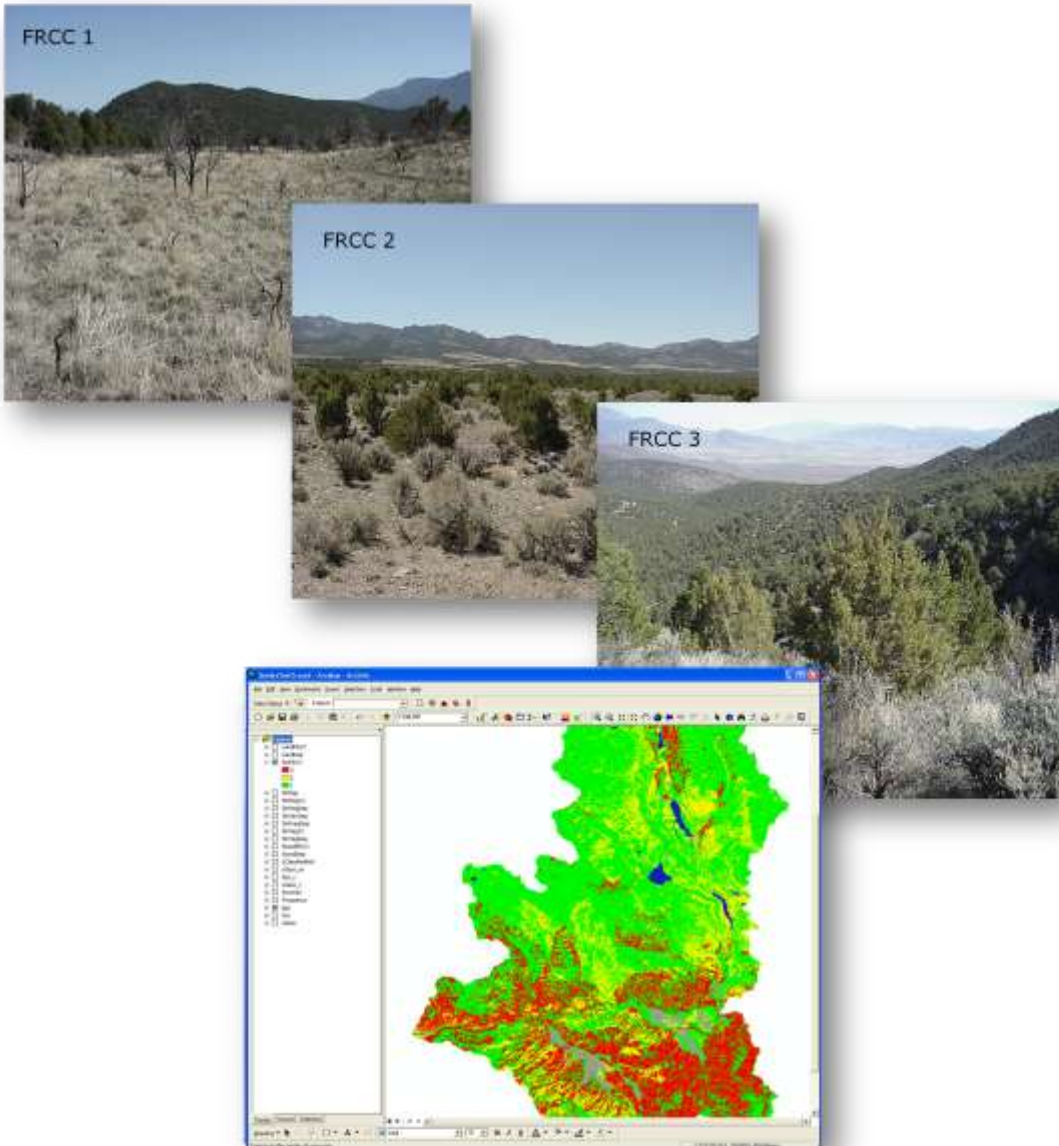


Fire Regime Condition Class Mapping Tool User's Guide

Version 3.0.0

For ArcGIS 9.2 and 9.3

June, 2012

Integrating science, technology and fire management.
Wildland Fire Management RD&A

Preface

Many federal land management agencies have been directed to manage lands to sustain ecosystems through time (USDA 1999, USDA 2000a, USDA 2000b). Allen and Hoekstra (1992) suggested that sustainability could be achieved only if managers worked with, not against, the underlying processes of the system to be managed. Several scientific concepts have been developed to help address sustainability through assessing ecosystem condition. The scientific concepts important to the development and understanding of the Fire Regime Condition Class Mapping Tool – or FRCC Mapping Tool – include the historical range of variation (HRV), ecological departure, and fire regime condition class (FRCC).

Historical range of variation

Recent federal policy has identified the need to consider current ecosystem condition in the context of historical variation (USDA 2000a, 2000b). Historical range of variation can be used as a reference to aid in understanding and evaluating vegetation change, as well as for evaluating current and future management goals (Hann and others 1997; Hessburg and others 1999; Morgan and others 1994; Swetnam and others 1999). Disturbance-driven spatial and temporal variation is a vital attribute of nearly all ecosystems (Landres and others 1999). Landres and others suggest that a primary objective in characterizing the historical range of variation is to understand: 1) how the driving ecosystem processes vary from site to site, 2) how these processes affected ecosystems in the past, and 3) how these processes might affect both current and future ecosystems. For example, historical conditions can be used to assess the impact of altered fire regimes on the structure and composition of forest ecosystems and for assessing the effectiveness of wildland fire use programs (Brown and others 1994; Hann and others 1997; Skinner and Chang 1996).

Ecological departure

Managers need to understand how ecosystem processes and functions have changed before they can develop strategies for sustaining those systems through time. An understanding of ecosystem departure provides the context necessary for managing sustainable ecosystems. The amount of change or departure from reference conditions can be derived by comparing the condition of existing or future ecosystems to the historical range of variation. Recent land management initiatives have addressed these important concepts with respect to fire and call for the development of spatial maps showing historical fire regimes as well as an estimate of fire regime departure (or condition class) (Healthy Forests Initiative: W House 2002; Healthy Forests Restoration Act: U.S. Congress 2003; USDA 2000a; USDA 2000b).

Fire regime condition class

Fire regime condition class (FRCC) is an index of ecological departure from reference conditions. The FRCC departure metric can be derived by evaluating the change in composition of succession classes, fire frequency, and fire severity (Barrett and others 2010 [Interagency Fire Regime Condition Class Guidebook]). Three classes corresponding to low, moderate, and high departure have been defined (Hardy and others 2001; Schmidt and others 2002) (see below table). Common causes of departure include fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plants, as well as introduced insects and disease (Schmidt and others 2002).

Table 0-1. Fire regime condition classes.

Class	Description
1	Fire regimes are within the natural or historical range of variation and risk of losing key ecosystem components is low. Vegetation attributes (composition and structure) are intact and functioning.
2	Fire regimes have been moderately altered. Risk of losing key ecosystem components is moderate. Fire frequencies may have departed by one or more return intervals (either increased or decreased), potentially resulting in moderate changes in fire and vegetation attributes.
3	Fire regimes have been substantially altered. Risk of losing key ecosystem components is high. Fire frequencies may have departed by multiple return intervals, potentially resulting in dramatic changes in fire size, fire intensity, and fire severity as well as landscape patterns. Vegetation attributes have been substantially altered.

FRCC is derived by comparing current conditions to an estimated central tendency of the historical range of variation that existed before significant EuroAmerican settlement. Departure of current conditions from this historical baseline can serve as a useful proxy for potential uncharacteristic fire effects and can be used to address risks to the sustainability of fire-adapted ecosystems. In applying the condition class concept defined by Schmidt and others (2002), we assume that historical fire regimes represent conditions under which fire-adapted ecosystems have evolved and have been maintained over time (Hardy and others 1998). Thus, if we observe that fire intervals, fire severity, vegetation structure, and/or vegetation composition have changed from historical conditions, we would also expect fire size, fire intensity, and burn patterns to be subsequently altered. If these basic fire characteristics have changed, then it is also likely that ecosystem components adapted to these historical fire regimes have been affected as well.

The FRCC Mapping Tool (FRCCMT)

The FRCC Mapping Tool (FRCCMT) quantifies the departure of current vegetation structure and composition, fire severity, and fire frequency from a set of reference conditions representing the historical range of variation. The tool, which operates from an ArcGIS platform, derives several metrics of departure at the succession class (S-class), biophysical setting (BpS), and landscape levels. FRCCMT outputs can be used to inform management plans and treatment strategies aimed at restoring fire-adapted communities.

What's new in version 3.0.0?

The following changes and improvements have been implemented with the release of version FRCCMT 3.0.0:

- Previous versions of FRCCMT were unable to derive departure estimates of current fire frequency and current fire severity. Consequently, earlier estimates of FRCC were based solely upon the departure of vegetation and ignored fire regimes entirely. A Fire Frequency and Severity Editor function has been added to allow the user to derive raster layers denoting current fire frequency and severity, thereby allowing the derivation of fire regime departure.
- New thresholds for deriving Stand FRCC have been incorporated.
- FRCC is now based upon the *average* of the regime departure and vegetation departure instead of selecting the maximum value of the two departure metrics.
- Departure metrics are now available for vegetation, fire regime, and vegetation/fire regime (in other words, FRCC).
- New "Summary Report" options have been added.

Prerequisites

FRCC Mapping Tool users should be familiar with the FRCC assessment process. At a minimum, users should review the Interagency Fire Regime Condition Class Guidebook (Barrett and others 2010; available at www.frcc.gov) before using FRCCMT. Completion of online FRCC training, available at www.frcc.gov, is also recommended. Since FRCCMT is a GIS application, users must also have a working knowledge of ArcGIS. Lastly, because FRCCMT incorporates Microsoft Access and Excel, users should have a basic working knowledge of these programs. Specific requirements are detailed in Chapter 1.

Credits

A beta version of the FRCC Mapping Tool was developed for the National Interagency Fuels, Fire, and Vegetation Technology Transfer (NIFTT) by J.D. Zeiler and Jeff Jones of the USDA Forest Service. Early versions of the software have been substantially modified by Lee Hutter of SEM LLC under the auspices of NIFTT.

Funding was provided by the USDA Forest Service and the US Department of Interior.

This FRCC Mapping Tool User's Guide was written by NIFTT members Jeff Jones (FS) and Deb Tirmenstein (SEM LLC), revised by Colleen Ryan (SEM LLC), and edited by Christine Frame (SEM LLC).

Your input

We value your input. Please forward any questions, comments, reports of bugs, or ideas to the National Interagency Fuels, Fire, and Vegetation Technology Transfer (NIFTT) at helpdesk@niftt.gov.

Table of contents

To cite the FRCC Mapping Tool (FRCCMT) and User's Guide, use the following references:

Hutter, Lee, Jeff Jones, and Dale Hamilton. 2012. Fire Regime Condition Class Mapping Tool (FRCCMT) for ArcGIS 9.2-9.3 (version 3.0.0). National Interagency Fuels, Fire, & Vegetation Technology Transfer. Available: www.niftt.gov.

Jones, Jeff and Colleen Ryan. 2012. Fire Regime Condition Class Mapping Tool (FRCCMT) User's Guide. National Interagency Fuels, Fire, & Vegetation Technology Transfer. Available: www.niftt.gov.

Chapter 1: About the FRCC Mapping Tool User's Guide

1.1 Before you begin

This user's guide describes the basic operation of FRCCMT, which quantifies the departure of vegetation and fire regime conditions from a set of reference conditions.

We recommend that FRCCMT users understand the concepts and methods presented in the Interagency FRCC Guidebook (Barrett and others 2010; available at www.frcc.gov) prior to working with the Mapping Tool. This user's guide reviews many of the concepts, definitions, and methods discussed in the Interagency FRCC Guidebook but does not consider them in detail.

Lastly, FRCCMT users must be familiar with Microsoft Windows and basic ArcGIS functions.

1.2 How to use this guide

It is not necessary to read the entire guide to carry out a specific task. Once you are familiar with the basic concepts associated with the FRCC Mapping Tool, you can quickly locate commonly performed tasks by reviewing the headings in the Table of Contents located near the beginning of this guide. You can then refer to the specific section pertaining to your needs. Whenever possible, screen captures are used to illustrate steps required to complete a task.

The FRCCMT User's Guide is not intended to provide step-by-step guidance on the tool's operation; rather, it is intended to serve as a reference guide. The FRCC Mapping Tool Tutorial (available at www.niftt.gov) provides basic step-by-step instructions for running the tool.

1.3 Computer requirements

Ensure the following programs are installed and functioning properly on your computer:

- ArcGIS 9.2 or 9.3 (including the latest Service Packs)
- Spatial Analyst extension of ArcGIS
- Microsoft Excel (2007 or higher)
- Microsoft Access (2007 or higher)

Although system requirements to run ArcGIS 9.3 will suffice to run NIFTT tools, at least 10 GB of free hard drive space and 2 GB of RAM are recommended to run FRCCMT. Generally, faster processors, more memory, and increased free hard drive space will improve performance. This version of FRCCMT was developed for the Windows XP operating system. Other operating systems are not supported.

Note:

- ***Important:*** *This version of the FRCC Mapping Tool is not supported by Windows 7.*

- *Make sure that you have sufficient space and adequate permissions for storing FRCCMT outputs on your computer.*

- *Make sure that the FRCCMT version you are using correctly matches the version of ArcGIS on your computer. This version of the Mapping Tool does not work with versions of ArcGIS older than 9.2.*

- *Although not required, ArcCatalog is a highly valuable tool for managing and organizing ArcMap data layers and should be used for all data manipulation such as copying, pasting, renaming, and deleting.*

Chapter 2: FRCC Mapping Tool Function

2.1 How the FRCC Mapping Tool operates

The FRCC Mapping Tool works within ArcMap to spatially assess the departure of vegetation and fire regimes from a set of reference conditions. These reference conditions represent the midpoint of the historical range of variation (see above section Historical range of variation). The tool generates a suite of metrics that characterizes vegetation departure, fire regime departure, and vegetation/fire regime departure with varying degrees of thematic detail and at various levels of ecosystem organization. For example, some metrics are based on continuous values, whereas others use categorical data made up of relatively few discrete classes. Departure indices are generated at the landscape, biophysical setting, and succession class levels. Users can select the metrics that best address a specific analysis question.

The FRCC Mapping Tool uses protocols and algorithms outlined in the Interagency FRCC Guidebook to derive FRCC and related departure metrics.

2.2 How the Fire Frequency and Severity Editor operates

A new function, the Fire Frequency and Severity Editor, installs with version 3.0.0 of the FRCC Mapping Tool. The Fire Frequency and Severity Editor allows the user to produce rasters for current fire frequency and current fire severity based upon values assigned by the user to each BpS. These rasters can in turn be used as inputs to the fire regime condition class algorithm used by FRCCMT. Layers depicting current fire frequency and current fire severity are required for deriving fire regime departure, and subsequently, FRCC.

2.3 Processing steps

2.3.1 Fire Frequency and Severity Editor

The Fire Frequency and Severity Editor first obtains the reference frequency and severity values from a Reference Condition Table for all of the biophysical settings that are present in the BpS layer used as input. These values are then exported into a table that will be used by the user to assign current estimates of fire frequency and severity. The Fire Frequency and Severity Editor uses the user-assigned data to create the Current Frequency and Current Severity grids. These grids are then available as inputs to FRCCMT.

2.3.2 FRCCMT

FRCCMT integrates ArcGIS and Access applications. To derive estimates of vegetation departure metrics, ArcGIS combines the spatial landscape, BpS, and S-Class layers, along with the current frequency and current severity layers, if used, so that each value in the resulting raster layer denotes a unique combination of values from the input layers. A series of queries is then made in an Access database to derive the composition of succession classes for every BpS within each landscape. The S-Class composition is compared to the table of reference conditions contained within another Access database, known as the Reference Condition Database, to calculate vegetation departure. Current fire frequency and severity values are also compared to reference frequency and severity values from the Reference Condition Table to calculate fire regime departure. Various departure indices are then computed within Access and, after that, joined back to the combined raster. Individual rasters representing each departure metric are then produced by ArcMap.

Finally, tabular data are exported to a Summary Report (MS Excel) where the difference between current and reference conditions is displayed. The Summary Report displays the amount of change necessary to restore or maintain landscapes according to reference conditions.

2.4 Applications

Outputs from FRCCMT can be used to inform management plans and treatment strategies aimed at improving the sustainability of fire-adapted ecosystems. That is, FRCCMT can be used to spatially identify restoration opportunities by determining the amount of change needed across a landscape. The tool can also be used to evaluate the effectiveness of proposed treatments in restoring departed landscapes. The FRCC Mapping Tool can be used for broad- to fine-scale planning; however, careful consideration should be given to the resolution, type, and accuracy of the input data when designing and interpreting FRCCMT applications.

Chapter 3: Input Data

3.1 Description of spatial input layers

Depending on outputs desired, FRCCMT requires four kinds of spatial information in ArcGRID format: a layer representing biophysical settings (BpS); a layer depicting succession classes (S-Class), layers depicting current fire frequency and severity, and a layer or layers depicting the landscape units (reporting units) within which the composition of succession classes is analyzed. This spatial information can be provided by a single layer having BpS, S-Class, Current Fire Frequency, Current Fire Severity, and landscape levels as attributes, or the information can be provided by unique layers that characterize BpS, S-Class, Current Fire Frequency, Current Fire Severity, and landscape units separately. All layers must have identical coordinate systems and projections. In addition, we recommend that the spatial layers also have identical cell sizes, cell alignment, and geographic extents. The tool also requires a set of reference conditions that can be associated with the BpS layer. These reference conditions are stored in a table (the Reference Condition Table) contained within an Access database. Each of the inputs will be considered in this user's guide, but readers are encouraged to refer to the Interagency FRCC Guidebook (available at www.niftt.gov) for a more detailed discussion of concepts pertaining to biophysical settings, succession classes, and reference conditions.

3.1.1 Landscape level layers

The Landscape layer identifies a hydrologic or other type of geographic area used for deriving the composition of succession classes for any given BpS. Thus, the Landscape layer and the BpS layer together create the strata for which vegetation departure and FRCC are derived. The concepts of ecological departure and FRCC are scale-dependent, and results differ as the landscape used to report those results changes in size and/or shape. It is therefore highly important to select appropriately sized landscapes when using FRCCMT.

To select an appropriately sized landscape, consider historical fire regimes and the resulting vegetation patterns that historically dominated a particular area. The landscape should be large enough to encompass the historical range of variation (HRV). That is, it should be large enough so that the full expression of succession classes would occur given natural disturbance processes. For example, in a forested setting, infrequent, high-severity fire regimes commonly led to relatively large patches of vegetation (in other words, coarse-grained patterns), whereas frequent, low-severity fire regimes resulted in relatively small patches (fine-grained patterns). Larger landscapes would be required to incorporate the full expression of HRV in areas having coarse-grained patterns, whereas smaller landscapes may suffice in areas having fine-grained patterns. Estimates of departure tend to be inversely correlated with landscape size. That is, departure estimates tend to increase as the landscape size decreases. Conversely, using exceedingly large landscapes may produce departure estimates that are too low.

> ***Tip:*** *The creation of a landscape layer commonly involves clipping a pre-existing layer. This process often creates slivers around the boundary of the assessment area. If these small slivers are not incorporated into the larger, adjacent landscape, erroneous departure estimates can result. In some instances, it may be advantageous to extend the assessment area beyond a project area's actual boundary to eliminate the presence of sliver landscapes within the project area.*

A nested hierarchy of up to three landscape levels (small, medium, and large) can be used to derive the composition of succession classes. A nested hierarchy allows for the analysis of areas containing multiple biophysical settings and historical fire regimes. For example, the smallest landscape level could be used to assess the departure of biophysical settings dominated by high frequency fire regimes (in other words, fire regimes resulting in fine-grained vegetation patterns); the mid-sized landscape level could be used to assess biophysical settings dominated by mixed-severity fire regimes (regimes resulting in both fine- and coarse-grained vegetation patterns); and the largest landscape level could be used to assess biophysical settings dominated by low frequency fire regimes (regimes resulting in coarse-grained vegetation patterns).

If multiple landscape levels are used, the smaller landscape levels must be nested within the larger landscape levels. To ensure that the landscape levels are in fact nested, we recommend using a single landscape layer that contains an attribute for each level of the hierarchy. For example, if a watershed hierarchy based on a hydrologic unit code (HUC) is used, the layer could contain three attributes representing subbasins (large), watersheds (medium), and subwatersheds (small). Similarly, if an ECOMAP hierarchy (Cleland and others 1997) is used, the landscape layer could contain attributes for subsections (large), land type associations (medium), and land types (small). Figures 3-1 and 3-2 show examples of a nested landscape layer made up of watersheds and an associated Attribute Table, respectively.

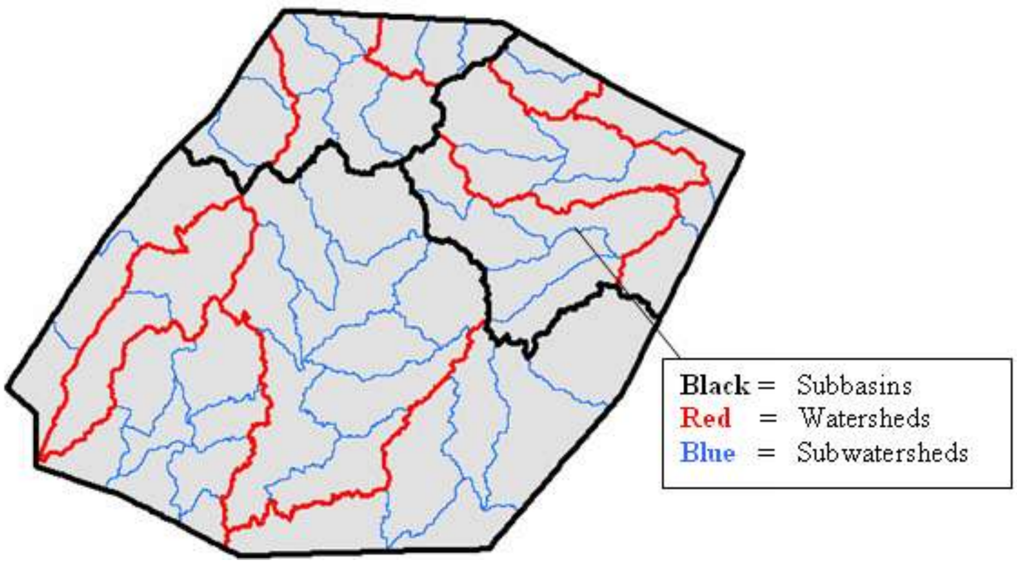


Figure 3-1. Example of nested landscapes composed of subbasins, watersheds, and subwatersheds.

Subbasin Watershed Subwatershed

Attributes of hucs_g

Rowid	VALUE *	COUNT	HUC_8	HUC_10	HUC_12
0	2	27211	15010008	1501000805	150100080505
1	3	121103	15010008	1501000802	150100080210
2	4	71692	15010008	1501000802	150100080206
3	5	49287	15010008	1501000805	150100080507
4	6	62557	15010008	1501000805	150100080504
5	7	98921	15010008	1501000801	150100080108
6	8	60502	15010008	1501000805	150100080508
7	9	46470	15010008	1501000805	150100080501

Record: 0 Show: All Selected Records (0 out of 55 Selected) Options

Figure 3-2. Example Value Attribute Table from a Landscape layer composed of nested watersheds.

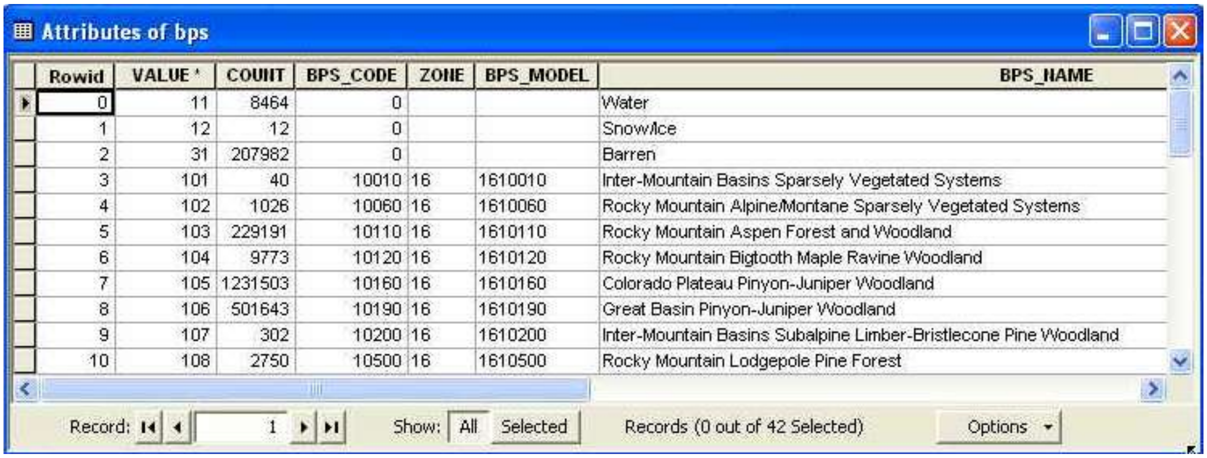
Although FRCCMT can use three hierarchical landscape levels to assess departure, it is not necessary to use all three. Using only one level may be appropriate if the analysis area is dominated by a single fire regime group, especially if the analysis area is small. In this instance, the landscape layer would contain only a single value (for example, one subwatershed).

> ***Tip**: The "LandscapeLevel" field in the Reference Condition Table must match the desired number of analysis levels. If you prefer to use one or two levels, then the LandscapeLevel field in the default Reference Condition Table must be edited. For example, if only one level is used, then the LandscapeLevel field must contain a value of 1 for every record in the table. If two levels are used, then the LandscapeLevel field must contain a value of 1 or 2 for every record. (Refer to Section 3.2: Reference Condition Table for additional information.)*

3.1.2 Biophysical Settings (BpS) layer

Biophysical settings reflect the integration of soils, climate, and topography that define native disturbance regimes and the composition of resulting plant communities. Biophysical settings are the taxonomic units used to characterize reference conditions. A more complete discussion of the BpS concept is available in the FRCC Guidebook, available at www.frcc.gov. The natural composition of succession classes is commonly determined for each BpS by using either spatial vegetation succession and disturbance models, such as LANDSUM (Keane and others 2006) and TELSA (ESSA Technologies Ltd. 2005a), or aspatial vegetation succession and disturbance models, such as the Vegetation Dynamics Development Tool (VDDT; ESSA Technologies Ltd. 2005b) or the Path Landscape Model Framework (Path; ApexRMS and ESSA Technologies Ltd. 2011).

FRCCMT derives departure values, and subsequently fire regime condition classes, for each BpS within the analysis area. The BpS layer must contain attributes with codes that coincide with BpS codes in the Reference Condition Table (figures 3-3 and 3-7). Departure values will be derived only for those biophysical settings common to both the BpS layer and the Reference Condition Table. Biophysical settings lacking a set of reference conditions (such as barren, water, agriculture, and urban) are ignored when calculating landscape composition and deriving departure indices. For example, if agriculture makes up 10 percent of a landscape, the composition of succession classes is determined from the remaining 90 percent of that landscape.



Attributes of bps

Rowid	VALUE *	COUNT	BPS_CODE	ZONE	BPS_MODEL	BPS_NAME
0	11	8464	0			Water
1	12	12	0			Snow/Ice
2	31	207982	0			Barren
3	101	40	10010	16	1610010	Inter-Mountain Basins Sparsely Vegetated Systems
4	102	1026	10060	16	1610060	Rocky Mountain Alpine/Montane Sparsely Vegetated Systems
5	103	229191	10110	16	1610110	Rocky Mountain Aspen Forest and Woodland
6	104	9773	10120	16	1610120	Rocky Mountain Bigtooth Maple Ravine Woodland
7	105	1231503	10160	16	1610160	Colorado Plateau Pinyon-Juniper Woodland
8	106	501643	10190	16	1610190	Great Basin Pinyon-Juniper Woodland
9	107	302	10200	16	1610200	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland
10	108	2750	10500	16	1610500	Rocky Mountain Lodgepole Pine Forest

Record: 1 Show: All Selected Records (0 out of 42 Selected) Options

Figure 3-3. The attribute *Bps_model* in the Value Attribute Table from a BpS layer must correspond to the field labeled *Bps_model* in the Reference Condition Table.

