Canadian Forest Products Ltd.
Alberta Region
Grande Prairie Operations

Fire Modeling on CANFOR
Grande Prairie FMA Area

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1. Objectives

The objective of this analysis was to determine the Fire Ratings that currently exist on the land base. Using the fire rating system, the current inventory information can be assessed to infer the possible impact of activities on the land base with respect to future fire susceptibility.

2. Methodology

2.1 Tools

The tools used for this analysis were provided by the Alberta Fire Protection Branch. The AVI to FBP (AVI2FBP) program uses Alberta Vegetation Inventory (AVI) data to predict the fire behavior whereas the Crowning Susceptibility Model (CroSuM) uses information generated from the AVI2FBP model to create crowning susceptibility ratings.

2.1.1 AVI2FBP Model

This model uses the AVI data to classify the landscape into fuels types. These fuel types have different behaviours during a fire. All of the polygons within the dataset are classified using the 2.1 AVI specifications. When the file is classified with the FBP code, it can then be joined or related to an AVI polygon attribute file using Arcview or Arcinfo to enable viewing and mapping.

If any records are not classified and have not been assigned an FBP fuel type code, the program copies these AVI attribute records to a separate output file. The user must first determine whether there are any data inconsistencies. If the data is complete and valid, the file must be sent to the Provincial Forest Fire Centre (attention: Cordy Tymstra). The file will be reviewed and if required modifications will be made to the avi2fbp.exe program.

As AVI data sharing agreements are completed, AVI data is provided to the Resource Data Division (RDD). RDD completes QC and normalization of the data. The AVI data is then loaded into a spatial database. Once loaded, the AVI data is used by the Forest Protection Division to update their spatial databases within the Spatial Fire Management Information System.

2.1.2 CroSuM Application

The Crowning Susceptibility Model (CroSuM) evaluates Alberta Vegetation Inventory (AVI) polygons to determine their probable susceptibility to crowning in wild fire situations. The evaluation process looks at a series of stand composition attributes and generates a score for each category. This score for each evaluation category is then accumulated and the total score ranked according to where it falls within the CroSuM class ranges. The categories that are used for evaluation include the following:

1. Cover Type;
2. Crown Closure;
3. Ladder Fuels; and
4. Crown Bulk Density.

Based on rules that use AVI attributes to generate a point score for each of these categories the accumulated sum of these scores are fitted into discrete ranges representing Crowning Susceptibility Risk. The default risk classes and associated accumulated ranges listed in Table 1.

Table 1

Default Fire Risk Classes and Ranges for the CROSUM Model

Crowning Susceptibility Risk	Default Ranges
Low	0-129
Moderate	130-209
High	210-279
Extreme	280-330

This application has been developed at the Provincial Forest Fire Centre (PFFC). It evaluates AVI stands and generates a CroSuM table. This application evaluates both AVI and Fire Behaviour Prediction (FBP) attributes (in a DBF format) to generate the scores for each CroSuM attribute into a separate DBF table. This table can then be utilized in ArcView for validation and cartographic display.

2.2 Process

The fire analysis encapsulated 3 processes:

1. verification of the AVI data;

2. running the AVI2FBP and CroSuM applications; and

3. generating a fire-rating index for the current landbase and predicted future landbase.

2.2.1 AVI Data Verification

While the AVI2FBP and Crosum applications are the main tools used for this analysis, an initial check of the AVI data to ensure its validity is essential. This initial check can be performed with any database program, however in this case was performed with MS Access. Some data irregularities were found (Table 2) and are listed below:

- The first character in the codes was not entered for 2 and 3 digit codes. In essence this reduced data entry, while still being understood for the data entry and interpretation phases. This did pose a problem for this analysis because the programs did not recognize the coding.

- The stand structure field had the structure attribute and the stand structure modifier. This had to be separated into 2 fields, one for stand structure and one for the stand structure modifier. These codes were translated to the correct attributes as designated by the 2.1 AVI standards.

- The only other abnormality in the AVI data was an incorrect entry for the understory natural nonproductive category. Approximately 93 hectares of the FMA was classified with as “M”. There was no indication of what this value means so it was re-assigned to a null value.

