

# User's Guide for the Spruce Beetle Risk Rating Event Monitor Addfile<sup>1</sup>

Andrew J McMahan, INTECS International, Inc.  
Eric L Smith, USDA Forest Service  
February, 2002

Forest Health Technology Enterprise Team (FHTET)  
USDA Forest Service  
NRRC, Bldg A, Suite 331  
2150 Centre Ave.  
Ft. Collins, CO 80526-1891

\*\*\*\*\*

## Introduction

The Spruce Beetle Risk Rating Event Monitor (EM) Addfiles are two FVS keyword component files (*.kcp* files) that calculate a stand's hazard rating based on a system developed by Schmid and Frye (1976). The system is designed for spruce beetle (*Dendroctonus rufipennis* Kirby) in Engelmann spruce-subalpine fir (*Picea engelmannii* Parry, and *Abies lasiocarpa* (Hooker) Nuttall) forest types in the Central Rocky Mountains.

These EM addfiles do not schedule or perform any activities that affect the simulated stand. They only schedule COMPUTE statements that calculate (at every cycle-beginning year) a numerical "risk susceptibility score" that ranks the risk of stands to attack by the spruce beetle.

## Overview

This pair of EM addfiles ranks the risk of stands to attack by spruce beetles by considering four stand attributes (or **risk factors**):

- physiographic location and/or site index (SI)
- average DBH of Engelmann spruce greater than ten inches DBH
- stand total basal area
- proportion of spruce in the stand

Because physiographic location information is not available to the Event Monitor, the risk rating system has been written as two separate EM addfiles: one for use with creek bottom stands (*SB\_haz\_ck\_bottom.kcp*), the other for use with non-creek bottom stands (*SB\_haz\_NON\_ck\_btm.kcp*). It remains up to the user to assign the appropriate *.kcp* file to

---

<sup>1</sup>This document is part of a package containing a number of files: (1) this document, (*SB\_EM\_User\_Guide.pdf*); (2) a pair of FVS/Event Monitor addfiles (*SB\_haz\_ck\_bottom.kcp* and *SB\_haz\_NON\_ck\_btm.kcp*), which this document describes; and (3) one or more ArcView® legend files. The that can be used by the custom ArcView® project FVS-EMAP. The package, a self-extracting WinZip® file (*SB\_EM.exe*), as well as the FVS-EMAP project software, is available online at:

<http://www.fs.fed.us/foresthealth/technology/products.htm>

For more information, contact: Eric Smith: email: [elsmith@fs.fed.us](mailto:elsmith@fs.fed.us) phone: 970 295-5841

each simulated stand, depending upon whether or not the stand is located in a well-drained creek bottom.

Stands are assigned risk values of 1, 2, or 3, for each of four risk factors listed above, depending upon the stand conditions for each of the risk factors. A final risk rating score is determined from the sum of the four risk factor values. The conditions defining each risk factor value are presented in Table 1, below.

**Table 1. Risk factors considered in the Spruce Beetle Risk Rating EM Addfile. A stand is assigned a risk factor value (column one) for each risk factor, depending upon the stand condition for each risk factor. The overall risk rating is the sum of the four risk factor values. Site indices (SI) are on 50-year basis.**

Risk Factor Value	Spruce Beetle Risk Rating RISK FACTORS			
	Physiographic location / Site Index	QMD of spruce >10" DBH (inches)	Stand Basal Area (Ft <sup>2</sup> )	Proportion of stand that is spruce <sup>2</sup> (%)
3	Spruce on well-drained sites in creek bottoms.	>16	>150	>65
2	Spruce on sites with a SI <sub>50</sub> ≥ 52 (ft.).	12-16	100-150	50-65
1	Spruce on sites with a SI <sub>50</sub> < 52 (ft.).	<12	<100	<50

The site indices in the table above are on a 50-year basis. Schmid and Frye (1976) use 100-year basis site indices (SI<sub>100</sub> threshold = 80 feet). Our conversion to 50-year basis is determined from site index tables by Alexander (1967). Note that site indices in FVS may be on a 50-year basis or a 100-year basis, depending upon the geographic variant of FVS in use. Users will need to determine what basis (100-year, 50-year, or other) their FVS variant uses, and adjust the Event Monitor thresholds accordingly (see following sections).