> ***Tip**: To view an example attribute table, open ArcMap and right click on any desired layer in the Table of Contents. Select Open Attribute Table from the menu options.*

3.1.3 Succession Classes (S-Class) layer

The Succession Class (S-Class) layer identifies the successional state at a particular point in time, often representing what is "currently" on the landscape. It is typically much less complex than the BpS layer, and may often include several standard S-Classes, as well as one or two uncharacteristic classes. Succession classes are unique to a BpS, and can be interpreted only within the context of the BpS. Consequently, succession classes must be nested within the BpS layer. Succession classes typically denote both seral status (early-, mid-, or late-seral) and structure (open or closed canopy), and are generally derived from a characterization of species composition (such as cover type), height classes, and density or cover.

FRCCMT can accept up to seven succession classes for a given BpS. This includes five natural states, and two "uncharacteristic" states denoting unnatural conditions that did not occur during the reference period, such as Uncharacteristic Native vegetation or Uncharacteristic Exotic vegetation. These states are commonly denoted by A, B, C, D, E, UN, and UE, respectively. In the LANDFIRE BpS models, the five natural states most commonly modeled were early-seral, mid-seral closed, mid-seral open, late-seral open, and late-seral closed. However, not all biophysical settings are characterized by five natural states, and the description of each state is not necessarily consistent. For example, some biophysical settings do not have open structures and some lack mid-seral states. For this reason, users must be familiar with the BpS model descriptions that apply to their local areas. For additional information on the LANDFIRE BpS models, go to http://www.landfire.gov/NationalProductDescriptions24.php.

> ***Note:*** *The S-Class layer produced by LANDFIRE includes two uncharacteristic classes: "UE" represents an uncharacteristic condition due to exotics, whereas "UN" depicts uncharacteristic native, a condition due to unnatural structure. FRCCMT searches for UE and UN classes and merges them into a single "U" class prior to deriving departure metrics.*

FRCCMT computes the composition of existing succession classes for each BpS within a given landscape. That is, it computes the percent of the area of that BpS that is composed of each S-Class. The existing composition is then compared to the reference composition to derive the departure indices. Consequently, every pixel in the BpS layer that has been assigned to a BpS having a reference condition must also be assigned to an S-Class. Biophysical settings lacking a reference condition (such as rock, barren, or water) do not need a corresponding S-Class since they are ignored when departure is derived.

The S-Class layer must contain an attribute denoting the S-Class as A, B, C, D, E, U, UE or UN (Figure 3-4) so that the layer can be associated with the Reference Condition Table. In the sample tables shown in figures 3-4 and 3-7, the attribute Label relates the S-Class layer to the succession classes in the Reference Condition Table. Succession classes identified by anything other than A, B, C, D, E ,U, UE, or UN will be ignored when calculating the S-Class composition of a BpS.

> ***Note****: The S-Class layer must have an attribute that can be related to the Reference Condition Table.*

FRCCMT is particular about the format of the S-Class layer in terms of grid values and the attribute values relating to the Reference Condition Table. Grid values 1 through 5 must correspond to S-Classes A through E, respectively. Furthermore, grid values 6 and 7 must correspond to the uncharacteristic classes, UN and UE, respectively. If only one uncharacteristic class is used (that is, U), it must be assigned to grid value 6. All grid values exceeding 7 are ignored when deriving departure metrics. When FRCCMT detects two uncharacteristic classes (for example, grid values 6 and 7 for UN and UE, respectively), the two classes are merged into a single class denoted as U prior to deriving the departure metrics.

Attributes of sclass_1

Rowid	VALUE *	COUNT	LABEL	DESCRIPTIO
0	1	1854916	A	Succession Class A
1	2	3860691	B	Succession Class B
2	3	2708750	C	Succession Class C
3	4	1565907	D	Succession Class D
4	5	3272214	E	Succession Class E
5	6	668459	UN	Uncharacteristic Native Vegetation Cover / Structure / Composition
6	7	1790808	UE	Uncharacteristic Exotic Vegetation
7	111	49318	Water	Water
8	112	107	Snow / Ice	Snow / Ice
9	120	103062	Urban	Urban
10	131	33197	Barren	Barren
11	132	47824	Sparsely Vegetated	Sparsely Vegetated
12	180	935779	Agriculture	Agriculture

Record: 12 Show: All Selected Records (0 out of 13 Selected) Options

Figure 3-4. Example of an Attribute Table for an S-Class layer.

3.1.4 Current Frequency layer

The Current Frequency layer depicts the mean fire return interval (MFRI) and is required for deriving the Regime and FRCC Vegetation/Regime outputs.

> ***Note**: In this guide and in the FRCCMT itself, "regime" refers to fire frequency and severity alone, while "fire regime" refers to outputs based on the integration of regime and vegetation. Since the FRCC algorithm is based on an evaluation of both vegetation (S-Class) inputs and fire frequency and severity inputs, a separate term was needed to refer to fire frequency and severity as evaluated separately from vegetation departure.*

One way to create a Current Frequency layer is to assign current fire frequency values based on expert opinion or literature reviews using the Fire Frequency and Severity Editor, as outlined in Chapter 7. This method assigns an overall value for current fire frequency across an entire BpS within an analysis area.

Another means of developing a Current Frequency layer is by using actual fire occurrence data in a particular area where such data exist. The user would need to obtain this information from a fire atlas or other source, parse out the information by year, and then use ArcMap to construct the Current Frequency layer. Frequency denotes the number of times that a particular pixel was disturbed by fire within a given time frame. (For example, in 80 years, how often did this pixel burn?) Despite the name of the layer, the value included in the frequency layer depicts the mean fire return interval (MFRI), expressed in years.

A BpS in which an average pixel is expected to burn four times in 80 years would have an MFRI of 20 years (80/4). Remember, frequency (that is, MFRI) applies to the entire BpS throughout the analysis area.

> ***Note**: Although the term "frequency" is used in the names of the input and output layers and tables, the values contained in the tables are actually expressed in terms of mean fire return interval, which is the inverse of frequency.*

Regardless of how the current frequency layer is created, it must contain an attribute denoting the MFRI in years as a whole number. Figure 3-5 shows an attribute table for a Current Frequency layer that denotes MFRI in the attribute labeled Frequency.

Attributes of FreqSupp

Rowid	VALUE *	COUNT	FREQUENCY
0	1	609	100
1	2	61203	133
2	3	500	150
3	4	72420	161
4	5	153199	17
5	6	450104	172
6	7	8012	19
7	8	371542	21
8	9	9	232
9	10	25833	26
10	11	204	307
11	12	124533	31
12	13	11416	32
13	14	10	334
14	15	355715	40

Record: 1 Show:

Figure 3-5. Example of an Attribute Table for a Current Frequency layer named "FreqSupp," created using the Frequency and Severity Editor.

FRCCMT then compares estimates of current frequency to reference frequency values and derives a fire frequency departure metric for each BpS. This metric is used as a component to derive regime departure and subsequently FRCC Vegetation/Regime outputs.

3.1.5 Current Severity layer

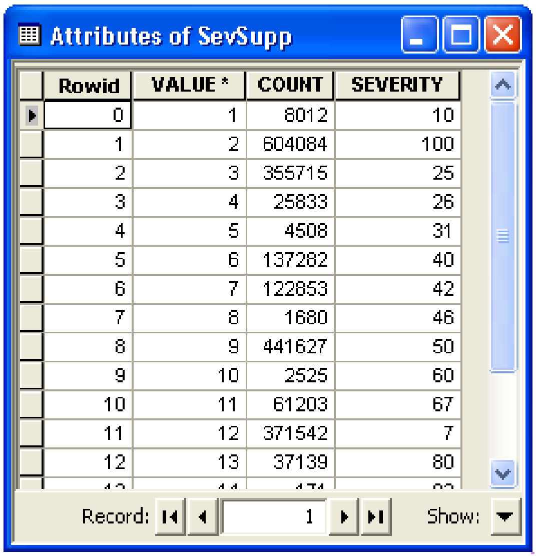
The Current Severity layer depicts severity in terms of the percentage of replacement fires (defined as the removal of at least 75% of the above-ground biomass) under 90th percentile burning conditions. The Current Severity layer is required for deriving Regime and FRCC Vegetation/Regime outputs.

A spatial layer depicting current fire severity is typically hard to come by and commonly needs to be developed by the user from other ancillary data layers.

The Fire Frequency and Severity Editor can be used to produce an approximation of current severity at the BpS level, as outlined in Chapter 7. This process relies on expert opinion to assign an overall value of current severity across an entire BpS within an analysis area.

Estimates of current fire severity need to be based upon potential first order fire effects and should consider existing vegetation composition, vegetation structure, fuel bed characteristics, slope, and aspect as a proxy to fuel moisture. Observations of fire severity from recent wildland fires can be extrapolated to areas having similar vegetation composition, structure, fuel beds, slope, and aspect. Software applications such as the Wildland Fire Assessment Tool (WFAT) can also be used to derive spatial approximations of current severity for a particular area.

Regardless of how the current severity layer is created, it must contain an attribute equivalent to percent stand replacement fire. Figure 3-6 shows an attribute table for a Current Severity layer. The attribute labeled Severity in this table denotes the percent replacement fire.


Attributes of SevSupp

Rowid	VALUE *	COUNT	SEVERITY
0	1	8012	10
1	2	604084	100
2	3	355715	25
3	4	25833	26
4	5	4508	31
5	6	137282	40
6	7	122853	42
7	8	1680	46
8	9	441627	50
9	10	2525	60
10	11	61203	67
11	12	371542	7
12	13	37139	80

Record: 1 Show:

Figure 3-6. Example of an attribute table for a Current Severity layer named SeverSupp, created using the Fire Frequency and Severity Editor.

The FRCC Mapping Tool compares estimates of current severity to reference severity values and derives a fire severity departure metric for each BpS. This metric is then used as a component to derive the Regime Departure as well as the FRCC Vegetation/Regime outputs.

3.2 Reference Condition Table

The Reference Condition Table provides key pieces of information for use with FRCCMT: 1) a list of biophysical settings; 2) the succession classes and corresponding reference landscape percentages for each BpS (expressed as the mid-point of the HRV); 3) the dominant historical fire regime group of the BpS; 4) a proposed landscape level for assessing each BpS to compute FRCC; 5) the reference fire frequency of the BpS (in other words, MFRI); and 6) the reference severity (in other words, percent replacement fire) of the BpS. Reference conditions are typically derived using a vegetation succession and disturbance model such as VDDT (ESSA Technologies Ltd. 2005b) or Path (ApexRMS and ESSA Technologies Ltd. 2011) , TELSA (ESSA Technologies Ltd. 2005a), or LANDSUM (Keane and others 2006). However, some users have developed reference condition tables by consulting the literature or by using General Land Office survey information.

The Reference Condition Table (Figure 3-7) must be formatted so that it can be associated with the BpS and S-Class layers. For example, the first field in the Reference Condition Table, BpS_Model, denotes the BpS and must coincide with an attribute in the BpS layer. The third through eighth fields in the Reference Condition Table, succession classes A through U, denote the percent composition of each S-Class within a particular BpS. Each of these six fields must have a heading that coincides with an attribute of the S-Class layer.

> ***Note:*** *The "U" field denoting the "uncharacteristic" class must be populated with a value of "0" because uncharacteristic succession classes did not occur naturally during the reference period.*

The next field, Fire Regime Group (FRG), describes the dominant historical fire regime (see Appendix B) for each BpS. The dominant fire regime group is used to assign a value to the last field, LandscapeLevel. LandscapeLevel identifies the appropriate landscape level to use for deriving the existing composition of succession classes within a BpS. The values in the LandscapeLevel field – 1, 2, and 3 – correspond to the small, mid-sized, and large landscapes, respectively.

The last two fields in the Reference Condition Table identify the reference fire frequency and severity, respectively.

> ***Note**: Some of the LANDFIRE National biophysical settings, such as Sonora-Mojave Mixed Salt Desert Scrub and Alaskan Pacific Maritime Western Hemlock Forest, are considered to be non-fire ecosystems. As such, no fire regime information appears in the model descriptions. In instances such as these, a set of dummy values was inserted into the default Reference Condition Table to ensure that FRCCMT functions properly. Values of "99" and "9999" were used for the reference fire severity and fire frequency, respectively, for non-fire systems. These values were used to minimize the values of the departure metrics for non-fire systems. Keep in mind that a value of "99" for reference severity could be a real value associated with a fire-dependent system, or it could be a dummy value assigned to a non-fire system. If confused, the user should direct his/her attention to the reference frequency – a value of "9999" will identify a non-fire system.*

Two fields in the Reference Condition Table, "Name" and "FRG", are optional and are not directly used by FRCCMT. These fields are included only for convenience and need not be populated. However, if the Name field is not populated in the Reference Condition Table, then the Summary Report will not show the BpS names (see Chapter 5).

Default reference condition tables can be found in an Access database labeled "refcon.mdb," which can be found in the folder where FRCCMT was installed (for example, C:\Program Files\NIFTT\FRCC Mapping Tool X.X.X\Reference Conditions Database if the default path was used during the installation procedure). Two reference condition tables developed by LANDFIRE are included with the FRCCMT installation. The first table (RAnat_090722) was developed for the Rapid Assessment phase of the LANDFIRE Project and covers the conterminous United States. The second table (LFnat_100108) includes the LANDFIRE National reference conditions for the conterminous United States, Alaska, and Hawaii.

BpS_Model	Name	A	B	C	D	E	U	FRG	LandscapeLev	Frequency	Severity
0110080	North Pacific Oak Woodland	10	5	85	0	0	0	1	1	10	3
0110110	Rocky Mountain Aspen Forest and Wc	25	20	10	30	15	0	3	2	55	45
0110180	East Cascades Mesic Montane Mixed-	10	20	5	15	50	0	3	2	77	23
0110350	North Pacific Dry Douglas-fir Forest ar	5	10	10	45	30	0	3	2	36	10
0110360	North Pacific Hypermaritime Sitka Sp	5	10	1	10	74	0	5	3	649	99
0110370	North Pacific Maritime Dry-Mesic Dou	5	15	5	15	60	0	3	2	80	24
0110380	North Pacific Maritime Mesic Subalpi	95	5	0	0	0	0	5	3	4950	91
0110390	North Pacific Maritime Mesic-Wet Do	5	15	5	5	70	0	5	3	400	99
0110411	North Pacific Mountain Hemlock Fore	1	5	5	4	85	0	5	3	3322	32
0110412	North Pacific Mountain Hemlock Fore	15	25	15	5	40	0	5	3	400	80
0110420	North Pacific Mesic Western Hemlock	1	4	1	2	92	0	5	3	1427	28
0110450	Northern Rocky Mountain Dry-Mesic I	10	5	30	45	10	0	1	1	20	15
0110460	Northern Rocky Mountain Subalpine '	25	20	55	0	0	0	3	2	63	21
0110500	Rocky Mountain Lodgepole Pine Fore	25	45	30	0	0	0	4	3	92	80
0110531	Northern Rocky Mountain Ponderosa	10	5	35	45	5	0	1	1	6	5
0110532	Northern Rocky Mountain Ponderosa	25	5	25	40	5	0	3	2	48	37
0110550	Rocky Mountain Subalpine Dry-Mesic	5	20	40	25	10	0	3	2	125	50
0110560	Rocky Mountain Subalpine Mesic-We	20	10	40	25	5	0	3	2	99	79
0110600	East Cascades Oak-Ponderosa Pine Fo	10	5	10	65	10	0	1	1	27	7
0110630	North Pacific Broadleaf Landslide For	20	80	0	0	0	0	5	3	300	66
0110650	Columbia Plateau Scabland Shrublanc	5	5	90	0	0	0	5	3	250	100
0110680	North Pacific Dry and Mesic Alpine Dv	100	0	0	0	0	0	5	3	9999	99
0110700	Rocky Mountain Alpine Dwarf-Shrubl.	15	85	0	0	0	0	5	3	232	100
0110800	Inter-Mountain Basins Big Sagebrush	15	35	40	10	0	0	1	1	33	45
0110830	North Pacific Avalanche Chute Shrubl	95	5	0	0	0	0	5	3	998	98
0110840	North Pacific Montane Shrubland	100	0	0	0	0	0	5	3	9804	83
0111060	Northern Rocky Mountain Montane-F	10	65	15	10	0	0	2	1	29	71
0111200	Willamette Valley Upland Prairie and	10	2	20	66	2	0	1	1	10	4
0111230	Columbia Plateau Steppe and Grassla	5	80	15	0	0	0	4	3	40	100

Record: 31 of 2474 No Filter Search

Figure 3-7. Example Reference Condition Table from the LANDFIRE National Project. *BpS_Model* = the BpS code; *Name* = BpS name; *A* through *U* = succession classes; *FRG* = fire regime group; *LandscapeLevel* = recommended level at which to assess each BpS; *Frequency* = reference mean fire return interval; and *Severity* = reference severity (percent replacement fires).

Following are some general guidelines for creating a Reference Condition Table in Access:

1. Each Reference Condition Table must be stored in the MS Access 2003 database format (that is, having an .mdb extension; not an .accdb extension). The database may contain more than one Reference Condition Table.

2. The total path length for the location of the Reference Condition Table database must be less than 80 characters.

3. The name of the Reference Condition Table cannot contain spaces or special characters (`~! @#$^()-+={ }[ ]|\?/:;"'< >, .) and should be less than 10 characters long.

4. The Name and FRG fields are optional and do not need any values. They are included within the Reference Condition Table for convenience.

5. The S-Class fields A through U cannot contain missing values (that is, cannot be left blank). For example, the record must contain a value of 0 in cases where an S-Class did not occur naturally; therefore, the U field must contain 0 for every record in the table. In addition, S-Class values should total 100 percent for each BpS.

6. The LandscapeLevel field in the Reference Condition Table must match the desired number of analysis levels. The default Reference Condition Tables were developed assuming that three analysis levels would be used to assess departure. If you wish to use one or two levels, then the LandscapeLevel field in the default Reference Condition Table must be edited. For example, if only one level is used, the LandscapeLevel field must contain a value of 1 for every record in the table. If two levels are used, then the LandscapeLevel field must contain a value of 1 or 2 for every record.

7. The reference frequency needs to be expressed as the mean fire return interval in years.

8. The reference severity needs to be expressed as the percent replacement fire.

The structure of the Reference Condition Table is critically important for successful execution of FRCCMT. The required structure for Reference Condition Tables is displayed below in Table 3-1. An approach for creating a customized Reference Condition Table is to copy one of the default tables included with the installation, rename it, paste it in the database and then edit values of interest.

> ***Note**: Un-installing the FRCCMT software will remove any custom reference condition tables developed by the user and stored in the default refcon.mdb (c:\Program Files\NIFTT\Reference Conditions Database). Consequently, we recommend storing custom reference condition tables in a location other than the default refcon.mdb.*

Table 3-1. Required structure of the Reference Condition Table.

Field name	Data type	Field size	Decimal places	Required	Allow zero length	Default value	Indexed	Unicode compression	IME mode	IME sentence mode	Text Align
BpS_Model	Text	16		Yes	No		Yes (No duplicates)	Yes	No Control.	None	General
Name	Text	128		No	Yes		No	Yes	No Control.	None	General
A	Number	Integer	Auto	Yes		0	No				General
B	Number	Integer	Auto	Yes		0	No				General
C	Number	Integer	Auto	Yes		0	No				General
D	Number	Integer	Auto	Yes		0	No				General
E	Number	Integer	Auto	Yes		0	No				General
U	Number	Integer	Auto	Yes		0	No				General
FRG	Text	4		Yes	Yes		No	Yes	No Control.	None	General
Landscape Level	Number	Integer	Auto	Yes		0	No				General
Frequency	Number	Integer	Auto	No		0	No				General
Severity	Number	Integer	Auto	No		0	No				General

Chapter 4: Spatial Output Layers

4.1 Vegetation outputs
- 4.1.1 S-Class Relative Amount
- 4.1.2 Stand Departure
- 4.1.3 Stand Fire Regime Condition Class
- 4.1.4 Stratum Vegetation Departure
- 4.1.5 Stratum Vegetation Condition Class

4.2 Regime outputs
- 4.2.1 Stratum Fire Frequency Departure
- 4.2.2 Stratum Fire Severity Departure
- 4.2.3 Stratum Regime Departure
- 4.2.4 Stratum Regime Condition Class

4.3 FRCC Vegetation/Regime outputs
- 4.3.1 Stratum Departure
- 4.3.2 Stratum Fire Regime Condition Class
- 4.3.3 Landscape Departure
- 4.3.4 Landscape Fire Regime Condition Class

A total of 13 output layers are available for supporting various types of analyses (See Table 4-1). FRCCMT can generate vegetation-only departure metrics, regime-only departure metrics, and metrics based on a combination of vegetation and regime departure.

FRCCMT output layers can address management questions at the landscape, BpS, and S-Class levels. Not all outputs will be useful to all users; instead, managers can select from a variety of layers to meet local analysis objectives.

Identifying which output layers are potentially useful depends largely on management questions and on the amount of detail needed. Some output layers simply provide a broader classification of other output layers. A user can determine the amount of detail needed to address management questions and then select appropriate output layers. In some instances, the level of detail desired may depend on the target audience. For example, a decision maker may determine that less detail will provide greater clarity when explaining a complicated scenario to members of the general public.

Table 4-1. Output layers produced by the FRCC Mapping Tool.

Layer Description	Layer Name	Analysis Level	Thematic Detail (number of potential values)
S-Class Relative Amount	SClassRelAmt	S-Class	5
Stand Departure	StandDep	S-Class	101
Stand Fire Regime Condition Class	StandFRCC	S-Class	3
Stratum Vegetation Departure	StrVegDep	BpS	101
Stratum Vegetation Condition Class	StrVegCC	BpS	3
Stratum Fire Frequency Departure	StrFreqDep	BpS	101
Stratum Fire Severity Departure	StrSevDep	BpS	101
Stratum Regime Departure	StrRegDep	BpS	101
Stratum Regime Condition Class	StrRegCC	BpS	3
Stratum Departure	StrDep	BpS	101
Stratum Fire Regime Condition Class	StrFRCC	BpS	3
Landscape Departure	LandDep	Landscape	101
Landscape Fire Regime Condition Class	LandFRCC	Landscape	3

The following sections discuss each of the FRCCMT outputs, including derivation and potential applications.

4.1 Vegetation outputs

Vegetation outputs include: S-Class Relative Amount, Stand Departure, Stand Vegetation Condition Class, Stratum Vegetation Departure, and Stratum Vegetation Condition Class. You do not need to produce or input Current Severity or Current

Frequency layers to obtain vegetation outputs. By selecting ONLY vegetation outputs, version 3.0.0 works much like the older version of FRCCMT (v. 2.2.0).

The first three vegetation outputs, S-Class Relative Amount, Stand Departure, and Stand FRCC, analyze vegetation at the stand level.

> ***Note**: The term "stand" has a special meaning in the context of FRCC Mapping Tool outputs. Here the term refers to all pixels having the same successional state within a given BpS across the analysis area.*

4.1.1 S-Class Relative Amount

The S-Class Relative Amount layer characterizes the relative departure of succession classes and is divided into five categories: Trace, Under-represented, Similar, Over-represented, and Abundant. See Table 4-2.

The S-Class Relative Amount layer provides information for those who would like to restore and maintain vegetation to emulate reference conditions. It indicates whether the current amount of an S-Class is deficient or excessive relative to reference conditions. In this respect, the S-Class Relative Amount layer is more informative than the S-Class Departure layer because the S-Class Relative Amount layer indicates departure on both sides of the scale. That is, the S-Class Relative Amount layer suggests whether a landscape has too much or too little of each S-Class within each BpS. If excessive amounts exist, a manager may want to convert some proportion of that class into another class that is deficient.

Not all excessive classes present restoration opportunities. For example, if the early seral class is excessive, little can be done except to allow succession to advance. On the other hand, if a class is deficient, a manager may want to maintain the amount that remains. It may not be practical to pursue treatment objectives in some instances because of costs or other management concerns. Treatment objectives should always be developed in an interdisciplinary context.

4.1.2 Stand Departure (formerly known as "S-Class Departure")

The Stand Departure layer is derived from the S-Class Percent Difference (see the FRCC Guidebook) and indicates those succession classes that are excessive relative to reference conditions. The values in the Stand Departure layer represent a continuous variable with values ranging from 0 (no departure or under-represented) to 100 percent (completely departed). Stand Departure values were rounded to the nearest integer to avoid the use of a floating point grid.

> ***Note**: A floating point grid is a layer in which values are denoted by a type of numeric field for storing real numbers with a decimal point. The decimal point can be in any position in the field and, thus, may "float" from one location to another for different values stored in the field.*

At a stand-level, an S-Class that is under-represented (in other words, value = 0) simply indicates that there is too little of that class. That is, there is no need to treat that stand if the management objective is to emulate reference conditions. On the other hand, values greater than 0 suggest an increasing need for treatment.

4.1.3 Stand Fire Regime Condition Class

The Stand FRCC layer is the final classification for the S-Class (stand) level of analysis. The Stand FRCC layer is derived by grouping the S-Class Relative Amount into three fire regime condition classes (Table 4-2). Consequently, the Stand FRCC layer is not as informative as the S-Class Relative Amount layer; information is lost due to the broader classification scheme. The overall premise behind the Stand FRCC layer is that, from a departure perspective, there is no reason to change the proportion of an S-Class that is either deficient across a landscape (Trace or Under-represented) or that occurs in approximately the same proportion as reference conditions (Similar).

The Stand FRCC layer is useful for project-level reporting and monitoring and for "futuring" exercises that can help planners devise restoration strategies (Table 4-2). For example, if emulating reference conditions is the management goal, then Stand Fire Regime Condition Class 1 suggests maintenance or recruitment, whereas Stand Fire Regime Condition Class 2 and Class 3 suggest that the area extent of the S-Class should be reduced. The Stand FRCC layer may also be useful in reporting systems that identify stand-level accomplishments, such as the National Fire Plan Operations and Reporting System (NFPORS).

Table 4-2. Relationship between Stand Departure, S-Class Relative Amount, and Stand FRCC.

Stand Departure	S-Class Relative Amount	Stand FRCC	Suggested Management Scenario[1]
(Value)	(Class)	(Class)	
0	Trace	1	Maintain/Recruit
0	Under-represented	1	Maintain/Recruit
0 to 5%	Similar	1	Maintain/Recruit
6 to 80%	Over-represented	2	Reduce
81 to 100%	Abundant	3	Reduce

[1] *When the objective is to manage towards reference conditions.*

4.1.4 Stratum Vegetation Departure (formerly known as "Strata Departure")

Stratum Vegetation Departure describes the overall departure across all succession classes within a particular BpS. It is derived by first determining the percent similarity between the existing BpS' S-Class composition and the reference conditions for that BpS. The sum of the percent similarities is then subtracted from 100 (Barrett and others 2010 [FRCC Guidebook]). Thus, the values in the Stratum Vegetation Departure layer represent a continuous variable with values ranging from 0 (no departure or under-represented) to 100 percent (completely departed). Stratum Departure values were rounded to the nearest integer to avoid the use of a floating point grid.

Managers can use the Stratum Vegetation Departure layer to identify those biophysical settings within given landscapes that exhibit the highest degree of vegetation departure. Thus, this layer is well-suited for prioritizing biophysical settings based upon their need for restoration. Although the Value Attribute Table could have hundreds of potential values, users can simplify the layer by changing the symbology and classifying values into user-defined categories designed to visually rank the biophysical settings by the level of departure.

4.1.5 Stratum Vegetation Condition Class

The Stratum Vegetation Condition Class layer depicts biophysical settings that have a low, moderate, or high vegetation departure. It is derived by classifying the Stratum Vegetation Departure layer into three condition classes (Table 4-3). Consequently, the Stratum Vegetation Condition Class layer is not as informative as the Stratum Vegetation Departure layer, which may contain hundreds of values. On the other hand, it is much easier to interpret the Stratum Vegetation Condition Class layer since it has only three values.