These errors were corrected for the analysis but left unresolved in the original AVI data at this point.

Table 2

AVI Coding Errors

Field Name	Code in the Original AVI Data	Required Code
STD_STRUCT	MO	Stn_struct field – M Struct_mod* – 0
	M0	Stn_struct field – M Struct_mod* – 0
	M	Stn_struct field – M Struct_mod* – 0
	C4	Stn_struct field – C Struct_mod* – 4
	C5	Stn_struct field – C Struct_mod* – 5
US_STRUC	MO	Us_struc field – M Ustr_mod* – 0
	M0	Us_struc field – M Ustr_mod* – 0
	M	Us_struc field – M Ustr_mod* – 0
	C4	Us_struc field – C Ustr_mod* – 4
	C5	Us_struc field – C Ustr_mod* – 5
ANTHRO_VEG & US_ANTHVEG	A	CA
	IP	CIP
	IW	CIW
	P	CP
	PR	CPR
ANTH_NOVEG	IG	AIG
	IH	AIH
	II	AII
	SR	ASR
NAT_NONVEG	MB	NMB
	MC	NMC
	MS	NMS
	WF	NWF
	WL	NWL
	WR	NWR
US_NATNVEG	M	Null

2.2.2 AVI2FBP Application

The model requires valid Alberta Vegetation Inventory (AVI) data to run. Descriptions of the data can be found in Alberta Vegetation Inventory Standards Manual. The model requires the input data in dbase format. The field names should be remapped to match those in the text file provided with the application.

2.2.2.1 Re-mapping the Data

The first step in using the AVI2FBP application is to re-map the avi attributes. This is done by clicking on the button “Remap AVI Attributes”.

1. A screen will appear that has input areas and output areas. In the input area, add the newly exported dbf table (i.e. the dbf table that was exported which contains the database corrections) and click on the type of file, dbase in this case.

2. Click on the browse button to select the remap file, in this case navigate to the avidc.map text file and select it.

3. Specify an output file.

4. Perform the re-mapping.

After re-mapping has been completed, then start the fbp coding process, using the re-mapped database.

2.2.2.2 FBP Coding Process

1. In the input section of the program, select the re-mapped AVI attribute file by clicking the Browse button and navigating to its location. Also specify the database type, DBF OR INFO. Note that it may already by inserted into the area, the program may save the location from the previous re-mapping section.

2. Select a year for the program to calculate ages

3. In the output section, insert the names of the files for the FBP coded file and the unclassified record file. This unclassified record file provides and opportunity to perform error checking and validation to determine if the program is working correctly.

4. Select the dbf file Type

5. Then click on the button “Process Attribute File”.

Once the attribute file is processed, the unclassified records can be viewed within the program or can be viewed externally by importing the dbase file into access or opening the dbase file in foxpro, etc.

2.2.2.3 AVI2FBP Output

The process will produce 2 files, a file with the fbp codes (resultant file) for each polygon and a file which the program could not determine codes for, a reconciliation file. Review the reconciliation file to ensure that everything looks OK. Reasons for why records make not be able to be coded are, no data because it’s a recent cut block, etc..

NOTE: For the CANFOR data, a large number of the areas that were not classified was due to not having any species information in the database, these areas were also coded as Non-Forest within the COMPLAN simulations.

2.2.3 CroSuM Application

The CROSUM model has been redesigned to reduce the amount of potential errors and be a stand-alone product. The CroSuM application interface is separated into an input section and an output section.

2.2.3.1 Input Section

1. Add the AVI attribute file (the re-mapped avi attribute dbase file)

2. Add the FBP file.

2.2.3.2 Output Section

1. Enter the desired location and name of the output file that the program will generate.

2. Users can set the Ranking Ranges, but in this case the default was used.

3. Click on the button “Process CroSuM”

The model produces an attribute table with Crosum Rankings for susceptibility, FBP Codes, and the other data it generated from the default scoring indices and input information. This information should be displayed on the screen to allow easy interpretation. Then use an existing shapefile and join it using the polygon number field. The data can then be viewed and symbolized accordingly.