Schmid and Frye group the final hazard rating numeric scores into five qualitative ratings: low, low-to-moderate, moderate, moderate-to-high, and high (Table 2). The addfile only reports the numerical rating. It remains up to the user to determine the qualitative rating.

**Table 2. Schmid and Frye's qualitative interpretation of the numerical risk rating scores.**

If the total score is...	The qualitative risk rating is...
4-5	<b>LOW</b>
6	<b>LOW-MODERATE</b>
7-9	<b>MODERATE</b>
10	<b>MODERATE-HIGH</b>
11-12	<b>HIGH</b>

<sup>2</sup> Schmid and Frye (1976) describe this stand characteristic as "proportion of spruce in the canopy", though they do not define this quantity. We define the proportion of spruce in the stand as: the basal area of spruce divided by the basal area of all trees; and we consider (for both numerator and denominator) only trees having a DBH greater than 2.6 inches.

## **Using the Spruce Beetle Risk Rating Event Monitor Addfile**

Note: the instructions below assume that the user wants to download the entire “package” (addfiles, documentation, & ArcView legend(s)). Users not desiring the entire package may, instead, download the EM addfiles (\*.kcp files) by themselves, in which case the reader should begin at step 3 (after downloading).

- 1) Download the file *SB\_HAZ.exe* by following the link from FHTET’s **Products** website at:

<http://www.fs.fed.us/foresthealth/technology/products.htm>

This WinZip® self-extracting file contains a number of files:

- i) the EM addfile for use with creek bottom stands: (*SB\_haz\_ck\_bottom.kcp*);
  - ii) the EM addfile for use with non-creek bottom stands: (*SB\_haz\_NON\_ck\_btm.kcp*);
  - iii) this User’s Guide: (*SB\_HAZ\_EM\_User\_Guide.doc*); and,
  - iv) at least one optional ArcView® legend file (*sb\_hazrd.avl*) to be used with FVS-EMAP. (More *.avl* files may be added in the future). See next section for more information about FVS-EMAP..
- 2) After downloading, begin the extraction process by double-clicking the self-extracting WinZip® file (*SB\_HAZ.exe*). Although the files may be extracted to anywhere on your computer; we recommend that you allow the extraction procedure to place the files into the default extraction destinations. By default, the EM addfiles and the User’s Guide will be extracted to **C:/fvsdata**; and the ArcView legend file(s) will be extracted to **C:/fvs\_emap/legends**.<sup>3</sup>
  - 3) Before adding the *SB\_haz\_NON\_ck\_btm.kcp* EM addfile to a simulation<sup>4</sup>:
    - i) verify that you are running an FVS variant that recognizes site index.
    - ii) check the FVS Keyword Guide to see what SI basis FVS is using for Engelmann spruce. The addfile—as downloaded—is configured for a 50-year site index (SI). If the FVS variant you are using uses something other than a 50-yr basis SI, you will need to convert the SI thresholds in the *.kcp* file (see next section).
    - iii) Check what the default site species is for the variant you are using, and if it is not Engelmann spruce, then either (1) using the SITECODE keyword, define Engelmann spruce (ES) as the site species, or (2) make sure that whatever the site species is, its site index is the same as the SI for Engelmann spruce (see next section).

Be sure to save the edited *.kcp* file before continuing.

- 4) Launch Suppose and build your FVS simulation (keyword) file.
- 5) Select the *Group* or individual *Stand* to which you want include the EM addfile by (1) toggling the applicable radio button (‘Current Group’ or ‘Current Stand’) in the main FVS ‘Selections’ window, and (2) selecting the applicable group or stand from the window above the ‘Change Group Membership’ button.

---

<sup>3</sup> Thus, the default extraction procedure for this package assumes you are using the default directory structure provided with FVS-EMAP. If your installation of FVS-EMAP is different, then you will want to extract the *.avl* file(s) to your FVS-EMAP project directory’s ‘Legends’ subdirectory. Both extraction and use of the *.avl* file(s) are optional.

