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Teton to Snake Fuels Management Project

Jackson Ranger District, Bridger-Teton National Forest
Teton and Lincoln Counties, Wyoming

Prepared By:

USDA Forest Service

TEAMS Enterprise

Errata corrected 01/18/2011

Corrections are indicated in bold/red font in the tables.

Table 1

- Minor updates to acreages as a result of boundary updates and number-rounding. Corrections range from 1 to 3 acres.

Table 9

- Prescribed fire treatment acres located in Roadless Areas were inaccurately displayed as those acres in the Defense Zone only. This has been corrected to reflect all acres of prescribed fire located in Roadless Areas, both inside and outside of the Defense Zone.

- Prescribed fire treatment acres located in the Wilderness Study Areas were inaccurately displayed as those acres in the Defense Zone only. This has been corrected to reflect all acres of prescribed fire located in the Wilderness Study Area, both inside and outside of the Defense Zone.

- Hand-operation commercial thinning units totaling 78 acres were changed to non-commercial thinning prior to scoping but was inadvertently left in the table as commercial thin. The treatment (hand-operation commercial thinning) has been removed from the table, and the acres are incorporated into the non-commercial thin treatments, which now reflect an increase of 78 acres.

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Acronyms

BPA	Bonneville Power Administration
BTNF	Bridger-Teton National Forest
CT	Commercial Thin
CTL	Cut-to-length
CWPP	Community Wildfire Protection Plan
DBH	Diameter at breast height
DF	Douglas-fir
DFC	Desired future condition
DZ	Defense Zone
ES	Engelmann spruce
FR	Forest Road
FSH	Forest Service Handbook
FSM	Forest Service Manual
GBY	Ground-based yard
HC	Hand cut trees
HPB	Hand pile and burn
IRA	Inventoried Roadless Area
JB	Jackpot burn
LP	Lodgepole pine
LS	Lop and scatter
MC	Machine cut trees
MOD	Moderate
MPB	Machine pile and burn
NCT	Non-commercial thin
NFS	National Forest System
PF-00	Prescribed Fire Unit
PR	Prune
PSB	Prescribed burn
RACR	Roadless Area Conservation Rule
RX	Prescribed
T-00	Thinning Unit
TZ	Threat Zone
USDA	United State Department of Agriculture
USDI	United State Department of the Interior
VQO	Visual Quality Objective
WSA	Wilderness Study Area
WUI	Wildland-Urban Interface

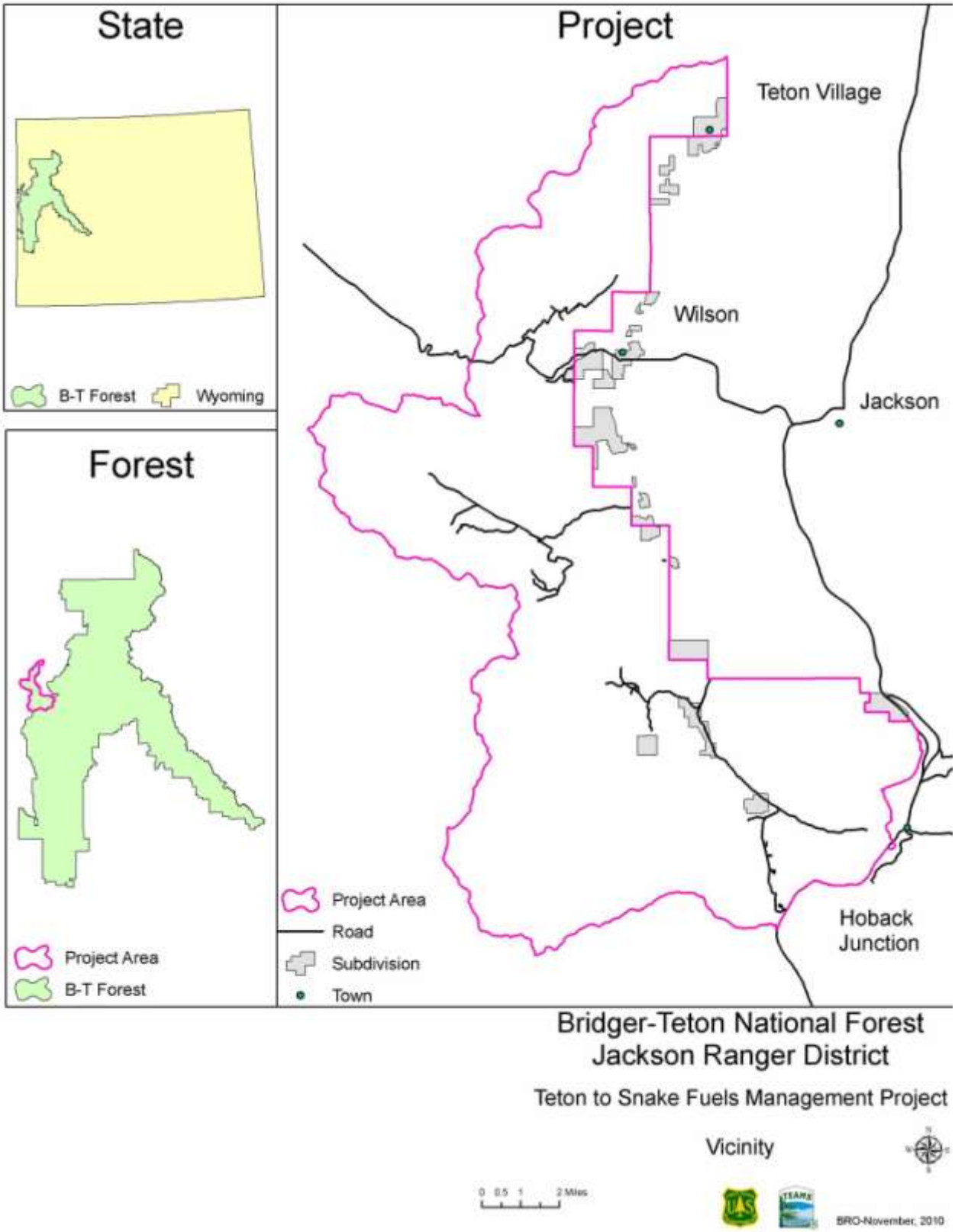

Figure 1. Project vicinity map

Project Introduction

The Jackson Ranger District of the Bridger-Teton National Forest (BTNF) is proposing the Teton to Snake Fuels Management Project. The project area lies west of the Jackson Hole valley and Snake River corridor, and east of the Caribou-Targhee National Forest (Figure 1). A small portion of the project area north of Dog Creek lies within the Caribou-Targhee National Forest but is administered by the Bridger-Teton National Forest. The majority of the project area is in Teton County, with a small portion in Lincoln County, Wyoming. The following communities are adjacent to or near the project area: Teton Village, Northern and Southern Fish Creek Homes, Heidelberg, Trail Creek, Town of Wilson, Heck of a Hill, Indian Paintbrush, Crescent H, Singing Trees/River Meadows, Taylor Creek, Highland Creek Hills, Red Top Meadows, Trails End, Fall Creek Ranch, and Hog Island. Wildfire occurring in forested land adjacent to these communities may be easily pushed into those communities by prevailing winds. The combination of prevailing winds, forest fuels conditions in the project area, and downwind development creates a higher threat to values in this wildland-urban interface area than in other areas on the Bridger-Teton National Forest.

This proposed action would implement fuels management activities on national forest system (NFS) lands that comply with the 2005 Teton County Community Wildfire Protection Plan (Teton County 2005) and move the landscape toward the desired future condition outlined in the Bridger-Teton Land and Resource Management Plan (Forest Plan 1990), hereafter called the Forest Plan. In the project proposed, the Forest Service would thin trees on approximately 2,527 acres and prescribe burn approximately 19,984 acres (about 5 percent and 40 percent of the WUI, respectively).

General Project Information

The Teton to Snake project area covers about 79,682 acres (78,400 of which are national forest system lands) extending from valley bottoms to mountain peaks. Elevations range from about 5,840 feet to 10,919 feet above sea level, averaging about 7,526 feet. The east side of the project area can be characterized as valley bottoms and adjacent mildly-sloped rolling hills. As one moves from the east side to the west and north in the project area the terrain steepens with increasing elevation and becomes mountainous.

Vegetation varies greatly across the complex terrain and consists of a mosaic of coniferous and deciduous forest, shrubland, and herbland providing habitat for many species of wildlife including elk, moose, mule deer, big horn sheep, lynx, bear, gray wolf, several owl species, bald eagle, and many neo-tropical migratory birds. Big game use the project area for summer and spring/fall transitional habitat. The Munger Mountain and Pritchard pass areas provide a small area of winter, yearlong, and parturition ranges for mule deer, elk, and moose. A state winter elk feed ground is located on private land east of Pritchard Creek.

The project area provides many recreational opportunities to the public including camping, hiking, mountain biking, hunting, fishing, and cross country skiing. Commercial outfitting is also common within the project area.

The Teton to Snake project area encompasses special land allocations including the Palisades Wilderness Study Area (WSA) and the Phillips Bench and Munger Mountain Inventoried Roadless Areas (IRAs). The Wyoming Centennial Scenic Byway and the newly designated Snake River Wild and Scenic River are outside but in close proximity to the project area.

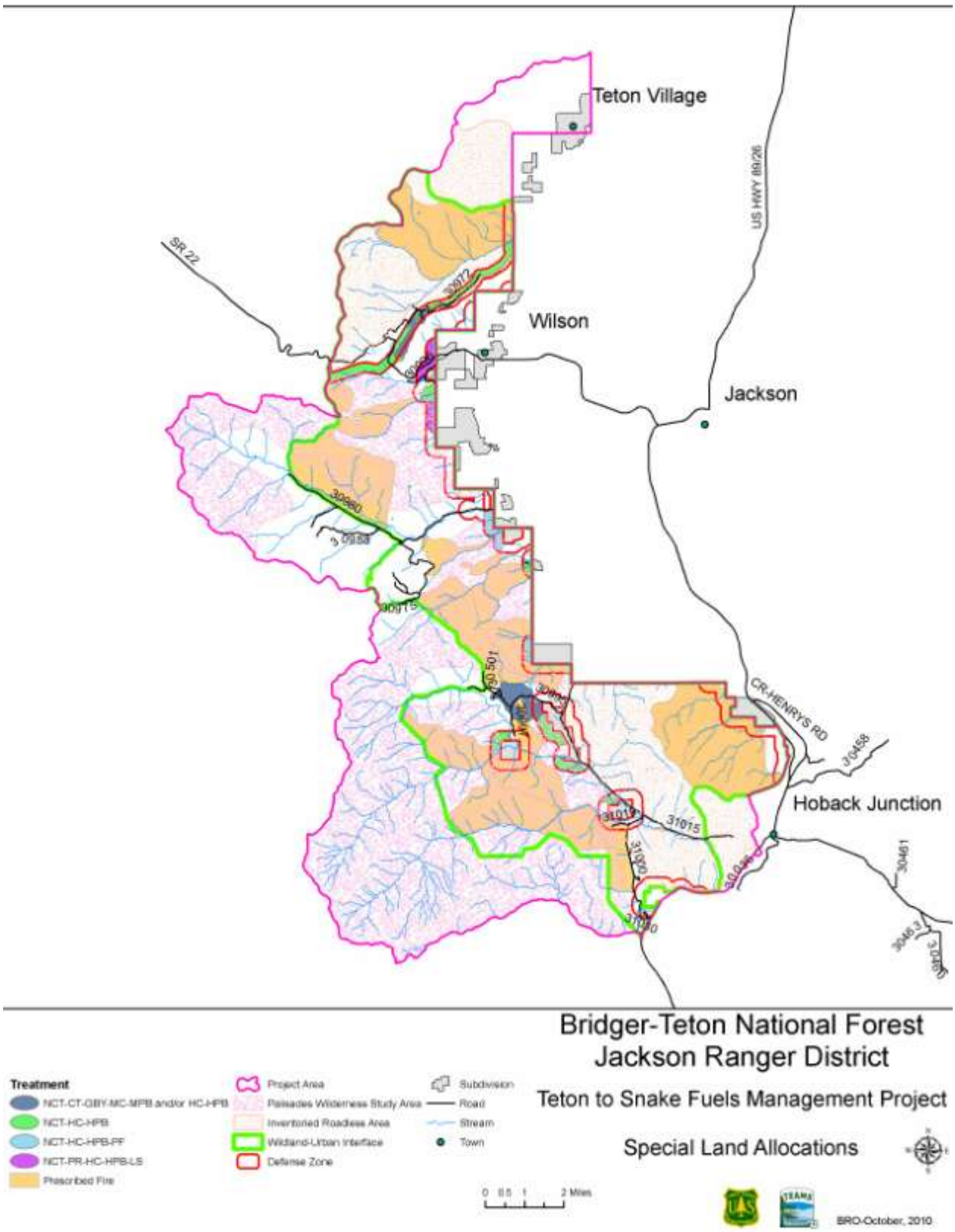

Figure 2. Special land allocations within the project area

The Teton County Community Wildfire Protection Plan identifies 50,178 acres of the project area as Wildland Urban Interface (WUI). For this project, the WUI is divided into two sub-classifications: defense zone and threat zone. The defense zone is an area extending one-quarter mile from the ownership boundary between national forest and private land (most occupied by residences or summer homes), and lands around the Bonneville Power Administration power line. The threat zone includes the remaining area within the WUI boundary. Figure 2 displays these land allocations and Table 1 notes the acres of treatment that are proposed on national forest system lands by WUI zone and land allocation.

Table 1. Proposed treatment acres by land allocation and WUI zone

Land Allocation	Project Area Acres	Proposed Treatment Acres			
		Prescribed Fire Units[a]		Thinning Units[b]	
		Defense Zone	Outside Defense Zone	Defense Zone	Outside Defense Zone
Palisades WSA	**20,572**	449	10,664	**754**	0
Phillips Bench IRA	**10,081**	159	2,854	**289**	0
Munger Mountain IRA	12,470	381	3,468	0	0
General NFS lands	43,904	220	1,789	1,006	478
Total	**87,027**	1,209	18,775	**2,049**	478

a - The goal of these burns is to achieve a mosaic of fire across the landscape, leaving observable fire effects on only 40-60 percent of the prescribed fire acres.
b - Thinning treatments include piling and burning slash to reduce fuels. In addition, approximately 319 acres of thinning units may also have prescribed fire as a final treatment.

Existing Condition

Climate

The climate of the project area could be characterized as dry continental with large daily and seasonal temperature changes. Summers are short with moderate daytime temperatures and cool nights. Winters are long and cold. Substantial amounts of precipitation can occur in all months, but it is higher during the winter months and early summer. Summertime precipitation normally occurs with afternoon thunderstorms and wintertime precipitation normally occurs as snow. Most of the annual precipitation in the area occurs as snow.

As displayed in Figure 3, annual precipitation in the Wyoming Snake River drainage varies greatly from year to year (NOAAb 2010), and Figure 4 illustrates that drought seasons occur on a regular basis (NOAAb 2010) as measured by the Palmer Hydrological Drought Index (PHDI) in the Snake River drainage over the last century. The PHDI is a modification of the Palmer Drought Severity Index, which determines dryness and models long-term drought using temperature, rainfall, and local available water capacity of the soil. The PHDI assesses longer-term moisture anomalies that affect streamflow, groundwater, and water storage.

In the index as displayed in Figure 4, 0.00 to -1.49 is near normal, -1.50 to -2.99 is moderate drought, -3.00 to -3.99 is severe drought, and -4.00 or less is extreme drought.

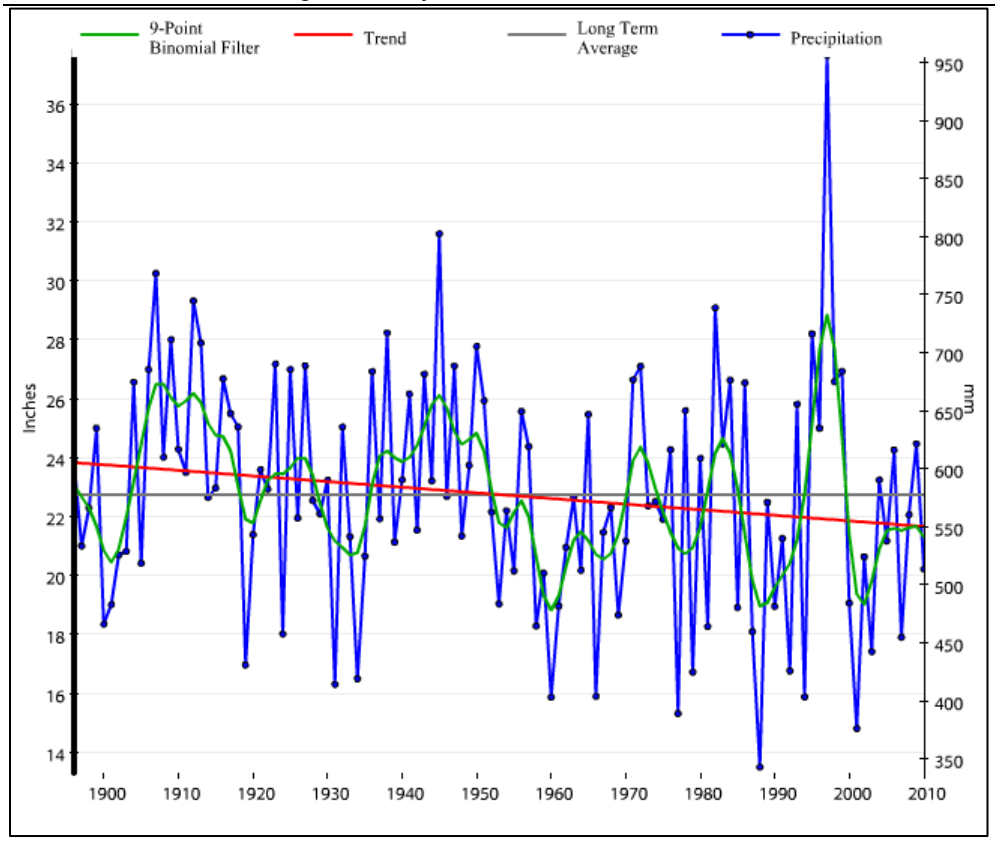

Figure 3. Wyoming Snake River drainage yearly statewide precipitation from 1895 to 2010

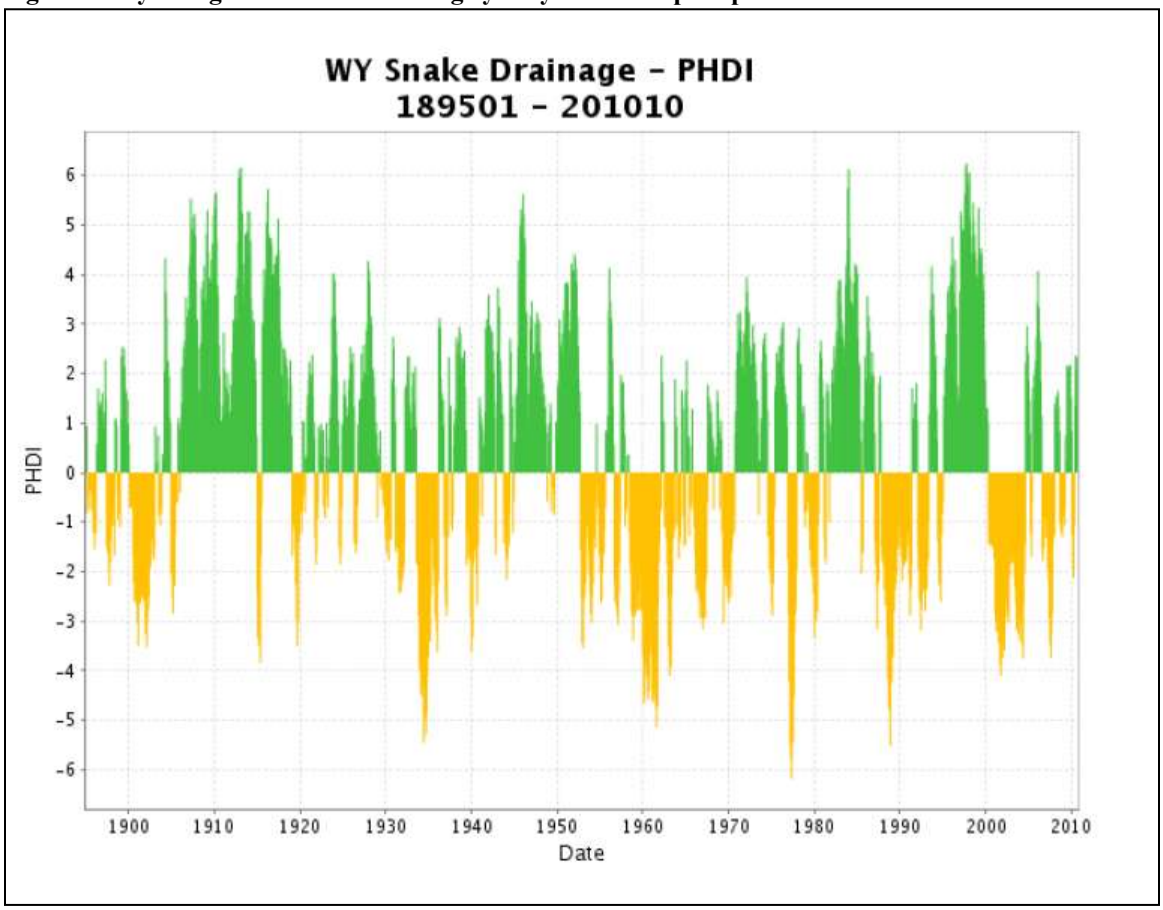

Figure 4. Wyoming Snake River drainage Palmer Hydrological Drought Index from 1895 to 2010

Based on the Palmer Hydrological Drought Index, drought in the state of Wyoming Snake River drainage reached its most severe level in the last 100 years in 2004 (NOAAc 2010) and July 1999 to June 2004 was the driest 5-year period in the state's and in the Wyoming Snake River drainage's 115-year instrumental record (NOAAc 2010). Since 2004 drought conditions have become less severe.

