Topic & Title of Project

Data Comparison and Sensitivity Analysis in Yellowstone National Park Summer 2007

Background

During the summer of 2007, Yellowstone National Park (YNP) experienced an active fire season with extreme fire behavior. Conditions were dry and comparisons were made to the 1988 fire season. These fires were managed by various incident management teams, and fire behavior was analyzed by Fire Behavior Analysts and Long Term Fire Behavior Analysts (FBANs & LTANs). Some of these fires included the Owl, Columbine, and Beaverdam fires. Data were evaluated to improve modeled results.

Use on Wildland Fires

Careful evaluation of both data and model are crucial. FBANs and LTANs conducted a sensitivity analysis of the data, which indicated that, given recent landscape changes, refinements and updates to the LANDFIRE National data products were needed to improve modeled results as compared to actual fire behavior conditions. YNP's Owl and Columbine wildland fires and Beaverdam wildland fire use (WFU) fire are good examples of the utility of consistent, gapless data across agency boundaries. Prior to LANDFIRE data, Yellowstone's fuel layers stopped at the park's boundary. Because the YNP model simulation landscape stopped at the park boundary, potential fire spread and fire behavior projections also stopped there. Also, a locally developed fuels layer for the Greater Yellowstone Area (GYA) was available and a FARSITE landscape was generated that was gapless across agency boundaries, however, the additional data themes for canopy base height, canopy bulk density, and stand height did not exist in these local data layers, thus crown fire activity could not be modeled adequately across the GYA landscape. The LANDFIRE data products consist of all of the necessary data themes to enable advanced modeling and analysis. Because LANDFIRE data sets were complete and loaded into the Wildland Fire Decision Support System (WFDSS), the Fire Spread Probability (FSPro) modeling was initiated quickly – in some cases within a couple hours of the request.

Columbine Wildland Fire

A comparative analysis was conducted by FBANs and LTANs on un-modified (fig. 1) and modified (fig. 2) LANDFIRE data products to aid decision-makers for the Columbine fire in YNP. The following are a few of the changes:

- ►Canopy bulk density (CBD) was increased to improve the modeling of active crown fire (CBD * 2 if CBD < 0.2).
- ►Canopy cover was reduced as recommended by LANDFIRE experts (Canopy Cover * 0.67 if CC > 30%).
- ►The Landscape file was updated to reflect recent fires (2001 & 2003 fires were updated to fuel model 99: Barren). Local management made changes to the Lodgepole Pine cover-type (changed to TU-1 / Timber-Understory 1).
- ►1988 fire areas with GR-1 / Grass-Sparse 1 and 99-Barren assignments were changed to TL-1 / Timber-Litter 1).

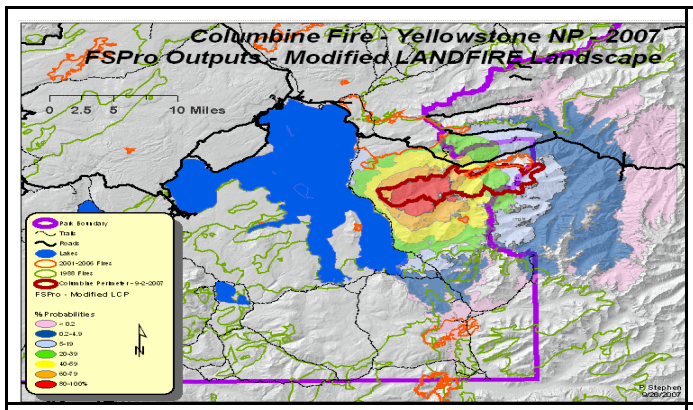

Figure 1. Columbine Fire Spread Probabilities using un-modified LANDFIRE data products. In the Columbine FSPro analysis using the unmodified landscape file, fire spread probability to the south was primarily due to some areas of the 1988 fires having inappropriate fuel models assigned: TU-5 / Timber-Understory 5 and GR-2 / Grass 2.

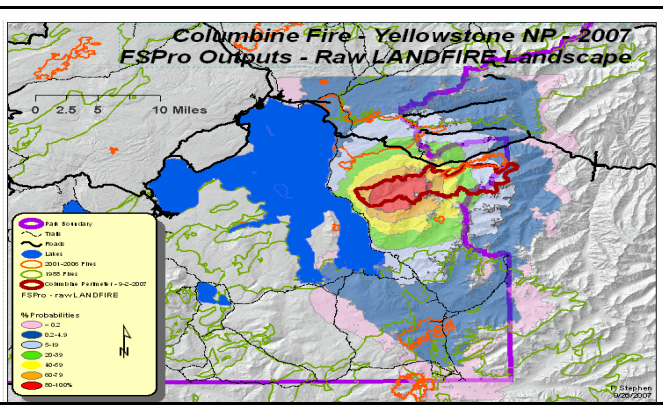

Figure 2. Columbine Fire Spread Probabilities using modified LANDFIRE data products. The fire spread to the north on the unmodified (fig. 1) landscape resulted from the fact that the data did not reflect the 2001 and 2003 fires. The direction of fire spread was more appropriately modeled using the analysts' modified landscape.

