Campbell County Forestry Strategy

A comprehensive strategy designed to address forest management concerns in Campbell County

Developed in Cooperation by:

Campbell County Conservation District

Campbell County Forestry Working Group

Campbell County, Wyoming

2017

Signature Page

In 2017, members of the Campbell County Forestry Working Group met and agreed to create a Forestry Strategy for Campbell County.

Following a total comment period of 64 days, the Campbell County Working Group approved the Campbell County Forestry Strategy on July 1, 2017

Jacob McCarthy, committee member

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The Campbell County Conservation District Board of Supervisors approved the Campbell County Forestry Strategy on July 11, 2017.

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CONTRIBUTORS

This strategy was made possible through the cooperation of the Campbell County Forestry Working Group. Special thanks goes to the Wyoming State Forestry Division for funding this work through the Forestry Collaborative Partnership grant.

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Campbell County Conservation District

Campbell County Fire Department

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Natural Resources Conservation Service- Gillette Field Office

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Wyoming Game and Fish Department

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EXECUTIVE SUMMARY

When discussing forest in Wyoming one typically envisions Bridger Teton National Forest or perhaps the Black Hills National Forest. Typically we do not associate places like Campbell County with forests; however they are present and face challenges similar to many of the large forests in the state. The challenges can range from drought to increased residential development and from highly destructive wildfires to insects and diseases. These challenges can lead to a lack of forest resiliency and the inability of the forest to support the full range of multiple uses that our citizens enjoy.

As a result of the concerns facing the forest systems in Campbell County, the Campbell County Forestry Working Group was formed fulfilling Recommendation 2 of the compiled Final Report: Governor's Task Force on Forests January 2015. The working group examined the current forest conditions, identified existing challenges, and complied future management directions. The working group utilized the Wyoming Statewide Forest Resource Assessment of June 2010 to determine and focus on the below specific topics:

- Fire
- Invasive & Noxious Species
- Native Damaging Agents
- Rural Interface
- Storm events
- Wildlife Habitat Concern
- Water Quality and Supply
- Agroforestry
- Forest Stewardship Potential
- Timber Industry
- Potential Markets

After coming to a consensus on these topics the Campbell County Forestry Working Group collaborated on a forest collaboration focus area map (see Appendix B). This map allowed the working group members to prioritize areas and reach a consensus on the focus areas, across agencies and landownership. This will help to guide future funding and resources to critical areas and make significant impacts to the resiliency of Campbell County's forests.

Note: The bolded words, phrases, and sentences are for the convenience of the reader to highlight reoccurring themes throughout the document.

MISSION STATEMENT

The mission of the Campbell County Forestry Working Group is to facilitate landscape scale forest management activities across ownership boundaries, through the development and integration of priority areas in Campbell County, helping to promote overall forest health.

GOALS & OBJECTIVES

The goals and objectives of the Campbell County Forestry Working Group are to:

a. Facilitate a locally lead collaborative effort to address forest management issues and concerns in Campbell County.
b. Establish priority areas for landscape scale forest management and pursuit of funding opportunities.
c. Outreach and education about the strategy once finalized.

ISSUES AND CONCERNS

FIRE AND DISTURBANCES

FIRE

CURRENT CONDITIONS

Forested areas within Campbell County generally occur in the more rugged terrain of the county on ridges and slopes, and in ravines in the sagebrush steppe. Although these woodlands comprise a relatively small proportion of the county, they **provide important diversity** for wildlife habitat, agricultural uses, and recreation opportunities.

Due to multiple influences, the ponderosa pine forests and juniper woodlands of Campbell County have been changing in the past half century. Use of forest materials such as juniper fence posts and ponderosa pine sawlogs has generally decreased since the 1950's (Agricultural Censuses for Wyoming and Campbell County, 1920 to 2012), while fire suppression capabilities have become well-coordinated and effective in most efforts. Ongoing **growth of forests and woodlands has created dense conditions** in some areas with increased susceptibility to stand-replacing wildfires or insect and disease issues. The photo below shows dense juniper in the ponderosa pine understory in northern Campbell County.

The forests and woodlands grow in diverse terrain with varying fuel loads associated with different slopes, aspects, and vegetation settings. Barring suppression actions, terrain and fuels affect **wildfire behavior and spread,** where natural fuel breaks such as bare slopes and hilltops may hinder or alter the path of a fire. Alternatively, densely forested drainages and northerly slopes may create crown fires which can send embers that ignite spot fires in advance of the main fire front (NWCG, 2014). Based on fuels information in northern Campbell County, the conifer canopy in the pine/juniper stands is as high as 80 percent cover with surface fuels as high as 19 tons per acre (BLM, 2016). Understory growth, such as juniper and pine, interconnect the surface fuels with the pine overstory. Where pine sapling thickets occur, tree densities can be as high as 5,700 trees per acre though the size of these thickets is variable and typically much smaller than an acre. In a wildfire these canopy characteristics can initiate torching and sustained crowning (Reinhardt, 2006; Agee, 2005). This is especially pertinent to areas with high juniper cover in the pine understory, where FuelCalc modeling in summer conditions show that crown torching could occur with little to no wind and sustained crowning could occur with 20 mile per hour winds. Surface fuels such as needle litter and dead branches contribute to crown fire behavior and increase surface fire intensity, especially dryer precipitation zones (Moghaddas, 2007; Agee, 2005).

Dense juniper in a ponderosa pine understory in northern Campbell County.

In many **sagebrush settings and drainage bottoms** conifer cover and density is increasing and creating additional fuel loading in areas that might otherwise be less flammable. The photos on the next page shows dense juniper in drainages (see page 7).

In drainage bottoms and cottonwood stands where conifer density is increasing, the **subsurface water availability is reduced** due to increased water use by the conifers, especially juniper (Marlow, 2008; Deboodt, 2009). Dense juniper growth hinders survival and regeneration of cottonwoods, box-elder, ash, and chokecherry, which are less flammable than juniper in normal weather conditions. In addition, juniper encroachment hinders erosion events that are needed for cottonwood recruitment. Refer to the *Water Quality and Supply* section on page 28 and photo on page 7.

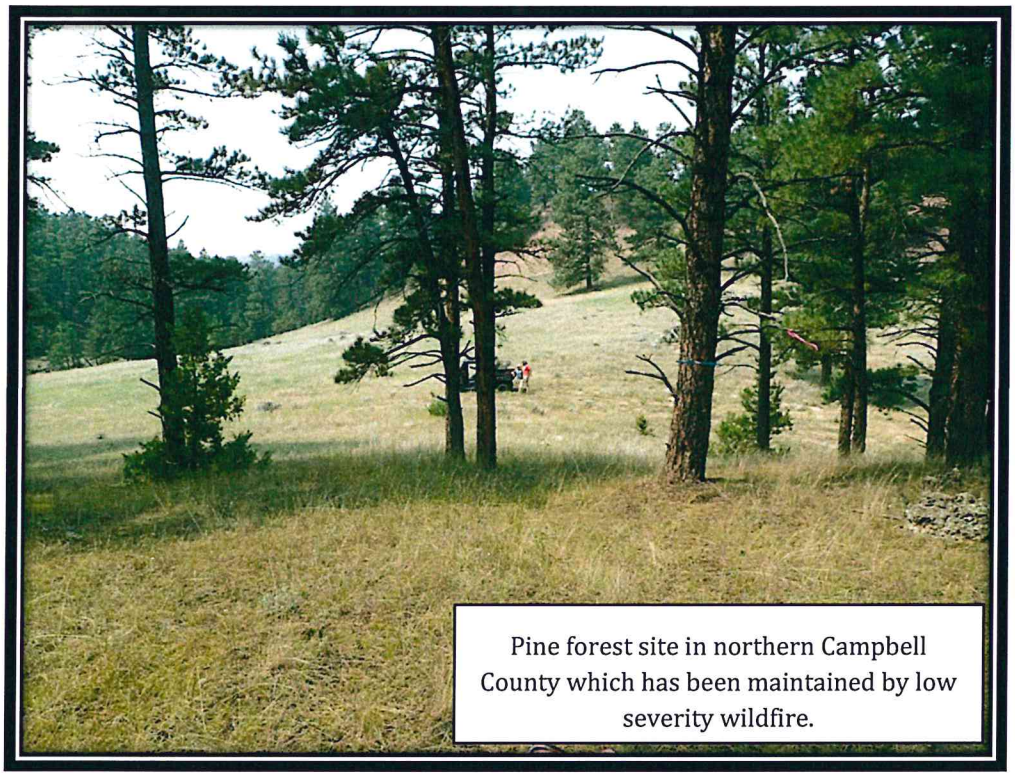
The photo above left shows juniper crowding out chokecherry and snowberry in a drainage bottom in Northern Campbell County. The photo above right shows dense juniper growing around cottonwoods in the Weston Hills area.

Ponderosa pine can withstand low severity fire and individual trees can survive partial crown scorching. **Low or mixed severity fires are beneficial** to pine forests by consuming fuels in the understory or mid-canopy. Though mixed severity fire may torch out groups of mature trees, the majority of the mature pine stand remains intact. Conversely, a crown fire is considered high severity and burns everything. Pine seedlings usually do reestablish after a crown fire but low and mixed severity fire maintains a healthy, mixed age stand by removing fuels and understory growth such as juniper. Juniper can withstand low severity fire but they can be highly flammable and individual trees are usually killed from scorching. Juniper grows in diverse situations from barren ridges to dense northerly slopes where mixed severity fire is beneficial and creates a mix of openings and woodlands.

Fire regimes describe and categorize fuel loading, fire behavior and fire frequency for a plant community (aka setting), such as ponderosa pine forests. The term refers to the typical conditions, the setting is adapted to, given no intervention by humans. For example, ponderosa pine settings are naturally adapted to fire that occurs often and is lower or mixed severity with fuel loading that remains lower. The range of natural fuel loading and fire behavior/occurrence for any setting includes both high and low ends, but the fire regime category is the dominant condition that would naturally occur for the setting (Sommers et al., 2011).

Altered fire regimes describe changes that negatively affect landscape health. When a fire regime is highly altered there is a risk that components of a system could be lost because those components are not adapted to the change. In Campbell County, changes in fuel

loading are key factors in altered fire regimes because they directly affect fire severity, spread, and size. For example in the pine settings, dense stands and stand-replacement fire should be less common on the landscape, while open park-like stands should be more prevalent. The photo below shows a pine forest site in northern Campbell County that has been maintained by surface fire. The juniper woodlands should include a wide range of conditions from grassy openings to dense patches, but **dense stands are prevalent and stand-replacing fire is common**. Likewise, conifers are expanding into many drainages and riparian areas and negatively affecting the health of those systems. Campbell County has experienced large high severity fires in the forest and woodland settings since the mid 1990's. There is risk of losing key system components such as cottonwood corridors.



Pine forest site in northern Campbell County which has been maintained by low severity wildfire.

In some areas of the county ponderosa **pine stands may be converting to grasslands**, where repeated fire has killed seedlings that had germinated after previous fires. This may be happening where the initial fire killed a large area of the mature canopy and though seedlings regenerated from scorched seeds, the new seedlings were killed by successive fires before they could produce the next generation of seed. In these situations, seed source for future stands must come from more distant pine stands.

In the past two decades, annual grasses such as **cheatgrass** have been increasing in burned areas in the county and surrounding areas. These non-native grasses expand into disturbed areas and utilize early spring moisture to grow and cure earlier than the native grasses. Cheatgrass and other annual grasses produce fine fuels and seeds that accumulate quickly in the litter layer. Because they complete growth early in the season, they are able to thrive in dry areas that would otherwise have very little fuel such as scoria knolls and ridges. The fine fuels from these grasses allow early-summer fire to spread where more typical

conditions such as bare ground or green perennial grasses would otherwise hinder fire spread. In addition, these grasses may be creating flammable conditions in lightning prone areas of the county and increasing fire ignitions. The seedbanks of annual grasses can persist in all but the most high severity surface fires. They are adapted to frequent fire and can highly alter the fire regime of sagebrush settings by creating stand-replacement fire behavior and then re-seeding themselves in the burned area. Cheatgrass prevalence in the western United States has contributed to larger and more frequent fire (Balch, 2014).

