

## Forested Vegetation - Fire

Fire is the most dominant disturbance factor in this landscape over the long term. This is based on the perspective of total number of acres affected. A very small percentage of the total number of fires on the landscape account for a majority of the acres burned. Fire plays a different roll in each of the major forest cover types on the Bighorn NF and is summarized below.

The descriptions of fire regime groups and condition classes are closely related to the descriptions used in *Historic Variability for Upland Vegetation in the Bighorn National Forest, Wyoming*, Meyer and Knight, (2001). The current conditions described here are consistent with the findings of Meyer and Knight. Additional information can be reviewed in their publication.

### FIRE REGIMES

Fire regimes have been created on the Bighorn NF to group major forest cover types into categories with similar fire return intervals and burning characteristics. Six fire regime groups have been created. The fire regime group and associated condition class characteristics are defined in *Fire and Land Management Planning and Implementation Across Multiple Scales*, Hann and Bunnell (2001). Table 1 shows the fire regime groups, the associated primary cover types and total acres in each group. Fire severity burn characteristics are also included.

**Table 1. Fire Regime Groups and Associated Primary Cover Types**

Fire Regime Group	Primary Cover Types	Burn Severity Characteristics	Total Acres
1	Ponderosa Pine Cottonwood	Understory Burn	38,727
2	Sage Brush Grass/Forb Willow	Stand Replacement	333,581
3	Limber Pine, Douglas Fir Rock Mountain Juniper	Mixed Severity (Some understory and some stand replacement)	135,139
4	Lodgepole -Pine	Stand Replacement	359,332
5	Engleman Spruce Subalpine Fir Aspen	Stand Replacement	247,707
No Fire	Bare Soil Rock Water	None	114,124

Each fire regime group is comprised of three different condition classes. The condition classes coarsely separate each fire regime group based on potential for change in smoke production; hydrologic function; and vegetative composition, structure and resilience. Condition class 1 indicates that the cover types are not at significant risk of change. Condition class 2 indicates moderate risk and condition class 3 indicates high risk for change. Table 2 summarizes each condition class below.

**Table 2. Condition Class Definitions, from Hann and Bunnell (2001)**

<u>Class</u>	<u>Departure from Historic Range of Variability</u>	<u>Description</u>
Condition Class 1	None, Minimal, Low	Vegetation composition, structure and fuels are similar to those of the historic regime and do not predispose the system to risk of loss of key ecosystem components. Wild land fires are characteristic of the historical fire regime behavior, severity and patterns.
Condition Class 2	Moderate	Vegetation composition, structure and fuels have moderate departure from the historic regime and predispose the system to risk of loss of key ecosystem components. Wildland fires are moderately uncharacteristic compared to the historical fire regime behaviors, severity and patterns.
Condition Class 3	High	Vegetation composition, structure and fuels have high departure from the historic regime and predispose the system to high risk of loss of key ecosystem components. Wildland fires are highly uncharacteristic compared to the historical fire regime behaviors, severity and patterns.

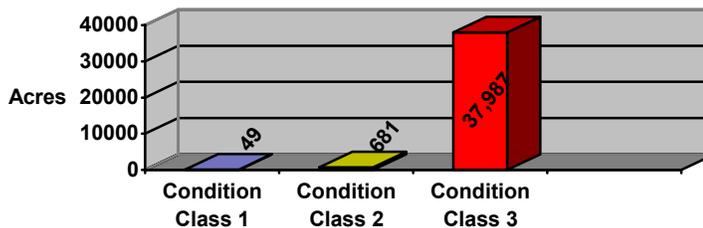
The condition class break points are discrete in reporting and are used in broad analysis over thousands of acres. The forest operates on a continuum with a range of conditions. For example forest conditions may show some characteristics of condition class 1 and some characteristics of condition class 2. These types of conditions are included in the higher condition class to facilitate planning for the future conditions.

**Fire Regime Group 1**

Fire regime group 1 has ponderosa pine as the primary cover type. There are limited amounts of cottonwood stands incorporated. Bighorn National Forest IRI-CVU stand polygon data were used to determine stand cover types. Douglas fir is present as a secondary species with additional tree species included in limited quantities. This regime group has low fire severity and frequent fires with an historic fire return interval between 0 to 35 years when in condition class 1. Ponderosa pine has a high adaptation to frequent low intensity fire.