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Beaverdam WFU Fire & Owl Wildland Fire After extensive refinement and updates to the landscape file and LF data products for both the Owl and Beaverdam fires, the probability of fire spread was modeled using FSPro to aid managers in the decision-making process. Given the active conditions of the 2007 fire season, managers requested additional FSPro analyses be conducted to provide insight into the fire's potential for reaching Forest Service land (fig. 3 and fig. 4).

- ►Shoshone National Forest managers were somewhat uncomfortable accepting the decision to manage as a WFU; however, after viewing modeled results, all agencies agreed to this management form. This was the first time in the park's history of managing WFU fires that a fire was managed across these agency boundaries.
- ►The Owl Fire threatened numerous structures with the potential to spread onto the Gallatin National Forest. Using updated data sets, the Fire Spread Probability and FARSITE runs were completed to help inform decision-making for long-term planning.
- ►Changes similar to those listed above for the Columbine Fire were also made for these analyses.

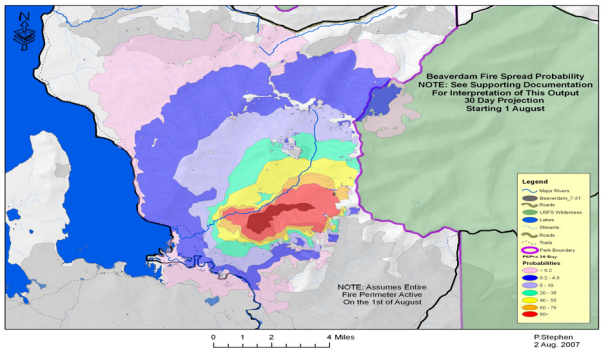

Figure 3. A 30-day FSPro analysis indicated that the probability of the Beaverdam WFU reaching USFS lands by August 31st was less than 5%. The red oval shows the area of concern where the fire could potentially cross over to the Shoshone National Forest**.** A similar analysis was conducted for the Owl fire.

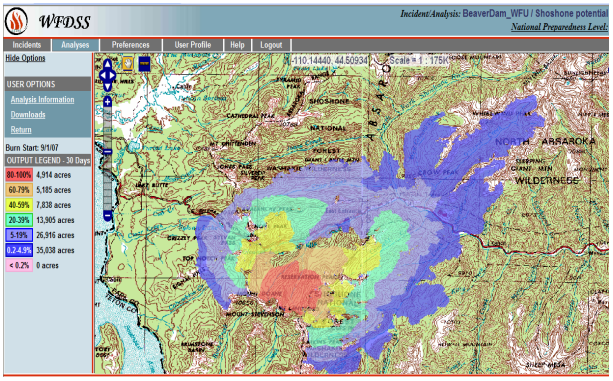

Figure 4. Hypothetical FSPro results: In the unlikely event (<5% probability) that the Beaverdam WFU were to become established in heavy fuels on the Shoshone NF by Sept 1, the model indicates there is less than a 40% chance the fire would escape the National Park boundary by the end of September.

Results / Summary Because LANDFIRE data were developed and available for the entire area, fire behavior outputs were consistent across agency boundaries. Prior to LANDFIRE data availability, some of the fire behavior analysis and modeling would have taken a prohibitively long time to accomplish or would not have been possible at all because of lack of data. Even though it did take time and effort to refine and calibrate LANDFIRE data to the observed fire behavior, it was, with out a doubt, worth the effort. Because fire spread from torching and spotting was a major contributor to the growth of many of these fires, the local GYA landscape fire behavior data were found to be inadequate to produce the complete suite of desired fire behavior modeling results. Thus, the modified LANDFIRE data better met modeling needs with additional predictor variables of torching and spotting helping inform the decision process for the Long Term Implementation Plans of these fires. With the delivery of LANDFIRE data products across the western United States and the recent fire science and modeling developments of the Fire Spread Probability (FSPro) model and the Wildland Fire Decision Support System (WFDSS), fire specialists and natural resource managers were provided data and models to enhance their decision making processes.

Recommendation Because LANDFIRE data are circa 2001, updates are needed to reflect recent fire disturbances.