The Stratum Vegetation Condition Class layer is commonly used by managers to help identify areas where there may be opportunities for vegetation restoration (such as those that fall into classes 2 and 3) or maintenance (Class 1). However, the Stratum Vegetation Condition Class layer provides little insight on treatment objectives or management prescriptions. For example, although the Stratum Vegetation Condition Class layer indicates relative departure, it doesn't indicate whether or not a landscape has too much or too little of a particular S-Class. Managers need to refer back to the Succession Class outputs to determine whether they should try to maintain, reduce, or recruit an S-Class in a particular landscape if they want to mimic reference conditions.

Table 4-3. Derivation of the Stratum Vegetation Condition Class layer.

Stratum Vegetation Departure	Stratum Vegetation Condition Class	Description
<34%	1	Low vegetation departure
34 to 66%	2	Moderate vegetation departure
>66%	3	High vegetation departure

4.2 Regime outputs

Regime outputs include: Stratum Fire Frequency Departure, Stratum Fire Severity Departure, Stratum Regime Departure, and Stratum Regime Condition Class. Remember, if you would like to generate any of these output layers, you must first input both Current Severity and Current Frequency layers (see Chapter 3).

4.2.1 Stratum Fire Frequency Departure

Stratum Fire Frequency Departure describes the overall departure of fire frequency across a particular BpS. It is derived by first determining the percent similarity between a BpS' reference fire frequency and current fire frequency. The percent similarity is then subtracted from 100 (Barrett and others 2010 [FRCC Guidebook]). Thus, the layer represents a continuous variable with values ranging between 0 percent (no departure) to 100 percent (completely departed). Because we did not want to produce a floating point grid, we simply rounded the calculation of the Stratum Fire Frequency Departure value to the nearest integer and then assigned each unique outcome to a unique value in the ArcGrid.

Managers can use the Stratum Fire Frequency Departure layer to identify those biophysical settings within a given landscape that exhibit the highest degree of fire frequency departure, which may then be used for identifying and prioritizing restoration opportunities. For example, a high fire frequency departure value may be indicative of areas that may have experienced an excessive build up of the fuel bed, which could result in unnatural fire effects. Although the Attribute Table can include up to 101 values, users can simplify the layer by changing the symbology and classifying values into user-defined categories designed to visually rank the biophysical settings by the level of fire frequency departure.

4.2.2 Stratum Fire Severity Departure

Stratum Fire Severity Departure describes the overall departure of fire severity across a particular BpS. It is derived by first determining the percent similarity between a BpS' reference fire severity and current fire severity and then subtracting that value from 100 (Barrett and others 2010 [FRCC Guidebook]). Thus, the layer represents a continuous variable with values ranging between 0 percent (no departure) to 100 percent (completely departed). To avoid the need for a floating point grid, the Stratum Fire Severity Departure value is rounded to the nearest integer and then each unique outcome is assigned to a unique value in the ArcGrid.

Managers can use the Stratum Fire Severity Departure layer to identify those biophysical settings within a given landscape that exhibit the highest degree of fire severity departure, which may then be used for identifying and prioritizing restoration opportunities. For example, areas with high fire severity departure may be more likely to experience fire effects outside the historical range of variation. Although the Attribute Table could have hundreds of potential values, users can simplify the layer by changing the symbology and classifying values into user-defined categories designed to visually rank the biophysical settings by the level of fire severity departure.

4.2.3 Stratum Regime Departure

The Stratum Regime Departure is derived from the average of Stratum Fire Frequency Departure and Stratum Fire Severity Departure. Thus, the layer represents a continuous variable with values ranging between 0 percent (no departure) to 100 percent (completely departed). To avoid the need for a floating point grid, the Stratum Regime Departure value is rounded to the nearest integer and then each unique outcome is assigned to a unique value in the ArcGrid.

Managers can use the Stratum Regime Departure layer to identify those biophysical settings within a given landscape that exhibit the highest degree of fire regime departure, which may then be used for identifying and prioritizing restoration opportunities. For example, highly departed fire regimes may be indicative of areas that may experience fire effects outside the historical range of variation. Although the Attribute Table can include up to 101 potential values, users can simplify the layer by changing the symbology and classifying values into user-defined categories designed to visually rank the biophysical settings by the level of Stratum Regime Departure.

4.2.4 Stratum Regime Condition Class

The Stratum Regime Condition Class represents a classification of the Stratum Regime Departure into three classes representing low, moderate, or high departure. Consequently, the Stratum Regime Condition Class layer is less informative than the Stratum Regime Departure layer.

Managers can use the Stratum Regime Condition Class layer to identify those biophysical settings within a given landscape that exhibit the highest degree of regime departure, which may then be used for identifying and prioritizing restoration opportunities. For example, areas with a Stratum Regime Condition Class value of 3 may be most likely to experience fire effects outside the historical range of variation.

> ***Note***: *The similarity of the **Stratum Regime Condition Class** and **Stratum Fire Regime Condition Class** layer names can be confusing. Recall that*

the FRCC algorithm is based on an evaluation of both vegetation (S-Class) inputs and "regime" (fire frequency and severity) inputs. Consequently, the name Stratum Regime Condition Class reflects only the frequency and severity departures (not the vegetation departure) when averaged together and subsequently classified. Stratum Fire Regime Condition Class reflects both the vegetation departure and the "regime" departure when averaged together and then classified.

4.3 FRCC Vegetation/Regime outputs

The FRCC Vegetation/Regime outputs include: Stratum Departure, Stratum Fire Regime Condition Class, Landscape Vegetation/Regime Departure, and Landscape Fire Regime Condition Class. Remember, to produce any of these output layers, you must first input both Current Severity and Current Frequency layers.

4.3.1 Stratum Departure

Stratum Departure represents the average of Stratum Vegetation Departure and Stratum Regime Departure. Thus, the layer represents a continuous variable, with values ranging from 0 (no departure) to 100 percent (completely departed). To avoid the need for a floating point grid, the Stratum Departure value is rounded to the nearest integer and then each unique outcome is assigned to a unique value in the ArcGrid.

Managers can use the Stratum Departure layer to prioritize biophysical settings within given landscapes for restoration. Although the Attribute Table can include up to 101 different values, the layer can be simplified by changing the symbology and by classifying values into user-defined categories designed to visually rank the biophysical settings by departure.

4.3.2 Stratum Fire Regime Condition Class

Stratum Fire Regime Condition Class is derived by classifying Stratum Departure into 3 classes depicting low, moderate, and high departure, respectively.

This layer depicts biophysical settings that have a low, moderate, or high departure. It is derived by classifying the Stratum Departure layer into three condition classes, as shown in Table 4-4. Consequently, the Stratum Fire Regime Condition Class layer is not as informative as the Stratum Departure layer, which shows departure to the exact percent. On the other hand, it is much easier to interpret since it has only three values.

Table 4-4. Derivation of the Stratum Fire Regime Condition Class layer.

Stratum Departure	Stratum FRCC	Description
<34%	1	Low departure
34-66%	2	Moderate departure
>66%	3	High departure

Because it is easy to interpret visually, the Stratum Fire Regime Condition Class layer is commonly used to help identify areas that may present opportunities for restoration (Stratum Fire Regime Condition Classes 2 and 3) or maintenance (Stratum Fire Regime Condition Class 1). However, the Stratum Fire Regime Condition Class layer provides little insight on actual treatment objectives or management prescriptions. For example, although the Stratum Fire Regime Condition Class layer indicates relative departure, it does not indicate whether a given BpS should be managed to create more or less of a given S-Class, nor does it indicate how current fire frequency and severity differ from reference conditions. In planning specific treatments, managers will be better informed by using other Stratum and S-Class layers.

4.3.3 Landscape Departure

The Landscape Departure layer is derived by averaging the Stratum Vegetation Departure and the Stratum Regime Departure for each pixel, and then computing an area-weighted average of this value across the Landscape Level 1 landscapes. Like the other Departure layers, the Landscape Departure layer can have values ranging from 0 to 100 percent.

Level 1 landscapes are the lowest (in other words, smallest) level of the landscape hierarchy used in the analysis. For example, if the landscape layer consists of a watershed hierarchy of subwatersheds, watersheds, and subbasins, the Landscape Departure metric would be derived at the subwatershed level. The lowest level of the landscape hierarchy is used as the reporting unit because it provides the most detailed information of the three landscape levels. That is, spatial information is commonly washed out when data are summarized by larger and larger units (in other words, decreasing resolution and increasing granularity).

The Landscape Departure layer can be used to prioritize entire landscapes based on restoration needs. The Landscape Departure layer proves useful for broad-level decisions at a landscape level; however, this layer does not provide information about what may be "wrong" with a particular landscape in terms of succession class composition, or even which biophysical settings are contributing most to the highest departure values. FRCCMT outputs at the succession class and Stratum (BpS) levels are more helpful for formulating restoration strategies.

4.3.4 Landscape Fire Regime Condition Class

The Landscape Fire Regime Condition Class layer is derived by classifying the Landscape Departure layer into three categories (low, moderate, and high departure; Table 4-5). The class thresholds are the same as those used to classify Stratum Departure for deriving the Stratum Fire Regime Condition Class layer.

Table 4-5. Derivation of the Landscape FRCC layer.

Landscape Departure	Landscape FRCC	Description
<34%	1	Low departure
34-66%	2	Moderate departure
>66%	3	High departure

The Landscape Fire Regime Condition Class layer has the least thematic detail and spatial resolution of the FRCCMT metrics because data are summarized into three classes at the landscape level. The layer has the same limitations as the Landscape Departure layer in that it cannot be used to directly address BpS or S-Class issues. However, it can be useful for producing a very simple map with departure summarized at the landscape level.

Chapter 5: Summary Report

5.1 Summary Report

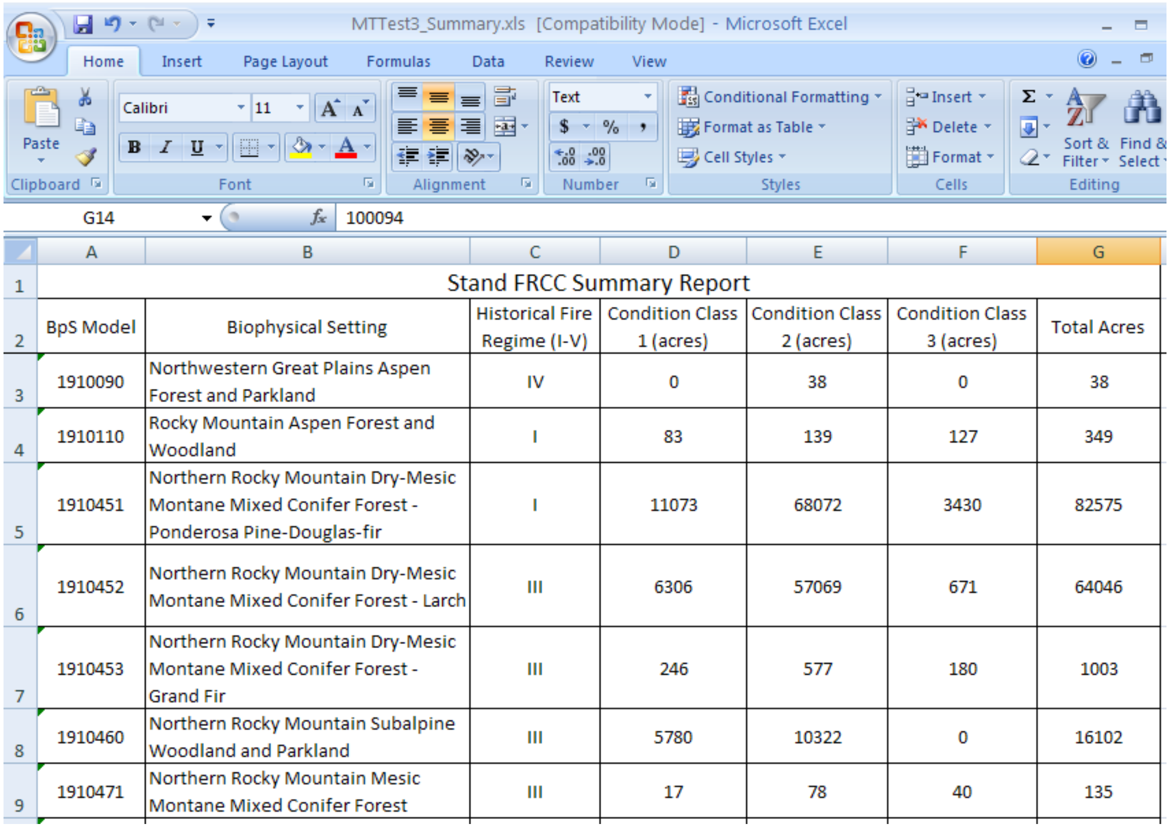
In addition to the output rasters discussed in Chapter 4, FRCCMT also generates two types of summary reports: a Stand FRCC Report and up to three different Landscape Reports. The Stand FRCC Report summarizes acres of Stand Fire Regime Condition Class 1, 2, and 3 by BpS (Figure 5-2). The Landscape Report(s) were created to facilitate treatment designs on the basis of managing landscapes towards reference conditions (Figure 5-3).

Both types of summary reports can be useful for pre- and post-treatment documentation, scenario testing, and monitoring trends of vegetation departure. This information can be used to identify which restorative actions are needed and where they should occur across an assessment area.

The Summary Report is generated by selecting **Open Summary Reports** after the output rasters have been created (Figure 5-1).

Figure 5-1. Opening the Summary Reports.

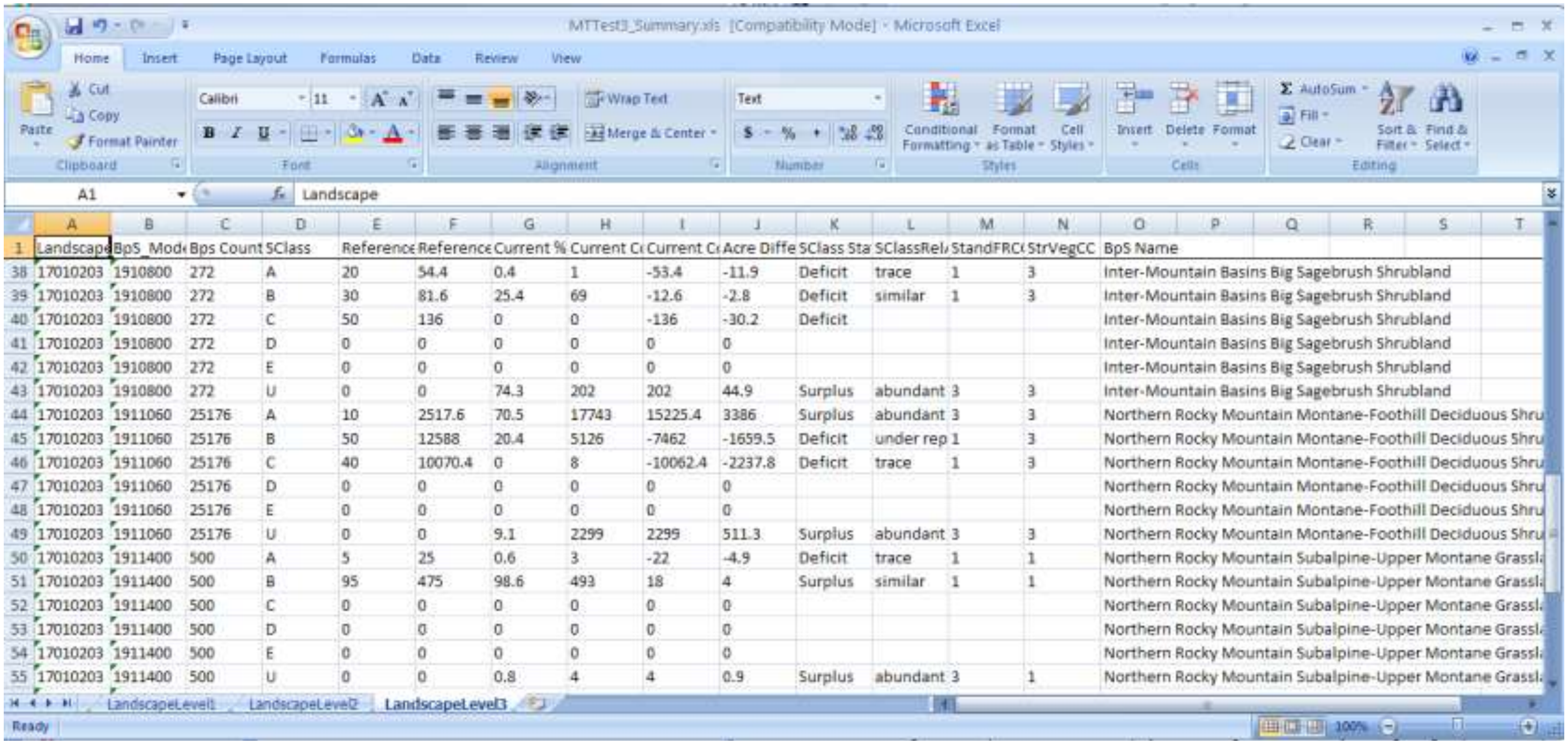
The Summary Report is a Microsoft Excel file that contains up to four worksheets: a Stand FRCC worksheet (Figure 5-2), and up to three landscape worksheets corresponding to each landscape level used in the assessment (specifically, landscape level 1, landscape level 2, and landscape level 3; Figure 5-3). For example, four worksheets are automatically included in the Excel file if three landscape levels were used in the analysis of vegetation departure.



Stand FRCC Summary Report

BpS Model	Biophysical Setting	Historical Fire Regime (I-V)	Condition Class 1 (acres)	Condition Class 2 (acres)	Condition Class 3 (acres)	Total Acres
1910090	Northwestern Great Plains Aspen Forest and Parkland	IV	0	38	0	38
1910110	Rocky Mountain Aspen Forest and Woodland	I	83	139	127	349
1910451	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Ponderosa Pine-Douglas-fir	I	11073	68072	3430	82575
1910452	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Larch	III	6306	57069	671	64046
1910453	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Grand Fir	III	246	577	180	1003
1910460	Northern Rocky Mountain Subalpine Woodland and Parkland	III	5780	10322	0	16102
1910471	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	III	17	78	40	135

Figure 5-2. Example of the Stand FRCC report displaying condition class acreages for each BpS stratum.



	Landscape	BpS_Mod	Bps Count	SClass	Reference	Reference	Current %	Current C	Current C	Acre Diffe	SClass Sta	SClassRel	StandFRC	StrVegCC	BpS Name
38	17010203	1910800	272	A	20	54.4	0.4	1	-53.4	-11.9	Deficit	trace	1	3	Inter-Mountain Basins Big Sagebrush Shrubland
39	17010203	1910800	272	B	30	81.6	25.4	69	-12.6	-2.8	Deficit	similar	1	3	Inter-Mountain Basins Big Sagebrush Shrubland
40	17010203	1910800	272	C	50	136	0	0	-136	-30.2	Deficit				Inter-Mountain Basins Big Sagebrush Shrubland
41	17010203	1910800	272	D	0	0	0	0	0	0					Inter-Mountain Basins Big Sagebrush Shrubland
42	17010203	1910800	272	E	0	0	0	0	0	0					Inter-Mountain Basins Big Sagebrush Shrubland
43	17010203	1910800	272	U	0	0	74.3	202	202	44.9	Surplus	abundant	3	3	Inter-Mountain Basins Big Sagebrush Shrubland
44	17010203	1911060	25176	A	10	2517.6	70.5	17743	15225.4	3386	Surplus	abundant	3	3	Northern Rocky Mountain Montane-Foothill Deciduous Shru
45	17010203	1911060	25176	B	50	12588	20.4	5126	-7462	-1659.5	Deficit	under rep	1	3	Northern Rocky Mountain Montane-Foothill Deciduous Shru
46	17010203	1911060	25176	C	40	10070.4	0	8	-10062.4	-2237.8	Deficit	trace	1	3	Northern Rocky Mountain Montane-Foothill Deciduous Shru
47	17010203	1911060	25176	D	0	0	0	0	0	0					Northern Rocky Mountain Montane-Foothill Deciduous Shru
48	17010203	1911060	25176	E	0	0	0	0	0	0					Northern Rocky Mountain Montane-Foothill Deciduous Shru
49	17010203	1911060	25176	U	0	0	9.1	2299	2299	511.3	Surplus	abundant	3	3	Northern Rocky Mountain Montane-Foothill Deciduous Shru
50	17010203	1911400	500	A	5	25	0.6	3	-22	-4.9	Deficit	trace	1	1	Northern Rocky Mountain Subalpine-Upper Montane Grassl
51	17010203	1911400	500	B	95	475	98.6	493	18	4	Surplus	similar	1	1	Northern Rocky Mountain Subalpine-Upper Montane Grassl
52	17010203	1911400	500	C	0	0	0	0	0	0					Northern Rocky Mountain Subalpine-Upper Montane Grassl
53	17010203	1911400	500	D	0	0	0	0	0	0					Northern Rocky Mountain Subalpine-Upper Montane Grassl
54	17010203	1911400	500	E	0	0	0	0	0	0					Northern Rocky Mountain Subalpine-Upper Montane Grassl
55	17010203	1911400	500	U	0	0	0.8	4	4	0.9	Surplus	abundant	3	1	Northern Rocky Mountain Subalpine-Upper Montane Grassl

Figure 5-3. Example of a Landscape Level 3 Summary Report. Landscape Level 3 includes the reporting units used to derive estimates of vegetation departure for those biophysical settings dominated by fire regime groups 4 and 5 (in other words, higher severity and longer fire return intervals). This example shows three biophysical settings (Inter-Mountain Basins Big Sagebrush Shrubland, Northern Rocky Mountain Montane-Foothill Deciduous Shrubland, and Northern Rocky Mountain Subalpine-Upper Montane Grassland) occurring within a single landscape unit (Subbasin 17010203). (See Table 5-1 below for field descriptions).

Table 5-1. Description of fields contained within the Landscape Reports.

Field	Description
Landscape	The landscape identifier contained in the landscape layer.
BpS_Model	The BpS model identifier corresponding to BpS_Model in the Reference Condition Table.
BpS Count	The total number of pixels of a specific BpS within a specific landscape.
Sclass	The S-Class identifier.
Reference%	The reference percentage of an S-Class of a BpS. Expressed as the mid-point of the simulated historical range of variation.
Reference Count	The number of pixels required for the S-Class to have the same composition percentage as the reference composition for that BpS in the landscape.
Current%	The current composition percentage of an S-Class within a BpS and a given landscape.
Current Count	The current number of pixels occurring within a specific S-Class of a BpS within a specific landscape.
Current Count – Reference Count	The difference between the current number of pixels and the number of pixels necessary to meet reference conditions.
Acre Difference	The difference between the current condition and reference condition, expressed in acres.
Sclass Status	Indicates whether a particular S-Class is currently in a deficit or surplus condition. Deficit denotes that the current composition percentage is less than the reference composition percentage. Surplus denotes that the current composition percentage exceeds the reference composition percentage.
SclassRelAmt	The difference between current conditions and reference conditions grouped into six classes (Trace, Underrepresented, Similar, Over-represented, Abundant, and Unclassified).
StandFRCC	Final classification for the S-Class (stand) level of analysis; derived by grouping the S-Class Relative Amount into three fire regime condition classes.
StrVegCC	Depicts biophysical settings that have a low, moderate, or high Stratum Vegetation Condition Class; derived by classifying the Stratum Vegetation Departure layer into three condition classes plus an unclassified category.
BpS Name	The name of the BpS as identified in the Reference Condition Table.

The Landscape reports, which are sorted by landscape, BpS, and S-Class, first identify the total pixel count of a BpS within a specific landscape. The reference condition of each S-Class within a BpS is then identified along with the corresponding pixel count necessary to simulate that reference condition. The report then compares current pixel counts in each S-Class to the pixel count of reference conditions to derive the number of acres of a particular S-Class to be maintained or converted to some other S-Class. Information pertaining to S-Class Relative Amount, Stand FRCC, and Stratum Vegetation Condition Class are also included in the Landscape Report.

> ***Tip:*** *The Landscape reports can be sorted in various configurations, depending on management questions. However, be careful to sort the entire worksheet. Excel worksheets can be easily scrambled, making them useless if only a subset of the fields is sorted independently of the other fields. We also recommend saving a master copy of the worksheet under another name before sorting and editing.*

The Landscape Reports can help address the following questions: "How much change is necessary to mimic the reference condition?" and "Which succession classes need to be treated?" The report designates succession classes as surplus or deficient for easy identification of the S-Class status within specific landscapes and biophysical settings. Prescriptions can be developed by identifying succession classes to be recruited by adding additional acres versus those to be reduced by decreasing acreage. For example, if we focus on a single BpS, Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland, and a single landscape, as shown in Figure 5-2, we can see that the current landscape has excess acres of the mid-seral open class (C), and deficient acreage in the early and mid-seral closed classes (A and B), compared with the reference landscape composition. Managers seeking to move this system toward reference conditions would want to identify strategies that could reduce the amount of class C , and increase the amount of classes A and B.

O31 | *fx* | Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland

Landscape	BpS_ Model	Bps Count	SClass	Reference %	Reference Count	Current %	Current Count	Current Count - Reference Count	Acre Difference	SClass Status	SClassRel Amt	Stand FRCC	StrVeg CC
17010203	1910560	450073	A	15	67511	13.2	59582	-7928.9	-1763.4	Deficit	similar	1	1
17010203	1910560	450073	B	30	135022	22.6	101662	-33359.9	-7419	Deficit	similar	1	1
17010203	1910560	450073	C	10	45007	18.7	84254	39246.7	8728.2	Surplus	over rep	2	1
17010203	1910560	450073	D	45	202533	45.4	204416	1883.1	418.8	Surplus	similar	1	1
17010203	1910560	450073	E	0	0	0	0	0	0				
17010203	1910560	450073	U	0	0	0	159	159	35.4	Surplus	abundant	3	1

LandscapeLevel1 | LandscapeLevel2 | **LandscapeLevel3**

Figure 5-2. An example of a Summary Report displaying a single BpS within a single landscape. The Summary Report can be used to determine how to treat a BpS if your objective is to mimic reference conditions. In this example, the Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest BpS has excess acres of the mid-seral open class (C), and deficient acreage in the early and mid-seral closed classes (A and B), compared with the reference landscape composition). (See Table 5-1 for descriptions of fields within the Summary Report).

The Stand FRCC Report and the Landscape Reports can be used to monitor the effectiveness of proposed treatments in reducing vegetation departure by comparing pre- and post-treatment conditions. The reports can also be used to calculate the total acres that would have to be treated within an analysis area to mimic reference conditions. For example, using the Stand FRCC Report, simply tally the acres of Stand Fire Regime Condition Class 2 and 3. Using the Landscape Reports, first total the acres (either positive or negative numbers – not both) in each landscape-level worksheet and then add those totals to calculate an overall sum.

Larger analysis areas generate larger Landscape Reports, which can be unwieldy to work with in an Excel spreadsheet. Few would want to use a spreadsheet to process thousands of records to glean information that could be useful in formulating treatment prescriptions. Since Excel has a limit of 65,536 records, the Landscape Report worksheet may be truncated to 65,536 records and some data may be lost. If this occurs, the analysis area has too many landscapes and/or biophysical settings to export the entire report to Excel. For large assessment areas exceeding one million acres in size, the Landscape Reports may be more useful if worksheets are imported into an Access database, which is better suited for summarizing large data sets.

Chapter 6: Installing the FRCC Mapping Tool

6.1 General installation instructions

All NIFTT tools, including FRCCMT, are now downloaded and installed as single tools. A complete or "package" install is no longer available for versions of NIFTT tools compatible with ArcGIS 9.2 or 9.3.

> ***Note**: FRCCMT 3.0.0 is designed for ArcGIS 9.2 or 9.3. Please ensure that the latest ArcGIS Service Pack has also been installed.*

If you have an earlier version of the FRCC Mapping Tool installed on your computer, you will first need to uninstall it before proceeding with installation of the current version (see Section 6.2.2)**.**

To determine which version is currently installed on your computer, go to **Start > Control Panel > Add or Remove Programs** as shown in Figure 6-1.

