ELK COUNTY

COMMUNITY WILDFIRE PROTECTION PLAN

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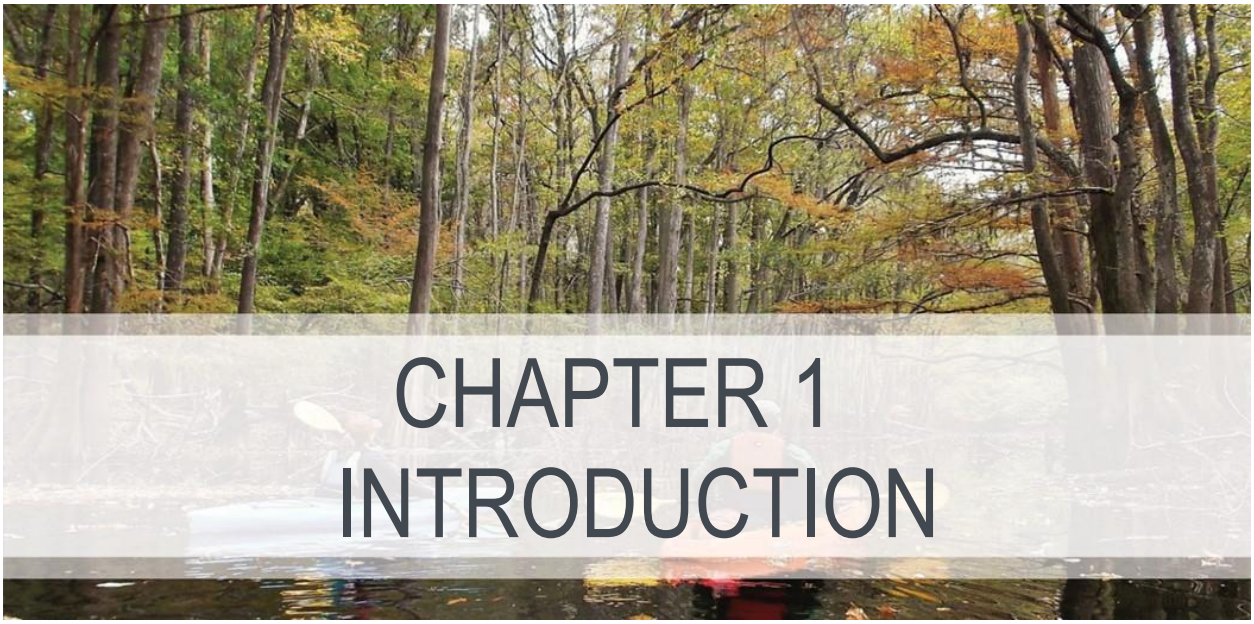


CHAPTER 1
INTRODUCTION

The incidence of tragic losses from wildfire have been increasing in recent decades as residents living within the wildland urban interface (WUI) come into closer contact with wildland fuels. Although Elk County, Pennsylvania, may differ from the classic fire-prone environments of the western United States, this county is heavily forested and exhibits many of the characteristics common in wildfire tragedies, including rural, dispersed populations in proximity to forested lands. In order to mitigate fire impacts, communities in WUI environments need to have a plan to prepare for, reduce the risk of, and adapt to wildland fire events. Community Wildfire Protection Plans (CWPPs) help accomplish these goals. A CWPP provides recommendations that are intended to reduce, but not eliminate, the severity or risk of wildland fire.

This CWPP, entitled the Elk County CWPP (ECCWPP), is a county-level plan that evaluates wildfire threat to communities and infrastructure, and identifies measures that homeowners, land managers, and fire departments can take to reduce the impact of wildfire to life, property, and other community values at risk (CVARs). The plan provides background information, a risk assessment, and recommendations to reduce or mitigate wildfire risk to communities. Chapter 1 provides an overview of CWPPs and describes the need for a plan; Chapter 2 provides demographic and background information about the communities within Elk County; Chapter 3 gives an overview of the fire environment; Chapter 4 describes the methodology for the risk assessment and the results in detail; Chapter 5 outlines the community outreach activities implemented during the planning process; Chapter 6 provides action plans that outline priorities and recommendations for reducing fuels, initiating public education and outreach, reducing structural ignitability, and improving fire response capabilities; and Chapter 7 provides suggested approaches to monitoring actions. The ECCWPP does not require implementation of any of the recommendations; however, these recommendations may be used as guidelines for the implementation process if funding opportunities become available. The recommendations for fuels reduction projects are general in nature, meaning site-specific planning that addresses location, access, land ownership, topography, soils, and fuels would need to be employed upon implementation. Also, it is important to note that the recommendations are specific to WUI areas and are expected to reduce the loss of life and property.

OVERVIEW OF COMMUNITY WILDFIRE PROTECTION PLANS

In response to a landmark fire season in 2000, the National Fire Plan (NFP) was established to develop a collaborative approach among various governmental agencies to actively respond to severe wildland fires and ensure sufficient firefighting capacity for the future. The NFP was followed by a report in 2001, entitled *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: A 10-year Comprehensive Strategy*, which was updated in 2002 to include an implementation plan. This plan was updated once more in 2006, with a similar focus on using a collaborative framework for restoring fire-adapted ecosystems, reducing hazardous fuels, mitigating risks to communities, providing economic benefits, and improving fire prevention and suppression strategies. The 2006 implementation plan also emphasizes information sharing and monitoring of accomplishments and forest conditions, a long-term commitment to maintaining the essential resources for implementation, a landscape-level vision for restoration of fire-adapted ecosystems, the importance of using fire as a management tool, and continued improvements to collaboration efforts (Forests and Rangelands 2006). Progress reports and lessons learned reports for community fire prevention are provided annually.

In 2003 the U.S. Congress addressed widespread declining forest health by passing the Healthy Forests Restoration Act (HFRA), and President Bush signed the act into law (Public Law 108–148, 2003). The HFRA was revised in 2009 to address changes to funding and provide a renewed focus on wildfire mitigation (H.R. 4233 - Healthy Forest Restoration Amendments Act of 2009). The HFRA expedites the development and implementation of hazardous fuels reduction projects on federal land and emphasizes the need for federal agencies to work collaboratively with communities. A key component of the HFRA is the development of CWPPs, which facilitates the collaboration between federal agencies and communities in order to develop hazardous fuels reduction projects and place priority on treatment areas identified by communities in a CWPP. A CWPP also allows communities to establish their own definition of the WUI, which is used to delineate priority areas for treatment. In addition, priority is placed upon municipal watersheds, critical wildlife habitat, and areas impacted by wind throw, insects, and disease. Communities with an established CWPP are given priority for funding of hazardous fuels reduction projects carried out in accordance with the HFRA.

In 2014 the final stage of the development of a national cohesive strategy for wildfire was developed, entitled *The National Strategy: The Final Phase in the Development of the National Cohesive Wildland Fire Management Strategy* (Forests and Rangelands 2014). The national strategy takes a holistic approach to the future of wildfire management:

To safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a Nation, live with wildland fire.

In order to achieve this vision, the national strategy goals are:

> *Restore and maintain landscapes: Landscapes across all jurisdictions are resilient to fire related disturbances in accordance with management objectives.*
>
> *Fire-adapted communities: Human populations and infrastructure can withstand a wildfire without loss of life and property.*
>
> *Wildfire response: All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.* (Forests and Rangelands 2014:3)

Like the 2014 national strategy, the NFP, state fire plans, the 10-year comprehensive strategy, and the Federal Emergency Management Agency (FEMA) Disaster Mitigation Act of 2000 all mandate community-based planning efforts with full stakeholder participation, coordination, project identification, prioritization, funding review, and multi-agency cooperation. In compliance with Title 1 of the HFRA, a CWPP must be mutually agreed upon by the local government, local fire departments, and the state agency responsible for forest management (Pennsylvania Department of Conservation and Natural Resources [DCNR], District Forester). As outlined in the HFRA, this CWPP is developed in consultation with interested parties and the U.S. Forest Service (USFS) (the applicable federal agency managing land surrounding the at risk communities).

NEED FOR A COMMUNITY WILDLIFE PROTECTION PLAN

Fire has been an important component of Pennsylvania natural history for thousands of years, shaping the development of hardwood forests in the region. Fire history for the pre-settlement era in northern Pennsylvania has shown that the area was prone to infrequent but large wildfires that occurred during periods of dormancy and were most likely initiated by Native American burning (Brose et al. 2013). Lightning-caused wildfires were rare historically and continue to be rare, accounting for just 1.4% of all fires annually and 1.5% of the total area burned (DCNR 2013; Marschall et al. 2016). Human-ignited fires (most often debris burning) therefore are the primary cause of wildfire in the state and in Elk County. Education and mitigation measures that prevent careless ignitions of wildfire are needed in order to protect homes and property from wildfire spread (Figure 1).

Figure 1. Debris fire that spread into the adjacent forest. Credit: DCNR.

In the 1920s suppression efforts were propagated in Pennsylvania, supported by the 1924 Clarke-McNary Act, which called for greater forest protection through improved detection and suppression of wildfire. The Civilian Conservation Corps (CCC) strengthened the suppression era in the 1930s as CCC camps were established. Pennsylvania had the second highest number of CCC camps (151) to California (DCNR 2017). Associated road construction improved access to forest lands, and accompanied with the building of fire detection towers, acres burned by wildfire fell (Conrad 1997). The influence and effects of fire have changed as attempts were made to suppress fires, with the consequent accumulation of more continuous and dense wildland fuels as historic burn mosaics were lost. More continuous fuels have led to larger, more intense wildfires, which are increasingly difficult and expensive to suppress, especially during periods of very dry or windy fire weather.

Many factors, including both ecological and demographic, have heightened the risk of wildfire in Elk County. Years of fire suppression, a lack of active forest management, periodic drought, and defoliating insect infestations have altered natural plant succession, species composition, and forest structure, and ultimately increased the fuel load in some areas. The combination of increasing development in or near wildlands, the accumulation of wildland fuels, extreme storm events that increase downed trees, and dry fire seasons has resulted in heightened wildfire risk to communities located in or near the WUI.

Elk County is characterized by a scattered population with homes in direct proximity to woodland and forest fuels. Elk County's communities are served by volunteer fire departments (VFDs) and emergency response staff. Although fire services are well developed in the planning area, these VFDs can become stretched, and some homes are located at quite some distance to stations, making some residents more vulnerable to wildfire due to slower response times.

GOAL OF A COMMUNITY WILDFIRE PROTECTION PLAN

A CWPP enables local communities to improve their wildfire mitigation capacity and work with government agencies to identify high fire risk areas and prioritize areas for mitigation, fire suppression, and emergency preparedness. The minimum requirements for a CWPP, as stated in the HFRA, are as follows:

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

PLANNING PROCESS

The SAF, in collaboration with the National Association of Counties and the National Association of State Foresters, developed a guide entitled *Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities* (SAF 2004) to provide communities with a clear process to use in developing a CWPP. The guide outlines eight steps for developing a CWPP and has been followed in preparing the ECCWPP:

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

Step Two: Involve Federal Agencies. Identify and engage local federal representatives and contact and involve other land management agencies as appropriate.

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

Step Four: Establish a Community Base Map. Work with partners to establish a base map(s) defining the community's WUI and showing inhabited areas at risk, wildland areas that contain critical human infrastructure, and wildland areas at risk for large-scale fire disturbance.

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

Step Six: Establish Community Priorities and Recommendations. Use the base map and community risk assessment to facilitate a collaborative community discussion that leads to the identification of local priorities for treating fuels, reducing structural ignitability and other issues of interest, such as improving fire response capability. Clearly indicate whether priority projects are directly related to the protection of communities and essential infrastructure or to reducing wildfire risks to other community values.

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

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

CORE TEAM

The first step in the CWPP process was to bring together a broad group of stakeholders representing both agency and private interests to form a Core Team. The CWPP Core Team was originally assembled in September 2016 and is made up of stakeholders who have jurisdictional responsibility related to wildfire suppression and prevention and/or planning for the planning area. The Core Team contact list can be found in Appendix A. The first Core Team meeting was held in Ridgway on November 7, 2016; a second meeting was held via conference call on February 16, 2017; a third meeting was held in Smethport on May 5, 2017; and the final meeting will be held in Ridgway on August 21, 2017. Average attendance at each Core Team meeting was approximately 10 people.

PROJECT AREA

The ECCWPP is a county-level plan that includes the entire Elk County (Figure 2).

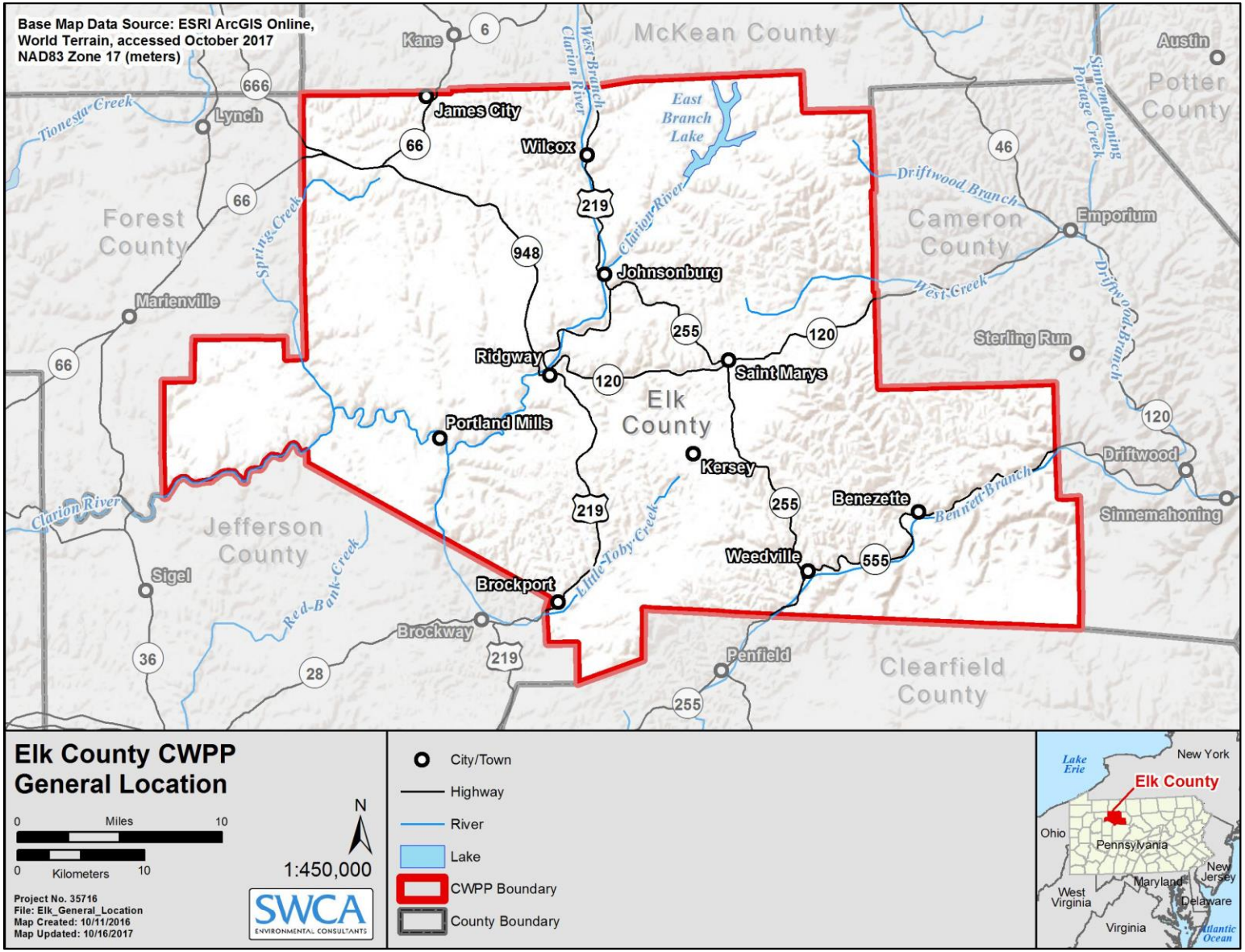


Figure 2. Project location map.

PUBLIC INVOLVEMENT

Engaging interested parties is critical in the CWPP process; substantive input from the public will ensure that the final document reflects the highest priorities of the local community. A key element in the CWPP process is the meaningful discussions it generates among community members regarding their priorities for local fire protection and forest management (SAF 2004).

Public involvement in the CWPP planning process was encouraged through a range of media. A Facebook page was developed for the CWPP (entitled Elk and McKean County CWPPs). The page included a description of the planning process and included links to an online community survey and other relevant pages for the communities. The page was also used to announce public outreach efforts for the project. The online survey was also distributed to all Core Team representatives.

A series of public outreach sessions was provided across the Elk and McKean County areas as part of the CWPP planning process. The Elk County outreach will be carried out through attendance at the Elk Expo on August 20, 2017. This expo attracts attendants from all over the county and as such was chosen as a forum to reach residents who live in the planning area. SWCA Environmental Consultants (SWCA) (contractor) will host an informational booth at the meeting and solicit input from the public through community surveys and presentations of WUI maps and other project information.

The Core Team produced a press release on December 1, 2016, February 20, 2017, and July 11, 2017, describing the project and inviting the public to get involved. *The Bradford Era* published an article on February 21, 2017. The article highlighted the need for ongoing public involvement in the project and directed residents to the online survey and upcoming public outreach opportunities.

OUTCOMES OF A COMMUNITY WILDFIRE PROTECTION PLAN

BUILDING COLLABORATION

The underlying theme of CWPPs is collaboration among the many stakeholders affected by wildfire. Chief among the components of collaboration is public education to provide not only information concerning the risk of wildfire but also to let stakeholders know about opportunities to participate in the management and mitigation of wildfire risk. CWPPs are often referred to as “living documents” because of the importance of revisiting and updating these documents periodically as new issues arise and results from recommendations in the CWPP, such as hazard reduction projects, develop. The value of the CWPP is ultimately to provide a framework for collaboration between the public, governments, agencies, and other entities affected by wildfire, so that they can discuss and jointly develop solutions and strategies for its management and mitigation. Specific CWPP topics requiring a collaborative effort are described in the following subsections.

Risk Assessment

The purpose of developing the risk assessment model described in this document is to create a unique tool for evaluating the risk of wildland fires to communities within the WUI areas of the planning area. Although many definitions exist for hazard and risk, for the purpose of this document these definitions include:

- Risk = Hazard – Mitigations
- Risk is essentially a measurement of the potential consequences of the hazard occurring, in this case a wildfire burning through the WUI community.
- Hazards are those existing bio-physical factors that, when combined, present a threat.
- Mitigations are actions taken to reduce the hazard or risk in order to reduce the unwanted consequences of the WUI fire.

The risk assessment is twofold and combines a geographic information system (GIS) model of hazard and risk (Composite Risk/Hazard Assessment) and an on-the-ground assessment of community hazards and values at risk.

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

Mitigation Strategies

The CWPP process identifies many types of mitigation strategies, including hazardous fuel modification, defensible space, signage, public education prevention messages, improved road access, water supply, and building materials and design. It should be noted that while all mitigation strategies will be useful, some will be a more important factor in preventing destruction of a home.

Outreach and Education

The CWPP process is designed to enhance outreach and education on the wildfire situation to the general public, local governments, and agencies that may be unaware of the steps they can take to mitigate the risk of wildfire. The collaborative effort encouraged during the construction, review, and approval of a CWPP continues into the future as lessons learned from activities identified in the ECCWPP are translated into more specific activities at the community level. Outreach increases the number of partners in this work; education promotes a more common understanding of the causes and nature of wildfire risk and increases general knowledge of the best practices to mitigate it.

Structural Ignitability

In some instances due to the size, speed, and intensity of the fire, or the building materials and surrounding vegetation, structures can ignite and potentially be destroyed before emergency responders can arrive. In order for a structure to survive it must be able to avoid ignition.

Structural ignitability, and responsibility of property owners in reducing this risk factor, is discussed in detail by Cohen (2008). Cohen (2008) notes that “the continued focus on fire suppression largely to the exclusion of alternatives that address home ignition potential suggests a persistent inappropriate framing of the WUI fire problem in terms of the fire exclusion paradigm.”

Reinhardt et al. (2008) state that "destruction (of homes) in the WUI is primarily a result of the flammability of the residential areas themselves, rather than the flammability of the adjacent wildlands." The dwelling's materials and design within 100 feet determine home ignition potential (also referred to as the home ignition zone). Therefore, if large flames are not causing home ignition, then the cause is often relatively low intensity flames contacting the base of the home and/or direct firebrand ignitions. Consequently, Cohen believes that the presence or absence of fuels in the immediate surroundings of the home, and its construction materials, will determine ignition potential. Therefore, the authority and responsibility for reducing structural ignition potential of existing buildings belongs to the property owner. Fire agencies can help educate property owners on the need and methods for reducing structural ignition potential.

Emergency Response and Evacuation

During wildfire events, the routes emergency responders take to the fire are often the same routes being used by residents fleeing from the fire. Other residents may be trying to return to their homes for children or pets. Roads may be too narrow to accommodate two-way traffic of responders and evacuees. Routes may be blocked by fallen trees, spot fires, smoke, downed power lines, or vehicle accidents. Road names and home addresses may be too indistinct to locate, confusing, or missing. Safe areas and evacuation centers may be unknown to residents.

Evacuation may be urgent, confusing, and disorderly, particularly in "No Notice" events during the early part of wildfire response where information about the fire is limited. Law enforcement officers may not be readily available in sufficient numbers, and incident management may be juggling both fire suppression and life safety without enough resources to accomplish both.

The possibility of fatal entrapments exists, and therefore planning for the sudden occurrence of a fire is a vital part of plans developed by local jurisdictions, as well as families. The CWPP will describe many actions that will improve the ability of firefighters to more quickly and efficiently access areas threatened by fire, as well as mobilize law enforcement to assist in providing the public with methods for safer evacuation.

Particular attention must be paid during the development of a CWPP to overgrown evacuation routes where high fuel loading near the road edge may cause a route to be unusable due to intense heat and long flame lengths, falling trees and power poles, or other hazards that an active fire can create and may lead to fatal results.

Prioritize Fuel Reduction

CWPPs provide stakeholders not only the opportunity to identify fuel reduction projects but also to assign priorities to them. Communities with an established CWPP are given priority for federal funding of hazardous fuels reduction projects carried out in accordance with the HFRA. The Core Team can develop a list of projects to help facilitate future planning efforts and help tie funding sources to projects. Speaking with one voice will carry more weight in the competitive environment of funding for wildfire hazard and fuel reduction projects.

The purpose of any fuels reduction treatment is to protect life and property by reducing the potential for and outcome of catastrophic wildfire, as well as to restore landscapes to a sustainable and healthy condition. Moderating extreme fire behavior, reducing structural ignitability, creating defensible space, providing safe evacuation routes, and maintaining all roads for firefighting access are methods of fuels reduction likely to be used around communities located in a WUI zone. Use of multiple treatment methods often magnifies the benefits.

It should be noted this CWPP is a countywide-level document. Therefore, fuel reduction projects will be described in general detail; more specific projects will be essentially “legs” to the CWPP, as jurisdictions identify and tailor projects to their specific needs over the coming years and as part of the CWPP update process.

CHAPTER 2
COMMUNITY BACKGROUND

LOCATION AND GEOGRAPHY

Elk County lies in the north-central part of Pennsylvania and is bounded on the north by McKean County, on the east by Cameron County, on the south by Clearfield County, on the southwest by Jefferson County, on the west by Forest County, and on the northwest by Warren County. Elk County consists of approximately 532,600 acres (Elk County Comprehensive Plan 1999) (see Figure 2).

Elk County lies in the Allegheny Mountain section of the Appalachian Plateaus Physiographic Province. The highest elevation in the county is Boone Mountain at 2,370 feet, and the lowest elevation at Dents Run is at 900 feet.

Elk County was named for the large elk (*Cervus canadensis*) herds that used to frequent the area. The present-day elk herd is one of only two herds east of the Mississippi. Elk County is also known for its industry, most notably the powdered metal industry, as well as hardwood timber.

POPULATION

According to the 2010 census, Elk County had a population of 31,946 residents. Estimates in 2015 suggest a 3.4% decrease in population to an estimated 30,872 residents. In 2010 the population density of the county was 38.6 persons per mile, with a land area of 827.36 square miles. The County Seat is Ridgway with a population in 2010 of 4,078. The county comprises the City of St. Marys; the Boroughs of Ridgway and Johnsonburg; the Townships of Benezette, Fox, Highland, Horton, and Jay; and the census designated places of Byrnedale, Force, James City, Kersey, Weedville, and Wilcox.

HISTORY AND LAND USE

The first inhabitants of Elk County are thought to have been the Seneca or Cornplanter Indians, with evidence of their occupation found throughout the County.

Early pioneers came into the region during the last decade of the eighteenth century. These settlers found mature northern hardwood forests composed of hemlock (*Conium maculatum*), beech (*Fagus* sp.), and maple (*Acer* sp.). Small stands of white pine (*Pinus strobus*) were also common. Disturbances such as wildfires and wind-throw created stands with different aged trees. Native American burning created some cleared areas and a patchy landscape. Early settlers cleared some land for agriculture and cut timber for their cabins and barns in the mid-1700s. Settlement was slow and more aggressive timber cutting did not occur until around 1840–1850. This was a period when portable steam power plants became available, and large sawmills began to be established. By 1850 the growing pace of settlement created an increased demand for lumber for houses, stores, and furniture. The expansion of the railroads during this period made inaccessible areas more accessible to lumber extraction, with white pine as the main target species. The lumber was floated down streams and rivers (Figure 3) to nearby mills and down the Susquehanna and Allegheny Rivers to major markets in Williamsport, Harrisburg, Philadelphia, Pittsburgh, and Cincinnati. Pine supplies began to become depleted and with demands for construction lumber increasing, more and more hemlock was cut. Larger, more valuable timber was removed for specialty products like furniture, paneling, and trim. Early cutting rarely resulted in clear-cuts, as the technology required to remove large volumes of logs was not advanced enough. Most of the cutting was confined to areas where streams could be used to transport the logs to the mills. However, during the last half of the nineteenth century, the industrial revolution provided enhanced methods for lumber extraction, drastically changing harvest volumes throughout the region. Railroad locomotives were introduced that were designed especially for transport of timber, and logging railroads were built intensively throughout the area, increasing access into areas previously out of reach. Accompanying the growth of the timber industry was the tanning industry that used large quantities of hemlock bark to extract tannin used to cure leather. Large sawmills, often with associated tanneries, were established, providing significant profits and revenues for local communities. Wood chemical plants also grew from the lumber boom, producing charcoal, wood alcohol, acetic acid, and other products.

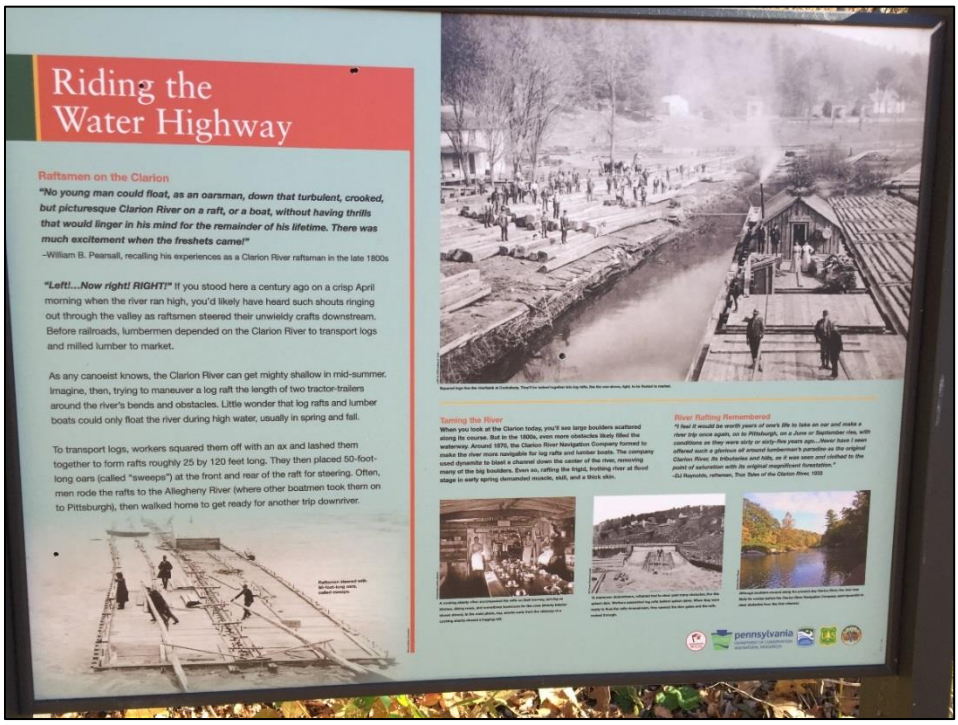


Figure 3. Timber industry heritage is displayed at Clarion River Trail

As a result of this intensive period of logging, between 1890 and 1930, the virgin and partially cut forests of the Allegheny Plateau were almost completely removed. In some areas, the heavy slash left after railroad logging, particularly in the coniferous stands, resulted in severe forest fires that damaged soils and combined with extensive deer browse persist to the present day as open stands. Larger areas however became established with new second-growth stands containing valuable species such as black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), yellow poplar (*Liriodendron tulipifera*), red maple (*Acer rubrum*), and sugar maple (*A. saccharum*). These stands were unaffected by deer browse due to extreme hunting pressure, which was not eased until around 1930 when stricter hunting regulations enabled the population to rebound.

Pennsylvania remains a leading hardwood producer in the nation, with more than 2,100 forest products companies and 500,000 forest landowners. More than 80,000 Pennsylvanians work in the forest products industry, accounting for about one of every nine manufacturing jobs in the state. The industry generates nearly $12 billion in annual sales and contributes about $19 billion a year to the state's economy. Elk County has 545,948 acres of land with 483,162 acres, or 88%, forested. Sixty percent of land is in public ownership, but the remaining 40% comprises an estimated 8,232 private forest landowners. There are 39 forestry and wood products establishments with 614 employees. The estimated volume of standing timber is 3,608.85 million board feet, with an estimated value of $721 million (Jacobson and Kovach, 2007). In 2016 the ANF sold 36,000 Million Board Feet (MBF) in timber sales throughout the Forest (USFS 2017).

Elk County is also known for its powdered metal and carbon industries, which provide employment for a large portion of the county's population.

LANDOWNERSHIP

Elk County has diverse land ownership, split between private (in white in Figure 4 below), state game land, State Parks, State Forest, and the Allegheny National Forest (ANF). The county falls within the heart of Pennsylvania's oil and gas region and the majority of subsurface mineral rights are privately owned in that a landowner may not own subsurface rights and in some occasions may not own timber rights. This situation of "split estates" is widespread in the region. A surface owner has few rights vis-à-vis the mineral owner. While landowners who sever their mineral rights themselves can negotiate for protective provisions in their oil and gas leases, a surface owner whose rights have already been severed cannot (Anderson 2013). The common law provides little protection: The mineral estate is the dominant estate and the mineral owner has the implied right to reasonable use of the surface in order to develop the oil and gas (Silberstein 2008). In some areas of the County, this has implications for development in forested vegetation, creating more fragmented forest structure and increasing wildfire hazards in forested areas.

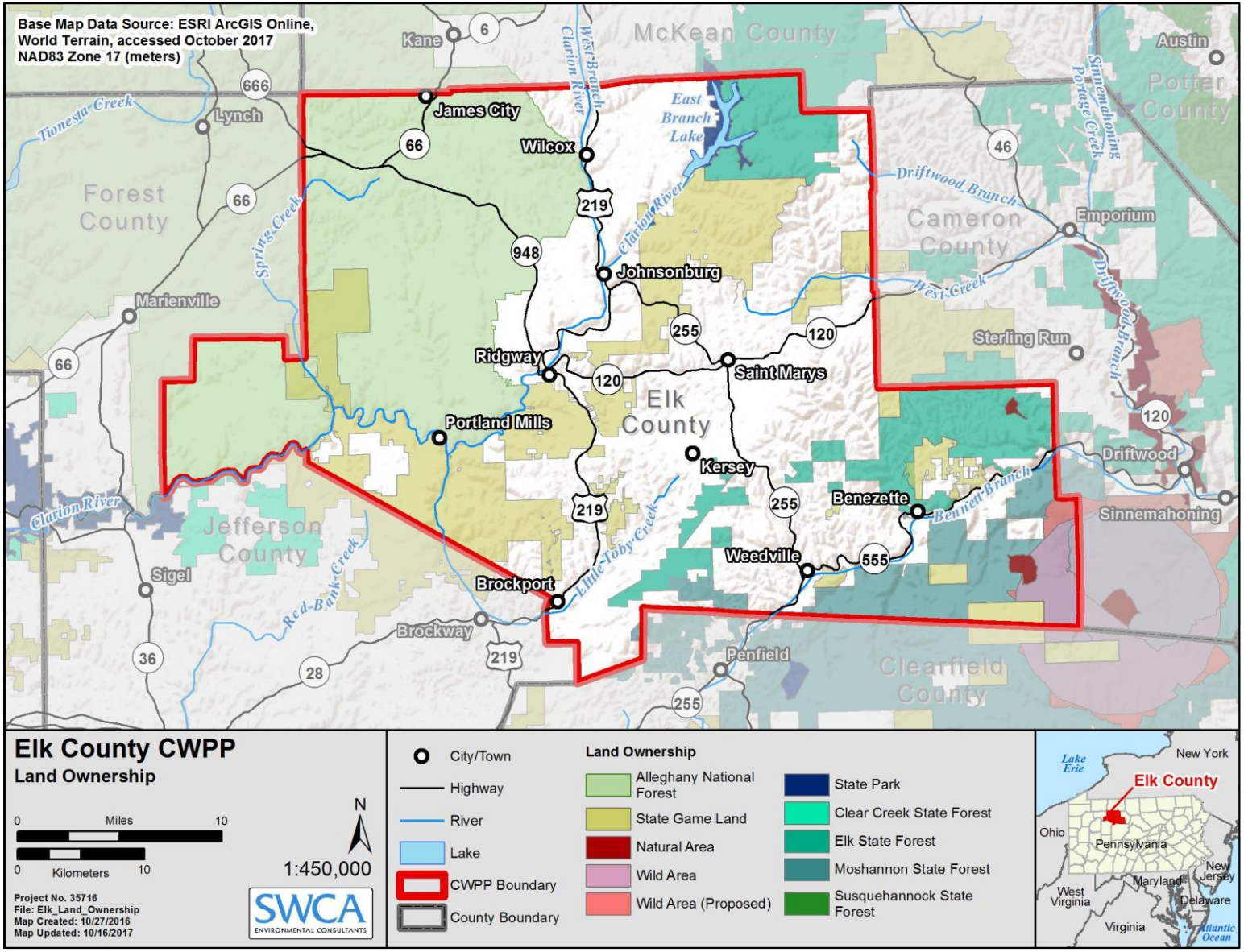


Figure 4. Land ownership.

RECREATION

Elk County is best known for the present-day elk herd that occupies portions of Elk and Cameron Counties. The herd, which is made up of more than 900 individuals, is one of only two wild herds east of the Mississippi. The elk range is located in the Benezette area of the Allegheny Plateau, primarily in Jay Township, Benzene Township, and the City of St. Marys. The herd attracts significant numbers of visitors throughout the year, centered primarily at a viewing area and visitor center near the top of Winslow Hill. The elk are held on public lands using cultivated feed plots and are managed by the Pennsylvania Game Commission. Tourism associated with viewing of the herd provides economic value to the local community.

The ANF and Elk and Moshannon State Forests draw significant visitors to the county and provides recreational opportunities for the residents of Elk County. The county is also home to two State Parks: the Bendigo State Park and the Elk State Park. Hunting is also a major draw to the region's forests. Pennsylvania ranks first in the nation in the sale of hunting licenses, with big-game animals, such as deer, a leading attraction. Between 100,000 and 150,000 deer are harvested annually in Allegheny Plateau forests, along with bear, turkey, and many kinds of small game.

Water resources are also an important benefit derived from Allegheny forests. Boating and fishing are available at East Branch Lake, and the Clarion River, a nationally designated wild and scenic river, which draws both fisherman and water sport enthusiasts. A number of campsites are located throughout the county on public and private land (Figure 5). The county comprises two major watersheds, the Clarion River Watershed and the Sinnemahoning Creek Watershed, as well as many smaller watersheds, with the Eastern Continental Divide splitting the county in two.

A large number of historic buildings are found throughout Elk County with 12 properties and districts listed on the National Register of Historic Places[1].

Figure 5. Recreational areas, including trails, are common throughout the County

[1] Elk County Register of Historic Places: https://en.wikipedia.org/wiki/National_Register_of_Historic_Places_listings_in_Elk_County,_Pennsylvania.

Elk County comprises extensive public lands both federally and state managed, including National Forest land and State lands.

Allegheny National Forest

The ANF is managed by the USFS and is the only National Forest in Pennsylvania. The forest is spread over Elk (Figure 4), McKean, Forest, and Warren Counties and is composed of plateau tops with elevations up to approximately 2,300 feet and valleys down to 1,000 feet (USFS 2016). National Forests are managed to provide multiple benefits and in a sustainable way for the benefit of future generations. This includes management of timber for "sustainable use" to furnish a continuous supply of timber and other functions and values such as recreation, tourism, wildlife habitat, and watershed protection. Municipalities receive 25% of the forest's gross receipts each year for schools and roads.

Historically, the Allegheny was a vast forest dominated by northern hardwoods of eastern hemlock and beech, with white pine and oak along ridgetops and valley bottoms (ANF 2007). As described previously, the area was heavily impacted by industrialization and unregulated logging during the late 1800s and early 1900s, which left vast areas as barren brush. The National Forest was established in 1923 and restoration efforts by the USFS resulted in the growth of diverse forest. Black cherry is now an important species both in terms of forest composition and commercial timber production. The valuable hardwood species in the forest are marketed globally and contribute to the local economy. Timber harvest is also designed to move forest composition towards a goal of plant and animal diversity (ANF 2007). The native hardwood species are increasingly under threat from beech bark disease, hemlock woolly adelgid (*Adelges tsugae*) infestation, emerald ash bore and sugar maple decline (ANF 2007).

Road density within the forest is high and there are numerous developed campgrounds and motorized and non-motorized trails for recreational use. Fishing, hunting, hiking, scenic driving, dispersed camping, and wildlife viewing are common uses. Visitor use is high, particularly during busy holiday weekends and opening weeks of fishing and hunting seasons. The opening week of Trout season for example coincides with fire season, creating a concern for land managers due to increased visitor use during that time.

Northwestern Pennsylvania is renowned as being the site of the first ever oil well in the nation (Drake's Well in Titusville). As a result, the ANF was heavily developed for oil and gas. To this day there are 2,442 active wells within the County (Pennsylvania Department of Environmental Protection, 2017), and over 13,000 shallow wells on ANF lands.

Bendigo State Park

Bendigo State Park is a 100-acre park in Jones Township that is located on the East Branch of the Clarion River. The park comprises 80 acres of undeveloped woodlands of beech, birch, cherry, and maple and 20 developed acres that comprise a pool and picnic facilities.

Elk State Park

Elk State Park is a 3,192-acre park, also located in Jones Township and Sergeant Township in adjacent McKean County. The park is also located on the East Branch of the Clarion River and comprises lakes and streams and 3,151 acres of woodland.

State Forest Lands

There are two State Forests within Elk County, the Moshannon State Forest and the Elk State Forest (Figure 4). The following is a breakdown of State Forest Lands (without regard to forest district) within the County:

Benezette	47,604.98
Fox	8,782.93
Horton	263.18
Jay	7,501.58
Jones	15,683.81
Totals	**79,836.48**

Moshannon State Forest

Moshannon State Forest is located within Pennsylvania Bureau of Forestry District 9. The forest covers a small portion of the southeast corner of Elk County and extends into Center, Clearfield, Cameron, and Clinton Counties (Figure 4). The State Forest was established in response to the depletion of Pennsylvania forests during the mid to late nineteenth century. The lands that now make up Moshannon State Forest were purchased by the Commonwealth of Pennsylvania following legislation passed in 1897 by the Pennsylvania General Assembly. The land was largely devoid of trees following a period of clear-cutting, described above. The current forest is made up of second-growth forests of beech, yellow poplar, birch, oak, hickory, cherry, chestnut, and maples.

Elk State Forest

Elk State Forest is located within Pennsylvania Bureau of Forestry District 13. The forest covers 217,000 acres in Elk and Cameron Counties, with small sections in Clinton, McKean, and Potter Counties (Figure 4). The forest is named for the elk, though native to Pennsylvania were extirpated in 1867. Rocky Mountain elk (*Cervus elaphus nelsoni*) were re-introduced to the area in the 1920s and the herd is now thriving. The Pennsylvania Game Commission is charged with the maintenance of the herd and manages sections of the forest for habitat improvement. Much like other State Forests in Pennsylvania, the land for Elk State Forest was acquired from lumber companies during the early twentieth century following extensive clear cutting of the area for white pine and hemlock.

State Game Lands

Some large tracts of state game land are located in Elk County (Figure 4): SGL 028, SGL 025, SGL 293, SGL 044, SGL 311, SGL 034, and SGL 014. The game lands are managed by the Pennsylvania Game Commission, Northcentral Region. The primary management goal on state game lands is the management of habitat for wildlife and to provide opportunities for lawful hunting and trapping. Secondary recreational uses are also permitted in accordance with Pennsylvania Game Commission regulations. The Pennsylvania Game Commission carries out habitat management through the use of mechanical treatments (i.e., mowing) and prescribed burning. The commission may plan prescribed burns for implementation throughout the county based on meeting a number of prescription windows that are determined by vegetative and weather conditions.

