# IV. WILDFIRE BACKGROUND AND HISTORY

## INTRODUCTION TO WILDFIRE

On average, the United States experiences 51,656[2] wildfire events annually, consuming over 2 million acres of land. Wisconsin averages 5,000[3] wildfires annually, consuming an average of 27,000[3] acres of land. While most wildfires in Wisconsin are generally small in area, large fires can and do occur. In fact, the largest and most devastating wildfire in U.S. history occurred in Wisconsin. In October of 1871, wildfire struck the Town of Peshtigo in northeastern Wisconsin killing 1,300-1,500 people. The fire occurred at the same time as the Great Chicago Fire, which received greater publicity. The Peshtigo fire burned over 1,200,000 acres in Wisconsin and the Upper Peninsula of Michigan before it was finally extinguished by late fall rains.

## FACTORS INFLUENCING WILDFIRE SUSCEPTIBILITY

### Weather

Weather conditions are a significant contributing factor to wildfire susceptibility. In Wisconsin wildfire weather hazards are generally the most severe during spring, following snowmelt and prior to the "green-up" of vegetation. Rains during the spring season and new green growth lessen the likelihood that wildfires will start and spread. Weather related risk is greatest when multiple condition factors occur simultaneously.

Precipitation levels, temperature, relative humidity and wind speed are the primary factors influencing wildfire risk. Precipitation levels strongly influence the moisture content of fuels. Drought conditions and low relative humidity (a measure of the amount of water in the air compared with the amount of water the air can hold at a given temperature) can desiccate these fuels, increasing vulnerability to ignition. High temperatures also reduce fuel moisture levels and tend to "preheat" fuels, allowing them to burn and spread faster. Wind conditions are the most significant weather related factor contributing to wildfire. Windy conditions dry fuels and increase oxygen supply. With a steady oxygen supply, fuel and temperature become critical to sustaining a fire once it's ignited. Winds also influence the direction and rate of fire spread. In Wisconsin, wind direction almost always changes in a clockwise rotation and winds tend to be the strongest in mid-afternoon.

### Fuels

Fuels are combustible materials comprised of both living and dead vegetation. Wildfire is part of the natural disturbance regime which serves to reduce the amount of fuels present. These fuels have been accumulating during at least the past 50 years due to

[2] NIFC Statistic
[3] WDNR Statistic

fire suppression, forest management and other wildland management policies and practices, and other factors.

Fuel types vary in the ways they respond to fire, although all plants will burn if exposed to enough heat. Jack pine and red pine are among the most flammable forest species found in the project area conversely, deciduous species do not readily burn therefore they are not as susceptible to wildfire.

Wildland fuels can also be described using vertical separation as ground, surface, ladder and aerial fuels.

**Ground fuels** are comprised of combustible materials lying beneath the surface including roots, buried logs, deep duff and other organic matter. Ground fires (sometimes referred to as "bog fires") burn ground fuels and tend to smolder rather than producing much flame. These types of fires occur relatively infrequently.

**Surface fuels** include combustible materials lying directly above the surface such as logs, stumps, logging slash, leaves, pine needles, grass and other understory vegetation. Surface fuels are referred to as light and flashy fuels because they ignite easily and burn rapidly. Surface fires consume surface fuels and are the most common type of wildfire occurring in the in mixed forests of northern Wisconsin4. These fires are generally low intensity and do not kill mature trees, although some mortality may occur in moderate to severe surface fires.

**Aerial fuels** include both living and dead plant materials in the upper forest canopy. Fires which burn through the canopy are referred to as crown fires, which are the most destructive and dangerous class of wildland fire. Crown fires are also generally the most difficult fires to control. In catastrophic crown fires, tree mortality can be high. Given a pathway, intense surface fires can spread to the aerial fuels to become crown fires. Ladder fuels such as shrubs or small trees of intermediate height, act as ladders carrying the flames from the forest surface up into the tops of trees.

## Topography

Topography has a strong influence on wildfire behavior. Because heat rises, up sloping fire spreads more quickly as pre-heated fuels readily ignite. It is also difficult to fight fires on steeply sloping lands. Aspect also influences wildland fire risk as southern or southwestern slopes generally have lower relative humidity and higher temperatures than those on north or northeast slopes. Because of longer and more intense solar exposure, fuels along these slopes may be drier. Consequently, fire hazard is often higher on south and southwest facing hills.