Most of the ponderosa pine stands are in condition class 3. These areas in fire regime group 1 have missed at least two historic fire return intervals as a result of successful fire suppression activities. Figure 1 displays the total number of acres in each condition class.

Figure 1. Fire Regime Group 1 Condition Class Acres

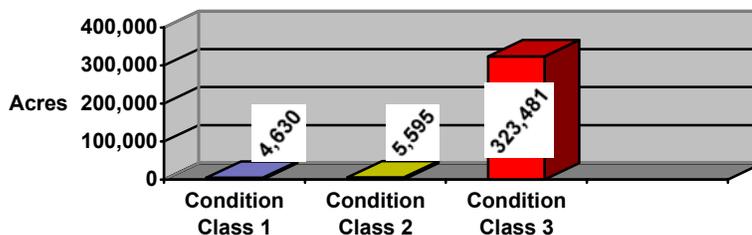


**Fire Regime Group 2**

Fire regime group 2, is defined as a high frequency high severity fire regime group. It has an historic fire return interval of 0 to 35 years and stand replacement burning. Bighorn National Forest IRI-CVU stand polygons with sage, grass/forb or willow as the dominant cover types are included.

The majority of fire regime group 2 is in condition class 3 and is at high risk for changes in vegetative composition, structure or resilience. This fire regime group needs frequent fire to maintain a variety of structural conditions in a mosaic pattern across the forest. Fire typically will crown kill the vegetation but will not kill the root system allowing the vegetation to regenerate and flourish.

Figure 2. Fire Regime Group 2 Condition Class Acres

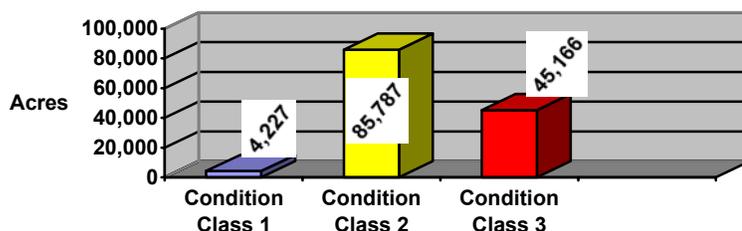


### Fire Regime Group 3

Fire regime group 3, is defined to have an historical fire return interval ranging from 35 to 100 years and mixed severity burning. Bighorn National Forest IRI-CVU stand polygons with Douglas fir, limber pine and Rocky Mountain juniper as dominant cover types are included. Fires can transition into the crowns of trees for short durations, but do not typically burn as significant stand replacement events. This regime group has potential for large fires, but is dependent on wind for fires to transition into large fire events.

Figure 3 shows most of the acres in fire regime group 3 to be in condition class 2. The areas in condition class 2 have missed one historic fire return interval and have moderate risk for changes to the stands. The acres in condition class 3 have missed at least two historic fire return intervals.

Figure 3. Fire Regime Group 3 Condition Class Acres

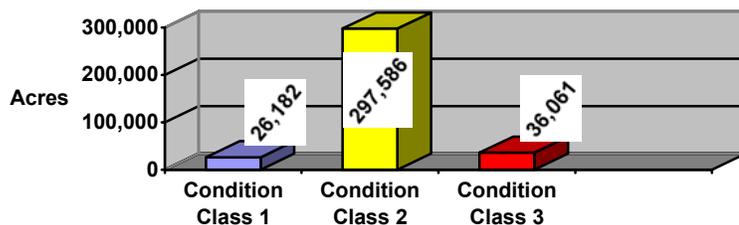


### Fire Regime Group 4

Fire regime group 4, is defined to have an historical fire return interval ranging from 35 to 100 years and stand replacement severity burning. Bighorn National Forest IRI-CVU stand polygons with lodgepole pine as the dominant cover type is included. The lodgepole pine on the Bighorn National Forest has an historic fire return interval ranging from 70 to 110 years. Lodgepole pine is adapted to stand replacement fires and has cones that only open after fire has heated them. Additionally lodgepole is able to reproduce after about 7 to 10 years.

The majority of fire regime group 4 is in condition class 2 and has missed one historic fire return interval. Condition class 3 acres have missed at least two historic fire return intervals. There are shade tolerant tree species in the understory of many of the stands and an over accumulation of dead and down fuels in condition class 3 stands.