PRIVATE LANDS AND FOREST INDUSTRY

Over 88% of Elk County is made up of forested land (Jacobsen and Kovach, 2007). Private forests are an important part of the County economy. According to data from the previous decade, there are almost 8,232 private forestland owners in the County, and 39 private forest and wood products establishments. The wood products industry employs approximately 614 people and produces an estimated 3608 million board feet of standing timber, at an estimated value of $721 million (Jacobsen and Kovach, 2007).

According to the 1999 Comprehensive Plan (Elk County 1999), Elk County wish to promote economic development of the forest resources industry, promoting multiple use, management and marketing, final product industries, tourism and cultural preservation. The Comprehensive Plan also encourages education of the local community and encourage collaboration and decision making by the community in the sustainable management of forest resources. Further, the Comprehensive Plan calls for the provision of incentives for private and public land owners to invest in professionally developed management plans. Finally, forest management under the Comprehensive Plan should be carried out in a manner that is compatible with other planning objectives such as scenic values and recreational development and should utilize scientific based forest practices that ensure the sustainability of the resource (Elk County, 1999).

Forest Industry

The forest industry in Pennsylvania is composed of loggers, foresters, paper mills, sawmills, manufacturers, and many others (Pennsylvania Forestry Association 2017). Forest industry is an important part of Pennsylvania forest management because one tool in managing forests is timber harvest in order to ensure stands do not become overstocked and decadent. Thinning and timber extraction can help to reduce competition and increase productivity and forest health in many timber species. A healthy forest industry is dependent upon market forces to ensure the viability of local sawmills, paper mills, and wood manufacturing. The economic impact of the forest industry is significant in Pennsylvania. The wood products manufacturing industry employs more than 80,000 people and the wages and salaries generated reach over $4.0 billion. This income generates taxes for the commonwealth and local communities.

Organizations like the Pennsylvania Forestry Association, Pennsylvania Forest Products Association, Pennsylvania Hardwood Development Council, Allegheny Hardwood Utilization Group (AHUG), Lumber Heritage Region and Forest Stewardship Council represent forest land owners, private industry, and commercial forest products companies.

Oil and Gas

Recently, the discovery of Marcellus Shale in Pennsylvania has generated significant interest in the state forest system for developing natural gas resources (DCNR 2017). Millions of acres of state and federal forest lands are underlain by Marcellus and other shale gas formations, making public and private lands a focus for energy development. The challenge for land managers is managing responsible development of natural gas development in a way that ensures long-term forest health, which includes consideration of the wildfire risk of oil and gas infrastructure, particularly in the WUI. Well pads and associated infrastructure can average approximately 5 acres; associated pipelines and pipeline corridors add to the area utilized for oil and gas development (Figure 6). This breaks up forest continuity creating fragmentation which can aid in breaking up fuel continuity (Figure 7), but can result in more adverse impacts related to the loss of forest acres, degradation of wildlife habitat and disturbance to ecosystem processes (Langlois 2017).

Figure 6. Gas development within a forested area. Credit: DCNR.

Figure 7. Pipeline corridor creates a fuel break but contributes to forest fragmentation. Access is restricted. Credit: DCNR.

CLIMATE AND WEATHER PATTERNS

Elk County is typified by a humid continental climate consisting of warm, humid summers and cold, snowy winters. The average annual temperature is 46.4 degrees Fahrenheit (°F) with an average minimum mean of 14.0°F in January and an average maximum mean of 78.1°F in July. Annual precipitation averages 59 inches and is distributed evenly throughout the year (Brose et al. 2013) (Figure 8 and Figure 9).

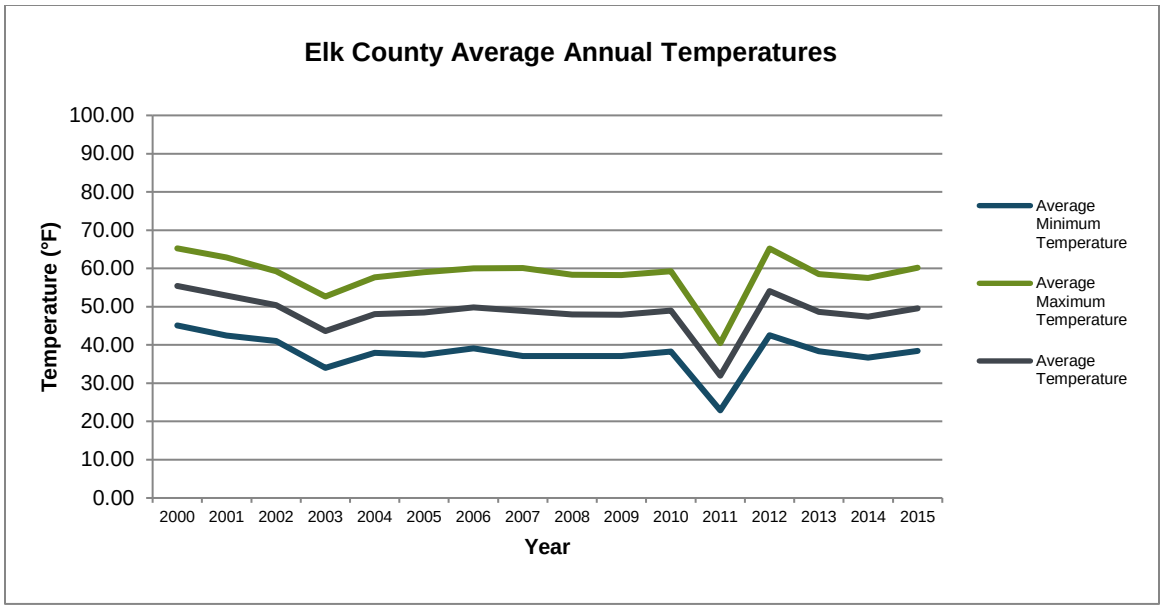


Figure 8. Average annual temperatures, 2000–2015. Source: Allegheny Remote Automated Weather Station.

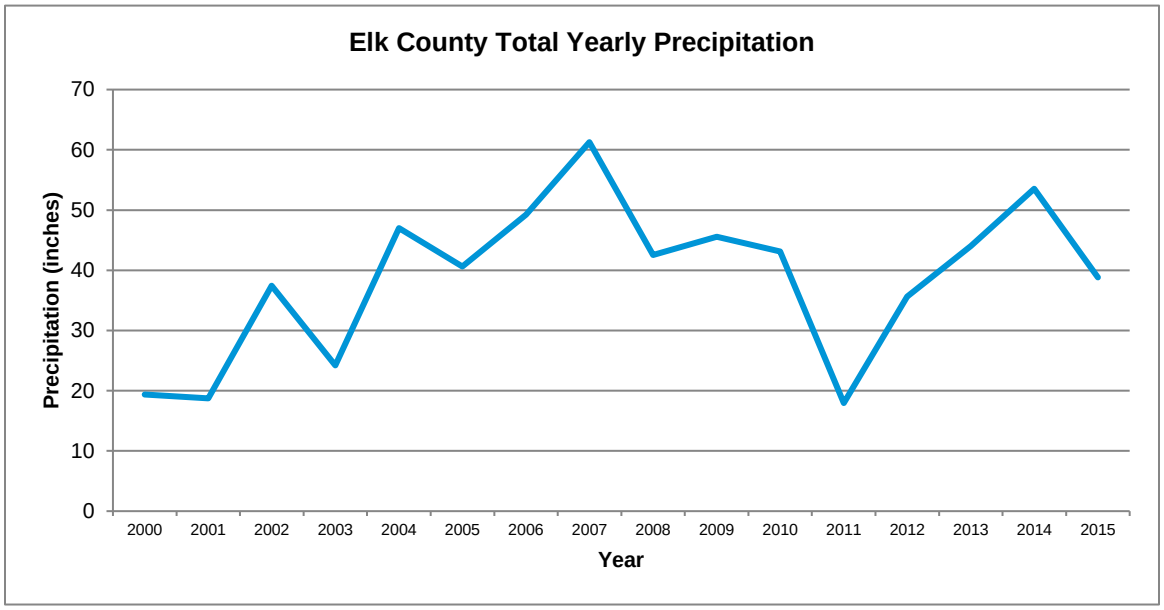


Figure 9. Average annual precipitation, 2000–2015.

Climate is important in determining the fire regime of an area because it influences the vegetative community, i.e., fuel type, determining when and how long fuel is suitable to support combustion (Brose et al. 2013). Below normal precipitation conditions are the primary contributor to fire events, with low fuel moisture (the water content of small and large woody debris). Stronger winds associated with frontal passages and thunder cell activity have historically influenced fire growth. In this region, a weather event that may lead to increased wildfire activity is a 3- to 5-day period in the spring following snowmelt, without measurable precipitation, with winds at 5 to 7 miles per hour (ANF 2015).

Periods of drought can occur in the County and contribute to increased fire hazard. Droughts are regional climatic events, so when these events occur in Elk County, impacts are felt across the entire County as well as areas outside County boundaries. Areas with extensive agricultural land use are most vulnerable to drought. Hydrologic drought events result in a reduction of stream flows, reduction of lake/reservoir storage, and a lowering of groundwater levels. These events have adverse impacts on public water supplies, soil moisture, and create conditions conducive to wildfire events (Elk County, 2017).

Three Drought Emergencies have been declared in Elk County since 1980. A worst case scenario for droughts occurred in 1998. The Governor declared a State of Drought Emergency from December until March of 1999 in fifteen northcentral Pennsylvania counties, including Elk. Based on national data from the late 1800's, Elk County is in severe or extreme drought approximately 5-10 percent of the time. Public water suppliers are vulnerable during periods of drought, particularly because in Elk County, most public and domestic water use is met by ground water sources without significant backup systems (Elk County Planning Department, 1999). This has implications for available water for fire suppression operations. There are twelve public water suppliers and one private that operate in the County or provide water to municipalities in the County. These include: Brockway Borough Municipal Authority, Horton Township Municipal Authority, Elbon Home Owners Association, Joy Gardens Mobile Home Park Authority, Jones Township Municipal Authority, St. Marys Area Joint Water Authority, Ridgway Township Municipal Authority, Johnsonburg Municipal Authority, Ridgway Borough Water Works, Fox Township Municipal Authority, Jay Township Water Authority, and the Highland Township Municipal Authority. The village of Daguscahonda, located in Ridgway Township, has its own private water supply. It is currently unregulated and has been subject to review by DEP on numerous occasions (Elk County, 2017).

Climate and Fire Season

Fire season is typically closed in early October through mid-November, with a season-slowing event for example of several days of wetting rain and freezing temperatures. Periods of warming and drying may occur in mid-October and result in accompanying fire starts; however, fires usually remain smaller.

This region of Pennsylvania is typified by a spring and fall fire season and is influenced by the presence of deciduous leaf cover. Once leaf development reaches 70%, the spring fire season declines; conversely, the fall season coincides with the beginning of leaf fall in October (Figure 10). The established fire seasons as defined by the ANF are March 15 through June 1 and mid-October through early December.

Figure 10. Fall leaf fall in the County

VEGETATION AND LAND COVER

The diversity of vegetation and land cover in the project area is shown in Figure 16. Elk County is made in large part by northern hardwood trees, Allegheny hardwoods, oak and white pine mixed woodlands, savannahs, grass, and shrubs.

FOREST

The forest resources of Elk County are significant both in terms of economics (timber and tourism) and aesthetics. The forests are diverse (Figure 16) and home to varied plants and wildlife species.

Deciduous Forest

Mixed Upland Hardwood

The mixed upland hardwood forest that makes up a large portion of the county is composed of red maple and black cherry, in association with sweet birch (*Betula lenta*), sugar maple, and American beech (*Fagus grandifolia*) (Figure 11). Based on ANF plot data, upland hardwoods on average consist of 36% red maple, 23% black cherry, 10% American beech, 8% sugar maple, 7% eastern hemlock (*Tsuga canadensis*), and 16% other species (ANF 2007).

Northern Hardwoods

The northern hardwood forest is composed of sugar maple-beech-yellow birch (*Betula alleghaniensis*), sugar maple, and beech, with less than 25% of trees being black cherry. Based on ANF plot data, the northern hardwood forest type on average consists of 24% eastern hemlock, 18% American beech, 13% sugar maple, 13% red maple, 13% black cherry, 6% yellow birch, and 13% other species (ANF 2007). Species composition depends on stand age, site characteristics, geographic region, and past land use.

Figure 11. Large uninterrupted expanse of hardwood forest is found throughout the County

Allegheny Hardwoods

The Allegheny hardwood forest is composed of black cherry, yellow poplar, and/or white ash, with greater than 25% of trees being black cherry. Black cherry and the maples usually dominate these stands. Based on ANF plot data, Allegheny hardwoods on average consist of 55% black cherry, 14% red maple, 12% sugar maple, 7% beech, and 12% other species.

The cherry-maple forest type covers about 12 million acres in the Allegheny Plateau and Allegheny Mountains sections of New York, Pennsylvania, Maryland, and West Virginia. Allegheny hardwoods or cherry-maple forests produce nearly all of the world's supply of commercial black cherry timber that is used for production of fine furniture, veneers, and paneling.

Most current hardwood stands developed after extensive commercial clear cutting between 1890 and 1930, which resulted in even-aged conditions. Harvesting of stands began again in the late 1950s and early 1960s as trees in previously clear-cut areas began to mature. Existing stands have a diversity of species in the overstory; however, regeneration is often difficult (USFS 2016). Clear cutting was chosen as the forest regeneration technique for modern day harvest because it had been successful in creating existing stands; however, many areas regenerated to ferns and grasses or to species with minimal commercial value.

Regeneration establishment is affected by a variety of factors, including seed supply, seedbed conditions, deer browsing, interfering plants, light levels, small mammal predation, insects, diseases, and soil-site conditions (USFS 2016). Deer browsing is an important factor that contributes to species composition, with pressure on recruitment of highly preferred browse species. The interactions of these factors determine the establishment of mixed species regeneration and practices, such as the use of shelter woods, promotion of desired species using fertilizer, removal of undesirable species using herbicide, and fencing to reduce deer browse, may be necessary.

Oak

The oak-hickory forest type covers a large portion of Elk County and includes all forest types where at least 25% of the stocking consists of oak (*Quercus* sp.) species. This forest type occurs primarily along river corridors (Figure 12). Based on ANF plot data, the oak forest type comprises on average 32% northern red oak (*Quercus rubra*), 24% red maple, 12% white oak (*Q. alba*), 5% beech, 4% black cherry, 4% eastern hemlock, and 19% other species.

Oak forests on the ANF contribute to regional biodiversity and are very important to many plant and animal species (ANF 2007). Periodic wildfire was an important element in establishing the mature oak stands that occur throughout the county; however, many oak stands have had little fire disturbance in the last century and comprise dense canopies and more shade-tolerant species in the understory. This sets the stage for oak types to transition to other forest types dominated by red maple. The ANF Land and Resource Management Plan (LRMP) emphasizes the importance of the reintroduction of fire into these fire-adapted oak-dominated forests. Land managers understand that habitat management to sustain oak mast crops and large den trees can be achieved through a combination of thinning, release, prescribed fire, and regeneration treatments.

Figure 12. Oak understory located along river corridor

Evergreen Forest

Evergreen forest makes up only a small portion of the forest expanse in the county. Eastern hemlock and eastern white pine are the only native conifer species found in any abundance on public lands in the county, with some scattered pitch pine (*Pinus rigida*) trees also found.

Red pine (*Pinus resinosa*), though not a native species, makes up a significant portion of the conifer cover type in planted stands. Conifer are often found in small amounts scattered with hardwood species (Figure 13).

Figure 13. Conifer component in hardwood dominated forest

Forest Management

The forests in the region are subject to disturbance from a number of agents, including timber harvest, oil and gas development, major storm events, and impacts from insects and disease. These disturbance events contribute to fuel bed development of larger fuels that will support wildland fire events.

Insects and diseases, such as beech bark disease and the hemlock woolly adelgid, have resulted in major defoliations and mortality of trees throughout the county; however, the increased diversity of vegetative conditions has improved the resiliency of the forest and reduced the levels of these impacts (ANF 2007).

Although human-, and in rare instances, lightning-caused wildland fires do occur across the landscape, intense stand replacement wildland fires are infrequent. Prescribed fire and mechanical treatments are used to reduce hazardous fuels on public lands and to maintain and enhance warm season grasses, improve wildlife habitats, and benefit landscapes where advanced oak regeneration is present. Major wind events, tornadoes, and other storms have disturbed large swaths of the forest in recent years and are usually followed with a management response to salvage downed and damaged timber (Figure 14).

On public lands many hardwood forests are managed for diversity through actions that increase understory vegetation and vertical diversity. Forests on the ANF are largely even-aged, with 62 percent of forest vegetation currently falling in the 81-110 year age class. Currently 3.8 percent of forest vegetation is less than 20 years old, compared to a Forest Plan objective of 8 percent. Forest stressors are increasingly disturbing forest vegetation across the plateau, but maintaining several structural-age classes and community composition and diversity at the landscape level helps to reduce the risk of insect and disease outbreaks and subsequent mortality (Nyland 1996, p. 466; Waring and O'Hara 2005).

Figure 14. Tornado damage to northern hardwood forest

On ANF lands, understory vegetation has transitioned from areas dominated by fern, beech brush, and striped maple (*Acer pensylvanicum*), to stands with multiple vegetative layers characterized by a diverse overstory, woody midstory, and a well-developed understory of shrubs, herbaceous plants, and tree seedlings (ANF 2007). A diverse understory of species creates a more resilient ecosystem where mature trees are replaced by new growth (Figure 15).

Figure 15. Diverse hardwood forest understory

Diverse forest structure increases habitat for wildlife including deer, which favor vertical diversity and rich understory for browse. Snags and downed logs are retained in order to provide habitat for various small mammals, birds, reptiles, and amphibians. Some areas are maintained as open clearings to add complexity. Important mammal species that live in the forested areas of the county include fishers (*Martes pennanti*), river otters (*Lontra canadensis*), northern water shrews (*Sorex palustris*), snowshoe hares (*Lepus americanus*), northern long-eared bats (*Myotis septentrionalis*), silver-haired bats (*Lasionycteris noctivagans*), and northern flying squirrels (*Glaucomys sabrinus*).

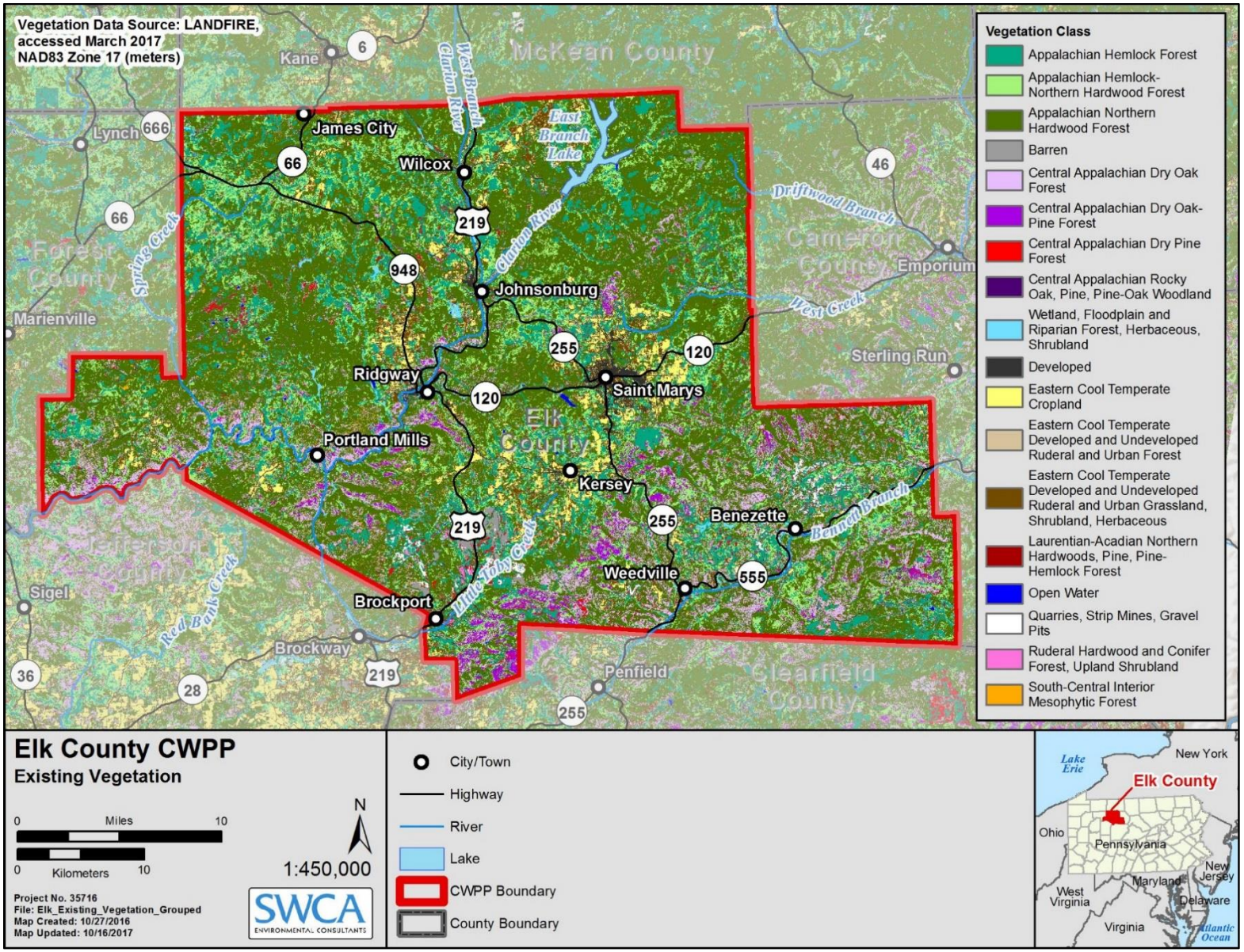


Figure 16. Elk County vegetation classification.

GRASSLAND

Natural grassland areas are uncommon in Elk County, with the exception of grassy areas surrounding homes on private property. On public lands such as the ANF, areas of grassland are managed for habitat for species with viability concerns, e.g., waterfowl, songbirds, and raptors (Figure 17). Grassland areas are managed using prescribed burning or mowing to prevent encroachment of shrubs and trees (ANF 2007).

Figure 17. ***Some large grassland areas are found interspersed with forest land, like this grassland-forest transition close to the Elk Country Visitor Center. Many areas like these are managed for elk feed plots.***

RIPARIAN AREAS, LAKES, AND WATERSHEDS

Elk County is drained by two major drainage basins (Figure 19). The eastern and southeastern portion lies in the Susquehanna River Basin and is drained by Sinnemahoning Creek and its tributaries. The western and central portions are in the Allegheny River Basin and drained by the Clarion River and its tributaries.

Riparian vegetation is particularly important for wildlife, as many species are dependent on unique riparian plants and this habitat type also serves as a landscape connector. Streams and rivers also provide suitable habitat for game species and aquatic species with viability concerns (ANF 2007).

Riparian areas are also a focal point for recreationists for hiking, fishing, and water sports.

The HFRA directs that riparian areas and watersheds be protected and enhanced. As such, management actions and timber harvest in riparian areas must follow strict guidelines such as buffer zones and restricted use of certain mechanized equipment. Because of their interconnected nature, the management of watersheds and riparian areas requires a collaborative approach between all federal, state, and local agencies, as well as non-governmental groups and organizations.

INVASIVE SPECIES

The DCNR provides a detailed list of invasive species that are threatening Pennsylvania lands.[2] A number of these invasive and non-native species is prevalent across Elk County. Species of particular concern to land managers include multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), blackthorn (*Prunus spinosa*), glossy buckthorn (*Frangula alnus*), goatsrue (*Galega officinalis*), and Japanese stiltgrass (*Microstegium vimineum*).

The ANF carry out forest health assessments annually and report Of the 1,200 plant species listed for the Allegheny National Forest, over 250 are non-native species, and 61 of these are considered invasive plants of concern. Of these species, 17 are considered highly invasive, with the potential to invade natural habitats and replace native species (ANF 2016).

Non-native invasive plants often lack their natural biotic controls that coevolved with them at their place of origin to keep them 'in check'. There is often a lag phase between first introduction and rapid expansion of the NNIP. If left unchecked, invasive plants will limit many uses on lands now and in the future. Some of the priority species for treatment on ANF lands are: garlic mustard, Japanese knotweed, Japanese barberry, Japanese stiltgrass, multiflora rose, glossy and common buckthorn (Figure 18) (ANF 2016).

Figure 18. Invasive species can crown access roads and increase fire hazard. Credit: ANF

INSECT AND DISEASE

There is potential for large areas of mortality in northern hardwood forests in the future due to insect and disease. The greatest threats include:

- **Oak** - Sudden oak death (may also impact black cherry), goldspotted oak borer (*Agrilus coxalis*), Gypsy moth (*Lymantria dispar dispar*) (Gypsy moth have been established in the County since the early 1980s. Approximately 210,000 acres of the ANF were defoliated from 1997-1993; 190,000 acres were defoliated in 2013 (ANF 2016). Host species include oak, aspen, beech, birches, basswood.
- **Eastern Hemlock** - Hemlock wooly adelgid. This disease has been present in the County since 2013.

[2] DCNR Invasive plants: http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20026634.pdf.

- **American Beech** - Beech bark disease. This disease has been present in the County since the early 1980s and has spread across forested land.
- Black Cherry- Cherry scallopshell moth (*Hydria prunivorata*) and fall webworm (*Hyphantria cunea*). These insects are native pests that periodically build up populations. Fall webworm defoliated 32,000 acres between 2011 and 2012. Cherry scallopshell moth defoliation occurred on hundreds of acres in 2014, over 56,000 acres in 2015 (all ownerships), and over 48,000 acres in 2016 (all ownerships). The proportion of standing dead cherry stems on monitoring plots containing black cherry on the ANF has increased from less than 10 percent in the 1998-2001 measurement cycle to more than 22 percent in the 2014-15 measurement cycle. Similarly, continuous forest inventory data collected on the Pennsylvania High Plateau (ANF region) noted an increase from around 3 percent dead black cherry stems in the 1997-2000 measurement cycle, to more than 30 percent in the 2009 to 2013 measurement cycle (ANF 2016).
- **Maples and Birch** - Asian long-horned beetle (*Anoplophora glabripennis*)
- **Green and White Ash** - Emerald ash borer (*Agrilus planipennis*). This insect has been confirmed present in the County since 2013, but likely was present since around 2008.
- **Walnut** - Thousand cankers disease
- **Chestnut** - Chestnut blight

The ANF and Forestry Bureau carryout forest health surveys and are developing mapping, especially of large concentrated areas of mortality. Many areas are difficult to map because of cases of single tree mortality. The Forestry Bureau carries out mortality flights in June/July and map areas if significant.

Table 1 summarizes the list of potential both native and introduced insect and disease agents that have reasonable potential to cause mortality, dieback and defoliation. The threat of insect, disease and non-native species is growing, as supported by annual forest health surveys; the Pennsylvania State Forest Resource Assessment; the National Insect and Disease Risk Map; the Allegheny National Forest Final Environmental Impact Statement, and by a substantial amount of published scientific studies.

Table 1. ***Allegheny National Forest (ANF) forest types, acres and current and potential insect and disease threats.***

FOREST TYPE	TOTAL ACRES (THOUSANDS)	PERCENTAGE OF ANF	PEST THREATS
Upland Hardwoods (red maple, American beech, black cherry, black birch)	154.0	30	Asian longhorned beetle, beech bark disease, bacterial leaf scorch, cherry scallopshell moth, fall webworm, pear thrips, and other native and introduced insect and disease threats
Allegheny Hardwood (black cherry, white ash, yellow poplar)	129.8	25	Cherry scallopshell moth, emerald ash borer, peach bark beetle, and other native and introduced insect and disease threats
Oaks (northern red, white, chestnut, black, scarlet oaks mixed with other hardwoods)	75.4	15	Gypsy moth, oak wilt, bacterial leaf scorch, sudden oak death, and other native and introduced insect and disease threats
Northern Hardwood (sugar maple, American beech, yellow birch, Eastern hemlock)	72.9	14	Asian longhorned beetle, beech bark disease, sugar maple decline, pear thrips and other native and introduced insect and disease threats
Hemlock	9.4	2	Hemlock woolly adelgid, elongate hemlock scale, and other native and introduced insect and disease threats
Conifer (spruce, red pine, white pine)	10.3	2	Sirex woodwasp, white pine blister rust, and other native and introduced insect and disease threats

WILDLIFE

Elk County falls within the Allegheny High Plateau Ecoregion of Pennsylvania, which has been described by the DCNR as “having the highest stream quality for the state, with the largest block of core forest state-wide.” The ecoregion is home to vast numbers of wildlife species, many of which are sensitive species. The forest habitats and river systems also provide refuge for an abundance of game species creating outstanding opportunities for hunting and fishing.

Pennsylvania’s Wildlife Action Plan (2015-2025) cites fire as an important disturbance in maintaining particular forest, barrens, and grassland habitats for species of greatest conservation need, while also promoting game species, native flora, and host species for rare invertebrates. Early successional habitat that is favored by a large number of species is maintained through frequent disturbance, especially fire. Important grasslands composed of warm season grasses are also important for game species, grassland birds, and rare invertebrates and can be maintained through application of prescribed fire. The Pennsylvania Game Commission and U.S. Fish and Wildlife Service (USFWS) have developed a habitat conservation plan for bats on state lands that advocates for the use of prescribed fire to improve habitat conditions.

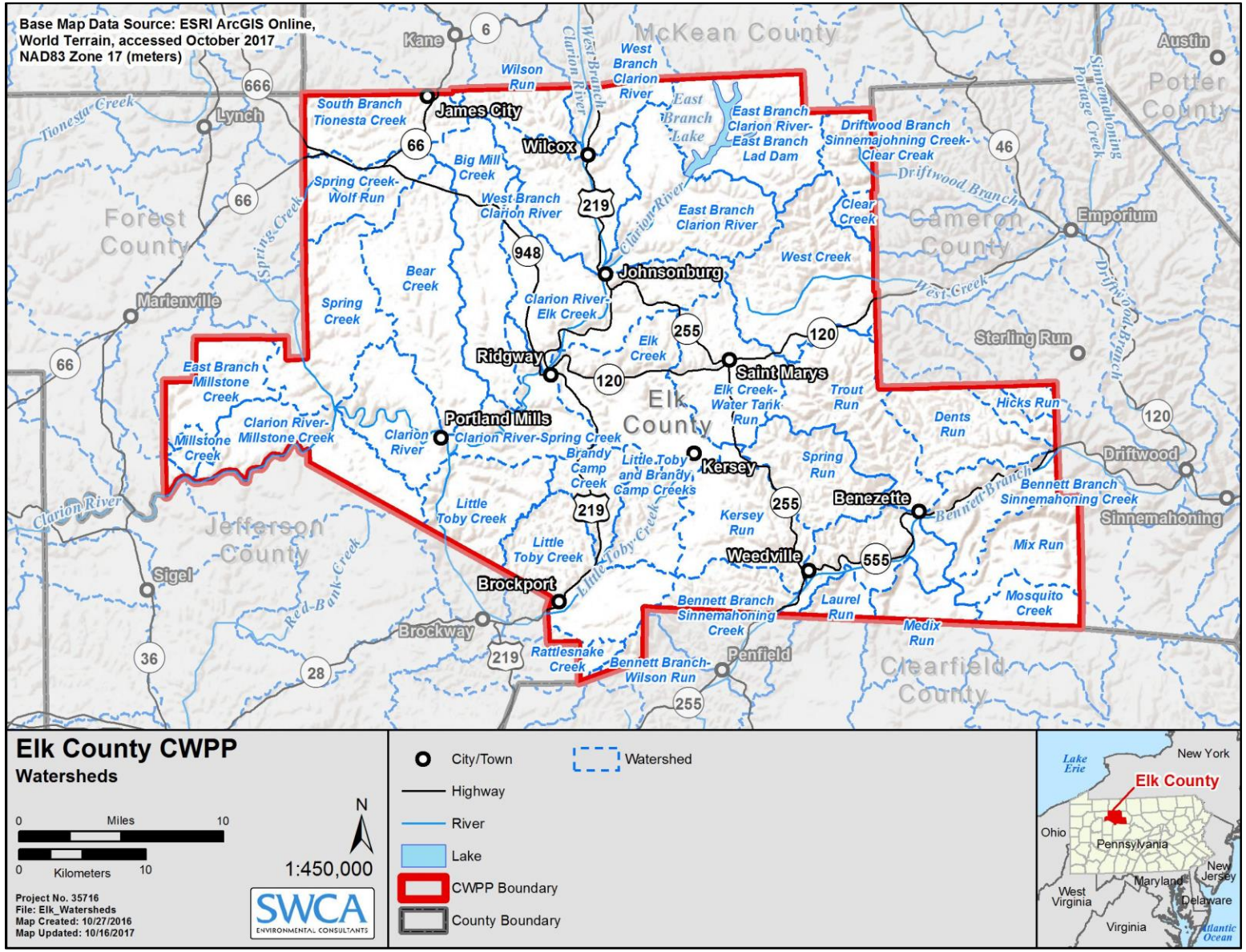


Figure 19. Elk County watersheds.

Threatened and Endangered Species

Public land managers, such as the ANF and State agencies, implement design criteria for timber stand improvements in habitat of species with viability concerns and threatened and endangered species. This includes species of bats, e.g., Indiana bat (*Myotis sodalis*), northern flying squirrel (*Glaucomys sabrinus*), northern goshawk (*Accipiter gentilis*), red-shouldered hawk (*Buteo lineatus*), great blue heron (*Ardea herodias*), osprey (*Pandion haliaetus*), yellow-bellied flycatcher (*Empidonax flaviventris*), eastern box turtle (*Terrapene carolina carolina*), wood turtle (*Glyptemys insculpta*), timber rattlesnake [a Management Indicator Species] (*Crotalus horridus*), Jefferson salamander (*Ambystoma jeffersonianum*), four-toed salamander (*Hemidactylium scutatum*), and coal skink (*Plestiodon anthracinus*).

In addition, there are several sensitive plant species that require special consideration in the development of timber treatments.

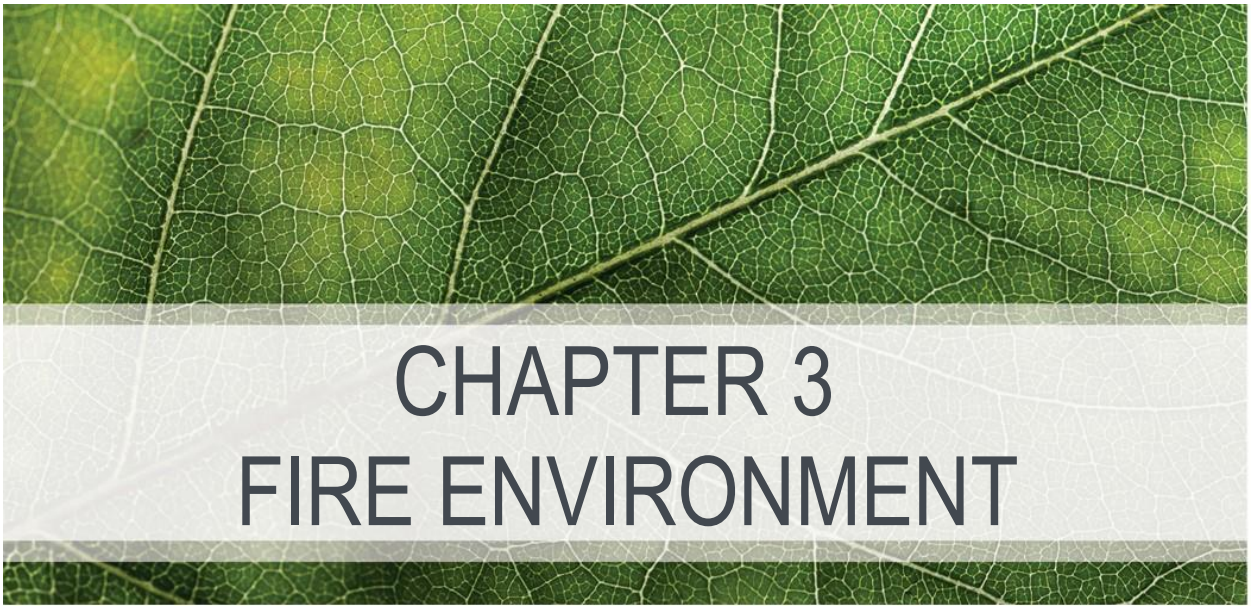
ROADS AND TRANSPORTATION

There are a number of major highways in Elk County. U.S. Route 219 runs directly through the towns of Brockway, Ridgway, and Johnsonburg before reaching Wilcox. Pennsylvania State Highway (PA) 66 runs through the northwest corner of the county, with a 2-mile concurrency with Pennsylvania Route 948 that heads northwest out of Ridgway towards Sheffield. PA 949 heads southwest from Ridgway to Sigel. PA 120 runs from U.S. Route 219 in Ridgway east to U.S. Route 220; PA 153 enters Fox Township in Elk County and becomes Penfield Road, turning west and passing through the Elk State Forest. The route heads into Horton Township and turns northwest, passing through more forested areas with occasional farmland and homes before ending at U.S. 219. PA 321 has its southern terminus at U.S. Route 219 in the community of Wilcox. The northern terminus is at PA 346 within the ANF. PA 321 heads northwest from Wilcox through rural areas to the borough of Kane. PA 555 connects Benezette and Force in the southeastern corner of the County. State Route 255 runs south to Interstate 80 and is a major connector for the County.

Road density within the ANF is high and there are many dead end forest roads and oil and gas development roads.

ADJOINING COUNTIES

Elk County is bounded on the north by McKean County, on the east by Cameron County, on the south by Clearfield County, on the southwest by Jefferson County, on the west by Forest County, and on the northwest by Warren County.



CHAPTER 3
FIRE ENVIRONMENT

WILDLAND URBAN INTERFACE

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

The WUI creates an environment in which fire can move readily between structural and vegetative fuels, increasing the potential for wildland fire ignitions and the corresponding potential loss of life and property. Human encroachment upon wildland ecosystems within recent decades is increasing the extent of the WUI throughout the country as a whole, which is having a significant influence on wildland fire management practices (Martinuzzi et al. 2015). Expansion of the WUI is also outpacing local infrastructure in many areas, stretching the capabilities of fire, police, and local emergency services (DCNR 2016). Combined with the collective effects of aggressive suppression policies, resource management practices, land use patterns, climate change, and insect and disease infestations, the expansion of the WUI into areas with high fire risk has created an urgent need to modify fire management practices and policies and to understand and manage fire risk effectively in the WUI (Pyne 2001; Stephens and Ruth 2005). Mitigation techniques for fuels and fire management can be strategically planned and implemented in WUI areas—for example, the development of defensible space around homes (Figure 20).

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

The Core Team decided to delineate the WUI using the 2010 conterminous WUI maps developed for each state by Martinuzzi et al. (2015). This mapping uses the WUI definitions for Intermix and Interface as outlined in Table 2.

Table 2. Definition of WUI and Non-WUI Land Use Classes

WUI DEFINITION	
Intermix	Areas with ≥6.18 houses per km² and ≥50% cover of wildland vegetation.
Interface	Areas with ≥6.18 houses per km² and <50% cover of vegetation located <2.4 km of an area ≥5 km² in size that is ≥75% vegetated.
NON-WUI, Vegetated	
No Housing	Areas with ≥50% cover of wildland vegetation and no houses.
VERY LOW HOUSING DENSITY	Areas with ≥50% cover of wildland vegetation and <6.18 houses per km².
Non-Vegetated or Agriculture	
Low and very low housing density	Areas with <50% cover of wildland vegetation and <49.42 houses per km².
Medium and high housing density	Areas with <50% cover of wildland vegetation and ≥49.42 houses per km².

Source: Martinuzzi et al. (2015).

For more information on delineation of the WUI see Martinuzzi et al. (2015:8). The WUI map used in the CWPP is presented in Figure 20.