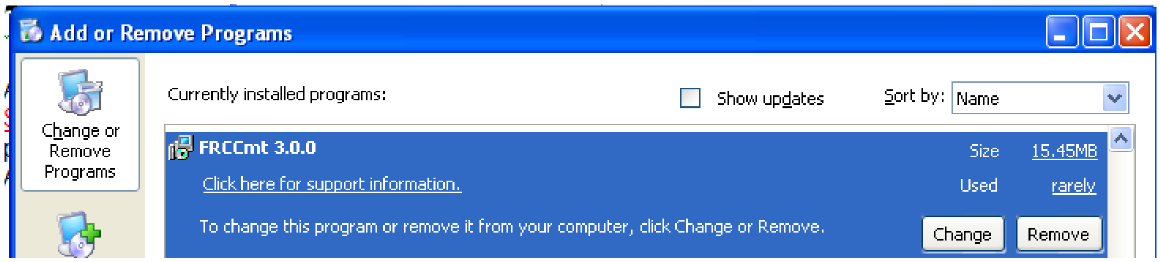


Figure 6-1. FRCC Mapping Tool version 3.0.0 is installed.

> ***Note**: NIFTT naming conventions are as follows: "FRCCMT_ 300_100429" indicates that this "install" is version 3.0.0, which was completed on 4/29/2010.*

You may need administrative privileges to install FRCCMT. Contact your system administrator if you experience problems with the installation.

6.2 FRCC Mapping Tool installation

6.2.1 Downloading the FRCC Mapping Tool

If you would like to install or reinstall FRCCMT, follow these steps:

Download FRCCMT from the website at www.niftt.gov. Go to **NIFTT > Tools and User Documents** located at the left side of the page, as shown in Figure 6-2, and then navigate to the FRCC Mapping Tool download.

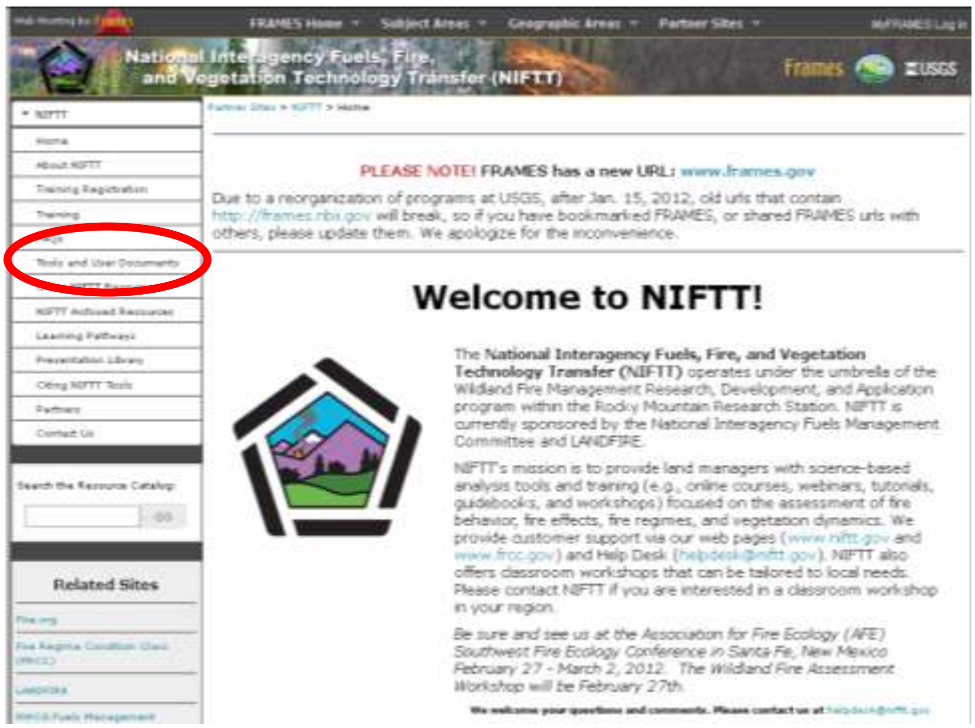


Figure 6-2. Select "Tools and User Documents" and navigate to the FRCC Mapping Tool.

Click on **FRCC Mapping Tool 3.0.0** to begin the download process.

> ***Note**: To continue with the download, you will need to have WinZip or a similar program installed on your computer.*

Click **OK** or **Save** to download the self-extracting WinZip FRCC Mapping Tool installation file and then save it to a convenient location on your computer.

6.2.2 Installing the FRCC Mapping Tool

> ***Note****: The following installation steps were developed for Windows XP and WinZip 14.0. The steps may be slightly different when using other software or versions.*

Go to the folder in which you stored the FRCCMT file and open the file.

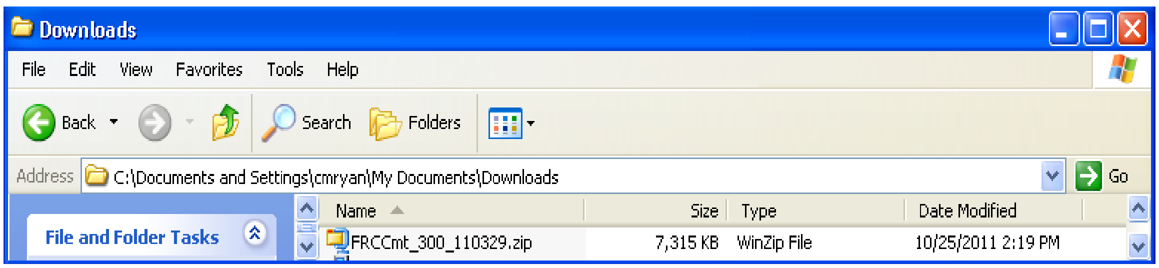


Figure 6-3. Self-extracting FRCC Mapping Tool installation file has been downloaded and saved.

WinZip will open, as shown in Figure 6-4. Unzip the files to the location of your choice by right-clicking on the file name. Select the option *Extract….*

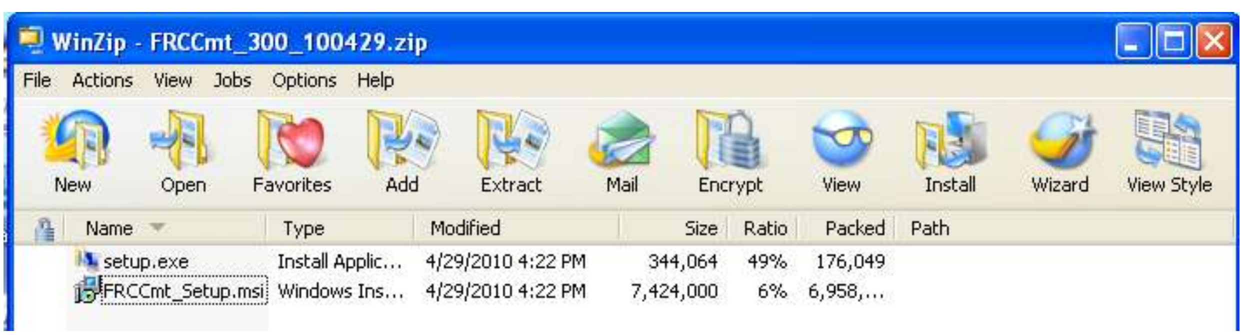


Figure 6-4. FRCC Mapping Tool installation files.

Click on **setup.exe**. If a security warning appears, click **Run** or **Yes** to install the software.

> ***Note**: If the setup determines that an earlier version of the FRCC Mapping Tool is already installed on your computer, go to **Start > Control Panel** and select **Add/Remove Programs**. Uninstall the previous version of FRCCMT and then rerun setup.exe.*

The installer may indicate that the setup requires the installation of .NET Framework that has not been previously installed on your computer. See Appendix C for instructions on obtaining the latest .NET Framework before continuing with installation of FRCCMT.

After clicking on the setup.exe file and installing the latest .NET framework, if necessary, the first in a series of FRCC Mapping Tool Setup Wizard dialog boxes will open (see Figure 6-5). Follow instructions as directed by the dialog boxes in the Setup Wizard. During the installation process, you may see a radio button asking you to specify whether the tool is to be installed for "Everyone" or "Just Me." Select the "Everyone" option.

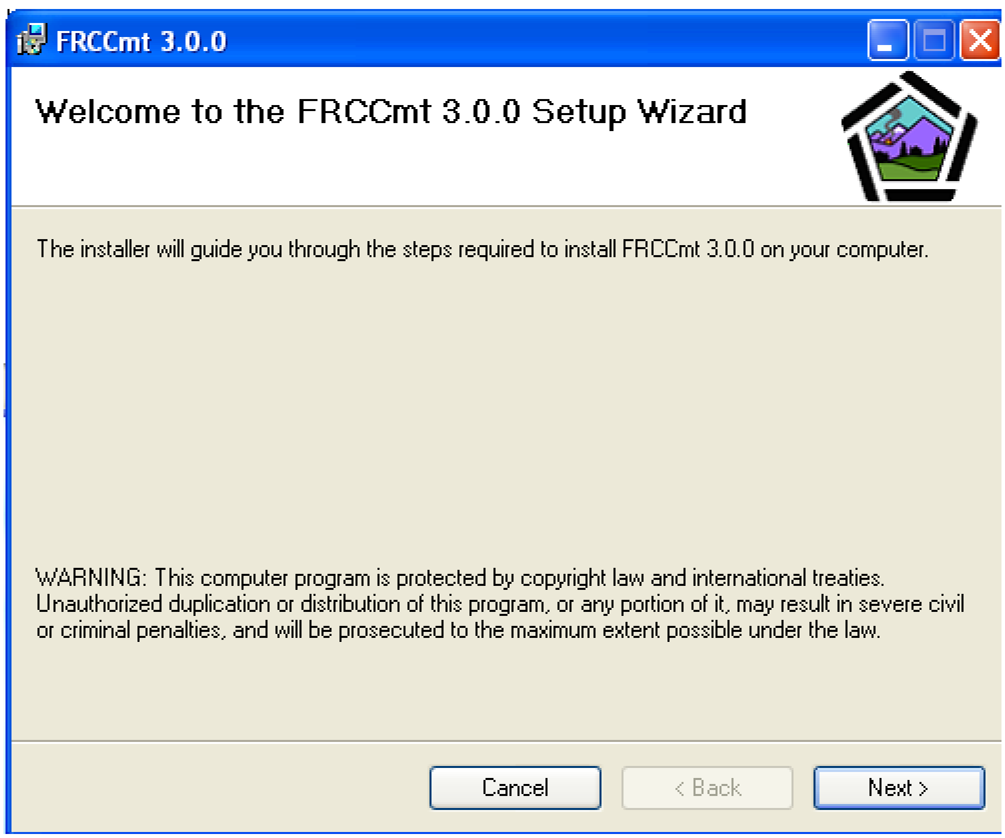


Figure 6-5. First dialog box of the FRCC Mapping Tool Setup Wizard.

> ***Note**: The default location for the FRCC Mapping Tool installation is C:\Program Files\NIFTT, as shown in Figure 6-6. You may install the program in a different location, but it is best to select a location with a short path name so that the total path length (including the subfolders containing the reference condition database) does not exceed the 80 characters. See Section 3.2: Reference Condition Table for more details.*

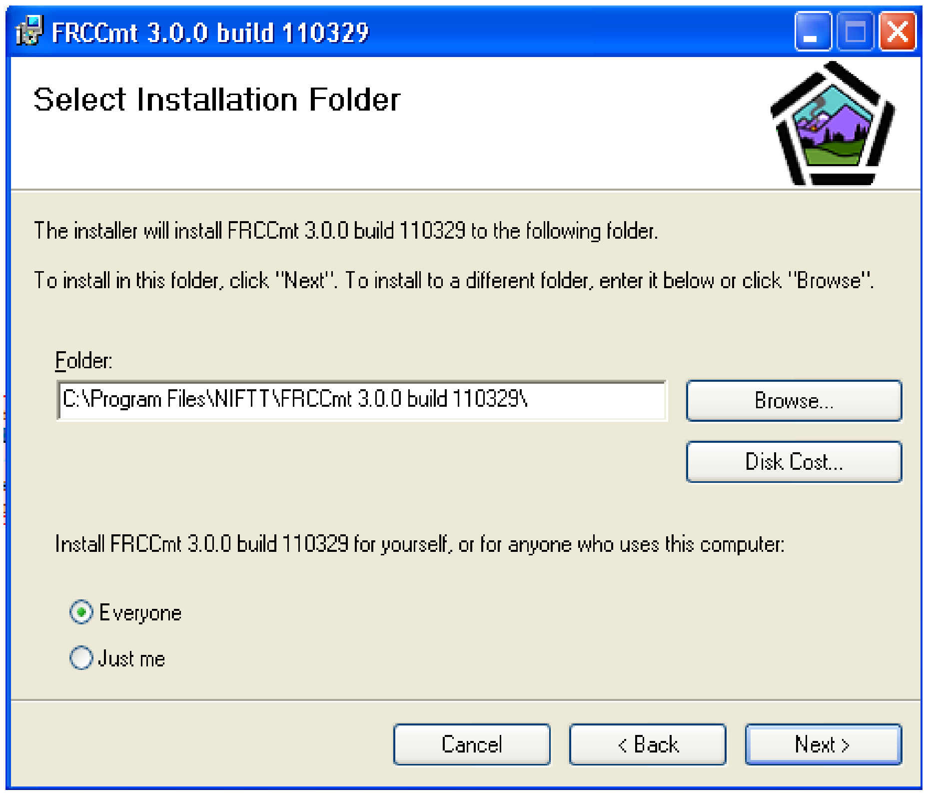


Figure 6-6. Selecting the installation folder.

Click on **Close** when the FRCCMT installation is complete.

Open ArcMap and make sure that the FRCC Mapping Tool and Fire Frequency Severity Editor Toolbar  is visible.

> ***Note:** The toolbar may be "floating" and, if so, you will need to anchor it in a convenient location.*

If the toolbar is not visible, you may need to select **Tools > Customize** and check the box to the left of "FRCCmt 3.0.0," as shown in Figure 6-7.

***Note**: To continue this process, it may first be necessary for you to log on as an "Administrator." Contact your systems administrator if you experience problems.*

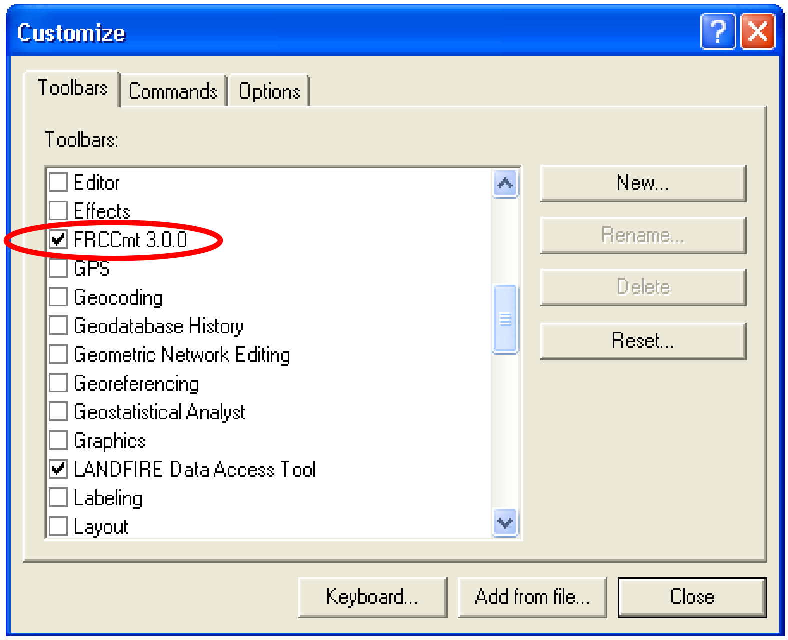


Figure 6-7. Selecting the FRCCMT toolbar.

***Tip:** For best results, make sure that you have installed the most recent ArcGIS service packs and patches. Go to www.esri.com to verify that you have the most recent versions already installed on your computer. If you do not, download the newest service packs and patches as directed on the website.*

Chapter 7: Using the Fire Frequency and Severity Editor

7.1 The FRCC Mapping Tool toolbar

The following diagram shows icons and associated tool tips on the FRCC Mapping Tool toolbar. Refer to the discussions below to learn more about the basic functions of each icon.

Figure 7-1. The FRCC Mapping Tool toolbar.

The first button on the toolbar is the **Fire Frequency and Severity Editor** icon, which opens the **Fire Frequency and Severity Editor** dialog box. This form launches the Editor and allows you to select various inputs and outputs. (See Section 2.2 for an overview of the Fire Frequency and Severity Editor.)

7.2 How to run the Fire Frequency and Severity Editor

This guide assumes a basic knowledge of ArcMap and thus does not include detailed instructions for basic steps such as creating a new project and adding data. Please refer to the FRCCMT tutorial (available at www.niftt.gov) for more detailed step-by-step instructions, including screen shots of each step.

7.2.1 Getting started

First, you will need to create a new ArcMap project that includes the three required input layers: BpS, S-Class, and Landscape. You can also add ancillary layers, such as cities and roads, to help identify landmarks.

Save your project with a file name that is meaningful to you and meets ArcGIS file naming standards. Figure 7-2 shows a project containing the required input layers.

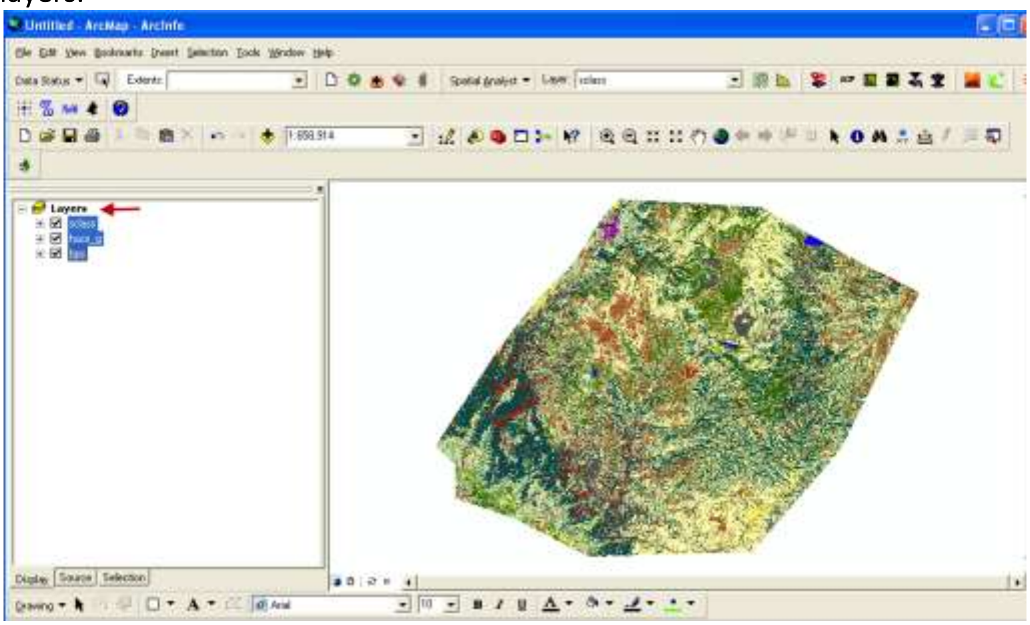


Figure 7-2. ArcGIS project including the input layers required to run the Fire Frequency and Severity Editor.

> ***Note:*** *When naming the file, you do not need to include a file extension. However, the file name must not exceed 10 characters in length and should not contain any spaces, leading numbers, or special characters (`~! @#$^()-+={ }[ ]|\?/:;"'< >, .).*

> ***Tip****: Convenient file names might include a location, a run number, or perhaps an indication of the number of landscape levels analyzed (such as SmithCr, sc1, or sc1_1).*

Click on the **Frequency and Severity Editor** icon to launch the Fire Frequency and Severity Editor dialog box (Figure 7-3). The fields in the box must be completed in sequential order from top to bottom.

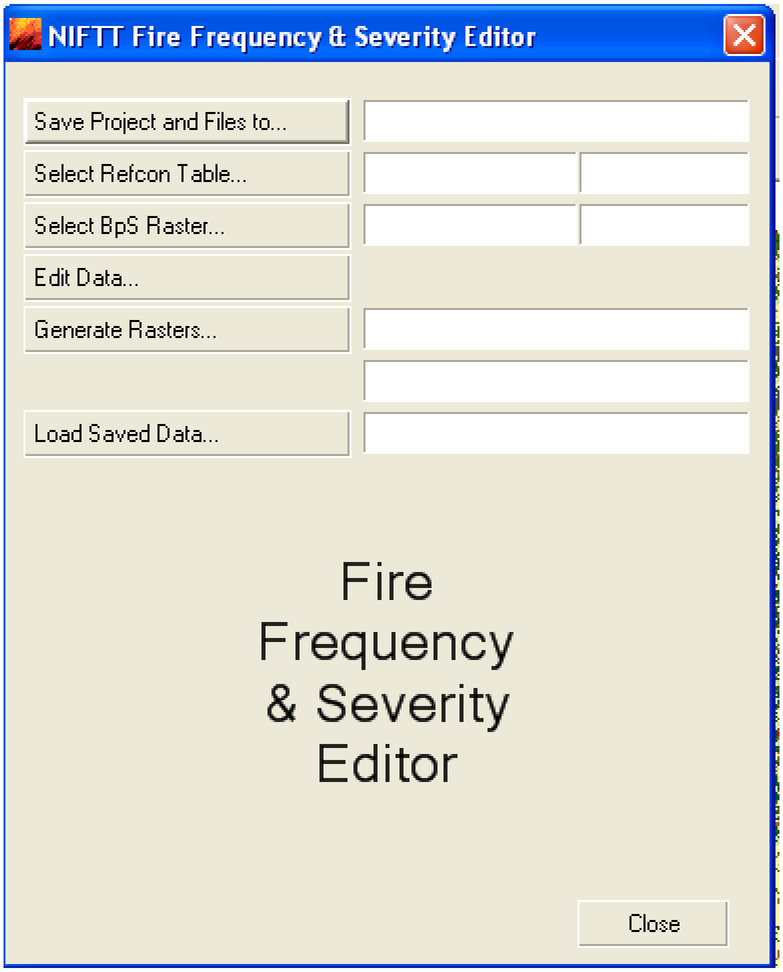


Figure 7-3. Fire Frequency and Severity Editor dialog box.

7.2.2 Identifying a project and file path

In the **Fire Frequency and Severity Editor** dialog box, click on the top bar labeled **Save Project and Files to...** to select an output path and a folder name for storing run outputs (Figure 7-4). You will need to be sure to select or create a new empty folder. The initial pathway "C:\" appears in red to warn you that you will need to specify a new folder and NOT overwrite the path shown when the box opens.

> ***Tip**: The total length of the path should not exceed 80 characters, nor contain any spaces. The file name chosen should be a maximum of 10 characters in length, must not contain any spaces, leading numbers, or special characters* (`~! @#$^()-+={ }[ ] |\?/:;"'< >, .), *and should be meaningful to the user.*

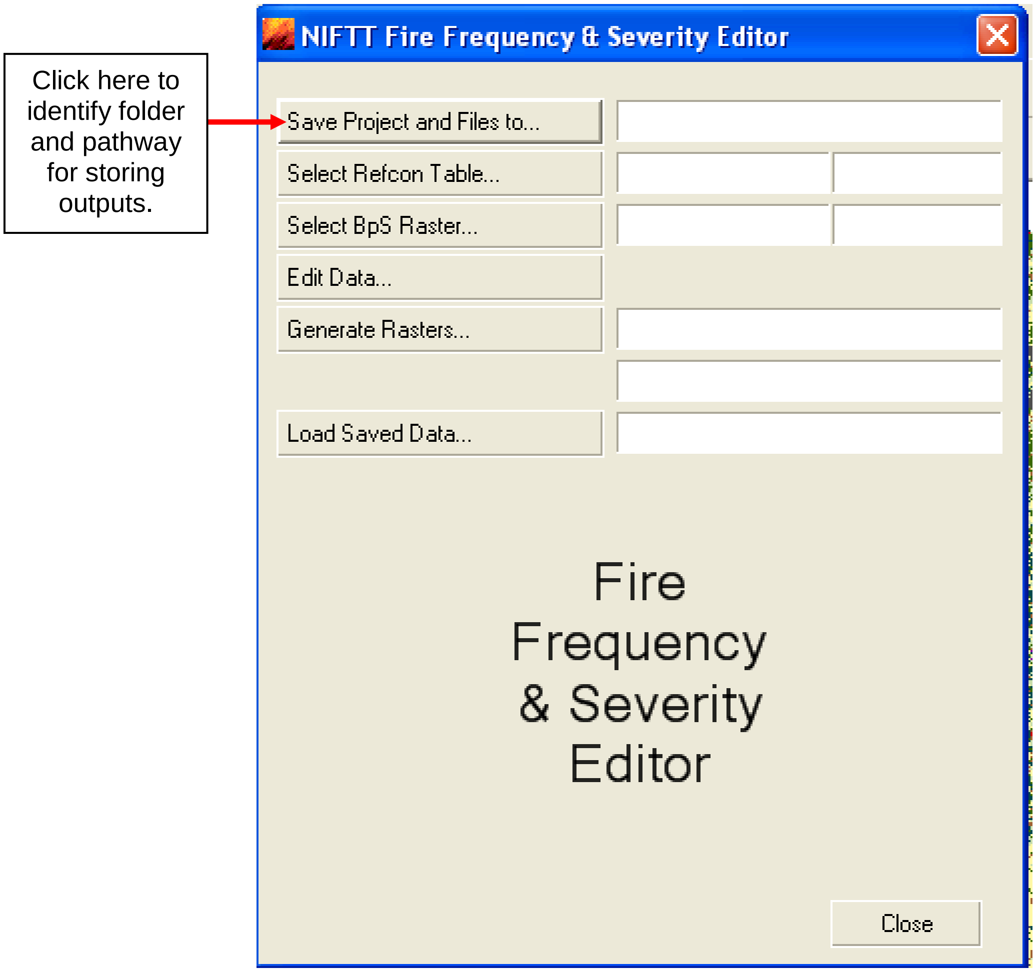


Figure 7-4. Selecting an output path.

The folder will be located in the path identified under the Path\Project Folder.

> ***Note**: Be sure to store outputs on your local hard drive. The following problems may occur when outputs are stored on a network server:*
>
> - *Performance (runtime) will be substantially slower*
> - *The server may time out, preventing file transport*
> - *Permission problems may prevent file transport*
> - *Overly long paths may exceed ESRI's space limitation*
> - *Special characters, leading numbers, or spaces in the path will cause run failure*

The output folder created by the Fire Frequency and Severity Editor will contain a unique folder for every output layer created. A layer file is also created for each of the output layers. Layer files maintain an assigned legend when loaded into an ArcMap project. An additional folder is created (denoted as "ModifiedRasters") if the Editor creates a new BpS grid by deleting classes that do not correspond to the Reference Condition Table or a modified S-Class layer that collapses any uncharacteristic S-Classes into a single class denoted as "U". A "Logs" folder, containing text files identifying the biophysical settings and succession classes that do not match the Reference Condition Table, is also created.

> ***Tip:*** *Modified rasters can be used in place of the original BpS and S-Class rasters to speed up processing time in subsequent runs.*

7.2.3 Selecting a Reference Condition Table

Next you will need to select an appropriate Reference Condition Table, as shown in Figure 7-5.

Two Reference Condition Tables are included when FRCCMT is installed. The first table (RAnat_090722) was developed for the Rapid Assessment phase of the LANDFIRE Project and covers the conterminous United States. The second table (LFnat_100108) includes the LANDFIRE National reference conditions for the conterminous United States, Alaska, and Hawaii.