CYCLICAL WEATHER PATTERNS

The frequency of large wildfires and the total area burned have been steadily increasing in the Western United States and Wyoming. This can be attributed to many factors including natural cyclical weather patterns and drought conditions. There are three main reasons why cyclical weather patterns effect wildfire risk: longer fire season, drought, and increased frequency of lightning.

Longer fire seasons can be the result of earlier spring runoff and a lengthened summer to fall season. Depending on snowfall amounts and moisture availability forests can become susceptible to ignition within a month after snowmelt finishes. This can result in a highly combustible stand for several months.

Wyoming is the 5th driest state in the Union, and **drought** is a constant threat in our region. Since 1999, much of Wyoming has been gripped by moderate to severe drought. The intensity of this drought event has varied from year to year, and counties or regions within the state have experienced varying levels of drought impacts. However, this drought has been a significant event by any measure, and communities will continue to feel its effects for years to come. Conditions eased somewhat in mid-2008, but a near decade with warm temperatures and relatively little precipitation has left the area very vulnerable (Wyoming State Climate Office, 2017). Drought can have major effects on forest stands including tree stress, increased tree mortality, and increased fire risk. When trees are stressed they become more susceptible to insects and diseases. This can result in higher mortality which in turn creates increased fuel loading.

Increased frequency of lightning is expected as thunderstorms become more severe. Summer thunderstorms and lightning occur repeatedly in many areas of Campbell County, and wildfires are ignited during dry storms. Some areas have burned many times in recent decades, and probably burned hundreds of times before the area was settled by homesteaders. It is likely that the early fires in the pine woodlands burned fairly frequently and usually at low severity, where most fires moved across the understory of the forest and did not kill most mature pine. Many fires in recent decades have scorched or consumed the ponderosa pine canopies across large areas, burning in stand-replacement patterns. This higher severity burn pattern is not abnormal, and pine are well adapted to reseed burned areas; however the large size and repetition of the stand-replacing burns seems to be a recent development. The fuel loading situation in the woodlands, combined with longer fire seasons that are anticipated from weather patterns, will encourage stand-replacing wildfires.

EXISTING CHALLENGES

Firefighter and public safety is a primary concern during wildfire management. In addition to other concerns described below, safety is always negatively affected by these challenges:

Campbell County land ownership is mixed and includes private, state, county, and federal lands. This complicates wildfire management because **different landowners have different objectives for land management**. County, state, and federal fire management agencies work together every pre-season to develop annual operating plans (AOP) which outline each partner's policy requirements and provides a framework for mutual understanding of each other's objectives. Though every fire is unique, the AOP provides a foundation to respond safely and effectively across multiple jurisdictions. Most private landowners are not involved with suppression operations or operating plans, and may have differing ideas or concerns about how fire should be managed on the land. Their concerns may differ from neighboring objectives which further creates complexity in wildfire response.

Fuel loading in the forests and woodlands has made many areas indefensible during a wildfire. When summer weather and dry fuel moisture conditions align together, these heavy fuels create a high risk of extreme fire behavior with long distance spotting and the potential for the fire to become large quickly.

Response time can be slow for many fires in the forests and woodlands due to distance and rough terrain. In many cases the fire may not be accessible by ground vehicles, or access may be complicated by multiple land owners. The rural volunteer firefighters are often the first responders and are highly effective, but they may not be available because of other jobs. The county, state, and federal firefighters may have a long distance to travel for initial attack. Aerial resources may be available but response time can vary, especially if there are other fires occurring simultaneously in the region or state.

Due to the remoteness of most forests and woodlands, local **water resources** are usually needed to control fires. This is certainly the case during initial attack when helicopter water drops can quickly reduce active fire behavior on critical portions of the fire. If a local water source is available, such as a stock pond, it reduces the 'turn-around' time for the helicopter and improves the possibility of controlling the fire quickly. In dry years, local water supplies may already be low and may become depleted quickly.

OBJECTIVE

Mitigate the severity of fires through vegetation management and cooperation across landownership.

FUTURE MANAGEMENT DIRECTION

Encourage all landowners, whether agency, industry or private to **reduce fuel loading** in their forests and woodlands. For every situation explore the full range of treatment types that remove or redistribute fuels - from thinning to forest product sales to prescribed fire. Prescribed fire is the most effective fuels reduction treatment and should be considered in any situation, whether in conjunction with mechanical treatments or as a stand-alone treatment.

Continue **collaborative projects** which implement fuels reduction and forest health treatments across multiple jurisdictions. These partnerships not only enhance landscape health, communications, and safety but improve competitiveness for grant funding. **Outside funding opportunities** should be pursued for treatment implementation and to further collaborative planning.

Provide e**ducation and outreach** to county and local agencies and groups, and private landowners to improve understanding of forest and fuels management, and wildfire management.

Revise the **Campbell County Community Wildland Fire Protection Plan (CWPP)** to support these management directions and tier to this document. Consider developing a Collaborative Wildfire Management Plan (FMP) for the county, or setting a framework within the CWPP for smaller collaborative groups to develop their own FMPs. Within the CWPP, define trigger points in which post-fire recovery actions would be necessary to address public safety and/or critical landscape health concerns such as erosion, flooding, weed infestations, and habitat damage.

INVASIVE & NOXIOUS SPECIES

CURRENT CONDITIONS:

In areas of northwest Campbell County leafy spurge has been the main priority for over 25 years. Crews work annually to cover approximately 40,000 acres of land. In addition to the Northwest corner, other areas along Cottonwood Creek and the East Campbell/Crook County line are also treated for leafy spurge. Other weeds of concern in the area include spotted and Russian knapweed, dalmation toadflax, whitetop and an abundance of Canada thistle.

While not on the state designated, nor the Campbell County declared list, cheatgrass or downey brome is also found in abundance in some areas. With funding from the BLM and Wyoming Game and Fish Department some cheatgrass projects have been conducted.

Areas with past fire history, with little to no competition from desirable species, have shown to be key habitat for noxious and invasive species to establish and spread rapidly.

EXISTING CHALLENGES

The **invasive nature** of noxious species is the primary challenge for Campbell County. The non-native and invasive plant species establish and spread rapidly, even in established healthy rangelands. Disturbed or unhealthy sites exaggerate the noxious weed potential.

With **limited funding** and Federal regulation, the efficacy of noxious weed and pest programs can be dramatically reduced, either by lack of funding or with limits on which pesticides can actually be applied. A restricted toolbox not only limits what can be used, it also hinders landowners in their control efforts when blocks of federal land restrict application of pesticides that are not only very effective, but can be a better tool for the job in certain areas. Although some federal funding is being contributed to projects, a single species target is often the management objective. While a certain species program can certainly be of great benefit, it's important to also manage for other existing threats to native range and ecosystems, and funding should be just as available to other high priority areas.

Declining local, state and federal budgets will significantly impact the areas ability to address invasive and noxious species. Cost shares in place for landowners may be reduced, as well as the availability and quantity of pesticides. Higher prices could lead to potentially high amounts of declining control efforts and lead to degradation of healthy ecosystems.

OBJECTIVE

To identify the threats to native landscapes and act on management strategies quickly and effectively to maintaining a balanced, healthy ecosystem that can sustain a variety of land use objectives.

- Control introduction of weeds, insects and diseases (I&D)
- Integrated pest management
- Do not increase with I&D and weeds through active timber management.

FUTURE MANAGEMENT DIRECTION

Future management decisions and successful programs are always going to be in direct correlation to the **funding** sources available at the time of need. It is important for all land managers to understand that prevention is the least expensive and most effective management tool available. Any land disturbance event has the potential to significantly change the plant and animal community and it is important to identify the threats to native ecosystems before they have a chance to take hold. Surveying current conditions, identifying noxious species of concern in an area and controlling noxious species early can considerably limit the time and money spent on projects and programs.

Outreach and education is a key component to maintaining a balanced and healthy ecosystem in Campbell County. A variety of agencies should continue to educate and provide the necessary tools to limit the establishment of noxious and invasive species to keep populations at manageable levels. This education should be provided to agencies, interested parties and the general public.

CURRENT CONDITIONS

Bark beetles continue to be a major damaging agent impacting coniferous forests throughout the West (Graham et al, 2016). Bark beetles include several types of beetles but can be generally classified as beetles that live and mine between the bark and wood of trees. Adults typically bore through the outer bark and create tunnels between bark and wood and lay eggs in the tunnels. Of the bark beetle species, spruce beetles, Douglas fir beetles, western pine beetle, and mountain pine beetle (MPB) are the most destructive insects of western conifers (Furniss & Carolin, 1977).

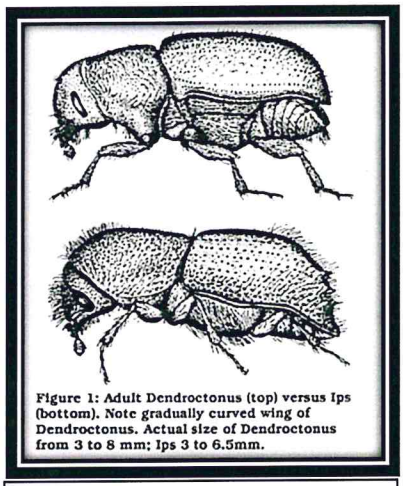


Figure 1: Adult Dendroctonus (top) versus Ips (bottom). Note gradually curved wing of Dendroctonus. Actual size of Dendroctonus from 3 to 8 mm; Ips 3 to 6.5mm.

Source:http://www.treefarmer.com/mountain_pine_beetle_bulletin.htm

Engraver beetles (*Ips sp.)* are a type of bark beetle that can also cause damage to ponderosa pine trees. Ips beetles are native and not generally considered to be as destructive as mountain pine beetles. Typically Ips beetles attack trees that are in decline from stress, wounding or root damage. However in large enough concentrations they can cause damage to trees. Large concentrations occur with stress events, like prolonged drought or when there is an abundance of green slash from natural events creating windthrow or timber management activities (Cranshaw & Leatherman, 2002).

Mountain pine beetle (*Dendroctonus ponderosae*), is native to the forests of western North America. Periodic outbreaks of the insect, previously called the Black Hills beetle or Rocky Mountain pine beetle, can result in losses of millions of trees. Outbreaks can occur in any forested area with pines, particularly ponderosa, lodgepole, scotch and limber pine. During early stages of an outbreak, attacks are limited largely to trees under stress from injury, poor site conditions, fire damage, overcrowding, root disease or old age. However, as beetle populations increase, MPB attacks may involve most large trees in the outbreak area (South Dakota Department of Agriculture, 2016).Currently there have been no epidemic populations found in Campbell County. However, pressure still exists as populations continue to be elevated in neighboring Crook County, Bearlodge Forest.

Porcupine damage

Porcupine *(Erethizon dorsatum)* are another native species that can cause damage to the forests in Campbell County. This species is commonly found in coniferous forests, cottonwood stands, and alpine tundra. These mammals are the second largest rodents in North America and have several adaptations to aid in their ability to reach food, which mainly consists of bark, fruit and leaves. Porcupines feed primarily on inner tree bark, twigs, and leaves with a preference towards ponderosa pine. Porcupines prefer to eat leaves and terminal twigs which will not cause tree mortality. This will instead cause undesirable growth habit. However, when feeding occurs on the lower trunk it can result in basal girdling. This may result in tree mortality (Olson, 1999).

EXSISTING CHALLENGES

Native damaging agents present their own unique set of challenges. When working to manage these insects and animals it is important to remember that as a native species they will always be present within the ecosystem. Typically their populations only reach epidemic levels when the ecosystem that they are present in has reached a level of imbalance. In some instances these agents can aid in balancing forest systems by removing a small amount of trees. However they can also escalate in population to the point that they can damage the system causing a chain reaction of ecosystem issues.

This can be seen with the epidemic levels of mountain pine beetle that have been present throughout the west. This increase in a native species, to epidemic levels, can be attributed to forest stands that are overly dense and have a lack of age class diversification. Campbell County forest, like many ponderosa pine systems, lack variation in age class and tend to be extremely dense. This creates a prime environment for populations of native species to increase.

OBJECTIVE

To identify the threats to native landscapes and act on management strategies quickly and effectively to maintaining a balanced, healthy ecosystem that can sustain a variety of land use objectives.