3. Results

3.1 Fire Model Results

The models that were used existing AVI data to classify the land base with respect to fire behaviour and crowning susceptibility in wild fire situations. Maps and GIS files were produced so the information can now be evaluated in a spatial environment. Table 3 shows the breakdown in area for FBP coded information and Table 4 has the area summary of the CroSuM model crowning susceptibility ratings for 1999.

Table 3

1999 Area Summary by FBP Classification

FBP Code	Description	Area (ha)
C-1	Spruce/Lichen Woodland	11,217.1
C-2	Boreal Spruce	197,087.3
C-3	Mature Jack or Lodgepole Pine	49,792.5
C-4	Immature Jack or Lodgepole Pine	432.8
C-7	Ponderosa Pine/Douglas Fir	635.5
D-1	Leafless Aspen	264,547.9
M-1	Boreal Mixedwood – leafless	28,158.2
NF	Non-Fuel	30,280.0
O-1A	Grass	60,971.5
UN	Unknown	8.1
WA	Water	4,874.9
Unclassified	N/A	1,154.1
Total Area		**649,159.9**

Table 4

1999 Area Summary by Crown Susceptibility Rating

CroSuM Code	Area (ha)
Non-forest	84,084.9
Low	326,133.0
Moderate	124,227.8
High	109,988.4
Extreme	4,722.8
Total Area	**649,156.9**

3.2 Incorporating the Fire data into the COMPLAN analysis

Once the initial run for the resultant is completed for 1999, the management activities have to be assessed with respect to fire and crowning susceptibility. The data from the fire

models and the COMPLAN input dataset did not have a correlation, therefore the approach used was to prioritize stands that were classified by the fire models as extreme and high for harvesting within COMPLAN. The stands classified as being extreme and high crowning susceptibility were targeted within COMPLAN using a yield table priority approach. The COMPLAN base case run (scenario 4) was re-run with this approach. For evaluation of the of the COMPLAN output a key assumption is that the species composition is not changing drastically over the 20-year period.

An area-weighted fire-rating index will be generated that assesses the activities on the land base. The process to perform this analysis will be as follows:

- Use the output from the CROSUM model to generate a Fire Rating Index for 1999.
- Identify the stands that are harvested in each period or quadrant, and exclude these from the Fire Rating Index calculation for each quadrant. By excluding the stands that were harvested this assumes that they will not contribute to the Fire Index during that timeframe.

The results for the analysis is illustrated in Tables 5 and 6 and Figures 1 and 2.

Table 5

Extreme and High Risk Area Summary
Comparison with Scenario 4C

Year	Scenario 4C	Scenario 7C
1999	114,711	114,711
2004	110,086	108,937
2009	106,274	103,750
2014	106,609	97,650
2019	99,196	92,929

Table 6

Fire Risk Index Area Summary
Comparison with Scenario 4C

Year	Scenario 4C	Scenario 7C
1999	127.2	127.2
2004	126.7	126.5
2009	126.5	126.0
2014	126.3	125.4
2019	126.0	125.0