Forest Vegetation

Existing Vegetation Cover Types and Size Classes

Due to variations in topographical and climatic factors discussed above, vegetation in the project area is a mixture of a number of vegetation cover types (Table 2). See Appendix A for a map of the vegetation types in the project areas. In general, the project area supports coniferous forests and woodland, aspen forest and woodland, shrublands, and herblands. About 56 percent of the area is dominated by conifers, 11 percent dominated by deciduous trees of all types, 18 percent dominated by shrublands of all types, and 15 percent dominated by herblands and non-vegetated (Table 2). Coniferous forests are almost evenly split between Douglas-fir (*Pseudotsuga menziesii*) dominated mixed-species forest, lodgepole pine (*Pinus contorta*) dominated mixed-species forest, and spruce/subalpine fir (*Picea engelmannii/Abies lasiocarpa*) dominated mixed-species forest. The main deciduous forest type is quaking aspen (*Populus tremuloides*) but there is a small acreage of cottonwood (*Populus angustifolia*) in the southeast corner of the project area in the Snake River flood plain. Shrublands of all types cover about 18 percent with the major shrubland being classified as mountain big sagebrush (*Artemisia tridentata*) at about 15 percent of the project area. Herblands of all types cover about 15 percent of the project area.

The highest elevations in the project area support a patchy mixture of whitebark pine (*Pinus albicaulis*), spruce/subalpine fir mix, grassland and forbland. See Appendix A for a map of vegetation types in the project area. As one descends in elevation, the mixture generally becomes one of spruce/subalpine fir mix and Douglas-fir mix, the dominant type dependant on aspect. Small areas of lodgepole pine and aspen also appear. With further descent, the subalpine fir component decreases, lodgepole pine and aspen increase, and sagebrush shrubland appears in the mosaic. In the lowest elevations, the landscape becomes a patchy mixture of forest and non-forest with Douglas-fir mix, lodgepole pine mix, aspen, and shrublands.

Douglas-fir mix stands can generally be split into dry Douglas-fir and moist Douglas-fir. Dry Douglas-fir mix stands tend to be relatively open, multi-storied, and dominated by large Douglas-fir. They also tend to be mixed-species with what can be considered higher-than-historic understory tree density and greater proportions of shade-tolerant species such as subalpine fir. Moist Douglas-fir stands are relatively dense and have a single-story structure, with few old trees. These stands are mainly comprised of pure Douglas-fir, but there usually are minor stand components of other species present.

Lodgepole pine mix stands vary in characteristics depending on age and site conditions. Most of the lodgepole pine growing in the project area is on sites where it can be considered as early successional to Douglas-fir, subalpine fir, or Engelmann spruce. Lodgepole is the major species in these stands, but there are usually minor stand components of other species present, especially in the understory. They tend to be even-aged, because they were initiated by a single disturbance event (such as a fire) in the past. In places these stands are beginning to become multi-storied, with the establishment of subablpine fir and spruce understories. On other sites, lodgepole pine is the only species present, and the lodgepole may be persistent due to site factors such as cold air pockets, and high water tables. In these areas, the lodgepole ranges from single-story to multi-story.

Table 2. Existing vegetation cover types (see also map in Appendix A)

Cover Classification	Percent of Project Area	Acres
Alpine Vegetation	0.3	261
Aspen	8.9	7,746
Aspen/Conifer Mix	0.3	261
Barren/Rock	1.2	1,044
Cottonwood	0.1	87
Douglas-fir Mix	16.4	14,273
Grassland/Forbland	9.1	7,920
Lodgepole Pine Mix	19.4	16,884
Mountain Big Sagebrush	14.6	12,706
Mountain Shrubland	1.3	1,131
Riparian Herbland	0.1	87
Sagebrush/Bitterbrush Mix	0.7	609
Silver Sagebrush/Shrubby Cinquefoil	0.1	87
Sparse Vegetation	0.4	348
Spruce/Subalpine Fir Mix	19.7	17,145
Tall Forbland	5.1	4,439
Whitebark Pine	0.5	435
Whitebark Pine Mix	0.3	261
Willow	1.5	1,305
Total	100	87,030

Aspen can be found throughout the project area especially in the eastern, lower elevation portion of the area. It occurs in pure stands, or mixed with subalpine fir, lodgepole pine, Douglas-fir, whitebark pine, or Engelmann spruce. In the lower elevations, it forms a mosaic with shrublands. Forests are typed as “aspen” forests when 60 percent or greater of the canopy cover is aspen. “Aspen/conifer mix” forests are identified where aspen accounts for 10 percent or greater of the canopy cover, and no single tree species accounts for greater than 60 percent canopy cover. The cover classification does not show that many of the aspen stands have components of other species and that patches of aspen can be found in stands with a different cover classifications, so the amount of area containing aspen (or that would be dominated by aspen following a fire disturbance) is underestimated in the classification scheme.

Table 3 displays the proportion of each tree size classification for the major forest types found in the project area. Most of the forest types are dominated by the 5- to 9.9- inch diameter-at-breast-height (DBH) size class, except for whitebark pine types which are dominated by the 10- to19.9- inch DBH size class. Forest Vegetation Simulator (FVS) modeled tree growth rates and recent tree growth rates measured during 2009 stand exams indicate that trees in the 5- to 10-inch DBH class are roughly 70 to 160 years of age. This age range coincides with observations of Loope and Gruell (1973) for the Jackson Hole area that large fires occurred in the early 1840s, about 1856, and in the interval of 1878-1885 and that “most forest stands in the valley originated following the fires of 1856 and 1879.” The lower end of the age range is also consistent with historic fire records showing several large fires having burned in the project area in 1934 (Table 5).

Table 3. Percent of forest type in the project area each DBH class

Forest Type	< 5" DBH Size Class (%)	5-9.9" DBH Size Class (%)	10-19.9" DBH Size Class (%)	20-29.9" DBH Size Class (%)
Aspen	26	61	13	0
Aspen/Conifer Mix	17	59	24	0
Douglas-fir Mix	0	61	38	1
Lodgepole Pine Mix	<1	70	28	2
Spruce/Subalpine Fir Mix	0	55	41	4
Whitebark Pine	0	23	75	2
Whitebark Pine Mix	0	33	67	0

Shrublands cover about 18 percent of the project area. The major species present in lower elevation shrublands is mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), but other shrubs are present including bitterbrush (*Purshia tridentata*), snowberry (*Symphoricarpos* sp.), willow (*Salix* sp.), and rabbitbrush (*Chrysothamnus* sp.). In addition, subalpine or spicate big sagebrush (*Artemisia tridentata* ssp. *spiciformis*) can be found in the higher elevations. Historic fires in big sagebrush shrublands would have usually not been continuous, leaving many unburned patches (Fire Effects Information System 2010). Mountain big sagebrush is easily killed by fire and its major post-fire regeneration strategy is through on-site and off-site seed (Fire Effects Information System 2010) and it can reestablish relatively quickly. Other shrubs in the area can reestablish through resprouting, e. g. rabbitbrush, willow, and snowberry. Under the historic fire regime, sagebrush shrublands would most likely have had lower density, with patches of herbaceous vegetation resulting from more recent fires. (Loope and Gruell 1973). Following fires, big sagebrush can gain dominance over the herbaceous layer in 5 to 30 years (Brown and Smith 2000) and with cessation of the fire regime sagebrush has likley colonized many areas formerly dominated by herbaceous vegetation. In their paper, Loope and Gruell (1973) characterized shrub cover in the Jackson Hole area as having “increased markedly.” With no fire having burned most of the big sagebrush in the project area in over 100 years, the shrublands could now be characterized as being older, denser and more extensive than they were historically.

Tree Mortality

As has also occurred in many other locations in the intermountain western states, several bark beetle species have been killing substantial numbers of trees in the project area in recent years. Douglas-fir beetle (*Dendroctonus pseudotsugae*) killed Douglas-fir in the area over the past 5-8 years and mountain pine beetle (*Dendroctonus ponderosae*) is killing lodgepole pine and whitebark pine. Although not confirmed, we can also expect other bark beetles such as spruce beetle (*Dendroctonus engelmanni*), *Scolytus* sp. and *Ips* sp. bark beetles to be impacting conifers in the area.

Annual aerial tree mortality detection surveys within the project area show that, in 2002, mortality attributed to mountain pine beetle and Douglas-fir beetle increased substantially in area impacted (Table 4), and in 2004 subalpine fir mortality (no causal agent identified) increased. Areas mapped in each year’s aerial survey show only mortality considered to have occurred in the year previous to the flight, and so each survey indicates the magnitude and location of new mortality only. Each year’s mapped mortality may be new pockets, separate from previously mapped mortality, or may be expanded and overlapping with previously mapped areas of mortality. The acreage values by damage-causing agent are not accumulative over years. The surveys indicate the highest area with mortality in 2004, but most significantly, they show consistently high acreage. The survey does not show Douglas-fir beetle mortality in 2009, but Skov (2009) reported both Douglas-fir beetle and mountain pine beetle to be causing extensive tree mortality in and around the project area.

Table 4. Aerial annual tree mortality survey acres recorded from 2001 to 2009

	Year								
Damage Causing Agent	**2001 Acres**	**2002 Acres**	**2003 Acres**	**2004 Acres**	**2005 Acres**	**2006 Acres**	**2007 Acres**	**2008 Acres**	**2009 Acres**
Mountain Pine Beetle	224	500	3,880	12,431	5,833	6,106	8,129	5,275	8,563
Douglas-fir Beetle	87	517	1,019	3,661	280	77	21	53	
Spruce Beetle		36							
Subalpine Fir Mortality				171	7		92	20	22
Decline					120		85	102	0
Total	311	1,053	4,899	16,263	6,240	6,184	8,327	5,450	8,585

Bark beetle activity tends to increase with larger trees and in trees under stress. Tree stress increases as stand density increases and competition for site resources, primarily water, becomes greater, causing the trees to become more susceptible to bark beetles. As water becomes more limited during droughts and tree stress increases, conditions exist for increasing susceptibility across the forested landscape. Landscape-level bark beetle epidemics, such as recently occurred in the project area as well as other places in the western United States and Canada, require large areas of susceptible trees.

Larger diameter trees are attacked by mountain pine beetle at higher rates than smaller diameter trees, and trees less than 5 inches in DBH have very low levels of attack (Cole and Amman 1969, Cole and Amman 1980, Klein et al. 1978). Douglas-fir beetle and spruce beetle also tend to attack trees that are mature or overmature, large diameter and in densely-stocked stands (Schmitz and Gibson 1996, Furniss et al. 1979, Schmid and Hines 1974, McCambridge and Knight 1972, Knight 1960, Holsten et al. 1999). Existing data shows that prior to the recent bark beetle activity, conifer forest within the project area were heavily dominated by lodgepole pine trees greater than 5 inches DBH. This condition contributed to their susceptibility to mountain pine beetle. Many of the forest stands also contained mature Douglas-fir and Engelmann spruce which were susceptible to bark beetles. The effects of both species of bark beetle on the project area will be to kill much of the overstory pine and Douglas fir trees and convert them to stands dominated by smaller diameter trees and shade-tolerant Engelmann spruce and subalpine fir

The large area covered by the recent bark beetle activity in the project area is an indication that forests were mostly densely stocked stands dominated by trees greater than 5 inches DBH. That the recent bark beetle activity coincides with droughty conditions discussed above indicates that the drought contributed to initiating the recent outbreak and probably contributed to the extent of the mortality.

Figure 5 displays stand exam data from several plots in the Red Top Thin Unit 2 area, which has had several years of mountain pine beetle activity. In the sample plots, most of the overstory lodgepole pine has died. As a result of the mortality, there are more openings in the stand which may promote understory growth of aspen or lodgepole pine.

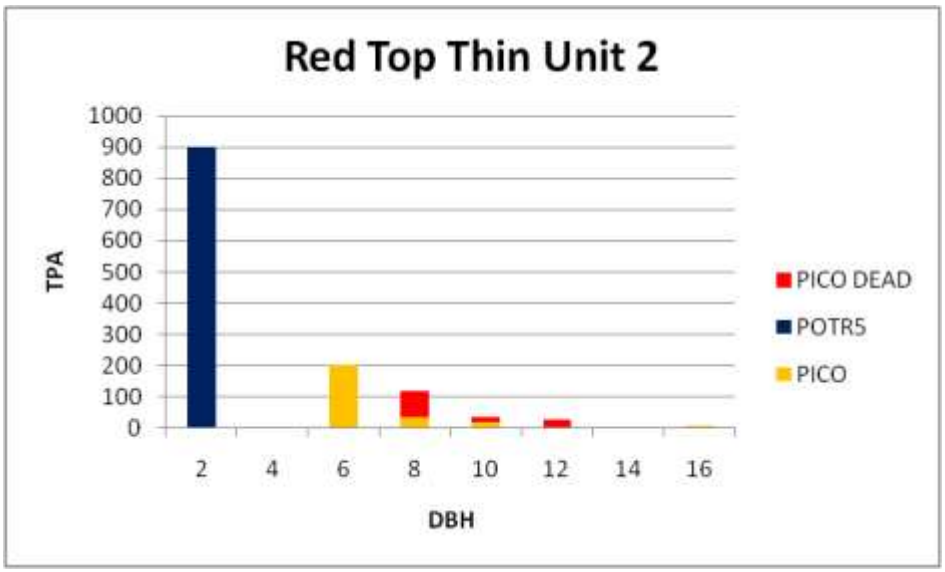

Figure 5. Diameter distribution and species composition of Red Top Thin Unit 2 area.

Note: PICO = Lodgepole pine; POTR5 = Quaking aspen; TPA = Trees per Acre; DBH= Diameter at Breast Height

Fire and Fuels

Fire Regime

Climate and topography in the project area created a historic fire regime in which the number, size, and severity of fires was highly dependent on the variable burning conditions from year to year (Loope and Gruell 1973). The historic fire regime in forested areas was generally characterized by small, low severity fires occurring almost yearly in the project area, mixed-severity fires occurring during drought periods in the absence of high winds, and large, stand-replacement severity fires occurring during drought periods associated with high winds. The result was forested (including aspen) patches of varying ages and sizes in an herbaceous and shrub-dominated landscape. Much of the lodgepole pine and aspen vegetation types on the landscape today are a result of stand-replacement severity fires in the mid to late 1800s (Loope and Gruell 1973). Due to site factors, fires tended to occur relatively frequently in lower elevation dry Douglas-fir stands and big sagebrush shrublands and relatively infrequently on wetter and higher elevation sites.

The current fire regime follows a similar pattern to the historic with respect to low- and high-severity fires. Most ignitions result in small, low-severity fires burning few acres, often as a direct result of fire suppression. There have been occasional large, stand-replacement fires occurring under very dry and windy conditions where firefighters were not able to immediately gain control. Recent examples on the BTNF include the Green Knoll (approximately 4,700 acres total, including approximately 4,165 acres on national forest system lands) and Purdy (approximately 17,000 acres) fires in 2001 and 2006, respectively.

However, the mixed-severity component of the historic fire regime is now largely missing due to effective fire detection and suppression programs. Fires are rarely allowed to persist throughout the fire season as they once did, burning with less activity during wetter periods and increased activity during drier, windier periods. This is now evident in Douglas-fir forests where fire-scarred trees indicate a history of frequent low- and mixed-severity burns (approximately every 40 years), but no burning has occurred for approximately the last 100 years. As early as 1973, Loope and Gruell noted that “plant succession in the

absence of fire has resulted in an increase in the extent and average age of coniferous forest stands and a deterioration of aspen stands" and that "shrub cover, especially big sagebrush, has increased markedly." Some stands in the Teton to Snake project area have a much denser component of young trees which would have been killed by creeping surface fires in historic times. This has created more continuous ladder fuels, so that stand-replacing crown fires are more likely to occur. Figure 6 displays the tree diameter distribution for a stand in the Phillips Bench Unit 2 area. It shows a stand dominated by medium to large Douglas-fir with a large number of small Douglas-fir and subalpine fir in the understory.

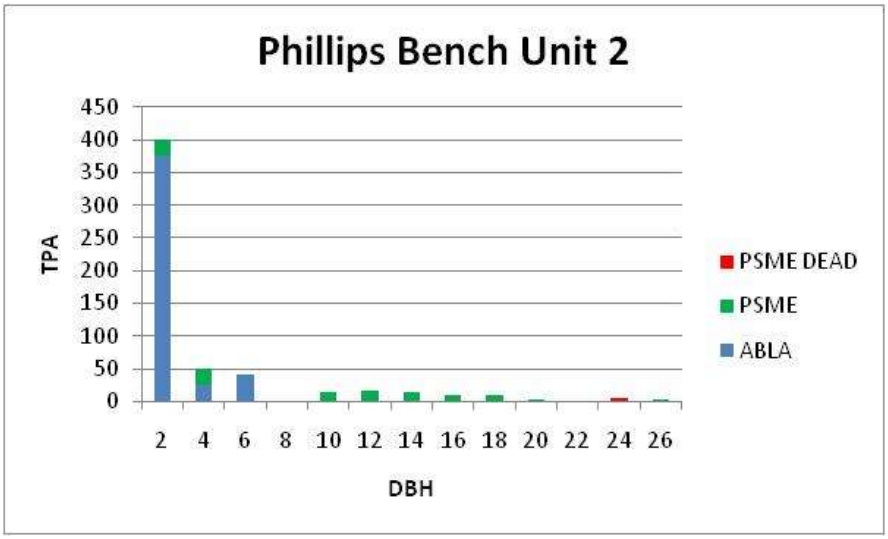

Figure 6. Example of tree diameter distribution in proposed treatment unit.