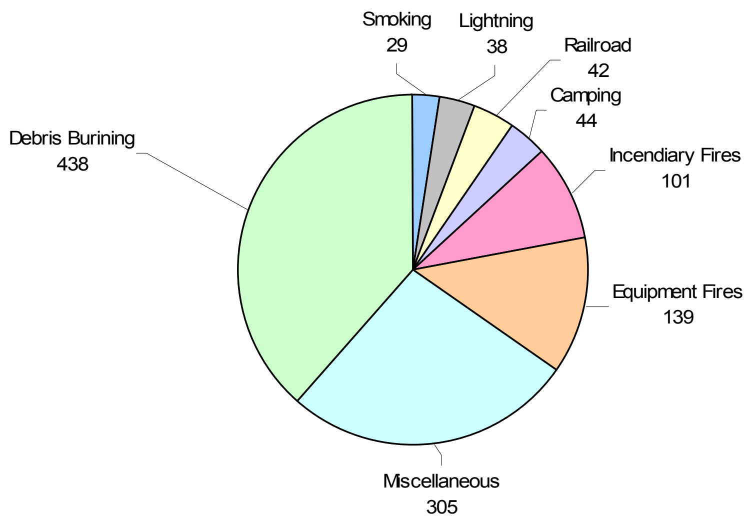
[4]" Influence of Forest Management Alternatives on the Risk of Wildfire in Northern Wisconsin," Gustafson et.al, 2003

## PRIMARY CAUSES OF WILDFIRE

Debris burning is the number one cause of wildfire in Wisconsin. In 2004, the burning of brush, debris and other working fires caused more than 1/3rd of all wildland fires on lands protected by WDNR (**Figure 2**). Outdoor burning is regulated by the state, which authorizes these activities through the issuance of burning permits. Illegal burning and failure to follow the requirements of a burning permit is the cause of numerous wildfires in Wisconsin.

Other human-related causes of wildfire in Wisconsin include miscellaneous causes, equipment use, deliberately set fires (incendiary), campfires, railroads, and smoking. Lightning is the primary natural cause of wildfire in the state.

*Figure 2, Wisconsin Wildfire Causes on Lands Protected by WDNR, 2004*




*Data Source: Bureau of Forestry, 2004*

## BARNES-DRUMMOND FIRE HISTORY

The Barnes-Drummond area, like much of northwestern Wisconsin, has had little recent exposure to large-scale wildfires. Fires occurring in the past 20 years have been relatively small, averaging less than 1 acre in size. **Maps 4 & 5** depict wildfire occurrences and causes within the project area from 1986 through mid 2005. The figures below (**Figures 3-6**) graphically depict select wildfire statistics for the project area based on the 1986-2005 data.

*Figure 4, 1986-2005 Fire Occurrences*

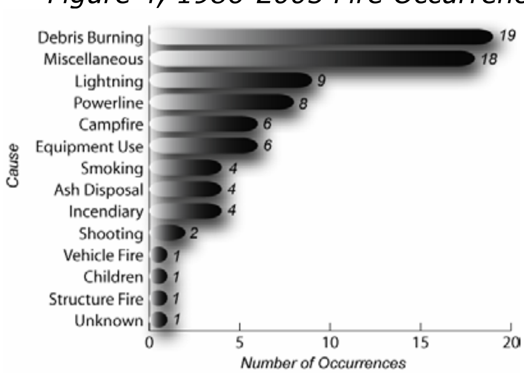



*Figure 3, 1986-2005 Acres Burned*

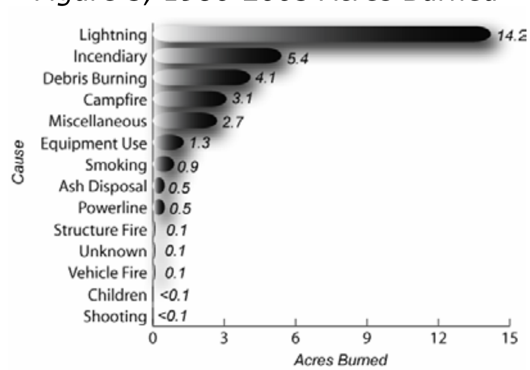



*Figure 5, Fire Occurrences by Month 1986-2005*

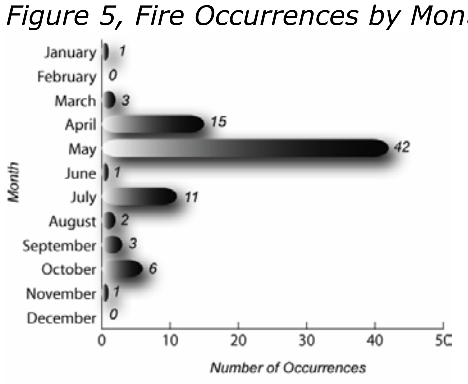
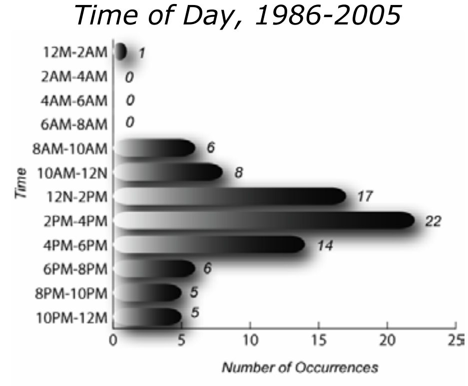



