Topic & Title of Project

Yellowstone Central Plateau Fire Behavior Assessment using LANDFIRE data products: 2007

Background

An assessment was conducted of expected fire behavior in the Yellowstone National Park's Central Plateau area to enhance understanding of potential fire behavior and help inform decision making when managing fires in this National Park. Regional and local park managers decided to use the LANDFIRE data as a basis for modeling fire behavior for this assessment. Initial model results from FlamMap and FARSITE using LANDFIRE data were validated by one of the park's Long Term Fire Analyst (LTAN) as being reasonable.

Key Points

Data evaluation and modeling

All analysis should begin with an evaluation of the data to understand the data set and make any needed adjustments for the specific analysis. For this assessment, adjustments were made to the LANDFIRE data set, described in the list below. It should be noted, however, that having a sound data layer to start from can often mean beginning an analysis within hours instead of days, the latter of which often occurs when data have to be gathered from a variety of sources.

The following changes were made to the LANDFIRE fuel layers to improve model results:

- ►Canopy covers of greater than 30 percent were multiplied by 0.66 and canopy bulk densities of less than 0.2 kg m-3 were multiplied by 2 to allow for better modeling of fire behavior (based on advice from the Missoula Fire Sciences Laboratory).
- ►All areas mapped as the Lodgepole Pine 1 (LP1- early seral stage of lodgepole pine with very little surface fuel; see fig. 1) fuel model by the park were defined as fuel model TU1 (Timber/Understory 1) to model the expected slow spread rates and low flame lengths that are observed in these areas.
- ►All fuels in areas that burned in 1988 (other than Grass/Shrub 1 [GS1]) were changed to the Timber/Understory 1 (TU1) fuel model to match observed fire behavior in the 1988 burned areas. All areas that have burned since the LANDFIRE mapping project (2000 and later) were changed to TU1 to model expected slow fire spread and reduced fire intensity (fig. 2.) in these areas while still allowing the use of live fuel moistures to modify spread characteristics.

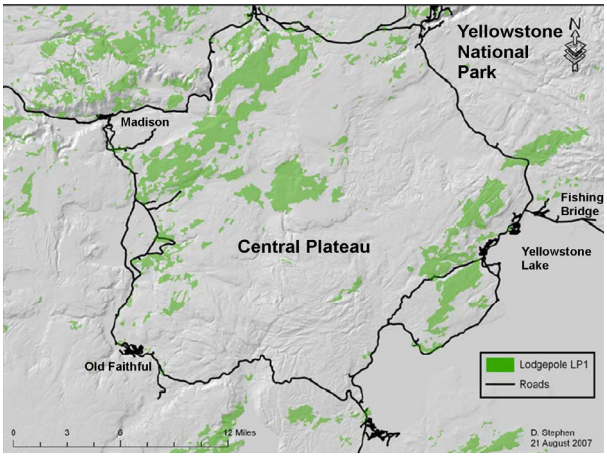

Figure 1. Assessment area map showing Lodgepole Pine 1 (LP1) fuel models across the Central Plateau.

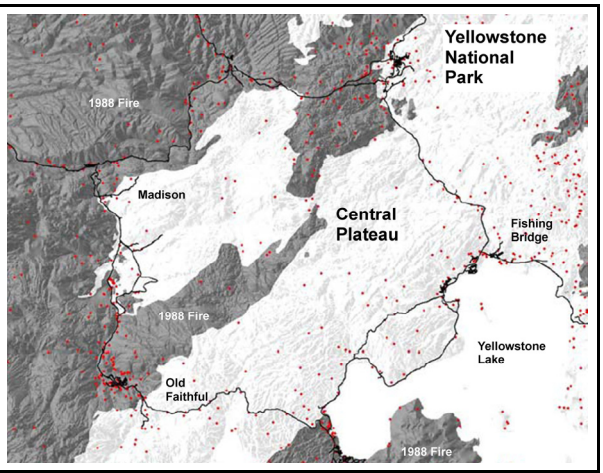

Figure 2. Map showing 1988 burn areas (in dark gray) and historical ignitions (red dots) in the area.

continued...

Key Points, continued...