<sup>4</sup> If you are using the EM asddfile for use *with* creek bottom stands (*SB\_haz\_ck\_bottom.kcp*) then this step is unnecessary, as site index is not used.

- 6) Select 'Edit Simulation File' from the main Suppose 'Selections' window.
- 7) Select 'Insert from file'.
- 8) Navigate to the directory where the .kcp file is located.
- 9) Select the file from the window browser; click 'Open'. The file is now included to all stands in the current group (or to the current stand—see step 5).
- 10) 'Close' the 'Edit Simulation File' window.
- 11) Continue building the simulation file, and when done, click 'Run Simulation'.

### **Special Considerations: Adjusting the Site Index**

This section applies to simulations using the Spruce Beetle Risk Rating Event Monitor addfile for use with **non**-creek bottom stands (*SB\_haz\_NON\_ck\_btm.kcp*). If you are using the Spruce Beetle Risk Rating Event Monitor for use with creek bottom stands (*SB\_haz\_ck\_bottom.kcp*), this information is moot; it does not use site index.

There are two “places” in your simulation where site indices may need to be adjusted: (1) in your input file(s), where the site index for Engelmann spruce will be defined for the stand, and (2) in the EM addfile *SB\_haz\_NON\_ck\_btm.kcp*, where the risk rating system's threshold site index is defined.

#### **Adjusting the Input Site Index**

Each geographic variant of FVS has default site indices for every tree species recognized by that variant. If your stand has an Engelmann spruce site index different than the default value, you may need to redefine the site index for Engelmann spruce via the SITECODE keyword. (This may have already been done when the stand inventory data were made FVS-ready.) If you are using Suppose, you may redefine the site index for a species (by stand) via the option 'Edit Stand List Files' from the 'Options' menu.

In addition to defining the correct site index for Engelmann spruce, you must also define Engelmann spruce as the **site species**. In FVS, you may re-define the site species by one of two methods depending upon whether you are using keyword SITECODE once, or more than once.

If you are using the SITECODE keyword only once (e.g. to define the site index for only one species), then the use of a single SITECODE keyword will result in the one species being defined as the site species (thereby over-riding the default site species). For the purposes herein, this method will work if the one instance of SITECODE is for Engelmann spruce.

If, on the other hand, you are defining site indices for more than one species (hence using the SITECODE keyword more than once), you should enter a non-zero value in field three of keyword SITECODE *in the instance of the keyword that defines the SI for Engelmann spruce*. Doing so defines this species as the site species.

Alternatively, if the site species is not Engelmann spruce, but the site species has a site index value that is the same as the site index value for Engelmann spruce, the EM addfiles will work appropriately. The important thing to know is that the Event Monitor, in evaluating the site index criteria in the addfile, is accessing the site index *for the site species* (as FVS interprets the site species to be). As long as the SI for the site species is the value you want to use, all will work fine.

*Adjusting the Threshold Site Index in the EM Addfile*

Site indices in FVS may be on 50-year, 100-year, or other-year basis, depending upon the geographic variant and on the tree species. The site indices in your FVS input data should be on the same basis as the site indices recognized by the FVS variant you will be using.<sup>5</sup>

The Spruce Beetle Risk Rating Event Monitor Addfile—as downloaded—is configured to evaluate site indices on a 50-year basis (SI<sub>50</sub>). If your Engelmann spruce site index is on a 100-year basis (SI<sub>100</sub>), you will need to adjust the threshold values in the Event Monitor addfile (*SB\_haz\_NON\_ck\_btm.kcp*).

To adjust the threshold values, open the kcp file in a text editor, comment out the lines you want the program to ignore by inserting leading exclamation points, and “un-comment out” lines you want to activate (by removing leading exclamation points).