FUTURE MANAGEMENT DIRECTION

Management of native species populations is twofold, one is **managing the species** itself and the other is **managing the forest system** to maintain a healthy balanced ecosystem. This means proactive management should take place to avoid costly management. Any land disturbance event has the potential to significantly change the plant and animal community and it is important to identify the threats to native ecosystems before they have a chance to take hold. Surveying current conditions, and identifying changes in population of native species that effect forest health early can considerably limit the time and money spent on projects and programs.

Outreach and education is a key component to maintaining a balanced and healthy ecosystem in Campbell County. A variety of agencies should continue to educate landowners and natural resource practitioners on native damaging species to keep populations at manageable levels.

RURAL INTERFACE

CURRENT CONDITIONS

The Campbell County Fire Department has evolved over the decades to include multiple full time career firefighters, part time and seasonal staff, and a variety of apparatus to respond to structure fires, medical emergencies, wildland fires, and hazmat situations. This evolution has paralleled the population growth of Campbell County.

Throughout the past three to four decades Campbell County has seen a growth in its coal, oil, and coal bed methane production. With the increase in the energy production industry the population of the County has also increased. According to US Census Bureau data, from April 1, 2010 to July 1, 2015 the population of Campbell County has increased by 6.7%. With this per capita growth, has come the increase in developments and subdivisions being constructed within rural interface areas. Many private landowners do not consider the wildland fuels that surround their homes, structures, and interface areas. This can pose a tremendous risk to life, property and infrastructure, and to the responding units tasked with the responsibility of fire suppression of structures and wildland fire events.

In 2001 "communities at risk" were identified for the National Registry. Criterion set forth within the State of Wyoming was that these communities must be in and among conifer vegetation. Identified in Campbell County were the Bitter Creek Area, Brunson Subdivision, Cedar Hills, Mader Subdivision, Silver Hills, and Wildwood Camp. Regardless of the intent of the registry, there is no doubt that other wildland vegetation, including grass/forbs/shrubs and riparian areas, also pose a high risk in terms of fuels interacting with the rural interface of Campbell County. The infrastructure of the County is not associated with subdivision growth alone. According to the Wyoming Oil and Gas Conservation Commission there are approximately 46,000 drill holes for oil and gas production in Campbell County. The Wyoming Mining Association shows 14 coal mines, 1 uranium mine, and over a 145 miles of Burlington Northern/Santa Fe rail lines. Based on 2015 Campbell County Assessor data, the County has an estimated total asset exposure of $3,651,674,674 including building value plus content value (see Table 1).

North Heptner Fire 2016

Table 1: Asset Exposure, Campbell County 2015

Jurisdiction	Building Count	Improved Value	Est. Content Value	Total Exposure
Gillette	9,405	$1,692,406,694	$1,051,939,917	$2,744,346,611
Wright	446	$56,883,430	$34,811,015	$91,694,445
Unincorporated	4,854	$511,014,089	$304,619,529	$815,633,618
Total	**14,705**	**$2,260,304,213**	**$1,391,370,461**	**$3,651,674,674**

Source: Campbell County Assessor, 2015

Fuels in Campbell County are predominately a grass/forb/shrub mix with areas having ponderosa pine and juniper trees, and cottonwood trees found within riparian areas. Composite Wildfire Risk Assessments Ratings have been prepared for the County via the BLM Eastern Wyoming Zone (aka High Plains District) (BLM, 2003). The Risk Assessment and Mitigation Strategies (RAMS) was a consistent modeling process for developing prevention and fuels management programs and was performed in 2003 for the BLM. The assessment was done across all ownerships on the landscape. These ratings have indicated the fuel hazard for the majority of the County to be moderate to high. This rating quantifies the potential for fire behavior characteristics to quickly exceed the capabilities of responding suppression resources.

A total of 2,014 fires have been recorded by the Campbell County Fire Department between 2001 and 2014 (see Table 2). Almost half of these fires were ignited by human activity.

Table 2: Summary of Wildland Fire Events

Total Acres Burned	Total Number of Fires	Natural Cause	Human Cause	Unknown
101,767	2,014	32.65%	48.06%	19.30%

Source: Campbell County Fire Department

This could illustrate that there seems to be a relationship between ignitions related to development and population growth. Response times average between 30 and 60 minutes and can be compounded due to the road systems of the County, landownership, and the sheer geographic area of the County.

The Risk Assessment and Mitigation Strategies prepared by the BLM summarizes the rural interface area as: "There is no reasonable nor practical area of delineation within the County in regards to assessment and subsequent management consideration. Rapid county-wide industrial development, dramatic population growth with a high demand for housing, and moderate to high fuel hazard ratings throughout the County makes compartmentalization impractical and ineffective." Basically, the whole of the County is in one degree or another affiliated with rural interface.

Cedar Draw 2 Fire 2016

The principal action plan for the State is the Wyoming Wildland Urban Interface Hazard Assessment was produced by a joint venture of the Wyoming State Forestry Division, USFS, BLM, NPS, and other interested parties, with the BLM hosting the data. This is a Geographic Information System (GIS)-based mapping mission building on The Front Range Redzone Project in Colorado—the first fire-hazard mapping program of its kind. The Assessment maps fire hazard incorporating population density against slope, aspect, and fuels. With the mapping analysis evaluating areas of varying wildfire vulnerability, the final output will result in a Risk, Hazard, and Value (RHV) map displaying areas of concern (Redzones) for catastrophic wildland fires. The Wyoming Wildland Urban Interface Hazard Assessment builds on the work of earlier hazard methodologies and provides new and updated data to further enhance accuracy and scale.

Figure 1 represents the result of the Redzone mapping. A **significant portion of Campbell County falls within the Redzone**, with nearly all of the incorporated area of Gillette, the most populous city in the County, having a wildland-urban interface. "Based upon a review of the mapping during the 2015 update to this plan the planning committee noted there is

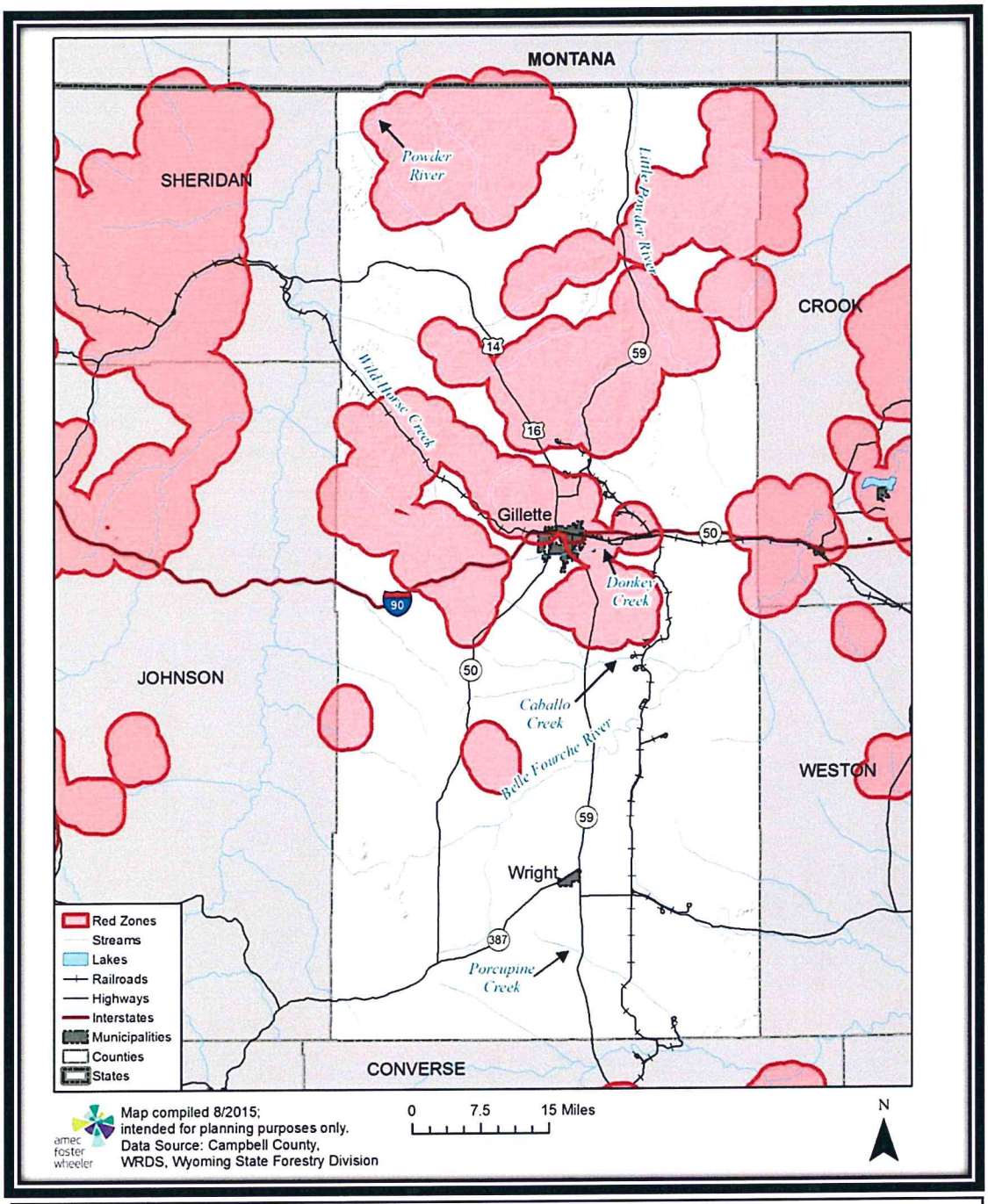


Figure 1: Campbell County "Redzones"

much more exposure to fire hazards, and an increased potential for ignitions, in the southern portion of the County due to more recent oil and gas development" (Campbell County Emergency Management, 2016).

EXISTING CHALLENGES

Campbell County, Wyoming is 4,807 square miles in size. The sheer **geographic area** of the County creates a challenge in the response times of suppression resources. As before mentioned **response times** can average between 30 to 60 minutes and can be compounded by road locations and road conditions. Related to geographic area is landownership. The majority of the County is privately owned (71%) and population densities can vary from sparse to high depending on the location within Campbell County. A challenge facing fire suppression resources can be the varying private landowner attitudes when related to fire suppression tactics. The **diversity in landowner attitudes** can vary between full suppression and willingness to allow mechanized resources (bulldozers and road graders) to participate in suppression tactics on their property to "let it burn" mentalities and unwillingness to allow mechanized resources (bulldozers and road graders) to participate in suppression tactics on their respected properties.

Another challenge that creates complexity in fire suppression activities in Campbell County is the availability of **water resources**. According to US Climate Data, the average rainfall and snowfall amounts for the County are 16.93 inches and 59 inches respectfully. The majority of the County's precipitation occurs in May and June (US Climate Data, 2017). The driest months correlate to the hottest parts of the year, with much of the naturally deposited water amounts becoming low to non-existent. Water resources that are conducive for drafting and air operations are not readily found in Campbell County. Much of the water needs in relation to wildland fire suppression are artificial in nature (port-a-tanks, stock tanks, stock ponds, etc.) and rely on being supplied via tender operations. This creates a situation where water needs to be hauled to the suppression sight. Tenders take time to shuttle water from appropriate sources. This can result in a time lag in relation to when water is available for suppression resources.

Campbell County has an active naturally ignited fire regime. As infrastructure and homes are built around the County the **rural interface area expands**. Without populace education on living with fire, many home sites do not have any artificially created barrier to separate structures from the natural fuel types found in Campbell County. The challenge of informing the County's populace to the realities of response times, resource availability, lack of water resources, and natural to artificial fuel continuity can combine with active wildland fire events compounding the risk to life and property. This **education** needs to occur with the entire populace of the County to help create fire adapted communities that are more resilient to wildland fire events. However, the populace must be receptive to this information in order to have an impact on fire behavior. The populace must also be willing to implement proper building techniques and fuels reduction projects that can often increase building costs and out-of-pocket expenses.

OBJECTIVE

Utilize integrated forest and fire management tools to help control and suppress wildfires occurring in rural interface areas in Campbell County.

