Models Used in the SPOT Workshop

We will be using both FARSITE and FlamMap for the analysis of fire spread and fire behavior. FARSITE and FlamMap allow us to simulate the "problem fire" in untreated and treated scenarios, and evaluate the changes in fire size and severity. We can test treatment and "no treatment" locations and effects, and evaluate our main goal, which is the effect of treatment type and placement on the communities in the analysis area, as well as on biological attributes in the Kimberley Nature Park.

Outputs from these two models can be input to the fire effects model FOFEM to determine overstory mortality levels, smoke production, fuel consumption, and soil impacts. Outputs can also be input to BehavePlus to determine suppression containment effectiveness.

Further Information

Further information on the SPOTS analysis process as well as the models used can be downloaded from the following sites:

SPOTS

www.nifc.gov/spots

FARSITE/FlamMap/FOFEM/BehavePlus

www.fire.org

This particular analysis area was chosen to conform to the central workshop goal which is designing a wildland-urban interface treatment plan for Kimberley. We also took into consideration the province's initial WUI wildfire hazard assessment, which investigated fuel hazards within 2,000 m of any community. This was based primarily on the influence of long-range spotting. Our analysis area boundary extends beyond this limit to the west and southwest in order to take in other values adjacent to the community such as the Kimberley Nature Park.

Pre-Developed Treatment Patterns

Two treatment scenarios will be set up prior to the workshop in order to 1) provide a graphic example of the model outputs on a known landscape, and, 2) to provide a comparison between two treatment alternatives. The first alternative is the "no treatment" alternative. This configuration of fuel types reflects the current situation as of January 1, 2007. Thinning has occurred at Forest Crowne, Levirs Avenue, Lois Creek, Trickle Creek, the ski hill, and the Nordic trails. The second alternative involves the proposed Tembec thinning using the planned residual densities (**Fig. 5**). This alternative only includes the thinning effect; it does not include any post-thinning fuel clean-up.

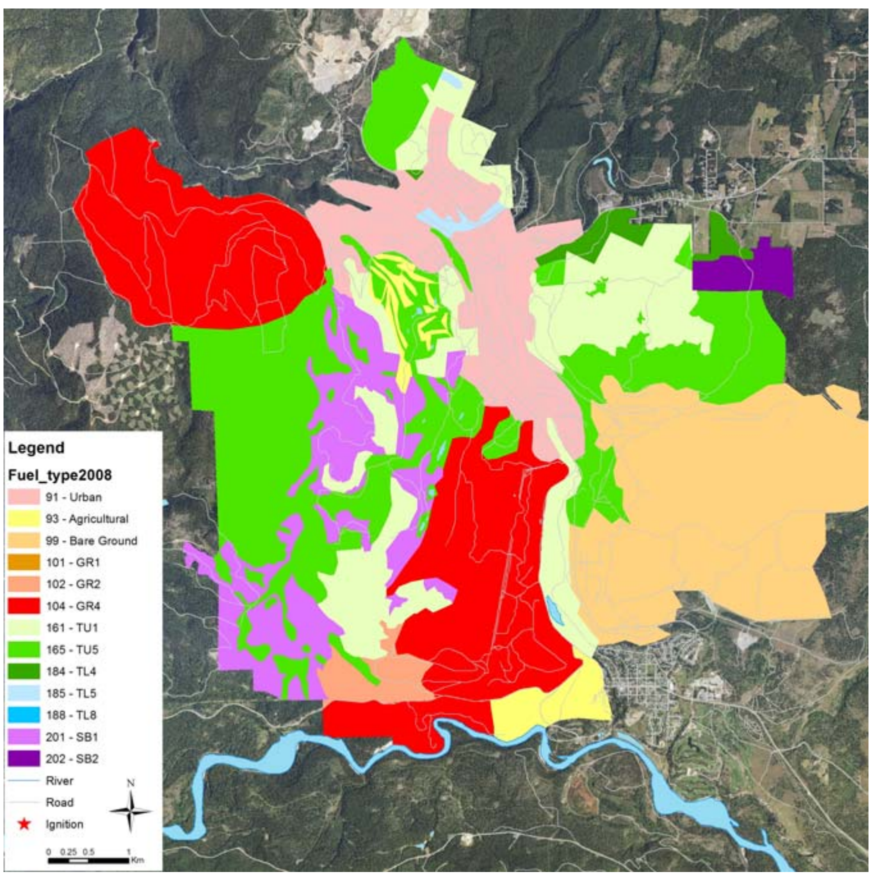

Figure 5. An example of the fuel typing layer in GIS that is used by the fire models FARSITE and FlamMap. In this case the fuel types are overlaid on the orthophoto for a portion of the analysis area.