For example, if you are using SI<sub>50</sub> values for Engelmann spruce, the applicable section of the addfile should appear as below, (as it does upon download—no editing is required):

```
IF
SITE GE 52
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!! Comment out the line above, and "un-comment out" the
!! line below if you want the 100-year SI threshold.
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!! SITE GE 80
THEN
```

If you are using 100-year Engelmann spruce site index, the edited kcp file should appear:

```
IF
!!SITE GE 52
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!! Comment out the line above, and "un-comment out" the
!! line below if you want the 100-year SI threshold.
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
SITE GE 80
THEN
```

Alternatively, you may type in some other SI threshold value you may want to use (in place of the “52” or the “80”). Note, however, that by altering the threshold value, you are altering the nature of the risk rating system as proposed by Schmid and Frye. Also note that the excerpted example above only depicts the first of two instances referring to site index. There is a subsequent line in the addfile (the evaluation of the “less than” condition) that will likewise need to be adjusted (see Appendix).

Be sure to save your edited version before including the file into an FVS simulation.

---

<sup>5</sup> Note: A few FVS variants do not use or recognize site indices at all. Thus, this EM addfile will not work with these variants: Central Idaho (CI), Eastside Cascades (EC), and North Idaho (NI).

## **Output**

If you want the Event Monitor output variables written to a file other than the standard FVS output file, you may request one or more of the post-processors that will create separate COMPUTE variable output files. These are accessible via the ‘Select Post Processors’ button from the main Suppose ‘Selections’ window. Three different types of output files are available for COMPUTE variables (via three different post-processors). In the ‘Select Post Processors’ window, the choices are:

- Compute1-Table of COMPUTE Variables (with headers)  
*This post processor produces a file of all COMPUTE variables displayed by stand and by year in a table with headers. The file has a filename extension “.cmp”*
- Compute2-Table of Concatenated COMPUTE Variables (comma delimited)  
*This post processor produces a file of all COMPUTE variables by stand, and by year, in a comma-delimited (machine readable) format. The file has a filename extension “.cp2”*
- Compute3-Table of COMPUTE Variable Averages  
*This post processor creates a file containing averages (across stands, by year) for all COMPUTE variables. The file has a filename extension “.avc”.*

## **Displaying Event Monitor Output in ArcView®**

Output from this EM addfile, written to a .cp2 file (via the Compute2 post processor), may be conveniently brought into ArcView® via **FVS-EMAP**. FVS-EMAP is a custom ArcView® project developed by FHTET, and available for download from FHTET at:

<http://www.fs.fed.us/foresthealth/technology/products.htm>

Users having an ArcView® shapefile (or an ARC/INFO® coverage) of the stands simulated in FVS, can use FVS-EMAP to **join** the FVS output data with their shapefile, resulting in **map displays** of user-defined COMPUTE variables over simulated time.

The ArcView® legend file that accompanies this package, while not necessary for the ArcView® project to work, facilitates the map creation process when making risk rating maps based on this application’s output. If the legend file resides in the ‘Legends’ subdirectory—immediately subordinate to FVS-EMAP’s project directory—then it will be available to the FVS-EMAP ArcView® project to be automatically loaded whenever a spruce beetle hazard rating score is to be mapped. See footnote 3.

**References:**

Alexander, Robert R. 1967. Site indexes for Engelmann spruce. USDA Forest Service Research Paper RM-32. Rocky Mountain Forest and Range Exp. Sta., Ft. Collins, CO. 7pp.

Crookston, Nicholas L. 1990. User's guide to the Event Monitor: Part of Prognosis Model Version 6. USDA Forest Service Gen. Tech. Rep. INT-275. Intermountain Res. Sta., Ogden, UT 29pp. [Electronic Version (modified Sept. 2001) available online: [http://www.fs.fed.us/fmsc/fvs/documents/gtrs\\_event\\_monitor.php](http://www.fs.fed.us/fmsc/fvs/documents/gtrs_event_monitor.php) (last accessed 11/01)]

Schmid J.M., and R.H. Frye. 1976. Stand Ratings for spruce beetles. USDA Forest Service Res. Note RM-309. 4pp.

\*\*\*\*\*

FVS software and documentation is available from the Forest Management Service Center, online at:

<http://www.fs.fed.us/fmsc/fvs/>

For further information, contact Eric Smith at: [elsmith@fs.fed.us](mailto:elsmith@fs.fed.us) . 970 295-5841

# Appendix

Note: users may "clip" the information below into a separate files and use them as FVS addfiles. Copying this information to their own files should be done in such a way as to preserve column spacing. The mono-spaced Courier font used below preserves column spacing.