FUTURE MANAGEMENT DIRECTION

Fire is always going to be present on the landscape of Campbell County, whether human or naturally caused. It is imperative that the population of the County is aware of this and takes steps to become more "fire adaptive" as a community. In May 2007, a **Community Wildfire Protection Plan** was drafted for Campbell County. This plan was never finalized through signature. It is recommended for the County to re-draft/revise and adopt a county wide CWPP that would help in identifying priority areas while offering recommendations on mitigating the risk of wildland fire in the rural interface of the County.

Many counties in Wyoming participate in the State's cost-share grant program, Western State Wildland Urban Interface (WSWUI). This program is designed to help **develop "fuels coordinator" positions**, within the counties, tasked with the contacting of landowners, evaluating interested parties' properties by developing a Wildfire Mitigation Plan, and to help the landowners to complete applications for the allocation of cost-share dollars to implement recommended fuels mitigation projects. This **cost-share program** offers participating landowners reimbursement dollars for the establishment of defensible space, fuel breaks, and/or fuel treatments on private property to help landowners become more "fire adaptive". As of 2014, Campbell County was one of the eight Wyoming counties not participating in the state cost-share grant program (WSWUI) for fire mitigation activities on private lands *(Wyoming State Hazard Mitigation Plan, 2014).*

Firewisewyoming.com Zone Map

Developing this position in Campbell County would also help in the **education** of the County's populace on living with fire on the landscape. There is a variety of sources of information dealing with the event of wildfire. Below are some of the sources that could be utilized in educational seminars for the public.

Firewise - www.firewise.org
Fire Adapted Communities - www.fireadapted.org
Ready, Set Go! - www.wildlandfirersg.org

Development requirements and restrictions could be another suggested area that Campbell County utilizes to help become more "fire adaptive". The County has already adopted certain development requirements for new subdivisions including street width and ingress/egress requirements. Future consideration could be given to water sources for fire suppression, as well as requiring certain fire resistant building materials for roofing and siding used in construction of new homes and buildings in the rural interface. This would need to be a collaboration of County Commissioners, Planning Commission officials, and

County Fire representatives and should also focus on future energy development projects as well.

STORM EVENTS

CURRENT CONDITIONS

Severe storm events are un-predictable and tend to occur annually in localized areas of Campbell County. The severity of these storms are often determined after the event has occurred and the damage has been surveyed. Campbell County Wyoming has seen multiple severe weather events, including tornados, high winds, lightning and heavy snow. There have been confirmed tornados reported in 2005, 2007, 2008, 2014, and most recently in August of 2016. The risk of tornado damage in Gillette is higher than the Wyoming average, but is lower than the national average. In 1993 a hail storm moved through Gillette causing a reported $17.0 million in damages and ranks in Wyoming's top five costliest hail storms (Wyoming Climate Atlas, 2017).

Weather prediction is challenge in Wyoming. The varied terrain of Campbell County blocks long range radar capabilities, making accurate forecasting challenging. In January 2009 a feasibility study was conducted using congressional appropriations sponsored by Senators Mike Enzi of Wyoming and Maria Cantwell of Washington; and was managed by the National Oceanic and Atmospheric Administration (NOAA) through the National Severe Storms Laboratory. The study was to investigate supplementing long range radar systems with low-cost, short-range Doppler radar networks. The study was contracted to CASA, the Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere. The study concluded that severe storm warning lead times are below-average for Campbell County, Wyoming (Brotzge et al., 2009).

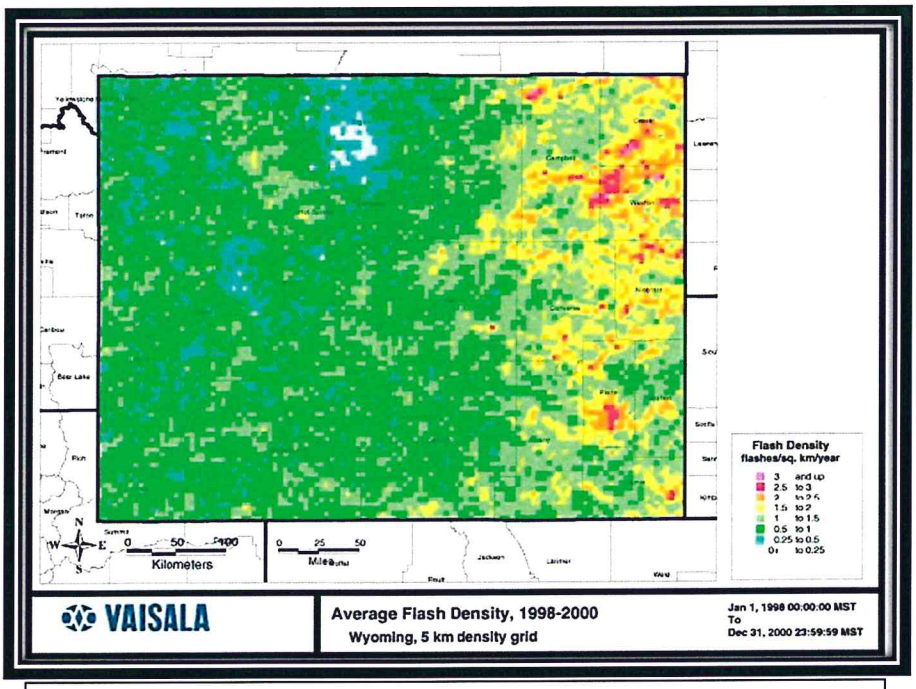
Storm events have a direct impact on the forest systems of Campbell County. The two most damaging outcomes of large storms on forest stands is wind-throw via thunderstorm outflow winds/microbursts and fire. Wind-throw amounts and severity is directly related to a storm's magnitude, and where the forest stand sits on the landscape in relation to wind direction (i.e. leeward v. windward, in draw bottom v. on ridgetop, etc.). All forest systems have some level of vulnerability to wind-throw. Campbell County experiences strong winds as a result of weather systems which both pass through and build up over the County. Summer thunderstorms create the potential for microburst and downburst winds as they dissipate, and strong updrafts become strong downdrafts (*Hazard/Risk Assessment and Mitigation Plan, 2001*). A microburst occurs when rain evaporates before hitting the ground, cooling

weather.gov Microburst Affects

the air as it drops. The cooler air plummets to the ground at great speeds similar to that of a tornado and upon reaching the ground will travel as a river of air for significant distances, creating the potential for wind damage. Every decaying thunderstorm has the potential to create a microburst, making them impossible to forecast or provide advance warning.

Three recorded microbursts which created significant damage have been reported by the Campbell County Emergency Management Agency.

- Northern Campbell County experienced a damaging microburst in the late 1980s which left a path of damage to trees, fences and fields nearly a mile long.
- In August of 1998, damage from one to two microbursts occurred simultaneously in the Antelope Valley, Sleepy Hollow and Freedom Hills subdivisions south and east of Gillette. Winds for the two events ranged from 70 to 120 mph based upon on-scene damage. Five mobile homes were destroyed, five additional mobile homes suffered major damage. Four people inside of one of the mobile homes sustained injuries.
- In June 2000, a microburst spawned by a thunderstorm destroyed a mobile home 14 miles north of Rozet.



Wyoming Multi-Hazard Mitigation Plan 2014

According to Vaisala, Inc. (which monitors lightning strikes nationwide) lightning occurrence in Wyoming is most frequent in the eastern third of the state and is the leading cause of most wildfire events for Wyoming. Fire suppression resources (Campbell County Fire Department, Bureau of Land Management, Wyoming State Forestry Division, and the US Forest Service) run multiple wildland fire calls annually, with many of the starts caused by lightning strikes. These fires have the potential to negatively impact forest health

conditions. The last 70+ years of fire suppression has lead Campbell County forest stands to have more fuel available resulting in fires that can burn more intensely, inflicting more tree mortality, and stand and overall site degradation.

EXISTING CHALLENGES

The largest existing challenge for Campbell County is the **lack in accurate data** from radar images that would allow for more accurate weather forecasting by the National Weather Service (NWS). The above mentioned report recommended the installation of a network of 42 short-range (X-band) radars, deployed strategically, to provide extensive multi-Doppler coverage of wind and rain at low levels (below 2 km AGL). Two long-range weather radars could provide equivalent coverage at and above 2 km AGL. This increased data would enable real-time monitoring and improved prediction of warm-season severe thunderstorms and low-level winter weather. The NWS would also be able to actively monitor storm tracks and outflows, helping in fire weather predictions. To date radar installations have not occurred in the area. These weather tracking systems continue to be identified as an area of improvement in the "Multi-Hazard Mitigation Plan" (Campbell County Emergency Management, 2016).

The **absence of real-time storm monitoring** creates a lag in response times to large wind-throw events. Wind-throw can cause a potential for increase in activity in certain *ips* species of bark beetle. *Ips* beetles tend to generate two "flights" per year. "Flights" are when larvae, developed into adults, bore out of the host tree and fly to another host tree to aggregate and reproduce. *Ips* bark beetles tend to be attracted to the green slash, typical of wind-throw, and can spread to standing trees as pest numbers begin to increase. If population numbers become epidemic more standing live trees will be affected, increasing mortality rates among forest stands. Increasing, mortality levels in the forest stands of Campbell County will increase fuel loads, in turn increasing forest stand susceptibility to large fire events.

Even with increased radar data wind-throw events are not 100% predictable. These events can happen to any forest at any time, treated or untreated. Some forest types are more susceptible to wind-throw due to their species composition and the species' dendrological characteristics (i.e. ponderosa pine v. lodgepole pine root depths). Treatment should not be disregarded because of this, but strategically viewed in terms of historic wind patterns v. stands' location on the landscape and its species composition.

Campbell County's expansive square mileage results in monitoring for wind-throw events challenging. Campbell County is 71% private landownership which could create a lag in response time to forest systems being damaged by large storms. Many of these events go un-noticed for weeks if not months or years. Landowners may not even be aware that an event occurred. Because of landownership, access to damaged areas may not be feasible or desired by the landowner.

Financing is another obstacle in managing storm events. Landowners may understand the hazard posed by storm events on a forested stand in Campbell County, but may not have the resources to mitigate the damage. If a marginally valued timber stand is damaged by a

storm event there may be a potential monetary value needed to clean-up the stand. Those funds may not be immediately available to the property owner.

OBJECTIVE

Mitigate possible bark beetle outbreaks and fuel loading tied to storm events through timely salvage operations and fuels mitigation projects. Use historic wind/storm patterns in correlation to stand composition and location on the landscape to help in creating treatment options to increase resiliency of forested landscapes in Campbell County.

FUTURE MANAGEMENT DIRECTION

Storm events are ever present on the landscape. These events can pose a hazard to forest health in Campbell County. **Educating private landowners** on the benefits of treating storm damaged areas could help to alleviate possible impacts of storm events. Private landowners could identify localized storm damage to be investigated for possible salvage opportunities to reduce the risk of bark beetle infestations, and to decrease the fuel loads on the forest system.

Further education of private landowners may also increase the interest in proactive forest management. Forest stewardship activities in Campbell County would create more resilient stands and help to harden the forest health of the area. Proactive management to reduce stem densities can help prevent bark beetle infestations. Restoring proper stem densities to Campbell County forests would also help align the system to historical fuel loads, decreasing fire intensity. Forest management plans and tactics would use historic wind/storm patterns in correlation to stand composition and location on the landscape to help in creating treatment options.

While emergency **funding** for clean-up of storm damage to forest stands may not be an option, grant dollars exist for accomplishing forest health projects. These grant dollars cannot be used to address clean-up activities, however they can provide proactive forest management, which is the best way to mitigate storm damage risks. Currently the Campbell County Conservation District is utilizing these project funds to thin stands to a more historical stem density. The focus on

The Radar Feasibility Study compiled in January of 2009 needs to be re-visited. Having real-time storm data is needed for Campbell County. Public and firefighter safety are the two most important objectives when dealing with wildfires. **Accurate fire weather forecasting** is paramount in accomplishing these two primary objectives. A discussion with Campbell County Emergency Management, Campbell County Commissioners, the NWS, the State of Wyoming, and other interested parties should occur to develop options that could be implemented to get more radar installations constructed. As of May 2017, Campbell County is again examining possibilities to address weather forecasting throughout the county.