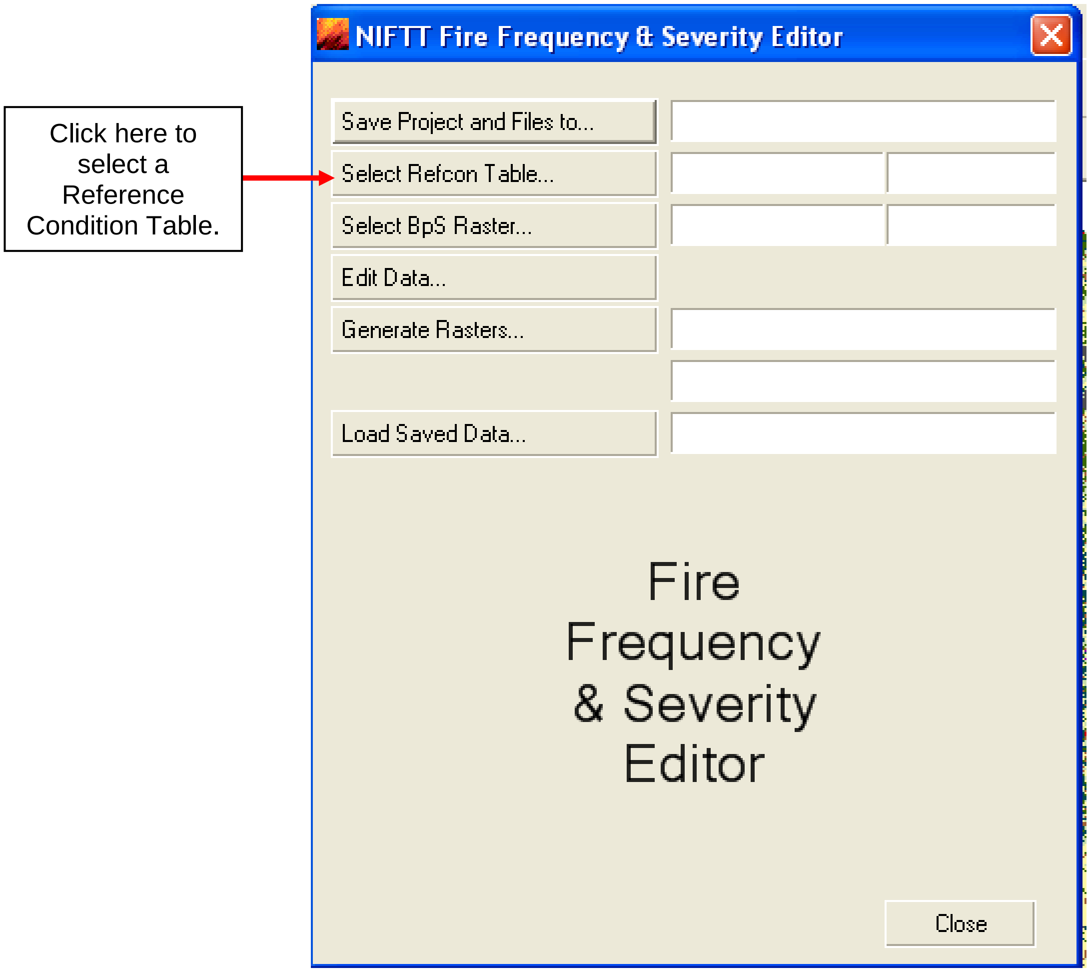


Figure 7-5. Selecting a Reference Condition Table.

Two options are available: **Select the Refcon table from the default database** and **Select the Refcon database from an Open File Dialog.** Click on the radio button to make your choice (Figure 7-6).

If you select the first option (**Select the Refcon table from the default database**), the drop-down menu will be populated with the Rapid Assessment and LANDFIRE National reference condition tables. Select the option that matches the BpS input layer you plan to use.

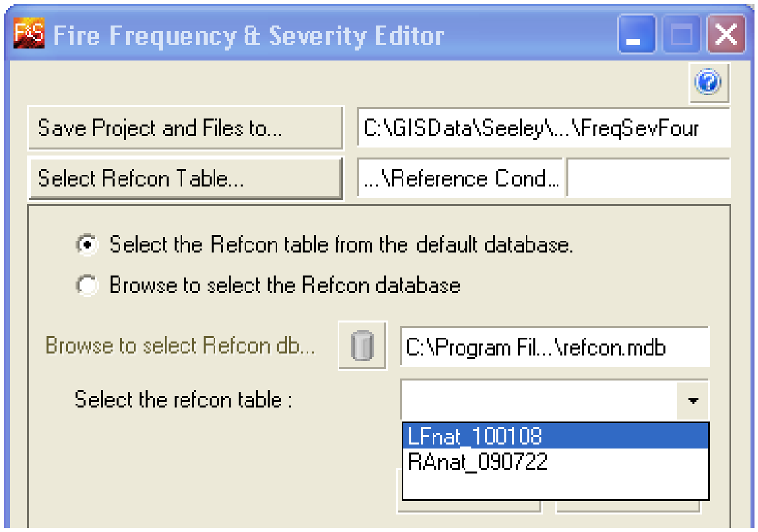


Figure 7-6. Use the drop-down menu to select a refcon.mdb that matches the BpS input layer.

Note: *Reference Condition Tables are stored in an Access database labeled "refcon.mdb" in the same directory that was selected for the Mapping Tool during installation. (The default is "C:\Program Files\NIFTT\FRCCmt 3.x.x build xxxxxx\Reference Conditions Database\refcon.mdb.") Navigate to the Reference Condition Database and double-click on refcon.mdb to display the default Reference Condition Tables.*

If you do not wish to use a default table, you must select the desired Reference Condition Table, as described below:

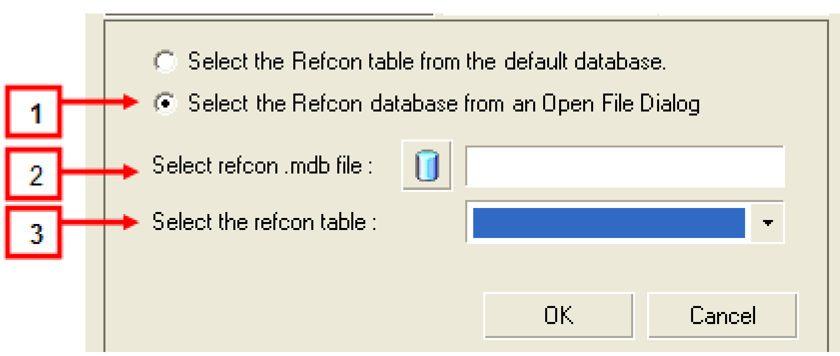


Figure 7-7. Browse to the location of the reference condition table you would like to select.

1. Click on the second radio button **Select the Refcon database from an Open File Dialog** (Figure 7-7).

2. Use the browse button to navigate to the folder containing the Reference Condition table that is appropriate for your assessment (Figure 7-7).

3. Use the drop-down menu to make your selection.

Recall that the Frequency and Severity Editor can only use a Reference Condition Table located in an Access database named refcon.mdb. See Section 3.2: Reference Condition Table for more details on creating and editing custom Reference Condition Tables.

7.2.4 Selecting a BpS Raster

Click on the **Select BpS Raster** button, as shown below (Figure 7-8).

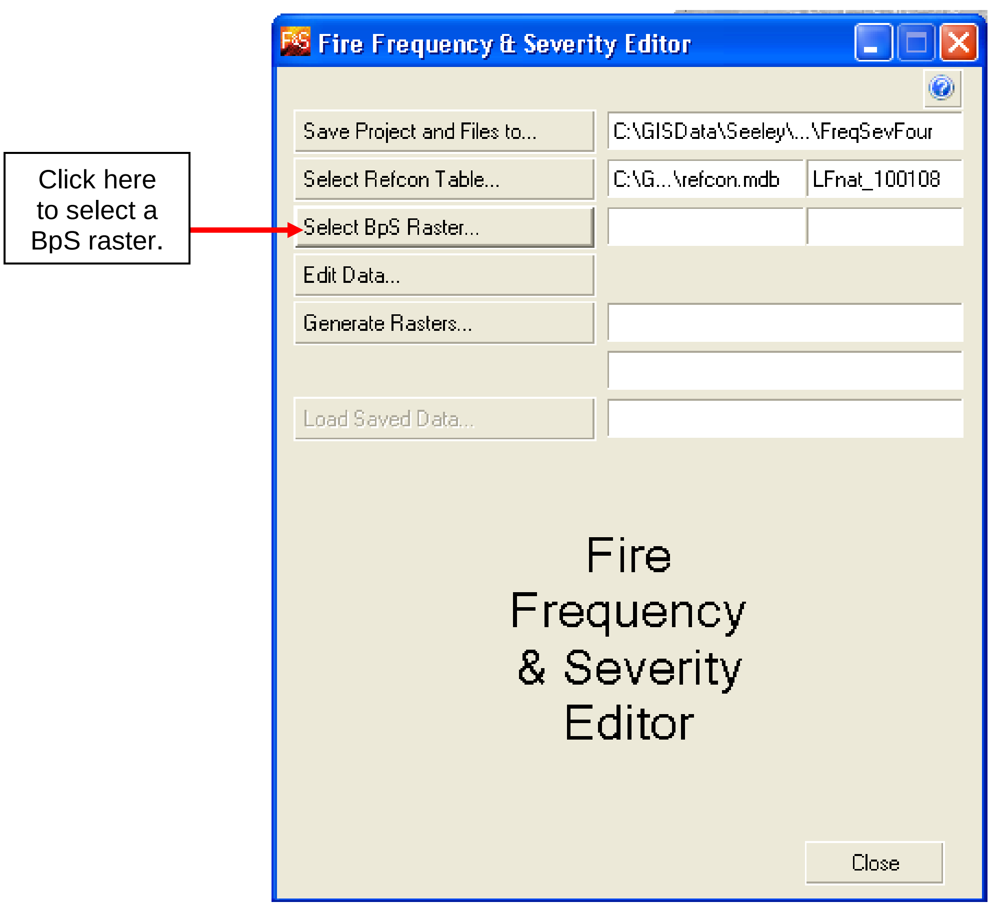


Figure 7-8. Selecting a BpS raster.

The following dialog box will open, allowing you to select the correct BpS layer. Two options are available: **Select the BpS from the Table of Contents** and **Select the BpS from an Open File Dialog.** Click on the radio button to make your choice (Figure 7-9).

If you select the first option (**Select the BpS from the Table of Contents**), a drop-down menu populated with several options will appear. Select the correct option from this list. If you choose the second option, **Select the BpS from an Open File Dialog**, use the browse button to navigate to the BpS layer of your choice. Next, select the attribute that identifies the BpS models. The attribute you select must contain values that correspond to the BpS_Model values contained within the Reference Condition Table selected in the previous step. When you have finished making your selections, click **OK**.

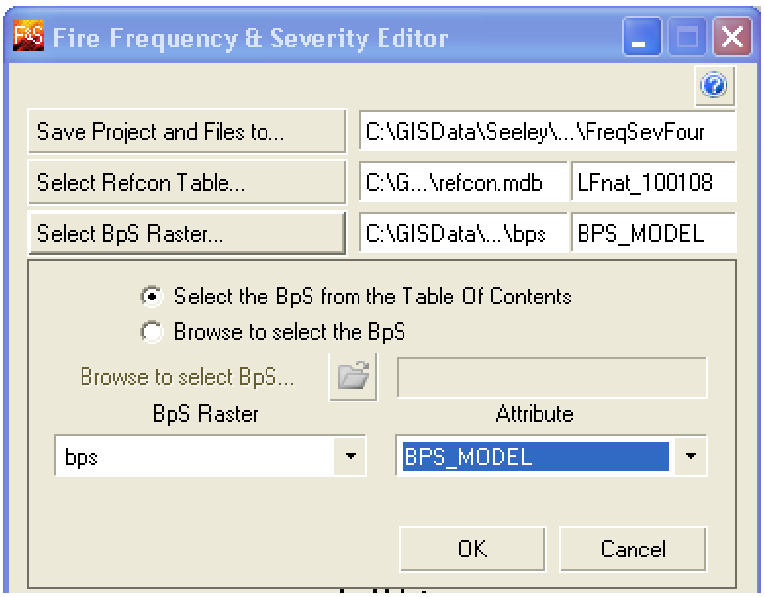


Figure 7-9. Use the radio buttons to select a BpS raster.

Tip: *If using a LANDFIRE BpS layer, the appropriate Attribute to select is "BpS_Model" for the LANDFIRE National version or" GROUPMODEL" for the LANDFIRE Refresh version.*

Note*: You may notice that a new BpS layer has been added to the Table of Contents. The new BpS layer will have an "_C" suffix added to the name indicating that it has been "cleaned". That is, biophysical settings not occurring in the Reference Condition Table have been removed from the layer.*

7.2.5 Editing data

Next, click on the **Edit Data** button as shown (Figure 7-10).

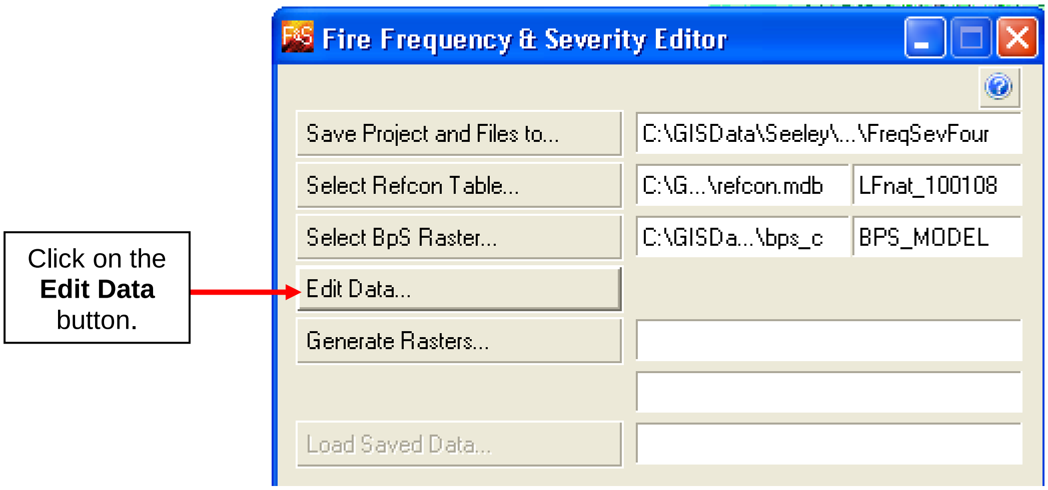
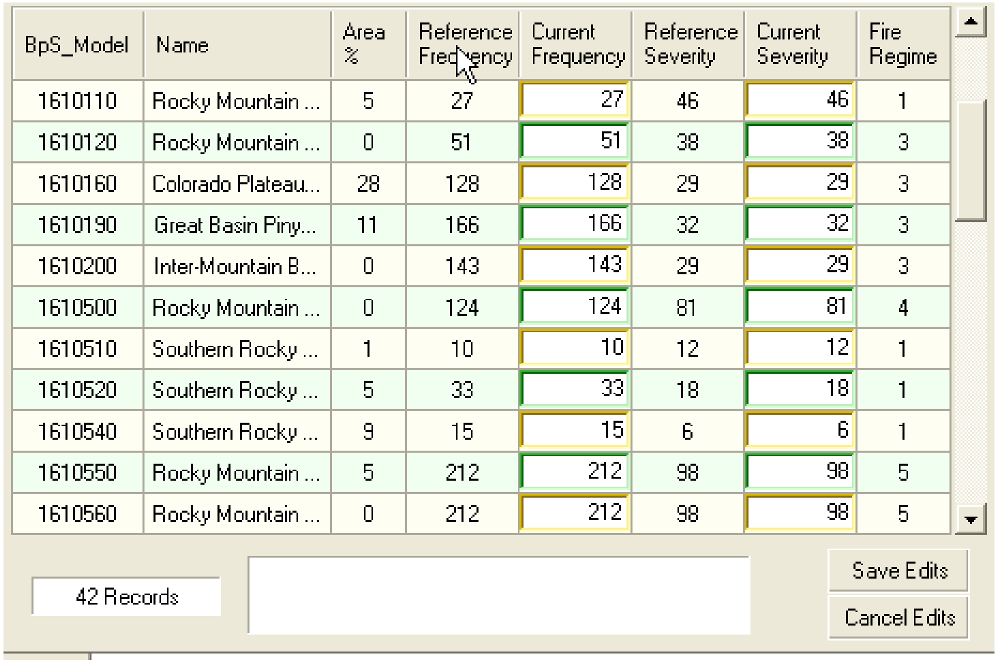


Figure 7-10. Opening the table of Frequency and Severity values for editing.

A table similar to the following example (Figure 7-11) will open, allowing you to edit Current Frequency and Current Severity values as you see fit. You will need to complete this table before generating the rasters (see Appendix D for additional information on selecting Current Frequency and Severity values). Reference Frequency and Reference Severity values (in years and percent replacement severity, respectively) are displayed for each BpS model; these values cannot be changed in the table. The table also shows the fire regime and area of each BpS.

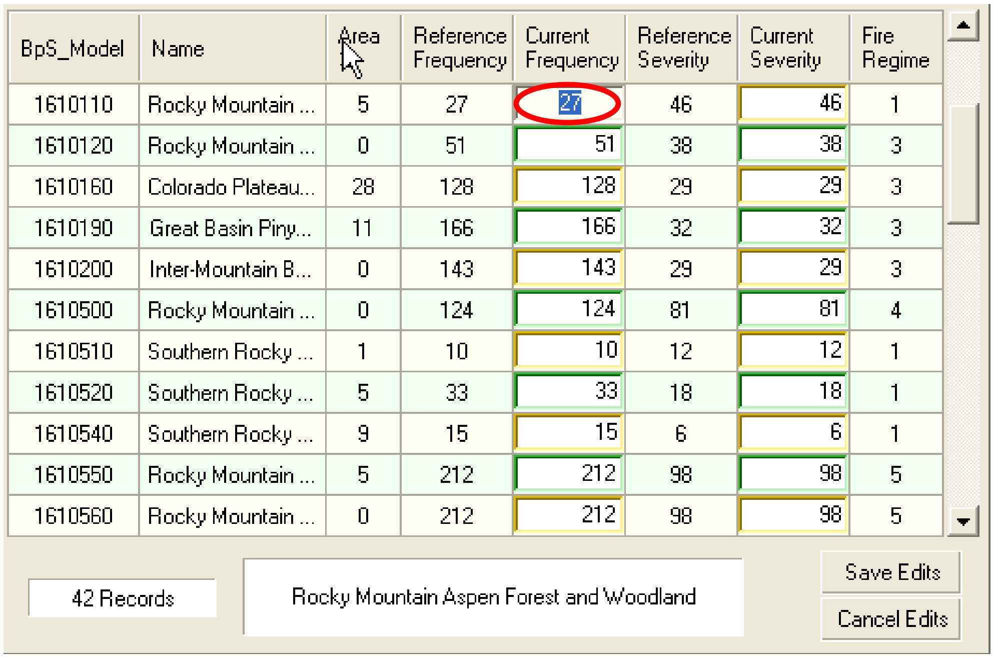
> ***Note**: Current Frequency and Severity must be edited one entry at a time. Global changes will not work. When editing the inputs table, it is most efficient to edit the rows sequentially, beginning with row 1 rather than attributing the rows non-sequentially.*



BpS_Model	Name	Area %	Reference Frequency	Current Frequency	Reference Severity	Current Severity	Fire Regime
1610110	Rocky Mountain ...	5	27	27	46	46	1
1610120	Rocky Mountain ...	0	51	51	38	38	3
1610160	Colorado Plateau...	28	128	128	29	29	3
1610190	Great Basin Piny...	11	166	166	32	32	3
1610200	Inter-Mountain B...	0	143	143	29	29	3
1610500	Rocky Mountain ...	0	124	124	81	81	4
1610510	Southern Rocky ...	1	10	10	12	12	1
1610520	Southern Rocky ...	5	33	33	18	18	1
1610540	Southern Rocky ...	9	15	15	6	6	1
1610550	Rocky Mountain ...	5	212	212	98	98	5
1610560	Rocky Mountain ...	0	212	212	98	98	5

Figure 7-11. Table used for editing Current Frequency and Current Severity values.

To edit values, click in the box and replace the highlighted value (Figure 7-12). Tab to the next entry you would like to modify. You may also use the up and down arrows to move between entries in the same column. The name of the system being edited appears in the box below the table.



BpS_Model	Name	Area	Reference Frequency	Current Frequency	Reference Severity	Current Severity	Fire Regime
1610110	Rocky Mountain ...	5	27	27	46	46	1
1610120	Rocky Mountain ...	0	51	51	38	38	3
1610160	Colorado Plateau...	28	128	128	29	29	3
1610190	Great Basin Piny...	11	166	166	32	32	3
1610200	Inter-Mountain B...	0	143	143	29	29	3
1610500	Rocky Mountain ...	0	124	124	81	81	4
1610510	Southern Rocky ...	1	10	10	12	12	1
1610520	Southern Rocky ...	5	33	33	18	18	1
1610540	Southern Rocky ...	9	15	15	6	6	1
1610550	Rocky Mountain ...	5	212	212	98	98	5
1610560	Rocky Mountain ...	0	212	212	98	98	5

Figure 7-12. Highlighted values are selected and ready to be edited.

When you are finished editing the table or you need to stop and continue later, click the Save Edits button. The edits to the table will be saved in the project file.

> ***Tip**: If you are changing values in many records, you may want to record where you left off if you need to take a break. There is currently no way to know which values you have already altered when you return to your edits. Some users prefer to create a screen capture and check off changes to mark their progress. If you close out of FRCCMT and need to later return to your project to complete the edits, you will need to click on the Load Saved Data button (see Section 7.2.7).*

7.2.6 Generating rasters

After completing your edits, click on the **Generate Rasters** button, as shown below in Figure 7-13.

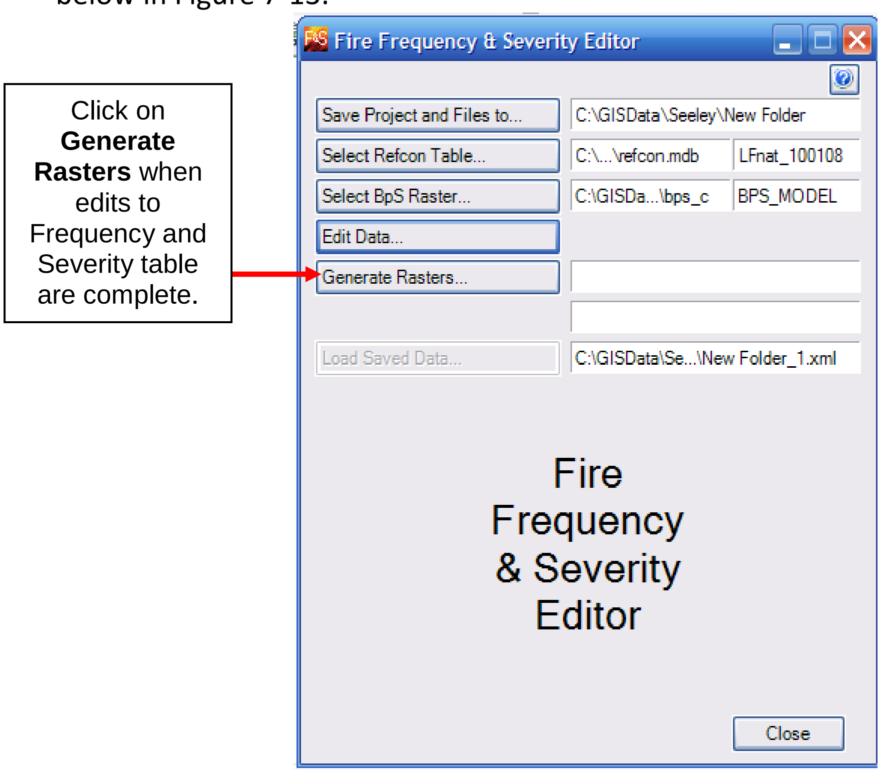


Figure 7-13. Generate Rasters… command.

The following dialog box will open.

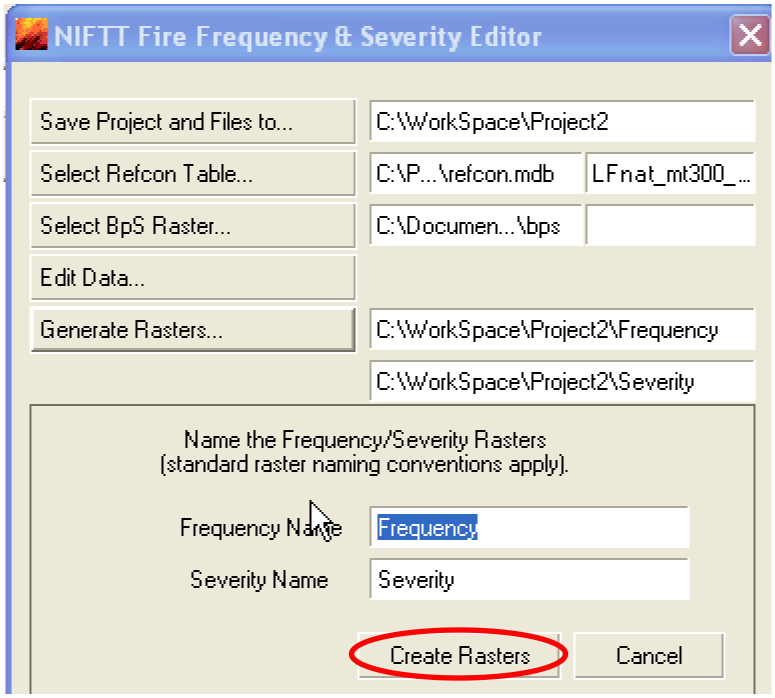


Figure 7-14. Naming the Frequency and Severity rasters.

At this point, you will be able to name your Current Frequency and Current Severity layers in the boxes provided. Highlight the default entry and type in a name of your choice.

> ***Note:*** *Select a meaningful name of 10 characters or less that contains no spaces or special characters.*

After you have provided names for both entries, click on the **Create Rasters** button (Figure 7-14). The Create Rasters button will become translucent and you will see a note in the lower left corner of the box indicating that your run is progressing. The run may take a few minutes, so please be patient.

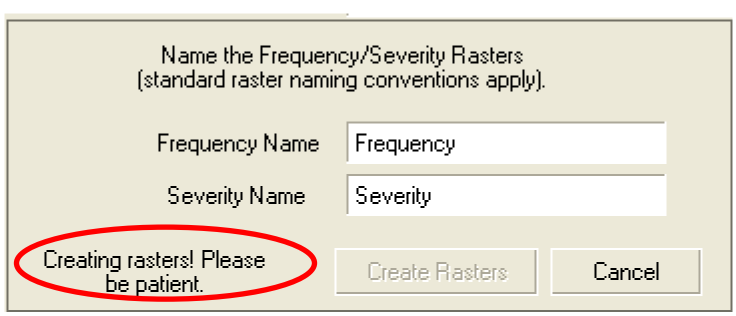


Figure 7-15. Note indicating raster creation.

When the run is complete, the new Frequency and Severity layers will be loaded into your ArcMap project.

> ***Tip**: The Frequency and Severity Editor can also be used to generate raster layers depicting reference frequency and reference severity. Simply leave the defaults unchanged in the "Current" columns and generate the grids using an appropriate name such as "reffreq" and "refseverity" in place of "currfreq" and "currsever". Although these layers are not required, they may provide useful ancillary information.*

After generating the current frequency and severity layers, a user can then proceed to use FRCCMT to derive Regime and FRCC Vegetation/Regime departure metrics, as described in Chapter 8.

7.2.7 Loading saved data

To continue your edits after exiting the Fire Frequency and Severity Editor (if, for example, you weren't able to finish editing the frequency and severity data in one session), reopen the Editor and click on the **Load Saved Data** button (Figure 7-16). Do not fill in the other fields until you have loaded the saved data. Navigate to a previously saved project folder and click on a file having that project name followed by, for example, "_1.xml" (note: the number prior to the file extension increases each time a project is saved). This will populate the dialog box with the previously selected reference condition table and BpS layer. However, you will have to identify a new project folder before continuing. After identifying a new project folder, click on Edit Data to resume work on assigning values for Current Frequency and Current Severity.