Note: PSME = Douglas-fir; ALBA = subalpine fir; TPA = Trees per Acre; DBH = Diameter at Breast Height

These changes in vegetation composition and structure result in a fuel complex that is more susceptible to large stand-replacement events and a loss of the vegetation mosaic that existed under the historic fire regime. The end result is that more acres are available to burn in fewer, less manageable events. The BTNF has been successfully addressing this condition in recent years as changes in Forest Service fire management policy now allow more flexibility in the use of wildland fire for resource benefit.

About 21,918 acres within the project area have been burned by wildfires greater than 80 acres since the early 1930s (Table 5), not including the numerous small wildfires that occurred and were suppressed or simply went out. Most of that acreage burned during three wildfires in 1934, which was prior to the institution of the "10 AM Policy" in 1935 which made aggressive fire suppression the standard response and which led to reductions in the numbers of wildfires. Table 5 includes about 700 acres of wildfire area that was burned in 1934 and then again in 2001. Historic fire occurrence data also show 198 fires, an average of four fires per year, suppressed in the project area from 1953 to 2007.

Table 5. Area burned in project area from 1931 to present

Fire Year	Acres
1931	284
1934	17,469
2001	4,165
Total	21,918

Although fires occur in the project area during most years, the drought years of 1934 and 2001 saw large acreages burned.

Fuels and Fire Behavior

Fire behavior is driven by the combination of fuels, topography, and weather across the landscape. Surface fire is fire that burns in the surface fuels (grass, shrubs, litter, dead and down branch wood, and short trees in contact with the ground surface). These fires spread according to the direction and speed of wind and/or the steepness of a slope. Passive crown fire encompasses a wide range of fire behavior from individual trees torching to nearly active crown fire. Active crown fire (also referred to as continuous or running crown fire) spreads very rapidly, and involves the entire surface and canopy fuel complex spreading from tree to tree through the canopy stratum. Crown fires are more difficult to control and have more severe and lasting effects than surface fire due to the increased rate of spread, increased intensity, and likelihood to start spot fires long distances ahead of the fire front from lofted embers.

Based on the Forest's locally calibrated LANDFIRE fuels data, the majority of the fuels in the project area consist of a low load of grass and shrubs mixed with forest litter. Pockets of heavier down and dead woody surface fuel with a significant shrub and/or small tree understory are found primarily on the cooler and wetter north facing aspects. These heavier timber understory fuels will likely lead to crown fire under drier conditions due to the abundance of ladder fuels. Also found on the northerly aspects are areas with a moderate load of fine litter and small diameter downed logs. Although fire behavior is relatively low in this fuel type the small logs can increase resistance to control. The majority of the non-forested fuel types within the project area consist of a combination of grass and shrubs or areas of sparse grass alone.

A fire behavior assessment was conducted to evaluate the current wildland fire behavior potential within the project area using the FlamMap fire behavior modeling system (Finney 2006). Dead fuel moisture was conditioned assuming a series of three consecutive warm, dry, cloud-free days: 80 F max temperature, 16 percent minimum relative humidity at 6740 feet elevation. The elevation of the Teton to Snake project area ranges from about 5,840 feet to 10,919 feet and therefore adiabatic adjustment of temperature in FlamMap results in dead fuel moisture above 6740 feet being conditioned to a cooler and wetter environment than indicated and dead fuel moisture below 6740 being conditioned to a warmer and drier environment.

Winds recorded at the Grand Teton Remote Automated Weather Station (RAWS) for the burn period (1000 to 2000 hours) between July 1, 1990 and August 31, 2009 are somewhat variable, but are predominantly out of the south to southwest with 10-minute average wind speeds up to 25 mph (Figure 7). Wind gusts of up to 45 mph were recorded at the Grand Teton RAWS during the Green Knoll Fire (2001) which burned approximately 4,500 acres within the project area. Simulation wind speed was set higher than the 95th percentile 10-minute average wind speed (approximately 15 mph) at the Grand Teton RAWS. The increase is to account for the difference between the 10-minute average and the 1-minute average more suitable for fire modeling. The 20-ft wind speed used in the FlamMap simulation was 25 mph in the upslope direction. The upslope direction is used to avoid under-predicting fire behavior potential in areas where the aspect faces away from the dominant wind direction (northeast-facing slopes in this case).

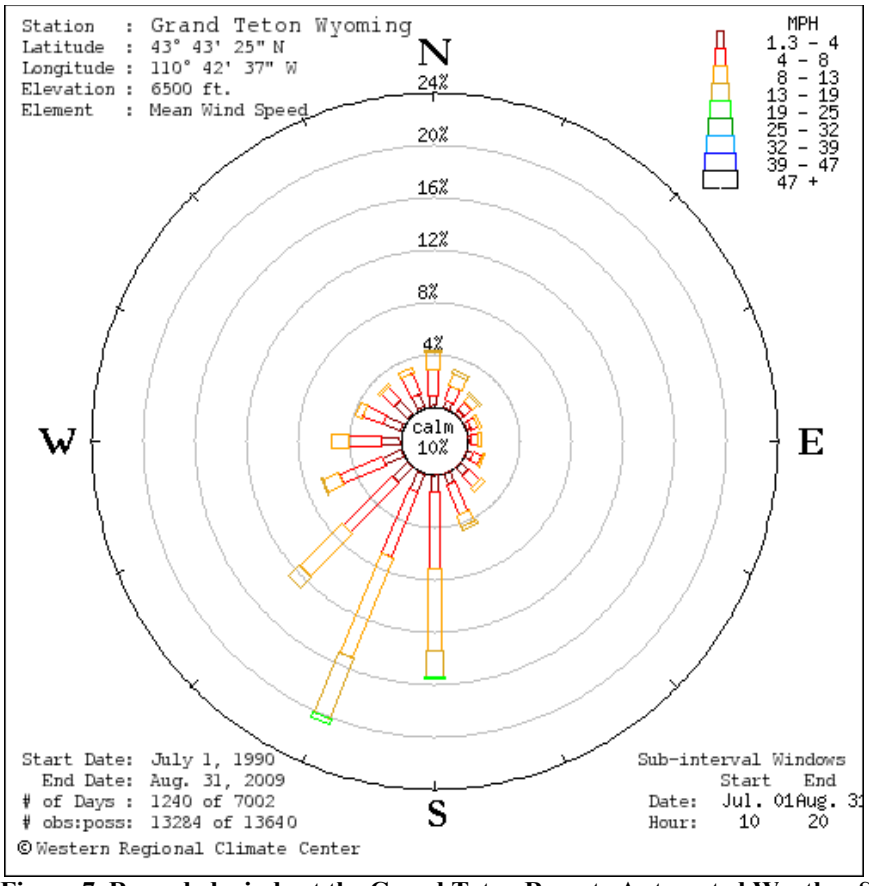

Figure 7. Recorded winds at the Grand Teton Remote Automated Weather Station

Table 6 and Figure 8 - Figure 11 display modeled fire behavior characteristics based on the existing fuel conditions in the project area and dry fuel moisture and wind scenario discussed above.

Wildland fire with flame lengths generally less than four feet allow for direct attack by firefighters using hand tools. These types of fires are less expensive to suppress and in some cases require less rehabilitation work once the fire is out. Flame lengths greater than four feet generally require the use of firefighting equipment such as bulldozers and aircraft, which increases costs and potential resource effects.

Table 6. Current fire behavior potential modeled under a dry fuel moisture scenario and 25 mph upslope 20-foot winds.

Potential Fire Behavior Characteristic		Defense Zone		Threat Zone	
		Acres	Percent[a]	Acres	Percent[a]
Flame Length	< 4 feet	3,519	58%	23,951	56%
	> 4 feet	2,530	42%	18,764	44%
Fire Type	Surface	4,557	75%	30,102	70%
	Passive Crown	820	14%	7,670	18%
	Active Crown	671	11%	4,943	12%

[a] Percent of burnable acres. Non-burnable acres are not shown in table.

Fire behavior descriptions include the fire type: either surface, passive crown, or active crown. A surface fire burns loose debris on the surface such as dead branches, leaves, and low vegetation. Passive crown fire consumes single or small groups of trees or bushes. Active crown fire occurs when the surface fire ignites tree crowns and the fire then spreads through the canopy.

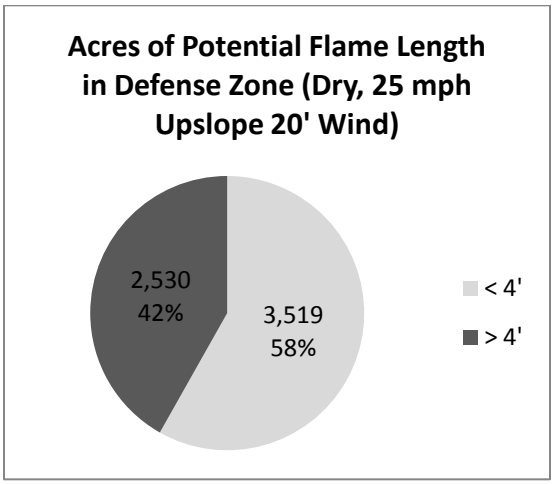

Figure 8. Acres of potential flame lengths in the defense zone

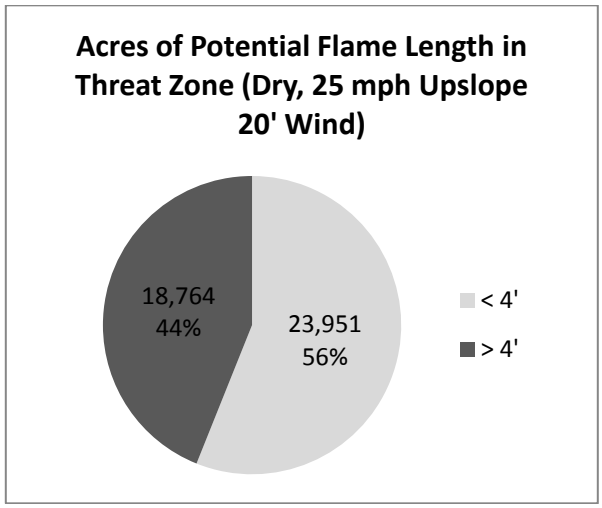

Figure 9. Acres of potential flame lengths in the threat zone

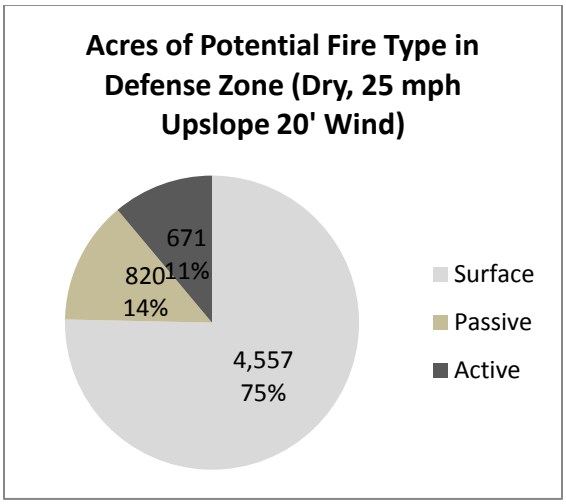

Figure 10. Acres of potential fire type in the defense zone

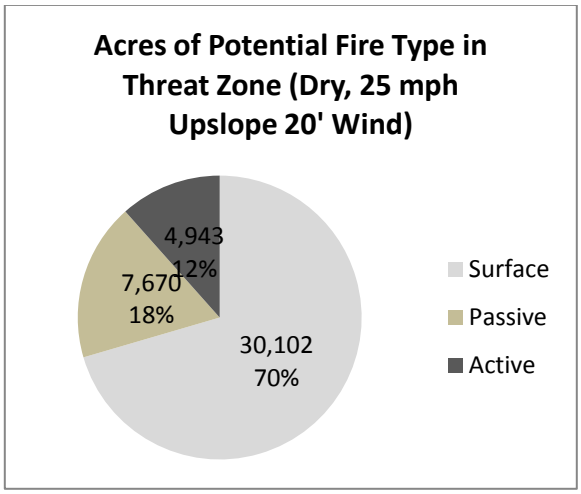

Figure 11. Acres of potential fire type in the threat zone

Areas with the potential for high flame lengths and crown fire (passive and active) are spread throughout the project area (Figure 12 and Figure 13). Local fire managers state that fires tend to spread on this landscape due to spotting and short run wind driven crown fires. The Green Knoll Fire of 2001 exemplified this type of fire behavior growing from 150 acres to 4,470 acres in an eight-day period with observed spotting distances of one-quarter mile (Soper and Fay 2001). Any areas expected to experience passive or active crown fire have the potential for long-range spotting.

Given the uncertainty of any modeling exercise, the results are best used to compare the relative effects, rather than as an indicator of absolute effects. Interpretation, professional judgment, and local knowledge of fire behavior were used to evaluate the outputs from the models and adjustments made as necessary to refine the predictions.

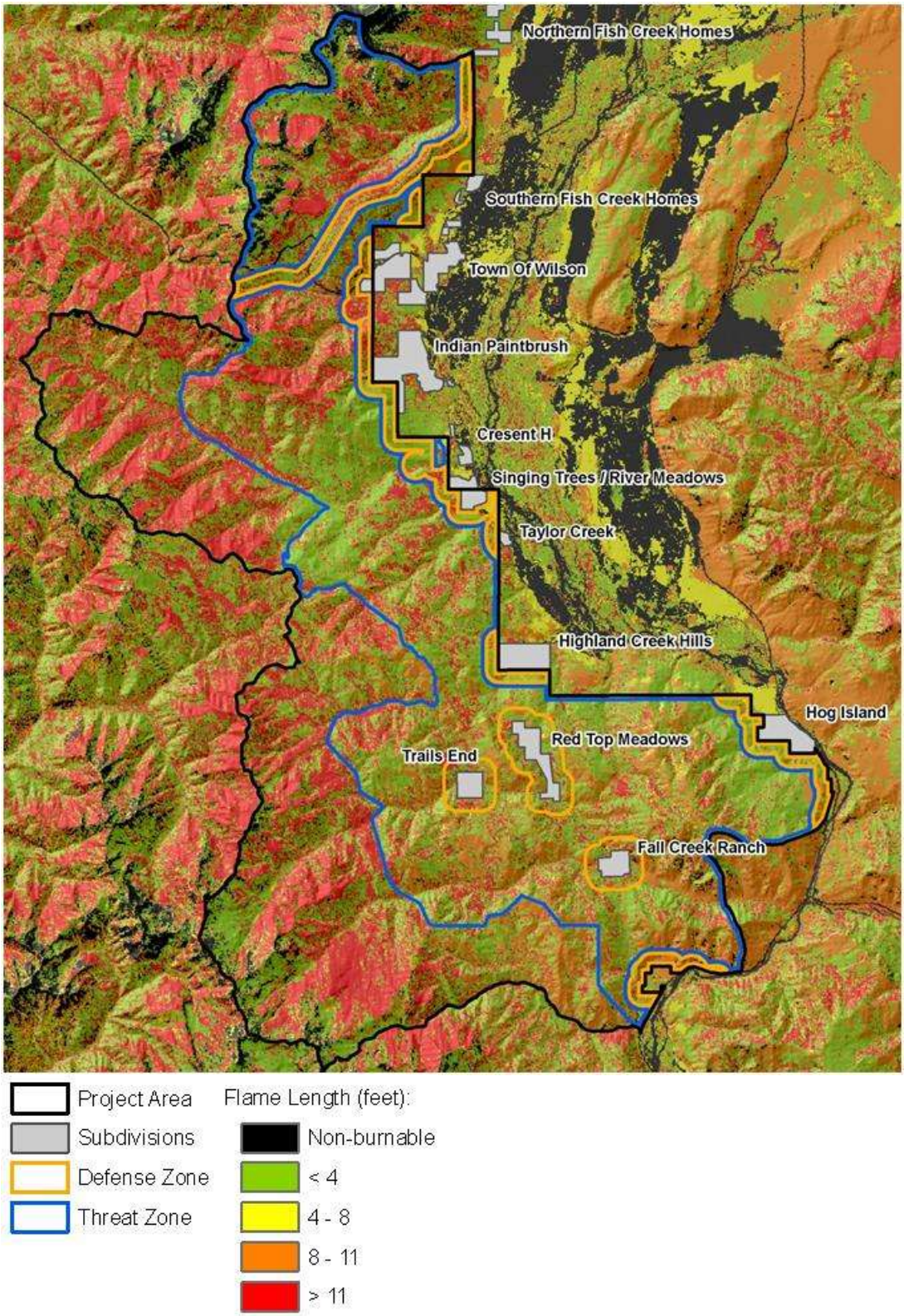

Figure 12. Modeled flame length in the Teton to Snake Project Area

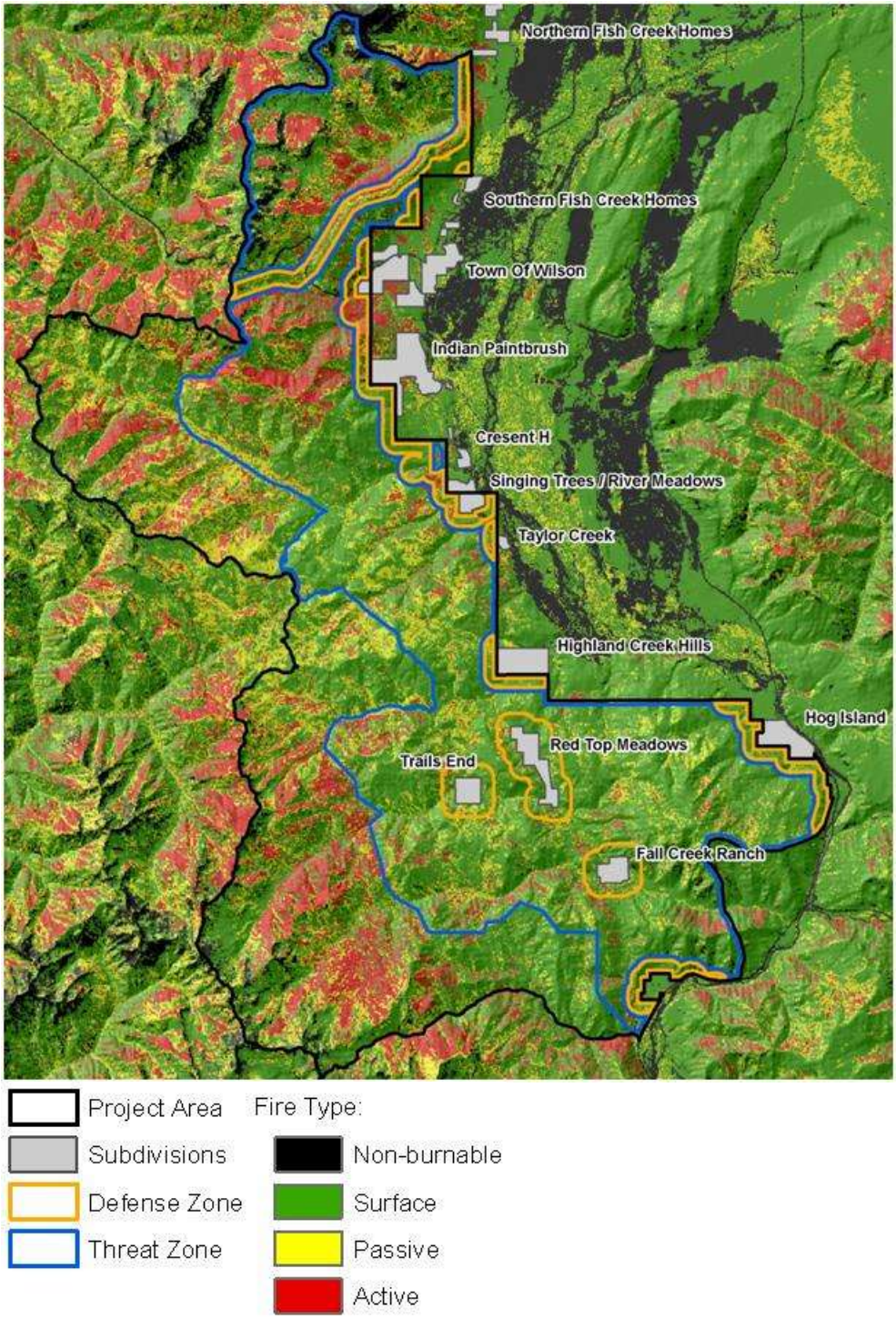

Figure 13. Modeled fire type in the Teton to Snake Project Area

Palisades Wilderness Study Area

The Palisades Wilderness Study Area (WSA) encompasses approximately 20,572 acres (24 percent) within the project area. Its status as a study area includes a variety of management objectives and restrictions intended to protect wilderness characteristics and potential addition to the National Wilderness Preservation System.