Figure 1

Extreme and High Risk Area Summary Comparison with Scenario 4C

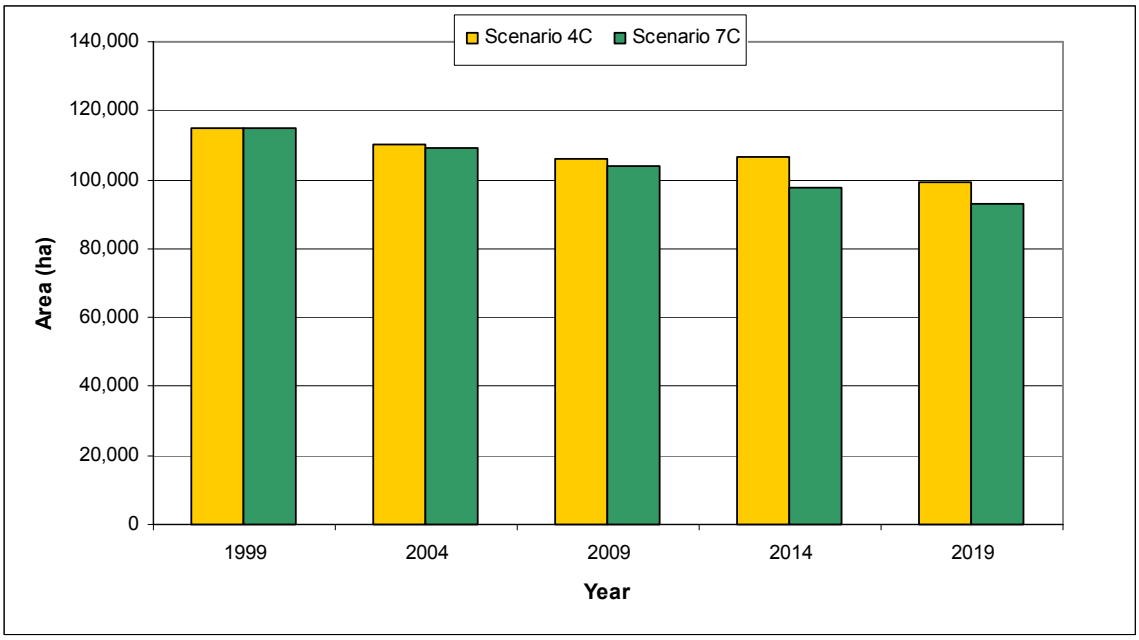
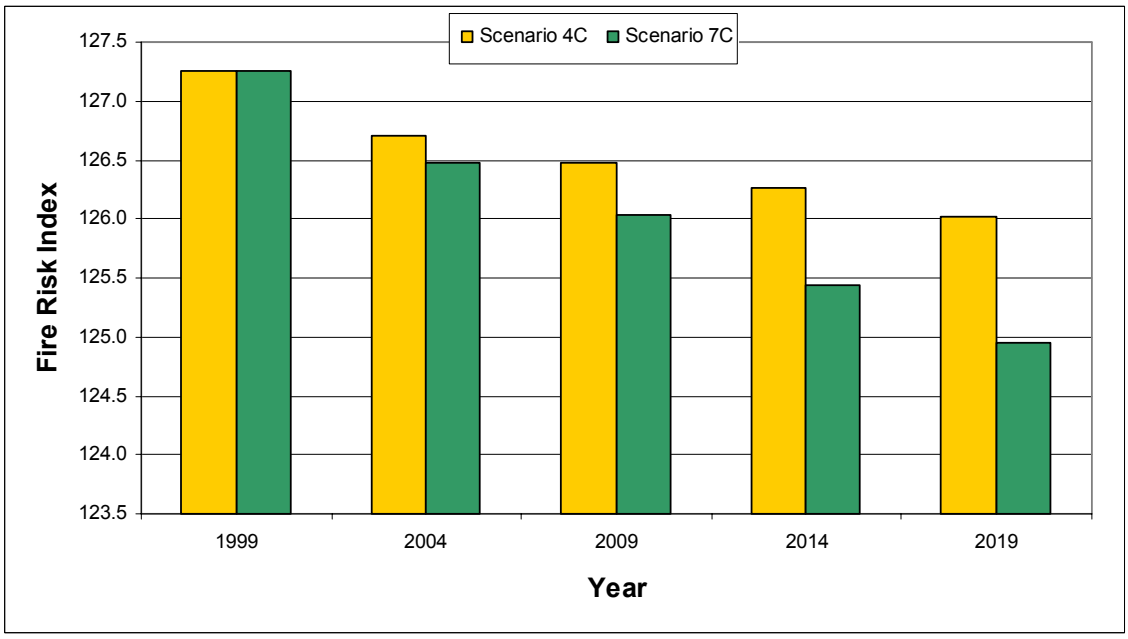


Figure 2

Fire Risk Index Area Summary Comparison with Scenario 4C



The results show that the area within the extreme and high fire risk classifications has been lowered by targeting the extreme and high risk stands as predicted by the fire models and the overall fire risk index to crowning has been lowered as well.