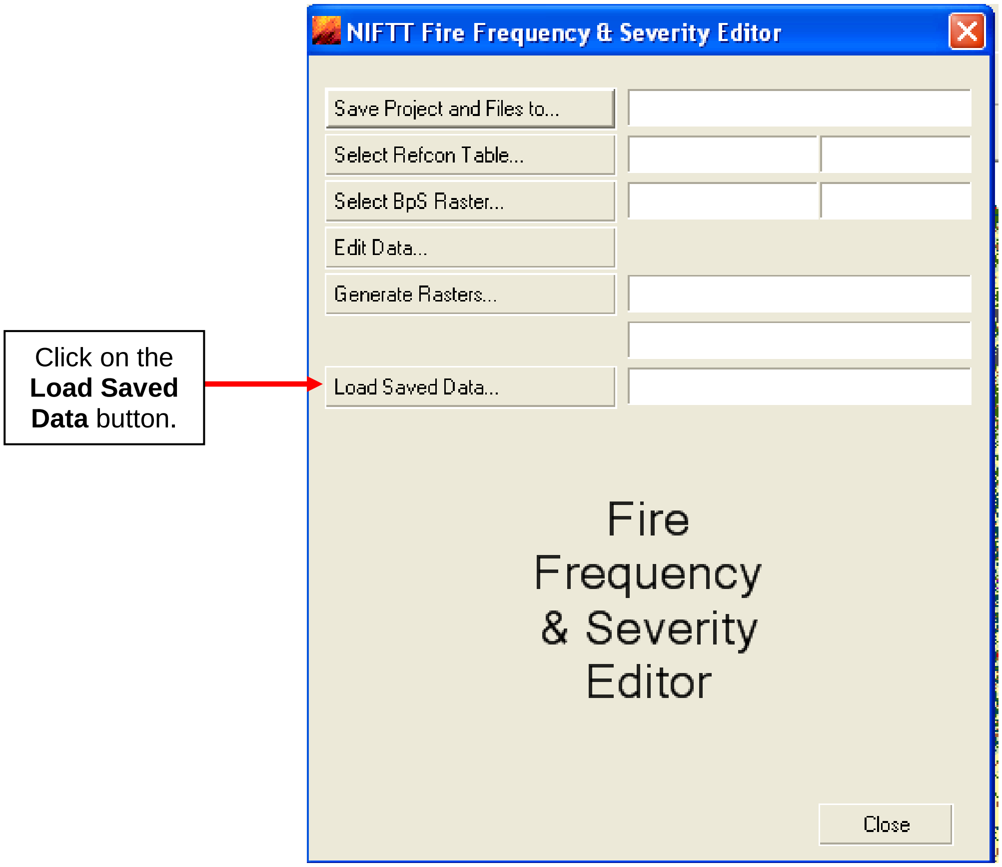


Figure 7-16. Loading saved data..

The following dialog box will open.

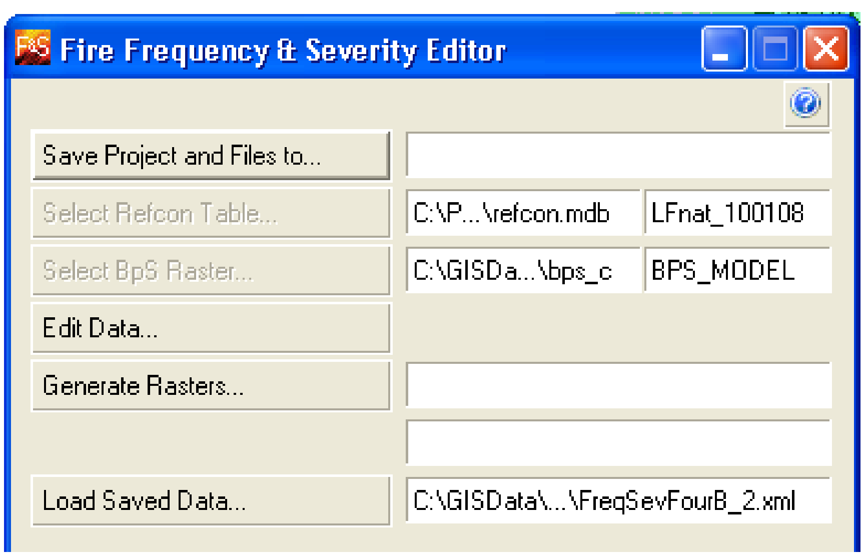


Figure 7-17. Saved data is indentified in the box to the right of **Load Saved Data…** Next, click on **Save Project and Files to…** and select a new, empty project folder.

7.2.8 Help Utility

The tool includes a help utility from which you can access information about the program. Click on the  icon to open the Help Utility.

Chapter 8: Using the FRCC Mapping Tool

8.1 The FRCC Mapping Tool toolbar

The following diagram shows the icons and associated tool tips on the FRCCMT toolbar. Refer to the discussions below to learn more about the basic functions of each.

Figure 8-1. The FRCC Mapping Tool and Fire Frequency and Severity Editor toolbar.

The icon on the left opens the Fire Frequency and Severity Editor dialog box; the icon on the right opens the FRCCMT dialog box. These forms allow the selection of inputs and outputs.

8.2 Running the FRCC Mapping Tool

This guide assumes a basic knowledge of ArcMap and thus does not include detailed instructions for basic steps such as creating a new project and adding data. Please refer to the FRCCMT tutorial for more detailed step-by-step instructions, including screen shots of each step.

8.2.1 Getting started

First, you will need to create a new ArcMap project, including the three required input layers: BpS, S-Class, and Landscape. If you intend to produce Regime and/or FRCC Vegetation/Regime outputs, you will also need to add Current Frequency and Current Severity input layers. You can also add ancillary layers, such as cities and roads, to help identify landmarks.

Save your project with a file name that's meaningful to you and meets ArcGIS file naming standards. Figure 8-2 shows a project containing the required input layers.

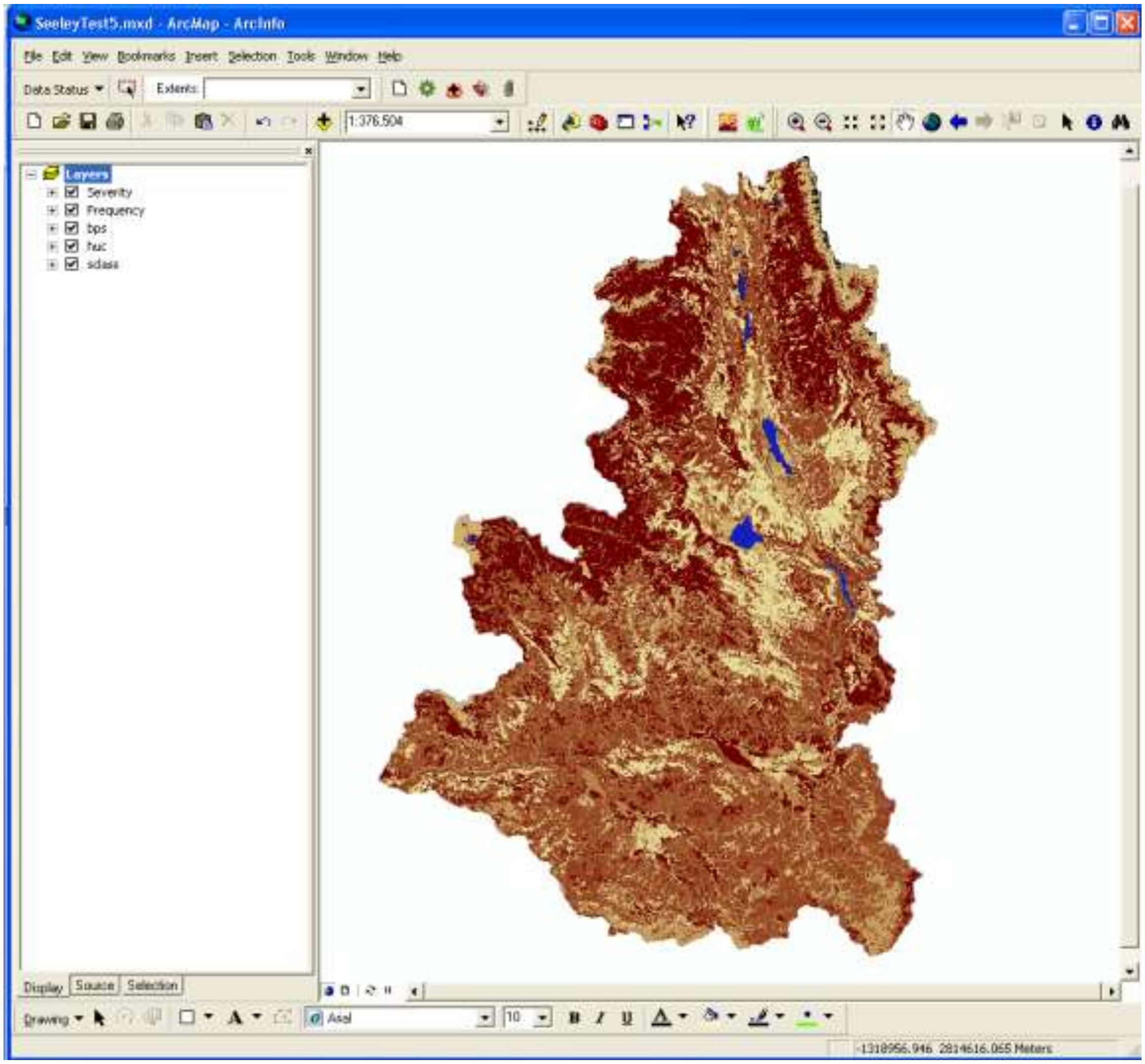


Figure 8-2. ArcGIS project including the input layers required to run FRCCMT.

Click on the second icon –  – on the FRCC Mapping Tool and Fire Frequency and Severity Editor toolbar to launch the FRCCMT dialog box (Figure 8-3). The fields in the input box must be completed in sequential order from top to bottom.

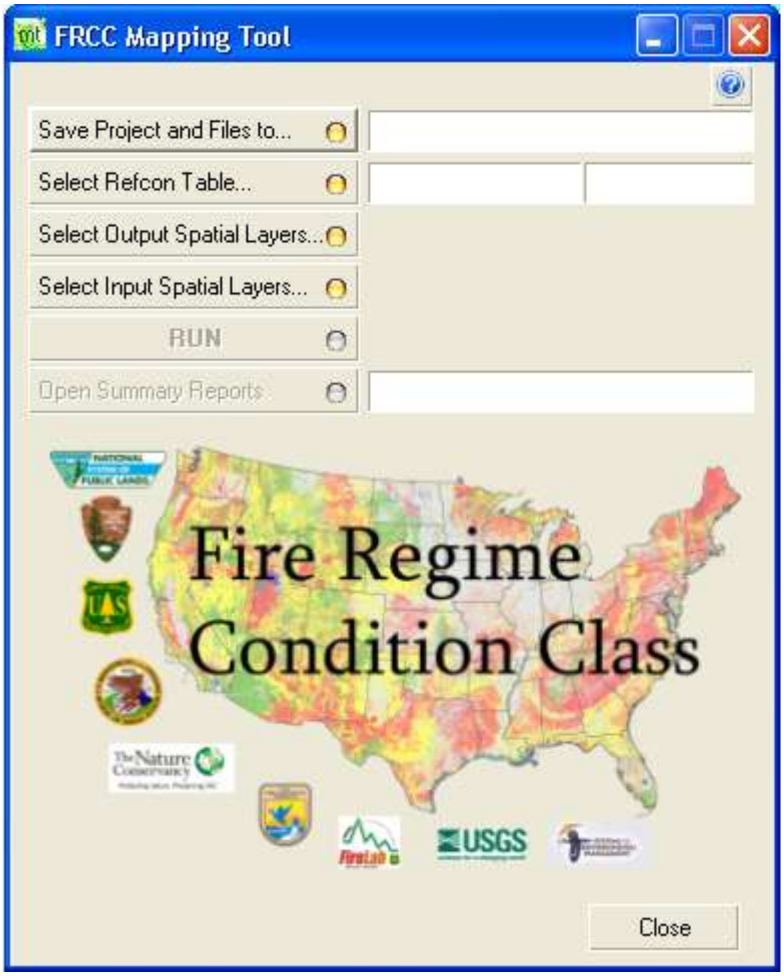


Figure 8-3. FRCCMT dialog box.

This form contains information necessary for:

- Identifying the path and folder for the outputs of the run
- Selecting the appropriate Reference Condition ("Refcon") Table
- Selecting the desired outputs
- Choosing input layers and associated attributes used by FRCCMT for conducting the analysis
- Running the tool
- Opening an Excel report

8.2.2 Identifying a project and file path

First, click on the top bar labeled **Save Project and Files to...** to select an output path and a folder name for storing the outputs of your run. The folder will be located in the path identified under the Path\Project Folder, as shown in Figure 8-4. Outputs must be stored in a new, empty folder for each run.

> ***Tip**: The total length of the path should not exceed 80 characters, nor contain any spaces. The file name chosen should be a maximum of 10 characters in length, must not contain any spaces, leading numbers, or special characters* (`~! @#$^()-+={ }[ ]|\?/:;"'< >, .), *and should be meaningful to the user.*

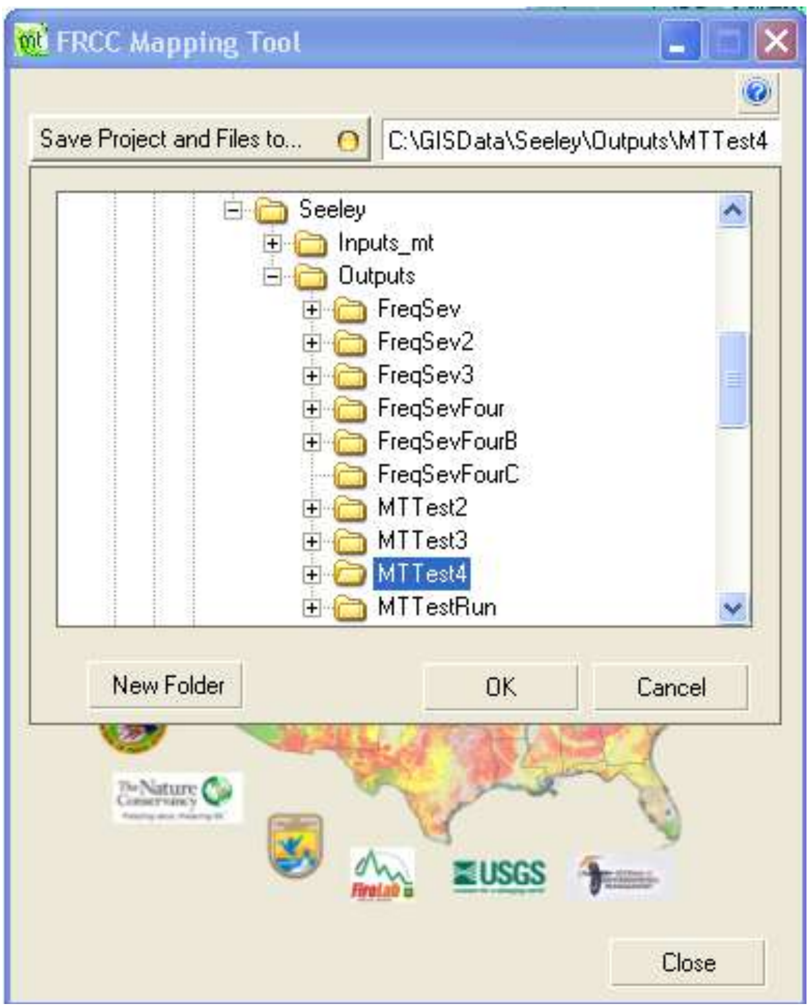


Figure 8-4. Saving your project to a pathway.

***Note**: Be sure to store outputs on your local hard drive. The following problems may occur when outputs are stored on a network server:*

- *Performance (runtime) will be substantially slower*
- *The server may time out, preventing file transport*
- *Permission problems may prevent file transport*

- *Overly long paths may exceed ESRI's space limitation*
- *Special characters, leading numbers, or spaces in the path will cause run failure*

The output folder created by FRCCMT will contain a unique folder for every output layer created. A layer file is also created for each of the output layers. Layer files maintain an assigned legend when loaded into an ArcMap project. An additional folder is created (denoted as "ModifedRasters") if the Mapping Tool creates new BpS or S-Class grids by deleting classes that do not correspond to the Reference Condition Table. The modified S-Class layer will also collapse any uncharacteristic S-Classes into a single class denoted as "U". A "Logs" folder containing text files identifying the biophysical settings and succession classes that do not match the Reference Condition Table is also created. FRCCMT will add a new log file documenting each processing step as it occurs.

> ***Tip:*** *Modified rasters can be used in place of the original BpS and S-Class rasters to speed up processing time in subsequent runs.*

8.2.3 Selecting a Reference Condition Table

Next, you will need to select an appropriate Reference Condition Table by clicking on the second bar labeled **Select Refcon Table...**, as shown below in Figure 8-5.

Two Reference Condition Tables are included when the FRCC Mapping Tool is installed. The first table (RAnat_090722) was developed from VDDT models for the Rapid Assessment phase of the LANDFIRE Project and covers the conterminous United States. The second table (LFnat_100108) was derived from LANDSUM and includes the LANDFIRE National reference conditions for the conterminous United States, Alaska, and Hawaii.

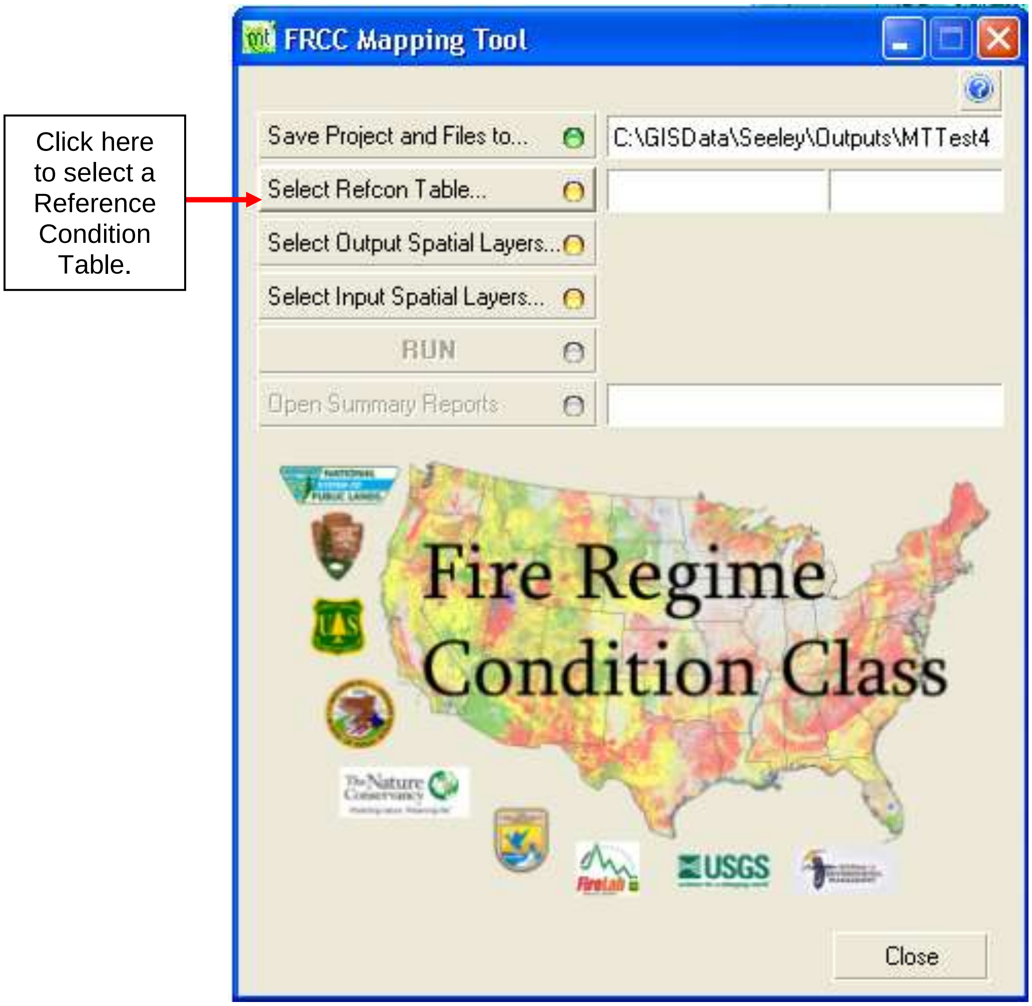


Figure 8-5. Using the FRCCMT dialog box to select a Reference Condition Table.

Two options are available: **Select the Refcon table from the default datab**ase and **Select the Refcon database from an Open File Dialog**. Click on the radio button to make your choice (Figure 8- 6).

If you select the first option (**Select the Refcon table from the default database**), the drop-down menu will be populated with the Rapid Assessment and LANDFIRE National reference condition tables. Select the correct option.

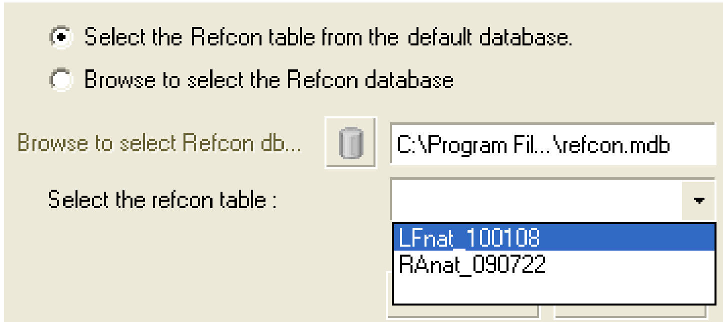


Figure 8-6. Selecting a Reference Condition Table using radio buttons.

Note: *Reference Condition Tables are stored in an Access database labeled "refcon.mdb" in the same directory that was selected for the Mapping Tool during installation. (The default is "C:\Program Files\NIFTT\FRCCmt 3.x.x build xxxxxx\Reference Conditions Database\refcon.mdb".) Navigate to the Reference Condition Database and double-click on refcon.mdb to display the default Reference Condition Tables.*

If you do not wish to use a default table, you must browse to another file location and select the Reference Condition Table of your choosing, as described below:

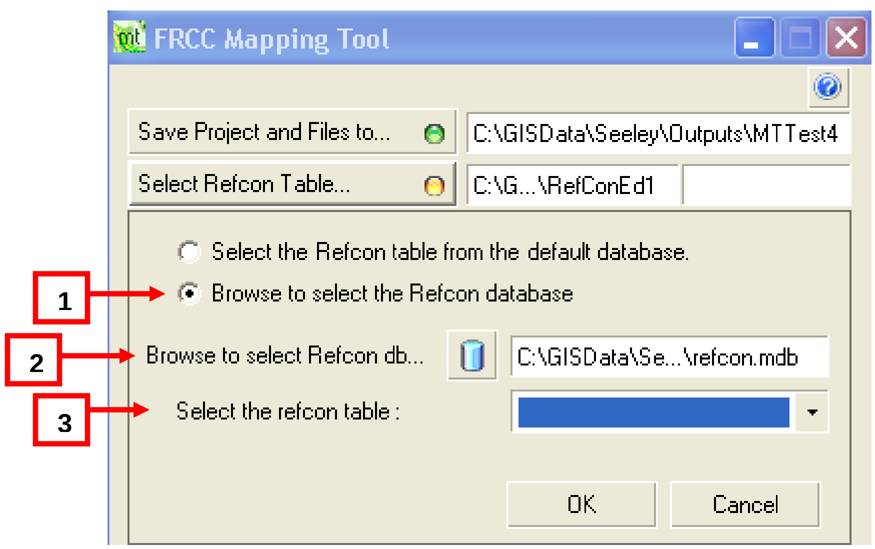


Figure 8-7. Selecting a Reference Condition database from an Open File Dialog.

1. Click on the second radio button **Select the Refcon database from an Open File Dialog**.

2. Use the browse button to navigate to the folder containing the Reference Condition table that coincides with the BpS, S-Class, and landscape layers selected for your assessment.

3. Use the **Select the refcon table** drop-down menu to make your selection.

8.2.4 Selecting output layers

Next you will need to select the desired output layers. There are three main categories of output layers: Vegetation, Regime, and FRCC Vegetation/Regime.

Choose the desired spatial output layers by checking the boxes to the left of the output layers (Figure 8-8). There are two ways to select layers: layers can be selected either individually, or, all layers in the category can be selected or deselected by checking or unchecking the category boxes. If you select the **Vegetation** category box for example, all five possible Vegetation outputs will be selected. Similarly, checking the **Regime** and **FRCC Veg/Regime** boxes will select all possible options in those categories.

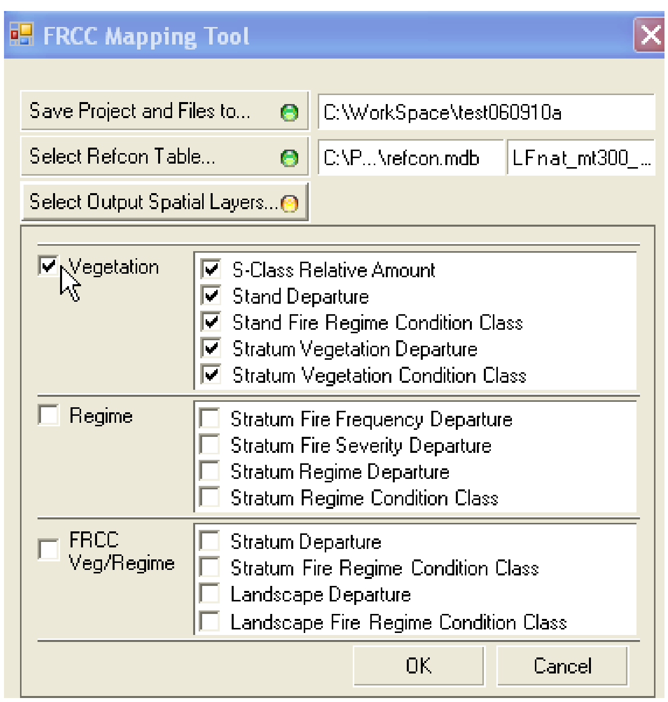


Figure 8-8. Check the boxes to the left of the spatial layers to be produced.

Tip: *You do not need to create or obtain Current Fire Severity or Current Fire Frequency layers if only vegetation outputs are desired. If ONLY vegetation outputs are selected, version 3.0.0 works much like the older version of FRCCMT (2.2.0). However, you must have Current Fire Severity and Current Fire Frequency layers available to derive Regime and/or FRCC Vegetation/Regime outputs.*

8.2.5 Selecting input layers

After you have specified the output layers, you will need to select the input layers. Required input layers depend on the output layers you selected in the previous section. If you selected only the Vegetation category or any layers within that category, the following dialog box will open. Notice that you do not need to enter Current Severity or Current Frequency and these fields are not available for editing.

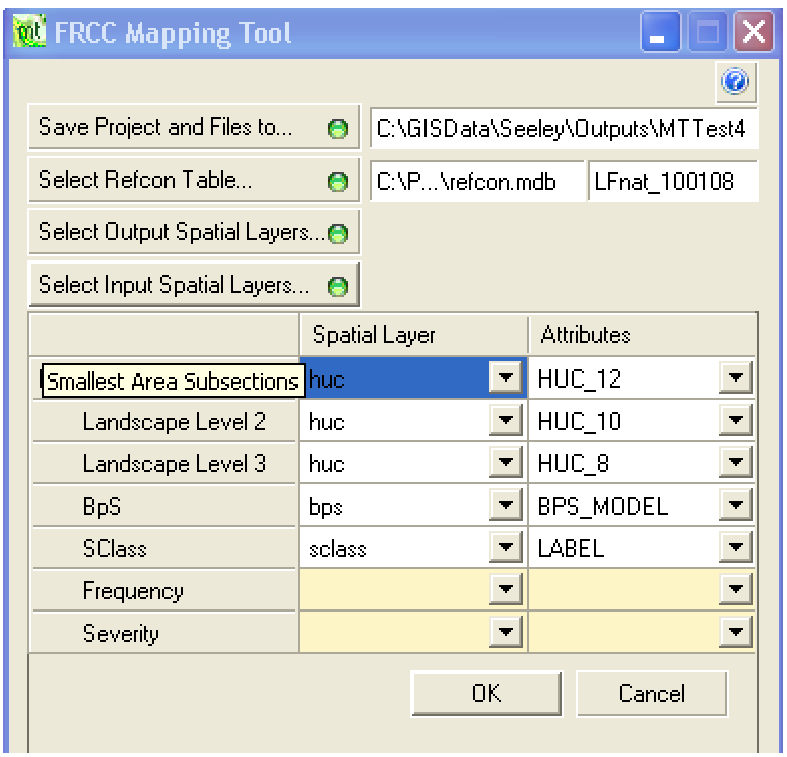


Figure 8-9. Input selections (showing defaults) for Vegetation outputs only.