*Figure 6, Fire Occurrences by Time of Day, 1986-2005*




*Data Sources: 1986-1996 National Fire Occurrence Database, US Forest Service, WDNR*

## HISTORIC & CURRENT FIRE REGIMES

Wildfire has been an important part of the natural disturbance and forest ecological processes in northern Wisconsin for thousands of years. Fires have shaped the forest composition by favoring certain tree and plant species, promoting nutrient recycling, and creating a large, landscape mosaic of mixed habitats for wildlife. In the historic, natural fire regime, wildfires occurred irregularly from year to year, and, varied greatly in their size and severity. The fire regime concept is a way to describe the inherent variability, extent, intensity, and role that wildfire plays in a particular ecosystem relative to its vegetation characteristics and fuel conditions.

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern, human mechanical intervention, but including the influence of aboriginal burning (Agee, 1993; Brown, 1995). The natural or historical fire regimes are classified based on the average number of years estimated between fires (fire frequency), combined with the potential severity (amount of replacement) of the fire on the dominant vegetation (e.g. trees). Some of the prevailing fire regimes found within the planning area are depicted below in **Table 9** and **Map 6**.

*Table 9, Project Area Fire Regimes*

| Fire Regime | Historic Fire Frequency | Historic Forest Cover Types |
|---|---|---|
| I | Frequent, low to moderate intensity surface fires occurring every 15-35 years, with stand-replacing fires @150 years. | Mixed white and red pine forests (with some red oak). |
| II | Frequent, high intensity stand replacement fires occurring every 15-50 years. | Jack pine and barrens (with some red pine) |
| III | Infrequent, mixed severity fires occurring @ intervals of 100-200 years. | White pine - hemlock forests |
| V | Very infrequent fire, typically occurring in association with a catastrophic windstorm and/or periods of extreme drought. | Northern hardwood forests, including sugar maple, beech, & hemlock. |

*Source: US Forest Service*

Historic fire regimes in the Upper Midwest have been recently studied and characterized under a USDA and USDI Joint Fire Science Program research project using historical fire data, landscape ecosystem and biophysical data (Cleland et al, 2005). In terms of fire size, this study found that in northern Wisconsin, historical forest fires larger than 10,000 acres represented about 7 percent of the total number of fires, but accounted for nearly 60 percent of the total area burned. The frequency of these large, severely burning historic wildfires ranged from periods of a few decades within the most fire-prone ecosystems (jack pine and mixed red, white, and jack pine forests) to more than a

1,000 years within wet, relatively fire-resistant ecosystems (wetland conifer-hardwood forests).

Historical forest fires smaller than 10 acres represented an estimated 40 percent of the total number of fires, but accounted for less than 1 percent of the total area burned. Regardless of size, historical fire ignitions were likely influenced by a combination of factors, such as weather conditions (particularly wind and drought), forest type, the longevity of the dominant tree species within a given ecosystem, and the frequency of indigenous burning and lightning-caused fire starts.

By contrast, modern fire regimes differ greatly in their size, frequency, and cause as compared to historical fires. Contemporary fire regimes are almost exclusively associated with human-caused ignitions, coupled with modern fire detection and suppression, and reflect the rearrangement of landscape fuels due to logging, forest management, and agriculture over the past 150 years. Cleland and others noted a strong relationship between the current fire occurrence and the presence of human populations, especially as measured by housing density. Additionally, the frequency of fire (at a landscape scale) is generally much longer due to the effective wildland fire suppression activities of the various Federal, State, county, and local agencies and/or entities towards safeguarding human life and property.

Contemporary fire regimes within the planning area have changed dramatically, with tremendously longer fire rotations and fire return intervals, smaller fire size, and the potential for more severely burning wildfire.

The characteristic vegetation and fuels conditions are considered to be those that occurred within the natural (historic) fire regime. This would include a landscape of fluctuating pine barrens and early to mid seral classes; stands of large, widely spaced red and white pine with sparse understory; stands of large white pine and hemlock; and hardwoods with a high percentage in old growth forest.