Table 1. Fire environment values for the modeled problem fire.

Fire Environment Element	Value
Fuel moisture:	
1-hour	3%
10-hour	4%
100-hour	6%
Live herbaceous	40%
Live woody	50%
Foliar moisture content	70%
Temperature minimum	13
Temperature maximum	35
Relative humidity minimum	12
Relative humidity maximum	25
6-m Windspeed	40 km/h
Wind direction	200º

The Analysis Area

The analysis area (**Fig. 4**) extends from the St. Mary's River in the south, to Mathew Creek in the west, the ski hill and Meadowbrook to the north, and Concentrator Hill to the east.

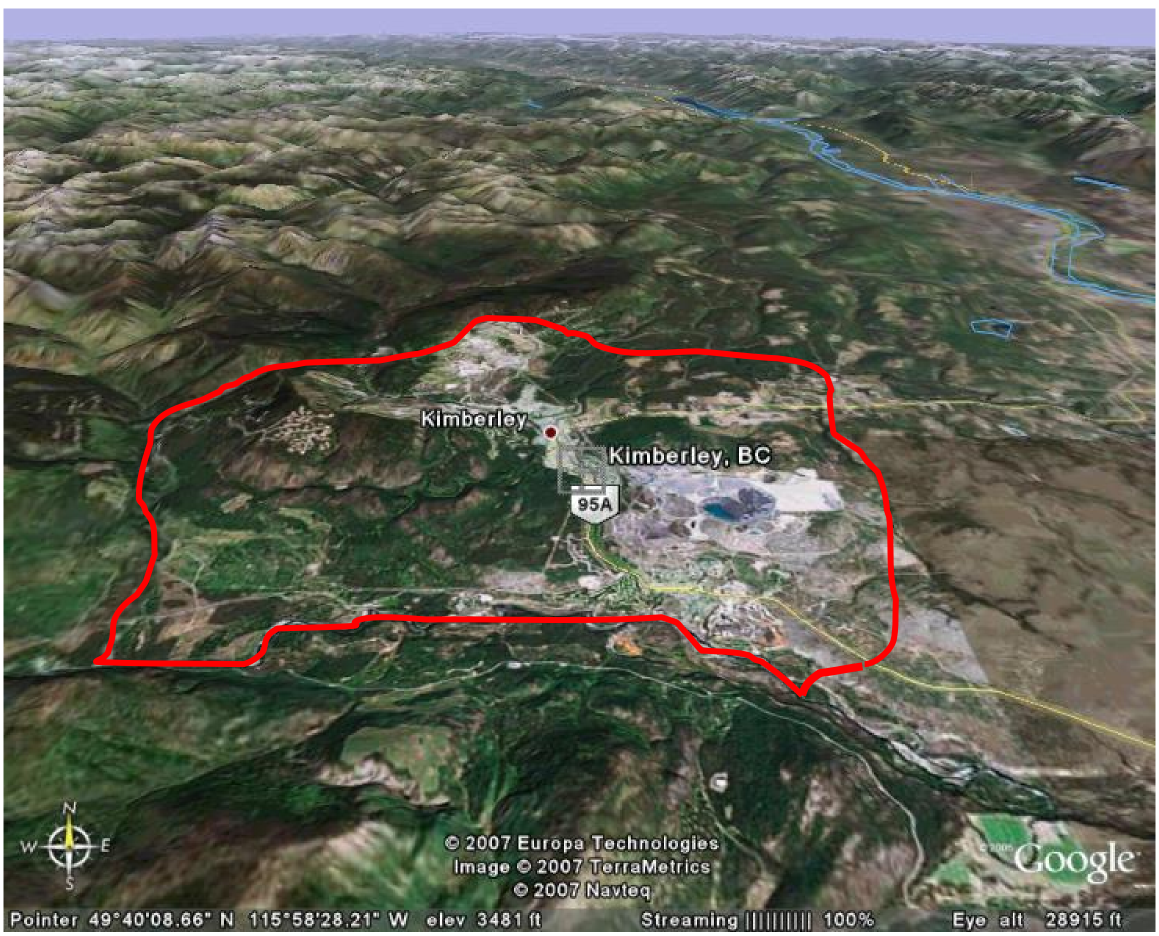

Figure 4. The proposed analysis area for Kimberley, including the communities of Marysville and Meadowbrook.

The last century has seen a significant number of wildfires impact Kimberley and the surrounding area (**Fig. 3**). Some have originated