Congress designated the Palisades Wilderness Study Area (WSA) as part of the 1984 Wyoming Wilderness Act. The 135,800-acre WSA extends from the Bridger-Teton National Forest west to the Targhee National Forest, with 82,584 acres within the BTNF. The WSA includes the crest of the Snake River Range and most of the major canyons on the south and east. Exceptions are Mosquito Creek, the North Fork of Fall Creek, and some of their tributaries.

For most of the WSA the presence and magnitude of human-induced changes such as physical developments (e.g. roads, utility right-of-ways) is limited to the northern edge where Wyoming Highway 22 climbs Teton Pass. Some alteration of native vegetation has occurred in places; for example, pure Wyethia stands and some non-native plants occur along trails and old sheep bed grounds, but these are local in scope. Constructed facilities for recreation, domestic livestock grazing, and other activities are minor and primitive in nature, and have no significant influence on long-term ecological processes. Therefore a high degree of natural integrity exists in the Palisades Wilderness Study Area. The trails network within the WSA provides access for the pursuit of diverse and challenging non-motorized recreation, Winter travel is unrestricted except in the Teton Pass area, which is closed to snowmobiles.

Wildlife

As noted in Table 5, there is a history of wildfire in the project area, with decades of associated wildfire suppression. Successful initial attack of most wildfires has altered the natural variability of wildlife habitat features across the project area, diminishing habitat diversity as plant successional changes advance habitat composition and structure toward a late/old seral condition. Although there are many different vegetation types in the project area (Table 2), the current condition of widespread even-aged lodgepole pine stands across the landscape reduces wildlife species richness and diversity. Wildlife habitat changes due to wildfire suppression are evident in the deterioration and loss of aspen clones; encroachment and in-growth of conifer cover in all plant communities; a loss of large diameter, open canopy Douglas-fir stands, an increase in the distribution and density of sagebrush in non-forested habitats and aspen; less vigorous and decadent mountain shrub and willow patches; and a reduction in the quantity and productivity of herbaceous forage cover species. Existing habitat conditions favor wildlife species associated with late/old seral vegetation, dense multi-canopy conifer stands, subalpine fir forest cover, aspen/conifer mixed stands, denser sagebrush communities, and less productive grass/forb and shrub habitats. Also, recent beetle epidemics in lodgepole pine, whitebark pine, and Douglas-fir, and mature tree mortality in late/old seral aspen clones have greatly increased the density and distribution of snag and dead/down habitats for associated and dependent wildlife species.

Raptor surveys were conducted informally during the summer, 2009, and during March and April, 2010. The project area provides suitable habitat and supports several species of resident raptors, including northern goshawks, red-tailed hawks, bald and golden eagles, and northern boreal, great gray, Northern pygmy, and great horned owls. Flamulated owls apparently do not occur as residents in the project area, but may occasional pass through during migrations.

Federally listed Threatened, Endangered and Non-essential Experimental Species

A variety of federally listed threatened and endangered species, Forest Service Region 4 sensitive species, BTNF management indicator species, and neo-tropical migratory birds are likely to occur in suitable habitat in the project area.

Threatened and endangered species or habitat present in the project area include Canada lynx, grizzly bear, and northern Rocky Mountain gray wolf. The candidate species yellow-billed cuckoo is not known to occur in project area, and habitat for this species in the project area is very limited. The mountain plover (proposed for threatened status) is not known to occur and habitat is not present.

The proposed project area spans two Forest lynx analysis units providing approximately 86,000 acres of potential lynx habitat, however there is no evidence of a resident lynx population in the project area. Transients may move through the project area. The project area is outside lynx designated critical habitat.

The area is located outside the grizzly bear Primary Recovery Conservation Area (USDA Forest Service 2006) but within the area the Wyoming Game and Fish Department considers as biologically suitable and socially acceptable for bear occupancy (State of Wyoming 2005). No resident bears are known to occupy the area, but transitory bears are known to move through the project area. It's possible that grizzlies could establish residency. There have been recent sightings in the Teton Pass, Teton Village areas, and upper Mosquito Creek area.

The Dog Creek wolf pack occupies the southern portion of the project area. This pack was reduced in 2009 because it preyed on livestock. However, the pack produced young in 2010.

USDA Forest Service Region 4 Sensitive Species

Birds

Field observations indicate that great gray owls are relatively common in forest stands in the project area, at least along the eastern Forest boundary south of the Teton Pass highway. Northern three-toed woodpeckers also are common within the project area wherever larger diameter dead trees provide adequate foraging and nesting habitats. Surveys during summer 2010 detected northern goshawks at one site in the southern portion of the study area that possibly were a nesting pair. Goshawks may have been present in other portions of the project area. An active bald eagle nest occurs in the Munger Mountain Rx Burn Unit 2 just east of the private land parcel. Northern pygmy owls and boreal owls were also detected during surveys.

Mammals

Wolverines occupy the Teton Range as both a resident population and transient individuals. Population size is estimated to fluctuate from 4 to 10 individuals, some of which are known to occur in the project area.

Amphibians

Columbia spotted frogs were observed during field surveys in the project area during 2010. They occur in many of the suitable wetland habitats present on the Jackson District.

Bridger-Teton National Forest Management Indicator Species

Mammals

Mule deer, elk, moose, and Rocky Mountain bighorn sheep are big game management indicator species present on various seasonal and yearlong ranges scattered across the project area.

American marten were not observed during field surveys, but resident marten are common where suitable habitat occurs on the Jackson Ranger District and are expected to be present in the project area.

Birds

Brewer's sparrow is a relatively common nester in the extensive mature sagebrush communities on the Jackson Ranger District. This species was commonly observed during surveys of the project area.

Amphibians

Boreal chorus frogs are ubiquitous around wetland habitats across the Jackson Ranger District. They were observed during field surveys in 2010.

Boreal toads have a limited range on the Jackson Ranger District. They were not observed during field surveys. Their infrequent occurrence in comparison to Boreal chorus and Columbia spotted frogs make it less likely that they would be present in the project area.

Neo-tropical Migratory Birds

The Migratory Bird Treaty Act, Executive Order 13186 (66 Fed. Reg. 3853, 2001), and the 2008 Memorandum of Understanding between the USDI Fish and Wildlife Service and USDA Forest Service provide for the protection of migratory birds and their habitats.

Various neo-tropical migratory species occur in the coniferous and deciduous forest habitats, and non-forest sagebrush, mountain shrub, willow and grass/forb habitats within the project area. Several species observed during various wildlife field surveys are: red-tailed hawk, Cooper's hawk, yellow-rumped warbler, mountain bluebird, Townsend's warbler, olive-sided flycatcher, Townsend's solitaire, ruby crowned kinglet, western tanager, American robin, and chipping sparrow. Although not observed, other neo-tropical migratory species undoubtedly present in the project area would include: Sage sparrow, rosy finches, water pipit, brown creeper, warbling vireo, dusky flycatcher, song sparrow, western wood peewee, red-naped sapsucker, hairy woodpecker, red-cross bills, hermit thrushes, house wren, western meadowlark, red-winged blackbird, mourning dove, swallows and warblers.

Defining the Purpose and Need

Defining the purpose and need for the Teton to Snake Fuels Management Project is based on the comparison of the existing conditions and the desired future conditions in the project area. The desired conditions in this analysis are provided in the Forest Plan, as amended.

Desired Future Condition

There are seven Desired Future Condition (DFC) areas represented in the Teton to Snake project area, each having specific management direction to accomplish Forest Plan goals and objectives (Forest Plan 1990, amended USDA 2004). Each DFC also has a unique set of prescriptions, standards, and guidelines to further define management direction. Area or resource-specific direction includes:

- Within the Palisades Wilderness Study Area, fire management emphasizes preservation of wilderness character and allows natural processes of ecological change to operate freely. The number, size, and intensity of fires approximate the known natural fire regime (USDA 2004), also thought of as the historic fire regime. Without the ecological effects of fire, the number, size, and intensity of fires in the WSA will continue to depart from the historic disturbance regime.
- Manage aspen to promote age class diversity and perpetuate the type. Prevent the loss of aspen stands due to old age and conifer conversion. For aspen management, priority is placed on perpetuating aspen stands that are in the process of conversion to conifer stands due to the lack of fire disturbance. One of the benefits of perpetuating aspen in the project area is its ability to moderate the spread of fire. Fuels associated with aspen vegetation typically burn at lower intensities and with less spotting potential as compared to fuels associated with conifer vegetation. Because the aspen forest does not readily burn, and fires that do occur spread slowly at low intensity, pure aspen stands may function as fuel breaks to help contain fires (DeByle et al 1987).

DFC direction applicable to the remainder of the Teton to Snake Fuels Management Project includes:

- Provide an appropriate fire protection and use program that is economically efficient, responsive to land management objectives, and provides for public safety and protection of property values (USDA 2004).
- Firefighter and public safety is the highest priority during all fire management activities (USDA 2004).

Gap between Existing and Desired Future Conditions

Palisades WSA fire regime

The natural fire regime within the Palisades WSA would be characterized by relatively infrequent, mixed- to high-severity fires. The history of successful initial attack of most wildfires within the WSA has disrupted this regime such that fires are constrained to either very small size, or burning as very large, higher severity events. Fewer acres have burned at lower intensities. This has removed an important natural disturbance process that formerly shaped the forest ecosystems. As mentioned above, fire management approaches have evolved over time and the Forest Service now looks for opportunities to manage fire for resource benefits. A range of fire intensities, from high-intensity stand-replacement fires, to low-intensity surface fires, is desired in the WSA in order to preserve the long-term resiliency, integrity, and, sustainability of its fire-adapted ecosystems and associated wilderness character. Continued suppression of small fires in the WSA will not move the landscape toward the desired condition but rather result in increased fuel accumulation and changes to vegetation composition and structure which lead to larger landscape fires burning in fewer, more unmanageable events, with greater consequences (Reinhardt et al. 2008).

Fire protection and use program

Forest Plan direction is for a fire protection and use program that is economically efficient, meets land management objectives, and provides for public safety and protection of property values. Currently there are fuel conditions conducive to high intensity fire (flame lengths greater than four feet and crown fire) adjacent to communities and electrical power lines. High intensity fire can overwhelm suppression resources posing a greater threat to public safety and potential for loss or damage of property. In response to these threats, some fires that would otherwise be beneficial in meeting land management objectives must be suppressed. A fire protection and use program that is both economically efficient and responsive to land management objectives hinges on strategically reducing the potential for fire to cause loss or

damage of property values in areas where they are most threatened while allowing fire to be used as a tool for meeting land management objectives in areas where the threat to public safety and property id low.

Firefighter and public safety

Firefighter and public safety is the highest priority during all fire management activities. As stated above there are fuel conditions conducive to high-intensity fire adjacent to areas where firefighters are likely to engage in fire management activities. Recent mountain pine beetle activity has created snag (standing dead tree) levels that are hazardous to firefighters. Fire can further weaken the snags' roots, making them even more prone to falling, especially under windy conditions.

Perpetuation of aspen

Depending on the understory, healthy aspen with minimal conifer encroachment will not burn or will burn with low intensity and often provides fuel breaks (DeByle et al 1987). Priority in the Forest Plan is to be placed upon perpetuating at-risk aspen stands being invaded by conifers and vegetation treatment projects are to be designed to retain diverse age classes (Forest Plan 1990). Conversion to conifer is common and most aspen on the Forest is mature with very little age/size class diversity with most of the aspen in Jackson Hole having been established after being burned between 1840 and 1890 (Gruell and Loope 1974, Loope and Gruell 1973).

Aspen produces abundant seed but few seedlings survive; its primary mode of reproduction is through root suckering (USDA Forest Service 2010, Burns and Honkala 2010). It is easily top-killed by fire, which stimulates suckering (USDA Forest Service 2010). Aspen in western Wyoming can produce abundant suckers in the year following fires (Bartos and Mueggler 1981, Bartos et al. 1991, Durham 2008, Kay 2001) and fire played a very important role in maintaining aspen as a major landscape component in the Jackson Hole area (Gruell and Loope 1974). Without fire, aspen in Jackson Hole will continue to deteriorate and restoration of aspen can only be answered through large-scale return of fire to aspen communities (Gruell and Loope 1974).

Aspen is also very intolerant of shade. On some sites, aspen is persistent and can be considered a climax species (Mueggler 1988), but on most sites, it is replaced by to a conifer species such as lodgepole pine, Douglas-fir, and subalpine fir. Over time, in most mixed conifer and aspen stands in the Jackson Hole area the conifers have attained dominance and accelerated the decline and death of the aspen component due to shading and competition (Loope and Gruell 1973). Without action to reduce competing conifers, aspen will continue to decline. Simply removing competing conifers has been shown to increase aspen stem density and can be an effective treatment for restoring aspen (Jones et al. 2005, Prévost and Pothier 2002).

Table 7 displays the gaps between the desired future conditions and the existing conditions found in the project area.

Table 7. Comparison of the desired future condition and existing condition

Desired Future Condition	Existing Condition	Gap
Within the Palisades Wilderness Study Area, fire management emphasizes preservation of Wilderness character and allows natural processes of ecological change to operate freely. The number, size, and intensity of fires approximate the natural fire regime.	Nearly all fires in the Palisades WSA are successfully suppressed resulting in less acres burning at lower intensities than would be characterized under the natural fire regime.	The overall number, size, and intensity of fires are outside of the natural fire regime. Known historic processes of ecological change are not operating freely thus the scientific and conservation value of this landscape to serve as a natural laboratory (in contrast to a more managed landscape) is being compromised.
Provide an appropriate fire protection and use program that is economically efficient, responsive to land management objectives, and provides for public safety and protection of property values.	National Forest system lands adjacent to communities and electrical transmission lines have potential for high-intensity fire. Due to threats to public safety and property values some fires that would otherwise be beneficial for meeting land management objectives must be suppressed.	High-intensity fire can overwhelm fire suppression resources and has greater potential to cause damage to communities and electrical transmission lines and threaten public safety. Fire use program is often not able to meet land management objectives due to the threat to public safety and property values related to the potential for crown fire and resistance to control.
Firefighter and public safety is the highest priority during all fire management activities.	Areas within NFS lands have potential for high intensity fire and contain hazardous snags from mountain pine beetle mortality.	The potential for high-intensity fire and snag fall are a threat to firefighter safety. Firefighters are likely to be engaged in fire management activities in areas adjacent to communities and the power line where these conditions exist.
Aspen is a major landscape component, providing wildlife habitat, seasonal colors, and acting to moderate fire behavior. A range of aspen age classes is present throughout the landscape. The loss of aspen stands due to old age or conifer conversion is being prevented.	Aspen representation on the Forest has declined over the last century due to age or conifer conversion. The structural stage distribution is skewed to more mature age classes than early or mid age classes.	Aspen representation on the forest is lower than desired and can be improved to help meet fire management goals. Under existing conditions, aspen decline is not being addressed and aspen will continue to decline in vigor and representation.

Purpose and Need for Action

The purpose of this project is to (1) improve firefighter and public safety, (2) reduce the threat of wildland fire to residential areas and power line corridors, and (3) allow Forest managers to transition from suppressing all fires to a more natural fire regime.

Background

Private lands adjacent to the national forest boundary from Red Top Meadows to Teton Village have experienced considerable residential development since the 1990s. The need to treat fuels in this area became readily apparent with the 2001 Green Knoll Fire, which burned approximately 4,700 acres over the course of eight days. The fire started well within the Forest boundary, however south to southwest winds quickly drove the fire onto adjacent private lands, with spotting observed one-quarter mile ahead of the fire front. The combination of high density housing adjacent to the Forest boundary, the forest fuels conditions in the area, and the prevailing winds that push wildfire toward residential areas indicated to fire managers that fuel treatments were urgently needed in this area to reduce wildfire threat.

In response, local fire managers in 2003 planned a small-scale mechanical thinning project called the Red Top to Teton Village Fuels Reduction project. This project treated fuels only within several hundred feet from the private land/Forest boundary and was considered effective as long as no fire spotting occurred and sufficient resources (people, equipment, and aircraft) were available in the event of a wildfire. While this treatment offered more ability to successfully fight fires near residential areas by increasing defensible space, the treatments did not reduce the overall probability of wildfire enough to alter fire response in the larger landscape; managers must suppress all fires in the area to minimize the probability of wildfire reaching and threatening the neighboring homes. This is because firefighting resource availability is not predictable from year to year. To avoid a full suppression response, fire managers need to be able to manage fire before it is in people's back yards.

Following the fuels reduction project, Teton County completed their Community Wildfire Protection Plan in August 2005. This was developed by county, state, and federal fire managers in collaboration with other agencies and the interested public. This plan reinforced that many of the residential areas adjacent to the National Forest in this project area were at high to extreme hazard levels from wildfire.

Need for Action to Reduce Wildfire Threat to Private Lands and the BPA Power Line

There are 1,579 private lots within one-half mile of the project area boundary. Forest changes due to years of fire suppression and the ongoing bark beetle epidemic combined with the high density of homes downwind of potential fire starts creates a higher wildfire threat in this area than in any other area on the Bridger-Teton National Forest. In the Teton Pass area, the Bonneville Power Administration maintains a high voltage power line which is the primary source of electricity for Jackson Hole. If a wildfire were to occur in this area, the power line could be shut down due to heavy smoke, flames, or fire suppression activities. This would pose a major disruption for people living, working, or visiting Jackson Hole and also would pose a significant threat to firefighter safety.

Homeowners are responsible to make their homes "Firewise," a program funded by the 2000 National Fire Plan, not only to protect their own home from a wildfire but also to protect their neighbors' homes. Likewise, BPA has maintenance responsibilities within the power line corridor with a focus on removing trees that could fall on the power line. The Forest Service has a complementary responsibility to reduce the probability of wildfire originating on the National Forest from burning onto private lands or impacting the power line. Policy from the 2000 National Fire Plan emphasizes treating and reducing hazardous fuels

in wildland-urban interface areas to reduce the threat to life and property while also maintaining firefighter safety and reducing fire suppression costs.

A fire behavior assessment conducted in 2010 revealed that 42 percent of the area within one-quarter mile of residential areas and the power line (defense zone) could produce flame lengths over four feet, and 25 percent of this same area could produce crown fires and potential spotting ahead of the fire. Under these kinds of conditions, fire fighters are ineffective without support from aircraft and heavy equipment and wildfires become very difficult to suppress. Snags are also of concern due to the increasing amount of beetle-killed trees. Falling snags and hazard trees are the second leading cause of fatalities and serious injury during wildland firefighting operation (14 fatalities/debilitating injuries in the last 6 years), thus reducing the number of snags in the defense zone is important to improve firefighter safety.

From this discussion two Needs for Action based on Forest Plan management direction arise:

Need for Action: There is a need to treat areas in the WUI defense and threat zone to reduce wildfire threat to highly valued resources and assets.

