FIRE BARRIER

HIGH CONSERVATION VALUE 4, QUESTION 15

Are there forest that provide a critical barrier to destructive fire (in areas where fire is not a common natural agent of disturbance)?

BACKGROUND

The HCVF Framework for Canada states: "This issue was raised by tropical forest ecologists and the writing team cannot identify any forest ecosystems in Canada where this basic service can be provided. However, we are leaving this item until consultation and/or application confirms its relevance."

The basis of the specific framework question clearly does not apply well to boreal forests, where fire is not only common, but is a critically important, pervasive natural disturbance. Indeed, boreal forests especially in western North America are structured by large wildfires (Johnson *et al* 1998, Weber and Stocks 1998). Fire in the boreal region has important social, economic, and ecological effects and thus we suggest that natural fire patterns should be considered when identifying areas of high conservation value and in developing best practices for forest management.

Change in forest composition or climate, fire suppression or loss of riparian forests could all impact forest fire dynamics in any boreal region. Indeed, natural fire barriers are relevant in determining naturally patchy patterns of fires in the boreal. These natural barriers include riparian vegetation, wetland soils, lake margins, and in some cases, ridge tops. Likewise more fire prone areas within the forest, including jack pine, lodgepole pine and black spruce stands and sites with sandy soils are equally important for maintaining the dynamic and patchy nature of fire on boreal landscapes. Maintaining fire and other natural disturbance regimes is an important factor in natural forest regeneration, maintaining diverse wildlife habitats, and perpetuating a fully functional ecosystem – in short, for maintaining a diversity of high conservation values within boreal forest ecosystems.

Further, as more forestland is developed with industrial infrastructure and as communities within and adjacent to forests grow, the possibility of destruction from uncontrolled fires increases and wildland fire management becomes more challenging. Often the response in these situations is to suppress fire, ultimately leading to decreased forest productivity and ecological conditions that are outside the range of natural variation. Contrary to popular belief, fire suppression in boreal forests where closed canopy ecosystems and crown-fire regimes dominate, may not lead to increased fuel loads and create conditions for catastrophic fires (Johnson *et al.* 2001).

There are likely limited cases in which forest areas in Canada will be identified as a "critical barrier to destructive fire". Rather, in this section, we consider two general areas of investigation that may lead to the identification of HCVFs related to fire dynamics. One issue to consider is whether the trend in fire disturbances is within natural ranges of variation. Related to this, a spatial assessment of fire risk or potential (*e.g.* whether forest areas are more fire-prone or are fire breaks) and active fire suppression may help to determine whether particular forest areas play a role in a healthy fire cycle.

DATA SOURCES

Data sources that would be relevant to addressing the issue of forest areas as a barrier to fire in critical situations include:

- Regional fire histories
- Regional or local fire boundary maps
- Historical aerial photography
- Soils maps
- Hydrologic features maps
- Biogeoclimatic Ecosystem Classification (BEC) in BC: http://www.for.gov.bc.ca/hre/becweb/

The Canadian Forest Service provides a variety of resources for understanding and predicting wildland fires:

- Large scale fire Regime Analysis for Saskatchewan: http://fire.cfs.nrcan.gc.ca/research/management/ifm/regime_e.htm
- SPARKY - Lightning-Caused Fire Occurrence Prediction Model (for Quebec and BC): http://fire.cfs.nrcan.gc.ca/research/management/fop/sparky_e.htm
- PEOPLENET - Ecoregion/Ecodistrict People-Caused Fire Occurrence Prediction Model (for Quebec): http://fire.cfs.nrcan.gc.ca/research/management/fop/peoplenet_e.htm
- Predicting Future Fire Regimes- Incorporating Fire Occurrence Prediction with Regional Climate Model (RCM) Projections to Predict Future Fire Regimes http://fire.cfs.nrcan.gc.ca/research/management/fop/rcm_e.htm

ADDITIONAL GUIDANCE

Natural disturbance regime of the region

Sustainable forest management requires a thorough understanding of current and past natural disturbance patterns including regional fire regimes.

A region's fire regime is defined according to the characteristics of natural fires including intensity, frequency, severity, season, extent, duration, behaviour, spatial distribution, and type of fire. Fire regime characteristics are the result of many different factors (*e.g.*, climate, vegetation composition, landform, *etc.*) operating at different spatio-temporal scales. The fire regime may differ markedly between ecozones and ecoregions. For example, the fire cycle values of the three ecozones in Saskatchewan are 267, 98, and 114 years for the Boreal Plain, Boreal Shield, and Taiga Shield, respectively (CFS 2004).