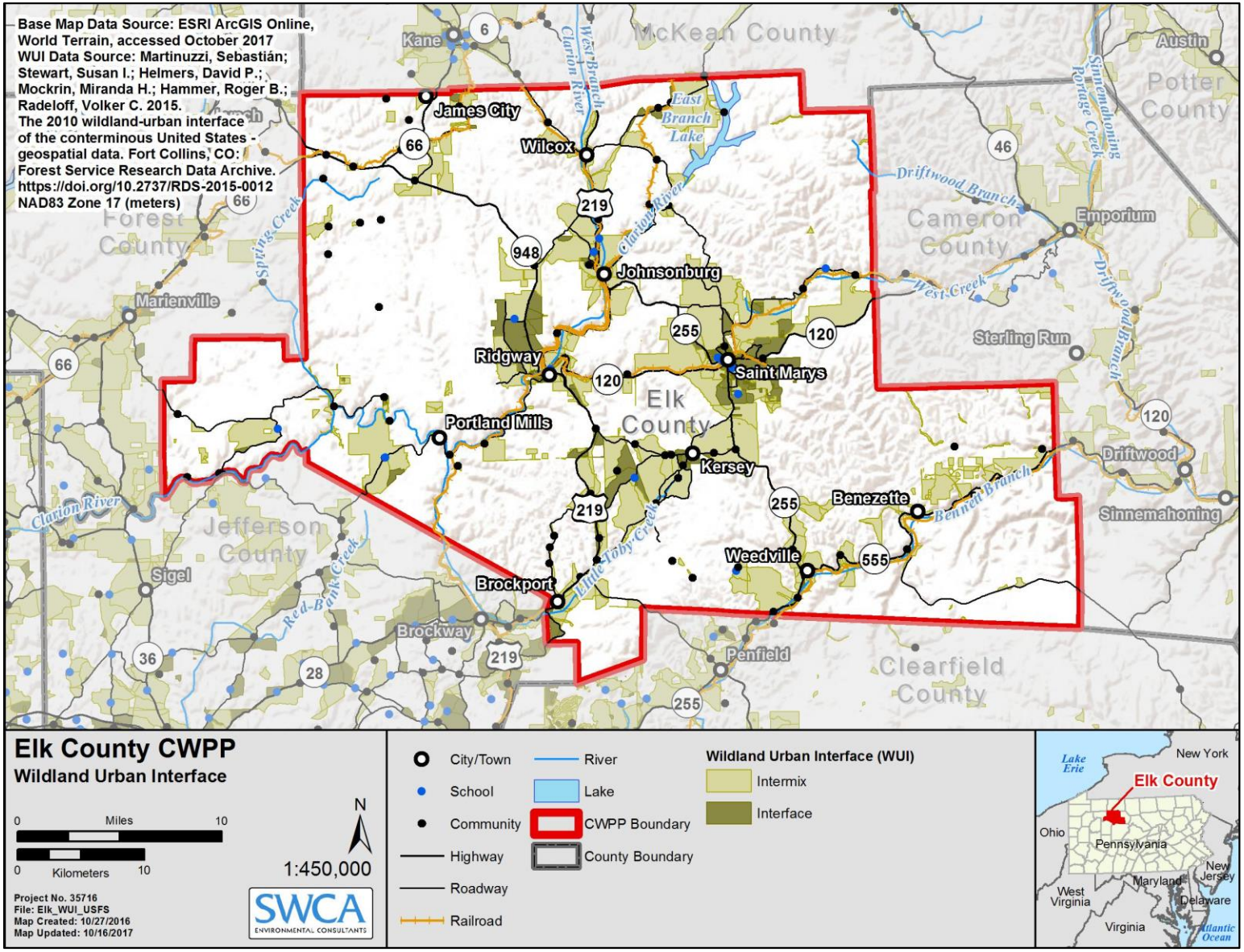


Figure 20. WUI designation.

FIRE HISTORY

In the eastern United States, fire history studies are uncommon because of the centuries of European settlement, extensive and intensive land use, and a humid climate that makes long-term preservation of fire-charred wood unlikely (Brose et al. 2013). As a result, fire histories are difficult to construct for this region (Marschall et al. 2016; Saladyga 2017). Despite this, Brose et al. (2013) were able to add to the meager body of literature through a study of fire-scarred red pine and pitch pine in north-central Pennsylvania. Their study found that the pre-settlement (1590–1790) fire regime consisted of sporadic, large, dormant season (Oct–late April) fires, sometimes burning at high intensities, separated by decades of no fire. These results are consistent with similar studies in the region (DCNR 2016; Marschall et al. 2016). Between the late 1500s and late 1700s, the sites in Brose's study burned every 35 to 50 years during early- to mid-spring. Through comparing climate data with burn scar data, the study showed that drought was not a significant factor contributing to the fire regime. Human influence through Native American burning is thought to have been the primary ignition source for nearly all fires in the pre-settlement period (Williams 2003; Brose et al. 2013).

The disturbance regime created by Native Americans was one of frequent to periodic low intensity fires that created a mosaic of forest structures with a diverse herbaceous understory and promotion of species like oak. For example, research suggests that the occurrence of oak forests in the major drainages (Allegheny River, Clarion River) is related to Native American use of fire for hundreds and thousands of years (Ruffner et al. 1997; Ruffner and Abrams 1999; Abrams 2005; Black et al. 2006). Native American burning was thought to be practiced as a means to promote production of fruiting shrubs like blueberry (*Vaccinium* sp.) and huckleberry (*Gaylussacia* sp.) (Hulbert 1910), increase oak woodlands for mast (acorns) and hunting purposes (Abrams and Nowacki, 2008), clear forests to prepare land for villages, and move preferred species for hunting (Brose et al. 2001). Nearly all fires during the pre-settlement period occurred during the dormant season when lightning is uncommon (Weatherspark 2013); lightning-caused fires account for only 1.4% of all fires annually in Pennsylvania and 1.5% of total area burned (DCNR 2013).

The settlement period (from late 1700s) saw a change to the fire regime (Brose et al. 2013), with a significant increase in the number of fires to an interval of only 4.9 to 7.2 years. Fire timelines developed for the region from 1872 to 1960 show frequent fires that often exceed 1,000 acres. Some fires were reported in neighboring counties that exceeded 50,000 acres. On June 22nd 1925 a 2,000 acre fire burned in the ANF south of Highland in Elk County. This appears to be the first large fire in the newly created ANF. On May 17th 1926 a 26,000 acre fire began in Owls Nest and is the largest wildfire reported on ANF lands. Two lumberjacks were reported missing and never found. Sadly a number of historic fires resulted in fatalities.[3]

[3] Timeline of Pennsylvania wildfires: http://www.mjklimkos.com/?page_id=218

The Owls Nest Fire

excerpt from article by M. Klimkos, 2016.

On May 17, 1926 one of the largest fires Pennsylvania history, began in Elk County. In the spring of 1926 the state had been experiencing a dry spell. Fires over 1,000 acres in various parts of the state were common. Throughout April the Pennsylvania Department of Forests and Waters continued to warn of the increasing fire danger. Governor, Gifford Pinchot, who was also running for a U.S. Senate seat, issued a warning that was carried by the press across the state.

"Because of the extremely dry weather, forest fires are doing great damage in our State in spite of every effort that can be made by our fire fighting force, which is the best in America. Carelessness on the part of the public can start more fires than an army of men can put out." Pinchot seemed almost to be making a campaign speech. He continued, "I call upon every patriotic Pennsylvanian to exercise the greatest care to prevent forest fires during this dry time…..The forest is our friend. We ought to protect it, and being careful with fire is the most necessary way."

Extensive logging operations in northwestern Pennsylvania had left the area near Bear Creek in Elk County ripe for fire. On May 14, 1926 a fire had begun near Loleta, ten miles west of Owls Nest and two days later over 7,000 acres had burned.

The source of ignition of the Owl Creek Fire is unknown. Considering the proximity to the Loleta fire (between ten and twelve miles) and the prevailing winds it is possible that an ember from that fire settled into the cuttings near Owls Nest and smoldered until it built enough heat to burst into flame. Or it could have been a dropped match, or a spark from a steam engine that started the fire. The cause can never be known with any great certainty.

Crews from the Central Pennsylvania Lumber Company and the Pennsylvania Gas Company began to battle the flames as soon as the fire was discovered. The crisscrossed logs, peeled bark and downed tree tops provided a massive amount of fuel and made fighting the fire extremely difficult. A lack of natural barriers, such as streams or mountain ridges allowed the fire to grow to massive proportions in a relatively quick time. The fire, fed by northwesterly winds drew in additional oxygen creating a firestorm. According to Conarro, "Many of the backfires hastily set around Company installations at the Owls Nest fire turned on those who set them and spread more fires over the land."[2]

Two men, reported as "Austrian wood cutters," were trapped in the inferno and no mention is made of them ever being heard from again or whether or not their remains were found.

The fire continued to burn and finally with the help of timely rains was contained and extinguished nearly a week after it had begun. It is estimated that more than 23,000 acres had burned in what became known as the Owls Nest Fire.

When the damage was totaled over $2,000,000 was lost, over $26,800,000 in 2015 dollars. Somewhere between 12 and 15 million feet of lumber was lost to the Central Pennsylvania Lumber Company. The Pennsylvania Gas Company sustained approximately $35,000 to pipelines and ancillary equipment. Railroads were damaged with burnt ties and warped rails and at least two lumber camps and equipment were lost. The press accounts state that more than 800 men were employed in fighting the fire.

Today – 90 years after the fire – the area is still largely devoid of good timber. The Pennsylvania Game Commission and the U.S. Forest Service are cooperators with the Ruffed Grouse Society in a grouse habitat management project over a large tract of the land. It is a prime example of how events of the past shape ecosystems of today and into the future.

Source: Klimkos 2016[4].

[4] Michael Klimkos, May 2016. 90 Years Ago, the Owls Nest Fire. http://www.mjklimkos.com/?p=290

Most fires continued to burn in the dormant season; however, spring and summer fires also became common. The increased fire occurrence is attributed to the human activity of the logging era, which bought increased human presence and logging slash. Early pioneers may also have adopted native practices regarding burning to promote desired conditions (DCNR 2016). The nineteenth century saw significant disturbance as land was cleared for agriculture and timber harvest (Tikusis 2009). Logging, railroad use, and charcoal and iron production by settlers created a rise in wildfires throughout the region and state. The frequent and sometimes severe fires of the settlement period created even-aged oak-dominant forests in many areas (Brose et al. 2013; DCNR 2016; Marschall et al. 2016).

According to the fire scar evidence from the Brose study, the fires of the settlement era in northern Pennsylvania ended abruptly after 1915 as a result of the end of logging and advent of forest protection policies and aggressive fire suppression. In the Brose study only one fire burned between 1915 and 2013. The Bureau of Forestry was given responsibility for wildfire detection, suppression, and prevention in 1901. In response, 250 fire towers were built and used throughout the state by 1920. In 1915 law was established that created a network of fire wardens to assist with the fire suppression mission. All wildfires under Bureau of Forestry jurisdiction are actively suppressed in order to provide protections for life and property. Prescribed burning has been used as a management tool, however, with requirements outlined in the 2009 Pennsylvania Prescribed Burning Practices Act.

The lack of periodic fire in these regions has had implications for fire-dependent ecosystems throughout the county, most notably the oak-dominated areas of the forest. Oak, a shade-intolerant species, requires frequent fire to create favorable growing conditions. The near absence of fire in oak forests since settlement by Europeans is a major reason for the present-day oak regeneration difficulties (Brose et al. 2013). The lack of fire in modern times is listed as one of the major contributors to the successional replacement of oak by mesophytic hardwoods. Prescribed fire has had to replace wildfire in modern forest management in order to promote oak regeneration where other woody vegetation is hindering the long-term persistence of the species (Day and Fan 2008).

MODERN FIRE OCCURENCE

Recent fire occurrence data show that fires in Elk County remain relatively infrequent. Data from 2002 to 2016 show there are on average seven fires a year throughout the county (Figure 21). Most of these fires are suppressed before they gain in size, with an average fire size of 6.11 acres.

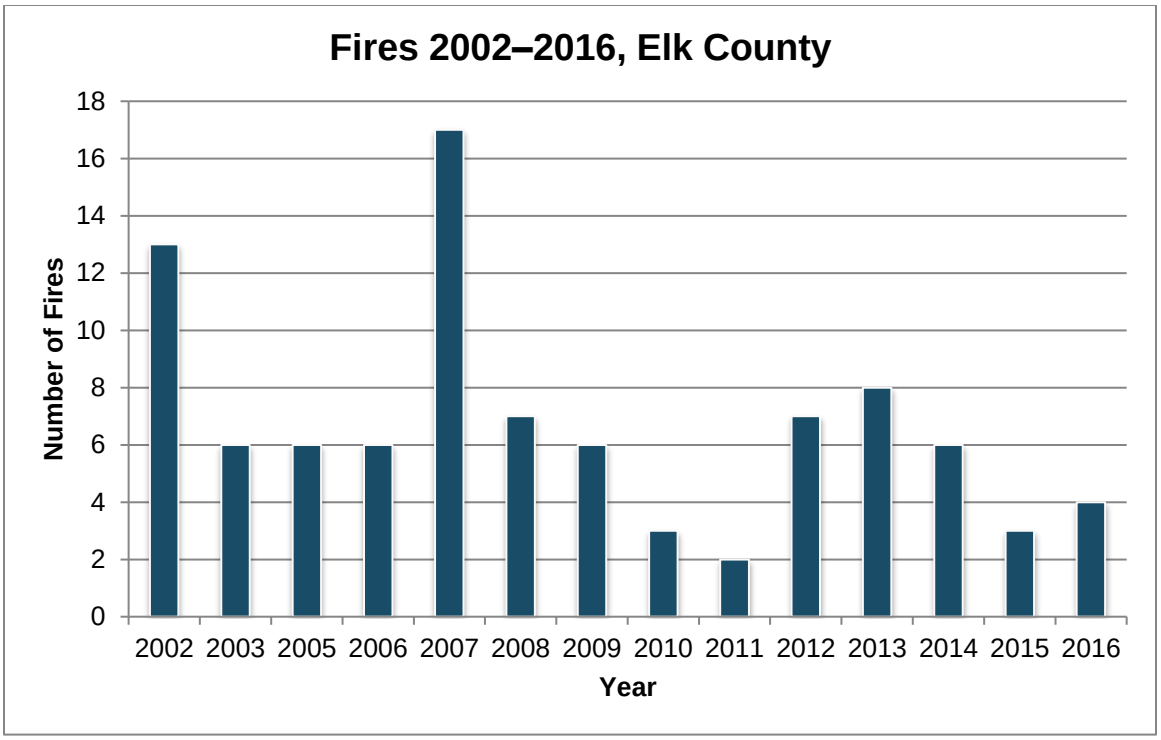


Figure 21. ***Fire history data for Elk County (2002–2016) on all jurisdictions. Note some smaller fires responded to by VFD's, may not be reported and therefore are not included in this data set.***

Natural ignitions in this region occur very rarely. The majority of fires are human caused, with debris burning being the greatest known cause of wildfire (Figure 22), followed by railroads. A number of fires are listed as miscellaneous because a cause was not determined (Table 3).

Table 3. ***Wildfire Causes (on DCNR and ANF Reported Fire 2002-2016)***

CAUSE	ELK COUNTY
Arson	9
Campfire	10
Children	1
Debris Burning	20
Equipment Use	8
Lightning	2
Miscellaneous	24
Railroad	18
Trash Burning	1
Smoking	1
Total	94

Debris fires are largely a spring phenomenon specifically during April and are probably a result of spring cleanup. Debris-burning fires are not often ticketed, as there is very little enforcement available. For this reason education and prevention methods should be promoted to counteract the prevalence of these fires. Fires ignited by oil and gas infrastructure are often caused by broken or leaking gas pipelines where static electricity will ignite leaking gas (Figure 23).

Some accidental starts result from discarded cigarettes, incendiary devices, vehicles, machinery use, and open burning; these are easily avoided incidences that could be avoided through outreach and education. Available fire history information does not always provide fire cause, so the exact number of human versus naturally ignited fires is unavailable. The majority of fires are thought to start on private lands, and most are detected early and suppressed before they gain acreage; however, given the right conditions, these fires may grow large and become difficult to suppress. This illustrates the importance of working with private landowners to reduce fire occurrence and reduce fuel loads and fire impacts in the WUI.

The USFS, DCNR, and other groups are developing fire prevention, fire safety, and public information programs regarding wildfire in the Allegheny region.

Figure 22. Aftermath of a debris fire that spread into adjacent forest land. Credit: DCNR.

Figure 23. Pipeline leak causing ignition. Credit: ANF

FIRE SEASON

As stated in the ANF Fire Management Plan (FMP), fire season is largely influenced by the presence of deciduous leaf cover. Once leaf development reaches approximately 70%, the spring fire season is essentially over. The lush understory and full canopy inhibit flammability. The fall fire season coincides with the beginning of leaf fall in October and the onset of winter moisture. The established bi-modal fire seasons for the ANF are March 15 through June 1 and September 30 through November 15 (ANF 2015). Wind speed also impacts fire season. Wind speeds tend to be higher during the peak of fire season in April, drying out fuels and influencing fire spread.

Even though most fires in the county would occur during these seasons, under the right conditions, and in some fuel types, wildfires could occur outside these periods.

FIRE REGIMES

Recurring fire regimes can create unique communities and species assemblages, and fire exclusion threatens the long-term persistence of these communities. Frequent fire regimes helped to maintain pine and oak dominated forests in the eastern United States. The widespread exclusion of fire is deemed as a major threat to key habitats of some species of greatest conservation need in the Pennsylvania State Wildlife Action Plan, and as a result landscape-level restoration efforts are underway in ecosystem types that are fire dependent (Marschall et al. 2016).

Fine fuels are a significant factor in wildfire spread, and in these hardwood forest types, cured grass, leaf litter, and brush are the main carrying component. Northern hardwoods—beech, cherry, and hemlock—do not have a heavy leaf litter component, however, so fire risk in that forest type are relatively low. Larger fires occur when fuel loading increases and when they are continuous across the landscape. Past fire suppression is increasing the fuel loads throughout the forest, as is tree mortality from insect infestations (e.g., hemlock wooly adelgid) and disease (e.g., beech bark disease). The area is also prone to frequent wind events, including tornadoes (Figure 24). These disturbances add large-diameter timber and woody debris to the fuel bed, which could contribute to wildfire intensity. Documented wildfires on the ANF have also been found to coincide with sites of disturbance. Another factor that could contribute to wildfire behavior and appropriate suppression strategies is activity surrounding oil and gas development, such as well pads, electric lines, gas lines, and tank batteries (Figure 25).

Figure 24. Tornado damage.

Figure 25. Well Pad development is ongoing in the region: Credit DCNR.

FIRE REGIME CLASSIFICATIONS

A natural, or historical, fire regime is a general classification describing the role fire would play throughout a landscape in the absence of modern human intervention but includes the influence of burning by Native American groups (Agee 1993; Brown 1995; Hann et al. 2008).

Fire regime (FR) classes are based on the average number of years between fires (also known as fire frequency or fire return interval) combined with the severity (i.e., the amount of vegetation replacement) of the fire and its effect on the dominant overstory vegetation (Hann et al. 2008).

The five FR classes are:

FR I: Frequency of 0 to 35 years and low (mostly surface fires) to mixed severity (less than 75% of the dominant overstory vegetation is replaced).

FR II: Frequency of 0 to 35 years and high severity (more than 75% of the dominant overstory vegetation is replaced).

FR III: Frequency of 35 to 200+ years and mixed severity (less than 75% of the dominant overstory vegetation is replaced).

FR IV: Frequency of 35 to 200+ years and high severity (more than 75% of the dominant overstory vegetation is replaced).

FR V: Frequency of 200+ years and high severity (more than 75% of the dominant overstory vegetation is replaced).

The fire regime in much of the County can be classified as an FR111, therefore the area would typically see a fire frequency of every 35-200 years.

FIRE REGIME CONDITION CLASS

Natural fire regime reference conditions have been developed for vegetation-fuel class composition, fire frequency, and fire severity in biophysical settings at a landscape level for most parts of the United States (Hann et al. 2008). The Fire Regime Condition Class (FRCC) is a measure of the degree of departure from reference conditions, possibly resulting in changes to key ecosystem components, such as vegetation characteristics (e.g., species composition, structural stage, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances, such as insect and disease mortality, grazing, and drought (Hann et al. 2008). Several factors, such as fire suppression, timber harvesting, livestock overgrazing, introduction and establishment of non-native species, introduced disease and insects, and other management activities, are all possible causes of this departure from historical conditions (Schmidt et al. 2002; Hann et al. 2008).

The three FRCC rankings are:

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

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

FRCC 3: Extreme departure from the central tendency of the reference conditions.

The central tendency is a composite estimate of the reference condition vegetation characteristics; fuel composition; fire frequency, severity, and pattern; and other associated natural disturbances. Low departure includes a range of ±33% deviation from the central tendency (Hann and Bunnell 2001; Hardy et al. 2001; Hann et al. 2008).

The fuels in this area are classified primarily as having a FRCC of 3, therefore they exhibit extreme departure from reference conditions (ANF 2017).

CHALLENGES FOR FUTURE RESTORATION EFFORTS

In the past few years, fires nationwide have grown to record sizes and are burning earlier, longer, hotter, and more intensely than they have in the past (Westerling et al. 2006). According to the National Interagency Fire Center (NIFC), occurrence of catastrophic wildfires has greatly increased over the last 20 years. The threat of wildfire outside of the western United States is often overlooked with much of the focus being on expansive conflagrations that are more common in western states. Aggressive fire suppression has resulted in a decline in areas burned in the east in recent years making many residents of fire-prone areas complacent regarding fire risk. Westerling et al. (2006) claim that a study of large (>1,000 acres) wildfires throughout the United States for the period 1970 to 2003 saw a pronounced increase in frequency of fire since the mid-1980s (1987–2003 fires were four times more frequent than the 1970–1986 average). The length of the fire season was also observed to increase by 78 days, comparing 1970–1986 to 1987–2003. Within just the last 10 years, a record number of acreages have burned and numbers are continually getting larger (NIFC 2016). In 2015, 10,125,149 acres were burned across the country, the highest total acres burned in 56 years of record (NIFC 2016).

Advanced computer models are now making national-scale simulations of ecosystems, providing predictions of how fire regimes will change in the twenty-first century (Neilson et al. 2004). Summer months are predicted to be hotter and longer contributing to increased fire risk (Neilson et al. 2004). Under greater climatic extremes widely predicted throughout the United States, fire behavior is expected to become more erratic, with larger flame lengths, increased torching and crowning, and more rapid runs and blowups associated with extremely dry conditions (Brown et al. 2004).

Although fire suppression is still aggressively practiced, fire management techniques are continually adapting and improving. Due to extensive human developments (homes and farms) and values (residential and commercial structures, historic and natural values) throughout the WUI, suppression will always have to be a priority. However, it is well accepted that a more dynamic forest mosaic (where oak is restored) means a more resilient forest in the face of climate change (Brandt et al. 2014; Nowacki and Abrams 2015), and therefore combining mechanical treatments with prescribed fire could help re-establish natural fire regimes and reduce the potential for catastrophic wildfires on public lands.

FIRE MANAGEMENT POLICY

The primary responsibility for WUI fire prevention and protection lies with property owners and state and local governments. Property owners must comply with existing state statutes and local regulations. These primary responsibilities should be carried out in partnership with the federal government and private sector areas. The current Federal Fire Policy states that protection priorities are 1) life, 2) property, and 3) natural resources. These priorities often limit flexibility in the decision-making process, especially when a wildland fire occurs within the WUI.

The 2013 Northeast Regional Action Plan (NRAP 2013) details the goals, desired outcomes, investment options, outcome measures, and priority implementation actions for the Northeast Cohesive Strategy Region. These actions, as identified by the Northeast Regional Strategy Committee, will help guide all the partners in wildland fire management in the Northeast Cohesive Strategy Region to make progress in achieving the overarching national goals: restore and maintain resilient landscapes, fire-adapted communities, and wildfire response.

LAWS, ORDINANCES, STANDARDS, AND CODES FOR WILDFIRE PREVENTION

Federal

Federal Emergency Management Agency Disaster Mitigation Act of 2000

FEMA's 44 Code of Federal Regulations 201 of the Disaster Mitigation Act of 2000[5] specifies criteria for state and local hazard mitigation planning. The act requires the following entities to have an approved local mitigation plan in order to apply for Hazard Mitigation Grant Program funds:

- local and Indian tribal governments (including county, municipality, city, town, township, public authority, school district, special district, intrastate district, or council of governments [regardless of whether the council of government is incorporated as a non-profit under state law]), regional or interstate government entity, or agency or instrumentality of a local government;
- any Indian tribe or authorized tribal organizations, or Alaska Native village or organization; and
- any rural community, unincorporated town or village, or other public entity.

Appropriate plans may include countywide or multi-jurisdictional plans as long as all jurisdictions adopt the plan. Activities eligible for funding include management costs, information dissemination, planning, technical assistance, and mitigation projects.

The National Fire Plan (2001)

The National Fire Plan[6] (NFP) established the collaborative approach to be used at all levels to develop wildfire risk reduction solutions. It was followed by *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: A 10-Year Comprehensive Strategy*, with updates in 2002 and 2006. In 2003, the HFRA (see below) was passed into law, which emphasized development of CWPPs and implementation of hazardous fuels reduction projects.

The Healthy Forests Initiative (2002) and Healthy Forests Restoration Act (2003)

The Healthy Forests Initiative[7] (HFI) was launched in 2002 to reduce the severe risks posed by wildfire to people, communities, and the environment. The HFRA[8] was passed as the central legislative component of the HFI.

The HFRA encourages local communities to collaborate with federal land managers and develop a comprehensive fuels-reduction strategy—a CWPP. The HFRA also offers federal land managers tools to

[5] FEMA Disaster Mitigation Act of 2000: https://www.fema.gov/media-library/assets/documents/4596.

[6] National Fire Plan: https://www.forestsandrangelands.gov/resources/reports/documents/2001/8-20-en.pdf.

[7] Healthy Forest Initiative: https://georgewbush-whitehouse.archives.gov/infocus/healthyforests/toc.html.

[8] HFRA: https://www.fs.fed.us/emc/applit/includes/hfr2003.pdf.

streamline the federal land management process and expedite management projects. While not a final solution for effective management, these tools can help mitigate the complexity of administering lands in a complicated regulatory field.

One important effect of HFRA is a streamlined National Environmental Policy Act (NEPA) process, which applies to actions that take place on federal lands, therefore on National Forest lands in the County. The HFRA specifically states that the Federal Advisory Committee Act (5 United States Code [USC] App.) shall not apply to the planning process and recommendations concerning community wildfire protection plans (16 USC 6513(b)(2)).[9] Thus, the USFS may work with counties, towns, and cities without opening up the process to litigation. Federal land managers may cooperate candidly and openly to develop the best possible plan in light of the increasing intensity and frequency of fire. Although federal land managers are not bound by the results of this collaboration, the federal government's ownership of a vast portion of the forests in the county means that any plan without the managers' valuable input will struggle to achieve meaningful control over wildfires.

The HFRA also reduces the burden of NEPA in the federal fuel reduction project selection process. It does this by reducing the required number of alternatives an agency must consider in an environmental assessment (EA) or environmental impact statement (EIS) for proposed federal projects within the WUI (16 USC 6514). Specifically, the EA or EIS must consider only the proposed action and one alternative (as long as it is in the WUI). If a project is located within 1.5 miles of an at-risk community, the agency is not required to analyze any alternative to the proposed action (6 USC 6514(b)(2)).

By taking advantage of these benefits, county and federal land managers will reduce overall costs and work load, and simultaneously achieve the goals of HFRA and this CWPP. Through the HFRA, federal land managers exert enormous influence over the long- and short-term health of both the local economy and forest ecosystems. Elk County can seek to maximize these benefits by using the HFRA's tools and collaborating with local entities to design projects in accordance with this CWPP.

Federal Land Assistance, Management and Enhancement Act of 2009

The Federal Land Assistance, Management and Enhancement Act (FLAME) Act of 2009[10] directed the development of the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy). In 2014, the final stage of a national strategy for wildfire was issued, titled *The National Strategy: The Final Phase in the Development of the National Cohesive Wildland Fire Management Strategy*.

Cohesive Strategy

The Cohesive Strategy was initiated in 2010 as a collaborative process led by the Wildland Fire Leadership Council (WFLC), an intergovernmental committee of federal, state, tribal, county, and municipal government officials, as well as the public, to seek national, all-lands solutions to wildland fire management issues. The Cohesive Strategy was rolled out over three phases with Phase III culminating in 2014 with the release of the national strategy.[11]

The WFLC adopted the following vision for the next century:

[9] 16 USC 6513(b)(2): https://www.law.cornell.edu/uscode/text/16/6513.

[10] FLAME Act (2009): https://www.forestsandrangelands.gov/strategy/documents/reports/2_ReportToCongress03172011.pdf.

[11] National Strategy (2014): https://www.forestsandrangelands.gov/strategy/documents/strategy/CSPhaseIIINationalStrategyApr2014.pdf.

> "To safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a Nation, live with wildland fire." (WFLC 2014:3)

The Cohesive Strategy is addressing the nation's wildfire problems by focusing on three key areas: restore and maintain landscapes, fire-adapted communities, and wildfire response (Figure 26).

Figure 26. The Cohesive Strategy: challenges, national goals, and vision. Source: Adapted from WFLC (2014).

The intent of the Cohesive Strategy is to provide "clear guidance on roles and responsibilities for all wildland fire management entities, and emphasize how effective public-private partnerships and the sharing of responsibility among stakeholders are essential to achieving the identified three national goals." (National Cohesive Strategy, 2014). See Table 4 for the premise of the Cohesive Strategy's goals.

Table 4. Cohesive Strategy Goals

GOALS	BASIC PREMISE
Restore and maintain landscapes	Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.
Fire-adapted communities	Human populations and infrastructure can withstand a wildfire without loss of life and property.
Wildfire response	All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

Northeast Regional Action Plan

Following the Cohesive Strategy, three regional strategy committees were formed: northeast, southeast, and west. These regional strategy committees were tasked with developing action plans to build on the recommendations outlined in the national Cohesive Strategy. The 2013 *Northeast Regional Action Plan* (NRAP) (revised in 2015) details the goals, desired outcomes, investment options, outcome measures, and priority implementation actions for the Northeast Cohesive Strategy Region. These actions, as identified by the Northeast Regional Strategy Committee, help guide all the partners in wildland fire management in the Northeast Region to make progress in achieving the overarching national goals: restore and maintain landscapes, fire-adapted communities, and wildfire response.

The NRAP includes regional options for addressing the national goals (Table 5).

Table 5. Northeast Regional Action Plan Regional Goal Options.

GOAL 1. RESTORE AND MAINTAIN LANDSCAPES	GOAL 2. FIRE-ADAPTED COMMUNITIES	GOAL 3. RESPONSE TO WILDFIRE
Regional Option 1A - Expand the use of prescribed fire as an integral tool to meet management objectives in the northeast.	Regional Option 2A - Focus on promoting and supporting local adaptation activities to be taken by communities.	Regional Option 3A - Improve the organizational efficiency and effectiveness of the wildland fire community.
Regional Option 1B - Maintain and increase, where possible, the extent of fire-dependent ecosystems and expand the use of fire as a disturbance process.	Regional Option 2B - Focus on directing hazardous fuel treatments to the WUI.	Regional Option 3B - Increase the local response capacity for initial attack of wildfires.
Regional Option 1C - Focus on mitigating "event" fuels to reduce the potential fire hazard.	Regional Option 2C - Focus on promoting and supporting prevention programs and activities.	Regional Option 3C - Further develop shared response capacity for extended attack and managing wildfire incidents with long duration fire potential.

Guidance for the Implementation of Federal Wildland Fire Management Policy (2009)

The 2009 interagency publication titled *Guidance for the Implementation of Federal Wildland Fire Management Policy*[12] states:

1. Wildland fire management agencies will use common standards for all aspects of their fire management programs to facilitate effective collaboration among cooperating agencies.

2. Agencies and bureaus will review, update, and develop agreements that clarify the jurisdictional inter-relationships and define the roles and responsibilities among local, state, tribal, and federal fire protection entities.

3. Responses to wildland fire will be coordinated across levels of government regardless of the jurisdiction at the ignition source.

4. Fire Management Plans will be intergovernmental in scope and developed on a landscape scale.

5. Wildland fire is a general term describing any non-structure fire that occurs in the wildland. Wildland fires are categorized into two distinct types:

    a. Wildfires – Unplanned ignitions or prescribed fires that are declared wildfires.

    b. Prescribed Fires – Planned ignitions.

6. A wildland fire may be concurrently managed for one or more objectives, and objectives can change as the fire spreads across the landscape. Objectives are affected by changes in fuels; weather; topography; varying social understanding and tolerance; and involvement of other governmental jurisdictions having different missions and objectives.

7. Management response to a wildland fire on federal land is based on objectives established in the applicable Land/Resource Management Plan, and/or the Fire Management Plan.

[12] *Guidance for Implementation of Federal Wildland Fire Management Policy*: https://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf.

8. Initial action on human-caused wildfire will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety.

9. Managers will use a decision support process to guide and document wildfire management decisions. The process will provide situational assessment, analyze hazards and risk, define implementation actions, and document decisions and rationale for those decisions.[13]

The *Interagency Standards for Fire and Fire Aviation Operations* (Red Book) states, references, or supplements policy for Bureau of Land Management, USFS, USFWS, National Park Service, and Bureau of Indian Affairs (BIA) fire and fire aviation program management.[14] The standards are intended to comply with the *Guidance for Implementation of Federal Wildland Fire Management Policy* (2009) and other existing federal policy.

U.S. Forest Service Strategic Plan

The USFS Strategic Plan (2010–2015) outlines the following strategic goals and objectives relevant to wildfire planning: *sustain our nation's forests and grasslands* through *1) fostering resilient, adaptive ecosystems to mitigate climate change, 2) mitigating wildfire risk, and 3) conserving open space*.[15] The plan includes strategies to restore ecosystems that are naturally adapted to wildland fire and repair ecosystems that have been damaged by severe wildfire. The plan also calls for use of information from climate change vulnerability assessments to inform adaptive management strategies.

The *Forest Service Climate Change Strategy* (2011) provided a road map to help guide the USFS as it works to ensure that national forests and private working lands are conserved, restored, and made more resilient to climate change.[16] The goal was to create a balanced approach to climate change that includes managing forests and grasslands to adapt to changing conditions, mitigating climate change, building partnerships across boundaries, and preparing USFS employees to understand and apply emerging science.

State

Pennsylvania Department of Conservation and Natural Resources State Forest Resource Management Plan (2016)

The DCNR uses the *State Forest Resource Management Plan* as a guiding document for the management of the state forest system. The plan relates the broad policies of the USFS's Strategic Plan into focused goals and objectives and specific operational guidelines (DCNR 2016).

The DCNR is legally mandated to protect forests within its jurisdiction from damage by wildfire. Part of the agency's mission is also to protect lives, property and natural resources from wildfire. DCNR rules and regulations dictate the following related to fire on DCNR properties:

[13] *Guidance for Implementation of Federal Wildland Fire Management Policy (February 13, 2009), page 7.*

[14] *Interagency Standards for Fire and Fire Aviation Operations* (Red Book): https://www.nifc.gov/PUBLICATIONS/redbook/2017/RedBookAll.pdf.

[15] USFS Strategic Plan (2015–2020): https://www.fs.fed.us/sites/default/files/legacy_files/media/types/publication/field_pdf/strategic-plan%5B2%5D-6_17_15_revised.pdf.

[16] USDA National Roadmap for Responding to Climate Change (2011): https://www.fs.fed.us/climatechange/pdf/Roadmapfinal.pdf.

§ 21.118. Fires-

(a) Prohibition. Fires are prohibited except in accordance with this section.

(b) Gas grills and camp stoves. Fires are permitted in gas grills and camp stoves when these appliances are used as designed.

(c) Charcoal fires. Charcoal fires are permitted in appliances designed for them. Disposing of hot charcoal, except in a facility designed for charcoal disposal, is prohibited.

(d) Fire rings. Fires are permitted in fire rings that are either provided by the Department or, if not provided by the Department, do not exceed 2 feet in diameter. Fire rings must be constructed of noncombustible material.

(e) Fireplaces. Fires are permitted in fireplaces provided by the Department.

(f) Forest-fire danger. Fires in fire rings and fireplaces are prohibited at the following times unless permitted by the Department:

(1) When the forest-fire danger is determined by the Department to be high, very high or extreme.

(i) The Department will notify the public of these danger ratings by means of the Department's web site, signs, news releases, fire wardens or volunteer fire departments.

(ii) The public may contact the district forester to obtain forest-fire danger ratings.

(2) From March 1 through May 25.

(g) Attending a fire. Failure to attend a fire at all times is prohibited.

(h) Extinguishing a fire. Leaving a fire that has not been completely extinguished is prohibited.

(i) Liability. A person who has caused a wildfire, in addition to possible criminal penalty, is liable for damages, costs of extinction and fines. (Title 17. Pennsylvania Code, Part 1. Department of Conservation and Natural Resources, Subpart C. State Forests Chapter 21. General Provisions)

County

There are currently no ordinances, laws, codes, or standards in Elk County for wildfire prevention and defensible space. There are a number of existing models used in other communities in other states with which Elk County could develop a WUI code if desired. Two national organizations, the International Code Council (ICC) and the National Fire Protection Association (NFPA), have developed model WUI wildfire protection codes as standards for states and local governments to adopt. A core concept in these model codes and the resulting wildfire mitigation ordinances is that of structure protection through the creation of defensible space (Haines et al. 2005).

International WUI Code (2015)

The International WUI Code was promulgated by the ICC in 2015. The objective of this code is to establish minimum regulations consistent with nationally recognized good practice for the safeguarding of life and for property protection. Regulations in this code are intended to mitigate the risk to life and structures from intrusion of fire from wildland fire exposures and fire exposures from adjacent structures and to mitigate structure fires from spreading to wildland fuels. The extent of this regulation is intended to be tiered commensurate with the relative level of hazard present (ICC 2015).

The International WUI Code includes a wide range of safeguards to prevent the occurrence of fires and to provide adequate fire protection facilities to control the spread of fire in WUI areas. Examples include:

- provisions for appropriate water supply for fire suppression for new subdivisions;
- driveway width and access requirements, e.g., 12-foot minimum width;
- address marker requirements at driveway entrances;
- approved grades only to allow fire apparatus access; and
- use of fire resistance rated construction materials only for new builds.

Municipalities and counties can choose to adopt the code to support development of ordinances for new construction within the WUI. The definition of the WUI should follow the agreed upon definition of WUI adopted by the municipality, e.g., the CWPP WUI defined herein.

FIRE PLANNING

Allegheny National Forest Land and Resource Management Plan (2007)

The LRMP contains management direction in the form of desired conditions and objectives to increase the amount of forest maintained in, or restored to, a healthy condition to reduce risk and damage from wildland fires. Hazardous fuel reduction treatments are a focus for the WUI and in oil and gas development areas and municipal watersheds. Prescribed fire and mechanical fuel reduction methods are used as management tools.

Consistent with the HFRA, the LRMP provides for public involvement in assessing and conducting hazardous fuels reduction projects. The LRMP also emphasizes protection and enhancement of riparian areas and watershed resources, as directed under the HFRA.

The LRMP also promotes the use of prescribed fire on 75 to 400 acres annually during the plan period to enhance ecosystem resiliency, conserve fire-adapted plant and animal biodiversity, and maintain and restore mixed oak ecosystems. The LRMP identifies areas for active management, as well as areas where active management will be avoided due to sensitive soils, protected vegetation, and wildlife species and riparian areas.

Large areas of the ANF are deemed suitable for regularly scheduled timber production. The area provides a mixture of high value hardwoods such as black cherry and oak but also is an important tool to improve health and ecological diversity. The timber that is harvested contributes to local communities through the provision of jobs, income, and biomass for energy production.

Vegetation management activities under the LRMP are carefully designed to move toward the goal of plant and animal diversity envisioned when the National Forest Management Act was enacted.

Allegheny National Forest Fire Management Plan (2015)

The mission of the 2015 FMP is:

- maintain firefighter and public safety as the first priority in every fire management activity;
- manage wildland fire to protect property and resources while maintaining ecosystem benefits;
- reduce hazardous fuel loading in WUI and intermix areas and intensive oil and gas development areas (Figure 27) to reduce risks associated with potential wildland fires; and
- use fire where appropriate to sustain and restore forest and non-forest vegetation communities.

Figure 27. ***Well Pads are often located in close proximity to forest vegetation, creating a fire hazard across the County. Credit: ANF.***

The FMP outlines that a range of tactics, including full suppression available to confine, contain or control, and manage fire, would be used to meet resource management objectives. Suppression techniques would be chosen based upon safety, minimal potential loss of our damage to resources, and cost effectiveness. Interagency standards for fire and fire aviation operations for minimum impact suppression tactics (MIST) would be followed. The ANF would also apply prescribed fire and mechanical treatment for hazardous fuel reduction on 100 to 600 acres annually. Prescribed fire may be used to create or maintain open conditions or control non-native invasive species even in vegetation communities not originally adapted to fire.

There are two separate Fire Management Units (FMUs) covered under the ANF FMP, the General Forest Area FMU and the Special Management Areas or MIST FMU, which includes wilderness areas, wilderness study areas, remote recreation areas, wild and scenic river corridors, national recreation areas, scenic areas, and research natural areas.

The ANF is currently updating their 2015 FMP into a new spatial format that will aid in fire operations.

Annual Operating Plan - Allegheny National Forest, Department of Conservation and Natural Resources and U.S. Fish and Wildlife Service

The Annual Operating Plan (AOP) was developed pursuant to the Master Cooperative Wildland Fire Management and Stafford Act Response Agreement of 2013. The AOP serves as a cooperative agreement between the USFS, DCNR, and USFWS regarding authority, response, coordination, and reimbursement for wildfire activity throughout the ANF, DCNR lands, and northeast region lands of the USFWS. The three agencies meet annually to review the agreement, identify training requirements, discuss wildfire prevention projects, and identify capabilities and limitations of each agency for the year. The AOP enables unified management of incidents.

Forest Fire Control and Resource Plans, Pennsylvania Department of Conservation and Natural Resources

Elk State Forest District 13 and Moshannon State Forest District 9

The District Fire Control and Resource Plans outline procedures for fire response in areas under the jurisdiction of the DCNR within Districts 13 and 9. The plans includes dispatch and initial response information and District contacts, readiness information, safety guidelines, Incident Command Structure, District boundary information for fire suppression, air operations information, communications information, equipment and personnel inventory and rates, fire warden information, emergency management system information, and lists of cooperators.