Need for Action: Firefighter safety is threatened by falling snags and high intensity fire behavior near developed areas where extensive tree mortality has occurred in recent years. There is a need to remove snags in close proximity to homes and the power line to promote safety during firefighting activities.

Need for Action to Transition from Suppressing All Fires to a More Natural Fire Regime

Land management objectives in the Forest Plan emphasize allowing natural processes such as fire to operate as freely as possible but fire managers and decision makers do not want to assume the risk of fire burning onto private land or near the power line without treating fuels to reduce the threat. Historic fire occurrence data shows that 198 fires burned within the project area between 1953 and 2007, an average of four fires per year, all of which were suppressed. In 2010 there were again four fires in the project area which were all suppressed. By comparison, in the Gros Ventre Wilderness on the Jackson Ranger District, four out of five fires in 2010 were allowed to play a nearly natural role. As a result of years of fire suppression in the project area, the fire regime has been altered, notably moderate size, mixed-severity types of fires no longer occur. Most ignitions today result in small, low-severity fires that burn less than 1 acre and occasional large, stand-replacement fires that burn under extreme dry and windy conditions overpowering suppression efforts. This change in the fire regime is most evident in the Douglas-fir forests where fire-scarred trees show a history of frequent low- and mixed-severity burns but no burning for approximately the last 100 years. Ecological effects from years of fire suppression include conifer expansion into meadows, aspen decline, and fuel build-up with subsequent effects on wildlife and water flow.

In addition to ecological changes due to an altered fire regime, activities associated with fire suppression are generally larger in scale and incorporate additional resources such as bulldozers and other heavy equipment. Such a management response has a greater potential to introduce weeds and directly impact vegetation, soil, water, and wildlife. Fire suppression of high intensity fires in the wildland interface can also be more costly than managing for a more natural fire regime. The Green Knoll fire exemplifies the issue well. Since this fire was burning in conditions that firefighters could not directly suppress (over 4 foot flame lengths), expensive suppression resources including fixed-wing planes, helicopters, bulldozers, and heavy equipment were used to control the fire. The total cost of the Green Knoll fire was $13.3 million which equates to about $2,830 per acre. By comparison, the national average suppression cost for large fires (over 300 acres) is roughly $500 per acre. By creating forest conditions that would allow the Forest to manage more fires in the project area with less suppression activity, future fire costs associated

with large catastrophic fires could be significantly lowered, while also lowering firefighter exposure to hazardous conditions. The most efficient and effective way to manage this area to meet land management objectives would be to allow more fires to play their natural role. The proposed action is intended to give fire managers more options for managing fires in this area to achieve this goal. Proposed treatments are strategically placed within the project area to enhance aspen and to create more diversity which in turn breaks up the continuity of fuels creating areas that fire managers can use to steer wildfires away from residential areas and the power line. If nothing is done to treat fuels in the project area, nearly all wildfires in the project area will be suppressed which will continue toward adverse changes to the fire regime and wilderness character and that will increase long-term fire threat to highly valued resources and assets.

From this discussion two additional Needs for Action based on Forest Plan management direction arise:

Need for Action: In the project area and in particular within the Wilderness Study Area, the natural fire regime cannot be reestablished due to the proximity of developed areas. Natural fire starts are not free to burn with the regularity or intensity of pre-settlement times. This has led to ecological effects such as Douglas-fir encroachment into meadows, aspen decline, and buildup of fuels. The potential for high-intensity fire restricts the opportunity to use fire for resource benefit in the project area and the proximity to private land, homes, and the power line indicates a need to reduce fire behavior to protect those values.

Need for Action: There is a need to perpetuate aspen communities by reducing competing conifers and increasing age-class diversity. Healthy aspen stands with minimal conifer encroachment may not burn or will burn with low intensity and can help meet fire management objectives by providing fuel breaks.

Proposed Action

The following methods are proposed to address the needs for action and to move the landscape in the Teton to Snake project area toward the desired future conditions.

Proposed Action Objectives

The following objectives would be met through implementation of the specific actions listed in Table 12 in Appendix B. Measurement indicators are included to determine the effectiveness of the actions in meeting the purpose and need for the project.

Within the WUI Defense Zone[1]:

- Treat areas using mechanical (thinning) and/or prescribed fire methods to: (1) reduce flame lengths at the head of potential wildfires to less than four feet, (2) reduce surface and ladder fuel conditions to make crown fire initiation highly unlikely, and (3) increase overstory tree spacing and reduce crown fuel continuity to make sustained crown fire highly unlikely. Meeting this need will reduce the potential for damage or loss to property, reduce threats to firefighter and public safety, and allow more flexibility in managing fire within the interior of the WSA to preserve wilderness character. The measurement indicator is modeled fire behavior.
- Reduce snag levels by removing dead and dying trees affected by bark beetles in close proximately to private property and the BPA power line. Meeting this need will reduce the threat to firefighters from snag fall. The measurement indicator is number of snags per acre.

[1] One quarter mile from the ownership boundary between NFS and private land occupied by residences or summer homes and around the Bonneville Power Administration power line.

Within the WUI Threat Zone (area extending from the defense zone to WUI boundary):

- Treat areas using mechanical (thinning) and/or prescribed fire methods to: (1) reduce fire behavior continuity and create a range of fire behavior potential over the landscape (surface to active crown), (2) create a heterogeneous fuelscape so that areas with high fire behavior potential are interspersed with areas of mixed and low fire behavior potential, thereby limiting the potential for high-intensity fire to spread into the defense zone or subdivisions. Meeting this need will reduce the potential for damage or loss to property, reduce threats to firefighter and public safety, and allow more flexibility in managing fire within the interior of the WSA to preserve wilderness character. The measurement indicator is modeled fire behavior.

Within all areas:

- Treat aspen community types using mechanical (thinning) and/or prescribed fire methods to reduce conifer and restore size and age class diversity. Meeting this need will reduce the decline of aspen, reduce fire behavior potential on the landscape, and allow more flexibility in managing fire within the interior of the WSA to preserve wilderness character. The measurement indicator is acres treated to perpetuate aspen in areas of conifer encroachment.

Proposed Action

Treatments

This project would treat approximately 22,511 acres of national forest system lands to reduce fire behavior potential, increase aspen representation and structural diversity, improve fire protection, and increase firefighter and public safety.

Table 8 displays the treatment units and primary treatment types –either thinning or prescribed fire, with map references for locating the units on the maps in Appendix B. Table 12 in Appendix B provides greater detail including treatment objectives, methods, access, land allocations, and additional pertinent information for each unit. Refer also to Appendix B for maps of the proposed treatments units.

Table 8. Proposed treatment units

Treatment Unit Map Reference	Name	Primary Treatment	Acres
PF-01	Phillips Canyon Rx Burn Unit 1	Prescribed Fire	1,161
PF-02	North Fork Phillips Canyon Rx Burn Unit 1	Prescribed Fire	1,875
T-03	Phillips Bench Unit 2	Thinning	159
T-04	Phillips Bench Unit 7	Thinning	138
T-05	Phillips Bench Unit 1	Thinning	64
T-06	Phillips Bench Unit 5	Thinning	194
T-07	Phillips Bench Unit 3	Thinning	8
T-08	Phillips Bench Unit 4	Thinning	6
T-09	Phillips Bench Unit 6	Thinning	104
T-10	Power Line Unit 1	Thinning	259
T-11	Recreation Trail Unit 2	Thinning	175
PF-12	Black Canyon Rx Burn Unit 2	Prescribed Fire	270
PF-13	Black Canyon Rx Burn Unit 1	Prescribed Fire	612
T-14	Recreation Trail Unit 1	Thinning	16

Treatment Unit Map Reference	Name	Primary Treatment	Acres
T-15	Recreation Trail Unit 4	Thinning	34
T-16	Recreation Trail Unit 3	Thinning	46
T-17	Recreation Trail Unit 7	Thinning	41
T-18	Recreation Trail Unit 6	Thinning	40
T-19	Recreation Trail Unit 5	Thinning	46
PF-20	Mosquito Creek North Rx Burn Unit	Prescribed Fire	2,639
T-21	Singing Trees Unit 1	Thinning	113
PF-22	Singing Trees Rx Burn Unit 1	Prescribed Fire	417
T-23	Singing Trees Unit 2	Thinning	70
PF-24	Singing Trees Rx Burn Unit 2	Prescribed Fire	174
T-25	Singing Trees Unit 4	Thinning	44
PF-26	Singing Trees Rx Burn Unit 3	Prescribed Fire	464
PF-27	Taylor Mountain Rx Burn Unit 5	Prescribed Fire	268
PF-28	Taylor Mountain Rx Burn Unit 3	Prescribed Fire	1,626
PF-29	Taylor Mountain Rx Burn Unit 4	Prescribed Fire	384
PF-30	Taylor Mountain Rx Burn Unit 2	Prescribed Fire	411
T-31	Highland Hills Unit 1	Thinning	69
PF-32	Highland Hills Rx	Prescribed Fire	298
T-33	Red Top Unit 1	Thinning	398
PF-34	Trails End Rd Rx	Prescribed Fire	347
T-35	Red Top Unit 2	Thinning	72
T-36	Red Top Unit 5	Thinning	166
PF-37	South Fork Fall Creek Rx	Prescribed Fire	1,001
T-38	Trails End Unit	Thinning	111
PF-39	Coburn Creek Rx Burn Unit 3	Prescribed Fire	115
PF-40	Coburn Creek Rx Burn Unit 2	Prescribed Fire	991
T-41	Red Top Unit 3	Thinning	120
PF-42	Coburn Creek Rx Burn Unit 1	Prescribed Fire	1,556
T-43	Red Top Unit 4	Thinning	33
PF-44	Fall Creek Ranch Rx Burn Unit 1	Prescribed Fire	735
PF-45	Fall Creek Ranch Rx Burn Unit 2	Prescribed Fire	332
PF-46	Wilson Fall Creek Rx	Prescribed Fire	396
PF-47	Munger Mountain Rx Burn Unit 1	Prescribed Fire	1663
PF-48	Munger Mountain Rx Burn Unit 2	Prescribed Fire	2,256

Table 9 displays the acres of each proposed treatment combination. Thinning treatments are displayed according to the specific combination of activities required for treatment. The “Total Treatment Acres” column includes general forest lands as well as lands in special land allocations, which are broken out and displayed in the columns 3-5. Also of note is that because the defense zone, roadless areas, and wilderness study area overlap in places, some acres are accounted for in more than one column.

Table 9. Specific treatments and acreage, with acres located in special land allocations

Treatment	Total Treatment Acres	Treatment Acres located in Defense Zone	Treatment Acres located in Roadless Areas	Treatment Acres located in Wilderness Study Area
Prescribed Fire	19,984	1,209	**6,857**	**11,113**
Non-commercial Thin (NCT) Hand Cut (HC) Hand Pile and Burn (HPB)	**1,245**	**1,222**	267	453
Non-commercial Thin (NCT) Hand Cut (HC) Hand Pile and Burn (HPB) Prescribed Fire last (PF)	252	248	0	178
Non-commercial Thin (NCT) Prune (PR) Hand Cut (HC) Hand Pile and Burn (HPB) Lop and Scatter (LS)	301	297	0	125
Non-commercial Thin (NCT) Commercial Thin (CT) Ground-based Yarding (GBY) Machine Cut/Machine Pile and Burn (MC/MPB) –OR-- Hand Cut/Hand Pile and Burn (HC/HPB)	729	282	23	0

Connected Actions

Mechanical (thinning) treatment of some units would require road maintenance, reconstruction, or construction in order to remove logs from the site. Table 10 displays the proposed road work. Log landings would be required and may be in the form of road widening for roadside landings, or constructed clearings at the end of haul roads. Landings will be designed and located using all Forest Plan standards and guides as well as Wyoming Best Management Practices to protect resources.

Table 10. Preliminary estimates of proposed road work by associated thinning treatment unit

Treatment Unit	Road Number	Road Work	Length of Road Work	# Landings	Comments
T-05 Phillips Bench Unit 1	FR 30972	Maintenance	4,800 feet	2-3	
	FR 30972B	TBD	TBD	TBD	
T-06 Phillips Bench Unit 5	Power Line	Reconstruction	6,000 feet	4-6	Narrow and steep in sections, requires widening.
T-33 Red Top Unit 1	FR 30995	Maintenance	11,800 feet	4	New temporary road would come off of FR 30995
	FR 30997	Maintenance	800 feet		
	FR 30993	Maintenance	1,600 feet		
	New Temp.	Construction	2,500 feet		
T-35 Red Top Unit 2	New Temp.	Construction	1,500 feet	2-3	Need to look at where this would come off FR 30995. May require several roadside landings.

Legal and Regulatory Framework

As required by the National Forest Management Act of 1976 the BTNF is managed under a Forest Plan (Forest Plan 1990). The original Forest Plan was approved in 1990 and an amendment of the fire management standards and guidelines was approved in 2004. The Forest Plan and subsequent fire amendment identify forest-wide desired conditions and management direction. Desired conditions particularly applicable to the Teton to Snake Fuels Management Project are outlined above and form the foundation of the purpose and need. The Palisades WSA and inventoried roadless areas (Phillips Bench and Munger Mountain) encompass 24 percent and 26 percent of the project area, respectively. Law, regulation, and policy associated with these areas are of key importance to the Teton to Snake Fuels Management Project and summarized below. In addition, the Forest Service manual includes particular safety requirements as described below.

Management Direction for Palisades WSA

Wyoming Wilderness Act of 1984 (Public Law 98-550)

Congress passed the Wyoming Wilderness Act on October 30, 1984. The purpose of the Act is to "designate certain National Forest System lands for inclusion in the National Wilderness Preservation System in order to preserve the wilderness character of the land and to protect watersheds and wildlife habitat, preserve scenic and historic resources, and promote scientific research, primitive recreation, solitude, physical and mental challenge, and inspiration for the benefit of all of the American people."

The 135,840 acre Palisades area was designated a "Study Area" due to its potential for oil and gas resources. Direction for this area includes the following:

> The Secretary of Agriculture "shall administer the area so as to maintain its presently existing wilderness character and potential for inclusion in the National Wilderness Preservation System."
>
> The Secretary of Agriculture, "shall, upon revision of the initial land management plans for the Bridger National and Targhee National Forests, review the Wilderness Study Areas as to their suitability for preservation as wilderness." This time period was considered sufficient for lessees to either prove or disprove the USGS survey assessment of the area's high potential for oil and gas. (Note: the neighboring Caribou-Targhee National Forest did recommend wilderness designation for their portion of the WSA along with adjacent portions of the Palisades in Idaho; the BTNF Forest Plan Revision effort is on hold)
>
> "Snowmobiling shall continue to be allowed in the same manner and degree as was occurring prior to the date of enactment of this Act."

Bridger-Teton National Forest Management Prescription 6S – Wilderness Study Areas

The wilderness study areas will be managed to protect long-term wilderness attributes. No activities will be allowed that will jeopardize the eligibility of the WSAs for future Congressional designation as wilderness.

National Policy Objectives for Fire within Wilderness (FSM 2324.2)

National policy objectives for fire within wilderness are:

1. Permit lightning caused fires to play, as nearly as possible, their natural ecological role within wilderness.
2. Reduce, to an acceptable level, the risks, and consequences of wildfire within wilderness or escaping from wilderness.

To meet the above objectives, management treatments are only permitted if all of the following conditions are met:

3. Fuel treatment measures outside of wilderness are not sufficient to achieve fire management objectives within wilderness.
4. An interdisciplinary team of resource specialists has evaluated and recommended the proposed action.
5. The interested public has been involved.
6. Lightning-caused fires cannot be allowed to burn because they will pose serious threats to life and/or property within wilderness or to life, property, or natural resources outside of wilderness.

2001 Roadless Rule

Activities involving road construction or reconstruction and timber cutting within Inventoried Roadless Areas have been subject to challenge for many years. The 2001 Roadless Area Conservation Rule (RACR) prohibits, with some exceptions, road construction and timber harvesting across 58.5 million acres of the National Forest System (USDA 2001). Years of litigation followed resulting in the California court reinstating the 2001 Roadless Rule in September 2006 and the Wyoming Court enjoining the Roadless Rule in August 2008. The Wyoming decision placed the Forest Service in a conundrum of trying to comply with the California court's order to follow the RACR and the Wyoming court's order to not follow the RACR. In response to this dilemma, Secretary of Agriculture Tom Vilsack issued Memorandum 1042-154 in May 2009 which reserves "to the Secretary the authority to approve or disapprove road construction or reconstruction and the cutting, sale, or removal of timber in those areas identified in the set of inventoried roadless area maps contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000." The Secretary issued Memorandum 1042-155 in May 2010 re-delegating some authorities back to the Forest Service.

The Chief is re-delegated authority to approve:

a. Any necessary timber cutting or removal or any road construction/ reconstruction in emergency situations involving wildfire suppression, search and rescue operations, or other imminent threats to public health and safety in inventoried roadless areas.

b. Timber cutting, sale, or removal in inventoried roadless areas incidental to the implementation of an existing special use authorization. Road construction/reconstruction is not authorized through this re-delegation without further project specific review.

c. The cutting, sale, or removal of generally small diameter timber when needed for one of the following purposes:

- To improve threatened, endangered, proposed, or sensitive species habitat;
- To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period; or,

- For administrative and personal use, as provided for in Title 36, Code of Federal Regulations 223, where personal use includes activities such as Christmas trees and firewood cutting and where administrative use includes providing materials for activities such as construction of trails, footbridges, and fences.

USDA Forest Service Manual

Forest Service policy (FSM 5103) includes the following fire management safety direction:

Safety: Firefighter and public safety is the first priority. All Fire Management Plans and activities must reflect this commitment.

Planning: Fire Management Plans must provide for firefighter and public safety.

Suppression: Fires are suppressed at minimum cost, considering firefighter and public safety, and all values to be protected, consistent with resource objectives.

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References Cited

Bartos, D. L. and W. F. Mueggler. 1981. Early succession in aspen communities following fire in western Wyoming. Journal of Range Management. 34(4): 315-318.

Bartos, Dale L.; Walter F. Mueggler; Robert B. Cambell, Jr. 1991. Regeneration of aspen by suckering on burned sites in western Wyoming. U. S. Department of Agriculture, Forest Service. Intermountain Research Station. Research Paper INT-448. 10 p.

Brown, James K.; Smith, Jane Kapler, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fort Collins, CO. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. 257 p.

Burns, Russell M. and Barbara H. Honkala. Tech Coord. 2010. Silvics of North America volume II: hardwoods. U. S. Department of Agriculture, Forest Service. Agriculture Handbook 654. Found online at: http://www.na.fs.fed.us/spfo/pubs/silvics_manual/table_of_contents.htm

Cole, Walter E. and Gene D. Amman. 1969. Mountain pine beetle infestations in relation to lodgepole pine diameters. U. S. Department of Agriculture, Forest Service, Intermountain Forest and Range experiment Station. Ogden, UT. Research Note INT-95. 8p.

Cole, Walter E. and Gene D. Amman. 1980. Mountain pine beetle dynamics in lodgepole pine forests part 1: Course of an infestation. U. S. Department of Agriculture, Forest Service, Intermountain Forest and Range experiment Station. Ogden, UT. General Technical Report INT-89. 58p.

DeByle, Norbert V., Bevins, Coilin D. and William C. Fischer. 1987. Wildfire occurrence in aspen in the interior United States. Intermountain Research Station, USDA Forest Service, Ogden, UT. 4 pp,

Durham, Daniel Avery. 2008. Aspen response to prescribed fire in southwestern Montana. MS Thesis. Montana State University, Bozeman, Montana. 62p.

Furniss, M. M.; M. D. McGregor; M. W. Foiles; A. D. Partridge. 1979. Chronology and characteristics of a Douglas-fir beetle outbreak in Northern Idaho. U. S. Department of Agriculture, Forest Service, Intermountain Forest and Range experiment Station. Ogden, UT. General Technical Report INT-59. 27p.