\*\*\*\*\*

## The *SB\_haz\_NON\_ck\_btm.kcp* Event Monitor Addfile

[For use with *non*-creek bottom stands.]

```
! Event Monitor Program to calculate Spruce Beetle Risk Rating
! Based upon Schmid and Frye 1976
! (Stand Ratings for Spruce Beetles.  RMF&RES,  USDA FS,  Research Note RM309)
!
! Physiographic location is one of the risk rating system's criteria.  This
! location information is not available in the Event Monitor.  Thus, users
! will need to identify these stands and then place them into their own
! "groups" in FVS/Suppose and attach the appropriate Event Monitor addfile
! to the appropriate groups.
!
! This Event Monitor file is for use with non-creek bottom stands.
! A separate Event Monitor file should be used for creek bottom stands.
!
! The system:
!
! RISK FACTOR
!   VALUE   PHYSIOGRAPHIC LOCATION   DBH(of trees>10")   STAND BA   %SPRUCE
!     3     Creek bottoms             >16"              >150       >65%
!     2     SI(100)>= 80               >12-16"          >100-150   >50-65%
!     1     SI(100) < 80              10-12"           <=100     <=50%
!
! Total risk is then determined by summing the risk factor values for the 4
! criteria.
!
! Note: SI in table above is on 100-year basis.  Some FVS variants (e.g. UT)
! use 50-year SIs.
! THIS EVENT MONITOR USES 50-YR SIs!  Threshold of SI=80 (100 yr) translates
! to SI=52 at 50 yrs (From Alexander site index curves for Englemann spruce,
! USDA FS Res. Pap. RM-32, 1967.)
! *****
!
! This Event Monitor written 11/01 by A J McMahan (INTECS International, Inc.)
! for the Forest Health Technology Enterprise Team, USDA Forest Service,
! 2150 Centre Ave., Bldg. A, Ft. Collins, CO 80526-1891.
!
! Contact:  Eric Smith      970 295-5841 (email:  elsmith@fs.fed.us)
!
! *****
!
! Variable Names:
!
! SB_HAZRD = Spruce Beetle Hazard Rating
!   Note: The Spruce Beetle Hazard Rating equals the sum of the 4 component
!   rating factors (SBF1, SBF2, SBF3, SBF4), ** UNLESS ** : (1) there is no
!   spruce in the stand with a dbh >= 10" (in which case the rating will be
!   "1"); or (2) less than 5% of stand BA is spruce, in which case the
!   overall rating is zero.
!
! QMD_SP10 = QMD OF SPRUCE GREATER THAN (or =) 10"
! TOT_BA   = TOTAL STAND BA
! PER_SPRC = PERCENT OF STND_BA THAT IS SPRUCE (of all trees >2.6"dbh)
! SITE_NDX = STAND SITE INDEX FOR THE SITE SPECIES
```



!! SITE LT 80

```
THEN
COMPUTE          0
SBF1=1
END
ENDIF
```

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!  
!!! SECOND FACTOR !!!  
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

```
IF
QMD_SP10 GT 16
THEN
COMPUTE          0
SBF2 = 3
END
ENDIF
```

```
IF
QMD_SP10 GT 12 AND QMD_SP10 LE 16
THEN
COMPUTE          0
SBF2 = 2
END
ENDIF
```

```
IF
QMD_SP10 LE 12 AND QMD_SP10 GE 10
THEN
COMPUTE          0
SBF2 = 1
END
ENDIF
```

```
IF
QMD_SP10 LT 10
THEN
COMPUTE          0
SBF2 = 0
END
ENDIF
```