WILDLIFE HABITAT CONCERN

CURRENT CONDITIONS

Currently, the forests in northern Campbell County provide habitat for a variety of wildlife species that require tree canopy cover to fulfill part of their life cycle needs. Campbell County is dominated mainly by short grass prairie, and the ponderosa pine (*Pinus ponderosa*) forests in the northern part of the county provide a unique habitat for wildlife that is not present throughout the county. Northern Campbell County contains a mixture of ponderosa pine/ Rocky Mountain juniper (*Juniperus scopulorum*) woodlands and large open grassland parks dominated by Wyoming big sagebrush (*Artemisa tridentate* ssp. *wyomingensis*). This mixed forest cover and grassland/shrubland creates ideal **edge habitat** for a variety species of wildlife, including wild turkeys, elk, mule deer, and several different bird species.

Historically, forest fire frequency was high to moderate, depending on location and forest fire severity is mixed throughout northern Campbell County. Given this fire regime, a **diversity of different age classes and seral states** of ponderosa pine/Rocky Mountain juniper forests should be present in northern Campbell County (Landfire, 2017). This diversity in age classes and seral states of ponderosa pine/Rocky Mountain juniper is **important for wildlife habitat** due to abundance of edge habitat that formed from the intersection of the variety of seral states (Thomas, 1979). An abundance of edge habitat increases the abundance and diversity of wildlife that can utilize a given area (Patton, 1975).

Another important habitat attribute that is found in northern Campbell County is the presence of numerous **mesic draws** and ravines that are present within the forest. These draws contain a variety of deciduous woody species such as chokecherry (*Prunus virginiana*), skunkbrush sumac (*Rhus trilobata*), western snowberry (*Symphoricarpos occidentalis*) wild rose (*Rosa* sp.) and wild currant (*Ribes* ssp.). These plant species provide a valuable food resource to a variety of wildlife species, including mule deer, wild turkeys, several small mammal and bird species (Severson, 1981; Faanes, 1984; Wichman, 1993).

Wild currant (*Ribes* spp.), a deciduous woody browse species commonly found in mesic draws in northern Campbell County.

An example of loss of canopy cover and conversion to grasslands associated with high intensity wildfires in northern Campbell County.

Currently, the stocking rate of ponderosa pine and Rocky Mountain juniper is increasing most likely due to lack of management and long term fire suppression. As a result, it appears that **fire frequency and intensity is increasing**. Due to the increasing lack of diversity exhibited in the forests in northern Campbell County, high intensity stand replacing fires are becoming increasingly common. These fires reduce habitat quality for wildlife species that depend on forest canopy cover, by completely eliminating the forest stand. Although some pine/juniper regeneration is observed on some sites, many sites appear to becoming dominated by grass after fires, and little to no tree regeneration is observed. In addition to destroying tree canopy cover, many of these fires burn hot enough to burn into the large sagebrush meadows, thus eliminating sagebrush stands. Forest fire movement in sagebrush meadows is also facilitated by conifer encroachment into sagebrush meadows. This is of concern in regards to wildlife habitat because Wyoming big sagebrush does not appear to be very fire tolerant, and reestablishment after wildfire is inconsistent (Beck et al., 2012). Wyoming big sagebrush provides important winter forage for a variety of wildlife species such as mule deer and sage grouse (Amdundson et al., 2002; Greer, 2002). In many of the mesic draw communities, Rocky Mountain juniper is becoming the dominate plant species. As result, many of the **deciduous browse species are declining** in these mesic draw habitats due to competition for water and sunlight from the

An example of juniper encroaching into mesic draw habitat in northern Campbell County.

junipers. In some mesic draws, junipers are becoming large enough that they are even shading out the herbaceous plant community, resulting in an understory with very little vegetation. Due to the constant drainage of water that these mesic draws receive, these areas have the ability to provide highly nutritious forage for longer periods during the growing season (Wichman, 1993). When juniper begin encroaching in these draws and competing for sunlight and water with deciduous woody species grasses and forbs, these mesic draws lose their ability to provide for wildlife due to the decrease in highly nutritious forage.

The effects of habitat degradation due to loss of forest age and seral state diversity and loss of sagebrush and mesic draw habitat can also have an economical effect for landowners in northern Campbell County. **Outfitting** for recreational hunting is an important part of the income for many landowners in northern Campbell County. The issues listed above associated with wildlife habitat directly affect the outfitting industry in northern Campbell County. Protecting habitat from catastrophic wildfire will protect crucial security cover that draws game species to northern Campbell County. Enhancing habitat by reducing conifer stocking level in forests, sage brush meadows, and mesic draw habitat will enhance quantity and quality of forage available for game species in northern Campbell County. This in turn will promote robust and healthy wildlife populations which contribute to an increase in quality and quantity of game animals. Higher quantity of higher quality game animals will increase the value of the hunting on the property, which in turn will increase the income received from recreational hunting on the property.

EXISTING CHALLENGES

To alleviate issues regarding habitat degradation due to catastrophic wildfire and loss of age class and seral state diversity, **conifers need to be thinned** to a lower stocking level and conifer encroachment into sagebrush meadows needs to be removed. To effectively reduce the threat of habitat degradation, conifer thinning and meadow regeneration need to be applied at a large scale across multiple different land ownerships. Two major challenges arise with applying these measures; ability to reduce conifer stocking level and/or rejuvenate meadows at the landscape level due to differences in land ownership and the cost of implementing these practices.

Northern Campbell County is dominated by private land, and due the number of different private landowners and management objectives, obtaining a consensus to reduce conifer stocking level and meadow rejuvenation can be difficult. This is a challenge, because in order to effectively reduce the threat of catastrophic wildfire across the landscape, **participation between multiple landowners** is imperative.

Another challenge is **the cost of thinning** conifers to appropriate stocking level and removing conifer encroachment from meadows and mesic riparian areas can be costly. Many landowners do not have the funds needed to implement such practices.

OBJECTIVE

To protect wildlife habitat from degradation, decrease loss of habitat from wildfires, and improve current habitat through active forest management and meadow restoration.

FUTURE MANAGEMENT DIRECTION

To achieve the objective and address the challenges, work needs to be directed at providing **education** to private landowners about the threats that overstocked forests pose to wildlife habitat in northern Campbell County. In addition, funding should be sought out to provide **cost share opportunities** for private landowner's to thin conifer stands and remove conifer encroachment in sagebrush meadows and mesic draws.
This can be accomplished by:

- Reduce conifer stocking rate to levels to facilitate low intensity wildfires, which in turn will protect wildlife habitat degradation from catastrophic wildfire.
- Remove junipers from mesic draw habitat to promote deciduous woody and herbaceous plant species production.
- Remove conifer encroaching into shrubland and grassland meadows to reduce fuel loads in these habitat types.

WATER QUALITY AND SUPPLY

CURRENT CONDITIONS

Forests play an important role in regulating **water quantity** and water quality. The forested areas in Campbell County typically receive more annual rain and snow fall than non-forested areas. The majority of forested land in Northern Campbell County receives an estimated 13-18 inches of annual rainfall, while the non-forested areas receive 11-13 inches. Trees also act as natural windbreaks that catch and accumulate blowing snow. The additional precipitation and snowfall received by the forested lands recharge the ground water supply and can generate a large portion of the water supply for a watershed.

Campbell County contains segments of seven (7) different 8-Digit Hydraulic Unit Code (HUC8) **watersheds**: Upper Powder, Middle Powder, Little Powder, Upper Little Missouri, Upper Belle Fourche, Upper Cheyenne, and Antelope watersheds (see Appendix C). The majority of the forested areas within the County are found in the Little Powder Watershed and Middle Powder Watershed, which contain an estimated 156,414 acres and 84,239 acres of forested land, respectively. Each watershed contains a network of streams and rivers that are supported by the seasonal precipitation and snowfall. Campbell County receives an estimated 11-18 inches of rainfall and 33-68 inches of annual snowfall. The forested watersheds in Campbell County are primarily made up of ephemeral streams that only flow after precipitation events. The ephemeral streams flow into intermittent streams that may only flow during certain seasons. Intermittent streams then flow into perennial streams, which flow all year round. Campbell County contains approximately 4,065 miles of ephemeral stream, 13,974 miles of intermittent stream, and 283 miles of perennial

streams. The five (5) primary perennial tributaries: The Powder River, Belle Fourche River, Little Powder River, Stonepile Creek, and Donkey Creek.

Forests provide many ecosystem services that improve the **water quality** as it moves towards perennial streams. These watershed services may include: nutrient cycling, water purification, flood control, food supply, recreation, and wildlife habitat. Heavy vegetation helps slows down the water's velocity, minimizes erosion, and allows the water to infiltrate into the soil. During a series of biological and chemical processes, a forest can greatly improve the water quality as it moves downstream. Harmful water contaminants are taken up by plant roots, adsorption into soil particles, or utilized by microorganisms (Klapproth, 2009). Water quality is one of the most important factors required to meet both ecological and human needs. The major **water uses** in Campbell County include: agriculture, wildlife, municipal, industrial uses, and power generation. Minor water uses include irrigation and recreation. These combined water uses can impact the overall water quality within the watersheds. Several surface waters in Campbell County have been impaired by various forms of nonpoint source pollution including phosphorous, sediment, *E. coli*, and fecal coliform. While forested areas greatly improve the overall water quality, it can be difficult to counteract the impairments that can occur downstream or outside of a forested watershed.

EXISTING CHALLENGES

Natural and human associated disturbances that occur within a forested watershed can greatly influence the water quality and quantity for the users downstream. The natural challenges that commonly affect forested watersheds include wildfires, soil erosion, and debris flow. The human associated challenges may result from urban development, agriculture production, timber harvesting, and forest management activities. Significant changes within a forested watershed can directly influence the chemical, biological, and physical water quality properties. Soil erosion, stream temperature, and non-point source pollution are some of the common human associated water quality challenges observed within a forested watershed.

Wildfires are natural and important processes that can improve the overall health of a forest and help cycle nutrients. However, high concentrations of fuel loads can lead to severe wildfires that burn hotter and produce more ash (Santin et al, 2015). These severe wildfire events can cause catastrophic impairments to water quality and water quantity. Severe wildfire events can produce hydrophobic or water repellent soil conditions. **Hydrophobic soils** develop when fires reach temperatures hot enough to vaporize organic matter and coats soil particles with a wax like substance (Brooks, 2017). In the absence of vegetative cover combined with hydrophobic soils, increased storm water runoff can rapidly transport contaminants from ash, accelerate soil erosion, and result in hazardous debris flows (Langhans et al, 2016).

Changes within a forest have the potential to increase or decrease the sustainability of the watershed services and their ability to meet human needs. Appropriate **forest management practices** can be effective tools for improving the fresh water quantity and quality. An increase in shallow groundwater availability has been observed in response to

prescribed burns, even at relatively low canopy reduction rates. Typically stream flow discharges only increase when a significant portion of the watershed has been burned (Marlow et al, 2005). However, special planning and protections should be implemented when preforming any management activity near lakes, streams, wetlands, and/or riparian areas. Any major changes that affect the amount of vegetative cover, within a forest, could potentially increase sediment and runoff. The "*Wyoming Forestry Best Management Practices*" is a supplemental resource, published by the Wyoming State Forestry Division and the Wyoming Department of Environmental Quality, to inform the public and forest managers about acceptable practices that control nonpoint source pollution within forested watersheds.

OBJECTIVE

Protect and improve the water quantity and quality of Campbell County's forested areas through site specific management practices that are based on accepted science and technology.

FUTURE MANAGEMENT DIRECTION

The ephemeral and intermittent forest streams in Campbell County are a greatly undervalued resource. Educating the landowners about implementing **best management practices** on their land will help protect and enhance the water quality and quantity. The local conservation district and NRCS can work with private landowners to help preserve water resources. In many cases, **cost share programs** and technical assistance are available to help conserve and enhance local water resources.

Forest management is a key component that can ensure the sustainability of water quality and water quantity over time. However, poor project design and destructive practices can drastically alter the water cycle of a forested watershed. Forest managers and contractors need to be made aware of the sensitive site specific riparian characteristics. Promoting credible training and accreditation programs will provide higher quality work across the landscape.

Forest fires have the potential to devastate the water resources within a watershed and threaten lives and property. Proactive efforts need to be made by the Natural Resources Conservation Service (NRCS) to educate and inform the County Commissioners about the **Emergency Watershed Protection Program** (EWPP), administered through their agency. Rapid response to emergencies created by natural disasters can help communities address watershed impacts that pose imminent threats. The EWPP program can help remove debris from stream channels, reshape and protect eroded banks, correct damaged drainage facilities, establish cover on critically eroding lands, repair levees and structures, and repair conservation practices (NRCS, 2017).