Gruell, G. E. and L. L. Loope. 1974. Relationships among aspen, fire, and ungulate browsing in Jackson Hole, Wyoming. U. S. Department of Agriculture, Forest Service. Intermountain Research Station, Ogden, UT. 33 p.

Holsten, E., Their, R. Munson, A., and Gibson, K. (1999). The Spruce beetle, U. S. Department of Agriculture, Forest Service, Forest Insect and Disease Leaflet 127. 11 pp.

Jones, Bobette E.; Tom H. Rickman; Alfred Vazquez; Yukako Sado; Kenneth W. Tate. 2005. Removal of encroaching conifers to regenerate degraded aspen stands in the Sierra Nevada. Restoration Ecology. 13(2): 373-379.

Jones, John R., Robert P. Winokur, Wayne D. Sheppard. 1985. Management Overview. IN: Aspen: Ecology and management in the western United States. Edited by Norbert V. DeByle and Robert P. Winokur. USDA Forest Service General Technical Report RM-119. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. Pages 193-195.

Kay, Charles E. 2001. Evaluation of burned aspen communities in Jackson Hole, Wyoming. In: Sustaining Aspen in Western Landscapes: Symposium Proceedings. Shepperd, Wayne D.; Binkley, Dan; Bartos, Dale L.; Stohlgren, Thomas J.; and Eskew, Lane G., compilers. U. S. Department of Agriculture, Forest Service. Rocky Mountain Research Station. RMRS-P-18. 215-224.

Klein, William H.; Douglas L. Parker; Chester E. Jensen. 1978. Attach, emergence, and stand depletion trends of the mountain pine beetle in a lodgepole pine stand an outbreak. Environmental Entomology. 7:732-737.

Knight, F. B. 1960. Measurement of Engelmann spruce beetle populations. Ecology. 41(2): 249-252.

Loope, Lloyd L. and George E. Gruell. 1973. The ecological role of fire in the Jackson Hole area, northwestern Wyoming. Quaternary Research. 3: 425-443.

McCambridge, William F. and Fred B. Knight. 1972. Factors affecting spruce beetles during a small outbreak. Ecology. 53(5): 830-839.

Mueggler, Walter F. 1988. Aspen community types of the intermountain region. U. S. Department of Agriculture, Forest Service, Intermountain Research Station. Ogden, UT. General Technical Report INT-250. 144p.

NOAA. 2010a. Climate of March 2010. National Climate Data Center. National Oceanic and AtmosphericAdministration. Found online on 05/05/2010 at: http://www.ncdc.noaa.gov/oa/climate/research/2010/mar/st048dv00pcp201003.html

NOAA. 2010b. Climate of 2004-June Wyoming Drought. National Climate Data Center. National Oceanic and AtmosphericAdministration. Found online on 05/05/2010 at: http://www.ncdc.noaa.gov/oa/climate/research/2004/jun/st048dv00pcp200406.html

Prévost, Marcel and David Pothier. 2002. Partial cuts in a trembling aspen – conifer stand: effects on microenvironmental conditions and regeneration dynamics. Can. J. For. Res. 33: 1-15.

Reinhardt, Elizabeth D.; Keane, Robert E.; Calkin, David E.; Cohen, Jack D. 2008. Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western United States. Forest Ecology and Management. 256: 1997-2006.

Schmid, J. M. and T. E. Hinds. 1974. Development of spruce-fir stands following spruce beetle outbreaks. U. S. Department of Agriculture, Forest Service. Rocky Mountain Forest and Range Experiment Station. Research Paper RM-131. 20p.

Schmitz, Richard F. and Kenneth E. Gibson. Douglas-fir beetle. 1996. U. S. Department of Agriculture, Forest Service. Forest insect & disease leaflet 5. 8p.

Skov, Kjerstin. 2009. Teton to Snake Fuels Project functional assistance trip report. Unpublished report. OFO-TR-09-08. U.S.D.A Forest Service. Bridger-Teton National Forest. Jackson, WY.

Soper, Kim and Fay, Brett 2001. Green Knoll Fire Narrative. FBAN fuel condition and fire behavior report.

State of Wyoming. Wyoming Game and Fish Department. 2005. Wyoming grizzly bear occupancy management guidelines, by D.S. Moody, C.R. Anderson, D.D Bjornlie, and J.M. Emmerich. Lander, Wyoming. 23 pp.

Teton County, Wyoming. 2005. Teton County Community Wildfire Protection Plan.

USDA Forest Service. 1990. Bridger-Teton National Forest Land and Resource Management Plan; U. S. Department of Agriculture, Forest Service, Bridger-Teton National Forest. Jackson, Wy.

USDA Forest Service. 2001. Roadless Area Conservation Rule. 36 CFR Part 294, Special Areas: Roadless Area Conservation: Final Rule. Federal Register, Volume 66, No. 9. January 12, 2001.

USDA Forest Service. 2003. Forest Service Handbook 2509.18, Region-4 Soil Quality Guidelines, Regional Office, Ogden, Utah.

USDA Forest Service. 2006. Forest Plan Amendments for Grizzly Bear Conservation for the Greater Yellowstone Area National Forests: Final Environmental Impact Statement.

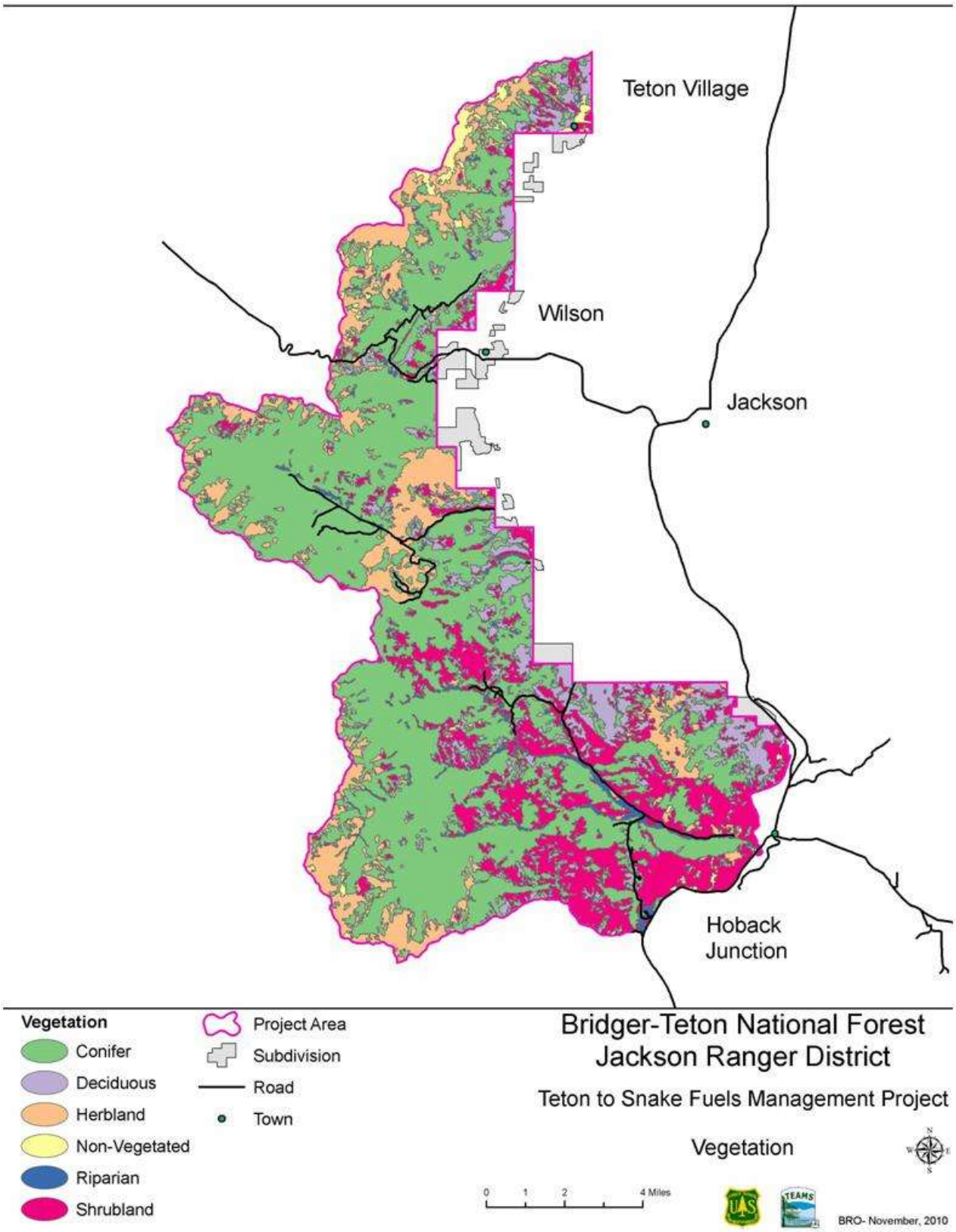
USDA Forest Service. 2010. *Artemisia tridentata*. Fire effects information system. Found on line on 05/20/2010 at: http://www.fs.fed.us/database/feis/plants/shrub/arttriw/all.html

USDA Forest Service. 2010. *Populus tremuloides*. Fire effects information system. Found on line on 10/07/2010 at: http://www.fs.fed.us/database/feis/plants/tree/poptre/all.html

USDA Forest Service. Forest Service Manual 2324.2 National Policy for Objectives for Fire in Wilderness. Washington D. C.

USDA Forest Service. Forest Service Manual 5103.1.Fire Management. 2005. National Headquarters, Washington, D.C.

Appendix A - Map of Vegetation in the Project Area


Teton Village
Wilson
Jackson
Hoback Junction
Vegetation
Conifer
Deciduous
Herbland
Non-Vegetated
Riparian
Shrubland
Project Area
Subdivision
Road
Town
Bridger-Teton National Forest
Jackson Ranger District
Teton to Snake Fuels Management Project
Vegetation
0 1 2 4 Miles
BRO- November, 2010

Appendix B – Proposed Treatment Units

Treatment Definitions

Commercial thin (CT): Remove merchantable trees as prescribed to meet unit objectives, and generate revenue from sale of wood products.

Cut-to-length (CTL): Cut-to-length is a harvesting system in which trees are cut, limbed and the tops removed so that the tree stems only can be transported (yarded) to collection points (landings).

Fuel Break (FB): Reducing fuels by mechanical or hand means to create an area in which fire behavior and spread is greatly reduced for structure protection or fire control purposes.

Ground-based yard (GBY): Thinned trees would be pulled from the site to landings by the use of ground-based machine such as a rubber tired skidder, tracked skidder (dozer), or ATV.

Hand cut (HC): Trees and/or shrubs would be cut or pruned using hand-carried machines (e.g., chainsaws) to the desired spacing.

Hand pile and burn (HPB): Fuels created by pruning, tree thinning or shrub thinning would be piled by hand and burned during conditions when risk of fire spread is low and when smoke will be adequately dispersed. Hand piles would be up to six feet high and eight feet in diameter and would be placed as far from the canopy drip-line of trees as possible to prevent scorch.

Jackpot Burn (JB): Jackpot burning involves igniting concentrations of fuels, whether they are natural fuels or activity fuels.

Lop-and-scatter (LS): Downed trees and tree limbs would be cut by hand and the material dispersed to reduce fuel concentrations.

Machine cut (MC): Trees would be cut by a ground-based machine such as a track-mounted feller-buncher, but on occasion, hand cutting may be necessary.

Machine pile and burn (MPB): Fuels created by tree thinning would be piled by machine and burned during conditions when risk of fire spread is low and when smoke will be adequately dispersed. Piles would be placed as far from the canopy drip-line of trees as possible to prevent scorch. The operation could be the use of a track-mounted excavator with a grapple to pile hand-cut trees, or it could be the use of a track-mounted feller-buncher to cut and pile trees.

Non-commercial thin (NCT): Remove trees which have little or no economic value and either leave on site or pile and burn.

Prescribed Fire (PF): Application of prescribed fire would be used in units where the objective is to reduce potential wildfire behavior, as well as a tool to restore more historic and “natural” vegetation species composition and coverage in portions of the project area. It would be accomplished by applying low- to moderate-intensity fire using hand, mechanical or aerial firing methods. All burning would take place under specific burn objectives and

guidelines documented in a prescribed fire burn plan developed specifically for all burning activities within the project area. Prescribed burn plans will address parameters for weather, air quality, contingency resources, other resource concerns, and potential escapes.

Prune (PR): Remove branches in standing trees to reduce ladder fuels. Trees would be pruned by hand to a height of 10 feet or up to 1/3 of the tree height, whichever is less.

Prescribed burn (PSB): see "prescribed fire."

Skyline (SY): Thinned trees would be transported from the site to landings by a skyline cable system. The leading end of trees being removed would be suspended, but in most cases the trees would not be fully suspended and ground contact would occur.

Underburn (UB): Controlled burning (flame lengths generally three feet or less) in forest stands to reduce natural fuel loads, activity fuels, and shrubs and understory trees. Where under-burning only is proposed, cutting and piling of ladder and ground fuels may be carried out to reduce potential flame lengths and scorch to residual trees.

Whole tree yard/leave tops attached (WTY/LTA): Whole-tree-yarding is a harvesting system in which whole trees are cut and transported (yarded) to a collection point (landing) with limbs and tops attached to the stem. In the case where the entire tree is too large to be transported as one piece, the trees would be cut into log length sections and the tree sections would be transported with the tops and limbs attached (leave-tops-attached).

Estimated Treatment Costs

Treatment costs depend upon a number of factors, many of which are at this point unknown and are unit specific. Costs differ greatly depending upon the interaction of the size and amount of material that has to be treated, terrain and access difficulty, the type of treatment and removal method, and who is doing it, e.g. the Forest Service is paying for the treatment directly or a timber purchaser is paying for the treatment as part of a timber sale package. The costs given here are meant to display the range and relative difference between treatment types and are not an accurate assessment of treatment costs for any proposed treatment unit. Table 11 displays Forest Service treatment costs from the Bridger-Teton National Forest Brush Disposal Cost Guide.

Table 11. Estimated costs of proposed treatment types

Treatment	Slash Load		
	Light	Moderate	Heavy
Hand Pile	$300/acre	$450/acre	$600/acre
Machine Pile	$50/acre	$100/acre	$200/acre
Lop and Scatter	$100/acre	$150/acre	$200/acre
Windrow	$550/acre	$750/acre	$950/acre
Fuel Break	$500/mile	$700/mile	$900/mile
Hand Fire Line	$14,000/mile	$16,000/mile	$18,000/mile
Machine Fire Line	$700/mile	$800/mile	$900/mile
Thinning (commercial or pre-commercial)	$400/acre	$500/acre	$600/acre
Slash Removal	$150/acre	$200/acre	$250/acre

Treatment	Slash Load		
Burn Machine Piles	$50/acre	$75/acre	$100/acre
Burn Hand Piles	$75/acre	$100/acre	$125/acre
Burn Windrows	$75/acre	$100/acre	$125/acre
Broadcast Burn	$50/acre	$75/acre	$100/acre
Burn Landing Piles	$75/acre	$100/acre	$150/acre

Illustrating the difference between treatment regimes using two proposed treatment units for examples:

Recreation Trail Unit 1 is in a dense lodgepole pine stand that has moderate to heavy mountain pine beetle activity. It is in defense zone and is in the Palisades Wilderness Study Area. The unit would fall with the "heavy" slash load category shown above. There are a number of treatment options that could take place in Recreation Trail Unit 1 including:

1. Hand Cut Commercial and precommercial thin, Remove Slash, Burn Landing Piles - $1000/acre. Note that in this option we are assuming that the trees are being "whole tree yarded" so that there would be little need for additional on-site slash treatments.
2. Hand Cut Commercial and precommercial thin, Remove Large Slash, Hand Pile, Burn Landing Piles, Burn Hand Piles - $1,165/acre. Note that in this option we are assuming that the large trees are being "whole tree yarded" but the smaller wouldn't so that there would be a need for additional on-site slash treatments, but the costs of hand piling and burning piles would be ½ of those stated above.
3. Hand Cut Commercial and precommercial thin, Hand Pile, Burn Hand Piles - $1,350/acre.
4. Hand Cut Commercial and precommercial thin, Machine Pile, Burn Machine Piles - $900/acre.
5. Machine Cut Commercial and hand cut precommercial thin, Remove Large Slash, Hand Pile, Burn Landing Piles, Burn Hand Piles - $1,105/acre. In this scenario a machine (e.g. feller buncher) would be used to fell and pile material greater than 5" DBH and smaller material would be hand felled. The costs are adjusted to reflect lower cost of machine cutting in larger material and that hand cutting would be less costly due to not having to cut the larger material assuming that about ½ of what would be cut would be by machine. Note, that in general one can say that the smaller the tree, the more costly it is to cut by machine up to about 5 inches DBH. From 5 inches DBH to about 8 inches the cost between machine and hand cut is about the same. Above 8 inches the machine becomes more cost effective.

In the treatment options given above, option 1, 2, and 5 would result in larger trees being removed from the site and sold for some amount of return, whereas in options 3 and 4 all material would be treated on site.

Treatment Unit Details – Table and Maps

Table 12. Treatment unit detail

Map Number	Unit Name	Treatment Objective	Treatment and Removal Options	Occurrence and Percent of Unit in Special Land Allocations			Proximity to Values at Risk	Fire Type (existing)			Flame Length (existing)		Cover Type	Comments/Access and Road Work
				In WSA?	In Roadless?	In Defense Zone?		% Surface	% Active Crown	% Passive Crown	% < 4 feet	% > 4 feet		
PF-01	Phillips Canyon Rx Burn Unit 1	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF	No	Phillips Bench IRA 99%	No	Approx. ½ mile to power line	68%	21%	11%	63%	37%	Conifer Aspen Herbaceous	Low priority.
PF-02	North Fork Phillips Canyon Rx Burn Unit 1	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	Prescribed Fire (PF)	No	Phillips Bench IRA 100%	Yes 9%	Adjacent to private land	67%	24%	9%	54%	46%	Conifer Aspen	High priority. Unit is adjacent to private/project boundary.
T-03	Phillips Bench Unit 2	Reduce ground and aerial fuels adjacent to power line and private land boundary.	Non-commercial Thin (NCT), Hand Cut (HC), Hand-pile and Burn (HPB)	No	Phillips Bench IRA 88%	Yes 99%	Adjacent to private land and power line	56%	16%	28%	55%	45%	Conifer Aspen	High priority. Small pockets of mortality, moderate overall. Access via FR 30973
T-04	Phillips Bench Unit 7	Reduce ground and aerial fuels adjacent to power line, enhance utility of ridgeline as fuelbreak.	NCT, HC, HPB	No	Phillips Bench IRA 92%	Yes 100%	Adjacent to power line	31%	16%	53%	30%	70%	Conifer	Steep area west of power line
T-05	Phillips Bench Unit 1	Reduce ground and aerial fuels adjacent to power line, enhance utility of ridgeline as fuelbreak.	Commercial Thin (CT) and NCT, Machine Cut (MC) and/or HC, cut-to-length (CTL) or whole tree yard (WTY), Ground based yard (GBY), HPB and/or machine-pile and burn (MPB)	No	Phillips Bench IRA 27%	Yes 100%	Adjacent to power line	57%	30%	13%	52%	48%	Conifer Aspen	High priority. High to moderate bark beetle mortality. Access: Road to ridge top provides ground-based access. Some restoration and maintenance needed on system road FR 30972. FR 30972B – road work to be determined.
T-06	Phillips Bench Unit 5	Reduce ground and aerial fuels adjacent to power line, enhance utility of ridgeline as fuelbreak.	CT and NCT, MC and/or HC, CTL or WTY, GBY, HPB and/or MPB	No	Phillips Bench IRA 4%	Yes 75%	Adjacent to power line	54%	13%	33%	53%	47%	Conifer Aspen	High priority. High to moderate bark beetle mortality. Access: Some road work needed to haul on the power line road (not a system road). Maintenance and restoration: requires some widening in places.
T-07	Phillips Bench Unit 3	Reduce ground and aerial fuels adjacent to power line, enhance utility of ridgeline as fuelbreak.	NCT, HC, HPB	No	No	Yes 100%	Adjacent to power line	39%	61%	0%	33%	67%	Conifer	Moderate priority. Young plantation. Low mortality. Little treatment need in west 2/3.
T-08	Phillips Bench Unit 4	Reduce ground and aerial fuels adjacent to power line, enhance utility of ridgeline as fuelbreak.	NCT, HC, HPB	No	No	Yes 100%	Adjacent to power line	52%	28%	21%	45%	55%	Conifer	Moderate priority. Young plantation. Low mortality.
T-09	Phillips Bench Unit 6	Reduce ground and aerial fuels adjacent to power line, enhance utility of ridgeline as fuelbreak.	NCT, HC, HPB	No	No	Yes 84%	Adjacent to power line	66%	12%	22%	65%	35%	Conifer	Steep area above highway at end of Phillips Bench.
T-10	Power Line Unit 1	Reduce ground and aerial fuels adjacent to power line.	NCT, HC, HPB	Yes 12%	No	Yes 100%	Adjacent to power line	69%	23%	8%	62%	38%	Conifer Aspen Grassland Forbland	High priority. Low mortality. Dense patches in east end and southwest side; the rest of the area won't require much work.