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!  
!!! THIRD FACTOR !!!  
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

```
IF
TOT_BA GT 150
THEN
COMPUTE          0
SBF3 = 3
END
ENDIF
```

```
IF
TOT_BA GT 100 AND TOT_BA LE 150
THEN
COMPUTE          0
SBF3 = 2
END
ENDIF
```

```
IF
TOT_BA LE 100
THEN
COMPUTE          0
SBF3 = 1
END
ENDIF
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!  FOURTH FACTOR  !!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
IF
PER_SPRC GT 0.65
THEN
COMPUTE          0
SBF4 = 3
END
ENDIF
```

```
IF
PER_SPRC GT 0.50 AND PER_SPRC LE 0.65
THEN
COMPUTE          0
SBF4 = 2
END
ENDIF
```

```
IF
PER_SPRC LE 0.50 AND PER_SPRC GE 0.05
THEN
COMPUTE          0
SBF4 = 1
END
ENDIF
```

```
IF
PER_SPRC LT 0.05
THEN
COMPUTE
SBF4 = 0
END
ENDIF
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!! RISK RATING  !!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
IF
SBF1 NE -1 AND SBF2 NE -1 AND SBF3 NE -1 AND SBF4 NE -1 AND SB_HAZRD EQ -1
THEN
COMPUTE          0
SB_HAZRD = SBF1 + SBF2 + SBF3 + SBF4
END
ENDIF
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!  CONDITION: IF NO SPRUCE GREATER THAN 10 INCHES  !!!
!!!                THEN RISK IS VERY LOW                !!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
IF
SB_HAZRD GT -1 AND SBF2 EQ 0 AND (NOT (SBF4 EQ 0))
THEN
COMPUTE
SB_HAZRD = 1
END
ENDIF
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!  CONDITION: IF SPRUCE BA IS VERY LOW  !!!
!!!  THEN RISK VALUE IS ZERO    !!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
IF
SB_HAZRD GT -1 AND SBF4 EQ 0
THEN
COMPUTE
SB_HAZRD = 0
END
ENDIF
```

```
*****
```

## The *SB\_haz\_ck\_bottom.kcp* Event Monitor Addfile

[For use *with* creek bottom stands.]

```
! Event Monitor Program to calculate Spruce Beetle Risk Rating
! Based upon Schmid and Frye 1976
! (Stand Ratings for Spruce Beetles.  RMF&RES, USDA FS, Research Note RM309)
!
! Physiographic location is one of the risk rating system's criteria.  This
! location information is not available in the Event Monitor.  Thus, users
! will need to identify these stands and then place them into their own
! "groups" in FVS/Suppose and attach the appropriate Event Monitor addfile
! to the appropriate groups.
!
! This Event Monitor file is for use WITH creek bottom stands.
! A separate Event Monitor file should be used for non-creek bottom stands.
!
! The system:
!
! RISK FACTOR
!   VALUE  PHYSIOGRAPHIC LOCATION  DBH(of trees>10")  STAND BA  %SPRUCE
!   3      Creek bottoms           >16"              >150      >65%
!   2      SI(100)>= 80             >12-16"          >100-150  >50-65%
!   1      SI(100) < 80            10-12"           <=100     <=50%
!
! Total risk is then determined by summing the risk factor values for the 4
! criteria.
!
! Note: SI in table above is on 100-year basis.  Some FVS variants (e.g. UT)
! use 50-year SIs.
! *****
!
! This Event Monitor written 11/01 by A J McMahan (INTECS International, Inc.)
! for the Forest Health Technology Enterprise Team, USDA Forest Service,
! 2150 Centre Ave., Bldg. A, Ft. Collins, CO 80526-1891.
!
! Contact:  Eric Smith      970 295-5841 (email:  elsmith@fs.fed.us)
!
! *****
! Variable Names:
!
! SB_HAZRD = Spruce Beetle Hazard Rating
! Note: The Spruce Beetle Hazard Rating equals the sum of the 4 component
! rating factors (SBF1, SBF2, SBF3, SBF4), ** UNLESS ** : (1) there is no
! spruce in the stand with a dbh >= 10" (in which case the rating will be
! "1"); or (2) less than 5% of stand BA is spruce, in which case the
! overall rating is zero.
!
```

```

! QMD_SP10 = QMD OF SPRUCE GREATER THAN (or =) 10"
! TOT_BA = TOTAL STAND BA
! PER_SPRC = PERCENT OF STND_BA THAT IS SPRUCE (of all trees >2.6"dbh)
! SITE_NDX = STAND SITE INDEX FOR THE SITE SPECIES
! (Note that the default SITE species for FVS variants may not be
! Englemann spruce, hence if ES is not entered as the site species in the
! FVS keyword file, then the site index variable available to the Event
! Monitor may not be the SI for ES!
*****

```

```

!!!!!!!!!!!!!!!!!!!!!!
!!! INITIALIZE !!!
!!!!!!!!!!!!!!!!!!!!!!