Figure 4. Fire Regime Group 4 Condition Class Acres

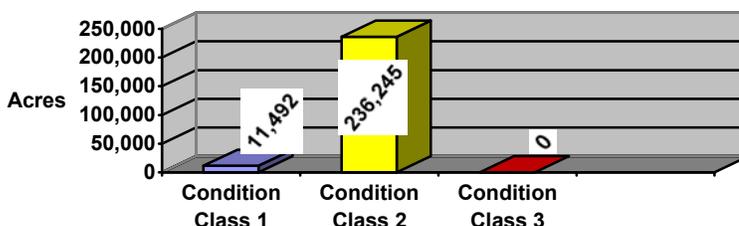


**Fire Regime Group 5**

Fire regime group 5, is defined to have an historical fire return interval of 100+ years and stand replacement severity burning. Bighorn National Forest IRI-CVU stand polygons with subalpine fir, Engelmann spruce and aspen as the dominant cover types are included. The aspen stands may start to deteriorate sooner, but typically burns at the same time as the other dominant cover types.

Most of the subalpine fir and Engelmann spruce stands on the forest are in condition class 2. They have missed, or are near missing, one historic fire return interval and have large accumulations of duff and downed logs. This is typical of mature stand in fire regime group 5 and is not outside of its historic range. An additional disturbance from wind or insects and disease would have to occur before a fire event that would significantly increase fuel loadings for these stands to be placed in condition class 3. Small pockets of these conditions may exist on the Bighorn National Forest, but are limited in size and would have to be assessed at the project level.

Figure 5. Fire Regime Group 5 Condition Class Acres



**Fire Regime Group No Fire**

Fire regime group no fire is comprised of Bighorn National Forest IRI-CVU stand polygons with bare soil, rock and water as the dominant cover types. There are 114,124 acres of the Bighorn National Forest in the no fire fire regime group. The majority of these acres are in the Cloud Peak wilderness area.

**FIRE HISTORY**

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Historical literature searches have resulted in known fires previous to 1910, but the exact locations and sizes are not known. Locations can be assumed from the names given to the fires and sizes should be viewed as estimates. Table 3 gives the names, years and acres for these large fires. Additional history talks about large portions of the Bighorn Mountains being burned off in the 1870's, but locations and acres are unknown at this time.

**Table 3. Known Historical Fires on the Bighorn National Forest**

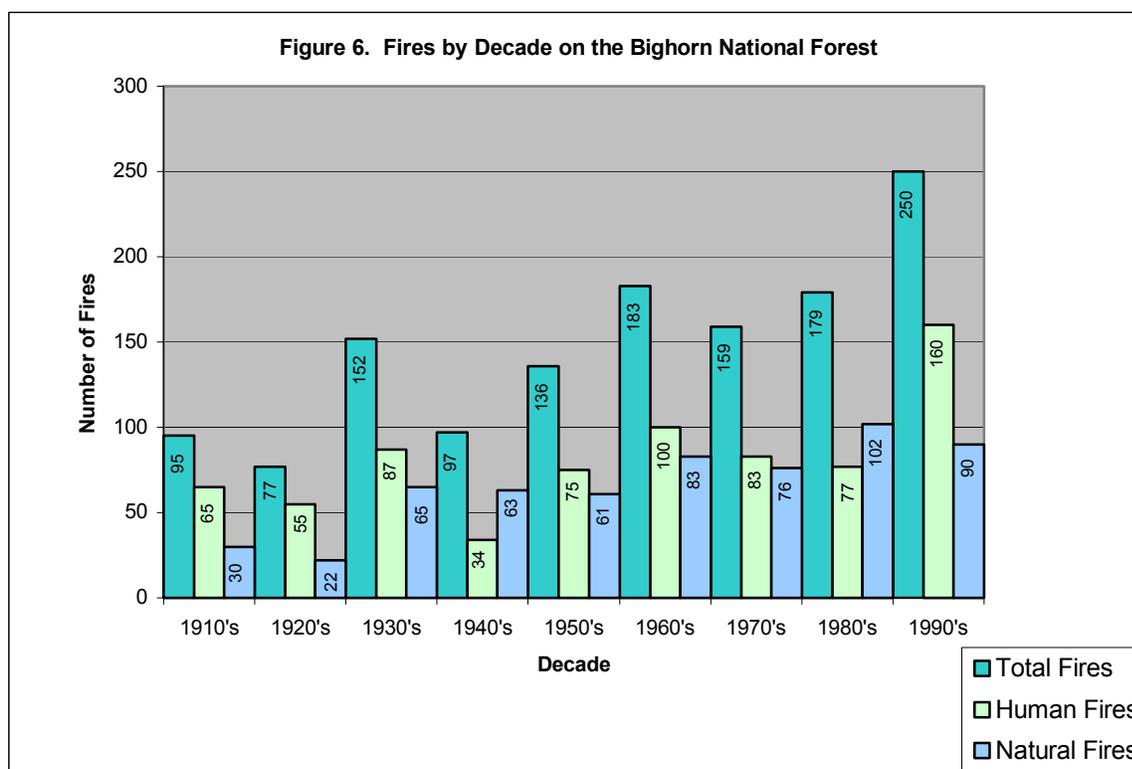
<b>Fire Name</b>	<b>Year</b>	<b>Acres</b>
Shell Creek	1895	10,000
Copman's Tomb	1897	6,000
Piney Creek	1898	30,000
Beaver Creek	1898	12,000
Little Horn River	1898	12,000
Rockwood	1899	50,000
Tensleep Creek	1900	13,000
Cross Creek	1900	Unknown
Goose Creek	1900	Unknown
Wolf Creek	1909	1,230