EMERGENCY MANAGEMENT PLANNING

Elk County is currently developing an update to the 2011 Hazard Mitigation Plan. FEMA defines hazard mitigation planning as the process of determining how to reduce or eliminate the loss of life and property damage resulting from natural hazards such as floods, earthquakes, tornadoes, landslides, wildfires, and more. Mitigation planning involves assessing risk, estimating losses in the event of a natural disaster, and determining how to reduce that risk by putting measures in place before a natural disaster occurs. This CWPP will complement the Elk County Hazard Mitigation Plan by providing more detailed information on the prevention and mitigation of wildfire.

LAND MANAGEMENT STRATEGIES

Strategic timing and location of fuels treatments and timber management are critical for safe and effective fuels management practices and should be prescribed based on the conditions of each particular treatment area. There are many ways to achieve this; these methods are described in Chapter 6.

Methods may vary by individual project and individual land ownership direction. Spatial considerations for mechanical methods, for example, could include placing fuel breaks to break up fuel continuity in areas where topography is favorable, where fire crews have good access, and/or where the fuels are heavier with high spotting potential. Temporal considerations would include mowing grasses after their growing season and just after they cure and become flammable.

In the use of prescribed fire, burning at the drier end of the prescription may be desired since hotter fires are typically more effective at reducing heavy fuels and shrub growth, as long as this is balanced with controllability and smoke management. The timing of prescribed fire projects can be affected by seasonal air quality conditions, state smoke regulations, wildlife nesting or breeding seasons, visitor use trends, or other constraints.

In areas where vegetation is sparse and not continuous, fuels treatments may not be necessary to create defensible space where firefighters can work. In this situation, where the amount of fuel to carry a fire is minimal, it is best to leave the site in its current condition to avoid the introduction of non-native invasive plant species that may establish or spread following a disturbance.

Figure 28 and Figure 29 illustrate forest management activities that have been completed on USFS and DCNR lands in Elk County in recent years.

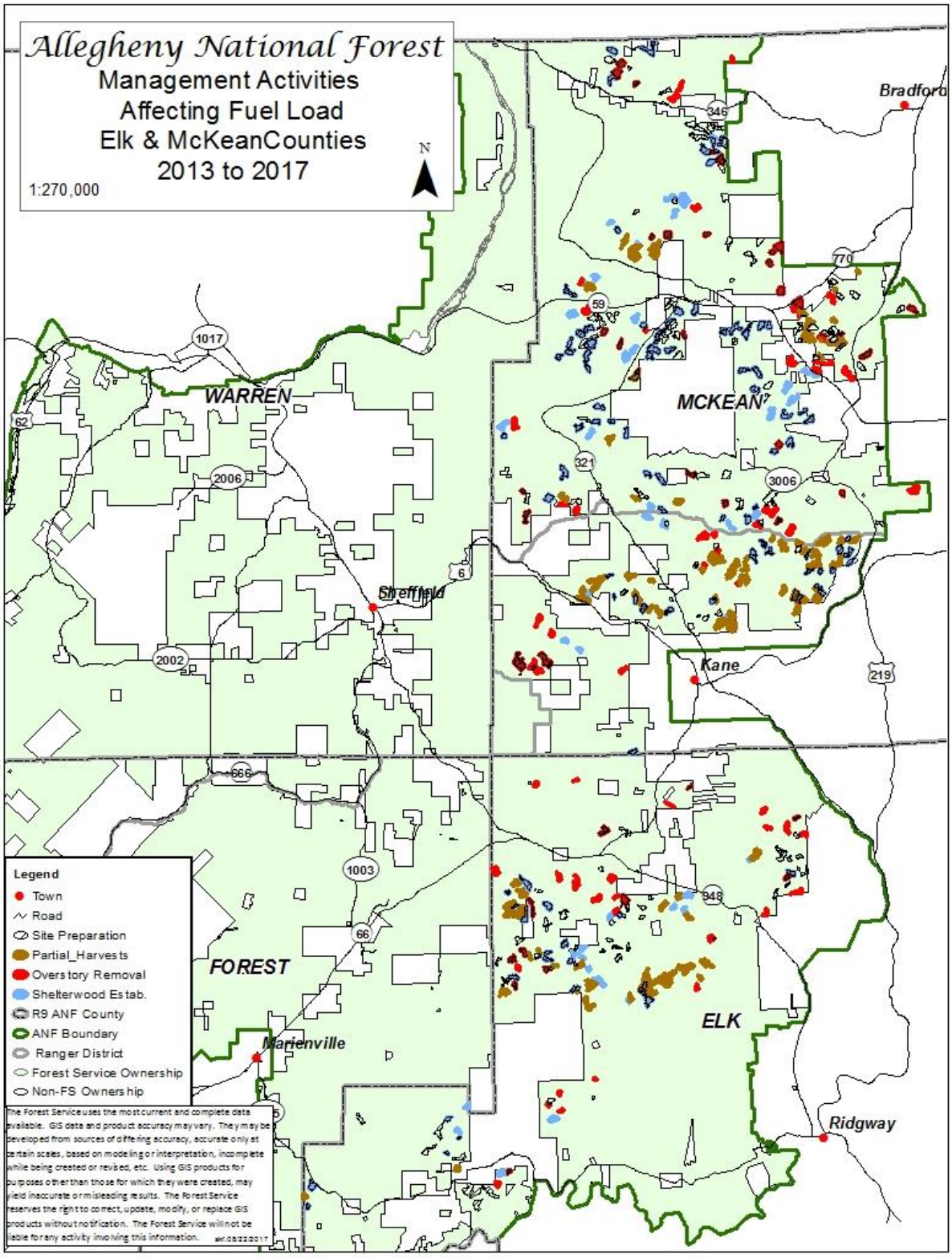


Figure 28. Fuel treatments completed on ANF lands between 2013 and 2017

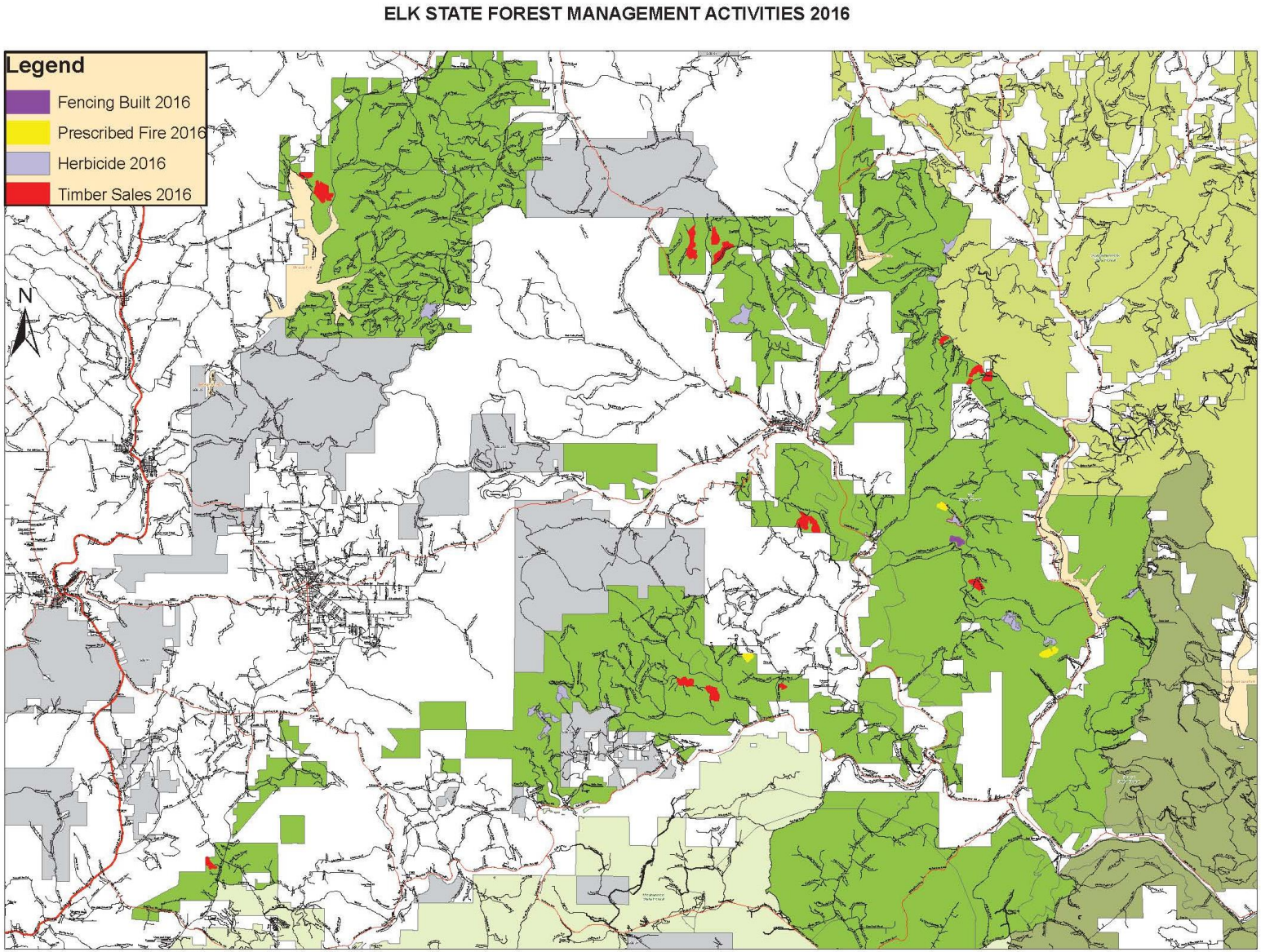


Figure 29. Fuel treatments and other forest management activities completed in 2016 on Elk State Forest Lands. Source: DCNR.

The following photos (Figure 30-Figure 34) illustrate a mechanical treatment for mountain laurel (an invasive shrub that is found in the County) that was recently completed in the Marienville Ranger District. In this treatment the ANF thinned and mulched the site, leaving mulched material in place before introducing prescribed fire into the area after 1-2 growing seasons.

Figure 30. Post treatment mulched material which will be left on site and later burned. Credit: ANF.

Figure 31. Post-treatment area showing more open understory. Credit: ANF.

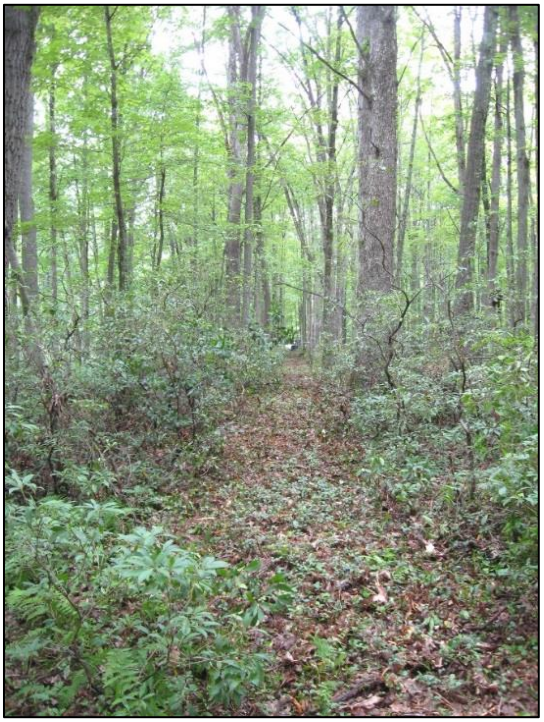


Figure 32. Visible cut line following treatment. Credit: ANF.

Figure 33. Hitachi mulcher used to breakdown piece size of cut vegetation. Credit: ANF.

Figure 34. Skid Steer used to remove vegetation for mulching. Credit: ANF.

FIRE AND RESPONSE CAPABILITIES

Large destructive wildfires occur infrequently in the region when compared to other areas of the country; however, homes and infrastructure can be lost or damaged on small fires, as well as large wildfires, in forest, non-forest, and urban areas. Rapid initial attack with adequate manpower and equipment is often the difference between a small and large wildfire (Haines et al. 2005); however, Elk County's initial attack response falls largely to VFDs that can become overstretched.

RESPONSIBLE WILDFIRE AGENCIES (FEDERAL, STATE, COUNTY, AND CITIES)

Several partnership agreements exist for fire response in Elk County:

- Central Appalachian Intra-Agency Dispatch Center between the USFS, ANF, Monongahela National Forest, and Northeastern Area State and Private Forestry.
- Master Cooperative Wildland Fire Management and Stafford Act Response Agreement between the USFS, ANF, Northeastern Area State and Private Forestry, USFWS, and DCNR. The AOP is the guiding document for this agreement.
- Cooperative Fire Agreement between the Nature Conservancy and the USFS and ANF for working cooperatively in the prevention, detection, and suppression of wildland fires and prescribed fire operations and training.
- State agency cooperators include:
  - Black Moshannon State Park
  - Parker Dam and S.B. Elliott State Parks
  - Pennsylvania Game Commission
  - Pennsylvania Fish Commission
  - Pennsylvania Department of Environmental Protection
  - Department of Corrections Quehanna Boot Camp
  - Pennsylvania Department of Transportation District 2-0

County and Municipal Resources

Elk County has eight fire departments, as well as Elkland Search and Rescue that provide mutual aid for all fire departments. All of the departments are manned by volunteers. The fire departments are listed in Appendix B. VFDs are dependent upon local residents volunteering their time and some departments struggle to retain recruits. All fire departments have a defined response area that they serve and average response is 5 to 15 minutes depending on the location of the fire, access roads, road conditions, and availability of volunteers. Because volunteer firefighters often have full-time jobs, response times may be impacted depending on the time of day and location of the fire. Some departments have shorter average response times depending on the remoteness and access available throughout their response area.

Some departments lack appropriate personal protective equipment (PPE) for wildfire incidents, with volunteers using structural fire gear, which is not designed for use with wildland fires. Although most departments have volunteers that have completed wildland fire training, some firefighters are not fully trained in wildfire response, which impacts the ability of a department to apply for reimbursement from the state.

DCNR Bureau of Forestry Resources

Since its creation in 1895, the Bureau of Forestry has been tasked with protecting all of the commonwealth's wildlands from wildfire; however, this mission is increasingly becoming one of protection of life and property from wildfire. Coordinated training and unified command with volunteer fire companies is essential to address these issues now and in the future (DCNR 2010).

On state forest land, appropriate strategies and tactics are used in managing wildfires or fuels to minimize damage to forest ecosystems. The Bureau of Forestry has increased investments in training and equipment for suppression, prevention, and prescribed fire activities over the past several years (DCNR 2016)(Figure 35). The majority of Elk County is covered by DCNR District 13, with a small portion in the southeast corner covered by District 9. The District 13 and 9 Forest Fire Control and Resource Plans outline fire response protocols, resource availability, and other standards for fire response within the district's boundaries. Management of the wildfire incident follows the Incident Command System protocols.

Figure 35. Wildland Fire Training, provided by DCNR. Credit DCNR.

Although the local fire departments provide initial response to most fires, the Bureau of Forestry has overall jurisdiction for wildfire on state and private land. The bureau can provide additional staffing if wildfires become large, and incident management teams can be dispatched as needed.

Wildfire Readiness

The DCNR uses a District Fire Readiness Code based on the conditions related to fire potential. The code has 5 levels:

Code 1: Recent wet weather, very low fire danger, and district staff is working at normal assignments.

Code 2: Conditions are beginning to dry, fire danger is rising to a moderate level, district staff is still working at normal assignments, and if needed the recon plane may make trip. Fire towers may be manned.

Code 3: Fire danger has reached a rating of high, and wildfires can be expected. Fire towers may be manned, the air recon plane will fly in the afternoon if weather permits. District staff will still work at normal assignments, but they will have portable radios with them or be close to their mobile radios. On weekends a crew may work. This may amount to the following: District Office manned and supplemented by a stand-by crew, forest foreman, forest fire inspector, and crews at specific headquarters or in area of responsibility, three fire towers, and the air recon plane making at least one trip around. The airtanker will be used, if needed.

Code 4: Fire danger has reached a rating of very high, and many wildfires can be expected with some difficulty in controlling and extinguishing them. Fire towers may be manned and the air recon plane may make at least one or two trips. District staff members will be in assigned areas checking on smoke or responding to reports of wildfires, radio contact will be constant with the district office, and the airtanker will be used when needed. On weekends a designated crew may work in their areas of responsibility and may be supplemented by stand-by crews. Three fire towers may be manned, the air recon plane may make at least one or two trips, and the airtanker will be used as needed. If needed the specialized fire crew or local wardens with crews will be activated and used.

Code 5: Fire danger has reached a rating of extreme, and numerous wildfires can be expected with much difficulty in controlling and extinguishing them. The district work force will perform exactly as described for a Code 4 day.

Wildfire Detection

The DCNR has a number of fire towers that are used for fire detection:

The following three towers are located in Elk County:

- Bootjack Fire Tower- which is being replaced in 2017-18
- Brooks Run Fire Tower
- Whittimore Fire Tower

The following four towers are located in District 9, within Clearfield County:

- Rockton Fire Tower
- Knobs Fire Tower
- Rattlesnake Fire Tower
- Summit Fire Tower

Although located in Clearfield County, these towers can be used to monitor forests in adjacent Elk County.

Aerial resources are also used for reconnaissance as conditions dictate.

Suppression

The basic response procedure upon a fire report is as follows:

- Fire reported
- Dispatch notified and activity logged
- Dispatch sends “smoke chaser” or any forestry crew in vicinity
- Air reconnaissance is requested as needed
- Initial attack crews are dispatched

Ground Resources

A range of resources are available to the DCNR for suppression of wildfire within Elk County. DCNR staff trained in wildfire are positioned for wildfire readiness during wildfire season. The forest fire warden and support crews are also available throughout District 13, including support crews from neighboring Districts 9 and 15. Members of the support crews have completed PA-130, S-190, and I-100 wildfire training and members are equipped with Nomex and hand tools (Figure 36). The DCNR can provide grant funding (up to $7,500) for PPE.

Figure 36. Students practicing digging fire line during Wildland Fire Training. Credit: DCNR.

Vehicles, equipment, and hand tools are available at the district level. Aerial Resources

When a wildfire is discovered in a remote area or when a fire is threatening a large forested area that has camps or other structures in it, the District Office will immediately contact Mid-State Tanker Base and request an airtanker retardant drop to aid in the suppression of the fire (DCNR 2016). Close coordination is needed between the ground and aerial resource in order to locate the specific location of the fire and maximize the success of any retardant drops.

Elk County Emergency Management has a drone for use in incidents.

Communications

Communications during an event are generally good, especially when Elk County Emergency Management is on scene. Communications are lacking when radio systems vary, for example Elk County VFD's use VHF (very high frequency) radio, while the federal and state agencies use UHF (ultra-high frequency) 800mHz radios. This prevents VFD's from communicating with federal and state responders via radio. Many responders are dependent upon cell phone networks, which can be poor in some areas of the county.

Allegheny National Forest

According to the ANF FMP, all ignitions must receive an appropriate suppression or management for resource objectives following criteria outlined in the FMP. Wildland fires that do not meet established criteria will be managed using the full range of suppression options available to confine, contain, and control. Approved suppression strategies vary depending on restrictions in each FMU. Fire suppression techniques are chosen based on safety, minimal potential loss of or damage to resources, and cost effectiveness. MIST are followed. Safety is the number one focus during all USFS fire activities; the ANF FMP outlines all safety procedures to be followed by personnel.

Ground Resources

The ANF fire organization is as follows:

- Forest Fire Management Officer,
- Assistant Forest Fire Management Officer
- Forest Dispatcher
- Engine Captain
- Senior Fire Fighter
- 2- Fire seasonals
- 1 Type 6 Engine
- 1 side by side utility terrain vehicle
- 75 red-carded employees of which 43 employees are qualified at the arduous level.

Incident Management Teams

In 2006, the Bureau of Forestry began the development of interagency incident management teams to increase its capacity to deal with large or complex wildfires. This program has focused on building and maintaining partnerships with other state emergency management agencies, dealing with all hazard situations, credentialing and training staff, and responding to wildfire incidents.

EVACUATION RESOURCES

The Elk County EMA has implemented an emergency notification system (named SwiftReach) for county residents designed to make phone calls to specific people or areas in the event of an emergency or for sharing important information. SwiftReach is a mass warning system that provides a user friendly interface, backed by a fault-tolerant network which delivers 2-way messages via voice, text, email, fax, RSS and social media to a large number of people in a short time span. This system would be activated in case of an emergency situation such as fires, floods, water emergencies, road closures, missing persons, evacuation orders, and weather emergencies.

Road Systems

Much of Elk County is accessible via surfaced roads and highways; however, some communities are accessed only via unsurfaced roads, which are often narrow and windy (Figure 37). These routes may prove hazardous during emergency evacuation, especially where they are adjacent to forested lands with vegetation close to or overhanging the road. Fuel treatment may be needed along some roads where vegetation is overhanging and could prevent safe evacuation of residents or safe access by emergency responders.

Figure 37. Unsurfaced, narrow road

Horses, Livestock, and Animals

Many rural homes also have horses and other large animals and livestock, and pets are common in homes throughout the county. In the event of a wildfire it is important that residents and fire responders have a plan for evacuation of pets and livestock. Evacuation planning often neglects to describe how animals will be evacuated and where they will be taken. The loading of horses, for example, during a fire and smoke situation, and transport of stock vehicles down narrow roads under stressful situations, can be very difficult. Public education could emphasize the need to practice loading horses quickly, for example.

There is also a need to pre-identify where animals can be taken, such as county fairgrounds, for large animal shelter. Similarly, locations where small animals such as dogs and cats picked up in the fire area should also be pre-identified, as well as the lead agencies, such as humane societies, coordinating this work.

Appendix C provides an example of a livestock evacuation plan that could be implemented in Elk County, as well as actions that pet and livestock owners should take to prepare for evacuation of their animals.

WATER AVAILABILITY AND SUPPLY

Water supply is variable around the county and may be provided by hydrants, wells, cisterns, and reservoirs. Fire departments are aware of areas where water supply may be limited and plan for it, using tankers and portable pumps in those instances.

Ponds and rivers could also provide alternative sources for suppression, depending on weather conditions. Compatibility of cistern connections to fire apparatuses and vegetation clearance to allow fire apparatuses to access cisterns are other common water supply issues.

Dry hydrants were installed throughout the county several years ago. Although these dry hydrants could serve as a water source for suppression activities, the whereabouts of the hydrants are not well known by fire responders. Mapping of dry hydrants and tests of the functionality of each hydrant is necessary to fully use this resource since maintenance of dry hydrants is needed. Installation of new dry hydrants is hampered by the need for a permit. The Pennsylvania Department of Environmental Protection has restricted the use of dry hydrants in some streams.

PUBLIC EDUCATION AND OUTREACH PROGRAMS

Public education and outreach programs are a common factor in virtually every agency and organization involved with the wildfire issue.

Allegheny National Forest

The ANF utilizes the well-established Smokey Bear Program as its main fire prevention outreach tool. The USDA Forest Service provides extensive fire prevention literature that is available for the public at all ANF offices- the Supervisors Office located in Warren, PA; Bradford Ranger District located in Bradford, PA; and, Marienville Ranger District located in Marienville, PA.

Pennsylvania Department of Conservation and Natural Resources

The DCNR provides a large amount of fire prevention information to the community through its website, traveling displays (Smokey the Bear trailer), and informational brochures.[17] In addition, the DCNR carries out school programs and Boy and Girl Scout activities related to wildfire and fire prevention on an annual basis, and the department compiles news releases that are aired on TV and radio at the beginning of fire season. Much of the material and information is tailored to actions that homeowners can take to reduce wildfire risk to their properties, using methods like defensible space and retrofits to properties that harden the home to embers. Defensible space protocols follow Firewise protocols (Figure 38).

[17] DCNR fire prevention information: http://www.dcnr.state.pa.us/forestry/wildlandfire/firewise/index.htm.

Figure 38. ***Fire prevention brochure distributed by the DCNR. Source: Middle Atlantic Interstate Forest Fire Protection Compact.***

National Programs

Ready, Set, Go!

The Ready, Set, Go! Program, which is managed by the International Association of Fire Chiefs, was launched in 2011 at the WUI Conference. The program seeks to develop and improve the dialogue between fire departments and residents, providing teaching tools for residents who live in high risk wildfire areas—and the WUI—on how to best prepare themselves and their properties against fire threats (Ready, Set, Go! 2016).

The tenets of Ready, Set, Go! as included on the website (http://www.wildlandfirersg.org) are:

Ready – Take personal responsibility and prepare long before the threat of a wildland fire so your home is ready in case of a fire. Create defensible space by clearing brush away from your home. Use fire-resistant landscaping and harden your home with fire-safe construction measures. Assemble emergency supplies and belongings in a safe place. Plan escape routes and make sure all those residing within the home know the plan of action.

Set – Pack your emergency items. Stay aware of the latest news and information on the fire from local media, your local fire department, and public safety.

Go – Follow your personal wildland fire action plan. Doing so will not only support your safety, but will allow firefighters to best maneuver resources to combat the fire.

National Fire Protection Association

The NFPA is a global non-profit organization devoted to eliminating death, injury, property, and economic loss due to fire, electrical, and related hazards. Its 300 codes and standards are designed to minimize the risk and effects of fire by establishing criteria for building, processing, design, service, and installation around the world.

The NFPA develops easy-to-use educational programs, tools, and resources for all ages and audiences, including Fire Prevention Week, an annual campaign that addresses a specific fire safety theme. The NFPA's Firewise Communities program (www.firewise.org) encourages local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, and others in the effort to protect people and property from wildfire risks.

The Firewise program provides federal grants to assist fire prevention activities around communities such as fuel reduction activities, fire suppression preparations, and Firewise construction.

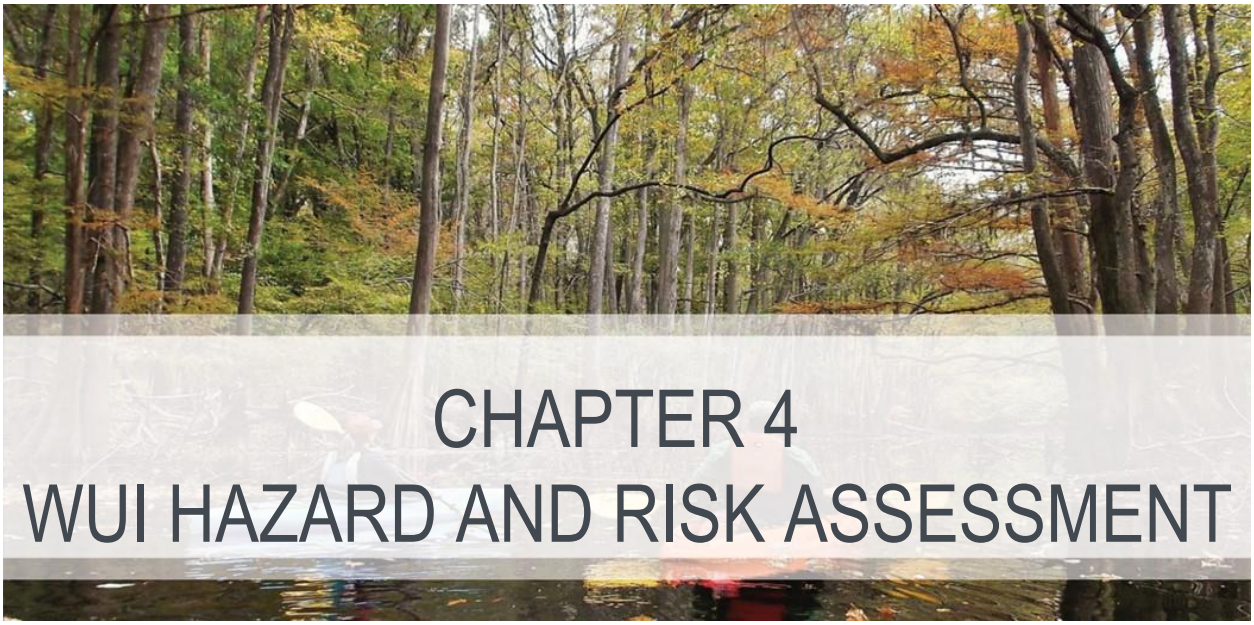
The NFPA is a premier resource for fire data analysis, research, and analysis. The Fire Analysis and Research division conducts investigations of fire incidents and produces a wide range of annual reports and special studies on all aspects of the nation's fire problem.

Insurance Institute for Business and Home Safety

The Insurance Institute for Business and Home Safety (IBHS) is an independent, non-profit, scientific research and communications organization supported solely by property insurers and reinsurers. The IBHS's building safety research leads to real-world solutions for home and business owners, helping to create more resilient communities. Its mission is to conduct objective, scientific research to identify and promote the most effective ways to strengthen homes, businesses, and communities against natural disasters and other causes of loss.

The IBHS conducts laboratory and field experiments in structural ignitability and has helped develop new guidelines for defensible space zones to emphasize ember resistance and a "home ignition zone" (Figure 39).

Figure 39. Insurance Institute for Business and Home Safety defensible space standards.



CHAPTER 4
WUI HAZARD AND RISK ASSESSMENT

PURPOSE

The purpose of developing the risk assessment model described here is to create a unique tool for evaluating the risk of wildland fires to communities within the WUI areas of Elk County. Although many definitions exist for hazard and risk, for the purpose of this document these definitions follow those used by the firefighting community:

> ***Hazard*** is a fuel complex defined by kind, arrangement, volume, condition, and location that forms a special threat of ignition and resistance to control.
>
> ***Risk*** is defined as the chance of a fire starting as determined by the presence and activity of causative agents (National Wildfire Coordinating Group [NWCG] 1998).

The risk assessment is twofold and combines a GIS model of hazard based on fire behavior and fuels modeling technology (Composite Risk/Hazard Assessment) and a field assessment of community hazards and values at risk (Community Risk/Hazard Assessment).

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

FIRE BEHAVIOR MODEL

OVERVIEW

The wildland fire environment consists of three factors that influence the spread of wildfire: fuels, topography, and weather. Understanding how these factors interact to produce a range of fire behavior is fundamental to determining treatment strategies and priorities in the WUI. In the wildland environment, vegetation is synonymous with fuels. When sufficient fuels for continued combustion are present, the level of risk for those residing in the WUI is heightened. Fire spreads in three ways: 1) surface fire spread—the flaming front remains on the ground surface (in grasses, shrubs, small trees, etc.) and resistance to control is comparatively low; 2) crown fire—the surface fire "ladders" up into the upper levels of the forest canopy and spreads through the tops (or crowns) independent of or along with the surface fire, and when sustained is often beyond the capabilities of suppression resources; and 3) spotting—embers are lifted and carried with the wind ahead of the main fire and ignite in receptive fuels. Crown fire and spotting activity is typically minimal in these fuel types and therefore not a significant concern for fire managers unless fire occurs under extreme weather conditions. Surface spread can occur if fuel loading (the amount and arrangement of vegetation and woody debris) is great enough to support wildfire spread. In areas where homes are situated close to timber fuels and/or denser shrubs and trees, potential spotting from woody fuels to adjacent fuels should always be acknowledged.

Treating fuels in the WUI can lessen the risk of intense or extreme fire behavior. Studies and observations of fires burning in areas where fuel treatments have occurred have shown that the fire either remains on or drops to the surface, with fewer instances of crown fire or erratic fire behavior. Also, treating fuels decreases spotting potential and increases the ability to detect and suppress any spot fires that do occur. Fuel mitigation efforts therefore should be focused specifically where these critical conditions could develop in or near communities at risk.

FIRE BEHAVIOR MODEL COMPONENTS

For this plan, an assessment of fire behavior has been carried out using well-established fire behavior models: FARSITE, FlamMap, BehavePlus, and FireFamily Plus, as well as ArcGIS Desktop Spatial Analyst tools. Data used in the Composite Risk/Hazard Assessment is largely obtained from LANDFIRE.

LANDFIRE

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

FARSITE

FARSITE is a computer model based on Rothermel's spread equations (Rothermel 1983); the model also incorporates crown fire models. FARSITE uses spatial data on fuels, canopy cover, crown bulk density, canopy base height, canopy height, aspect, slope, elevation, wind, and weather to model fire behavior across a landscape. In essence, FARSITE is a spatial and temporal fire behavior model. FARSITE is used to generate fuel moisture and landscape files as inputs for FlamMap. Information on fire behavior models can be obtained from http://www.fire.org.

FlamMap

Like FARSITE, FlamMap uses a spatial component for its inputs but only provides fire behavior predictions for a single set of weather inputs. In essence, FlamMap gives fire behavior predictions across a landscape for a snapshot of time; however, FlamMap does not predict fire spread across the landscape. FlamMap has been used for the ECCWPP to predict fire behavior across the landscape under extreme (worst case) weather scenarios.

BehavePlus

Also using Rothermel's (1983) equations, BehavePlus is a multifaceted fire behavior model and has been used to determine fuel moisture in this process.

FIRE BEHAVIOR MODEL INPUTS

Fuels

The fuels in the planning area are classified using Scott and Burgan's (2005) Standard Fire Behavior Fuel Model classification system. This classification system is based on the Rothermel surface fire spread equations, and each vegetation and litter type is broken down into 40 fuel models.

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

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

Table 6 provides a description of each fuel type that has significant presence in Elk County.

Table 6. Fuel Model Classification for the ECCWPP Planning Area

1.	**Nearly pure grass and/or forb type (Grass)**
i.	**GR1:** Grass is short, patchy, and possibly heavily grazed. Spread rate is moderate (5–20 chains/hour); flame length low (1–4 feet); fine fuel load 0.40 (ton/acre).
ii.	**GR2:** Moderately coarse continuous grass, average depth about 1 foot. Spread rate high (20–50 chains/hour); flame length moderate (4–8 feet); fine fuel load 1.10 (tons/acre).
iii.	**GR3:** Very coarse grass. Spread rate high (20-50 chains/hour); flame length moderate (4–8 feet).
iv.	**GR5:** Dense coarse grass, average depth 1–2 feet. Spread rate very high (50–150 chains/hour); flame length moderate (4–8 feet).
2.	**Mixture of grass and shrub, up to about 50% shrub cover (Grass-Shrub)**
i.	**GS1:** Shrubs are about 1 foot high, low grass load. Spread rate moderate (5–20 chains/hour); flame length low (1–4 feet); fine fuel load 1.35 (tons/acre).
ii.	**GS2:** Shrubs are 1–3 feet high, moderate grass load. Spread rate high (20–50 chains/hour); flame length moderate (4–8 feet); fine fuel load 2.1 (tons/acre).
3.	**Shrubs cover at least 50% of the site; grass sparse to non-existent (Shrub)**
i.	**SH2:** Moderate fuel load (higher than SH1), depth about 1 foot, no grass fuels present. Spread rate low (2–5 chains/hour); flame length low (1–4 feet); fine fuel load 5.2 (tons/acre).
ii.	**SH3:** Moderate shrub load, possibly with pine overstory or herbaceous fuel. Fuel bed depth 2–3 feet. Spread rate low (2–5 chains/hour), flame length low (1–4 feet).
iii.	**SH4:** Low to moderate shrub and litter load. Spread rate high (20–50 chains/hour); flame length moderate (4–8 feet).
4.	**Dead and downed woody fuel (litter) beneath a forest canopy (Timber Litter)**
i.	**TL2:** Low load, compact. Spread rate very low (0–2 chains/hour); flame length very low (0–1 foot).
ii.	**TL3:** Moderate load. Spread rate very slow (0–2 chains/hour); flame length low (1–4 foot); fine fuel load 0.5 (ton/acre).
iii.	**TL6:** Moderate load, less compact. Spread rate moderate (5–20 chains/hour); flame length low (1–4 feet).
iv.	**TL9:** Very high load broadleaf litter. Spread rate moderate (5–20 chains/hour); flame length moderate (4–8 feet)
5.	**Insufficient wildland fuel to carry wildland fire under any condition (Non-burnable)**
i.	**NB1:** Urban or suburban development; insufficient wildland fuel to carry wildland fire.
ii.	**NB3:** Agricultural field, maintained in nonburnable condition.
iii.	**NB8:** Open water.
iv.	**NB9:** Bare ground.

Notes: Based on Scott and Burgan's (2005) 40 Fuel Model System.
For more information refer to Scott and Burgan (2005).

Map 1 in Appendix D illustrates the fuels classification throughout the planning area, Table 7 shows the acreage within each fuel class for Elk County (classes with less than 10 acres were removed). The original LANDFIRE fuel data set for the planning area accurately represented most fuels found within the county.

Table 7. Fuel Model Breakdown

FBFM40	ACRES	%
GR1	2,703	0.5
GR2	7,769	1.5
GR3	11,534	2.2
GR5	691	0.1
GS1	840	0.2
GS2	8730	1.6
NB1	10,712	2.0
NB3	3,920	0.7
NB8	2,383	0.4
NB9	4,601	0.9
SH1	1,386	0.3
SH2	526	0.1
SH3	8,536	1.6
SH4	850	0.2
TL1	31	<0.01
TL2	80,705	15.2
TL3	21,790	4.1
TL4	6	<0.01
TL5	1,684	0.3
TL6	301,749	56.6
TL8	95	<0.01
TL9	58,334	11.0
TU1	1,671	0.3
TU2	69	0.01
TU3	1,366	0.3

Hardwood Forest

Fuel Models TL6, TL2, and TL9

Northern hardwood forests are modeled using a TL6, TL2, and TL9 fuel model depending on the vegetation species composition and forest structure. These models make up 56%, 15%, and 11% of the land cover, respectively. These timber-litter (TL) fuels burn with low (0–2 chains/hour) to moderate (5–20 chains/hour) rates of spread, with low flame lengths (1–4 feet). TL9 burns with higher spread rates and flame lengths (4–8 feet) due to higher fuel loads and fluffy broadleaf litter. The litter load for these TL forest types tend to exhibit low compaction due to the structure of the leaf litter, with curling of the leaves during curing. Windy conditions occurring during fire season increase the spread rates in these fuel type due to drying.

Grassland and Shrubland Fuels

Grassland fuels are uncommon throughout Elk County, making up only 6% of the land cover. Of the various grass and shrub fuel classes shown in Table 6, the most common are the low load, coarse humid climate grasses classified as GR3 that burn with high rates of spread and moderate flame length, and the grass shrub mixes, classified as GS2 that burn with high rates of spread and moderate flame length. Some small areas of moderate shrub load are found in the county and are classified as SH3, a fuel type that burns with low spread rate and flame lengths.

Topography

Topography is important in determining fire behavior. Steepness of slope, aspect (direction the slope faces), elevation, and landscape features can all affect fuels, local weather (by channeling winds and affecting local temperatures), and rate of spread of wildfire. Slopes in Elk County are generally even to gently rolling, however there are some areas of steep slopes in the southeast corner of the county near Benezette.

Weather

Of the three fire behavior components, weather is the most likely to fluctuate. Accurately predicting fire weather remains a challenge for forecasters, particularly during drought conditions. As summer winds and rising temperatures dry fuels, conditions can deteriorate rapidly, creating an environment that is susceptible to wildland fire. Fine fuels (grass and leaf litter (Figure 40)) can cure rapidly, making them highly flammable in as little as 1 hour following light precipitation. Low live fuel moistures of shrubs and trees can significantly contribute to fire behavior. With a high wind, grass fires can spread rapidly, engulfing communities, often with limited warning for evacuation. The creation of defensible space is of vital importance in protecting communities from this type of fire. For instance, a carefully constructed fuel break placed in an appropriate location could protect homes or possibly an entire community from fire. This type of defensible space can also provide safer conditions for firefighters, improving their ability to suppress fire and protect life and property.

One of the critical inputs for FlamMap is fuel moisture files. For this purpose weather data have been obtained from FAMWEB (NWCG 2012), a fire weather database maintained by the NWCG. A remote automated weather station was selected (Allegheny) and data were downloaded from the website.

Using an additional fire program (FireFamily Plus) with the remote automated weather station data, weather files that included prevailing wind direction and 20-foot wind speed were created. Fuel moisture files were then developed for downed (1-hour, 10-hour, and 100-hour) and live herbaceous and live woody fuels. These files represent weather inputs in FlamMap; 95 to 100 percentile weather is used to predict the most extreme scenarios for fire behavior.

Figure 40. Dry leaf litter during Fall could contribute to fire spread under the right conditions.

FIRE BEHAVIOR MODEL OUTPUTS

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

Flame Length

Map 2 in Appendix D illustrates the flame length classifications for the planning area. Flame lengths are determined by fuels, weather, and topography. Flame length is a particularly important component of the risk assessment because it relates to potential crown fire (particularly important in timber areas) and suppression tactics. Direct attack by hand lines is usually limited to flame lengths less than 4 feet. In excess of 4 feet, indirect suppression is the dominant tactic. Suppression using engines and heavy equipment will move from direct to indirect with flame lengths in excess of 8 feet.

The majority of the planning area is composed of flame lengths that are less than 4 feet in height. Patches of 4- to 8-foot flame lengths and greater are predicted in the grassland and shrubland fuel types, including mountain laurel (*Kalmia latifolia*), that can burn with 40-foot flame lengths under some conditions.

Fireline Intensity

Map 3 in Appendix D illustrates the predicted fireline intensity throughout the planning area. Fireline intensity describes the rate of energy released by the flaming front and is measured in British Thermal Units per foot, per second (BTU/ft/sec). This is a good measure of intensity, and suppression activities are planned according to it. The expected fireline intensity throughout the planning area is similar in pattern to predicted flame length, as fireline intensity is a function of flame length. The pattern for fireline intensity is similar to flame length in that intensities are primarily low to moderate with some spotty patches of extreme in areas dominated by tall grass and heavy shrub loads.