AGROFORESTRY

CURRENT CONDITIONS

Silvopasture Activities

Agroforestry or agro-silviculture is a land use management system in which trees and/or shrubs are grown around and/or among crops or pastureland. It combines shrubs and trees in agricultural and forestry technologies to create more diverse, productive, profitable, healthy, ecologically sound, and sustainable land-use systems (NAC, 2014). For Campbell County agroforestry systems are typically seen in areas where rangeland systems meet timbered areas. These systems can consist of a wide variety of plant communities and can be a profitable system, if managed properly. These land-use systems can provide forage and cover to livestock and wildlife as well as timber products for commercial harvest. Agroforestry practices broadly fall into three basic categories: silvopasture, riparian buffer strips, and windbreaks. Silvopasture is probably the most common agroforestry practice in Wyoming. It incorporates forage production with traditional forest management to enhance forest health and diversity, reduce fuel loading and the impact of wildfire, and improve product quality and revenues.

Currently in Campbell County many areas have high stem densities of ponderosa pine making access to available forage difficult for livestock and wildlife. In many locations high density ponderosa pine stands are coupled with an increased amount of understory (i.e. juniper). This results in less sunlight reaching the forest floor for grass and forb production. A duff layer, a layer of moderately to highly decomposed leaves, needles, fine twigs, and other organic material found between the mineral soil surface and litter layer of forest soil, is also seen in many of these areas. The duff layer, when undisturbed can also result in less available forage production.

AUM's based on Canopy Class:

Plant Community	Soil	Canopy class	AUM's/ acre
Ponderosa pine	Loamy	Medium 35-55%	0.1-0.2
Ponderosa pine	Loamy	Sparse 21-35%	0.2-0.3
Ponderosa pine	Loamy	Open 10-20%	0.25-0.3
Ponderosa pine/ Little bluestem	Loamy	Medium 50-75%	0.06-0.08
Ponderosa pine/ Little bluestem	Loamy	Open 0-50%	0.09-0.14

EXISTING CHALLENGES

Agroforestry in Campbell County offers economic diversity potential to private landowners. Opportunity exists for landowners to **utilize forest management techniques to increase available animal unit month (AUM)** production while potentially profiting from the sale of wood products. However, there exists many challenges. Agroforestry returns are best generated through the sustainable harvesting of wood products. Campbell County has seen past timber harvesting and is fortunate to have forest products industry in close proximity in northeastern Wyoming and in the Black Hills of South Dakota. The biggest question that needs to be answered is: "Is there currently interest from forest products companies in harvesting timber in Campbell County, and if so, what is the volume required to make the sale conducive to industry?". It will be a challenge to **gain the interest of the forest products industry** and keep the industry vested in Campbell County.

Tied to this challenge is the amount of the timber in Campbell County that is of marginal quality and hard to access. To proactively manage this timber type would most likely incur a **cost to the landowner**. A landowner who is interested in growing grass may not see the value of investing in the management of the timber of their property without incentives to do so. If the timber is marginal the incentive will not be there in the harvesting and payment for that timber.

Another challenge to agroforestry development in Campbell County is the **interest of private landowners** to practice this activity. Many of the larger landowners in Campbell County are in the business of livestock production. They often do not view the forested portions of their properties as something that needs to be managed to increase the production of available forage, while diversifying their agricultural operation with timber harvesting. Work that needs to be completed may need to be invested in. Tree densities in Campbell County can be very high in certain stands (well over 300-500 stems per acre where ponderosa pine trees tend to grow best at, and an average of 200 stems per acre or approximately one tree every 15 feet). This results in tree thinning that will need to be

Unit 6 Before	Unit 6 After
	

Grant Funded Bitter Creek Vegetation Project Phase III, Campbell County

completed that does not generate a product. It may take several decades after a thinning before the landowner will see any returns on their investment. Landowners may not see the need, or able to monetarily support necessary projects related to agroforestry practices.

Juniper is a common tree/shrub found throughout Campbell County. Juniper is often found in the understory of ponderosa pine stands. The berries of juniper are prized by birds as a source of mast. The birds ingest the berries, roost in the boughs of the over-story canopy, and distribute seeds in their feces. This seed dispersal has propagated vast understories dominated by juniper. The exclusion of fire has created a horizontal to vertical fuel continuity for flames to establish and carry. The result is stands that would be unaffected by, and actually benefit from ground fires are now faced with **the high potential of total stand loss** due to the ladder fuel affect that the juniper understory presents. To treat this issue will require an investment, while not necessarily gaining a return for years if not decades. Again, the challenge being **monetary investment in the proactive management and fuels reduction** needs of Campbell County versus the return from any timber purchased from the forest products industry. However, the above statement does not take the increase of forage production into account, which may bring beneficial returns sooner when compared to a forest products return.

Forested stands are often viewed as a resource to be preserved. Some private landowners may not want to practice agroforestry as timber harvesting is unacceptable to their "values". This challenge of **changing an individual's "values"** is one the most difficult and reoccurring obstacles to proactive forest management.

OBJECTIVE

To educate private landowners on the benefits of diversifying income through timber harvesting and timber stand improvement work to produce healthy woodlands, as well as to increase production and sustainability of forage resources for wildlife and livestock.

FUTURE MANAGEMENT DIRECTION

Education of the private landowners to the benefits of proactive forest management will be one key to opening the door of possibility in agroforestry in Campbell County. To get the populace to "buy in" to the idea of managing their forested lands will help in obtaining willing landowners to invest in their properties' forest systems. Landowner workshops on juniper encroachment and control, fire ecology, and tree thinning in relation to allocating more resources to residual trees while increasing forage production will help to present agroforestry as something that is beneficial to the private landowner.

The Campbell County Conservation District has been active in **pursuing grant funding** to help private landowners shoulder the burden of cost in regards to tree thinning projects. Approximately 400 acres of timber stand improvement has been accomplished on private landownerships in 2015 and 2016. These project areas can also act as a showcase to other landowners. Visual cues of actual work on the ground are a great way to help relay the message of proactive management to landowners. These projects can also benefit other grant funds pursued by the conservation district by illustrating what has been accomplished and the need to continue to accomplish more.

As mentioned above monetary funds are the biggest challenge to agroforestry. Much of the management to be accomplished is dealing with high stem density regenerated forest systems. Unless a **Biomass** market becomes prevalent in northeastern Wyoming, small diameter product is virtually non-existent and much of the work needing to be accomplished will need additional sources of funding. The NRCS has Farm Bill programs that can help "producers" obtain funds to complete thinning projects. This program is called the Environmental Quality Incentives Program (EQIP) and can be used to clear brush and thin trees helping to increase resource availability to residual stands and forage production, while decreasing fuel loads to a more historic level. These potential thinning projects would also allow the disturbance of the duff layer of the forest floor while increasing sunlight, two components essential to growing and maintaining healthy forage for domestic stock and wildlife.

Fire is a natural management tool that can be utilized to clear the understory of fire resistant ponderosa pine stands. There may exist an opportunity to engage private landowners and county, state, and federal resources in implementing prescribed fire projects in Campbell County, on private, state, and federal lands. Landowners that reduce fuel levels in their forest systems would have an opportunity to use fire to clear duff layers and brush to increase forage production in the future, while checking juniper encroachment. Setting up prescribed fire projects correctly can be very time consuming, and may not occur on planned dates due to weather not being appropriate to "put fire on the ground". This management tool should be investigated for use in the future.

State and Federal cooperators need to continue to produce work on their ownerships as well. **Landscape scale management** is the most appropriate approach to forest systems. Forests do not recognize property boundaries. Completing work on all ownerships will help to gain popular support in the county. The BLM has been active in tree thinning on strategic parcels bordering private land and the WSFD is beginning to investigate further harvesting and thinning operations in the area. Besides technical assistance to the conservation district, WSFD is continually developing projects on its parcels as well.

As stated in the 2010 Wyoming Statewide Assessment of Forest Resources, "Wyoming's timber industry is now dependent on private forest lands as the primary source of raw material for production. Wyoming's private timber supplies are often associated with multi-function ranches and affected by the price of timber relative to other ranch products and services. This underscores the importance of maintaining these private forests and facilitating forest management and planning." **Interest from nearby existing mills** must be gained in Campbell County in order to accomplish this long term forest management. The statewide assessment also states "Without the forest products industry, forest management on a meaningful scale becomes difficult to accomplish. There is an opportunity to use forest management projects to produce raw materials to sustain the industry while addressing the problems described elsewhere in this document, such as forest health and wildfire risk.". The Wyoming State Forestry Division has last offered and sold timber in the early 2000's in the area, and is currently working to offer a timber sale in the Bitter Creek area of northern Campbell County. This sale is proposed to be offered in conjunction with BLM timber and may implement the Farm Bill's Good Neighbor Authority. This and other projects planned could be the catalyst to re-introducing the harvesting of forest products in the area.

FOREST STEWARDSHIP POTENTIAL

CURRENT CONDITIONS

In Wyoming, 10,288 private landowners held 1,697,900 acres of non-industrial private forested land (NIPF). The Forest Stewardship Program (FSP) brings professional resource management expertise to private landowners to assist landowners in the development of management plans that will meet their overall long-term objectives for their forested property.

The 1990 Farm Bill (officially called the 1990 Food, Agriculture, Conservation and Trade Act) was the first to include the forestry title (Title XII), called the Forest Stewardship Assistance Act. This Act included several amendments to the 1978 Cooperative Forestry Assistance Act, including authorization of the FSP.

The intent of the FSP program in Wyoming is to provide sound resource management advice resulting in management plans that improve the health and productivity of private forested lands while addressing landowner objectives. Currently, many private landowners

in Campbell County are not participating in plan generation, though many landowners could benefit from recommendations on forest stewardship and management for multiple use. It is speculative to discuss why this is occurring, but one reason may be that private landowners are not fully aware of the options that are available to them through the use of consulting foresters or the WSFD's Rural Forestry Assistance Program.

EXISTING CHALLENGES

One possible challenge to forest stewardship plan development may be that private landowners in the business "to grow grass not trees" may not see the **value in generating a forest management plan**. These individuals may only see the necessity to seek forest management advice when questions or a forest health issue arise.

The WSFD's Rural Forestry Assistance Program provides stewardship plans, free of charge, for long term direction concerning the management of forested property. Landowner participation in the program is strictly voluntary, though, landowners are asked to make a good faith commitment to implement management strategies that are outlined in forest stewardship plans. This program is free to the noncommercial private forested landowners of Wyoming. There does exist a challenge in plan development, and that is **capacity**. The WSFD District 5 (D5) staff consists of a District Forester and an Assistant District Forester. Plan development can take up to three years depending on the workload of D5 staff.

OBJECTIVE

Foster a strong forest stewardship program in Campbell County to help in the proactive management of the private forested acres located in this part of Wyoming.

FUTURE MANAGEMENT DIRECTION

Outreach and education is the main future management direction that can be taken in regards to fostering a forest stewardship program in Campbell County. Publicizing the available resources to the landowners will allow them to be fully informed on the resources available. All willing cooperators (CCCD, NRCS, Wyoming Game and Fish, BLM, USFS, and WSFD) can be a voice for the promotion of forest stewardship and forest management plan development. Each individual landowner has specific expectations and goals for their property. Professional foresters work with landowners to determine their goals and provide recommendations that will help them reach those goals. Plans can contain information on the past history of a property, current condition and future potential among others. Resources including water, vegetation, wildlife and soils can be addressed.

As stated previously, the forest products industry is a main driving force of accomplishing forest management activities on a meaningful scale. **Industry interest** in the area must be obtained through forest product sales, and retained. Private landowners gaining revenue from forest product sales will be better equipped to perform pre-commercial thinning operations and other forest management activities that currently have an associated cost, but result in healthier forest systems. This will also help promote diversity to those "producers" that raise livestock as discussed in the previous section dealing with agroforestry development in Campbell County (see page 31).