Fire history data have been reconstructed dating back to 1910 on the Bighorn National Forest. This data is compiled from old records and must be viewed in the context of the times.

### Fire Occurrence

Figure 6 shows fire ignitions by decade since 1910, including the number of human as opposed to natural ignitions. For example, there were 30 fire ignitions resulting from natural events in the 1910's and 22 in the 1920's. This probably under states the actual number of natural fire ignitions and results from not knowing about many lightning fires due to the remoteness of the area and limited access during the time period.

The 1990's decade shows a significant increase in the total number and person caused fires compared to the decade of the 1980's and before. This may be a result of changes made to increase the consistency and accuracy of reporting fires on the Bighorn National Forest.



The mean and median fire occurrences are reported in table 4 for total, human and natural fires for the period from 1910 through 1999. These numbers should be used with caution due to the lack of consistency for reporting through out the data.

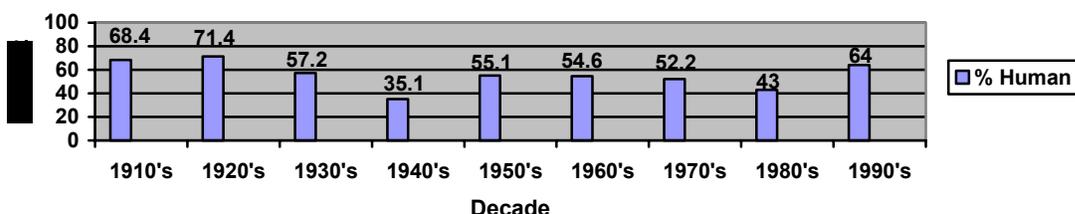
**Table 4. Mean and Median of Fire Occurrence on the Bighorn National Forest, 1910-1999**

	Mean	Median
Total Fires	148	152
Human Fires	82	77
Natural Fires	66	65

The Bighorn National Forest averages 15 fires per year for the given time period. Eight of these fires have been human caused and seven have been natural. The last 30 years show an average fire occurrence of 20 fires per year. Eleven of these were human caused and nine were natural.

Human caused fires account for 55.4% of the total fires reported on the Bighorn National Forest during the period from 1910 through 1999. This is an unusually high percentage of human caused fires when compared to other National Forests in western states. These findings are consistent with Meyer and Knight (2001). Figure 7 shows human caused fires as a percentage of total fires for each decade.

Figure 7. Percent of Human Caused Fires on the Bighorn National Forest



### Acres Burned

Total acres burned on the Bighorn National Forest do not increase with a corresponding increase in total number of fires reported. Large numbers of acres burned are associated with drought periods and or wind events in given years. This results in very few fires accounting for large portions of the total acres burned. Decades with low total number of acres are a result of fewer large fires occurring. Table 5 below shows total fires, human fires and natural fires larger than 100 acres for each decade.