Rate of Spread

Map 4 in Appendix D illustrates the rate of spread classifications for the planning area. The rates of spread are a little more diverse than flame length and fireline intensity with rates in the low, moderate, and high category, and some small patches in the extreme category. Low rates of spread are associated with the hardwood fuel component (TL6, TL2, TL3, and TL9). Low spread rates are also associated with short grass areas and moderate load shrub areas. The highest rates of spread are associated with the grass and shrub fuels (GR2, GR3, GR5, and GS2). Agricultural areas are delineated in this model by their low rate of spread; however, these fuel types can also pose a severe hazard during certain times of the year (prior to harvest or following harvest when residual materials remain) and are often areas of ignition through human activity such as agricultural burning practices.

Crown Fire Potential

Map 5 in Appendix D illustrates the lack of passive or active crown fire in Elk County, with most fuels predicted to burn through surface fire.

Fire Occurrence/Density of Starts

Map 6 in Appendix D illustrates the fire occurrence density for the planning area. Fire occurrence density has been determined by performing a density analysis on fire start locations with ArcGIS Desktop Spatial Analyst. These locations have been provided by the USFS and the DCNR and when combined the points show the location of fire starts within the planning area from 2002 to 2016. The density analysis has been performed as a kernel density, using a 2,500-meter search radius. The density of previous fire starts is used to determine the risk of ignition of a fire. Map 6 in Appendix D reveals a pattern of fires close to populated areas, at intersections and along all highways, but also in more remote areas.

Since most fire starts in Elk County are human ignited, the fire occurrence maps are used to provide information on areas where human-ignited fires are prevalent and hence could be more prone to fire in the future.

COMPOSITE RISK/HAZARD ASSESSMENT

All data used in the risk assessment have been processed using ESRI ArcGIS Desktop and the ESRI Spatial Analyst Extension. Information on these programs can be found at http://www.esri.com. Data have been gathered from all relevant agencies, and the most current data have been used.

All fire parameter datasets were converted to a raster format (a common GIS data format comprising a grid of cells or pixels, with each pixel containing a single value). The cell size for the data is 30 × 30 meters (98 × 98 feet). For Flame Length, Rate of Spread, and Crown Fire Activity, the original cell values were reclassified with a new value between 1 and 4, based on the significance of the data (1 = lowest, 4 = highest). For Fireline Intensity, the original cell values were reclassified with a new value between 1 and 6, based on the significance of the data (1 = lowest, 6 = highest). Prior to running the model on the reclassified datasets, each of the input parameters was weighted; that is, assigned a percentage value reflecting that parameter's importance in the model.

The parameters were then placed into a Weighted Sum Model, which “stacks” each geographically aligned dataset and evaluates an output value derived from each cell value of the overlaid dataset in combination with the weighted assessment. In a Weighted Sum Model, the weighted values of each pixel from each parameter dataset are added together so that the resulting dataset contains pixels with summed values of all the parameters. This method ensures that the model resolution is maintained in the results and thus provides finer detail and range of values for denoting fire risk.

This ranking shows the relative fire risk of each cell based on the input parameters. Figure 41 illustrates the individual datasets and the relative weights assigned within the modeling framework.

Figure 42 is the risk assessment for the planning area; it combines all the fire behavior parameters described above. The risk assessment classifies the planning area into low, moderate, high, and extreme risk categories. The risk assessment is designed to be used to prioritize fuel treatments and other wildfire mitigation actions. Conceptual areas for fuel treatments are identified in Chapter 6, Figure 69, with priority placed on areas that fall within or adjacent to the WUI and in areas identified as being at moderate to extreme risk for wildfire.

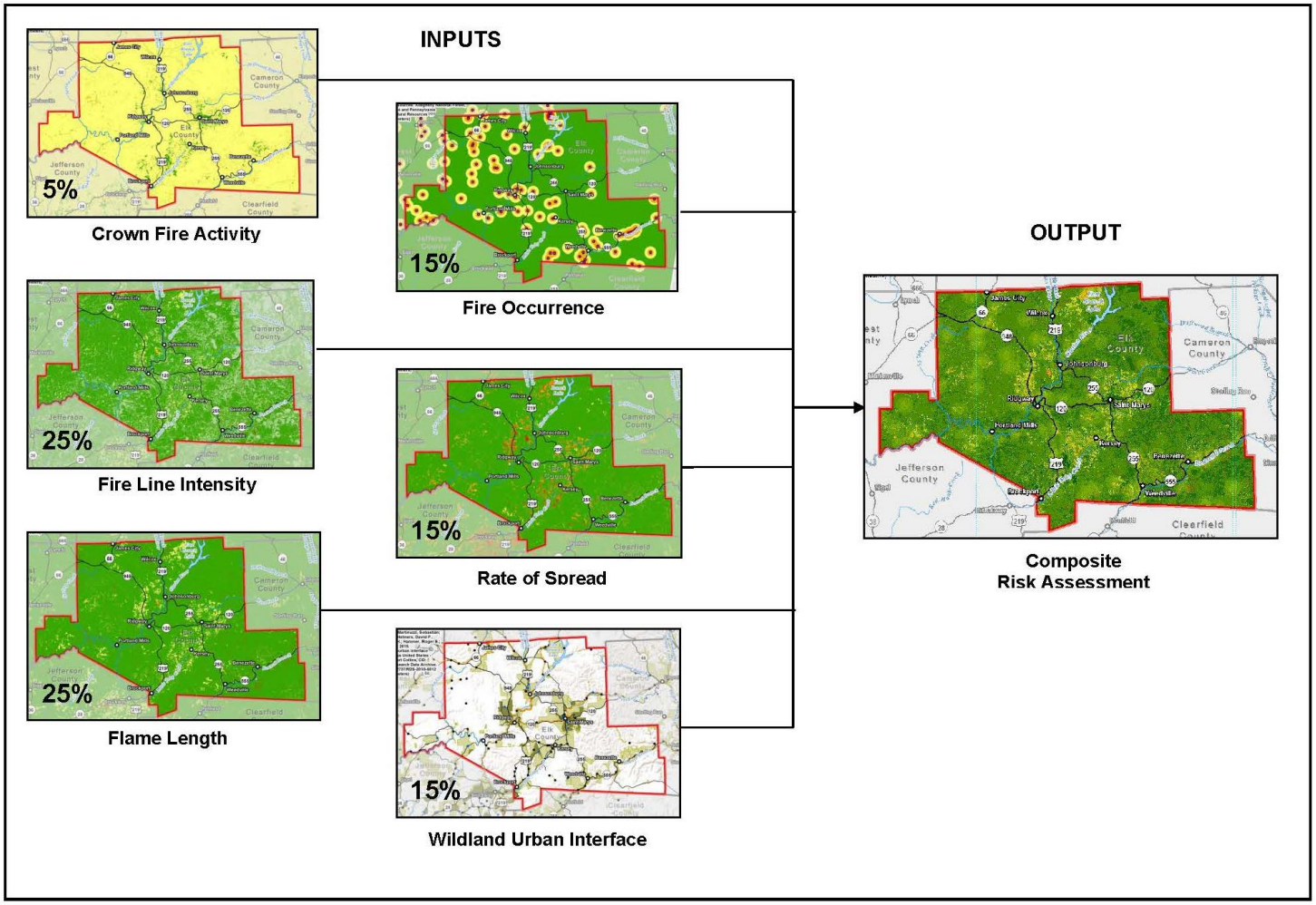


Figure 41. Composite Risk/Hazard Assessment overlay.

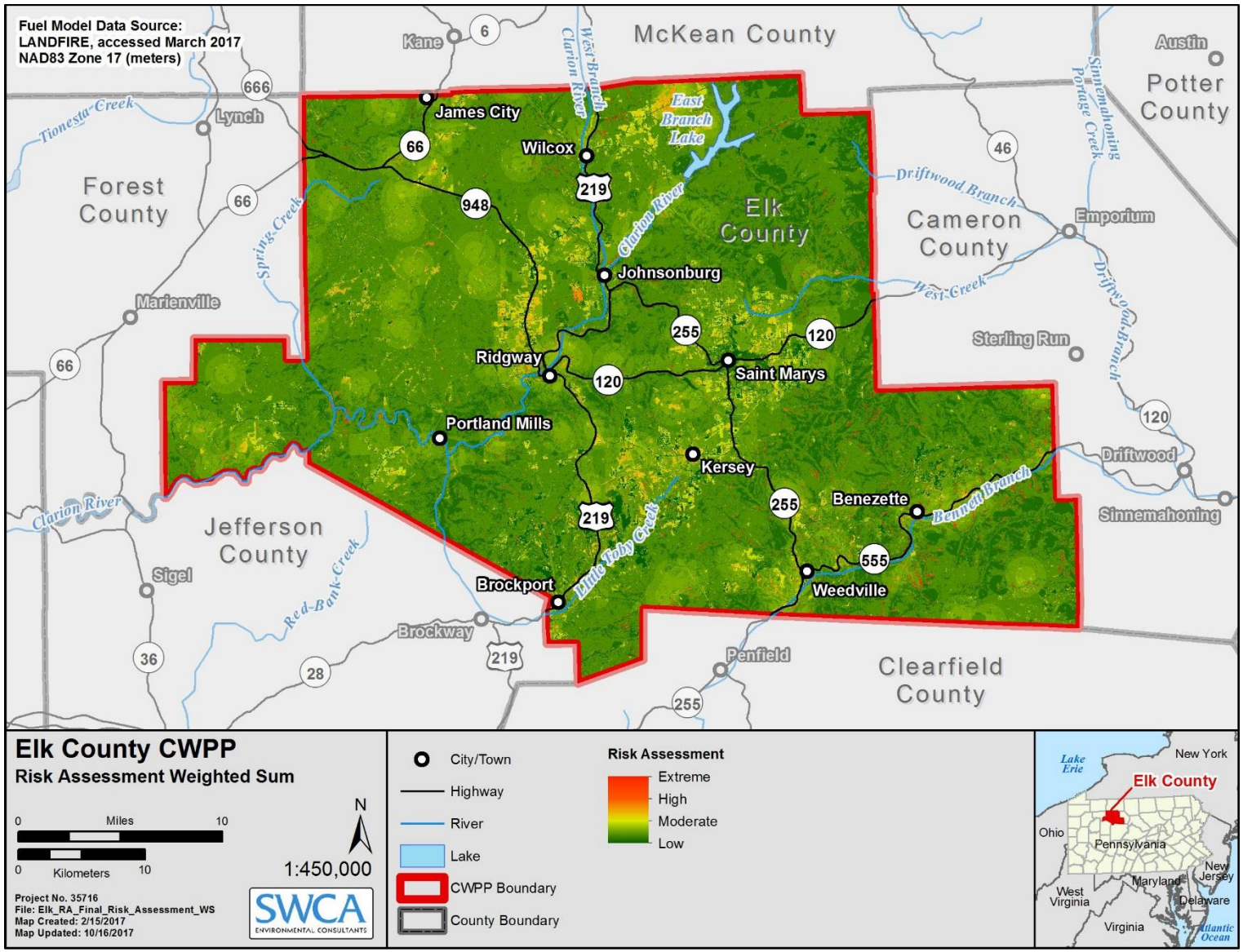


Figure 42. Composite Risk/Hazard Assessment map.

COMMUNITY HAZARD ASSESSMENTS

As part of the planning process, the Core Team identified several areas within Elk County that are considered at the greatest risk from wildfire. In order to properly assess the hazards in and around these communities, a field day was implemented to carry out community assessments.

The assessments were conducted in November 2016 with assistance from Elk County staff. The community assessment was carried out using the NFPA Wildland Fire Risk and Hazard Severity Form 1144 (Appendix E). This form is based on the NFPA Standard for Reducing Structure Ignition Hazards from Wildland Fire 2013 Edition, which was in turn developed by the Technical Committee on Forest and Rural Fire Protection and originally issued by the Standards Council on June 4, 2007. The NFPA standard focuses on individual structure hazards and requires a spatial approach to assessing and mitigating wildfire hazards around existing structures. It also includes ignition-resistant requirements for new construction and is used by planners and developers in areas that are threatened by wildfire and is commonly applied in the development of Firewise Communities (for more information, see www.firewise.org).

Each area was rated based on conditions within the community and immediately surrounding structures, including access, adjacent vegetation (fuels), defensible space (Figure 43 and Figure 44), adjacent topography, roof and building characteristics, available fire protection, and placement of utilities. Where a range of conditions was less easily parsed out, a range of values was assigned on a single assessment form. Each score was given a corresponding adjective rating of low, moderate, high, or extreme. An example of the assessment form used in this plan can be found in Appendix E. The purpose of the community WUI assessment and subsequent hazard ratings is to identify fire hazard and risks and prioritize areas requiring mitigation and more detailed planning. These assessments should not be seen as tactical pre-suppression or triage plans. The community assessment helps to drive the recommendations for mitigation of structural ignitability, community preparedness, and public education. The assessment also helps to prioritize areas for fuels treatment based on the hazard rating.

The hazard ratings from the community assessment and the GIS hazard/risk assessment are provided in Table 8. This table also includes a summary of the positive and negative attributes of a community as they relate to wildfire risk.

This information can be used to fulfill the requirement for a Firewise Assessment for interested communities.

Figure 43. An absence of defensible space around a wooden structure adjacent to forest fuels

Figure 44. Trees overhanging a wood cabin, with heavy conifer component that could transmit fire easily from the ground to the canopy

Table 8. Community Assessment Summary

COMMUNITY	NFPA 1144 RISK RATING	GIS RISK RATING	POSITIVE	NEGATIVE
Spring Creek Township	70 (High)	Low-Moderate	• Defensible space good in most areas, with some lacking • Fire Department • Hardwood fuels with lower combustibility	• Narrow windy roads • Slow response times possible • Some older construction • No water available • Heavily wooded
Millstone Township	73 (High)	Moderate-High	• Defensible space good in most areas, with some lacking • Fire Department • Hardwood fuels with lower combustibility • Agricultural lands as buffer	• Narrow windy roads • Slow response times possible • Poor ingress/egress • Steep slopes • No water available • Heavily wooded
Ridgway	41 (Low)	Low-Moderate	• Hardwood fuels with lower combustibility • Agricultural lands as buffer • Water supply • Good access • Fast response times	• Vacant/blighted properties • Historic properties and CVARs • Some older construction with higher combustibility
Johnsonburg	41 (Low)	Low-Moderate	• Hardwood fuels with lower combustibility • Agricultural lands as buffer • Good access • Fast response times	• Water supply limited • Some ingress/egress concerns • Some older construction with higher combustibility
James City and Lamont	61 (Moderate)	Low-Moderate	• Hardwood fuels with lower combustibility • Fast response times • Defensible space good in most areas, with some lacking	• Narrow roads • Water supply limited • Limited separation between structures • Some older construction with higher combustibility
Wilcox	61 (Moderate)	Low-Moderate	• Good access • Good response times • Hardwood fuels with lower combustibility • Valley location • Agricultural lands as buffer	• Recreational area attracting residents and visitors • Water supply limited • Some older construction with higher combustibility
St Mary's (Downtown)	37 (Low)	Low-Moderate	• Urban setting • Good access • Fire Department in town • Fast response times • Good water supply	• Limited separation between structures • High population density • Numerous CVARs
St Mary's (Township)	60 (Moderate)	Low-Moderate	• Hardwood fuels with lower combustibility • Fast response times • Defensible space good in most areas, with some lacking • Good access	• Heavily wooded • Slower response times in remote areas due to distance • Water supply limited

COMMUNITY	NFPA 1144 RISK RATING	GIS RISK RATING	POSITIVE	NEGATIVE
Kersey	50 (Low)	Low-Moderate	• Hardwood fuels with lower combustibility • Good access • Agricultural lands as buffer • Defensible space good in most areas, with some lacking	• Water supply limited • Some older construction with higher combustibility
Weedville, Byrnedale and Force	61 (Moderate)	Moderate with some High and extreme	• Good access along main roads • Fire Department • Good separation • Agricultural lands as buffer • Forest is patchy	• Varied topography • Narrow side roads • Dry oak-pine forests • Water supply limited in some locations • Some older construction with higher combustibility
Benezette Township	77 (High)	Moderate with some high and extreme	• Patchy hardwood fuels with lower combustibility • Some agricultural lands as buffer • River for water supply • Defensible space good in some areas, with some lacking	• Varied topography • Steep slopes • Heavy use area- elk viewing • Narrow roads and congestion common • Dry-oak pine forests • Slow response times • No public water supply • Heavy density of CVARs • Seasonal populations

COMMUNITIES AT RISK DESCRIPTIONS

The following are community descriptions for WUI communities within the County. The descriptions include summaries regarding surrounding fuels, access, water supply, fire response, structural characteristics and community values at risk (CVARs). Mitigation measures to address wildfire hazards, that are often common to communities throughout the County, are described in Chapter 6.

SPRING CREEK TOWNSHIP

Rated 70 (High) with NFPA Assessment; low–moderate with some extreme with Composite GIS Risk Assessment

Spring Creek Township is in the southwest part of Elk County and is bordered by Jefferson County to the southwest. The Clarion River crosses the township from east to west. The topography is variable with some steep areas. The township comprises 64.4 square miles, of which a large majority is forested (Figure 45). The township is sparsely populated with approximately 230 people.

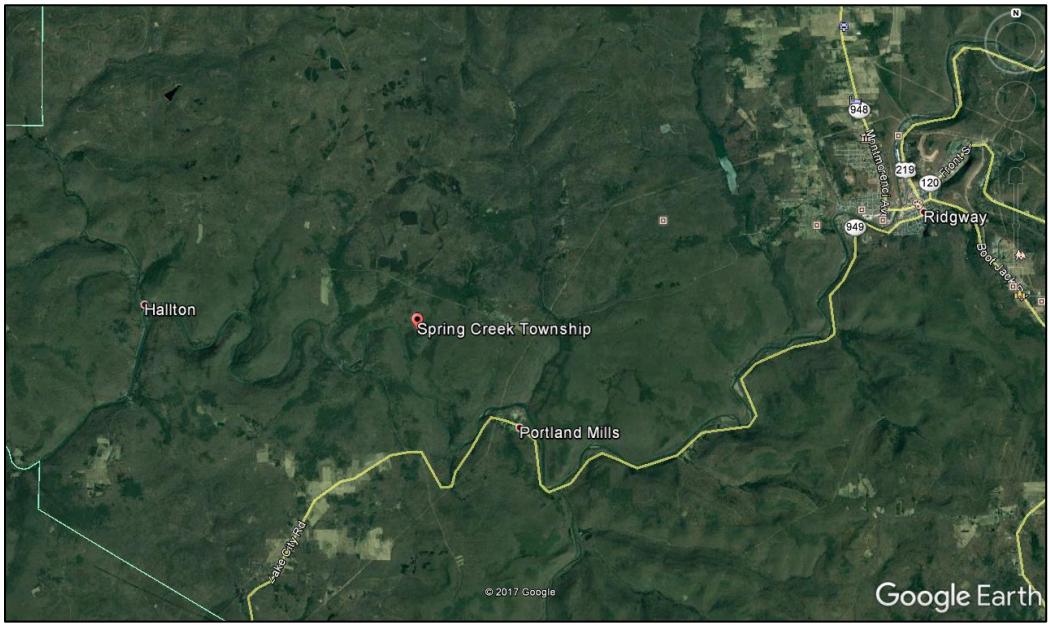


Figure 45. Spring Creek Township, showing large area of forested land and distance to Ridgway.

Fuels: Predominantly northern hardwood forests and dry oak pine woodlands. The dominant fuel types are: TL2, TL6, and TL9.

Access: The area is accessed via Route 3002. The area is typified by narrow, windy roads, with some homes located at significant distances from urban areas. There are some unsurfaced roads and dead ends and a number of narrow single track bridges; ingress and egress has been raised as a concern by some responders. There are some steep areas.

Fire Response: The Ridgway Fire Department serves the Township. Slow response times are possible, depending on the location of the fire (estimated 30 minutes).

Water Supply: There is no available water in many areas. Tankers and engines, as well as portable pumps, are required for fire suppression.

Structural Characteristics: There is a mixture of construction—some older homes, some seasonal homes, and hunting cabins. Most homes within the community have good defensible space with many being located on large lots with good clearance and good separation from adjacent structures. Some homes are located in heavily wooded areas with insufficient clearance (Figure 46).

CVARs: ANF forest resources, recreation, trails, and Clarion River. Recreational and seasonal users of the river increase population during some times of the year, particularly summer for canoeing and fall/winter for hunting season.

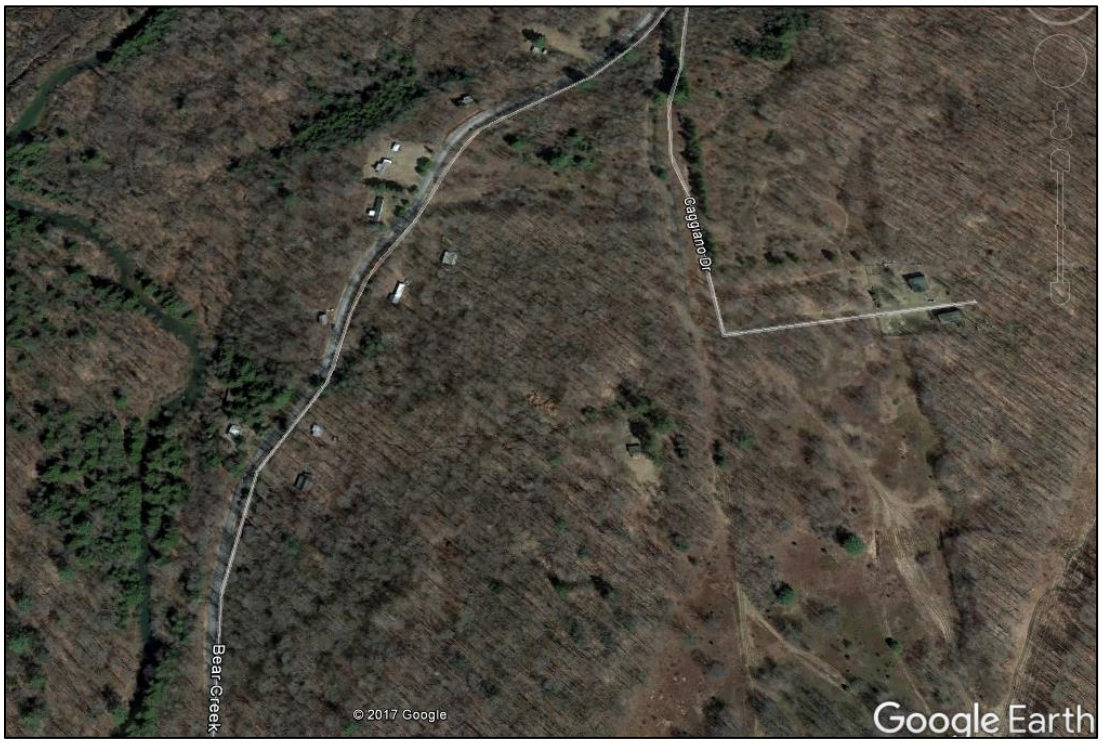


Figure 46. ***Spring Creek Township homes showing the wooded setting, lack of defensible space, and dead-end roads.***

MILLSTONE TOWNSHIP

Rated 73 (High) with NFPA Assessment; Moderate- High with some extreme with Composite GIS Risk Assessment

Millstone Township is located in far western Elk County and is bordered by Forest County to the north and Jefferson County to the west (Figure 47). The Clarion River forms the southern boundary of the township. The Township is very sparsely populated with only 95 people spread over 41.6 square miles (2.3 people/square mile). The communities of Millstone and Loleta are located within the township.

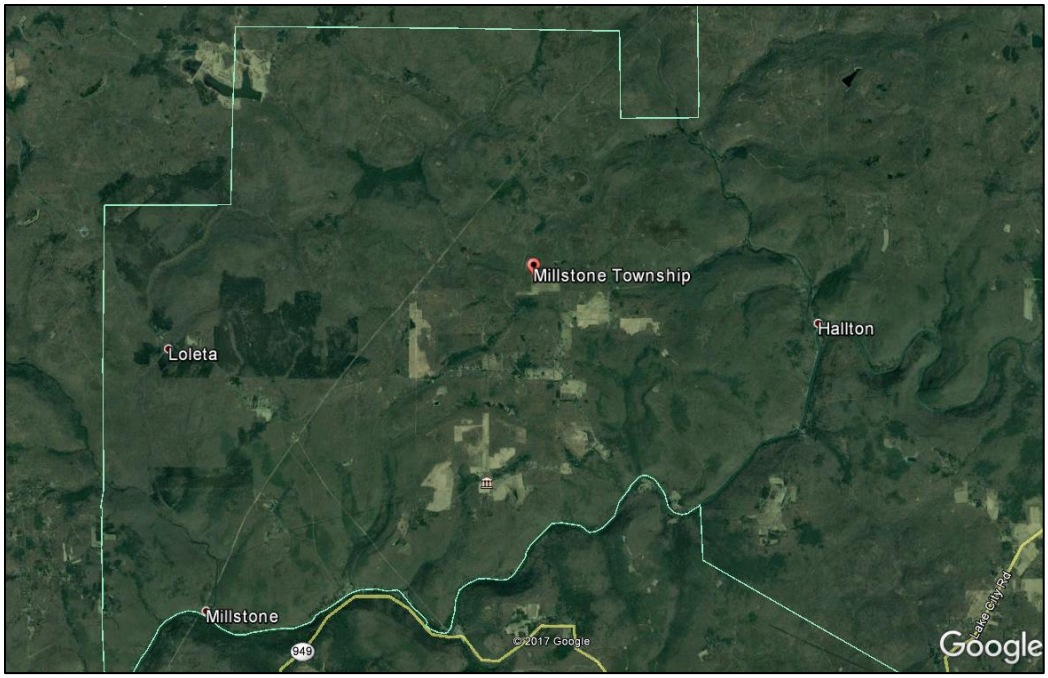


Figure 47. Millstone Township, showing large area of forested land and dispersed agriculture.

Fuels: Northern hardwood forests and dry oak pine woodlands, with areas of grassland/agriculture. The dominant fuel types are: TL6, TL2, GR2, and TL9.

Access: The area is accessed via Route 3001 and 3002. The area is accessed via narrow, windy roads and some homes are at a long distance from urban areas. There are some unsurfaced roads and dead ends as well as narrow single-track bridges; ingress and egress has been raised as a concern by responders. There are some steep areas.

Fire Response: The Ridgway Fire Department serves the Township. Slow response times are possible, depending on the location of a fire (approximately 30–40 minutes).

Water Supply: There is no available water in many areas. Tankers and engines, as well as portable pumps, are required for suppression.

Structural Characteristics: There is a mixture of construction with some older homes, some seasonal homes, and hunting cabins. Most homes within the communities of Loleta and Millstone are located within grassland and have good defensible space with many being located on large lots with good clearance and good separation from adjacent structures (Figure 48). Some homes are located in heavily wooded areas with insufficient clearance.

CVARs: ANF forest resources, recreation, trails, and Clarion River. Recreational and seasonal users of the river increase population during some times of the year.

Figure 48. Millstone showing larger grassland plots with good separation between structures.

RIDGWAY

Rated 41 (Low) with NFPA Assessment; Low–moderate with some high with Composite GIS Risk Assessment

Ridgway is a borough in and the County Seat of Elk County. The community comprises 4,500 people, most of whom are located in the urban area (Figure 49). The borough is surrounded by Ridgway Township and is located within the valley of the Clarion River, so land is gently rolling. Urban areas are well protected from wildlands and exhibit low fire risk; some structures on the outskirts of town may be in proximity to forest fuels and homeowners should increase defensible space to mitigate risk. Agricultural lands north and south of the borough provide a good buffer to wildland areas.

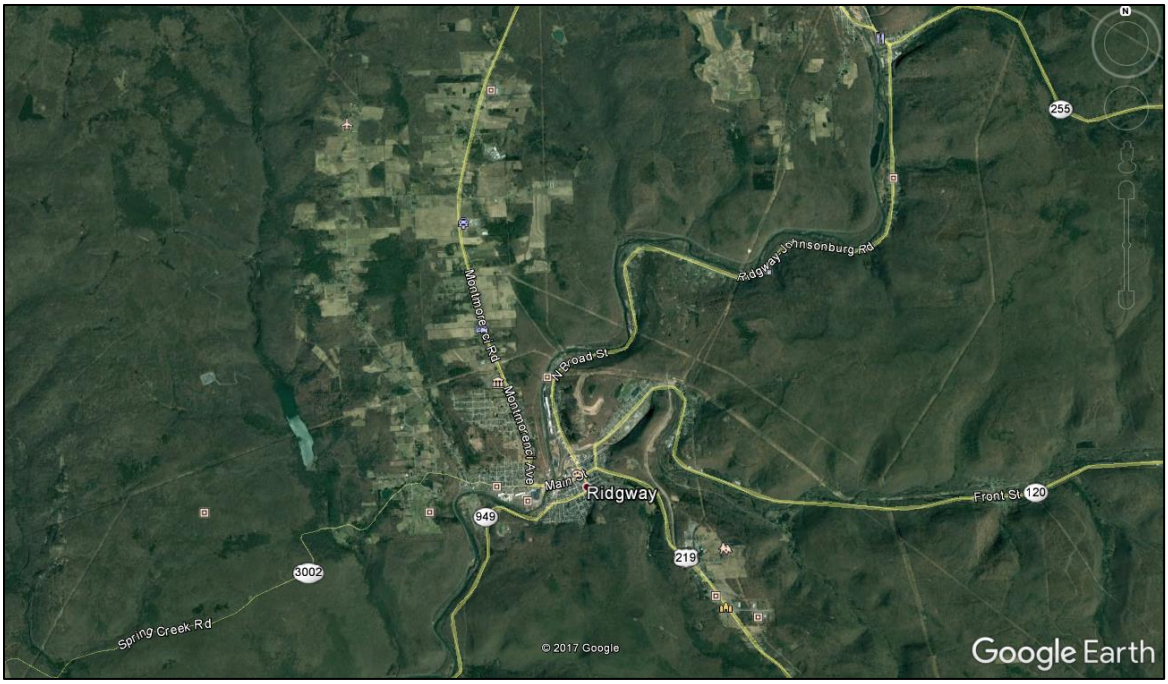


Figure 49. ***Ridgway showing urban area and agricultural lands along access roads to the north and south. Source: Google Earth.***

Fuels: Northern hardwood forests and dry oak pine woodlands, with areas of grassland/agriculture close to the urban center. The dominant fuel types are: GR1, GR2, GR3, TL2, and TL6.

Access: The area is easily accessed from a number of main routes, including 219, 120 and 948.

Fire Response: Ridgway Fire Department; Elk Co. 4 serves the borough. Response times are fast due to good access.

Water Supply: Water is available in most area within the borough.

Structural Characteristics: There is a mixture of construction but mostly older homes with combustible wood siding and decks. Most homes have good defensible space but are on smaller lots with limited separation. There are some vacant lots and some blighted/derelict properties, but most yards have manicured lawns and are well maintained.

CVARs: There is a number of historic properties within the borough and township, as well as Ridgway Historic District with properties on the National Register of Historic Places. The area is home to the powdered metal industry, timber production (black cherry), and other retail and commercial businesses. Oil and gas development is occurring away from the community on adjacent forested lands.

JOHNSONBURG

Rated 41 (Low) with NFPA Assessment; Low–moderate with some high with Composite GIS Risk Assessment

Johnsonburg is a borough in Elk County, comprising more than 2,400 people, most of whom are located in the urban area (Figure 50). The community is surrounded by private forested land but buffered from wildlands in some areas by agricultural land. The area has varied topography.

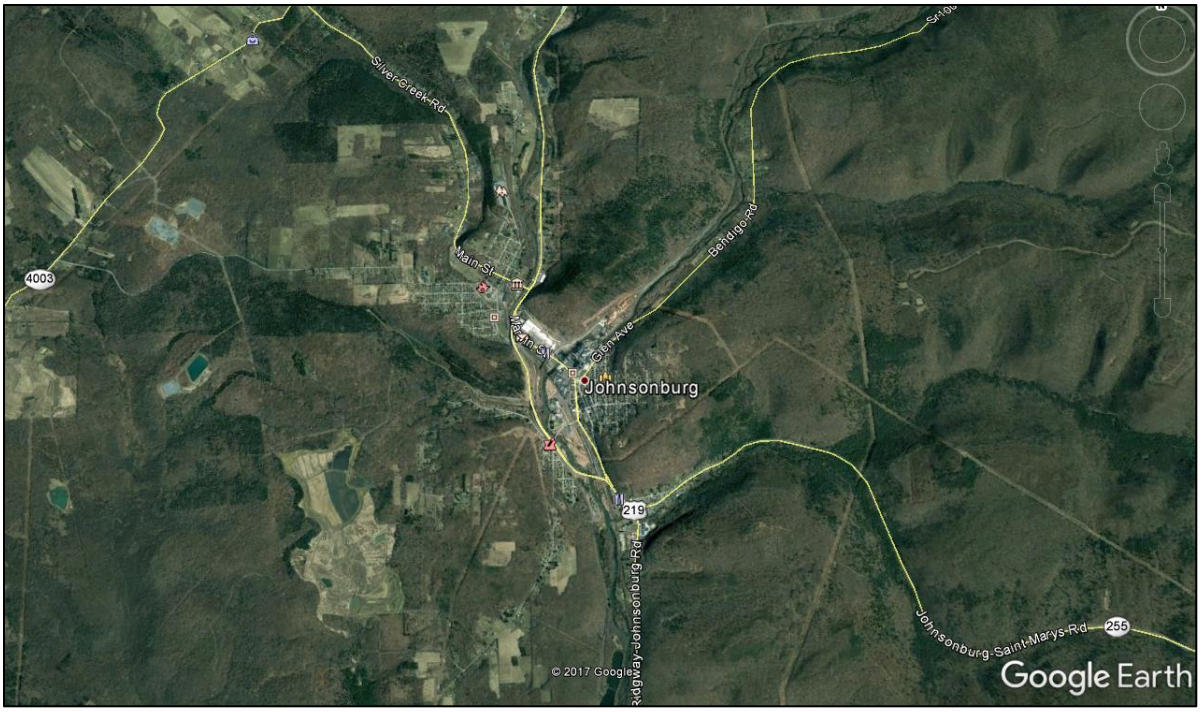


Figure 50. Johnsonburg and surroundings. Source: Google Earth.

Fuels: Northern hardwood forests and dry oak pine woodlands, with areas of grassland/agriculture close to the urban center. There are some large shrubs in the fuel mix. The dominant fuel types are: TL6, TL9, and GR2.

Access: The area is easily accessible from a number of main routes, including 219 and 255, but smaller roads are narrow and ingress and egress can be a concern for responders.

Fire Response: Johnsonburg Fire Department, Elk Co. 2 serve the area. Response times are fast (5–7 minutes). All-terrain vehicles (ATVs) and PPE are needed to access some areas and volunteers are few and hard to recruit. Specific areas of concern to responders include Terra Cotta, Dill Hill, and the Old Airport area due to ingress concerns and lack of water supply.

Water Supply: Water supply is limited. Engines and tankers are needed to support suppression operations.

Structural Characteristics: There is a mixture of construction but mostly older homes with combustible wood siding and decks. Most homes have good defensible space but are on smaller lots with limited separation.

CVARs: Paper Mill (Domtar), historic properties, Johnsonburg Commercial Historic District listed on the National Register of Historic Places, Clarion River, and oil and gas infrastructure.

JAMES CITY AND LAMONT

Rated 61 (Moderate) with NFPA Assessment; Low–moderate with Composite GIS Risk Assessment

James City and Lamont are unincorporated census designated places in the northern portion of Elk County, adjacent to the border with McKean County (Figure 51). The population is approximately 280 people. The community is surrounded by forested ANF lands.

Figure 51. James City and Lamont. Source: Google Earth.

Fuels: Northern hardwood forests, with areas of grassland/agriculture close to the urban center. The dominant fuel types are: TL2, TL6, TL9, and GR2.

Access: Narrow roads hinder use of large apparatus in some areas.

Fire Response: Highland Township Fire Department, Elk Co. 8 serves the area. The Department covers 586 square miles. Response times average 5 minutes, 10–15 minutes if a fire is located in Owls Nest.

Water Supply: Water supply is limited in all locations. The department uses tankers and portable pumps. Available water depends upon weather conditions, if it is dry there is limited water available in the streams. Responders are able to drop a suction hose in a stream or pond, even during the winter.

Structural Characteristics: There is a mixture of construction but mostly older homes with combustible wood siding and decks. Most homes have good defensible space but are on smaller lots with limited separation.

CVARs: ANF, natural resources, recreation, and oil and gas infrastructure.

WILCOX

Rated 61 (Moderate) with NFPA Assessment; Low–moderate with Composite GIS Risk Assessment

Wilcox is an unincorporated community and census designated place located in Jones Township in northern Elk County (Figure 52). The community is located near the East Branch of the Clarion River and the East Branch Dam, popular with residents and visitors. The community is located in an area of varied topography and adjacent to dense ANF forest lands to the west.

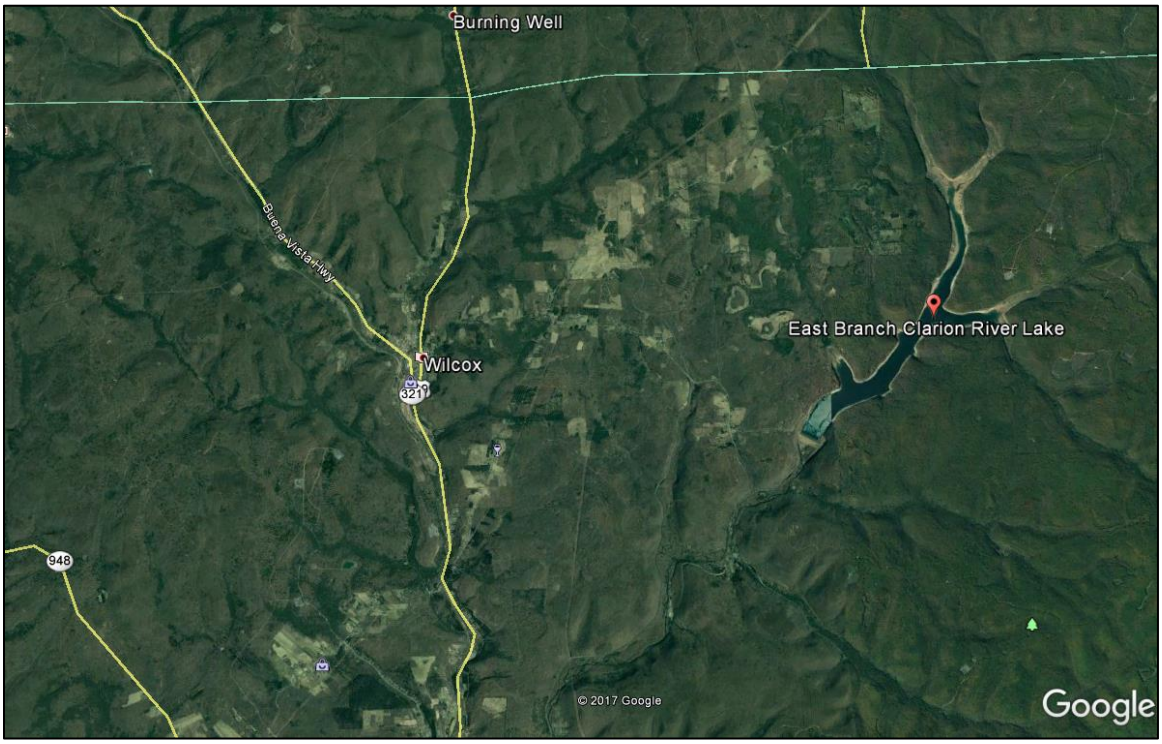


Figure 52. Wilcox showing the nearby East Branch Clarion River Lake. Source: Google.

Fuels: Northern hardwood forests, with areas of grassland/agriculture close to the urban center. The dominant fuel types are: TL2, TL6, TL9, and GR2.

Access: The urban area is accessible via Route 219. Some smaller roads are narrow but responders report this does not hinder ingress or egress due to the presence of multiple routes available for access.

Fire Response: Jones Township Fire Department, Elk Co. 6 serves this area. Average response times are 10 minutes. Areas of concern include Glen Hazel and Shawmut Grade due to travel times.

Water Supply: Water supply is limited; 1,400-gallon tankers are used to transport water for suppression.

Structural Characteristics: There is a mixture of construction but mostly older homes with combustible wood siding and decks. Most homes have good defensible space but are on smaller lots with limited separation. Most homes are located along the valley bottom.

CVARs: East Branch Clarion River Lake, hunting, fishing, and recreation.

SAINT MARYS

Downtown Area- Rated 37 (Low) with NFPA Assessment; Low–moderate with Composite GIS Risk Assessment

St Mary's Township- Rated 60 (Moderate) with NFPA Assessment; Low–moderate with Composite GIS Risk Assessment

St Mary's is a city located on the eastern side of Elk County. The population is over 12,000. St Mary's is located within Pennsylvania elk country and is a popular location for outdoor activities, including hunting and fishing. This assessment is split into the downtown area (former borough) and the township which includes more wooded area. The downtown area, though surrounded by forests, has a large amount of urban infrastructure and grassland and agricultural areas that buffer homes from forest fuels, reducing the overall wildfire risk when compared to the township where population is more disparate (Figure 53). The following information pertains primarily to the township area which falls within the WUI.