upwind of town, while others have started in town and spread to the east. What is fairly obvious from the historical fire map is the general spread direction of most fires: southwest to northeast. As for where the problem fire is likely to occur we can often rely on fire risk statistics; this is a spatial assessment of where the highest number of ignitions have occurred or where we believe the highest number of potential ignitions (threats of ignition) could occur. In the case of Kimberley, the combination of lightning strike occurrences plus the threat of human ignitions suggests that the problem fire would originate in the St. Mary's River Valley.

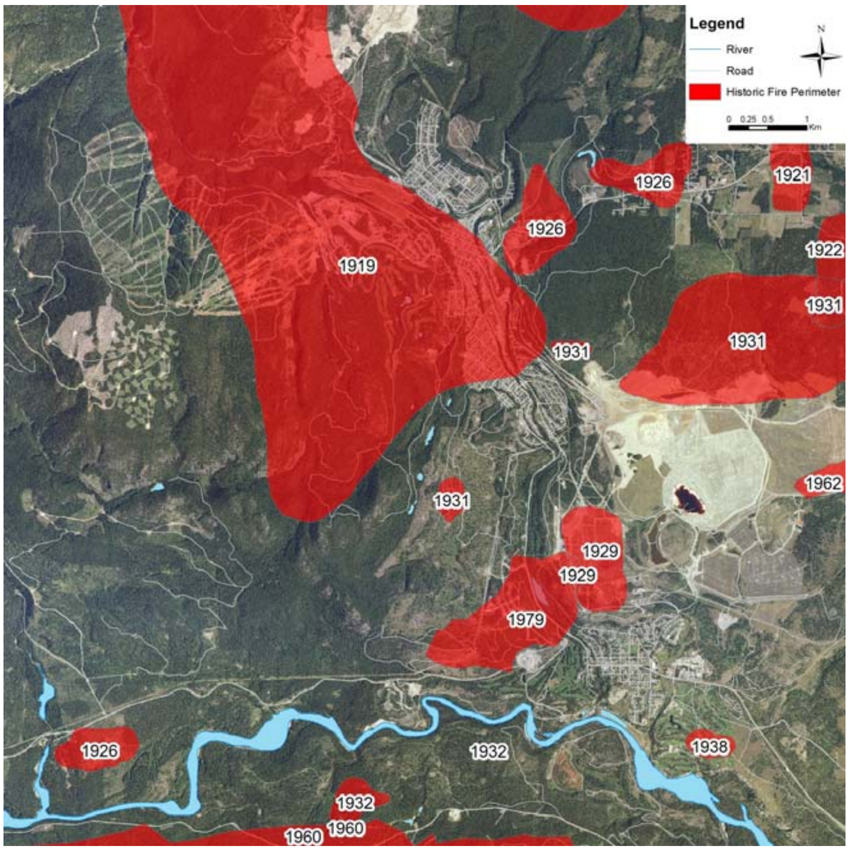

Figure 3. Current century wildfires within the SPOT analysis area. This data is useful for identifying some of the elements of the problem fire.