```

```

COMPUTE          0
SBF1=-1
SBF2=-1
SBF3=-1
SBF4=-1
SB_HAZRD=-1

```

```

QMD_SP10 = SPMCDBH(5,ES,0,10,999)
TOT_BA = SPMCDBH(2,0,0)
PER_SPRC = SPMCDBH(2,ES,0,2.6,999) / SPMCDBH(2,0,0,2.6,999)

```

```

END

```

```

!!!!!!!!!!!!!!!!!!!!!!
!!! FIRST FACTOR !!!
!!!!!!!!!!!!!!!!!!!!!!

```

```

! assume this IS a creek bottom stand !
! (if it is a not creek bottom stand, a different *.kcp file should be
! attached, not this one!).
! Since we assume a creek bottom, Site Indices won't be used.

```

```

COMPUTE          0
SBF1=3
END

```

```

!!!!!!!!!!!!!!!!!!!!!!
!!! SECOND FACTOR !!!
!!!!!!!!!!!!!!!!!!!!!!

```

```

IF
QMD_SP10 GT 16
THEN
COMPUTE          0
SBF2 = 3
END
ENDIF

```

```

IF
QMD_SP10 GT 12 AND QMD_SP10 LE 16
THEN
COMPUTE          0
SBF2 = 2
END
ENDIF

```

```

IF
QMD_SP10 LE 12 AND QMD_SP10 GE 10
THEN
COMPUTE          0
SBF2 = 1
END
ENDIF

```

```
IF
QMD_SP10 LT 10
THEN
COMPUTE          0
SBF2 = 0
END
ENDIF
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!  THIRD FACTOR  !!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
IF
TOT_BA GT 150
THEN
COMPUTE          0
SBF3 = 3
END
ENDIF
```

```
IF
TOT_BA GT 100 AND TOT_BA LE 150
THEN
COMPUTE          0
SBF3 = 2
END
ENDIF
```

```
IF
TOT_BA LE 100
THEN
COMPUTE          0
SBF3 = 1
END
ENDIF
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!  FOURTH FACTOR  !!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
IF
PER_SPRC GT 0.65
THEN
COMPUTE          0
SBF4 = 3
END
ENDIF
```

```
IF
PER_SPRC GT 0.50 AND PER_SPRC LE 0.65
THEN
COMPUTE          0
SBF4 = 2
END
ENDIF
```

```
IF
PER_SPRC LE 0.50 AND PER_SPRC GE 0.05
THEN
COMPUTE          0
SBF4 = 1
END
ENDIF
```

```
IF
PER_SPRC LT 0.05
THEN
COMPUTE
SBF4 = 0
END
ENDIF
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!! RISK RATING  !!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
IF
SBF1 NE -1 AND SBF2 NE -1 AND SBF3 NE -1 AND SBF4 NE -1 AND &
SB_HAZRD EQ -1
THEN
COMPUTE          0
SB_HAZRD = SBF1 + SBF2 + SBF3 + SBF4
END
ENDIF
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!! CONDITION: IF NO SPRUCE GREATER THAN 10 INCHES  !!!
!!!          THEN RISK IS VERY LOW          !!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
IF
SB_HAZRD GT -1 AND SBF2 EQ 0 AND (NOT (SBF4 EQ 0))
THEN
COMPUTE
SB_HAZRD = 1
END
ENDIF
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!! CONDITION: IF SPRUCE BA IS VERY LOW  !!!
!!!          THEN RISK VALUE IS ZERO  !!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
IF
SB_HAZRD GT -1 AND SBF4 EQ 0
THEN
COMPUTE
SB_HAZRD = 0
END
ENDIF
```