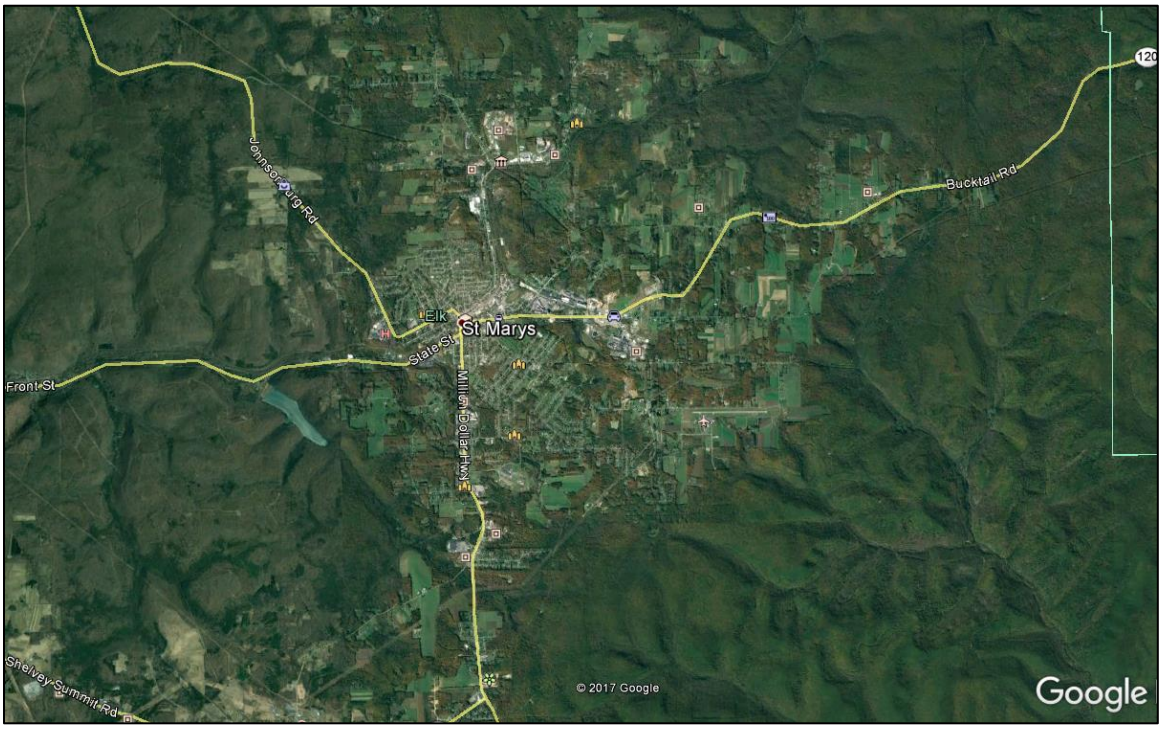


Figure 53. St Mary's and surroundings. Source: Google Earth.

Fuels: Northern hardwood forests, with areas of grassland/agriculture close to the urban center. The dominant fuel types are: GR1, GR2, GR3, TL2, TL6, and TL9.

Access: The city's main highways are Routes 255 and 120. Responders do not report ingress or egress problems within the service area; however, some roads may be narrow for large equipment.

Fire Response: Crystal Fire Department, Elk Co. 1 serves the area. Response times can reach 10 to 15 minutes for more remote areas. Some equipment is needed for potential larger fires. Personnel may be lacking on larger incidents. Specific areas of concern to responders include Glen Hazel, Flower Valley, and the Grade. Better radio communications are needed, especially for multi-agency response.

Water Supply: Water supply is limited in some locations. Mapping of dry hydrants is needed.

Structural Characteristics: There is a mixture of construction but mostly older homes with combustible wood siding and decks. Most homes have good defensible space but are on smaller lots with limited separation. Most homes in the downtown area are located within an urban setting, reducing overall risk, but an equal number of homes are spread throughout the township in a more rural and wooded environment.

CVARs: There are numerous historic properties within the community that are listed on the National Register of Historic Places, and commercial properties and industry. Oil and gas infrastructure is located in the vicinity.

KERSEY

Rated 50 (Low) with NFPA Assessment; Low–moderate with Composite GIS Risk Assessment

Kersey is an unincorporated community and census designated place in Fox Township, southeast of Ridgway. The community is located in an agricultural area with private forested land to the east (Figure 54).

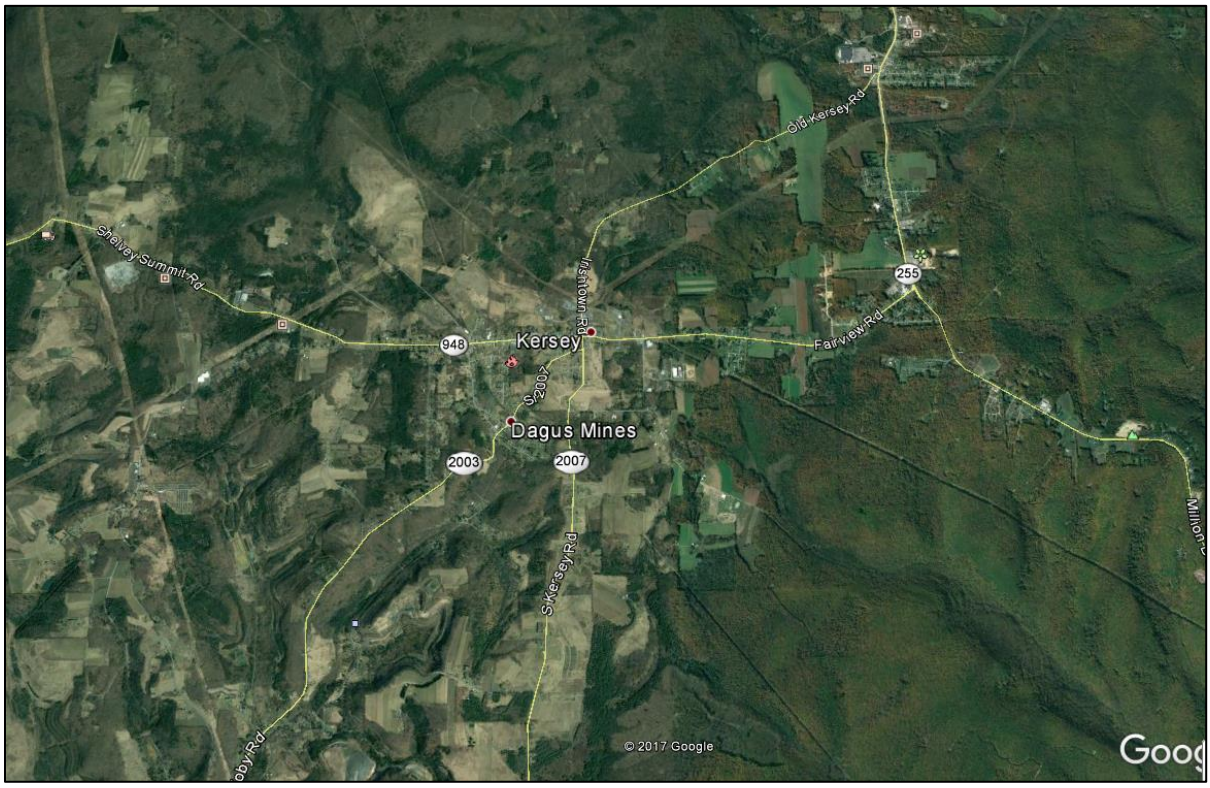


Figure 54. Kersey and surroundings, showing the agricultural and urban setting. Source: Google Earth.

Fuels: Agricultural cropland, herbaceous shrubland, northern hardwood forests. The dominant fuel types are: GR1, GR2, GR3, TL2, TL6, and TL9.

Access: The community is easily accessible via a number of routes.

Fire Response: Fox Township VFD serves the community.

Water Supply: Water supply is limited in some locations.

Structural Characteristics: There is a mixture of construction but mostly older homes with combustible wood siding and decks. Most homes have good defensible space but are on smaller lots with limited separation. Most homes are located within an urban and agricultural setting, reducing overall risk.

CVARs: Agricultural lands; commercial, retail, and industrial properties.

WEEDVILLE, BYRNEDALE, AND FORCE

Rated 61 (Moderate) with NFPA Assessment; Moderate with some high and extreme with Composite GIS Risk Assessment

Weedville, Byrnedale, and Force are unincorporated communities and census designated places in southeastern Elk County. The communities are situated in the valley of the Bennett Branch Sinnemahoning Creek and are located on and near the intersection of Routes 255 and 555. Most homes are located along the highway in the valley setting. Although the communities are adjacent to private forested land, there are large swaths of agriculture and grasslands that buffer the communities from forest fuels and break-up fuel continuity. The communities are in an area of varied topography and rolling hills (Figure 55).

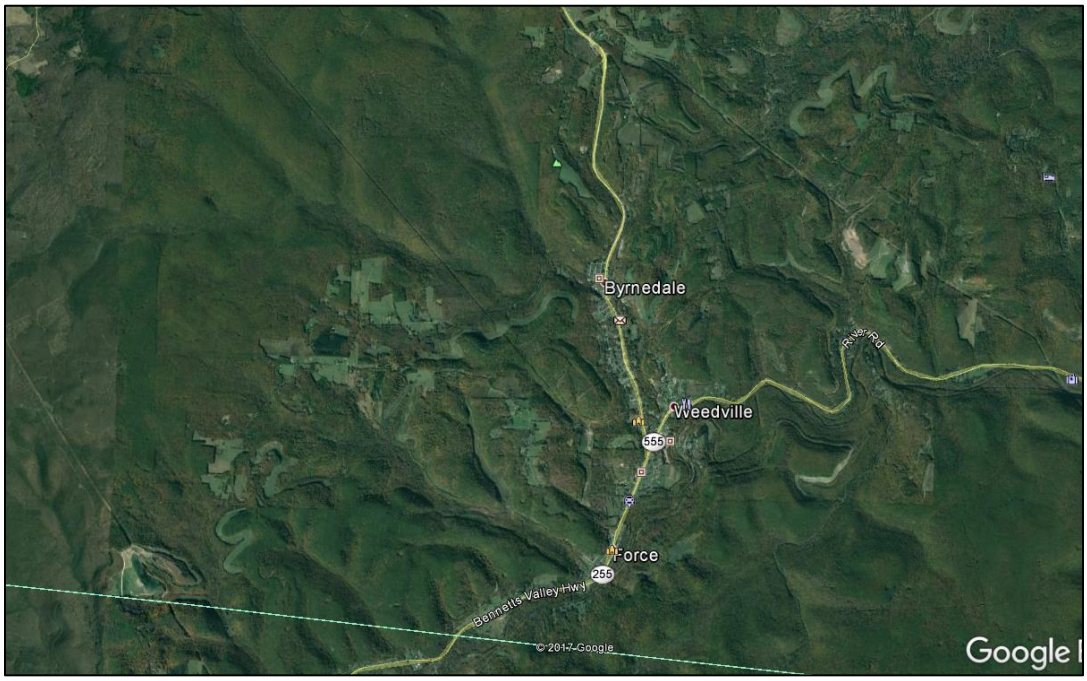


Figure 55. ***Byrnedale, Weedville, and Force, showing patchy forests, varied topography, and proximity between communities. Source: Google Earth.***

Fuels: Agricultural cropland, northern hardwood forests, dry oak-pine forests. The dominant fuel types are: TL2, TL3, TL6, and TL9.

Access: All three communities are located along the highway, with some homes off of side roads that may be narrow and impede access for large apparatus.

Fire Response: Jay Township Fire Department, Elk Co. 5 serve the area.

Water Supply: Water supply is limited in some locations.

Structural Characteristics: There is a mixture of construction but mostly older homes with combustible wood siding and decks. Most homes have good defensible space (Figure 56) but are on smaller lots with limited separation. Most homes are located within an urban and agricultural setting, reducing overall risk.

CVARs: Agricultural lands; commercial, retail, and industrial properties.

Figure 56. Highway 255 between Force and Weedville showing open setting of homes and patchy surrounding forest and woodland. Source: Google Earth.

BENEZETTE TOWNSHIP

Rated 77 (High) with NFPA Assessment; Moderate with some high and extreme with Composite GIS Risk Assessment

Benezette Township occupies the eastern end of Elk County (Figure 58) and is bordered by Cameron County to the north and east and Clearfield County to the south. The township contains the unincorporated communities of Medix Run (Figure 59), Benezette, Summerson, Grant, and Dents Run, all within the valley of the Bennett Branch Sinnemahoning Creek. There are approximately 220 people living in the township, with a population of 2.1 persons per square mile. Benezette is home to the famous elk herd that attracts large numbers of visitors throughout the year (Figure 57). The community is situated adjacent to state forest and state game lands.

Figure 57. The Benezette elk attract large numbers of visitors every year.

Figure 58. Benezette and Winslow Hill elk viewing area. Source: Google Earth.

Figure 59. ***Medix Run, a small community located in a valley bottom with a scattered population. Source: Google Earth.***

Fuels: Riparian, northern hardwood forests, dry oak-pine forests. The dominant fuel types are: TL2, TL6, and TL9.

Access: Benezette is accessed via Route 555. Most homes are located north of the highway along narrow roads near the highway and in the Winslow Hill area. Access is extremely limited due to narrow windy roads and steep grades. Access is hindered in busy visitor periods due to congestion associated with elk viewing (Figure 60) and visitors to the Elk Country Visitor Center (Figure 61). Emergency access during these periods is a concern for responders.

Figure 60. Elk Viewing Area

Figure 61. Elk Country Visitor Center

Fire Response: Jay Township Fire Department, Elk Co. 5 serve the area. Ingress and egress is a concern due to narrow, windy roads and steep grades. Slow response times may be experienced during busy visitor periods.

Water Supply: Water supply is limited in most locations. There is no public water, everyone uses a well for water supply

Structural Characteristics: There is a mixture of construction but mostly older homes with combustible wood siding and decks. Most homes have good defensible space but are on smaller lots with limited separation and with some considerable slope in some areas. Some homes are located along ridgelines and mid slope, which is a concern due to the impacts of topography on fire spread and fire

behavior. Access to properties may be difficult due to steep grades and limited turnaround space for emergency apparatuses.

CVARs: Elk herd, Elk Country Visitor Center, Winslow Hill elk viewing area and scenic overlook, State Forest lands, tourist amenities, picnic grounds, campsites, seasonal properties, riparian areas, and historical properties.

COMMUNITY VALUES AT RISK

Earlier compilation of the critical infrastructure in the planning area (see Map 7, Appendix D), coupled with the community assessments, public outreach, and Core Team input, has helped in the development of a list of CVARs from wildland fire. The public was encouraged to provide additional CVARs during the public outreach effort.

In addition to critical infrastructure, CVARs can also include natural, social, and cultural resources (Figure 64). It is important to note that although an identification of CVARs can inform treatment recommendations, a number of factors must be considered in order to fully prioritize areas for treatment; these factors include appropriateness of treatment, land ownership constraints, locations of ongoing projects, available resources, and other physical, social, or ecological barriers to treatment.

The scope of this CWPP does not allow determination of the absolute natural, socioeconomic, and cultural values that could be impacted by wildfire in the planning area. In terms of socioeconomic values, the impact due to wildfire would cross many scales and sectors of the economy and call upon resources locally, regionally, and, in extreme circumstances, nationally.

NATURAL CVARS

The CWPP planning area has a variety of natural resources of particular concern to land managers, such as rare habitats and listed plant and wildlife species. The public outreach has emphasized the importance of natural/ecological values to the general public. Examples of natural values identified by the public and the Core Team include:

- Natural areas
- Native species
- Wildlife habitat
- Threatened and endangered species
- Wetland areas
- Wild and scenic river
- Agricultural lands (Figure 62)
- Timberland/hardwood lumber
- Game habitat
- Air quality

Figure 62. ***Agricultural lands are values that are at risk throughout the County and also create a buffer between homes and forested land. Grassland and cropland can still pose a fire hazard under the right conditions.***

SOCIOECONOMIC CVARS

Social values include population, recreation, infrastructure, agriculture, and the built environment. Much of the built environment in the planning area falls within the WUI zones. Examples include the following:

- Stores and businesses
- Cabins and campgrounds
- Oil and gas infrastructure
- Timber resources
- Trails and recreational infrastructure
- Signage
- Utility lines, infrastructure, etc.
- Fire departments
- Fire towers
- Highways
- Schools
- Churches
- Rest homes, senior housing, day care, and other groups homes
- Water storage
- Communication sites
- Maple syrup production
- Experimental forest
- Powdered metal industry
- Family farms
- Hunting/fishing
- Benezette elk herd and Elk Visitor Center
- Clarion River Water Trail (Figure 63)
- Twin Lakes Trail & CG
- Brush Hollow Trail
- Mill Creek Trail
- Laurel Mill Trail
- Little Drummer Trail
- Pine Camp, Pigs Ear, Buehler Corners and Timberline ATV Trailhead
- Timberline and Marienville ATV trails
- Irwin Run Car-Top Boat Launch

Figure 63. ***Clarion River Water Trail and Irwin Run Canoe Launch attracts visitors and recreationists to a remote area of the County.***

CULTURAL CVARS

Many historical landmarks are scattered throughout Elk County. Particular CVARs that have been identified by the Core Team and the public in the CWPP planning area are:

- Cemeteries
- Churches
- Barns and other historic infrastructure from agricultural land uses
- 12 properties and districts on the National Register of Historic Places (most are of brick construction and located within more urban areas away from wildland fuels; however, some wood frame structures may be at threat from wildfire damage)

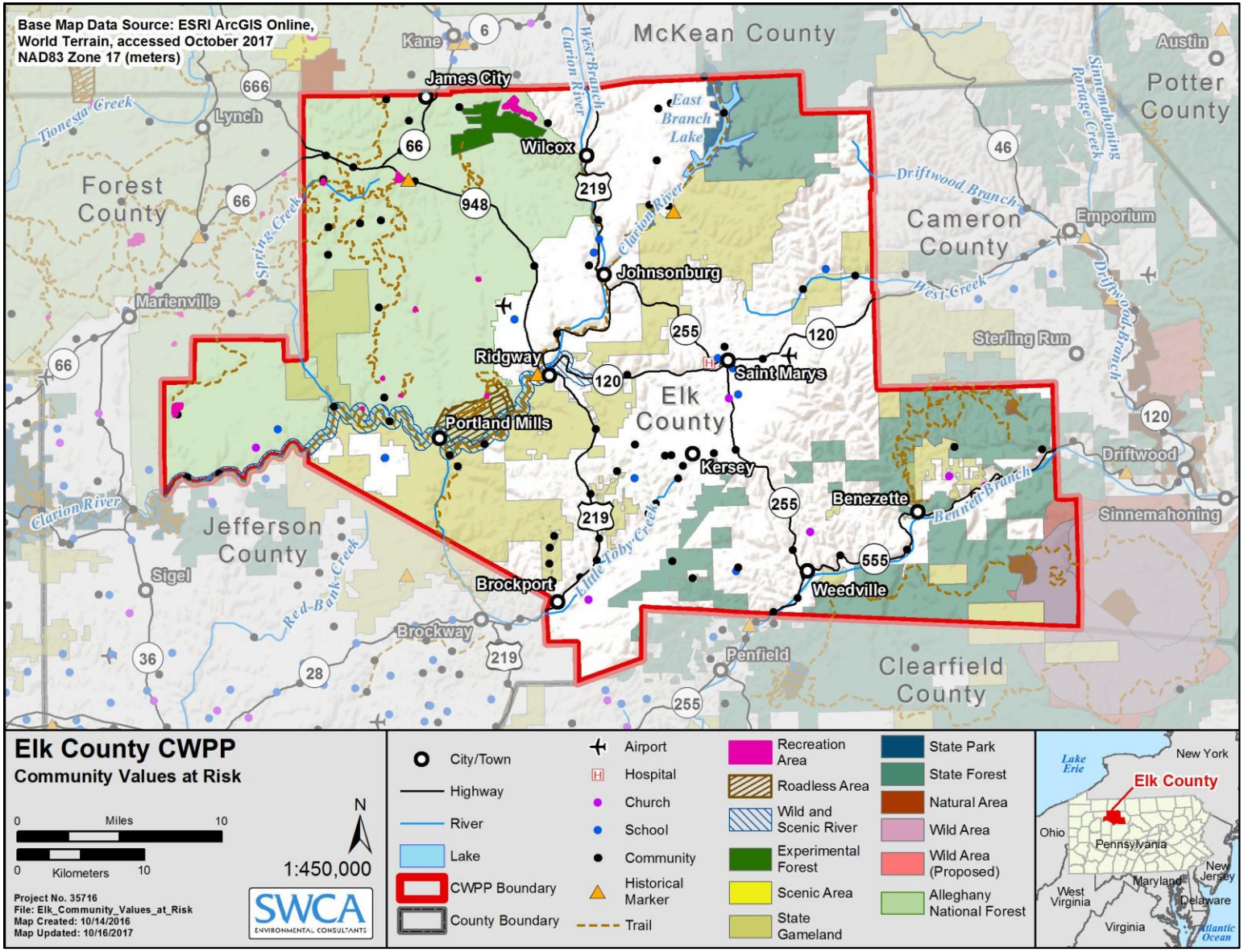


Figure 64. CVARs in Elk County.

Oil and Gas Infrastructure

This region is famous for its oil and gas production; notably, the world's first commercial oil well was drilled close by in Titusville in 1859. Over the past few years, Marcellus Shale development has increased in Pennsylvania. There are 2,442 active wells currently in the County including conventional (shallow wells) and non-conventional (deeper Marcellus Shale wells)(Pennsylvania Department of Environmental Protection, 2017)((Figure 65). Conventional wells are more common and are spread throughout the land area.

The ANF has the following breakdown of wells in Elk County:

- 2,500 active, inactive, plugged, orphaned and abandoned wells.
- 4 unconventional wells

93% of the subsurface mineral rights on ANF lands are privately owned and a total of 13,000 producing wells are found on the ANF as a whole.

The Elk State Forest has the following breakdown of wells in Elk County:

- Shallow – 94
- Marcellus/Utica – 90
- Oriskany – 1

Fire responders follow strict guidelines with regards to oil and gas related fires. Due to inherent safety concerns with producing wells, firefighters can only contain fires along the perimeter of the well site; this creates implications for fire responders trying to suppress a fire, since access to an area may be prevented. Well sites are also often located at the end of dead-end roads threatening safe egress in the event of a fire. Aboveground pipelines, tanks, and well heads are a concern due to potential leaks and/or explosions (Figure 66).

Much of the oil and gas infrastructure is mapped, but some data may be sensitive. The volume of active wells changes depending on markets and new development can occur rapidly. Oil and gas companies do not have fire management plans, nor do they have any defensible space guidelines that they have to adhere to in the ANF. In order to reduce the potential risk of wildfire in and around oil and gas infrastructure, fuel treatments could be carried out to provide a buffer between the well site and adjacent vegetation.

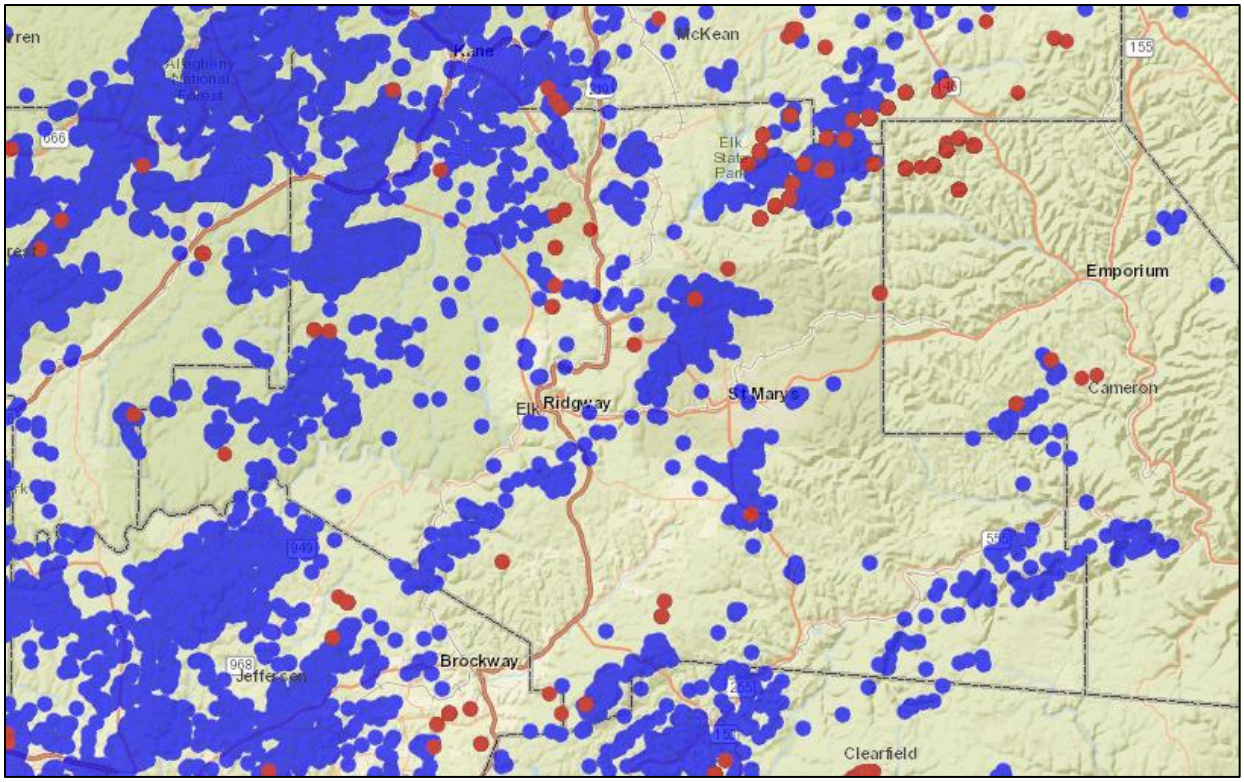
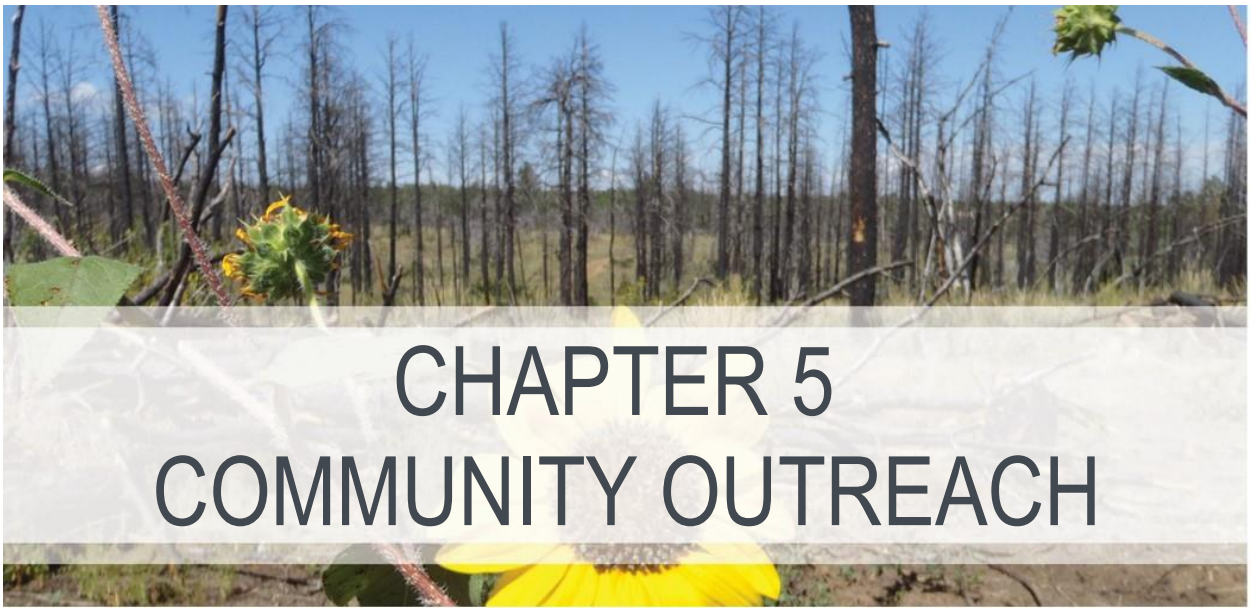


Figure 65. ***This map shows the extensive coverage of conventional wells (shown in blue) and unconventional wells (shown in red) located throughout Elk County; ANF lands are shown in green. Source: Pennsylvania Department of Environmental Protection.***

Figure 66. ***Pipeline with unknown storage barrels and a burn barrel. Credit: ANF.***



CHAPTER 5
COMMUNITY OUTREACH

COMMUNITY SURVEY, WEBINAR, AND SOCIAL MEDIA

The community survey, social media page, and the public outreach events provided a wealth of information that can be used to develop recommendations for fire prevention and preparedness in the county.

COMMUNITY SURVEY

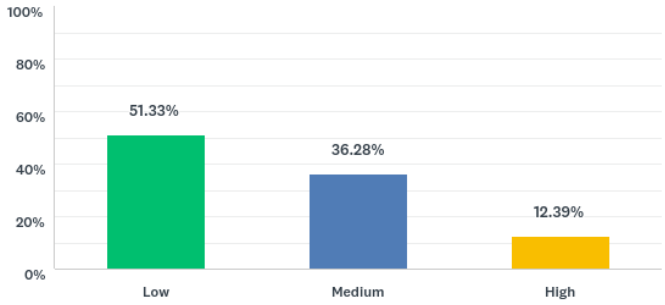
An online and hard copy community survey was developed for the project in order to gather input from the public on wildfire hazard within the communities, wildfire risk perception amongst residents, and compile community values at risk in the County. A copy of the survey questions can be found in Appendix F. The survey was distributed at outreach events, via email list serves and posted on the CWPP Facebook page. The community was also notified about the survey via a number of local media articles.

The survey was developed for the two county area of Elk and McKean County. The survey was completed by 113 residents with a relatively even split between the counties. The following are summary statistics compiled from survey responses.

Note: Questions 3,5,6 and 7 illustrate a weighted average of responses, since residents were asked to rank each item in order of importance.

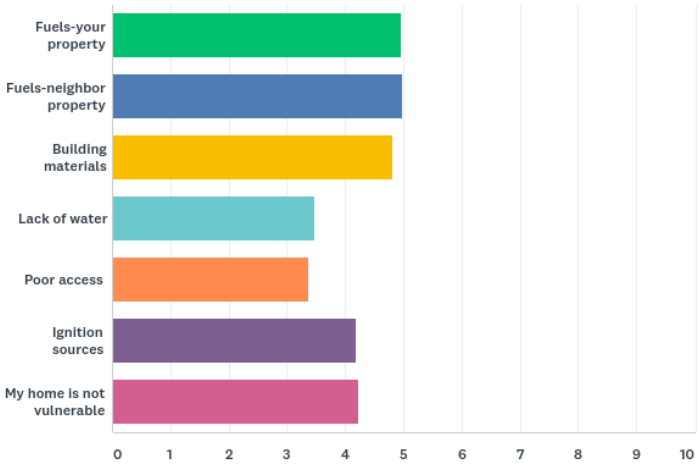
Q2 How would you rate your house in terms of risk from wildfire? (consider the proximity of your house to tracts of undeveloped land, vegetated land, emergency response and access).

Answered: 113 Skipped: 0



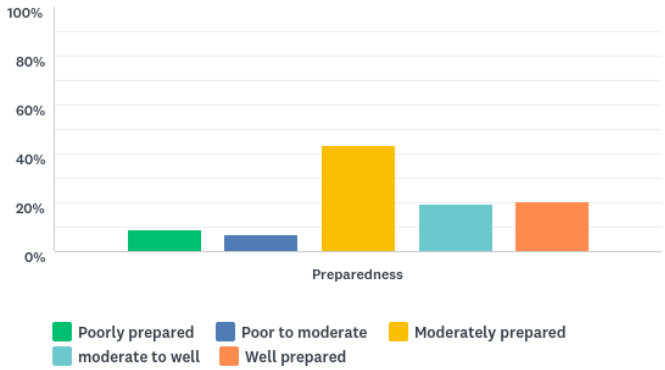
Q3 My home is vulnerable to wildfire because of:

Answered: 107 Skipped: 6



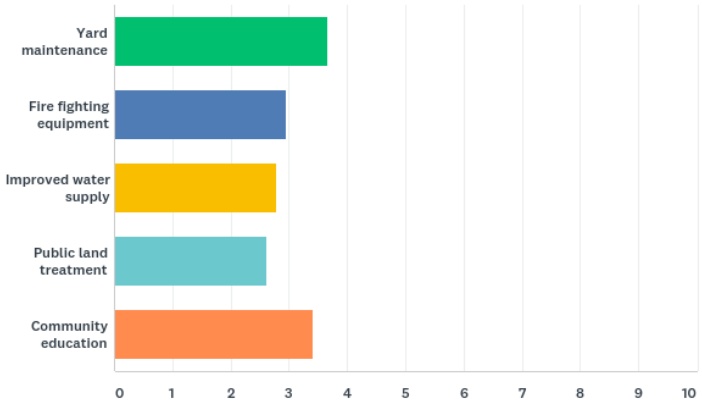
Q4 How prepared is your community for a large wildfire?

Answered: 112 Skipped: 1



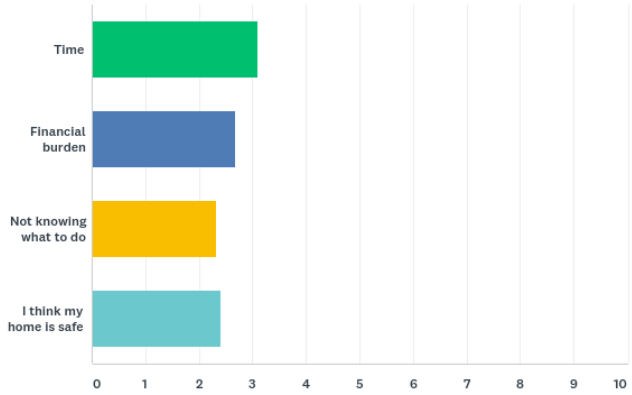
Q5 Rate the following actions in their importance to making the community better prepared for wildfire?

Answered: 106 Skipped: 7



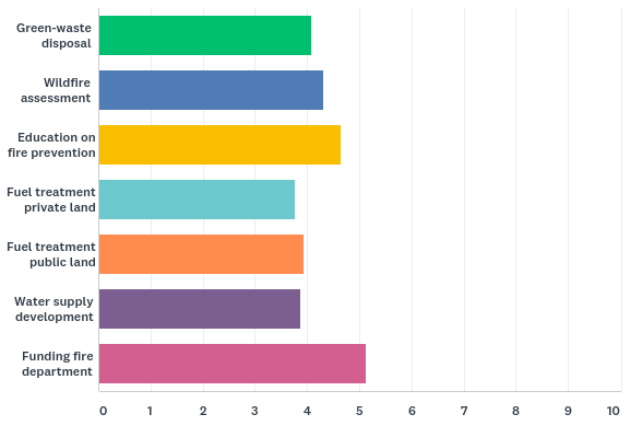
Q6 My biggest challenge to making my home fire safe is:

Answered: 103 Skipped: 10



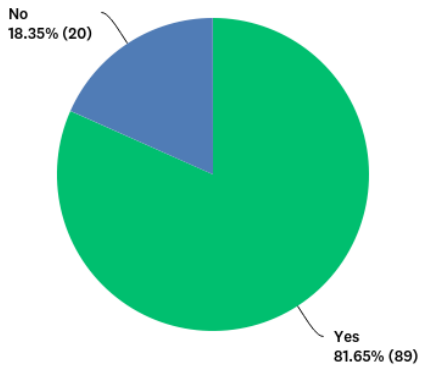
Q7 I would be most interested in funding to help me and my community with:

Answered: 101 Skipped: 12



Q8 Do you support the use of prescribed fire to treat areas that have become overgrown and overstocked with timber?

Answered: 109 Skipped: 4



Interpretation of Survey Results

- Q 2- Most residents perceived themselves to be at low to medium risk from wildfire, with a lower amount perceiving themselves to be at high risk. This could be a result of the sample of residents who answered the survey, although data regarding address suggests a good cross section of the population was captured, with residents represented from most areas of each County. Most residents engaged in discussions during outreach commented on the low frequency of wildfire in the region, though many acknowledged that under certain conditions all areas could potentially be at risk.

- Q 3- Although the weighted average for this question showed a relatively even split for each answer, many residents attribute wildfire risk to surrounding fuels on both their property and neighboring properties. Building materials was also rated high. Water supply, access and ignition sources are not considered as important when it comes to weighting risk.

- Q 4- A large majority of residents felt their community was moderately to well prepared for wildfire, although when questioned some residents were not sure what capacity fire departments had to respond to a wildfire incident. Improved education and outreach from fire departments into the community is needed so that residents are better engaged with their local fire responders.

- Q 5- When asked what factors residents felt could help better prepare them for wildfire, answers were mixed but slightly more people would like to see a focus on yard maintenance and clean-up of properties and fuels in their community, showing that they recognize that they have a responsibility for reducing wildfire risk and do not depend entirely on external response from fire departments. Community education also rated high which was reflected in the interest that residents had for fire prevention information, defensible space literature and other emergency preparedness actions.

- Q 6- Time is considered the greatest hurdle by residents in making their home more fire safe, followed by financial burden of maintaining clearances and structure maintenance. Many residents responded that they didn't know what to do which supports the results of question 5, where residents would like more community education regarding fire prevention. These results suggest that information on implementing cost effective and realistic measures for risk reduction are needed.

- Q 7- When asked what residents would like to see funded for reducing wildfire hazard, funding fire departments was the most popular response, followed by education, wildfire assessments and green-waste disposal. These patterns suggest that while residents depend on external fire response to protect their life and property, they understand that preventative measures, associated with reducing hazardous fuels (green-waste disposal), are also a key part of the wildfire preparedness process. Their desire for additional education and wildfire assessments further solidify that this community is looking for information on how they can independently reduce wildfire risk by addressing hazards on their property, and that current educational programs are not fulfilling their need for information.

- Q 8- In order to determine community perceptions of prescribed fire, the survey asked residents if they support the practice for vegetation management. Over 80% of residents were in favor of prescribed fire, and many residents provided additional comment suggesting that they would encourage expanded use in both counties. This is encouraging as it shows the public are interested in increasing the use prescribed fire for fuel reduction or forest restoration and this could increase opportunities being sought by state and federal partners to increase landscape level treatments.

- Responses to open ended questions:

    - A resident suggested the use of portable tanks or construction of permanent ponds in remote areas to provide water for the use of fire departments.

    - A resident suggested that better coordination is needed between federal, state and local responders in order that they align objectives for suppression of fires. Specifically they state "If we put all this money into prescribed fire why do we put out wildfires with no harm to infrastructure?"

    - A resident suggested that "The predominant major fire risk is from the DCNR and Allegheny Forest. They have reasonable plans in place, but there is not enough coordinating between state and federal agencies and local entities. As a result a small burn could be more major than it needs to be. Also, some of the normal "target issues" are different here than other forest. The forest is actively managed to cut on a rotational basis, smaller scale than most western forests and needs unique planning".

    - A resident was concerned about oil and gas development in forested areas or areas with heavy brush and how that infrastructure may be a fire hazard.

    - A number of residents called for an increase in the use of "controlled burns".

    - Another resident who supports prescribed burning wrote "Prescribed burning will not only reduce the risk of high heat/high intensity wildland fires, but will also help with tick issues and could help with Lymes Disease issues by allowing naturally vegetated areas to burn during prescribed burns".

- A residents suggested “reactivating the high school forest firefighting teams”.
- A resident called for local governments to impose burning bans during dry periods.
- Residents place immense value on the public lands within the counties, and many call for protection of these public forest lands.

SOCIAL MEDIA

A Facebook page was developed for the project in order to provide an alternative forum through which to reach community members. The page provided a link to the online survey and a place to post announcements about the project and other relevant fire preparedness information. The profile page can be found at: https://www.facebook.com/ElkandMcKeanFirePlans.

PUBLIC OUTREACH

The main outreach for the Elk County CWPP occurred during the Elk Expo in August 2017. An information booth was established at the Expo and visitors were encouraged to complete the CWPP survey, discuss their concerns regarding wildfire in the county, and were provided with educational materials regarding the development of defensible space, hardening the home and emergency preparedness (Figure 67 and Figure 68). Elk County residents were also shown the risk assessment and asked to provide feedback.

CWPP outreach was also completed by DCNR through their attendance at the Elk County Fireman’s Carnival from July 17th to 22nd and the Elk County Fair from August 8th to 12th. A large number of surveys were completed and returned during that outreach effort.

Figure 67. Educational outreach for the Elk County CWPP at the Elk County Expo on August 20th 2017.