If you selected any or all outputs from either the Regime or FRCC Veg/Regime categories, two additional spatial layers – Frequency and Severity – are required and must be input as shown below.

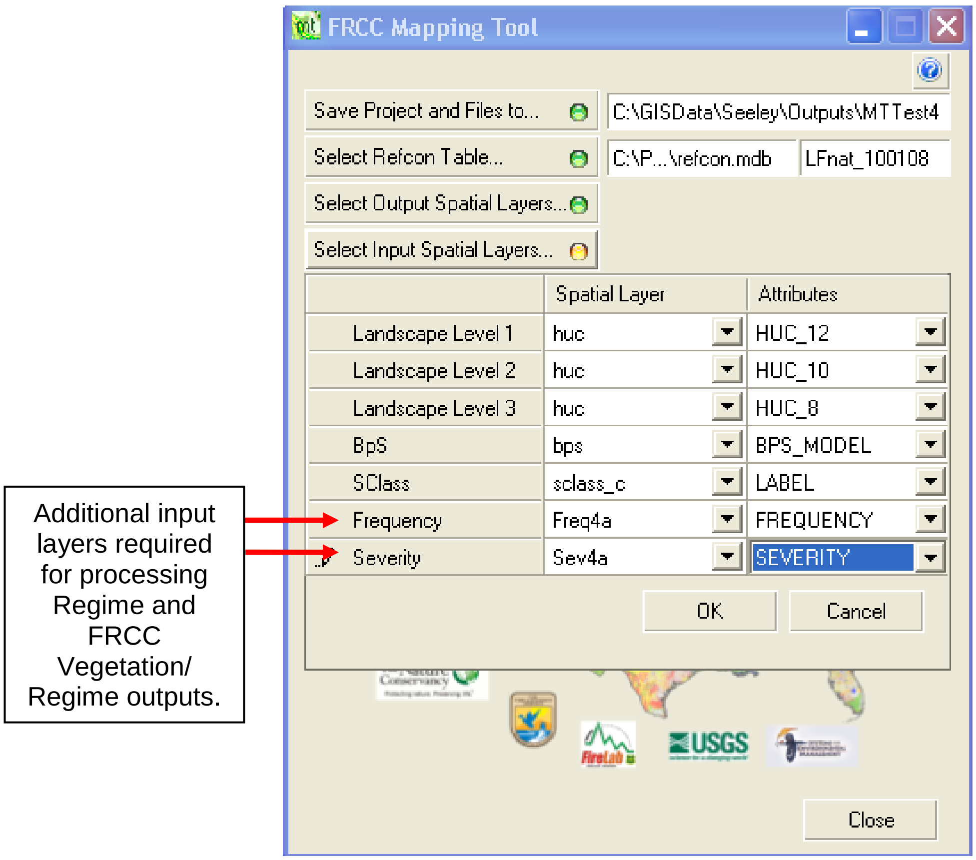


Figure 8-10. Input selections for Regime and/or FRCC Veg/Regime output selections.

Select landscape level

To input the Landscape Levels, use the drop-down menus indicated below in Figure 8-11 to specify the spatial layer and attribute that you will be using to define each Landscape Level that will be used in the analysis. A valid spatial layer and attribute must be specified for Landscape Level 1. The use of Levels 2 and 3 is optional. Refer to Chapter 3 for more information on landscape levels.

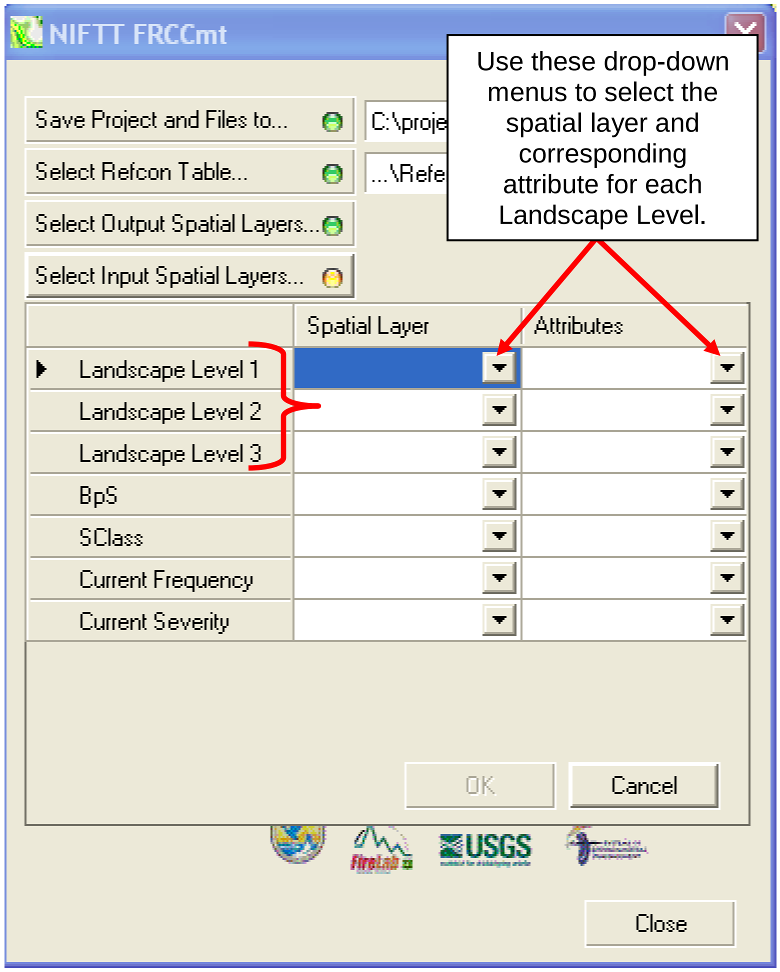


Figure 8-11. Selecting a spatial layer and attribute to define each landscape level.

Remember that these landscape levels correspond to a nested hierarchy (for example, a layer containing subwatershed, watershed, and subbasin units) that will be used in the analysis. The number of landscape levels used in the analysis must match the LandscapeLevel field in the Reference Condition Table (Figure 8-12). If three different levels are represented in the LandscapeLevel field of your Reference Condition Table, then three levels must be used. Otherwise, output layers will contain a large number of pixels classified as NoData. Alternatively, if you want to assess departure using only a single landscape level, then all values in the LandscapeLevel field must be 1.

LFnat_100108

BpS_Mo	Name	A	B	C	D	E	U	FRG	LandscapeLevel	Frequency
0110080	North Pacific Oak Woodland	10	5	85	0	0	0	1	1	10
0110110	Rocky Mountain Aspen Forest and Wc	25	20	10	30	15	0	3	2	55
0110180	East Cascades Mesic Montane Mixed-	10	20	5	15	50	0	3	2	77
0110350	North Pacific Dry Douglas-fir Forest ar	5	10	10	45	30	0	3	2	36
0110360	North Pacific Hypermaritime Sitka Spr	5	10	1	10	74	0	5	3	649
0110370	North Pacific Maritime Dry-Mesic Dou	5	15	5	15	60	0	3	2	80
0110380	North Pacific Maritime Mesic Subalpi	95	5	0	0	0	0	5	3	4950
0110390	North Pacific Maritime Mesic-Wet Do	5	15	5	5	70	0	5	3	400
0110411	North Pacific Mountain Hemlock Fore	1	5	5	4	85	0	5	3	3322

Figure 8-12. Landscape-level field in the Reference Condition Table.

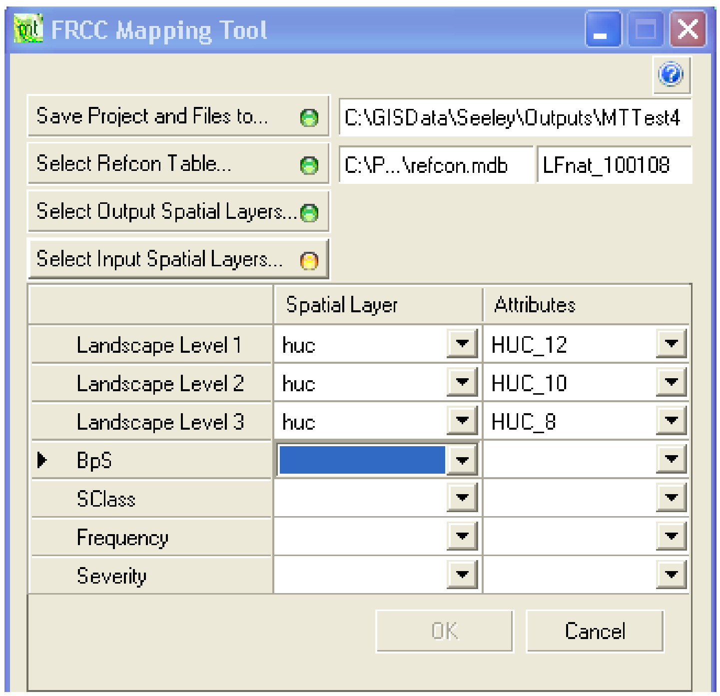


Figure 8-13. FRCCMT dialog box with one landscape layer. Different attributes have been selected for each of the three Landscape Levels.

In the example shown in Figure 8-13, three landscape levels have been selected because we are working with a tri-level nested hierarchy of landscape units, ranging from multiple subwatersheds to a single subbasin encompassing the entire analysis area. Only one spatial layer (huc) has been chosen for the analysis. However, the selected layer (huc) has three different attributes (HUC_12, HUC_10, and HUC_8), which correspond to landscape levels 1, 2, and 3, respectively.

An alternative approach would be to use three unique spatial layers for each of the landscape levels used in the analysis. However, this approach can sometimes lead to problems caused by limitations of ArcMap. When ArcMap attempts to combine the five spatial layers (three landscape levels, S-Class, and BpS), the software conducts an internal test to evaluate the potential number of unique combinations. An error message will appear if the software determines that there could be more than 10 million possible combinations. This error message can be misleading as there may not actually be 10 million possible combinations between the five layers. This inconsistency results from the fact that the internal software test is largely based on the maximum grid values rather than on the actual number of unique values.

For example, if an analysis area has three landscapes with grid values of 1000, 2000, and 3000, ArcMap will determine that there could be as many as 3,000 landscapes instead of three landscapes. The likelihood of this problem occurring can be substantially reduced by using a single layer containing individual attributes for the landscape levels. Using a single layer will also ensure that the multiple landscape levels are nested. Consequently, we recommend using a single landscape layer that contains multiple attributes to denote the different landscape levels.

> ***Tip**: Store all input layers on the computer's local hard drive. Performance time is slowed down significantly if layers are stored on a network drive.*

Select a BpS layer

Next, select the appropriate BpS Spatial Layer, and the appropriate Attribute from the drop-down menus, as shown in Figure 8-14.

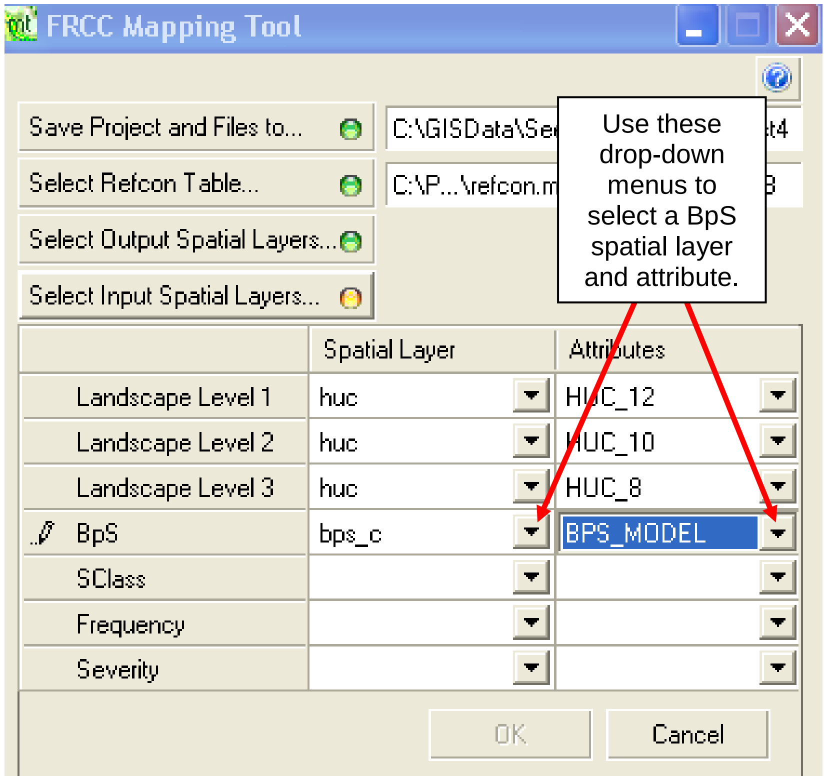


Figure 8-14. Selecting a BpS Spatial Layer and associated Attribute.

Tip: *If using a LANDFIRE BpS layer, the appropriate Attribute to select is "BpS_Model" for the LANDFIRE National version or "GROUPMODEL" for the LANDFIRE Refresh version.*

Note*: The Attribute that is selected from the BpS layer must match the BpS_Model field in the Reference Condition Table. Departure indices will be derived only for those BpS codes that coincide with the Spatial Layer as specified in the dialog box, and the Reference Condition Table. Figure 8-15 shows the fields that must correspond on the FRCCMT dialog box, the Attribute Table for the BpS layer, and the Reference Condition Table.*

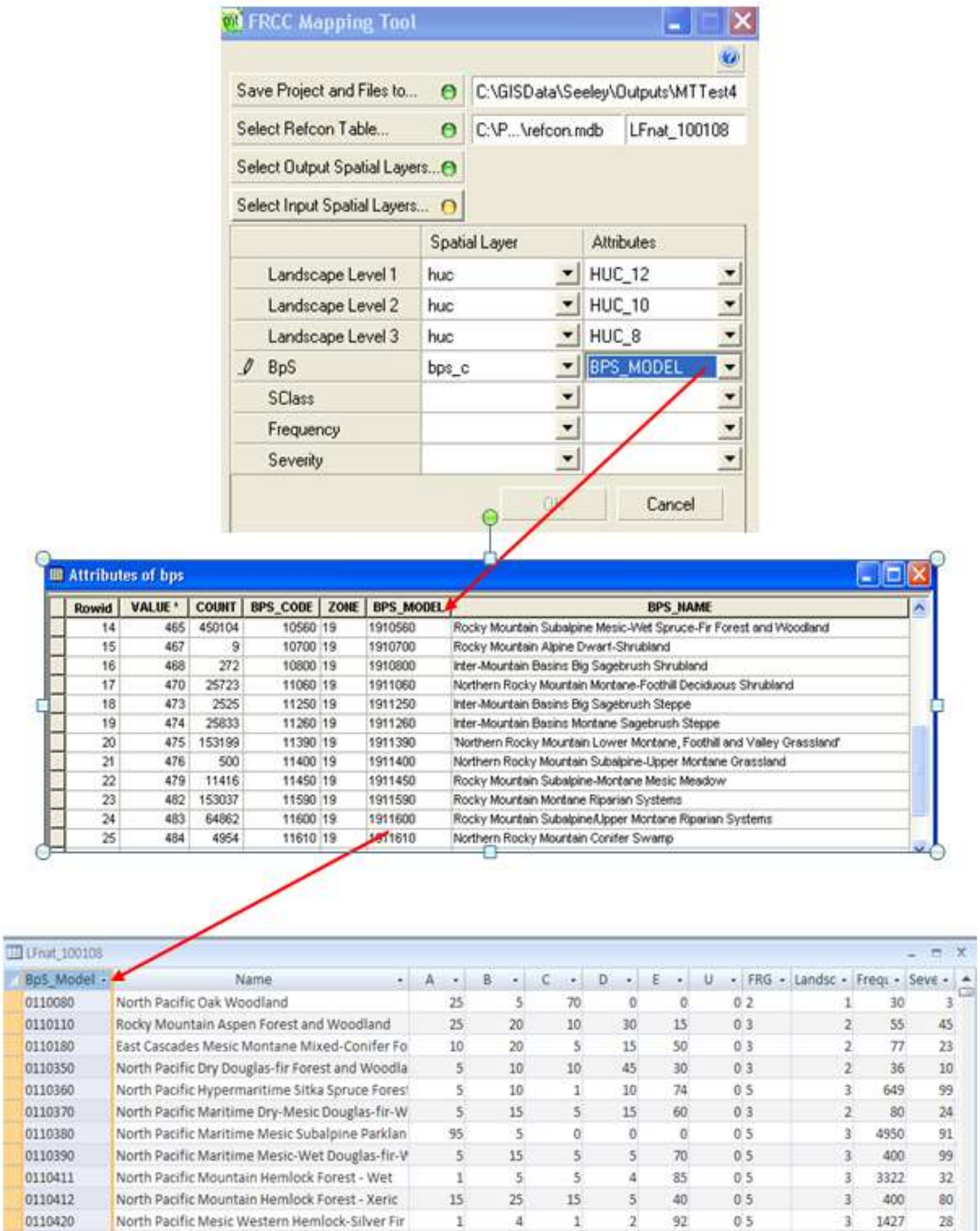


Figure 8-15. Relationship between the FRCCMT dialog box, the Attribute Table for the BpS layer, and the Reference Condition Table.

Select an S-Class layer

Next, specify an S-Class Spatial Layer and the appropriate Attribute from the drop-down menus, as shown in Figure 8-16. Make sure to select the Attribute that includes the S-Class codes (A, B, C, D, E, and U). In the S-Class layers produced by LANDFIRE, the relevant Attribute is "Label." See Section 3.1.3 Succession Classes (S-Class) layer for more information on the required format of the S-Class layer and attribute table.

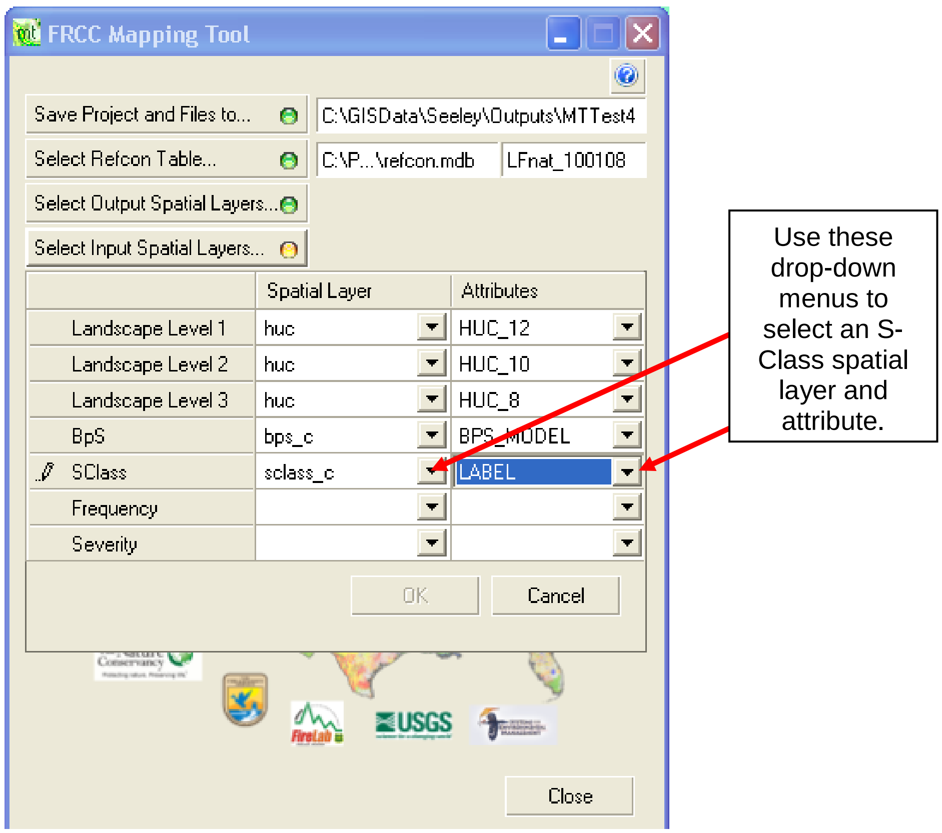


Figure 8-16. Selecting an S-Class Spatial Layer and an appropriate Attribute.

Note: *BpS and S-Class raster names should not exceed 10 characters in length and should not contain any spaces, leading numbers, or special characters (`~! @#$^()-+={ }[ ]|\?/:;"'< >, .).*

Select a Current Frequency layer

The Current Frequency layer is required for Regime and FRCC Veg/Regime outputs. The Fire Frequency and Severity Editor can be used to produce this layer, as discussed in Section 3.1.4, or a Current Frequency layer can be produced by using actual fire data in a particular area where such data exist. Use the drop-down menu to the right of the Current Frequency box to select an appropriate Current Frequency Spatial Layer. The appropriate attribute denoting frequency in years must also be selected by using the drop-down menu to the right of the box, as shown in Figure 8-17.

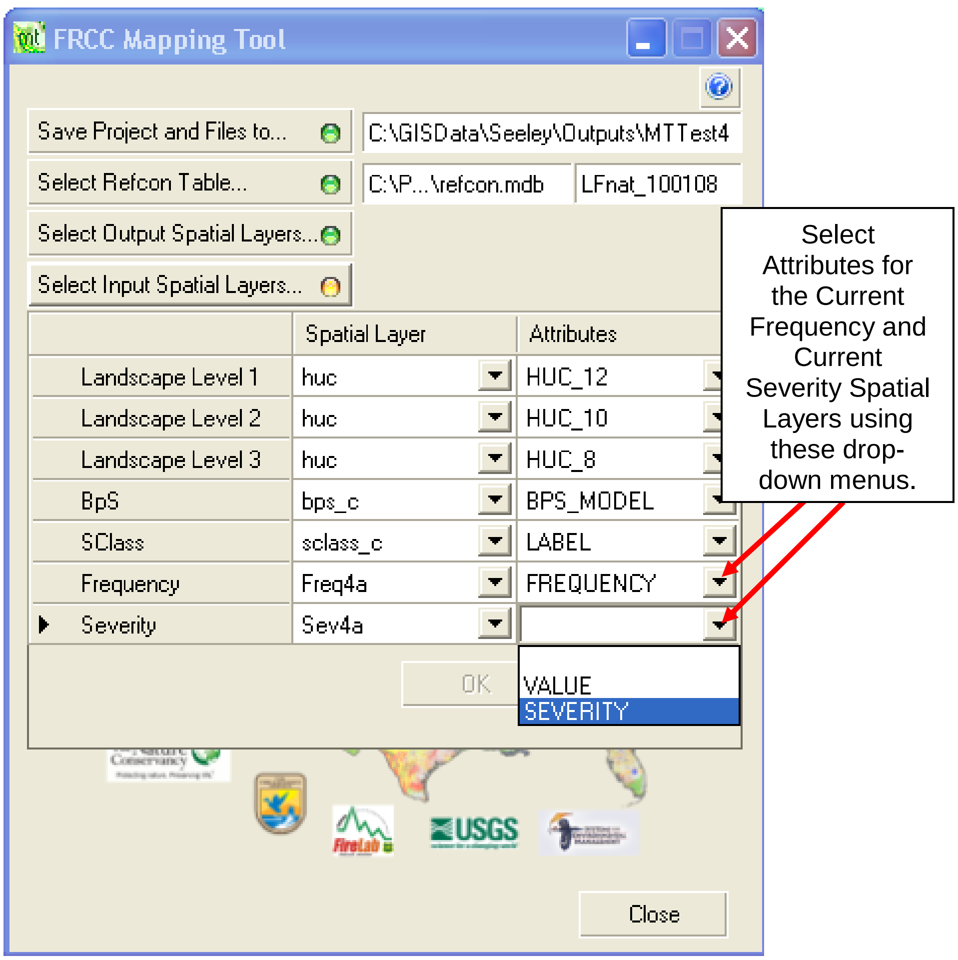


Figure 8-17. Selecting Current Frequency and Severity Spatial Layers and appropriate Attributes.

***Note**: Remember that a Current Frequency layer is not required, and in fact cannot be used, if you have selected only outputs associated with the Vegetation category.*

Select a Current Severity layer

The Current Severity layer is required for Regime and FRCC Veg/Regime outputs. The Fire Frequency and Severity Editor can be used to produce this layer (as discussed in Section 3.1.5), or a Current Severity layer can be created by using actual fire data in a particular area where such data exist. A third option is to use the Wildland Fire Assessment Tool (WFAT) to develop a Current Severity layer for a particular area. For additional information on creating a Current Severity Layer, see Section 3.1.5.

Use the drop-down menu to the right of the Current Severity box to select an appropriate Current Severity Spatial Layer. An associated Attribute denoting percent stand replacement severity must also be selected by using the drop-down menu to the right of that box, as shown above in Figure 8-17.

> ***Note***: *Remember that a Current Severity layer is not required and in fact cannot be used if you have only selected options from the Vegetation category of spatial outputs.*

8.2.6 Running the tool

FRCCMT can be run only after a project has been identified, a reference condition table has been selected, and all output and input layers have been selected.

After all selections have been made, FRCCMT automatically performs an internal error checking routine to identify any discrepancies between the biophysical settings in the Spatial Layer and biophysical settings in the Reference Condition Table. A notice appears at the bottom left corner of the dialog box (Figure 8-18).

> ***Tip***: *Be patient because the validation process can take a few minutes.*

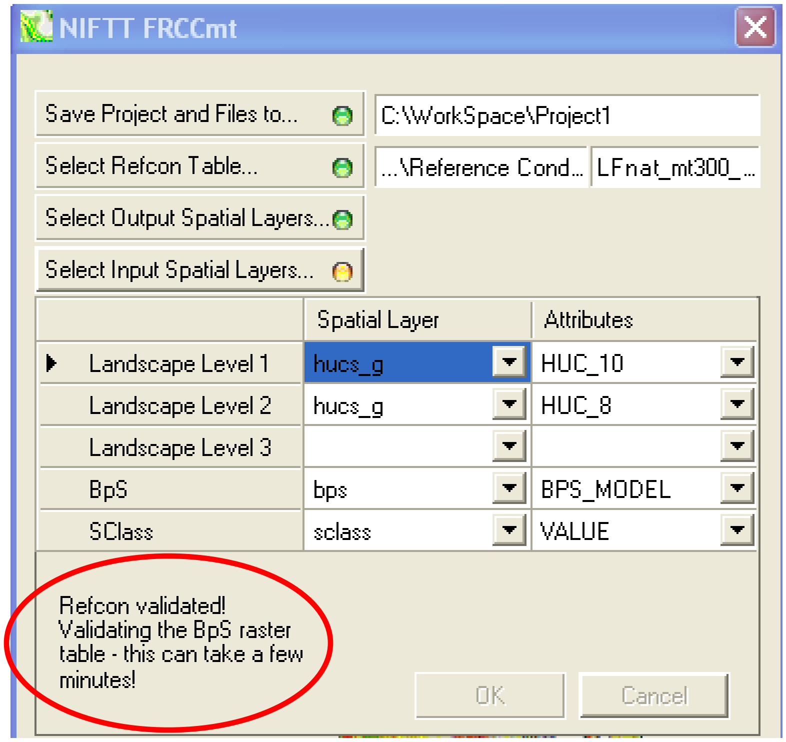


Figure 8-18. Validating the BpS raster table.

The error message shown in Figure 8-19 will appear when none of the biophysical settings in the BpS layer coincide with those in the Reference Condition Table. This error message suggests that you may have inadvertently selected the wrong Reference Condition Table, selected an incorrect attribute for the BpS layer, or that the Reference Condition Table is structured incorrectly.