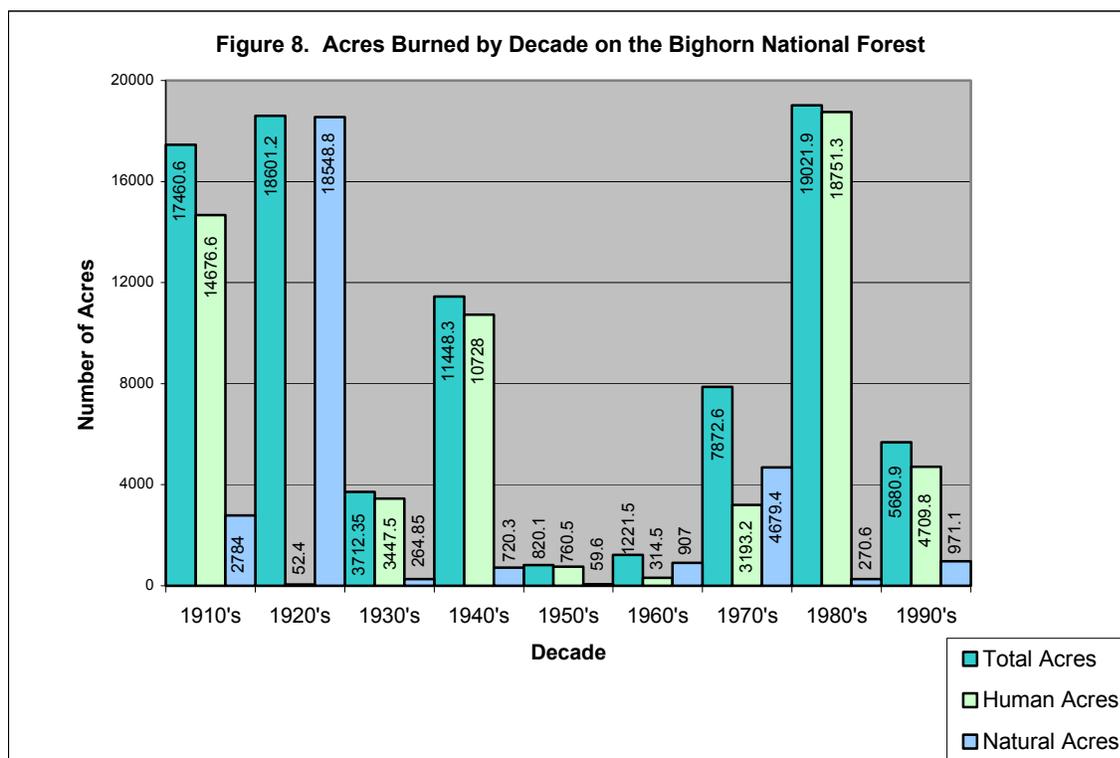
Table 5. Fires 100 Acres and Larger for the Bighorn National Forest

Decade	Total Fires	Total Acres	Human Fires	Human Acres	Natural Fires	Natural Acres
1910's	17	17,065	14	14,140	2	2,750
1920's	2	18,440	0	0	2	18,440
1930's	6	3,166	5	3,016	1	150
1940's	6	11,135	4	10,535	2	600
1950's	2	388	2	388	0	0
1960's	1	750	0	0	1	750
1970's	5	7,706	3	3,081	2	4,625
1980's	9	18,686	8	18,461	1	225
1990's	5	5,412	4	4,482	1	930

Figure 8 below shows large numbers of acres burned in the 1910's, 1920's and 1980's. Relatively few acres were burned during the 1950's and 1960's. The 1990's had the

highest quantity of reported fires for the period but only the fifth highest quantity of total acres burned.

Four of the five highest acreage totals by decade are a result of human caused fires that burned for large acreage totals. The 1980's had the highest total burned acres and the highest human caused burned acre totals in the period. The 1990's had the fifth highest total acres and the third highest burned acres from human causes.



High quantities of burned acres result from certain fires during given years. Figure 9 displays the boom or bust cycle of burned acres that occur on the Bighorn National Forest. This cycle results from ignitions occurring during drought conditions in stand replacement fire regimes. This data is consistent with wildfire patterns observed in other subalpine forests (Bessie and Johnson, 1995).