Map Number	Unit Name	Treatment Objective	Treatment and Removal Options	Occurrence and Percent of Unit in Special Land Allocations			Proximity to Values at Risk	Fire Type (existing)			Flame Length (existing)		Cover Type	Comments/Access and Road Work
				In WSA?	In Roadless?	In Defense Zone?		% Surface	% Active Crown	% Passive Crown	% < 4 feet	% > 4 feet		
T-11	Recreation Trail Unit 2	Reduce ground and aerial fuels adjacent to private land-fuelbreak.	Lop-and-scatter (LS), Prune and HPB 300 feet adjacent to private land north of highway. HPB all south of highway.	No	No	Yes 98%	Adjacent to private residence and highway	72%	8%	21%	58%	42%	Conifer Aspen Grassland Forbland	High priority. Patches of high mortality south of highway. Patches of heavy timber, mostly open DF north of highway.
PF-12	Black Canyon Rx Burn Unit 2	Reduce surface and ladder fuel conditions to reduce and modify fire behavior.	PF	Yes 100%	No	Yes 2%	Adjacent to power line	42%	17%	41%	36%	64%	Conifer Herbaceous	High priority. Unit lies in close proximity to power lines.
PF-13	Black Canyon Rx Burn Unit 1	Reduce surface and ladder fuel conditions to reduce and modify fire behavior.	PF	Yes 100%	No	No	Approx. ½ mile to private land	67%	20%	13%	53%	47%	Conifer Herbaceous	Moderate priority
T-14	Recreation Trail Unit 1	Reduce ground and aerial fuels adjacent to private land and summer homes.	NCT, HC, HPB	Yes 100%	No	Yes 100%	Adjacent to summer homes	18%	3%	79%	18%	82%	Conifer	High priority. Patches of high mortality, moderate overall. Priority is to treat the fuels, not promote aspen.
T-15	Recreation Trail Unit 4	Reduce ground and aerial fuels adjacent to private land and summer homes. Enhance aspen.	NCT, HC, HPB	No	No	Yes 100%	Adjacent to private residence and summer homes	25%	7%	68%	25%	75%	Conifer	High priority. Patches of high mortality; overall moderate. Open up around the aspen clones. Clear around the area immediately adjacent to the cabins (within 200 feet of cabins) is owners' responsibility. Thin on the north side of cabins.
T-16	Recreation Trail Unit 3	Reduce ground and aerial fuels adjacent to private land and summer homes.	NCT, HC, HPB	Yes 96%	No	Yes 99%	Adjacent to private residence and summer homes	29%	0%	71%	29%	71%	Conifer Aspen	High priority. Emphasize treatments within 300 feet of boundary.
T-17	Recreation Trail Unit 7	Reduce ground and aerial fuels adjacent to private land.	PR, NCT, HC, LS and/or HPB	Yes 98%	No	Yes 98%	Adjacent to private land	40%	1%	59%	40%	60%	Conifer	Moderate priority. Patches of high mortality, low overall.
T-18	Recreation Trail Unit 6	Reduce ground and aerial fuels adjacent to private land.	PR, NCT, HC, LS and/or HPB	Yes 98%	No	Yes 98%	Adjacent to private land	26%	31%	43%	26%	74%	Conifer Grassland	Moderate priority. Patches of high mortality, low overall.
T-19	Recreation Trail Unit 5	Reduce ground and aerial fuels adjacent to private land.	PR, NCT, HC, LS and/or HPB	Yes 100%	No	Yes 98%	Adjacent to private residence	45%	24%	31%	46%	54%	Conifer Grassland	High priority. Patches of high mortality, low overall.
PF-20	Mosquito Creek North Rx Burn Unit	Reduce surface and ladder fuel conditions to reduce and modify fire behavior. Create a buffer adjacent to Green Knoll.	PF	Yes 67%	No	No	Approx.1 mile	55%	28%	16%	51%	49%	Conifer Aspen Shrub	Moderate priority. Create an additional buffer adjacent to Green Knoll perimeter.
T-21	Singing Trees Unit 1	Reduce ground and aerial fuels adjacent to private land; enhance aspen	NCT, HC, HPB, PSB PSB after HP –option to underburn the whole unit to add fire on the landscape and promote aspen.	Yes 50%	No	Yes 100%	Adjacent to private residence	58%	21%	22%	58%	42%	Conifer Aspen	Moderate priority. Patches of high mortality. Reduce mortality adjacent to private, thin encroaching conifers from within and adjacent to aspen.

Map Number	Unit Name	Treatment Objective	Treatment and Removal Options	Occurrence and Percent of Unit in Special Land Allocations			Proximity to Values at Risk	Fire Type (existing)			Flame Length (existing)		Cover Type	Comments/Access and Road Work
				In WSA?	In Roadless?	In Defense Zone?		% Surface	% Active Crown	% Passive Crown	% < 4 feet	% > 4 feet		
PF-22	Singing Trees Rx Burn Unit 1	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF	Yes 40%	No	No	Approx. 1/4 mile to private land	67%	26%	8%	62%	38%	Conifer Aspen Shrub	High priority.
T-23	Singing Trees Unit 2	Reduce ground and aerial fuels adjacent to private land; enhance aspen.	NCT, HC, HPB, PSB PSB after HP –option to underburn the whole unit to add fire on the landscape and promote aspen.	Yes 80%	No	Yes 100%	Adjacent to private residence	48%	30%	22%	49%	51%	Conifer Aspen	Moderate priority. Patches of high mortality, overall low. Reduce mortality adjacent to private, thin encroaching conifers from within and adjacent to aspen.
PF-24	Singing Trees Rx Burn Unit 2	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF	Yes 99%	No	Yes <1%	Approx.1/4 mile to private land	73%	24%	2%	61%	39%	Aspen Shrub	High priority. Unit lies adjacent to private/project boundary.
T-25	Singing Trees Unit 4	Reduce ground and aerial fuels adjacent to private land; enhance aspen.	NCT, HC, HPB	No	No	Yes 97%	Adjacent to private residence	62%	28%	10%	62%	38%	Conifer Aspen	High priority. Moderate mortality.
PF-26	Singing Trees Rx Burn Unit 3	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF	Yes 100%	No	Yes 2%	Corner adjacent to private land	70%	18%	12%	67%	33%	Conifer Aspen	High priority. Unit borders private to the north. Unit is adjacent to Singing Trees Unit 4, a proposed thinning and fuels reduction treatment.
PF-27	Taylor Mtn. Rx Burn Unit 5	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF	Yes 100%	No	No	Approx. one mile to private land	63%	21%	15%	63%	37%	Conifer Aspen	Moderate priority.
PF-28	Taylor Mtn. Rx Burn Unit 3	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF. Unit may be divided into smaller sections to facilitate burning.	Yes 89%	No	No	Approx. 1/2 mile to private land	67%	29%	4%	55%	45%	Conifer Aspen Shrub	Moderate priority. Unit lies primarily on N & NE aspect with a large amount of conifer present.
PF-29	Taylor Mtn. Rx Burn Unit 4	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF HC trees and shrubs in the defense zone portion of the unit as needed prior to burning.	Yes 99%	No	Yes 3%	Adjacent to private land	76%	21%	3%	72%	28%	Conifer Aspen	High priority. Unit is adjacent to private. Small area in the SE corner is in the defense zone.
PF-30	Taylor Mtn. Rx Burn Unit 2	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	HC trees and shrubs adjacent to structures and throughout the defense zone as needed. HPB PF	Yes 99%	No	Yes 20%	Adjacent to private land	82%	16%	2%	77%	23%	Conifer Aspen	High priority. Unit is adjacent to Highland Creek Hills subdivision and Highland Hills Unit 1, a proposed thinning and fuels reduction treatment.
T-31	Highland Hills Unit 1	Reduce ground and aerial fuels adjacent to private land; enhance aspen.	NCT, HC, HPB, PSB; PSB after HP – prescribe burn with adjacent burn unit.	Yes 94%	No	Yes 94%	Adjacent to private residence	58%	41%	1%	61%	39%	Conifer Aspen	High priority. High mortality in north 1/2. Remove mortality and thin green trees.

Map Number	Unit Name	Treatment Objective	Treatment and Removal Options	Occurrence and Percent of Unit in Special Land Allocations			Proximity to Values at Risk	Fire Type (existing)			Flame Length (existing)		Cover Type	Comments/Access and Road Work
				In WSA?	In Roadless?	In Defense Zone?		% Surface	% Active Crown	% Passive Crown	% < 4 feet	% > 4 feet		
PF-32	Highland Hills Rx Burn	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	HC trees and shrubs adjacent to structures and throughout the defense zone as needed. HPB PF	Yes 94%	No	Yes 41%	Adjacent to private land	87%	13%	0%	82%	18%	Conifer Aspen	High priority. Unit is adjacent to Highland Creek Hills Subdivision. Recommendation is to thin and pile burn along north boundary to create a fuelbreak. North side is in the defense zone.
T-33	Red Top Unit 1	Reduce ground and aerial fuels to modify fire behavior enhance aspen.	CT and NCT, MC and/or HC, WTY or CTL, GBY, HPB or MPB. The unit area bounded by Road 30997 on the west and PF-34 on the east may be underburned after thinning.	No	No	No	Threat zone, forest and private land access route	54%	40%	6%	54%	46%	Conifer Aspen	Moderate priority. High to moderate mortality. Treatment emphasis is to promote aspen. Access: FR 30995—maintenance needed for wet spots. FR 30997 may need work if they pull material down from the east to the road. Temporary road construction in northeast area off FR 30995; up through middle of unit (rough estimate is about 2500 feet).
PF-34	Trails End Road Rx Burn Unit	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF	Yes 29%	No	Yes 26%	Adjacent to private land	92%	7%	0%	42%	58%	Aspen Shrub	High priority. Trails End Ranch lies to the west. Red Top #2 is east. A large portion of the unit is in the defense zone.
T-35	Red Top Unit 2	Reduce ground and aerial fuels adjacent to private land; enhance aspen.	CT and NCT, MC and/or HC, WTY or CTL, GBY, HPB or MPB or JB	No	No	Yes 100%	Adjacent to private residence	49%	34%	17%	47%	53%	Conifer Aspen	High priority. High to moderate mortality. Access: Would likely need roughly 1500 feet of temporary road off of FR 30995.
T-36	Red Top Unit 5	Reduce ground and aerial fuels adjacent to private; enhance aspen.	NCT, HC, HPB	Yes 96%	No	Yes 100%	Adjacent to private residence	73%	18%	8%	69%	31%	Conifer Aspen	High priority. Patches of high mortality, moderate overall. Dense forest next to private. Narrow strip next to private is not WSA.
PF-37	South Fork Fall Creek Rx Burn Unit	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF	Yes 100%	No	No	Approx. ¼ mile to private land	82%	16%	2%	56%	44%	Conifer Aspen Shrub	Moderate priority.
T-38	Trails End Unit	Reduce ground and aerial fuels adjacent to private; enhance aspen	NCT, HC, HPB	Yes 62%	No	No 100%	Adjacent to private land	52%	34%	14%	51%	49%	Conifer Aspen	Moderate priority. Moderate mortality. Thin and pile burn strip along boundary to create fuelbreak.
PF-39	Coburn Creek Rx Burn Unit 3	Reduce surface and ladder fuel conditions to reduce and modify fire behavior.	PF	Yes 98%	No	Yes 40%	Adjacent to private land	79%	14%	7%	73%	27%	Conifer	High priority. Trails End Ranch lies to the North adjacent to the unit. Recommendation is to thin and pile burn as needed along common boundary of Trails End Ranch to create a fuelbreak in defense zone.
PF-40	Coburn Creek Rx Burn Unit 2	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	HC trees and shrubs adjacent to structures and throughout the defense zone as needed. HPB PF	Yes 95%	No	Yes 16%	Adjacent to private land	70%	26%	4%	57%	43%	Conifer Aspen Shrub	High priority. Trails End Ranch lies to the North adjacent to the unit. Recommendation is to thin and pile burn as needed along common boundary of Trails End Ranch and the Coburn Unit 2 to create a fuelbreak in defense zone.

Map Number	Unit Name	Treatment Objective	Treatment and Removal Options	Occurrence and Percent of Unit in Special Land Allocations			Proximity to Values at Risk	Fire Type (existing)			Flame Length (existing)		Cover Type	Comments/Access and Road Work
				In WSA?	In Roadless?	In Defense Zone?		% Surface	% Active Crown	% Passive Crown	% < 4 feet	% > 4 feet		
T-41	Red Top Unit 3	Reduce ground and aerial fuels adjacent to private land; enhance aspen	NCT, HC, HPB	Yes 96%	No	Yes 100%	Adjacent to private land	79%	12%	9%	72%	28%	Conifer Aspen Shrub	Moderate priority. Moderate mortality.
PF-42	Coburn Creek Rx Burn Unit 1	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF	Yes 100%	No	No	Approx. ½ mile to private land	76%	19%	5%	42%	58%	Conifer Aspen Shrub	Moderate priority.
T-43	Red Top Unit 4	Reduce ground and aerial fuels adjacent to private land; enhance aspen.	NCT, HC, HPB	Yes 57%	No	Yes 100%	Adjacent to private land	76%	11%	13%	74%	26%	Conifer Aspen	Moderate priority. Patches of high mortality.
PF-44	Fall Creek Ranch Rx Burn Unit 1	Reduce surface and ladder fuel conditions to reduce and modify fire behavior.	PF	Yes 100%	No	No	Approx. ¼ mile to private land	69%	17%	15%	52%	48%	Conifer Shrub	High priority. Unit is adjacent to the defense zone around Fall Creek Ranch. Predominately conifer cover type with brush patches. In WSA.
PF-45	Fall Creek Ranch Rx Burn Unit 2	Reduce surface and ladder fuel conditions to reduce and modify fire behavior.	PF	Yes 66%	Munger Mountain IRA 1%	Yes 29%	Less than ¼ mile to private land	72%	10%	18%	69%	31%	Conifer	High priority. Unit is in the defense zone south of Fall Creek Ranch. Predominately conifer cover type with brush patches. West 2/3 of unit is In WSA.
PF-46	Wilson Fall Creek Rx Burn	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	PF	Yes 56%	No	No	Adjacent to private land	88%	7%	5%	59%	41%	Conifer Aspen Shrub	High priority. The unit's east boundary is the Wilson-Fall Creek Road Corridor. Adjacent to the defense zone.
PF-47	Munger Mtn. Rx Burn Unit 1	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	HC and HPB trees and shrubs adjacent to the private boundary as needed. Follow up with prescribed burning. Unit may be divided into smaller sections to facilitate burning.	No	Munger Mountain IRA 100%	Yes 13%	Adjacent to private land and close to highway	88%	12%	0%	65%	35%	Conifer Aspen Herbaceous	High priority. Unit lies adjacent and west of Hog Island community. West side is in defense zone...
PF-48	Munger Mtn. Rx Burn Unit 2	Reduce surface and ladder fuel conditions to reduce and modify fire behavior; enhance aspen.	HC and HPB trees and shrubs adjacent to the private boundary as needed. Follow up with prescribed burning. Unit may be divided into smaller sections to facilitate burning.	No	Munger Mountain IRA 97%	Yes 9%	Adjacent to private land and close to highway	82%	13%	4%	75%	25%	Conifer Aspen Shrub	High priority. Unit lies adjacent and west of Hog Island community. North and east sides are in defense zone.