Figure 68. Elk Expo

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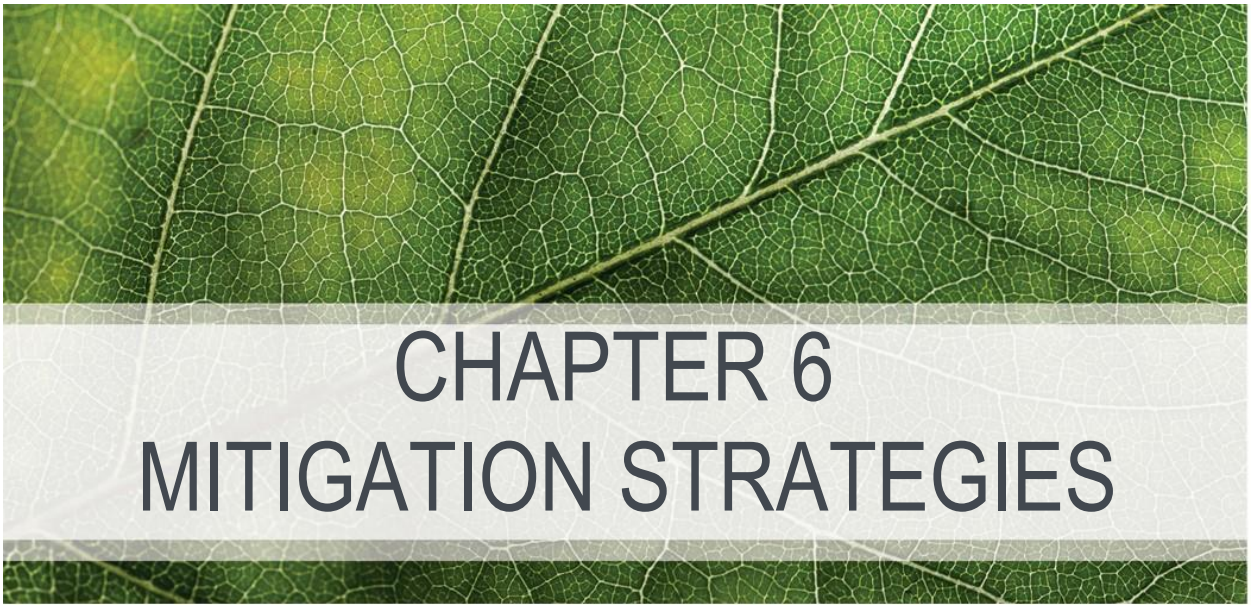

CHAPTER 6
MITIGATION STRATEGIES

RECOMMENDATIONS AND ACTION ITEMS

This chapter addresses four different types of recommendations: 1) fuels reduction projects, 2) public education and outreach, 3) actions homeowners and communities can take to reduce structural ignitability, and 4) actions to improve firefighting capability. These recommendations are based on Core Team input, public outreach, the Composite Risk/Hazard Assessment, and the Community Risk/Hazard Assessment. These recommendations address common wildfire hazards that are found throughout WUI communities in the County (described in the Communities at Risk descriptions section in Chapter 4), for example, limited defensible space, poor access, limited wildfire response and fuel hazards. The recommendations are general in nature to provide maximum flexibility in implementation.

RECOMMENDATIONS FOR FUELS REDUCTION PROJECTS

The purpose of any fuels reduction treatment is to protect life and property by reducing the potential for catastrophic wildfire, as well as to restore landscapes to a sustainable and healthy condition. Although Elk County is not prone to frequent fires with extreme fire behavior, in the event that fuels accumulate to a high level and the conditions are prime for fire there remains potential for more severe wildfire impacts. Moderating severe fire behavior, reducing structural ignitability, creating defensible space, providing safe evacuation routes, and maintaining all roads for firefighting access are methods of fuels reduction likely to be used around communities located in a WUI zone. Use of multiple treatment methods often magnifies the benefits.

Fuels should be modified with a strategic approach across Elk County to reduce the threat that wildfires pose to lives, property, and other values. Pursuant to these objectives, recommendations have been developed that focus initially on areas adjacent to structures (defensible space), then near community boundaries (fuel breaks, cleanup of adjacent open spaces), and finally in the wildlands beyond community boundaries (larger-scale forest health and restoration treatments).

While not necessarily at odds with one another, the emphasis of each of these treatment types is different. Proximate to structures, the recommendations focus on reducing fire intensity consistent with Firewise and International Fire Code standards. Further into open space areas, treatments will tend to emphasize the restoration of historic conditions and general forest health, with consideration for commercial timber production which is key management focus in the region. Cooperators in fuels management should include federal, state, and local agencies as well as timber industry representatives and interested members of the public.

Table 9 summarizes the types of treatments recommended throughout the planning area. Many of these treatment recommendations are general across the communities because similar conditions and concerns were raised for all communities that border wildland areas. Table 9 addresses the requirement for an action plan and assessment strategy by providing monitoring guidelines and a timeline for implementation. This timeline is obviously dependent on available funding and resources, as well as NEPA protocols for treatments on public lands.

Figure 69 provides some conceptual hazardous fuel reduction projects that could be implemented by communities and land managers to address wildfire risk close to WUI communities. Fuel treatments could be developed on a landscape scale or could be small scale treatments that serve as fuel breaks, buffering WUI communities from wildland fuels. These treatment areas are delineated based upon the results of the Composite Risk Hazard Assessment (Figure 42) in Chapter 4. It is important to note that recommended fuel treatment projects in this CWPP are conceptual and have not been field verified for viability and if on federal lands, would have to undergo the NEPA process to assess their impacts on natural and cultural resources. The best type of fuels treatment for each area would be determined during this process, which incorporates thorough public scoping. Various fuel treatment methods are discussed in detail below. Although fuel treatments are designed to help to mitigate high intensity fire behavior and allow firefighters access for suppression efforts, no fuel treatments suggested here can be 100% guaranteed to protect life and property, particularly when environmental conditions are primed to create catastrophic fire behavior.

The treatment list is by no means exhaustive and should be considered purely a sample of required projects for the future management of the planning area. Many projects may be eligible for grant funds available from federal and/or state sources. For a list of funding sources please refer to Appendix G.

Fire management cannot be a one-size-fits-all endeavor; this plan is designed to be flexible. Treatment approaches and methods will be site-specific and should be adapted to best meet the needs of the landowner and the resources available. Moreover each treatment recommendation should address protection of CVARs, particularly the protection of sensitive species. It is the intent of this plan to be an evolving document that will incorporate additional areas of the ECCWPP planning area as they change in risk category over time.

Table 9. Fuels Reduction Treatment Recommendations

PROJECT DESCRIPTION	PURPOSE	LOCATION	LAND OWNERSHIP	METHOD AND GOAL	TIMELINE	RESOURCES/ FUNDING SOURCES AVAILABLE	PRIORITY
Roadside thinning along access roads and evacuation routes with scheduled maintenance to improve sustainability.	Helps address poor ingress and egress, especially narrow roads found throughout the County.	All communities where appropriate.	Private, USFS, DCNR lands	Reduce fuel loading along roadways in order to mitigate potential ignitions from highway, but also provide safe clearance to facilitate evacuation and emergency access. Mechanical treatment: tree removal, mowing. Herbicide treatment as needed or appropriate. Design maintenance schedule depending upon vegetation type. Goal is to maintain clearance during both spring and fall fire season.	High priority on over grown routes. Implement within 2 years and maintain annually or as outlined in maintenance schedule.	Hazardous Fuels funding	High
Develop wood product related industry for small diameter timber.	Provides a market for fuel reduction material.	Countywide	All jurisdictions		Long-term goal- over the next decade.	Lumber Heritage region as a partner Johnsonburg paper mill	Low
Build additional landscape-level treatments to support restoration of oak-hickory forest where appropriate.	Improves forest health.	Countywide	All jurisdictions	Develop an interagency working group (or similar) to provide detailed action plan and strategy for landscape treatment on all jurisdictions where restoration is viable and appropriate. Continue current initiatives to increase collaboration across boundaries. Utilize the risk assessment to help locate priority areas within the WUI. Appoint a chair and a representative responsible for seeking grant opportunities.	High priority Quarterly meeting of working group.	See Appendix G	High
Design and implement insect and disease focused treatments to combat existing and potential threats to native species.	Reduces potential for increased wildfire behavior generated by high mortality.	Countywide	USFS, DCNR	Design and implement treatments to combat for example beech bark disease, emerald ash borer and the hemlock woolly adelgid that would create an increased fuel hazard over the next decade or more. Continue to implement annual monitoring flights to identify and map badly hit areas. Implement proactive treatments to reduce spread, i.e., reduce restrictions on firewood cutting of potentially impacted stands and/or implement timber sales in areas to reduce competition in stands that could be prone to infestation. Model on actions taken to encourage firewood cutting of ash at camp sites in order to address emerald ash borer infestations. Continue removal of diseased trees.	Medium to long term; seek to develop plan out 10 years to address potential future threats.	See Appendix G	Moderate

PROJECT DESCRIPTION	PURPOSE	LOCATION	LAND OWNERSHIP	METHOD AND GOAL	TIMELINE	RESOURCES/ FUNDING SOURCES AVAILABLE	PRIORITY
Develop and promote integrated treatments across jurisdictions that serve to meet wildlife habitat goals while also providing fuel reduction benefits. **See** Figure 69 **for conceptual treatments.**	Increases funding pool for treatments that serve more than one management goal.	Countywide	All jurisdictions	Follow treatment guidelines for sensitive species, i.e. ruffed grouse, and utilize to maximize complimentary beneficial impacts on reducing wildlife hazard. Example: creation of permanent grassland openings in upland forest areas to support ruffed grouse (per the ANF LRMP), can also reduce fuel continuity in upland forests, promote early seral species, and establish greater structural diversity for overall forest health. Utilize a mixture of even-aged and uneven-aged management to create mosaics of forest structure that enhance habitat quality while also slowing wildfire spread.	Medium to long term; seek to develop plan out 10 years.	Cooperative work with oil and gas companies during installation and/or remediation	Moderate
Develop and promote integrated treatments across jurisdictions that serve to meet commercial timber output objectives while also providing fuel reduction benefits.	Increases funding pool for treatments that serve more than one management goal.	Countywide	All jurisdictions	Design timber sales with consideration of wildfire hazard mitigation.	Ongoing	See Appendix G	High
Develop action plan for landscape treatment of invasive species to reduce impacts of infestation on fire hazard.	Provide landscape wildfire hazard mitigation.	Countywide	Federal and state, but encourage landscape-level treatments on private lands.	Work closely with Conservation District to develop action plan for control of problem species on a landscape scale and/or watershed scale throughout the county. Consider pre-treatment of areas scheduled for timber stand improvement.	Fall 2018	See Appendix G	High
Promote increased use of prescribed fire on private forest lands to promote landscape scale restoration of oak-dominated forest. **Include planning for treatment monitoring and maintenance.**	Address residents' desire for increased use of prescribed burning for forest management.	Countywide, where appropriate	All jurisdictions	Build on federal and state prescribed burn programs. Utilize volunteer fire fighters if possible in order to provide training opportunities. Pursue grants that would allow continued monitoring and maintenance burns. *Maintenance cycles for treatments:* *Repeat treatment 2–5 years for prescribed fire.* *Invasive species treatment: annual return to start and then maintenance.* *2–4 entries and then back off (timber)* *Grassland and shrubs: 2 year cycle.* *Thinning treatments follow up with fire every 2–3 years; 10–15 years thinning again.*	2019	See Appendix G	High

PROJECT DESCRIPTION	PURPOSE	LOCATION	LAND OWNERSHIP	METHOD AND GOAL	TIMELINE	RESOURCES/ FUNDING SOURCES AVAILABLE	PRIORITY
Promote private forest landowner forest improvement plans (FIPs) and seek funds to implement.	Increase active forest management on private lands that would promote healthy forests and address wildfire fire hazard.	Countywide	Private	Develop public outreach campaign to promote adoption of FIPs Form a task force to identify grant funding for FIP implementation. Utilize existing organizations and networking to gain traction with landowners already active in forest management.	2018–2019	See Appendix G	High
Create new or maintain existing fuel breaks on the western edge of communities whenever fuel condition warrant it. **See Figure 69 for conceptual treatments.**	Reduce wildfire hazard where communities are most at risk due to prevailing wind direction.	High risk areas in the CWPP planning area.	Federal and state lands	Strategically place treatments on public land to improve effectiveness. Fuel break prescriptions should be site-specific, depending on fuel type, topography, soils, and adjacent land management practices. Examples include mowing and blading strips along fence lines or shaded fuel breaks. Help mitigate fire behavior and provide an area from which firefighters can safely suppress a fire. Regular maintenance needed to ensure access is clear of vegetation or obstructions including stumps that impact access by emergency vehicles. Monitoring should occur prior to fire season (January).	2018–2019	See Appendix G	High

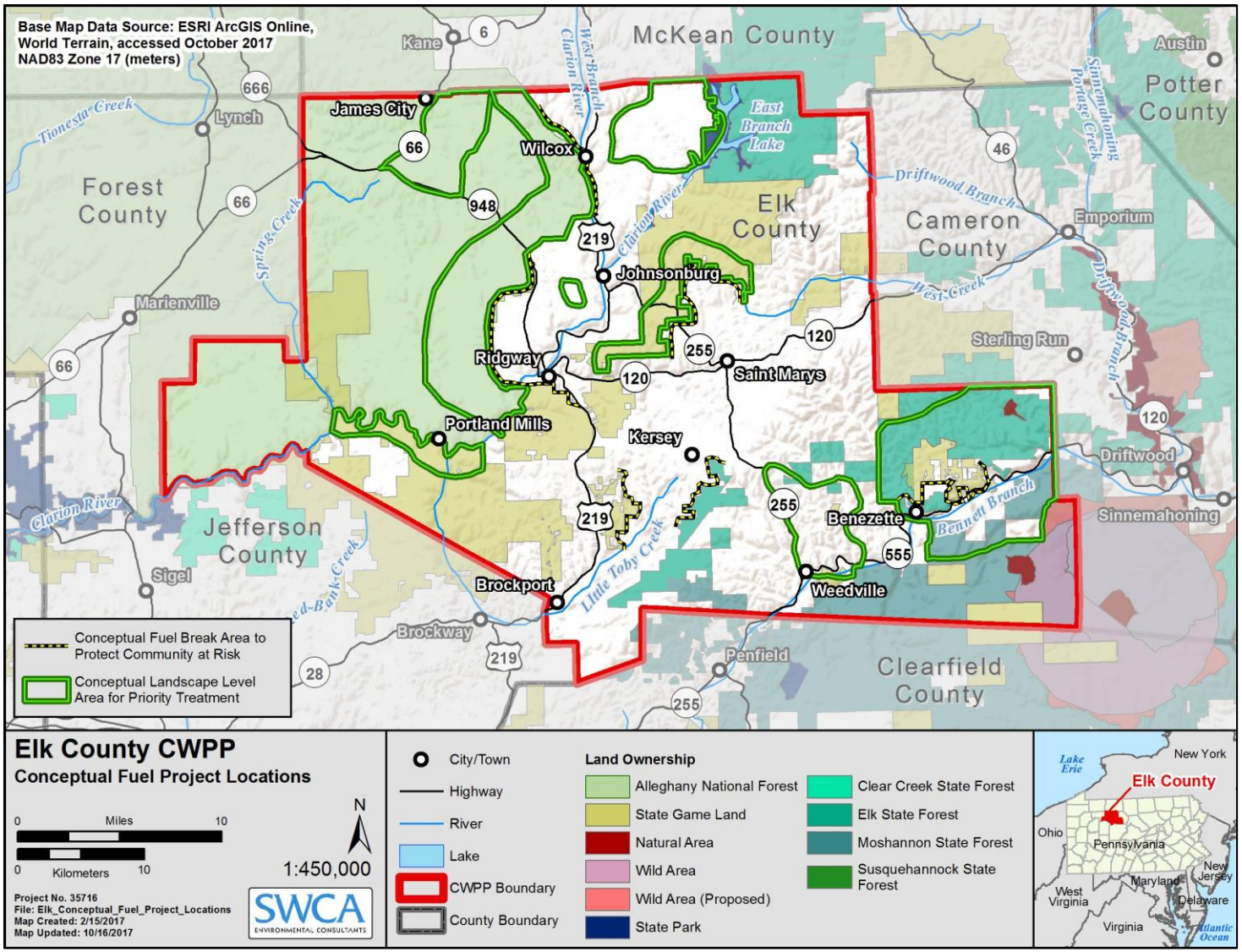

Figure 69. ***Conceptual fuel project locations showing possible landscape level treatments and fuel breaks that could be implemented in order to address wildfire risk to communities in the WUI.***

FUELS TREATMENT SCALES

DEFENSIBLE SPACE

Defensible space is perhaps the fastest, most cost-effective, and most efficacious means of reducing the risk of loss of life and property. Although fire agencies can be valuable in providing guidance and assistance, creating defensible space is the responsibility of the individual homeowner. See Chapter 5 for more details.

Effective defensible space consists of creating an essentially fire-free zone adjacent to the home, a treated secondary zone that is thinned and cleaned of surface fuels, and (if the parcel is large enough) a transitional third zone that is basically a managed forest area. These components work together in a proven and predictable manner. Zone 1 keeps fire from burning directly to the home; Zone 2 reduces the adjacent fire intensity and the likelihood of torching, crown fire, and ember production; and Zone 3 does the same at a broader scale, keeping the fire intensity lower by maintaining a more natural, historic condition (Figure 70).

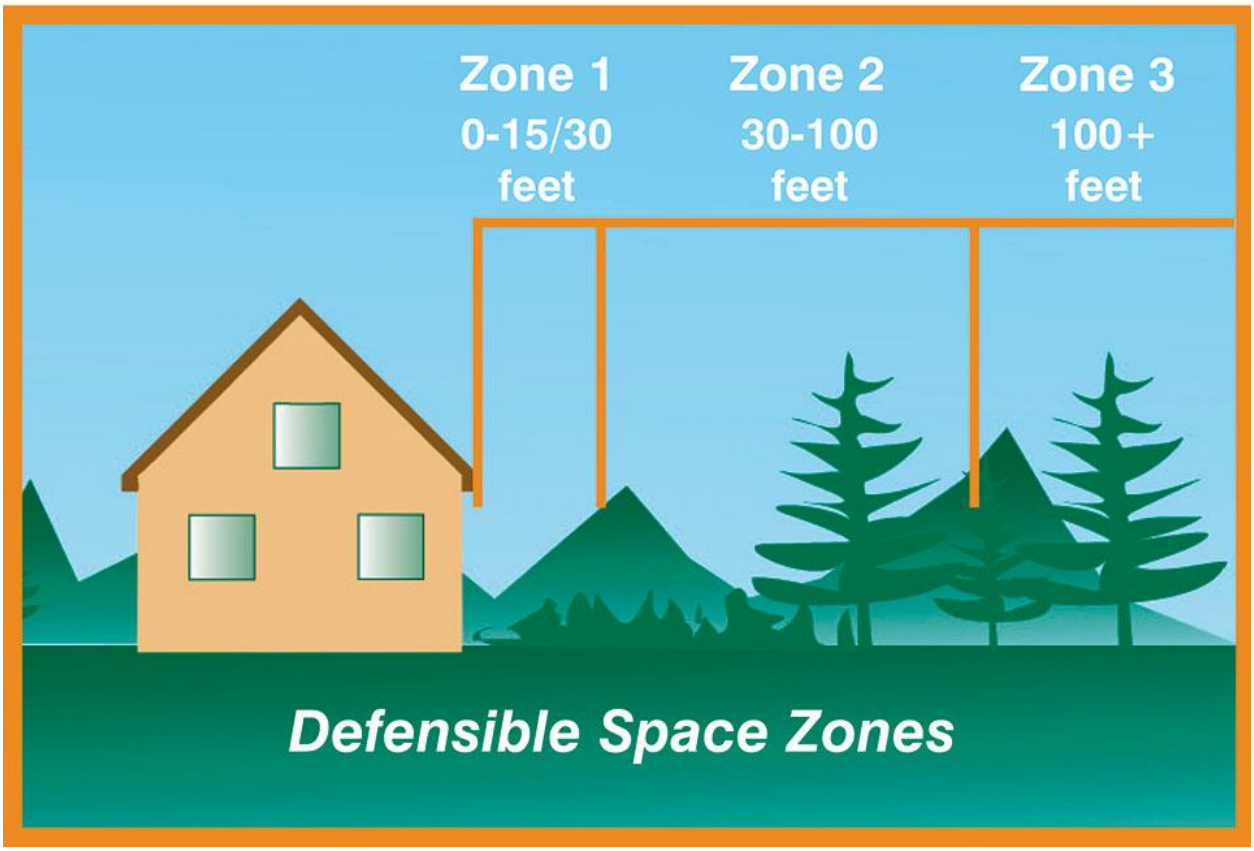

Figure 70. Defensible space zones. Source: www.firewise.org

It should be emphasized that defensible space is just that—an area that allows firefighters to work effectively and with some degree of safety to defend structures. While defensible space may increase a home's chance of surviving a fire on its own, a structure's survival is not guaranteed, with or without firefighter protection. Nevertheless, when these principles are consistently applied across a neighborhood, everybody benefits.

Specific recommendations should be based on the particular hazards adjacent to a structure such as slope steepness and fuel type. Local fire authorities or a state forester should be contacted if a professional assessment seems warranted. Firewise guidelines and the Homeowners Guide (Appendix H) are an excellent resource, but creating defensible space does not have to be an overwhelming process. Assisting neighbors may be essential in many cases. Homeowners should consider assisting the elderly, sharing ladders for gutter cleaning, and assisting neighbors with large thinning needs. Adopting a phased approach can make the process more manageable and encourage maintenance (Table 10).

Table 10. Example of a Phased Approach to Mitigating Home Ignitability

YEAR	PROJECT	ACTIONS
1	Basic yard cleanup (annual)	Dispose of clutter in the yard and under porches. Remove dead branches from yard. Mow and rake. Clean off roofs and gutters. Remove combustible vegetation near structures. Coordinate disposal as a neighborhood or community. Post 4-inch reflective address numbers visible from road.
2	Understory thinning near structures	Repeat basic yard cleanup. Limb trees up to 6–10 feet. Trim branches back 15 feet from chimneys. Trim or cut down brush. Remove young trees that can carry fire into forest canopy. Coordinate disposal as a neighborhood or community.
3	Understory thinning on private property along roads and drainages	Limb trees up to 6–10 feet. Trim or cut down brush. Remove young trees that can carry fire into forest canopy. Coordinate disposal as a neighborhood or community.
4	Overstory treatments on private property	Evaluate the need to thin mature or diseased trees. Prioritize and coordinate tree removal within neighborhoods to increase cost effectiveness.
5	Restart defensible space treatment cycle	Continue the annual basic yard cleanup. Evaluate need to revisit past efforts or catch those that were bypassed.

FUEL BREAKS AND OPEN SPACE CLEANUP

The next location priority for fuels treatments should be where the community meets the wildland. This may be the outer margins of a town or an area adjacent to occluded open spaces such as a park. Fuel breaks (also known as shaded fuel breaks) are strips of land where fuel (for example, living trees and brush, and dead branches, leaves, or downed logs) has been modified or reduced to limit the fires ability to spread rapidly. It is important to note that roads, trails, clearings etc. are all a form of fuels breaks. On State Forest lands for example Forest Roads are routinely brushed on both sides, even those roads that are gated. Right of Ways for pipeline and transmission lines are also periodically mowed. In Elk County there are also 450 acres of food plots on State lands that act as fuel breaks.

Fuel breaks should not be confused with firebreaks, which are areas where vegetation and organic matter is removed down to mineral soil. Shaded fuel breaks may be created to provide options for suppression resources or to provide opportunities to introduce prescribed fire. In many cases, shaded fuel breaks may be created by thinning along roads. This provides access for mitigation resources and firefighters, as well as enhancing the safety of evacuation routes.

LARGER-SCALE TREATMENTS

Farther away from WUI communities, the emphasis of treatments often becomes broader. While reducing the buildup of forest fuels from wind damage, insect and disease outbreaks, or general mortality remains important, other objectives are often included, such as restoration of historic conditions and forest health. Wildfires will burn across jurisdictional boundaries, sometimes on landscape scales. As such, these larger treatments need to be coordinated on a strategic level. This requires coordination between projects and jurisdictions, as is currently occurring. Land managers have carried out numerous forest restoration projects across the county and region and have ongoing projects planned on public lands that are designed to reduce hazardous fuels to protect communities and resources, while restoring the declining oak forest community (see Figure 28 and Figure 29).

FUEL TREATMENT METHODS

Silvicultural treatments are designed to achieve site specific resource management objectives. On public lands such as the ANF, these include improving age class diversity; developing desired visual conditions; maintaining tree vigor and forest health; carrying out integrated pest management; maintaining species composition; enhancing wildlife habitat; responding to overstory mortality, blowdown, or catastrophic damage; accelerating the development of late structural characteristics; and restoring structural conditions in forested stands (USFS 2007). Objectives will vary depending on the landownership and forest uses; however, timber harvest is the common, primary tool used to accomplish most objectives. Because of the focus on hardwood timber production in the region, timber product mix, revenues, and contributions to local and regional economies is key to determining the forest management approach. Prescribed fire, non-commercial reforestation treatments, and herbicide application are also used however to achieve vegetation management objectives of a non-commercial nature, such as wildlife habitat improvements, recreation and insect and disease control (Figure 71).

Figure 71. Herbicide application used in forest management and treatment of invasive species. Credit: DCNR.

Since specifics of the treatments are not provided in detail in Table 9, different fuels reduction methods are outlined in the following narrative.

Several treatment methods are commonly used, including manual treatments, mechanized treatments, and prescribed fire (Table 11). This brief synopsis of treatment options is provided for general knowledge; specific projects will require further planning. The appropriate treatment method and cost will vary depending on factors such as the following:

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

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

Table 11. Summary of Fuels Treatment Methods

TREATMENT	COMMENTS
Machine mowing	Appropriate for large, flat, grassy areas on relatively flat terrain.
Prescribed fire	Can be very cost effective. Ecologically beneficial in certain forest types. Not appropriate for all species. Can be used as training opportunities for firefighters. May require manual or mechanical pretreatment. Carries risk of escape, which may be unacceptable in some WUI areas. Unreliable scheduling due to weather and smoke management constraints.
Brush mastication	Brush species tend to re-sprout vigorously after mechanical treatment. Frequent maintenance of treatments are typically necessary. Mastication tends to be less expensive than manual (chainsaw) treatment and eliminates disposal issues.
Timber mastication	Materials up to 10 inches in diameter and slopes up to 30% can be treated. Eliminates disposal issues. Environmental impact of residue being left on site is still being studied.
Manual treatment with chipping or pile burning	Requires chipping, hauling, pile burning of slash in cases where lop and scatter is inappropriate. Pile burning must comply with smoke management policy.
Feller buncher	Mechanical treatment on slopes more than 30% or of materials more than 10 inches in diameter may require a feller buncher rather than a masticator. Costs tend to be considerably higher than masticator.

MANUAL TREATMENT

Manual treatment refers to crew-implemented cutting with chainsaws. Although it can be more expensive than mechanized treatment, crews can access many areas that are too steep or otherwise inaccessible with machines. Treatments can often be implemented with more precision than prescribed fire or mechanized methods allow. Merchantable materials and firewood can be removed while non-merchantable materials are often lopped and scattered, chipped, or piled and burned on site. Care should be exercised to not increase the fire hazard by failing to remove or treat discarded material in a site-appropriate manner.

Strategic timing and placement of fuels treatments is critical for effective fuels management practices and should be prescribed based on the conditions of each particular treatment area. Some examples of this would be to place fuel breaks in areas where the fuels are heavier and in the path of prevailing winds and to mow grasses just before they cure and become flammable. Also, burning during the hotter end of the prescription is important since hotter fires are typically more effective at reducing heavy fuels and shrub growth. In areas where the vegetation is sparse and not continuous, fuels treatments may not be necessary to create a defensible area where firefighters can work. In this situation, where the amount of fuel to carry a fire is minimal, it is best to leave the site in its current condition to avoid the introduction of exotic species.

MECHANIZED TREATMENTS

Mechanized treatments include mowing, mastication (ground-up timber into small pieces), and whole tree felling. These treatments allow for more precision than prescribed fire and are often more cost effective than manual treatment (Figure 72 and Figure 73).

Figure 72. Use of a Rower to open-up forest understory- Before Treatment. Credit: DCNR.

Figure 73. Following Treatment, open understory. Credit: DCNR.

Mowing, including ATV and tractor-pulled mower decks, can effectively reduce grass fuels adjacent to structures and along highway rights-of-way and fence lines. For heavier fuels, a number of different masticating machines can be used, including drum- or blade-type masticating heads mounted on machines and ranging in size from a small skid-steer to large front-end loaders. Some masticators are capable of grinding standing timber up to 10 inches in diameter. Other masticators are more effective for use in brush or surface fuels. Mowing and mastication do not actually reduce the amount of on-site biomass, but alter the fuel arrangement to a less combustible profile.

In existing fuel break areas maintenance is crucial especially in areas of encroaching shrubs or trees. In extreme risk areas more intensive fuels treatments may be necessary to keep the fire on the ground surface and reduce flame lengths. Within the fuel break, shrubs should be removed, and the branches of trees should be pruned from the ground surface to a height of 4 to 8 feet, depending on the height of the fuel below the canopy, and thinned with a spacing of at least two to three times the height of the trees to avoid movement of an active fire into the canopy.

Mechanical shears mounted on feller bunchers are used for whole tree removal. The stems are typically hauled offsite for utilization while the limbs are discarded. The discarded material may be masticated, chipped, or burned in order to reduce the wildfire hazard and to speed the recycling of nutrients.

Commercial Timber Practices

Even-aged Management

Even-aged management can occur with or without tree retention. Timber harvest with tree retention matures to a multi-aged stand with more complex forest conditions. Timber harvest without tree retention, otherwise known as a “clear cut” is the most economical method of harvest and maximizes volume production, but creates a single-story, single-aged stand. A mosaic of stand ages is present across the landscape. Areas managed under this prescription result in a forest of Allegheny, upland, or oak hardwood stands with inclusions of conifer, shrub, and herbaceous openings (USFS 2007).

Uneven-aged Management

Uneven-aged management is designed to create a stand with multiple ages of trees. This approach increases forest resiliency by increasing spacing between tree crowns and is appropriate where emphasis is on retention of older forest stands (which is essential for the long-term overall health of the stand). Diameter limits are generally seen as sideboards that help facilitate successful project implementation. Areas managed under this prescription consist of a forest of uneven-aged northern or upland hardwood stands with inclusions of conifer, shrub, and herbaceous openings. Species composition varies, but shade-tolerant and mid-tolerant species will be dominant.

Uneven-aged Management with “Gap” Openings

Similar to uneven-aged management, this approach creates open gaps that are regenerated with younger stands. This practice helps retain areas of older forest, but also promotes younger growth.

Pre-commercial Thinning

Pre-commercial thinning can be used as an intermediate harvest to improve tree growth or to expedite structural complexity. Trees are removed from the understory to improve growing conditions for residual trees. This treatment improves forest resiliency to insect, disease, and drought by reducing competition. Treatments to improve structural complexity involve the harvest of a range of sizes of trees to increase structural diversity. The openings created increase botanical diversity within the understory. Density reduction can also be used to make a stand more resilient to wildfire by reducing fuel loading (the volume of fuels that could contribute to wildfire intensity and spread). Stands are treated by the removal of commercial sized trees, and cutting and removal of non-commercial trees.

Individual Tree Selection

This practice targets harvest of individual trees within a stand, creating minimal impact on the overall stand structure. Small openings can be created, which increases stand diversity.

FUEL BREAKS

Fire behavior in the CWPP planning area has been modeled using FlamMap. This assessment provides estimates of flame length and rate of spread; the information should be used by land managers when prescribing treatments. Land managers are cautioned, however, that fuel breaks will not always stop a fire under extreme fire behavior or strong winds; these should only be seen as a mitigating measure and not a fail-safe method for fire containment. Furthermore, fuel break utility is contingent upon regular maintenance, as regrowth in a fuel break can quickly reduce its effectiveness and vegetation in this ecosystem is known to quickly re-sprout and re-establish.

Because of the dominant wind patterns in Elk County (i.e., out of the west-southwest), fuel breaks are recommended on the west sides of communities.

It is not possible to provide a standard treatment prescription for the entire landscape because fuel break dimensions should be based on the local fuel conditions and prevailing weather patterns. For example, in some areas, clearing an area too wide could open the landscape to strong winds that could generate more intense fire behavior and/or create wind throw.

Strategic placement of fuel breaks is critical to prevent fire from moving from wildland fuels into adjacent neighborhoods. For effective management of most fuels, fuel breaks should be prescribed based on the conditions in each particular treatment area. Some examples of this would be to place fuel breaks in areas where fuels are heavier or in areas with easy access for fire crews. In areas where the vegetation is discontinuous, fuel treatments may not be necessary. In this situation it is best to leave the site in its current condition to avoid the introduction of more flammable, exotic species which may respond readily following disturbance.

Well-managed fuels reduction projects often result in ecological benefits to wildlife and watershed health. Simultaneously, planning and resource management efforts should occur when possible while reducing fuels to ensure that the land remains viable for multiple uses in the long term. The effectiveness of any fuels reduction treatment will increase over time with a maintenance and monitoring plan. Monitoring will also ensure that objectives are being met in a cost-effective manner.

PRESCRIBED BURNING

Although the focus of wildfire risk mitigation is often on the reduction and removal of vegetation, and the prevention and suppression of wildfire, fire under the right circumstances can be not only a useful tool to reduce hazardous amounts of fuel but also an important factor in wildland ecosystems. Many fire and resource management agencies at the local, state, and federal levels include the use of fire in their programs (Figure 74), but current use of fire is limited.

Figure 74. Prescribed fire in grassland areas. Credit: DCNR.

It is important to note that only some vegetation types found in Elk County are suitable for prescribed fire. Some species may experience significant adverse impacts from prescribed fire as they are not fire adapted. According to land managers, frequent burning is necessary for the maintenance of eastern oak-dominated forests (Haines et al. 2001; Parker and Ruffner 2004; Ruffner 2006; Nowacki and Abrams 2008), but would be inappropriate in many other hardwood forests in the county. Prescribed fire in oak woodlands can achieve many management goals, including controlling forest diseases or insects, maintaining early successional habitats, and reducing excessive build-up of biomass in wildland areas (Riechman et al. 2014)(Figure 75). Prescribed fire is often coupled with harvest or mechanical treatments in order to achieve an appropriate level of disturbance needed to initiate oak regeneration (Brose et al. 2013; Riechman et al. 2014).

Figure 75. Prescribed burning in woodlands. Credit DCNR.

Applying fire to a mosaic of landownership requires exhaustive collaboration between landowners and extensive training of crews. The use of prescribed fire has several requirements to be successful, including the following:

- Planning documents include approval authority, burn objectives, preparation requirements, weather and fuels conditions under which the burn will be performed, operational responsibilities, contingency planning in the event of an escape, and post-burn monitoring to document the attainment of burn objectives and other potential fire effects, such as the occurrence of invasive species.
- Specific attention must to be given to smoke management and weather forecasts concerning smoke direction and atmospheric mixing patterns. Consultation between the agencies involved with the burn and the air district needs to occur early in the planning cycle, especially with regard to identification of suitable weather periods for the burn to be conducted. Conditions suitable for the fire agency may not be suitable from the perspective of the air district. If there are known smoke sensitivities in the community, the agencies should reach out to those people and should consider that in the burn plan.
- Public education and outreach is vital given the frequent concern by the public over smoke, risk of escape, and post-fire appearance of the burn unit. It is unlikely that all of the public will support the prescribed fire program, but outreach conducted through social media and on-site visits to the post-burn areas as they recover can develop a broad base of support, especially if the fire has stimulated the occurrence of desirable species considered to be rare.

Prescribed Burning Practices Act (2009)

Prescribed fire activities are governed by the Pennsylvania Prescribed Burning Practices Act, Act 17 of 2009. The act recognizes the function of prescribed burning as a land management tool that benefits the safety of the public, the environment, and the economy of the commonwealth. The act encourages the continued use of prescribed burning for fuel reduction and ecological, forest, wildlife, and grassland

management purposes. The act stipulates the necessary procedures that agencies should follow in implementing a prescribed burn and outlines the required qualifications of prescribed burn managers and the content that should be included in a prescribed burn plan.

Pennsylvania Prescribed Fire Council

The Pennsylvania Prescribed Fire Council was formed to promote the exchange of information, techniques, and experiences of the Pennsylvania prescribed fire community and to promote public understanding of the importance and benefits of prescribed fire. The council comprises a wide range of land management agency representatives from federal, state, and county levels, conservation organizations, and non-profit organizations. More information on the Pennsylvania Prescribed Fire Council can be found here: http://www.paprescribedfire.org.

Allegheny National Forest Prescribed Fire Program

On ANF lands, LRMP guidance is to use fire where appropriate to sustain and restore forest and non-forest vegetation communities. According to the FMP, the ANF will apply prescribed burning (and mechanical treatment) for hazardous fuel reduction on 100 to 600 acres annually. Each year the ANF plans and prepares areas to conduct prescribe burns in various locations across the forest.

Prescribed burn objectives may include one or more of the following:

- to stimulate growth of native vegetation that are well-adapted to fire and impede vegetation that is not;
- to improve wildlife habitat;
- to improve the visual quality of the area; and
- to reduce the likelihood and severity of a wildfire, thereby increasing safety for the public and firefighters in case of a wildfire.

The ANF FMP requires that all fire suppression and prescribed fire should employ suppression techniques based on safety, minimal potential loss of or damage to resources (using MIST), and cost effectiveness. In order to mitigate for potential smoke impacts from wildfire, the best available smoke management practices should be used in prescribed fire design and implementation to avoid or reduce adverse effects on public health and safety.

An integral part of ecological burning is an understanding of historic fire regimes, as these often serve as justification for burning as well as restoration targets (Brose et al. 2013). As described previously, many oak-dominated areas evolved with frequent fire. Prescribed burning is used on ANF lands in these fire-adapted ecosystems in order to improve the successfulness of regenerating certain oak species, particularly where overstory maple and beech may lower success. Prescribed burns can also be applied to prepare seedbeds for white pine, aspen, or hemlock regeneration, though on a limited basis. Timely surface fires have been shown to increase oak seedlings and sprout densities by disturbing the ground, top killing competing species, and promoting sprouting by oak species (Figure 76). New information and science indicates this will give the species the competitive advantage needed to ensure an oak component in the next stand (Brose et al. 1999a, 1999b, 2006). Repeated burns over a 10-year period may be necessary to fully promote oak regeneration.

Figure 76. Prescribed Fire in oak dominated hardwood forests. Credit: DCNR.

Prescribed fire has several limitations on the Allegheny Plateau. First, the numbers of operational burning days are limited in some years, depending on factors such as weather and precipitation. Additionally, the fuel that carries fire on the ANF typically consists of leaf litter. Differences exist in the flammability of leaf litter between different forest types. The leaf litter of oaks contains high lignin content, decomposes more slowly, and is more flammable than the leaf litter of other forest types found on the ANF (Abrams 1992). Conversely, the Allegheny, upland, and northern hardwood forests typically do not develop a fuel accumulation large enough to sustain fires in each of several successive years. Due to the susceptibility of trees and seedlings comprising non-oak types on the ANF to damage and/or mortality from the use of fire, fire is not a viable option for controlling interfering vegetation in non-oak types.

DCNR Prescribed Fire Program

Pennsylvania prescribed fire standards outlined in the 2009 Prescribed Burning Practices Act specify qualifications, training requirements, safety issues, and burn plan content (DCNR 2016). The prescribed fire program in the DCNR is increasing as agency staff are trained in the use of prescribed fire as a tool. Acres treated have been increasing since 2010 (Table 12), with most treatments focused on oak regeneration. The DCNR is interested in expanding the use of prescribed fire beyond oak regeneration treatments into landscape level management.

Table 12. Prescribed Fires Conducted on DCNR Lands, 2010–2015

YEAR	NO. OF PRESCRIBED FIRES	ACRES TREATED	AVERAGE SIZE (ACRES)
2010	12	186	14
2011	11	189	17
2012	10	208	21
2013	33	844	26
2014	22	357	16
2015	47	1,317	28

Agency use of prescribed fire on public lands is carried out within the confines of the agency's fire management planning documents and would require individual prescribed burn plans that are developed for specific burn units and consider smoke management concerns and sensitive receptors within the WUI (Figure 77).

Figure 77. DCNR prescribed fire in hardwood forests in the region. Credit: DCNR.

Following any type of fuels reduction treatment, post-treatment monitoring should continue to ensure that management actions continue to be effective throughout the fire season. The vegetation within this ecosystem can change rapidly in response to drought or moisture from year to year and during the course of the season, so fuels treatments should be adjusted accordingly.

Several re-entries may be needed to meet full resource management objectives in this vegetation type, so a solid maintenance plan is needed to ensure success.

State Game Lands

The Pennsylvania Game Commission has an active burn program with the dominant objective being improvement of wildlife habitat and improvement to hunting opportunity. The Game Commission conducts burns from February through May. Prescribed fires are designed to rejuvenate habitat and promote production of soft mast on shrubs like blueberry, huckleberry and blackberry and generate succulent browse favored by deer and elk. Prescribed burns on State Game Lands are conducted under very specific weather and "fuel" conditions ensuring burns are low to moderate intensity. Burns are normally repeated every 3 to 10 years, preventing fuels from building to dangerous levels which also reduces the potential for unplanned wildfires. The Game Commission has highly trained prescribed burn crews and all burns are conducted following extensive planning operations.

Since 2015 when the prescribed burn program began in the County, the Game Commission has burned the following acres in a mix of grass and woodland vegetation (Table 13).

Table 13. Pennsylvania Game Commission Prescribed Fire Activity in Elk County

ELK COUNTY	LOCATION	ACRES BURNED	UNIT TYPE	DATE
2015	SGL 311	145	Grass	16-Apr
	SGL 311	21	Grass	20-May
	SGL 311	51	Grass	9-Nov
	SGL 44	12	Grass	17-Aug
2016	SGL 311	10	Grass	9-Mar
	SGL 311	37	Grass	23-Mar
	SGL 44	56	Grass	8-Mar
	SGL 44	345	Woods	20-May
	SGL 44	202	Woods	15-Nov
2017	SGL 311	143	Grass	30-Mar
	SGL 311	64	Grass	12-Apr
	SGL 44	147	Grass	18-Apr
	SGL 25	264	Woods	9-May
	SGL 25	195	Woods	17-May

Source: Pennsylvania Game Commission

Information on planned prescribed burning is provided on the agencies website via an interactive map. [18] The active burn program could be used to reduce hazardous fuels in and adjacent to WUI areas and improve forest health and resilience to wildfire.