Unfortunately, the only data we have on the historic fires is the approximate location (early century fire perimeter mapping was not highly accurate); versus highly detailed information on fire behavior. Besides wind direction, other elements of the fire environment have to come from local weather station data; in this case the Cranbrook Airport. In the typical SPOT analysis, or Fireshed analysis as conducted in California, and in other wildfire hazard analysis, the 95th percentile fire environment values are used to define the conditions under which the problem fire would occur. For this analysis we considered both the statistical values from the nearest weather station plus we looked at the conditions under which the Lamb Creek Fire burned. This particular fire would easily fit the definition of the problem fire considering how and where it burned and its potential consequences. The weather station plus Lamb Creek Fire data are listed in **Table 1.**

Assets and protection targets may include houses and other structures, private land where fire is considered unacceptable, sensitive wildlife habitat, and local watersheds that may be destabilized by catastrophic fire.

3. Define the analysis area on a map

It is important to define an analysis area that is of an appropriate size for containing an entire problem fire event. Consideration should be given for how fire burns across the local landscape. Artificial boundaries like ownership lines, or roads may not be sufficient barriers to the spread of a problem fire. Depending on the scale of the perceived problem fire, appropriate analysis areas may be in the 1,000's of hectares, including one to several canyons and watersheds. It is also important that the defined analysis area be small enough for designing treatments and keeping complexity to a minimum.

4. Design treatment patterns to mitigate the problem fire and meet a range of objectives

Among the members of the collaborative team exists a range of concerns – as well as expertise – relating to treatment design. It is important to focus on addressing this range of objectives but also to keep in mind that it is impossible to cover all issues and contingencies initially. At this point, concentrate on designing fuel treatments according to the best knowledge of your team. These treatments will then be tested with the fire behavior model to evaluate how well they accomplish the goal of reducing the size or intensity of the problem fire.

5. Test treatment patterns with FARSITE or FlamMap; adjust and re-test

Next, fire behavior analysts and GIS specialists will assess your treatment patterns and test how well they mitigate the problem fire potential on the landscape. As you digest the model output and learn how your treatments effect – or fail to affect – the problem fire, you may want to redesign and improve your treatment plan. Test it again and evaluate how treatment performance may be improved.

6. Display the trade-offs

Gaming different treatment patterns on the landscape has now given the team a range of possible results concerning the problem fire. These trade-offs or pros and cons may be displayed graphically, in a table, or in a screen-capture showing the spatial representation of potential fire spread or behavior on the landscape.

Data Preparation for the Kimberley Workshop

In advance of the two-day workshop, a great deal of background work has been completed defining the "problem fire," defining the analysis area, and building a number of treatment patterns.

Kimberley's "Problem Fire"

The "problem fire" is defined by where it is likely to originate on the landscape, and the conditions (i.e., windspeed, direction, fuel moisture, etc.) under which it is likely to occur.

Why is SPOTS necessary?

The SPOTS concept contributes to an overall understanding of the spatial dynamics of fuel and related fire behavior through the use of a collaborative planning process and fire modeling tools that describe fire potential on a specific landscape. The SPOTS approach considers trade-offs between multiple treatment options by gaming fire scenarios with fire behavior and spread modeling software. SPOTS is designed not only for fire and fuel planning, but rather as a holistic land management process. While problem fire is the filter through which potential treatment patterns are tested, the objectives of many planned treatments are related to timber management, silviculture, forest health, wildlife, and watershed issues, as well as protection of assets from unwanted wildland fire. Strategically placed treatments have potential to add value to hectares treated by affecting large fire spread and effects at the landscape level. Better than simply assessing fuel treatment success by "hectares achieved," the SPOTS approach assesses the effectiveness of treatment design by comparing the pros and cons of a variety of tested treatment options.