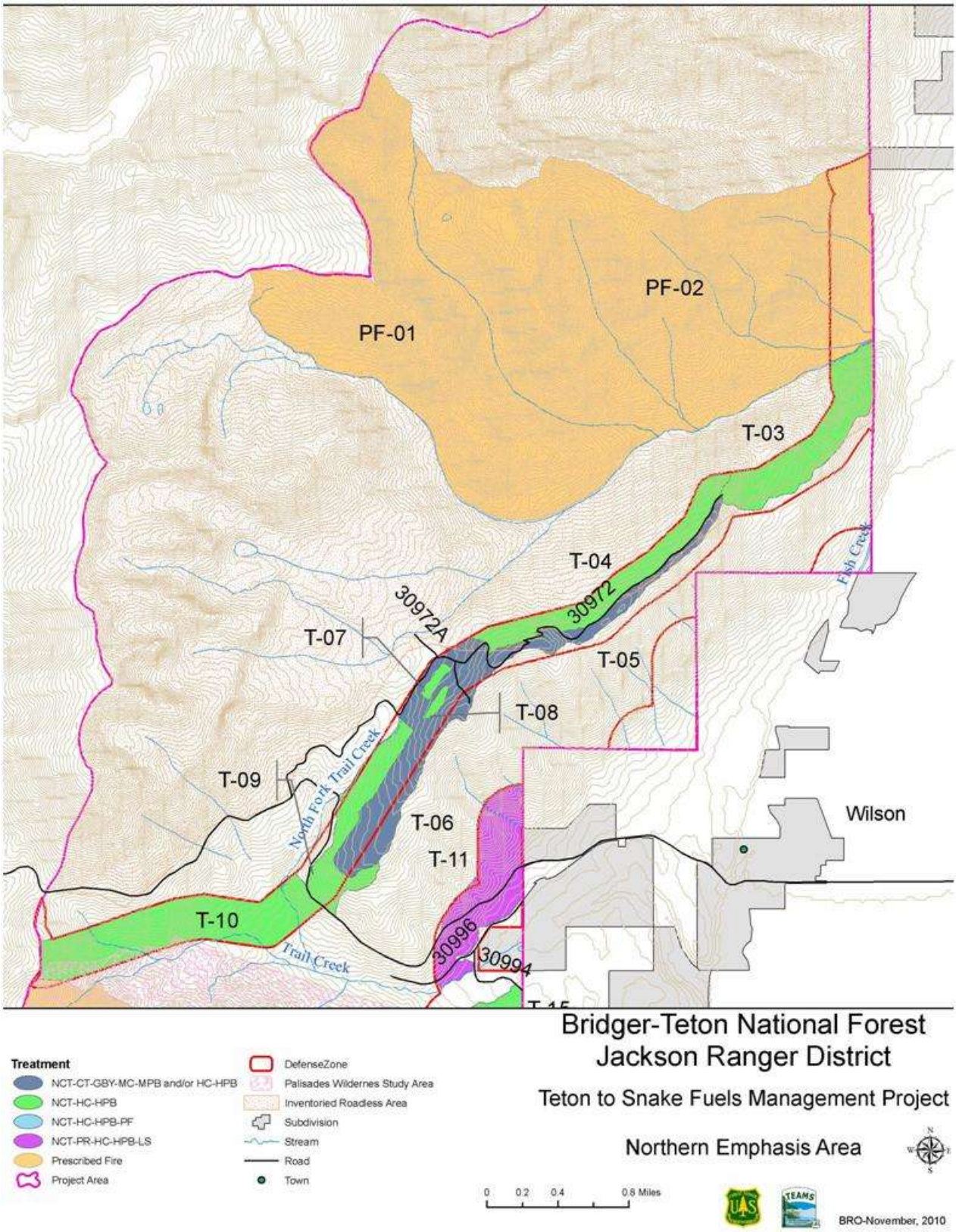


Figure 14. Treatment unit map - northern emphasis area

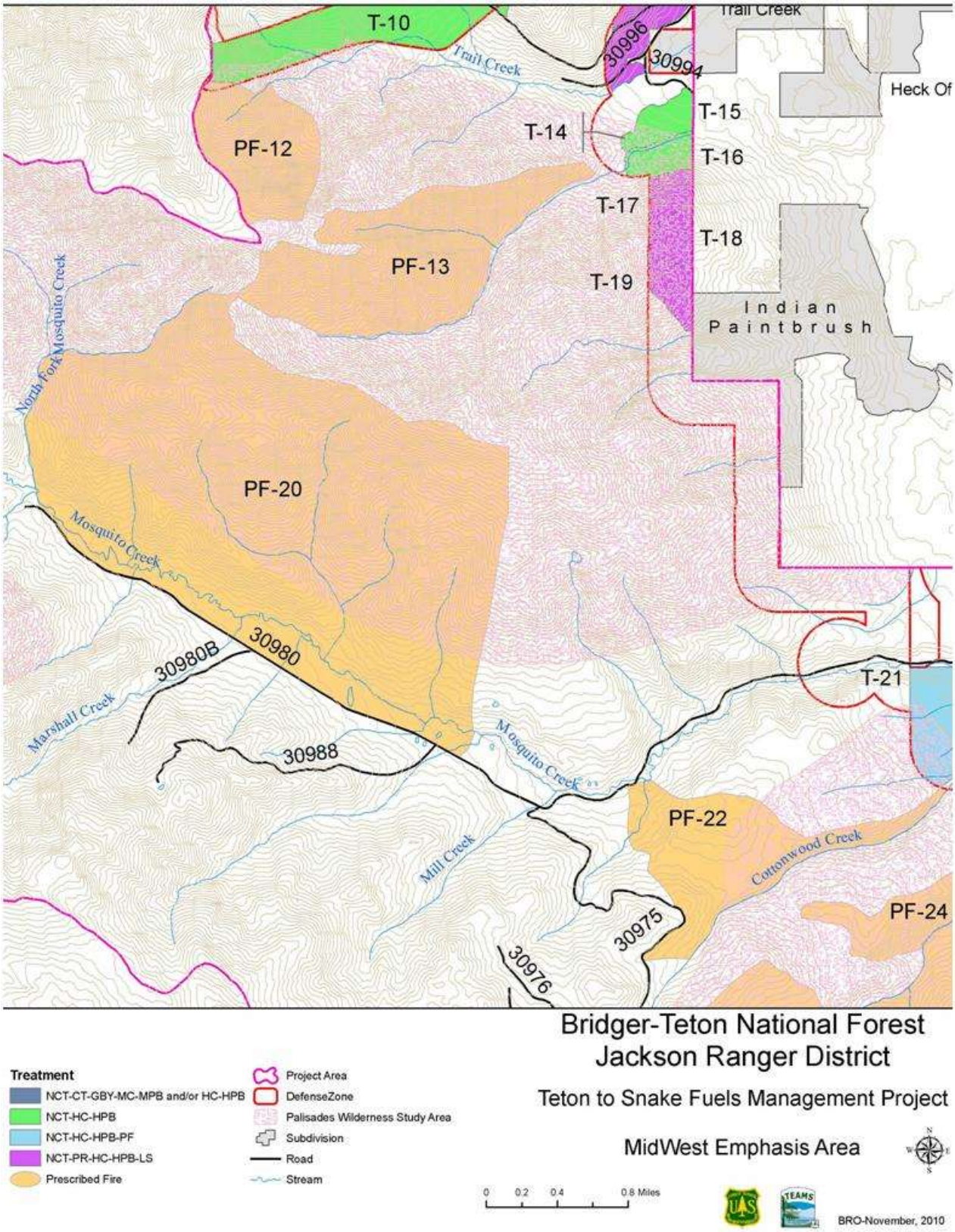


Figure 15. Treatment unit map - midwest emphasis area

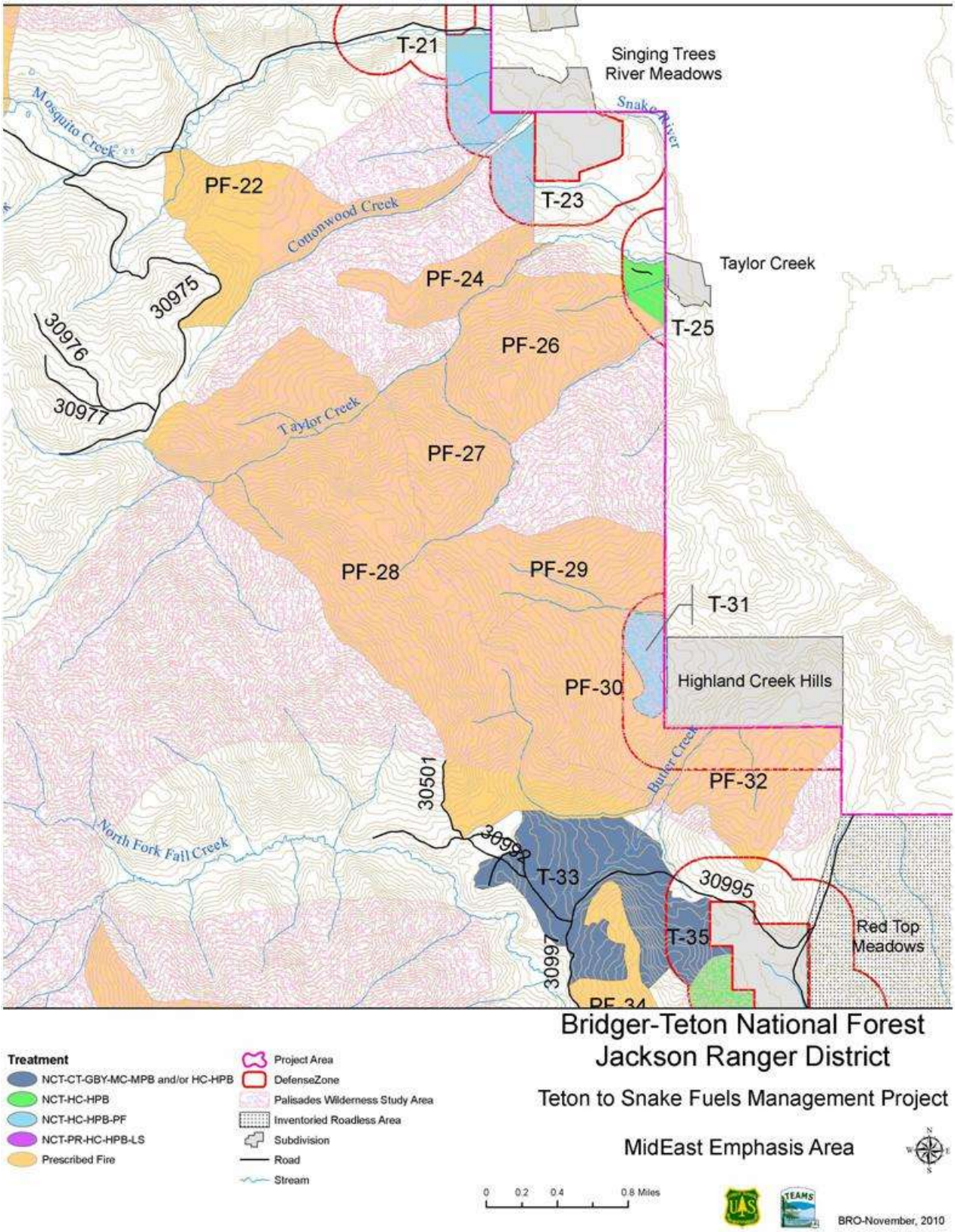


Figure 16. Treatment unit map - mideast emphasis area

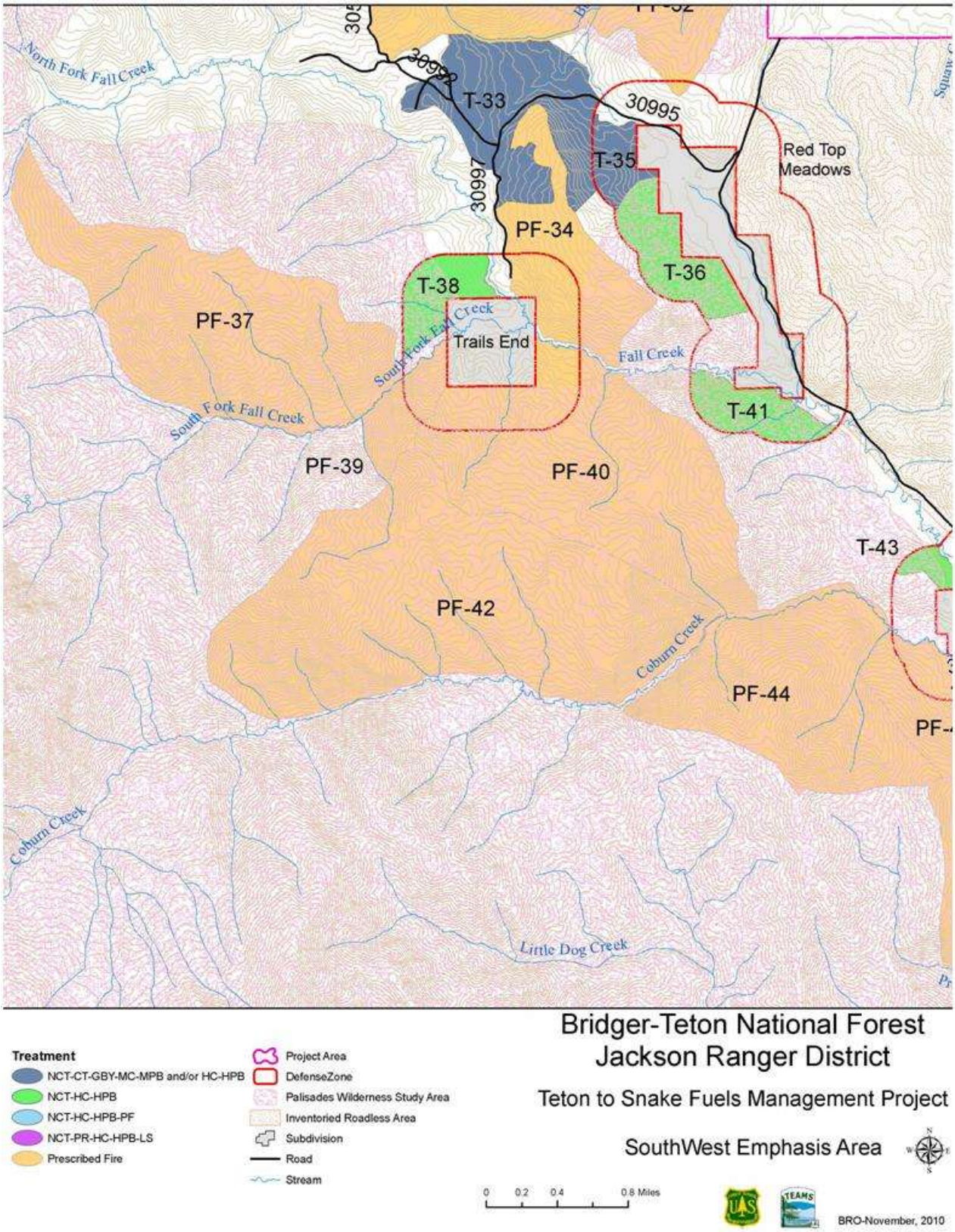


Figure 17. Treatment unit map - southwest emphasis area

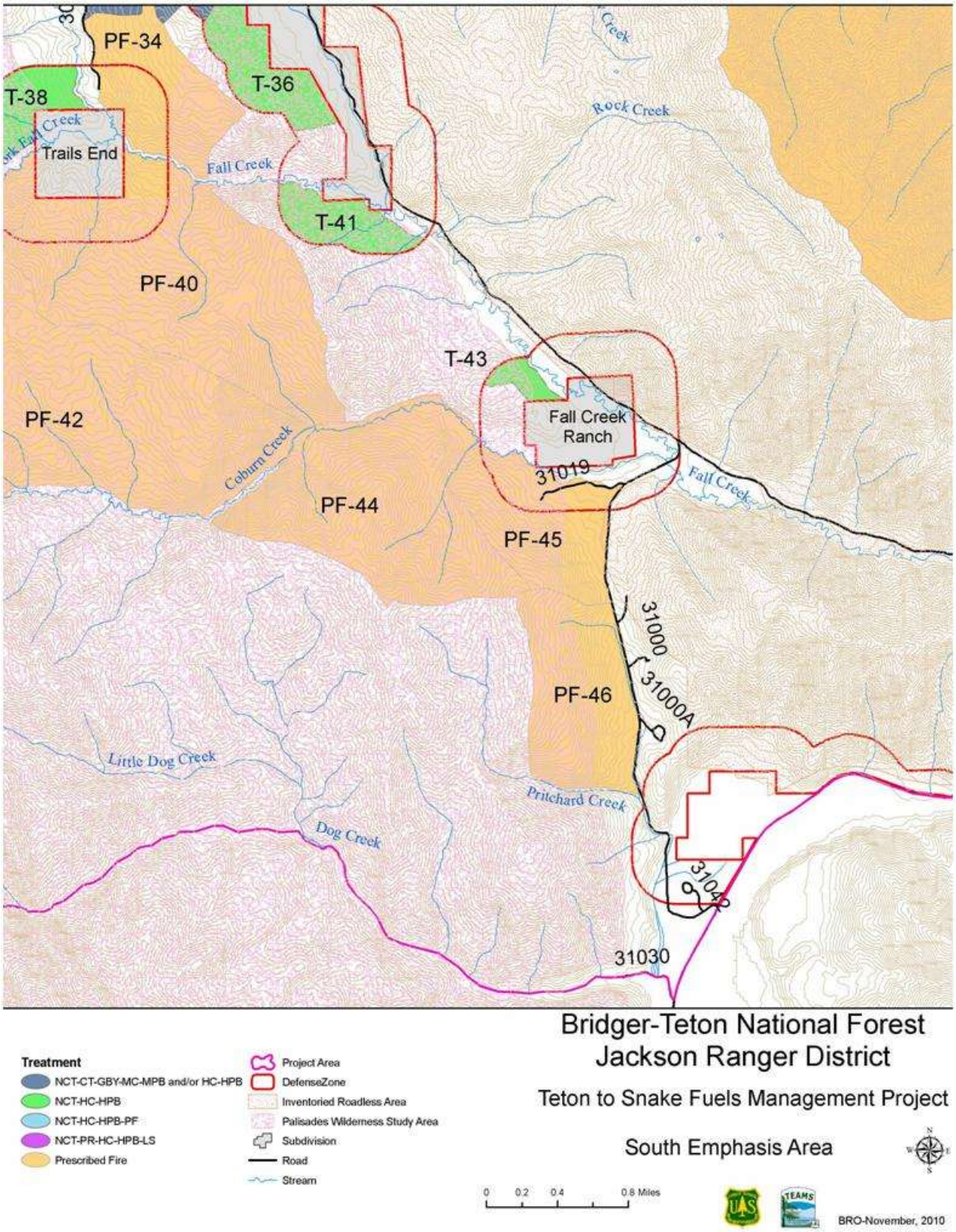


Figure 18. Treatment unit map - south emphasis area

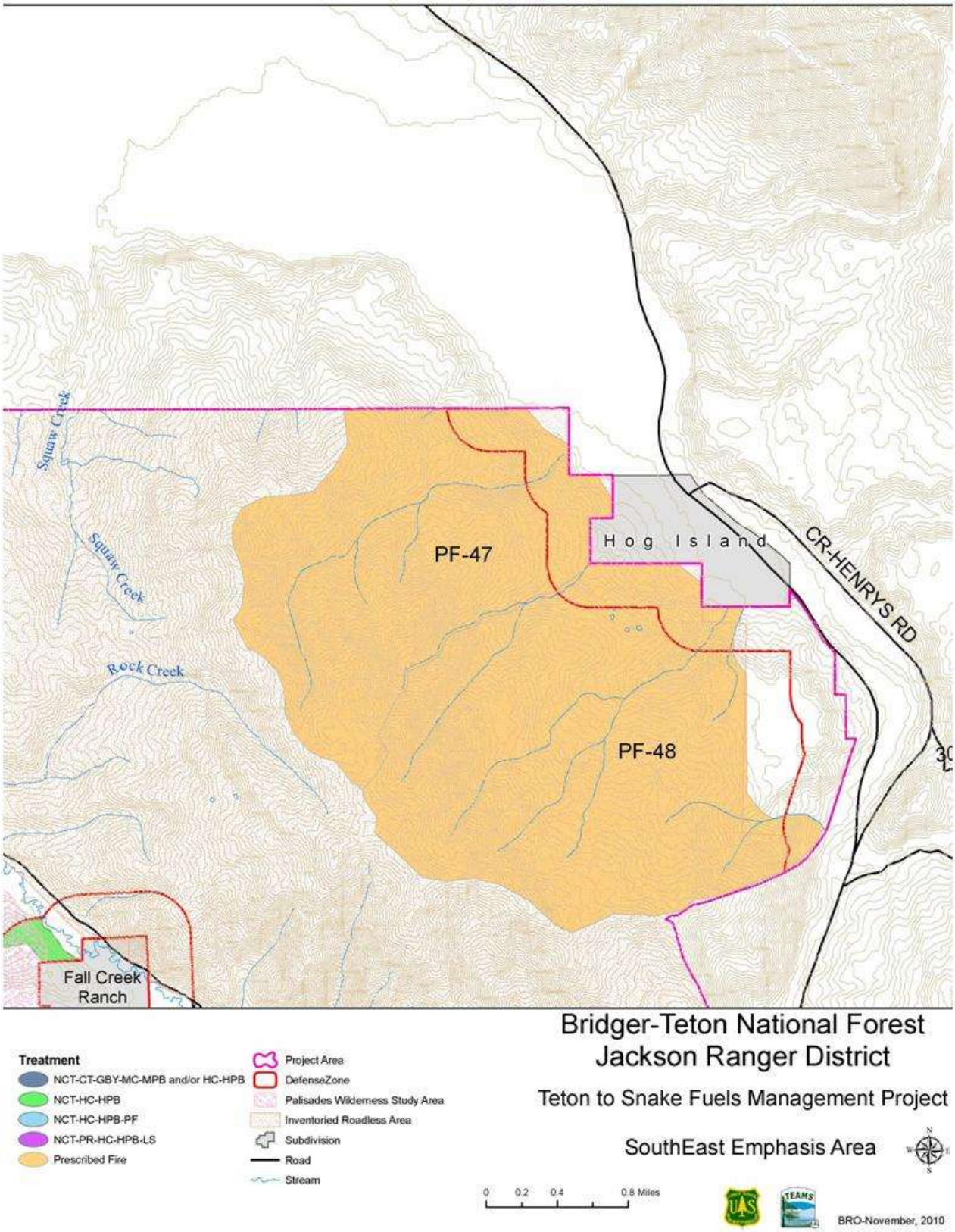


Figure 19. Treatment unit map - southeast emphasis area