Forest stewardship plan development will assist in the development of the scheduling of forest management practices, aiding the landowner by helping to keep necessary management projects on track by planning for the future implementation of these projects. These plans can also help participating landowners qualify for NRCS Farm Bill programs (i.e EQIP) that would help to cover the cost of timber stand improvement work and brush removal as well as qualifying for participation in becoming an American Tree Farm if so desired by the landowner. Information of the American Tree Farm program can be found at, https://www.treefarmsystem.org/.

TIMBER INDUSTRY

CURRENT CONDITIONS

The Wyoming timber/forest products industry is not only an important component of the State's economy, but it also plays and influential role in modern forest management. Wyoming's primary forest products industry is comprised of: sawmills, house log and log home manufacturers, log furniture producers, post and pole manufactures, and other primary wood products manufactures (i.e. wood pellet, commercial firewood and animal bedding producers). While there is currently no forest product industry in Campbell County, the geographic location of the county is in close proximity to one of the most active timber industry areas, the Black Hills.

In 2014, Wyoming's **Northeast Resource Area** provided 35% of the State's timber harvest (McIver, Sorrenson & Morgan, 2016). The Northeast Resource Area includes Campbell, Crook and Weston Counties. Crook County provided nearly all of the Northeast Resource Area's timber harvest in 2014. Although, Campbell County is not well known for its abundance in forested land, there is an estimated 313,038 acres or 10.2 percent of forested lands within the county. In 2013, only .01% of total jobs in Campbell County were associated with the timber industry (EPS, 7 April 2016). The Northeast Resource Area timber harvest volume has increased at a substantial rate, from 11.6 MMBF in 2010 to 23.8 MMBF in 2014, over a 100% increase in production (McIver et al, 2016).

Wyoming's timber resource is comprised by approximately 6 million acres of "nonreserved timberlands," lands which are not reserved through statue or administrative designations such as Wilderness Areas. In 2014, Wyoming mills received 91.4 MMBF from both in state and out of state sources. During 2005, 57% of the timber supply was supplied from privately owned lands, while private lands only supplied 22% of the timber supply during 2014 (EPS, 7 April 2016).

The total number of **active mills** in Wyoming has shown a slight decrease from 29 mills in 2010 to 28 mills in 2014 (EPS, 7 April 2016). While the total number of mills showed a slight decrease in 2014, the overall output capacity of the state has increased significantly. This increase in capacity was due in part to reopening of a large saw mill in the Southeast resource area, Saratoga Forest Management opened in 2011. The current, 28 primary wood-processing facilities in operation are comprised of 12 sawmills, 11 post and pole

operations, and the remainder being log home/furniture and other wood products facilities (McIver et al, 2016).

Many of the **forested areas within Campbell County** were harvested for timber sales during the 1980's thru the early 2000's. Currently the federal, state, and private landowners are utilizing pre-commercial thinning practices, as a management tool, to help improve the overall tree size class of maturing forest stands, while sale development is again occurring on state and federal properties.

EXISTING CHALLENGES

An agreement in 1996 established quotas and **tariffs** on imported Canadian lumber products. In October of 2015 that agreement expired (Canadian Softwood Lumber Agreement). The expiration of this agreement allowed for one year of Canadian lumber imports while negotiations occurred. A new agreement was not reached and Canadian lumber is currently imported into the United States tariff-free. This has created the challenge of high competition reducing the economic return on timber harvested within the United States, creating a major economic challenge for the forest products industry.

Campbell County is unique in that no wood products industry exists, but infrastructure does exist in Hulett, WY and in the Black Hills of South Dakota. With these facilities proximity to Campbell County, harvesting can be economically viable if the volume of timber is appropriate. Here in lies the existing challenge of offering harvestable timber volumes on a scale that provides economic viability to the purchaser, making it conducive for the area forest products industries to harvest in Campbell County. Sales of cross-boundary ownership will be needed to **supply volume amounts attractive to industry**. This will help produce better returns to all landownerships involved, helping the private landowners see actual value in forest management. This could result in more private landownership being proactively managed due to future returns.

The forest systems of Campbell County predominantly consist of ponderosa pine (*Pinus ponderosa*) mixed with Rocky Mountain juniper (*Juniperus scopulorum*). Ponderosa pine is a highly desirable species for the timber industry due to its aesthetic appeal and structural properties. Juniper is not commercially viable in the traditional lumber sense. Much of the ponderosa pine has been previously harvested resulting in smaller diameter stands and stands of regeneration that need to be thinned to produce a future timber supply. Actual product is an existing challenge for Campbell County. Thinning would need financial backing to accomplish and smaller diameter pine and unviable juniper offer little in economic return.

The above challenge of small diameter pine has been created in part by a technique of logging classified as **"high grading"**. Many of the previous sales (regardless of ownership) resulted in most of the larger diameter trees being harvested. To properly harvest a mix of diameters should be targeted to allow sustainability for future harvesting. Poor forest management techniques have not only resulted in poor forest health (highly stocked stands not receiving thinning, etc.), but have resulted in the marginal timber yields for present day harvesting.

OBJECTIVE

Utilize the timber industry as a management tool to improve forest health, increase economic opportunities, and reduce hazardous fuel loads.

FUTURE MANAGEMENT DIRECTION

As stated in the 2010 Wyoming Statewide Assessment of Forest Resources, "Wyoming's timber industry is now dependent on private forest lands as the primary source of raw material for production. Wyoming's private timber supplies are often associated with multi-function ranches and affected by the price of timber relative to other ranch products and services. This underscores the importance of maintaining these private forests and facilitating forest management and planning." **Mill interest in the area must be gained** in Campbell County. The statewide assessment also states "Without the forest products industry, forest management on a meaningful scale becomes difficult to accomplish. There is an opportunity to use forest management projects to produce raw materials to sustain the industry while addressing the problems described elsewhere in the document, such as "forest health and wildfire risk.". The WSFD has offered and sold timber up to the early 2000's in the area and is currently working to offer a timber sale in the Bitter Creek area of northern Campbell County. This sale is proposed to be offered in conjunction with BLM timber and may implement the Farm Bill's **Good Neighbor Authority**. This and other projects planned could be the catalyst to re-introducing forest products industry in the area, enticing private landowners to take the opportunity to seek technical assistance in offering timber for sale from their ownerships.

Collaboration with industry leaders, private landowners, state, and federal agencies to increase timber supply while improving forest health will be a key component to the challenges facing Campbell County forest systems. A serious investigation into forest biomass and other **non-traditional/non-log forest products** must also occur. This will aid in creating an industry that, as stated earlier, will help to accomplish forest management on a meaningful scale, making Campbell County forest systems more resilient to climate change and forest health issues, and more economically viable to harvest in the future.

POTENTIAL MARKETS

CURRENT CONDITIONS

In northeast Wyoming, state, federal, and local agencies currently hire contractors each year to clear large quantities of ponderosa pine and juniper stands, in an effort to break **up hazardous fuel loads** and improve the overall health of a forest. These management practices reduce competition, remove undesirable species, prevent disease and pest outbreaks, and improve wildlife habitat. Most of these projects result in leftover limbs, tops, needles, and other woody parts, or biomass materials which are left on site to decompose naturally or piled and burned. Utilization of these byproducts has the potential to generate economic opportunities for a broad range of stakeholders. According to the USFS, **woody biomass utilization** is the harvest, sale, offer, trade, or utilization of woody

biomass to produce bioenergy and the full range of bio-based products including lumber, composites, paper and pulp, furniture, housing components, round wood, ethanol and other liquids, chemical, and energy feed stocks (USFS, 7 March 2017). A consistent supply of woody biomass material is currently being generated from many different types of forest management practices that already occur in northeast Wyoming.

Timber harvesting, thinning practices and insect and disease control generate large quantities of biomass in northeast Wyoming. Incorporating **potential sources** for biomass utilization could support a new and sustainable economic market. Thinning practices on private lands can improve the overall quality and quantity of merchantable timber. Fuel reduction and insect and disease control on state and federal lands can reduce the size and severity of seasonal wildfires. While the mountain pine beetle epidemic in northeast Wyoming has declined, tree mortality rates remain high. Utilizing this woody biomass source for energy production or other potential markets could help improve the overall forest health.

Residents of Wyoming have traditionally relied on the affordable and abundant sources of woody biomass provided by their local forest, for heat generation purposes. While a traditional wood burning fireplace can provide an ample amount of heat to warm a small to medium sized home, the newer pellet fired and wood stoves are becoming more efficient and economical. In Wyoming, the residential sector, was responsible for the majority of the woody biomass consumption. In 2014, Wyoming residents consumed an estimated 1.5 trillion BTU produced from woody biomass sources (EIA, 2017). Most small scale facilities such as schools, hospitals, and detention facilities that operate a boiler/furnace could be a potential candidate for a cost efficient wood boiler installation or conversion. However, new boiler construction projects are more cost effective than retrofitting an existing boiler (WSFD, 2016). A pre-feasibly study can be used to determine how long a return on the investment may take.

EXISTING CHALLENGES

Woody biomass utilization is a relatively **new concept** for most forest managers. The slash created from timber harvests and thinning practices has traditionally been loped and scattered or piled and burned. Shifting to a biomass utilization model will require significant planning and coordination along with financial and economic considerations.

Multiple stakeholders may be required to pool resources in order to produce the quantity of biomass that would entice industry. The forests found in Campbell County are disperse and the surface ownership is highly subdivided. Many of the private landowners found in Campbell County, solely, lack the quantity of harvestable biomass material that is necessary to attract a buyer. In addition, each stakeholder has a different set of priorities and personal interests. Conflicting timelines regarding hunting and outfitting, fire season, and grant funding/administration can limit the amount of overlap and cooperation between stakeholders. Private landowners, Wyoming State Forestry Division, Campbell County Conservation District, and other cooperating federal agencies need a forum to conduct communication and coordination.

Uncertainties regarding energy and power utility regulations have forced states to reanalyze their energy portfolios. Some states have even replaced their voluntary renewable energy objectives with a mandatory renewable portfolio standard. These types of regulations require utility companies to use a certain percentage of renewable energy technologies, to meet their state energy profile goals. Green Energy Standards have been an effective regulatory tool that has **incentivized the growth of many new woody biomass markets**. While a Green Energy Standard may not be an ideal solution for Wyoming's unique energy portfolio, the idea of a Green Energy Goal may help stimulate new and innovative biomass markets.

OBJECTIVE

Develop economically viable markets and processes that reduce hazardous fuels on private, state, and federal lands.

a. Attract and develop a biomass industry in Campbell County.
b. Diversify forest products that provide economic opportunities.

To gain industry interest to help implement forest management by offering a volume suitable to meet industry needs (i.e. cross boundary sales, sales on large tract landowners).

FUTURE MANAGEMENT DIRECTION

Biomass utilization has the potential to not only aid in forest management, but also to diversify the local economy. With a consistent supply of biomass from local and surrounding forests there is potential for the biomass sector to expand. However as with other emerging markets there are potential risks to investors entering the market. In order to expedite the expansion of a biomass sector **regulatory incentives** may be necessary to overcome initial risks. With incentives there would be the potential to diversify existing timber industry as well as create infrastructure for new products.

Diversification of wood products is imperative to the success of the biomass sector. Woody biomass is not just for energy creation, but may consist of several other products. Through technological and academic advancements, entrepreneurs have been able to develop many new innovative markets using woody biomass including: advanced composites, erosion control material, and bioremediation agents. More research needs to be performed on the feasibility of establishing a biomass utilization facility in northeast Wyoming for energy creation. Absent any incentive programs, it may not be economically feasible.

Supporting biomass utilization can have many **secondary benefits** such as, improved wildlife habitat, reduced hazardous fuel loading, and improved forest health. This is due to the active management that can take place when outlets exist for end products. Currently the commercial timber sector is limited by the timber sales that are available within a feasible trucking area. This can be improved by encouraging timber sales on state lands to help generate industry's interest in areas of Campbell County where landowners may not have a large enough supply to make a sale attractive to local industry. Conversely if a state or federal timber sale is occurring in Campbell County promoting private timber sales while industry is working in the area, this will allow the communities to engage with the timber industry to enhance the efficiency of economic benefits for biomass removal.