Analysis FlamMap (a fire behavior and analysis program that computes potential fire behavior characteristics such as spread rate, flame length, fireline intensity, crown fire potential, etc. over an entire landscape using constant weather and fuel moisture conditions) model runs showed expected fire behavior characteristics (surface fire, passive crown fire, and active crown fire) for all points on a landscape at one instant in time across the landscape using an extreme weather conditioning period to set dead fuel moistures (daily highs of 80 degrees and lows of 50 degrees, RH highs and lows of 40 and 15%) and clear days. All analysis runs were conducted with 20-foot gusts of 30 miles per hour from the southwest.

Results / summary The Central Plateau has a wide range of fuels and expected fire behavior based on multiple vegetation types and area conditions. Historically, fires burning in this area of Yellowstone National Park have been moderate except in the most severe conditions. These conditions were manifested in the 1988 fires where very large crown fire runs occurred. From a fire planning perspective, it is important to continue to monitor fire behavior in the areas that were burned during the 1988 fires, and it is also important to factor in other changes to vegetation, such as growth and disturbances, across the park over time to increase knowledge used in the decision-making process. The bands of lodgepole (LP1; fig. 1) can be expected to offer significant reductions in fire behavior compared to much older lodgepole and mixed-conifer stands under almost all conditions for some time to come and may offer opportunities for reinforcement through future fire use events or prescribed fires. The FlamMap analysis runs (fig. 3) show that crown fire activity could be expected in the southeastern portion of the plateau, especially between Old Faithful and Fishing Bridge. The FARSITE simulation (fig. 4) shows a large range of expected fire sizes under the same weather conditions, with fire sizes varying by more than an order of magnitude depending on the location of the fire ignition point and associated vegetation/fuels in the area.

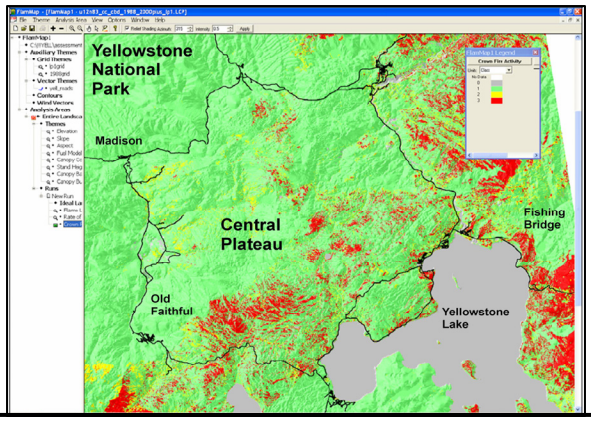

Figure 3. FlamMap was used to gauge the potential for crown fire behavior. Green signifies surface fire, yellow signifies passive crown fire, red signifies active crown fire, and gray signifies no fire potential. From this analysis, crown fire activity could be expected in the southeastern portion of the plateau.

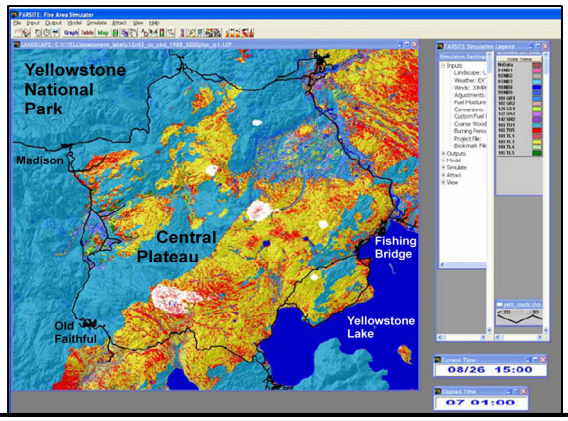

Figure 4. FARSITE simulation of 6 simultaneous ignitions for 7 days showing the large range of expected fire sizes under the same weather conditions. These size differences are shown in the white areas on the map with the expected fire size and perimeter. The other colors signify fire behavior fuel models.

Recommendation In Yellowstone National Park and in the greater Yellowstone area, updating and improving the LANDFIRE fuels data for the entire area would be a worthwhile effort both for pre-planning and support of fire operations. One of the improvements that could be made to further the analysis would be to delineate those areas that are grazed and convert them to a more appropriate fuel model.