Uncharacteristic conditions are those that did not likely occur historically. Within the planning area conditions exhibiting non-native invasive plants, extremely dense understory shrubs and trees (in areas associated with a frequent, surface fire regime), plantations, and the “high graded” composition of the forest resulting in a lack of old forest structures are indicative of a significant degree of departure from the natural fire regime. In the event of a fire start under adverse weather conditions (e.g., prolonged drought or high winds), the potential fire intensity and severity could be much more severe than the historical counterpart.

## FUEL MODELS

Vegetation data helps demonstrate how susceptible certain forest types are to a wildfire and how a fire may behave within a given forest type. Fuel model data for the publicly-owned and managed lands in the Barnes-Drummond area was collected from Forest Service, County Forest and WDNR data. Fuel data for privately-owned lands was derived from the Wisconsin Initiative for Statewide Cooperation on Landscape Analysis and Data (WISCLAND) land cover model. Map 7 reflects a composite of all three data sources.

There are 7 fuel models present in the project area (**Map 7**). Fuels depicted include grass, brush, timber and slash. These models were chosen because they best correspond to the Washburn District's and Bayfield County's current stand data and the Great Lakes region vegetation.

**FM2 High hazard** - Grass with open timber-brush overstory

- Fast moving: can out run single engine capacity in moderate conditions, and single dozer capacity in high conditions.
- Hand tools effective only in low or moderate condition.
- Green-up moderates fire behavior rapidly in the spring: will not carry fire in the fall until after a severe frost (late September) and is capable to carry fire after green-up if thick matted layer is dry.

**FM4 High hazard** - Closed canopy pine stands in the lakes' states

- Assuming a crown base height of less than 20 ft.
- Main carrier of the fire is the live foliage aided by conifers flammable chemical characteristics.
- Sustained crown fire model: fast moving, very intense fires that occur with the following thresholds: 15+mph 20ft wind speed, <30%RH, >70 degrees temperature.
- Live fuel moisture (foliar moisture) is low during the dormant season and dips to the lowest when the new growth begins in the middle of spring fire season. Ladder fuels greatly add to the hazard by aiding crown, intermittent crown, and torching fire behavior and the resulting spotting.
- Lack of fuel or ladder fuel virtually eliminates hazard after green-up when foliar moisture is at its highest during the growing season.

**FM 13 High hazard -** This slash model is used for forest that has been heavily damaged by wind or ice.

- Conifer blowdown or a released conifer understory (balsam-spruce) associated with blowdown is especially hazardous.
- This fuel model can remain hazardous throughout the snow-free season as dead fuel is the main carrier of the fire. Fire behavior is moderated by green-up but an extended drying period during the summer can cause intense fires.

**FM9-1 Moderate to high hazard** - Mature red/white pine, loosely compacted needle litter.

- Wildfires generally intense enough to cause significant overstory mortality. During periods of high to extreme burning conditions, suppression actions could be ineffective (torching and spotting).
- Ladder fuels significantly add to intensity and fire spread through spotting. Very receptive to spotting and ignition, flammable because of chemical properties, and loose needle compaction.
- Flammability lingers well into green up and arrives early in the fall.

**FM9-2 Low to moderate hazard -** Oak, loosely compacted leaf litter.

- Most flammable in late fall before snow compacts leaves.
- Receptive to spotting from blowing leaves and torching of understory conifers. Only during periods of very high to extreme burning conditions suppression actions could be ineffective.
- Conifer understory could add to intensity and rates of spread.
- Flammability generally does not linger as long into green-up or arrive as early in the fall as the pine fuel model.

**FM 8 Low hazard** - Compacted leaf litter, aspen, birch, northern hardwood types, also includes short needle conifer (spruce, jack pine) if weather conditions under the crown fire-torching threshold (see fuel model 4).

**FM 5 Low hazard -** Hardwood brush model

- FM 8 and 5 have very similar fire behavior
- The lowest rates of spread and fire intensity of any fuel models
- Suppression action effective except under the most extreme fire weather
- Need live or dead conifer understory for this fuel model to be hazardous
- Can be used as fire lines on landscape type Rx burns or as fuel breaks on wildfire.

## LONG-RANGE PLANNING

Both local units of government have engaged in local level land use planning. Drummond completed a land use plan in 2001, and both jurisdictions are currently developing long-range comprehensive plans. The recommendations, maps and policies contained in these plans will be used by the local units of government and Bayfield County to make decisions regarding land use in the CWPP project area. It is important that both communities and the county consider the contents of this CWPP when engaging in long-range planning and making land use and other local decisions.