Vegetation composition and seral class distributions are useful for predicting likely fire size and distribution at a local and regional scale. For example, Cumming (2001) developed a parametric model to predict the distribution of large fire sizes within boreal forests. Within his study region of boreal mixedwood forests in Alberta, Cumming found that the expected size of a fire is positively related to the abundance of pine-dominated stands in the vicinity of ignition, and negatively related to the abundance of previously disturbed areas. This type of analysis paired with a predictor of ignition (*e.g.*, The Wildfire Ignition Probability Predictor System (WIPP) developed by the Canadian Forest Service (CFS): http://fire.cfs.nrcan.gc.ca/research/management/fop/wipps_e.htm) can help managers identify fire prone areas within an FMA.

<u>What HCVs and processes are dependent on fire or shaped by fire</u>

Rare ecosystems, intact forest blocks, certain plant and animal species, forest regeneration, and other processes in boreal forests may be dependent on or shaped by fire. We recommend a cumulative effects analysis of all HCVs identified within an FMA relative to fire regime, including fire frequency and likely burn pattern. This analysis is part of what we recommend for Question 19 in this paper, and may be conducted while addressing Question 19.

<u>Understand what actions change fire regime</u>

Fire suppression, human caused fires, introduction of non-native species and a decrease in mean fire size due to fragmentation are all factors that may contribute to alteration of natural fire regimes. A warmer climate is predicted to cause changes in fire regime, declines in some boreal forest communities and changes in the structure of others (Chapin *et al* 2004, Carcaillet *et al* 2001). We recommend these factors be included in an analysis of fire regime relative to HCVFs within a FMA.

Spatial assessment of fire risk

<u>Identify fire prone vegetation and landforms within the FMA</u>

Jack pine, lodgepole pine and black spruce are the most fire-prone boreal tree species. All are fire-adapted species with serotinous cones, high ignition rates and high flammability. Landforms and areas underlain by sandy soils and with abundant rock outcrops tend to be dry and the most fire prone within boreal forests. While relationships between ignition, seasonality and vegetation type are complex, these basic fire-prone vegetation types, soils and landforms are easily identified and mapped from Forest Resource Inventory (FRI) data and soils and geology maps, or can be derived from ecological classification systems such as the Biogeoclimatic Ecosystem Classification (BEC) in BC (see above).

A larger scale approach to this question is to identify and map areas where there have been substantial changes in temperature and moisture regime. These changes will inform fire risk mapping based on stand and topographic parameters described above.

<u>Identify natural and man-made fire barriers</u>

Riparian areas including stream banks, floodplains, wetlands, islands and associated water bodies all act as natural fire barriers, and there is an inverse relationship between length of fire cycle and the mean distance to a water-break in boreal forests (Larsen 1997). During most of the natural fire season, early and mid-successional vegetation, including forbs and deciduous shrubs, saplings and trees have low ignition rates and low flammability. An exception exists during the early spring of most years in the North American boreal region when abundant sunlight and low humidity combine to create dry conditions prior to green-up and leaf-out.

Roads often create breaks in low intensity, ground and surface fires, but may not block the spread of high intensity crown fires. Likewise, seismic lines may or may not serve as fire breaks depending on the nature and condition of the vegetation and fire. Again, these features are easily identified and mapped from data that exists for most Forest Management Areas (FMAs).

<u>The Wildland-Urban-Interface (WUI)</u>

To maintain a fire regime within the range of natural variation it is important to consider the effect of fire suppression zones - known locations where fire will be suppressed if ignited. We recommend these areas be identified and mapped within FMAs.

SUMMARY OF RECOMMENDATIONS

Fire disturbances within natural ranges of variation:

- Understand the natural disturbance regime of the region and what actions may change the fire regime.
- Understand what HCVs and processes are dependent on fire or shaped by fire and conduct a cumulative impacts analysis

Spatial distribution of fire disturbance events:

- Identify fire prone vegetation and landforms within the FMA
- Identify natural and man-made fire barriers
- Consider the effect of fire suppression zones such as the Wildland-Urban-Interface.

LITERATURE CITED

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HCV4 Q15 – Fire Barrier

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