; light slash or mortality fuel. Spread rate is low; flame length low.
Long Needle litter (TL8)	Long-needle pine litter	Moisture of extinction is high at 35 percent in pine litter	The primary carrier of fire in TL8 is moderate load long-needle pine litter, may include small amount of herbaceous load. Spread rate is moderate; flame length low.

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