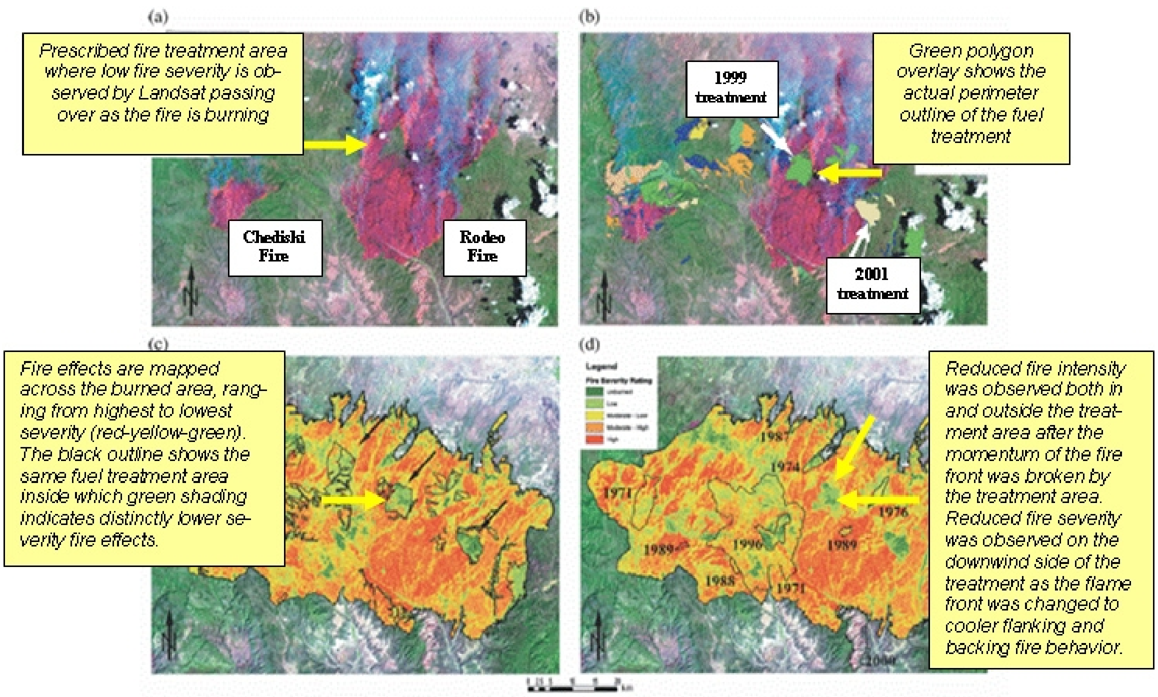

Figure 2. The effects of fuel treatments on the spread and severity of the Rodeo-Chediski Fire.

Steps in the SPOTS Process

1. Define the "problem fire"

Different areas have different issues in terms of fuel and fire behavior. Studying past fires helps to clarify the particular "problem fire" for the specific area. Problem fires may include large, hard to control weather-driven events, fires in which smoke levels become unacceptable, or wildland-urban interface fires.

2. Identify assets and protection targets

STRATEGIC PLACEMENT OF TREATMENTS WORKSHOP

What is SPOTS?

The “**S**trategic **P**lacement **O**f **T**reatments” or “**SPOTS**” strategy is an interdisciplinary, collaborative, landscape-scale planning approach centered around fuel treatment design to address fire threat.

SPOTS Theory

While fuel reduction treatments have proven effective in changing fire behavior and effects at the individual stand level (**Fig. 1**), the more complex issue of changing landscape-scale fire behavior, fire effects, and suppression costs may also be addressed through fuel treatments if they are applied in a deliberate, strategic pattern at meaningful scales. Evidence of fuel treatment patches altering the progression of an extreme fire event was observed and documented during the Rodeo-Chediski Fire in Arizona in 2002. Areas treated by prescribed fire before the Rodeo-Chediski wildfire not only altered severity and fire effects within their area, but also reduced fire severity on downwind hectares (**Fig. 2**).

Figure 1. Aerial view of the 2005 Camp 32 Fire in northwest Montana (just east of Lake Kocanusa). The wildfire spread as a crown fire from the west (left) until it encountered a thinned and burned area to the east of the road running through the center of the photograph. Once the fire hit the treated area it spread only through the surface and under much lower intensity. Hand crews were able to easily stop the spread of the fire once it hit the treated area.

Researchers have sought the optimum spatial pattern for disrupting large fire spread in the modeling environment. Various treatment patterns of the same landscape proportion (20%) were tested using FARSITE to determine their effects on over-all fire size. This research revealed that the ultimate size and severity of an unplanned ignition may be greatly reduced if treatment units are placed in a staggered, overlapping pattern that is perpendicular to the prevailing wind and treatment prescriptions are sufficient to reduce expected rate of spread and flame length.