THINNING AND PRESCRIBED FIRE COMBINED

Combining thinning and prescribed fire can be the most effective treatment (Graham et al. 2004). In forests where fire exclusion or disease has created a buildup of hazardous fuels, prescribed fire cannot be safely applied and pre-burn thinning is required. The subsequent use of fire can further reduce residual fuels and reintroduce this ecologically imperative process.

MANAGEMENT OF NON-NATIVE PLANTS

The USDA maintains a list of noxious weeds rated from A to C based on the current degree of infestation of the species and the potential for eradication (USDA 2010). Fuel treatment approaches should always consider the potential for introduction or proliferation of invasive non-native species as a result of management actions. Elk County Conservation District and Penn State Extension provide education and outreach regarding invasive species and actions to counteract infestations.

[18] Pennsylvania State Game Commission- Controlled Burn Map: http://pagame.maps.arcgis.com/apps/webappviewer/index.html?id=d7ab50bde980460fab22de6316ec73ca

RECOMMENDATIONS FOR REDUCING STRUCTURAL IGNITABILITY

The community assessments described in Chapter 4 highlight that many structures in the County have wooden construction, wooden decks and wooden fences. Wooden construction increases potential wildfire damage and spread in the event of a wildfire ignition. This section outlines actions that communities and individual residents can take to reduce the risk of fire to their homes and businesses associated with home construction and defensible space.

FIREWISE COMMUNITY CERTIFICATION

This CWPP is designed to be used by communities throughout Elk County to pursue Firewise certification. Much of this certification process depends upon residents assessing their risk and taking action to reduce structural ignitability around their homes and within their community. Table 14 provides a list of community-based recommendations that should be implemented throughout the ECCWPP planning area that would help move communities towards Firewise certification. Results of the community survey clearly demonstrate that residents are willing to implement these actions but may lack the knowledge of what actions should be taken. In order to address this, a list of action items that individual homeowners can follow can be found below Table 13. Carrying out fuels reduction treatments on public lands may only be effective in reducing fire risk to some communities; however, if homeowners have failed to provide mitigation efforts on their own land, the risk of home ignition remains high and firefighter lives are put at risk when they carry out structural defense.

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

It is important to note that no two properties are the same. Homeowners and communities are encouraged to research which treatments would have the most effect for their properties. Owners of properties on steep slopes, for example, should be aware that when constructing defensible space they have to factor in slope and topography, which would require extensions to the conventional 30-foot recommendations. In achieving Firewise status residents can access a multitude of literature online and from their local land management agencies, for example- Ready, Set, Go! (http://www.wildlandfirersg.org) and Firewise (www.firewise.org). More detailed information on reducing structural ignitability can also be found in Appendix H (Homeowner's Guide).

Some structural ignitability hazards are related to homes being in disrepair, vacant or abandoned lots, and minimal yard maintenance. In order to influence change in homeowner behavior, ordinances may be needed, at the discretion of the municipality.

Table 14. Recommendations for Reducing Structural Ignitability

PROJECT	PURPOSE	PRIVATE LANDS/ HOMEOWNER	PROGRAMS AVAILABLE	DESCRIPTION	POSSIBLE CONTACTS FOR MORE INFORMATION	PRIORITY
Initiate a drive to encourage Firewise certification of communities within the WUI.	Increase community engagement in wildfire mitigation across the County.	Oversight from DCNR, USFS and cooperation by all fire departments.	Firewise Communities USA	The CWPP hazard assessments can be used in certification process. Residents would need to initiate the certification process in cooperation with DCNR WUI specialists. Activities would include projects in italics listed below. Align efforts with goals of the County Hazard Mitigation Plan.	www.firewise.org, DCNR	High 2018
Offer fire protection workshops	Address a need for increased fire prevention information desired by residents.	All residents would be encouraged to participate. Could work in cooperation with fire departments in Elk County.	Agency outreach personnel, Firewise, Ready, Set, Go!	Offer hands-on workshops to highlight individual home vulnerabilities and teach how-to techniques to reduce ignitability of common structural elements. Examples include installing metal flashing between houses and fences or decks, and installing wire mesh over eaves, vents, and under decks.	www.firewise.org, www.nfpa.org, www.wildlandfirersq.org.	High 2018–2019
Individual home-hazard assessments	Address a need for increased fire prevention information desired by residents.	All residents would be encouraged to participate. Could work in cooperation with fire departments in Elk County, adopt a "train the trainer" approach to develop a citizen strike team.	Firewise Assessing Hazards in the Home Ignition Zone	Develop or train a team of citizens that could do home assessments. Could be tiered from workshops described above. Would build through word-of-mouth between neighbors. Elk County fire departments could provide senior oversight and training.	www.firewise.org, www.nfpa.org, www.wildlandfirersq.org.	High 2018–2019
Provide printed list of mitigation measures to homeowners with different scales of actions	Address a need for increased fire prevention information desired by residents.	All residents would be encouraged to participate.	Fire departments, Firewise Communities, academic and peer-reviewed literature	List of Action items broken down by cost: Low or no cost – ensure house numbers are easily viewed from the street. Medium cost – annual clearance and thinning of trees and shrubs along driveways to facilitate save access by emergency vehicles.	Elk County fire departments, DCNR, seek community "spark plugs" to assist in coordination and lead Firewise Community effort.	High 2018
Implement spring community yard clean-up days and provide chipper and/or other green waste disposal opportunities to residents. Target blighted areas.	Provide a repository for green-waste to encourage increased yard maintenance.	All residents would be encouraged to participate in each community.	County Waste Management	A community led day of yard clean-up with fire mitigation in mind would encourage large numbers within the community to carry-out mitigation measures and implementation of defensible space. The event could be promoted by Elk County and waste pick-up coordinated with the event. St Mary's has a compost site that can be used by residents for disposal of vegetation and slash.	Elk County fire departments, DCNR, seek community "spark plugs" to assist in coordination and lead Firewise Community effort.	High 2018

PROJECT	PURPOSE	PRIVATE LANDS/ HOMEOWNER	PROGRAMS AVAILABLE	DESCRIPTION	POSSIBLE CONTACTS FOR MORE INFORMATION	PRIORITY
Target Blighted property clean-up as part of Firewise initiative.	Address a need for clean-up identified by residents and highlighted during community assessments.	Municipalities	Firewise	Education should be provided to assist communities in targeting blighted properties. Municipalities could consider ordinances if supported by the residents. Clean up could be organized with assistance by the Elk County Conservation District. There is a need for property management companies who could assist with maintenance of properties owned by out-of-town owners.	Municipalities, Elk County Conservation District.	High 2018
Assess and improve accessibility to property	Address concerns regarding narrow roads and narrow driveways.	All residents would be encouraged to participate.	Elk County Fire Departments	Weekend program to inform homeowners about the importance of keeping driveways accessible to fire trucks and emergency responders.	Elk County fire departments, DCNR, seek community "spark plugs" to assist in coordination and lead Firewise Community effort.	Moderate 2018
Develop a Firewise landscaping plant list for homeowners to use. Assess potential to develop a demonstration site	Encourage landscaping that will enhance Firewise efforts. Capitalize on residents desire to maintain presentable properties and civic pride.	Available to all residents through Elk County.	Firewise	Research Firewise plants suitable for the region. Staff time to develop plant list, poster materials and research demonstration site. Provide residents with an alternative landscaping option that enables them to maintain an aesthetically pleasing yard, while reducing flammability and risk of fire spread to property.	Elk County fire departments, DCNR, seek community "spark plugs" to assist in coordination and lead Firewise Community effort.	Low 2019

ACTION ITEMS FOR HOMEOWNERS TO REDUCE STRUCTURAL IGNITABILITY

Low or No Cost Investment (<$50)	Regularly check fire extinguishers and have a 100-foot hose available to wet perimeter.
	Maintain defensible space for 30 feet around home (see Table 11). Work with neighbors to provide adequate fuels mitigation in the event of overlapping property boundaries.
	Make every effort to keep lawn mowed and green during fire season.
	Screen vents with non-combustible meshing with mesh opening not to exceed nominal ¼-inch size.
	Ensure that house numbers are easily viewed from the street.
	Keep wooden fence perimeters free of dry leaves and combustible materials. If possible, non-combustible material should link the house and the fence.
	Keep gutters free of vegetative litter. Gutters can act as collecting points for fire brands and ashes.
	Store combustible materials (firewood, propane tanks, grills) away from the house; in shed, if available.
	Clear out materials from under decks and/or stacked against the structure. Stack firewood at least 30 feet from the home, if possible.
	Reduce your workload by considering local weather patterns. Since the prevailing winds in the area are often from the west-southwest, consider mitigating hazards on the west corner of your property first, then work around to cover the entire area.
	Seal up any gaps in roofing material and enclose gaps that could allow fire brands to enter under the roof tiles or shingles.
	Remove flammable materials from around propane tanks.

Minimal Investment (<$250)	When landscaping in the Home Ignition Zone (HIZ) (approximately 30 feet around the property), select non-combustible plants, lawn furniture, and landscaping material. Combustible plant material like junipers and ornamental conifers should be pruned and kept away from siding. If possible, trees should be planted in islands and no closer than 10 feet to the house. Tree crowns should have a spacing of at least 18 feet when within the HIZ. Vegetation at the greatest distance from the structure and closest to wildland fuels should be carefully trimmed and pruned to reduce ladder fuels, and density should be reduced with approximately 6-foot spacing between trees crowns (Figure 35).
	Box in eaves, attic ventilation, and crawl spaces with non-combustible material.
	Work on mitigating hazards on adjoining structures. Sheds, garages, barns, etc., can act as ignition points to your home.
	Enclose open space underneath permanently located manufactured homes using non-combustible skirting.
	Clear and thin vegetation along driveways and access roads so they can act as a safe evacuation route and allow emergency responders to access the home.
	Purchase or use a National Oceanic and Atmospheric Administration weather alert radio to hear fire weather announcements.
Moderate to High Investment (>$250)	Construct a non-combustible wall or barrier between your property and wildland fuels. This could be particularly effective at mitigating the effect of radiant heat and fire spread where 30 feet of defensible space is not available around the structure.
	Construct or retrofit overhanging projections with heavy timber that is less combustible.
	Replace exterior windows and skylights with tempered glass or multilayered glazed panels.
	Invest in updating your roof to non-combustible construction. Look for materials that have been treated and given a fire-resistant roof classification of Class A. Wood materials are highly combustible unless they have gone through a pressure-impregnation fire-retardant process.
	Construct a gravel turnaround in your driveway to improve access and mobilization of fire responders.
	Treat construction materials with fire-retardant chemicals.
	Install a roof irrigation system.
	Replace wood or vinyl siding with nonflammable materials.
	Relocate propane tanks underground.

RECOMMENDATIONS FOR PUBLIC EDUCATION AND OUTREACH

According to the results of the community survey many residents are seeking more information from their community leaders and agency land managers on actions that they can take to reduce wildfire risk to their homes and property.

It is important to continually raise awareness of fire risk and improve fire education in the local community, particularly since Elk County is composed of such a vast area of forested public land (Winter and Fried 2000; McCaffrey 2004). Table 15 lists recommendations for improving public education and outreach. These actions work hand-in-hand with the actions described above for reducing structural ignitability, and will help move a community closer to the goal of becoming Firewise.

Other methods to improve public education could include increasing awareness about fire department response and fire department resource needs; providing workshops at demonstration sites showing Firewise Communities landscaping techniques or fuels treatment projects; organizing community cleanups to remove green waste; publicizing availability of government funds for thinning and prescribed burning; and, most importantly, improving communication between homeowners and local land managers.

Table 15. Recommendations for Public Outreach and Education

PROJECT	DESCRIPTION	PRESENTED BY	TARGET DATE	RESOURCES NEEDED	PURPOSE
Targeted wildfire info sessions	Review existing programs (Ready, Set, Go!, Firewise) for suitability of existing fire prevention materials and where necessary fund development of unique adapted materials and presentations to highlight how a fire might affect particular groups within the community. Use various modes and multifaceted public outreach/education about wildfire prevention, mitigation, and emergency situations. Utilize proven media outlets, i.e., social media like Solomon's Word. Focus efforts on communities at greatest risk- i.e. areas along ridges and communities adjacent to volatile fuel types- i.e. oak-hickory dominated woodlands.	USFS	Summer/Fall 2017	Funding for research, writing, and presentation of detailed information on how large-scale wildfire would affect the target audience and the measures that could be taken to reduce the threat. Flyers could be sent out with utility bills or other community mailings.	Deliver a clear and consistent message that impacts of wildfire are far-reaching and that it is in the best interest of a diverse set of stakeholders to become involved in planning and preparing for fire.
Fire departments open invitation days	Raise awareness of the Elk County VFDs through open houses and tours of equipment. Have local fire department personnel embed in the community to increase face-to-face interactions.	Fire Departments within Elk County	Annually- pre-fire season would be advised.	Advertising, refreshments, handouts.	Protect communities and infrastructure by potentially increasing recruitment and financial support for the fire service.
Neighbors for defensible space	Organize a community group made up of residents and agency personnel to develop materials and communicate relevant defensible space messages. Could coordinate with fire departments, DCNR, or USFS. Possibility to coordinate actual implementation of defensible space and slash clear-up with Girls Scouts, Boy Scouts etc. Facilitate information exchange and networking opportunities	Fire Departments within Elk County	Spring 2018	Funding to help cover costs of materials (green waste removal or chipper) and participation. People trained in defensible space practices. Defensible space brochures could be provided in building permit packets	Engage diverse stakeholders in reaching out to community members and encourage defensible space practices. Improve defensible space practices for new construction. Empower homeowners to make affordable and effective changes to reduce the vulnerability of individual homes.
Media involvement	Develop a local newspaper column that provides fire safety information, promotional information for VFDs, fire announcements, and emergency planning.	Agency Public Information Officers, County Emergency Management	Monthly column year-round with emphasis at beginning of bi-modal fire season March 15–June 1 and September 30– November 15	Columns, information, and articles to be provided by fire departments, municipalities, county, state representatives.	Protect communities and infrastructure through increasing public awareness and providing a channel for information regarding emergency fire response.

PROJECT	DESCRIPTION	PRESENTED BY	TARGET DATE	RESOURCES NEEDED	PURPOSE
Radio announcements	Create public service announcements to be run during periods of elevated fire danger.	Agency Public Information Officers, Emergency Manager	Annually, seasonal	Radio contacts, Professional voice over person to create and record announcements.	Raise awareness of elevated fire danger.
Promote and Increase the use of prescribed burning as a fuels reduction method	Gain public support for using prescribed burns to reduce fuel loads and to improve ecosystem health through a pilot burn project and demonstration site. Consider developing informational material for distribution at natural areas or via email distribution lists.	USFS, DCNR, Conservation District, Elk County, Fire Departments.	Spring 2018	Prescribed burn prescription, type-6 engines, hand crews, equipment. Research and costs of producing[1], printing, and distributing paper informational flyer.	Protect communities and infrastructure by reducing fuel loads.
Homeowner's guide	Develop a handbook that gives locally relevant and detailed information to help residents be more prepared for wildfire, including a defensible space checklist specific to local structural and wildland fuel considerations. Refer to Appendix H. Utilize local landscape and residence photos. Could include prescribed burn information as in project above.	Local fire departments, County Emergency Management	Fall 2018	Review existing materials for potential to adapt to local conditions. Funding to develop and print copies of the handbook. Volunteers to help distribute and explain the document.	Give residents detailed and locally specific tools that they can use to improve preparedness. Address concerns raised by residents that they didn't know what actions to perform to reduce their wildfire danger.
Emergency preparedness meetings	Use American Red Cross volunteers and other preparedness experts. Attend community functions and hold special meetings to provide guidance for creating household emergency plans. Ready Set Go Program	American Red Cross, town, county, state personnel VFDs, etc.	Ongoing	Written materials.	Improve preparedness by facilitating the communication between family members and neighbors about what procedures to follow in the event of a wildfire.
Plan livestock evacuation routes and inform communities	Work with emergency management officials to plan evacuation routes for residents with livestock and then hold community meetings to disseminate to the public.	Emergency management officials, livestock agencies	Fall 2017	GIS software or maps.	Protect communities, livestock and infrastructure through increased awareness.
Raise awareness of fire prevention at a young age	Introduce wildfire prevention into school curriculum. Work with fire departments, school board and Public Information Officers to organize kid-focused travelling workshops as has been completed by DCNR.	County, VFDs, town, and state representatives, USFS Public Information Officers	Spring 2018	Firewise materials, Smokey Bear literature, presenters.	Protect communities and infrastructure through increased awareness.
Educate elected officials on the importance of investing in wildfire mitigation	Establish greater connection between elected officials and local fire departments. Initiate bi-annual meetings to increase Commissioner awareness of emergency response and challenges facing fire departments.	Elk County Emergency Management	Spring 2018	Meeting costs	Resolve disconnect between elected officials and County emergency responders.

RECOMMENDATIONS FOR IMPROVING FIREFIGHTING CAPABILITIES

The community descriptions in Chapter 4 highlight that many communities are served by fire departments situated within the community. There are eight fire departments that have district jurisdiction within the planning area, however all of these departments are run by volunteers. Educating the public so they can reduce its dependence on fire departments is essential because these resources are often stretched thin due to limited personnel. Table 16 provides recommendations for improving firefighting capabilities. Many of these recommendations are general in nature so that they can be adapted and applied throughout the County.

Table 16. Recommendations for Improving Firefighting Capabilities

PROJECT	PURPOSE	FIRE DEPARTMENT	DESCRIPTION	TIMELINE	CONTACT	PRIORITY
Provide minimum wildland PPE for all firefighters in Elk County	Allow for safe firefighting in the wildlands.	All departments	Seek grant money to be spent on acquisition of PPE. Task a member of each department to inventory PPE. Develop a schedule of equipment replacement to allow for allocation of funds and seeking of grants. Ensure that FDs carry both types of equipment.	Monthly review of grant opportunities Annual audit of PPE	DCNR grants available up to $7500 (matching grant) Responsibility of Fire Chief See Appendix G	Very high
Increase the number of "red-carded" individuals in the fire departments to improve safety during a wildfire incident	Allow for safe firefighting in the wildlands.	All departments	NWCG Basic Wildland Fire Fighting and Fire Behavior, S-130/S-190 classes are already offered to all firefighters, and much of the class can be completed online, however more weekend or evening classes should be offered for mandatory field exercises in order to cater to volunteers who work full-time Facilitate Annual refresher participation by having in-house refreshers available or convene agencies to have an Elk County-wide refresher.	Annually, or following recruitment drives	USFS, DCNR, fire departments	Very high
Carry out detailed pre-incident planning for remote communities that may be subject to slow response times.	Address concerns raised by responders and residents on wildfire response times to distant locations.	All departments	The CWPP identifies areas of high risk and hazard that is largely due to their remote location and slow response times. Pre-planning in these areas may help identify actions that could be taken to mitigate response times or better prepare the community.	Annually during winter months	Fire Departments	Very high
Increase VFD recruitment (diversify age classes)	Address concerns raised by responders regarding volunteer turnover and retention.	All departments	Target fire education in schools to encourage younger generations to become interested in firefighting. Carry out recruitment drives through open house and mailings. Provide training incentives for VFD firefighters. Better outreach and education is needed for employers to alleviate conflicts with volunteers leaving their place of work to respond to incidents.	Annually	Fire department chiefs, school districts, Public Information Officers	High

PROJECT	PURPOSE	FIRE DEPARTMENT	DESCRIPTION	TIMELINE	CONTACT	PRIORITY
Increase funds for VFDs	Increase capacity of local VFDs.	Elk County and municipalities	1) Maintain contact with State Division of Fire Safety and regularly seek grant money. 2) Implement regular evaluations of resource needs for each VFD and make available to public to raise awareness of shortages. 3) Ensure all VFDs understand the state process for reimbursement. 4) Maintain updated list of district fires and provide to DCNR for reimbursement. 5) Ensure firefighters have up-to-date wildfire qualifications in order to qualify for reimbursements. 6) Use local media to inform public of fire resources situation. Work with local newspaper editor to have a year-round column that documents fire department activities. 7) Apply for rural fire assistance program grants. 8) Improve International Standards Organization ratings. 9) Utilize grant writing assistance provided by DCNR and County Planning Department. 10) Ensure Fire Chiefs are familiar with the CWPP and engaged in future revisions.	Monthly review of grant opportunities	State and county See Appendix G	High
Install global positioning system (GPS) tracking systems on all vehicles	Allow for safe firefighting in the wildlands.	All departments	In order to track fire department vehicles and improve oversight install GPS tracking on all vehicles.	Fall 2018	Elk County Fire Department Chiefs	Moderate
Improve communication between agencies and dispatch through development of an Interagency Communication Plan.	Allow for safe firefighting in the wildlands across jurisdictions.	All departments, DCNR, USFS	See text below (page 147). Convening pre-fire planning meetings with all partners to determine roles and responsibilities and revisit mutual aid agreements. Institute an annual meeting of cooperators to review status of Memoranda of Understanding and review previous fire season "lessons learned."	Spring 2018 and then annual	Elk County Fire Department Chiefs	High
Develop database of interactive maps for use by emergency responders.	Improve fire- fighting effectiveness, public and firefighter safety.	Emergency Management	Install on tablets/laptops. Print large format detailed road maps to be posted at each station and supplied to each firefighter as well as to dispatch. Utilize a coordinate grid system and road name index to label smaller roads. Print on high quality paper- waterproof if possible.	Spring 2018	Emergency Management	High
Map available water sources and test dry hydrant systems	Address concerns raised by responders regarding insufficient water sources.	Elk County Fire Department in cooperation with Department of Environmental Protection	Inventory and map all existing viable water sources. Locate existing dry hydrants and map locations- provide to fire departments- and/or install new dry hydrants in areas with minimal water supply for suppression.	Spring 2018	Department of Environmental Protection, Emergency Management, Fire Departments.	High

PROJECT	PURPOSE	FIRE DEPARTMENT	DESCRIPTION	TIMELINE	CONTACT	PRIORITY
Improve radio communication between responders	Improve fire- fighting effectiveness, public and firefighter safety.	All jurisdictions.	Seek funding for programmable radios to improve communication between agencies. There is currently a lack of interoperability of some systems. Training component would be needed. Convene a workshop for all operators	Fall 2018	All jurisdictions	High
Improve road mapping and standardized house numbering	Improve fire- fighting effectiveness, public and firefighter safety.	Elk County Planning	There is a need for improved mapping with associated house numbers actually signposted on the road. Would alleviate confusion and delay by responders due to unfamiliar house numbering. Seek grant funding to support standardization of address markers throughout the county using reflective numbers. Community ordinance could require that all residents are required to have reflective house number.	Spring 2018	Elk County	High
Greater enforcement of burn permitting.	Address high rates of human-ignitions reported throughout the County.	All departments	Although burn permitting is required for all burning there is very little enforcement. Since most wildfires are human caused (resulting from debris burning) then better enforcement of burning is necessary to reduce unintended wildfires.	Spring 2018	Elk County	High
Installation of fire boxes at all recreation areas and improved fire prevention signage	Reduce potential fire starts on public lands and areas with increased public use.	Depends on agency managing lands	Installation of fire boxes to house fire equipment (buckets, extinguishers, tools) at trail heads, campsites and recreation areas. Benezette Township could be a priority community due to congestion problems during busy periods. Example guidelines for fire prevention signage at recreation areas have been developed by NWCG. [19]	Fall 2018	Elk County	High
Inventory narrow roads and bridges	Address concerns regarding ingress and egress on narrow roads and unrated bridges.	All departments in conjunction with County Emergency Management and Department of Transportation	Carry out inventory of road widths and unrated bridges and work with Department of Transportation on identifying priority improvements. Improve maintenance of existing roads in order to allow safe passage of large apparatus under all weather conditions.	Spring 2018	Emergency Management and Department of Transportation	High

[19] Recreation Area Fire Prevention, 1999. National Wildfire Coordinating Group. Available at: https://www.nwcg.gov/sites/default/files/products/recreati.pdf

COMMUNICATIONS PLAN

A weakness that has been raised during development of the CWPP is the need for improved communications between agencies. This is a common goal for wildfire planning because most wildfires receive response from a large array of agencies, and even though mutual aid agreements are well established in Elk County, some departments may have limited experience working together on an incident.

A recommendation of the CWPP is for all jurisdictions to work closely together in the future to develop a Communication Plan that can be regularly updated. The Communication Plan should address technological issues as well as cultural issues to ensure the responding departments are able to work together effectively to achieve containment.

Some existing problems are:

- Terminology - differing terminology and differences in how orders are given and understood.
- Technical - radio communications, differing units, frequencies or features.
- Cultural differences and few commonalities.
- Difference in level of training and qualifications.

There are a number of solutions to these issues that can be put into practice by fire agencies in Elk County. Convening all jurisdictions on a regular basis is critical to success. Representatives from each agency should:

- Carryout a full Situation Analysis - assess the broad and long range wildfire challenges and multi-jurisdictional communication that face Elk County.
- Identify all the players and determine protocols, procedures, command, and organization structures.
- Identify challenges both technological and cultural.
    - Identify differences in culture and command structure. Review previous incidents for issues.
    - Compile an inventory of available resources and capabilities and identify gaps and budget constraints.
    - Review available technology, e.g., radios, global positioning system (GPS), units, and share information and advances.
- Develop objectives, strategies, and tactics for overcoming technological and cultural challenges.
- Share information on funding opportunities and collaborate on funding applications.
- Develop written plans and execute in mock incidents on at least an annual basis.
- Evaluate and revise plans according to outcomes.

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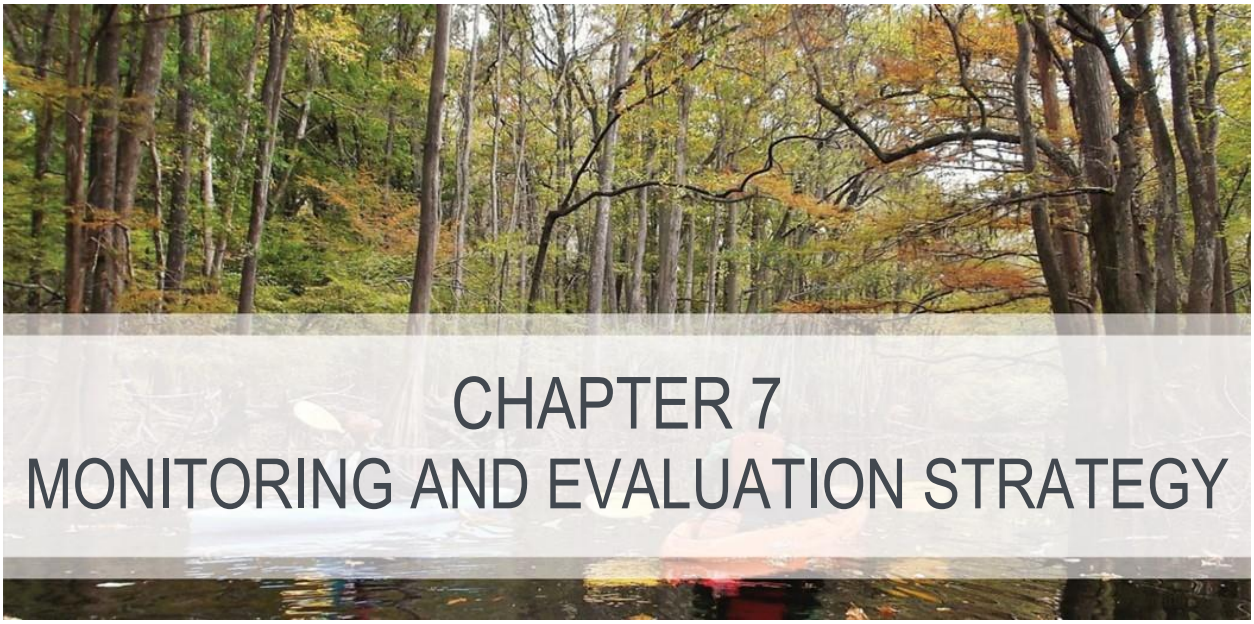

CHAPTER 7
MONITORING AND EVALUATION STRATEGY

Developing an action plan and an assessment strategy that identifies roles and responsibilities, funding needs, and timetables for completing highest priority projects is an important step in organizing the implementation of the ECCWPP. Table 14 through Table 16 in the previous chapter identify tentative timelines and actions for mitigation treatments, the details of which are outlined below.

All stakeholders and signatories to this CWPP desire worthwhile outcomes. We also know that risk reduction work on the ground, for the most part, is often not attainable in a few months—or even years. The amount of money and effort invested in implementing a plan such as this requires that there be a means to describe, quantitatively or qualitatively, if the goals and objectives expressed in this plan are being accomplished according to expectations.

This section will present a suite of recommended CWPP monitoring strategies intended to help track progress, evaluate work accomplished, and assist planners in adaptive management.

Strategies outlined in this section take into account several variables:

- Do the priorities identified for treatment reflect the goals stated in the plan? Monitoring protocols can help address this question.
- Can there be ecological consequences associated with fuels work? We may be concerned about soil movement and/or invasive species encroachment post-treatment. Relatively cost-effective monitoring may help clarify changes.
- Vegetation will grow back. Thus, fuel break maintenance and fuels modification in both the home ignition zone and at the landscape scale all require periodic assessment. Monitoring these changes can help decision makers identify appropriate treatment intervals.

As the CWPP evolves over time, there may be a need to track changes in policy, requirements, stakeholder changes, and levels of preparedness. These can be significant for any future revisions and/or addendums to the CWPP.

Table 17 identifies recommended monitoring strategies, both quantifiable and non-quantifiable, for assessing the progress of the CWPP. It must be emphasized that these strategies are 1) not exhaustive (new strategies and protocols can evolve with new CWPP action items) and 2) dependent on available funds and personnel to implement them.

Table 17. Recommended Monitoring Strategies

STRATEGY	TASK/TOOL	LEAD	REMARKS
Photo record (documents pre- and post-fuels reduction work, evacuation routes, workshops, classes, field trips, changes in open space, treatment type, etc.)	Establish field GPS location; photo points of cardinal directions; keep photos protected in archival location	Core Team member	Relatively low cost; repeatable over time; used for programs, and tracking objectives
Number of acres treated (by fuel type, treatment method)	GPS/GIS/fire behavior prediction system	Core Team member	Evaluating costs, potential fire behavior
Number of home ignition zones/defensible space treated to reduce structural ignitability	GPS	Homeowner	Structure protection
Number of residents/citizens participating in any CWPP projects and events	Meetings, media interviews, articles	Core Team member	Evaluate culture change objective
Number of homeowner contacts (brochures, flyers, posters, etc.)	Visits, phone	Agency representative	Evaluate objective
Number of jobs created	Contracts and grants	Core Team member	Evaluate local job growth
Education outreach: number, kinds of involvement	Workshops, classes, field trips, signage	Core Team member	Evaluate objectives
Emergency management: changes in agency response capacity	Collaboration	Agency representative	Evaluate mutual aid
Codes and policy changes affecting CWPP	Qualitative	Core Team	CWPP changes
Number of stakeholders	Added or dropped	Core Team	CWPP changes
Wildfire acres burned, human injuries/fatalities, infrastructure loss, environmental damage, suppression and rehabilitation costs	Wildfire records	Core Team	Compare with 5- or 10-year average

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

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

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

Minimum—Level 1: Pre- and Post-project Photos

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

Moderate—Level 2: Multiple Permanent Photo Points

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

High—Level 3: Basic Vegetation Plots

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

Intense—Level 4: Basic Vegetation Plus Dead and Downed Fuels Inventory

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

IDENTIFY TIMELINE FOR UPDATING THE CWPP

The HFRA allows for maximum flexibility in the CWPP planning process, permitting the Core Team to determine the timeframe for updating the CWPP; it is suggested that a formal revision be made on the fifth anniversary of signing and every 5 years following. The Core Team are encouraged to meet on an annual basis to review the project list, discuss project successes and strategize regarding project implementation funding. A long standing October meeting of municipalities would be an ideal time to convene all players to discuss the CWPP and identify needed updates. These meetings should be organized by USFS or Forest Bureau representatives tasked with wildfire management for the County.

IMPLEMENTATION

The ECCWPP makes recommendations for prioritized fuels reduction projects and measures to reduce structural ignitability and carry out public education and outreach. Implementation of fuels reduction projects need to be tailored to the specific project and will be unique to the location depending on available resources and regulations. Information pertaining to funding can be found in Appendix G.

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REFERENCES

Abrams, M. D. (1992). Fire and the development of oak forests. *BioScience, 42,* 346-353.

Abrams, M. D. (1998). The red maple paradox. *BioScience, 48,* 355-364.

Abrams, M. D., & Nowacki, G. J. (2008). Native Americans as active and passive promoters of mast and fruit trees in the eastern USA. *The Holocene, 18,* 1123-1137.

Agee, J.K. 1993. Fire Ecology of Pacific Northwest Forests. Washington, D.C.: Island Press.

Allegheny National Forest (ANF), 2007. Record of Decision for Final Environmental Impact Statement and the Land and Resource Management Plan. USDA Forest Service. Allegheny National Forest. March 2007. Available online at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5044088.pdf. Accessed April 2017.

_____. 2015. Fire Management Plan. 14 pages.

Brose, P.H. and D.H. Van Lear. 2004. Survival of hardwood regeneration during prescribed fires: The importance of root development and root collar location. In: Spetich, M.A. (ed.) 2004. Upland oak ecology symposium: History, current conditions, and sustainability. General Technical Report SRS 73. USDA Forest Service, Southern Research Station: 123-127.

Brose, P.H., Schuler, T.M., and J.S. Ward. 2006. Responses of oak and other hardwood regeneration to prescribed fire: What we know as of 2005. In: Dickinson, M.B. (ed.). Fire in eastern oak forests: Delivering science to land managers. USDA Forest Service, General Technical Report P-NRS- 1: 123-135.

Brose, P.H., D.C. Dey, R.P. Guyette, J.M. Marschall and M.C. Stambaugh. 2013. The influence of drought and humans on the fire regimes of northern Pennsylvania. Can. J. For. Res. 43: 757-767.

Department of Conservation and Natural Resources (DCNR 2010). Pennsylvania Statewide Forest Resource Assessment. Available online at: http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_007864.pdf

_____. 2016. Wildfire Statistics. Available online at: http://www.dcnr.state.pa.us/forestry/wildlandfire/firestatistics/index.htm. Accessed May 2016.

_____. 2017. Natural Gas Development and State Forests. Available online at: http://www.dcnr.state.pa.us/forestry/NaturalGas/index.htm

Forests and Rangelands. 2006. *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Strategy Implementation Plan*. Available at: https://www.forestsandrangelands.gov/resources/plan/documents/10-yearstrategyfinal_dec2006.pdf. Accessed May 2017.

———. 2013. National Cohesive Wildland Fire Management Strategy, Northeast Regional Action Available online at: https://www.forestsandrangelands.gov/strategy/documents/rsc/northeast/NERAP_Final2013April.pdf. Accessed April 2017.

———. 2014. *The National Strategy: The Final Phase in the Development of the National Cohesive Wildland Fire Management Strategy*. Available at: https://www.forestsandrangelands.gov/strategy/documents/strategy/CSPhaseIIINationalStrategyApr2014.pdf. Accessed April 2017.

Haines, D., W. Main and E.F. McNamara. 2005. Forest Fires in Pennsylvania. Available online at: https://www.nrs.fs.fed.us/pubs/rp/rp_nc158.pdf.

Hulbert, A.B. 1910. David Zeisberger's history of the northern American Indians in 18th century Ohio, New York, and Pennsylvania. Wennawoods Publishing. Lewisburg, Penn.

Jacobson and Kovach 2007. Forest Economic Data. http://extension.psu.edu/natural-resources/forests/finance/county-forest-economic-data/mckean-county

Marschall, J.M., M.C. Stambaugh, B.C. Jones, R.P. Guyette, P.H. Brose and D.C. Dey. 2016. Fire Regimes of Remnant Pitch Pine Communties in the Ridge and Valley Region of Central Pennsylvania, USA. Available at: https://www.researchgate.net/publication/309120494_Fire_Regimes_of_Remnant_Pitch_Pine_Communities_in_the_Ridge_and_Valley_Region_of_Central_Pennsylvania_USA. Accessed May 2017.

Martinuzzi, S., S.I. Stewart, D.P. Helmers, M.H. Mockrin, R.B. Hammer, V.C. Radeloff. 2015. The 2010 wildland-urban interface of the conterminuous United States. Research Map NRS-8. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 124 p.

McKean County 2008. McKean County Comprehensive Plan.

National Interagency Fire Center (NIFC). 2016. Wildland Fire Statistics. Available at: http://www.nifc.gov/fire_info/fire_stats.htm. Accessed January 2016.

National Wildfire Coordinating Group (NWCG). 1998. Fireline Handbook. NWCG Handbook 3. PMS 410–1. NFES 0065. Boise, Idaho: National Interagency Fire Center.

Neilson, R., J. Lenihan, R. Drapek, and D. Bachelet. 2004. Forests Fire Risk and Climate Change. Pacific Northwest Research Station- Science Update. Issue 6. January 2004.

Northeast Regional Strategy Committee. 2013. National Cohesive Wildland Fire Management Strategy, Northeast Regional Action Plan. A Phase III Report by the Northeast Regional Strategy Committee, April 2013.

Nowacki, G.J. and M.D. Abrams. 2008. The demise of fire and —mesophication of forests in the eastern United States. BioScience 58 (2): 123-138

Ottmar, R., R. Vihnanek, and J. Regelbrugge. 2000. Wildland Fire in Ecosystems: Effects of Fire on Fauna. Vol. 1. Gen.Tech. Rep. RMRS-GTR-42. Ogden, Utah: U.S. Forest Service, Rocky Mountain Research Station.

Pennsylvania Department of Conservation and Natural Resources State Forest Resource Management Plan (2016). Available electronically at: http://www.dcnr.state.pa.us/forestry/stateforestmanagement/sfrmp/2016sfrmp/index.htm

Pennsylvania Forestry Association, 2017. Forest Industry. Available online at: http://www.paforestry.org/forest-industry-program/

Pennsylvania State Extension. 2017. County Forest Economic Data. Available at: http://extension.psu.edu/natural-resources/forests/finance/county-forest-economic-data . Accessed May 2017.

Pyne, S.J. 1982. Fire in America: a cultural history of wildland and rural fire. Princeton, NJ: Princeton University Press. 654 p

_____. 2001. The fires this time, and next. Science 294(2):12–17

Ready, Set, Go! 2016. Ready, Set, Go! Home. Available online at: http://wildlandfirersg.org/. Accessed October 2016.

Rothermel, Richard C. 1983. How to predict the spread and intensity of forest and range fires. Gen. Tech. Rep. INT-143. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 161 p.

Ruffner, C.M. and M.D. Abrams. 1998. Relating land use history and climate to the dendrochronology of a 326 year old Quercus prinus talus slope forest. Can. J. For. Res. 28: 347-358.

Saladyga, T. 2017. Reconstructing a cultural fire regime in the Pennsylvania Anthracite Region. Physical Geography. April 2017. Available at: https://www.researchgate.net/publication/316442882_Reconstructing_a_cultural_fire_regime_in_the_Pennsylvania_Anthracite_Region. Accessed May 2017.

Silberstein, W.M. 2008. Pitfalls Galore: Mineral Development and Conservation Easement Tax Law, 2008 A.L.I.-A.B.A. 407, 411 (2008).

Smith, B, P., Miles, C. Perry, and S. Pugh. 2009. Forest resources of the United States, 2007. Gen. Tech. Rep. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office: 336.

Society of American Foresters (SAF). 2004. Preparing a Community Wildfire Protection Plan: A Handbook for Wildland Urban Interface Communities. Sponsored by Communities Committee, National Association of Counties, National Association of State Foresters, Society of American Foresters, and Western Governors' Association. Available at: http://www.safnet.org/policyandpress/cwpp handbook.pdf. Accessed June 1, 2006.

Stein, S., R. McRoberts, R. Alig, M. Nelson, D. Theobald, M. Eley, M. Dechter, and M. Carr. 2005. Forests on the edge: housing development on America's private forests. Gen. Tech. Rep. PNWGTR-636. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 16.

Stewart, S.I., V.C. Radeloff, R.B. Hammer, and T.J. Hawbaker. 2007. Defining the wildland-urban interface. Journal of Forestry 105:201–207.

Tikusis, Paul David, "Classifying the Fire Regime Condition Class for Upland Oak-Hickory Forests" (2009). Theses. Paper 4.

United States Forest Service. 2016. Regeneration of Northern and Allegheny Hardwoods. Available at: https://www.nrs.fs.fed.us/sustaining_forests/conserve_enhance/biodiversity/regeneration_other_species/. Accessed May 2017.

US Census Bureau, 2017. McKean County Quick Facts: https://www.census.gov/quickfacts/fact/table/mckeancountypennsylvania,PA/PST045216

USFS 2016. Allegheny National Forest Fire Management Plan.

Weatherspark. 2013. Weather averages for Williamsport, Pennsylvania. Available from www.weatherspark.com/averages/Williamsport-Pennsylvani-UnitedStates.html [accessed January 2017].

Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Warming and earlier spring increase in western U.S. forest wildfire activity. Science 313(5789):940–943.

Williams, G.W. 2003. References on the American Indian use of fire in ecosystems. USDA Forest Service, Washington, D.C.

Winter, G., and J.S. Fried. 2000. Homeowner perspectives on fire hazard, responsibility, and management strategies at the wildland-urban interface. Society and Natural Resources 13:33–49.

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