CONCLUSION

The mission of the Campbell County Forestry Working Group is to facilitate landscape scale forest management activities across ownership boundaries, through the development and integration of focus areas in Campbell County, helping to promote overall forest health. The working group is composed of stakeholders that have active roles in forest resource management in Campbell County. It was formed to generate recommendations on future management direction in the below specific topics taken from the Wyoming Statewide Forest Resource Assessment of June 2010:

- Fire
- Invasive & Noxious Species
- Native Damaging Agents
- Rural Interface
- Storm events
- Wildlife Habitat Concern
- Water Quality and Supply
- Agroforestry
- Forest Stewardship Potential
- Timber Industry
- Potential Markets

Within the document these topics are discussed in terms of challenges and future management recommendations. The challenges listed in this document will be addressed on a case by case basis through collaboration and cooperation between the stakeholders involved with this process. The recommendations establish guiding principles to facilitate forest management activities in Campbell County. The group plans to continue proactive forest management efforts in the areas of focus through communication and collaboration for the foreseeable future, as each member fully realizes the benefits of landscape scale management. Priority will be driven by the interest in private landowners looking to participate in forest management activities coupled to active and potential projects being implemented/planned on adjacent public lands.

Forest systems are dynamic in nature, as a result it will be necessary to continue to update this document as the system changes overtime. The working group will re-evaluate and update this document at a minimum of every five years to capture forest conditions, disturbance events, treated acres, and the movement of focus areas that will occur as more interest is developed in the populace of Campbell County.

Much of the forests in Campbell County are under private ownership, which offers a unique aspect to the group's overall mission. The group will need to continue to utilize grant funding in order to gain momentum on private lands. This is the majority of landownership in Campbell County thus driving much of the prioritization of project areas. Funding sources such as the NRCS' programs, federal forest health dollars, federal wildfire

prevention funding, funding through non-governmental organizations, and other sources will be the catalyst to getting actual acres treated on the ground through cost share activities.

However, in order to gain outside funding, collaboration with several stakeholders is key. It takes priority ranking to justify the 'need' to accomplish work in a given area. The collaborative focus area map contained in this document will be important in future funding requests, as well as the future management direction. This information may also be important as the Wyoming State Forestry Division will be updating its Wyoming Statewide Forest Resource Assessment of June 2010 in the coming years. It will be necessary for the agency to take a look at the current priority rankings of Campbell County and possibly utilize this document to increase priority rankings for aspects of this unique forested area of Wyoming. In turn, this increase in priority ranking within the State of Wyoming's assessment will help to strengthen applications for possible future funding to continue to complete project work in Campbell County.

Obtaining and keeping the forest products industry's interest in the area will also help to facilitate management activities, and increased prescribe fire activities on private, county, state, and federal land will offer one more arrow to the management quiver. These too will take a collaboration of stakeholders to accomplish as forest systems do not recognize land ownership nor does the issues that can negatively affect these systems.

Proactive management has been shown to have a positive impact on forest systems, making these systems more resilient to insect and disease issues as well as other disturbance events. The forests of Campbell County are a unique ecological system in the State of Wyoming. These forest are where sagebrush steppe ecological systems interface with ponderosa pine forests. These forests are historically fire prone, and as fire suppression has occurred, this ecological system has continued to grow trees. This has created conditions not historically seen in mankind's interaction with these forests. These conditions are a natural process that has been brought on by human involvement and manipulation of the environment.

As insight to the processes of these systems is gained the understanding of the role of fire or a synonymous artificial disturbance in the environment is becoming more understood, creating a backlog of management that needs to occur to decrease detrimental effects of large fires or insect/disease outbreaks. The Campbell County Forestry Working Group will continue to build upon its collaboration to help facilitate proactive management on forest systems of all ownerships in the County. Helping to conserve these systems for the enjoyment of present and future generations.

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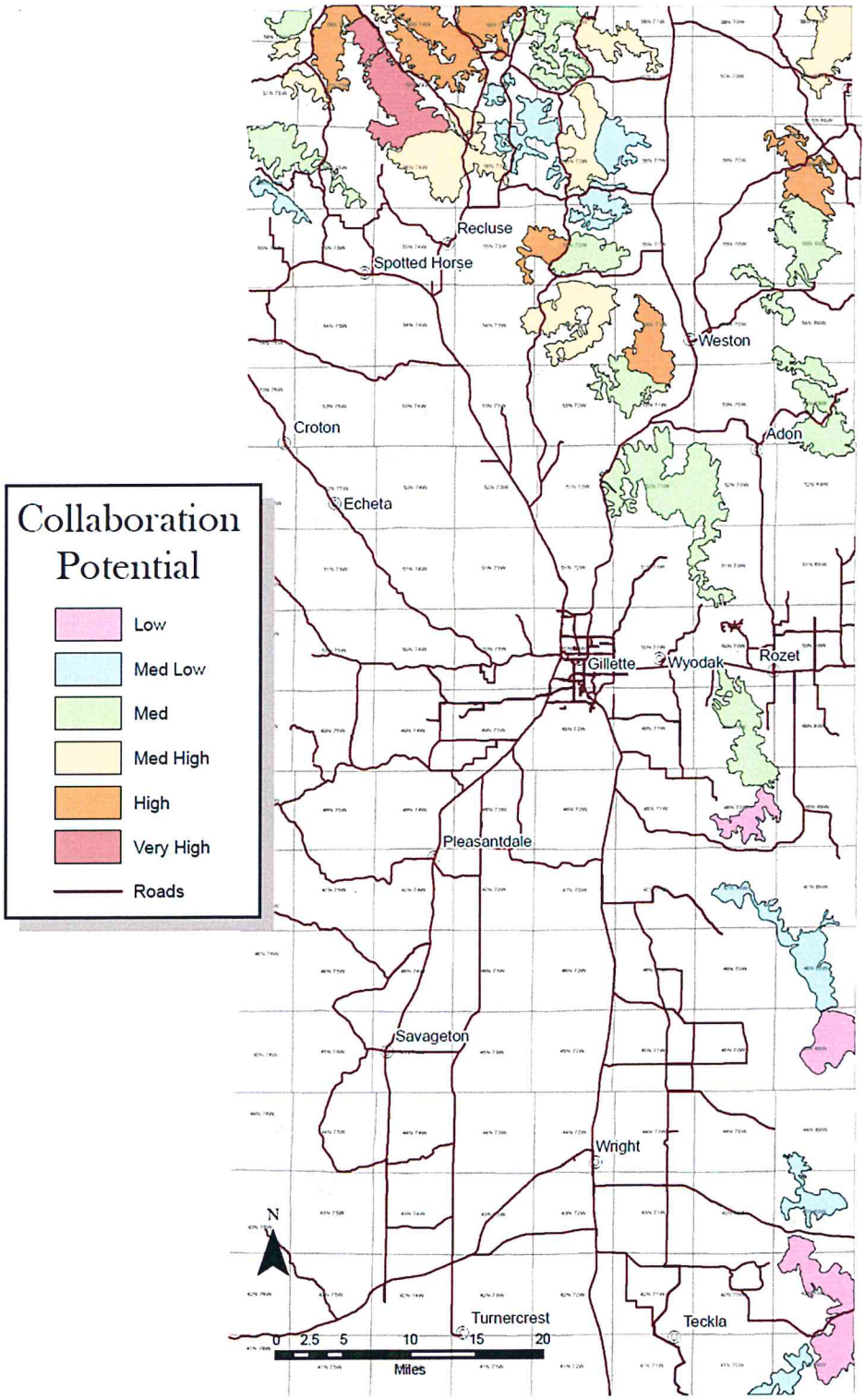
APPENDIX A: ACRONYMS

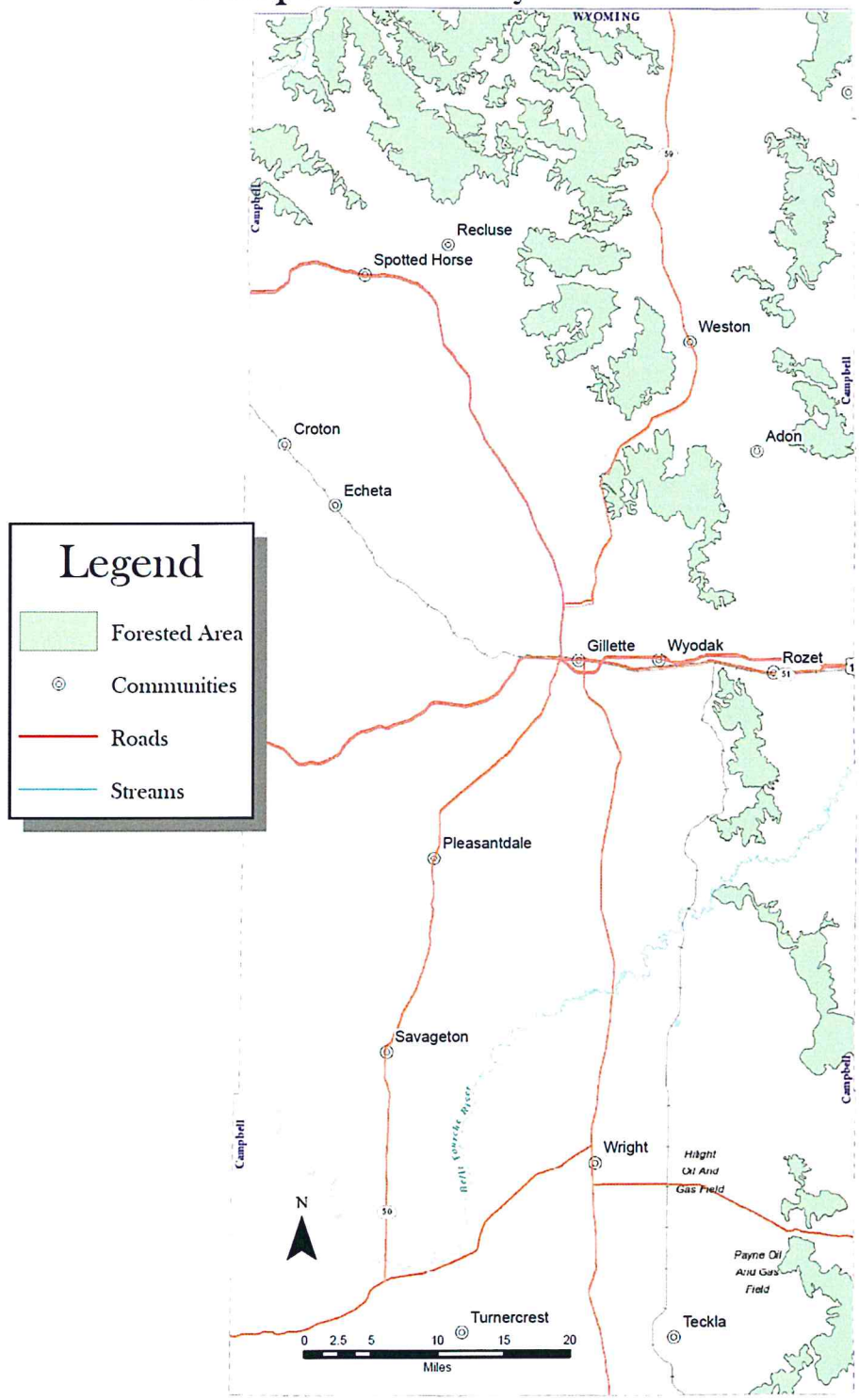
AMU	Animal Unit Month
AOP	Annual Operating Plans
BLM	Bureau of Land Management
BMP	Best Management Practices
BTU	British Thermal Unit
CCCD	Campbell County Conservation District
CWPP	Community Wildland Fire Protection Plan
D5	District 5 of the Wyoming State Forestry Division
EQIP	Environmental Quality Incentives Program
FMP	Collaborative Wildfire Management Plan
FSP	Forest Stewardship Program
GIS	Geographic Information Systems
I&D	Insects and Diseases
MMBF	Million Board feet
MPB	Mountain Pine Beetle
NIPF	Non-industrial Private Forest
NPS	National Parks System
NRCS	Natural Resources Conservation Service
NOAA	National Atmospheric Administration
NWS	National Weather Service
RHV	Risk, Hazard, and Value
USFS	US Forest Service
WSFD	Wyoming State Forestry Division
WSWUI	Western State Wildland Urban Interface
WUI	Wildland- urban Interface

Forest Collaboration Focus Areas



APPENDIX C: CAMPBELL COUNTY FORESTED AREA MAP

Campbell County Forested Area Map



Campbell County Hydrology Map