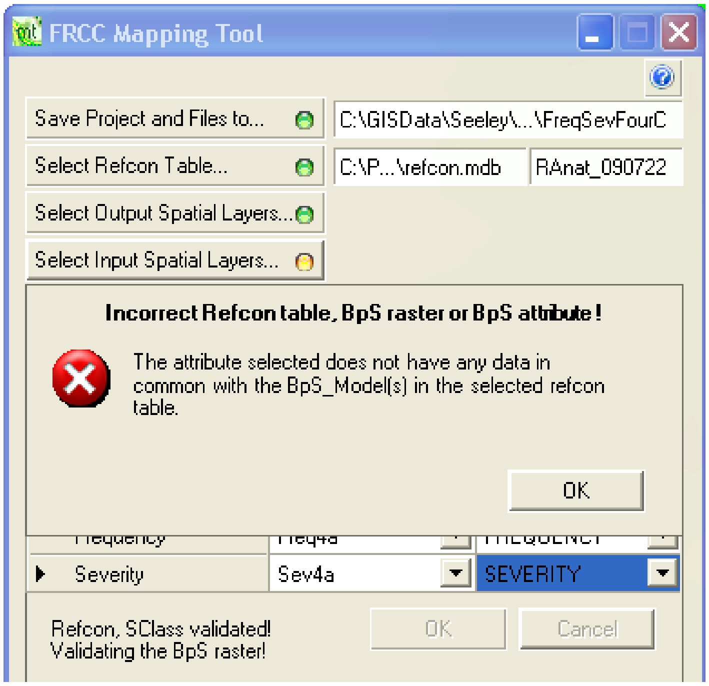


Figure 8-19. Error message indicating that none of the biophysical settings in the BpS layer correspond with those in the Reference Condition Table.

Once the inputs have been successfully validated, click on the **Run** icon shown below and wait for the run to finish. The run may take a few minutes.

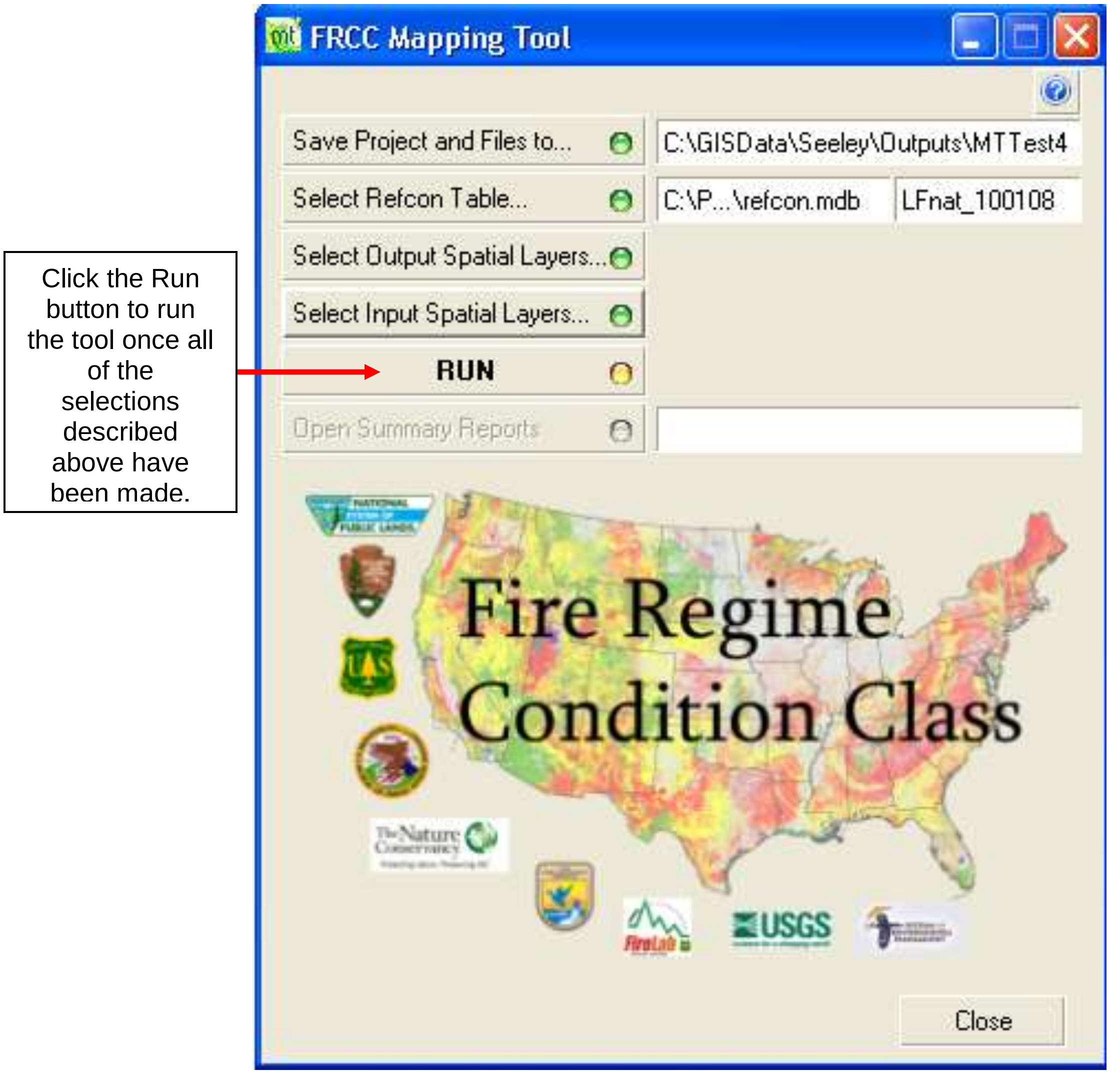


Figure 8-20. Running the FRCC Mapping Tool.

While processing, the dialog box will become semi-transparent. Each selected output layer will be added automatically to your ArcMap project and will appear in the Table of Contents (Figure 8-21). If you want to retain the output layers in an existing ArcMap project, save the project after completing a successful run.

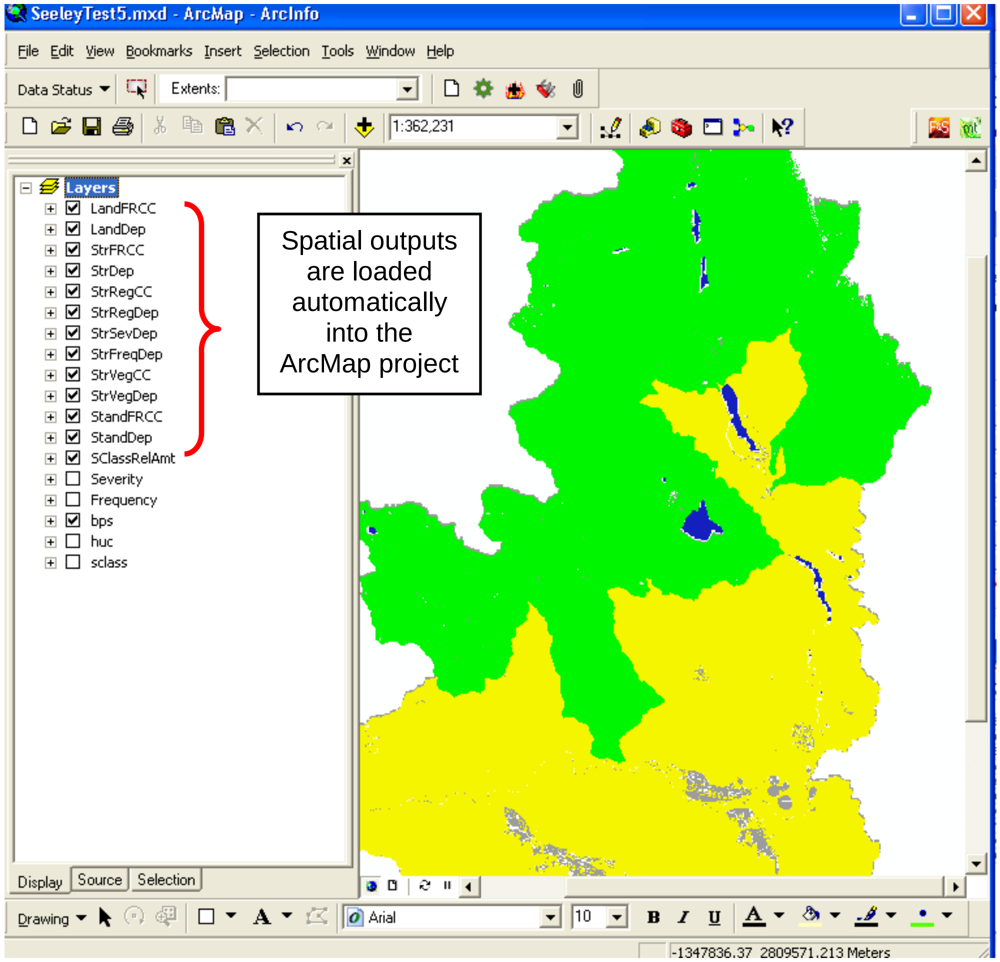


Figure 8-21. ArcMap Table of Contents.

> ***Note**: You may notice that several new layers have been added to the Table of Contents. Each of the new layers will have an "_re" or a "_c" suffix added to the name. The "_c" suffix indicates that the layers have been "cleaned," meaning that inappropriate types, such as Urban, have been removed from the S-Class grid, and areas without a BpS model have been removed from the BpS grid. Also, if the S-Class layer has more than one uncharacteristic class, they are combined into a single "U" class in this step. The "_re" suffix indicates that areas where the landscape, BpS, and S-Class grids did not overlap were removed in order to align the three layers.*

8.2.7 Open Summary Reports

Once the run is completed, the box to the right of **Open Summary Reports** is populated, as shown in Figure 8-22.

Figure 8-22. A Summary Report is created after FRCCMT is run.

Click on **Open Summary Reports** to view the Summary Report. The Summary Report can also be opened directly from the Project folder (See Chapter 5 for additional information on this subject).

8.2.8 Help Utility

The tool includes a help utility from which you can access information about the program. Click on the icon to open the Help Utility.

Chapter 9: Troubleshooting the FRCC Mapping Tool – Common Errors, Symptoms, and Solutions

9.1 Data quality

The output layers produced by FRCCMT can be only as accurate as the input data used to derive them. If any of the output layers seem questionable, the problem can often be diagnosed by comparing the output layers to the input data. Problems with the input data often go unnoticed until concerns are raised about the outputs. Experience with FRCCMT suggests that there are four primary sources of output error:

1. The S-Class layer does not accurately reflect conditions on the ground.
2. The BpS layer does not accurately reflect conditions on the ground.
3. The Reference Condition Table does not accurately reflect the BpS model, or the BpS model does not accurately reflect the historical range of variation for the assessment area.
4. An inappropriate landscape scale was used to assess the composition of succession classes for a given BpS or group of biophysical settings.

9.1.1 Output error related to the S-Class layer

FRCCMT outputs are most sensitive to the S-Class layer. Subtle changes in the classification of succession classes will often change the output layers substantially. Succession classes are commonly assigned by using canopy cover as one of the discriminating variables. Small changes to canopy cover thresholds may substantially change the composition of succession classes within a BpS, resulting in dramatic changes to any of the departure metrics. For example, it may be problematic if a canopy cover threshold of 40 percent was used in the model to distinguish open from closed classes, but the only canopy cover layer that is available for deriving succession classes has been grouped into classes with thresholds of 25 and 60 percent cover.

In addition, deriving an S-Class layer using remote sensing data can be particularly difficult. Thresholds defined in BpS models and used to develop succession classes are often based on field estimates of canopy cover rather than on remotely sensed data. Ground-based estimates of canopy cover may not coincide with satellite-based estimates and, consequently, the S-Class layer may be biased towards either more open or more closed classes. Mapping the Uncharacteristic S-Class with remotely sensed data alone can also be problematic due to limitations in data resolution. As a result, uncharacteristic conditions, such as the presence of exotic species or lack of large-diameter trees, can be particularly difficult to detect.

In some cases, the S-Class characteristics in a BpS model may have been inadequately defined or mapped. Diagnosing a possible problem with the output layers is best conducted by overlaying output layers with the BpS and S-Class input layers.

9.1.2 Output error related to the BpS layer

Remember that interpretation of succession classes depends on the BpS in which they occur. Therefore, the S-Class layer cannot be used independently of the BpS layer. We recommend using a single spatial layer that contains attributes for both the BpS and S-Class layers. Use of a single layer to depict both attributes will help ensure that the succession classes are indeed nested within biophysical settings.

If the BpS and S-Class layers do not seem reasonable, you should examine the process that was used to derive these layers. It is imperative that you completely understand the limitations of the input data for deriving departure metrics. This understanding can help you develop improvements for deriving the BpS and S-Class layers.

9.1.3 Output error related to the Reference Condition Table

If both the BpS and S-Class layers seem reasonable, the next troubleshooting step is to examine the Reference Condition Table. Remember that reference conditions depict the midpoint of the historical range of variation as characterized by succession and disturbance simulation models. Although modeling errors are always a concern, errors can also occur when transcribing model outputs to the Reference Condition Table, especially if the information is entered manually. Carefully proofread the Reference Condition Table to ensure that the composition of succession classes seems reasonable for a given BpS and that it matches model descriptions. A thorough understanding of the BpS models is critical for proper use of the FRCC Mapping Tool.

9.1.4 Output error related to landscape scale

Lastly, review the landscape levels used to derive the output layers. The compilation of reference conditions and departure indices are scale-dependent; that is, values are, in part, dictated by the geographic extent of the reporting unit – the unit used to derive composition. The most appropriate-sized landscape is the smallest landscape in which the full expression of succession classes would be observed under the natural disturbance regime.

In theory, the smaller the reporting unit, the greater the likelihood that you will obtain higher departure values (that is, as reporting units get smaller, the probability of detecting the optimum S-Class composition decreases). Use of reporting units that are inappropriately small will often produce departure metrics that are too high. We recommend evaluating the departure metrics for sensitivity to changes in reporting unit or landscape size. To do this, complete three different FRCCMT runs using a single landscape level to assess departure. Use a different landscape for each of the runs (for example, subbasin, watershed, and subwatershed). If the outputs vary dramatically, you should critically evaluate which landscape level is most appropriate for estimating departure. If the results do not vary substantially, then any unexpected outputs are probably not caused by use of an inappropriate analysis scale.

9.2 Landscape patterns

FRCCMT does not assess landscape patterns such as the departure in patch size and arrangement from that of reference conditions. Consequently, an analysis produced by FRCCMT may underestimate departure if current patterns are substantially different from historical patterns. In such cases, it may be advisable to supplement FRCCMT results with information obtained from other sources that address landscape patterns, such as fire history studies.

9.3 Naming conventions

Several problems associated with FRCCMT can be attributed to the improper naming of files and folders. Special characters, spaces, and leading numbers should not be used as part of a file or folder name. This rule applies to paths used for data inputs and outputs as well as to Access databases and tables.

9.4 Reference Condition Table

The most common problems encountered while using FRCCMT are typically associated with the Reference Condition Table. Most errors are related to the following:

- The design of the Reference Condition Table must match the criteria specified in Table 3-1.
- The name of the Reference Condition Table cannot contain spaces or special characters and should be 10 characters or less in length.
- The values in the Landscape Level field of the Reference Condition Table must correspond to the landscape levels used for the analysis. Often, one landscape level is selected, but users forget to change the Reference Condition Table so that the Landscape Level field contains only the value "1."

To report a bug, please contact helpdesk@niftt.gov.

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Appendix B: Fire Regime Groups

Fire Regime Group	Frequency	Severity
I	0 – 35 years	Low to mixed
II	0 – 35 years	Replacement
III	35 – 200 years	Low to mixed
IV	35 – 200 years	Replacement
V	200+ years	Any severity

Appendix C: Obtaining the latest .NET Framework

If the FRCCMT installer determines that the setup requires a .NET Framework that has not been previously installed on your computer, you will see a dialog box similar to Figure C-1 instead of the first screen of the Mapping Tool Setup Wizard, as shown in Figure 6-5.

Figure C-1. Dialog box indicating the need to first install .NET Framework for installation to proceed.

Click on **Yes** and follow all prompts as directed. If the .NET Framework 2.0 has not been previously installed on your computer, the setup will, at this point, direct you to a website where you will be able to download the appropriate file (see Figure C-2).

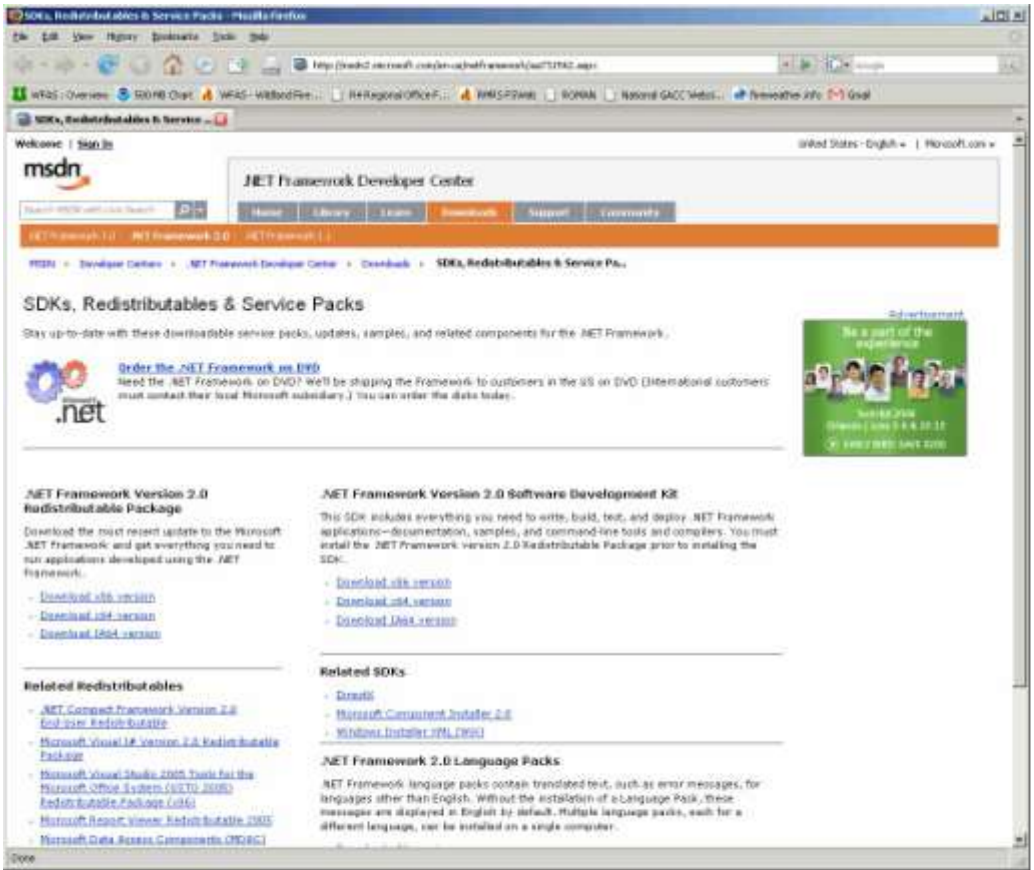


Figure C-2. Website for downloading .NET Framework 2.0.

As shown in Figure C-3, you will now need to specify which version of .NET Framework you would like to install on your computer. Select the x86 version if you have a Pentium (or other 32-bit) computer. Click on **Download x86 version**.

> ***Tip***: *Most users will need to specify the x86 version of NET Framework 2.0. If you are unsure of which version you need, contact your system administrator.*

Figure C-3. Select an appropriate version of .NET Framework.

A screen similar to the following will appear after your selection has been made. Click on the **Download** button to continue.

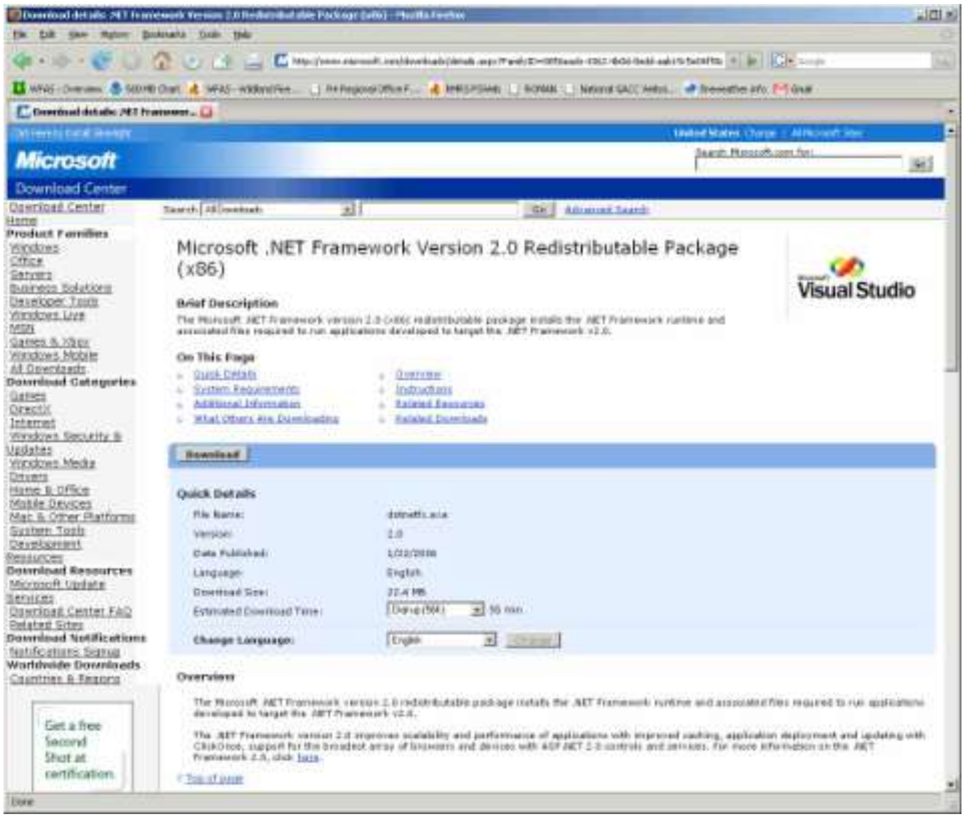


Figure C-4. Microsoft .NET Framework Version 2.0 (x86) download page.

Browse to a location of your choice. Download and save the dotnetx.exe file, as shown in Figure C-5.

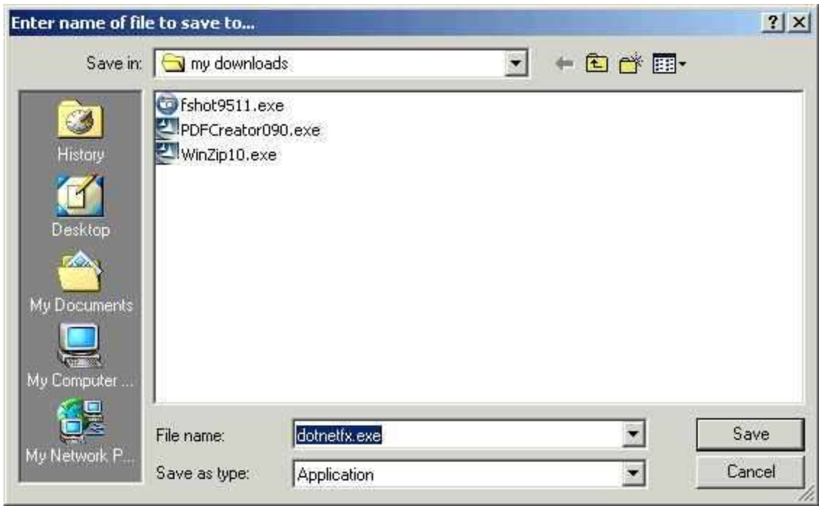


Figure C-5. Save the file to a location of your choice.

The Microsoft .NET framework 2.0 will download, extract and install automatically as shown in figures C-6 and C-7.

Figure C-6. Progress bar for download of dotnetfx.exe.

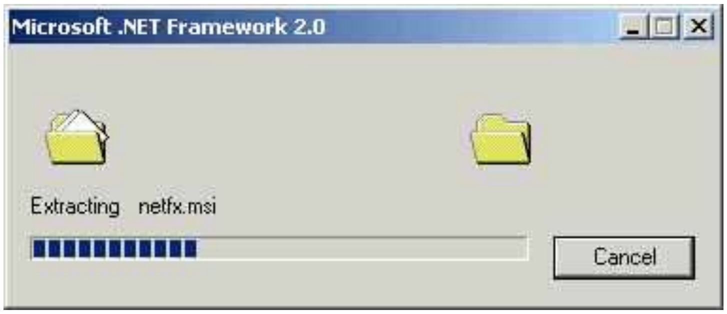


Figure C-7. .NET Framework installation

Click on the **setup.exe** file, as shown in Figure 6-4 to initiate the setup wizard and to continue installation of FRCCMT.

At this point, you may need administrative privileges to continue. Contact your system administrator if you experience problems

After clicking on the setup.exe file, the first in a series of FRCCMT Setup Wizard dialog boxes will open. Return to Section 6.2.2 to continue with installation.

Appendix D: Guide for Estimating Current Fire Frequency and Severity

This guide presents methods for deriving current fire frequency and severity inputs as a precursor to attributing the Fire Frequency and Severity Editor within the FRCC Mapping Tool (FRCCMT). The method described below provides a systematic way to conduct and document the process and make the data more defensible than when using a less structured "ad hoc" estimation method. We also recommend using a team approach or, at minimum, soliciting reviews from other experts once the initial estimates have been made.

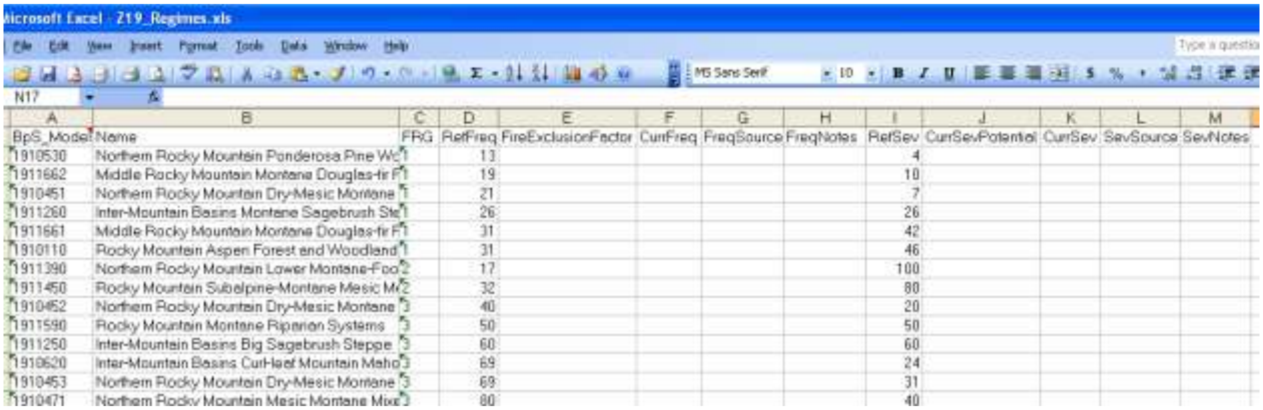
Preparing data sheets

The first step is to develop a master spreadsheet that can be used for summarizing reference and current fire regimes data for the BpS models in your assessment area. (Database software also could be used, if desired.)

Open the reference conditions database (*refcon.mdb*), and then highlight an applicable table, such as *LFnat_100108* (which contains data for the LANDFIRE National BpS models). Now, export the table as an Excel spreadsheet to a convenient folder on your computer after giving the file a distinctive name.

> ***Note**: You can copy and then edit the reference condition table that comes with the FRCCMT installation file, as follows: Open Windows Explorer and navigate to C:\Program Files\NIFTT\FRCCmt 3.0.0 build xxxxxx\Reference Conditions Database (if FRCCMT was installed in the default location).*

Open the new spreadsheet and delete the six columns that contain the vegetation succession class data (that is, the columns labeled *A* through *U* immediately to the right of the model names). Next, delete the *LandscapeLevel* column. Now rename the *Frequency* and *Severity* columns to *RefFreq* and *RefSever*, respectively. Finally, insert the following new data columns in the order shown in Figure D-1: *FireExclusionFactor, CurrFreq, FreqSource, FreqNotes, CurrSevPotential, CurrSev, SevSource, SevNotes*.



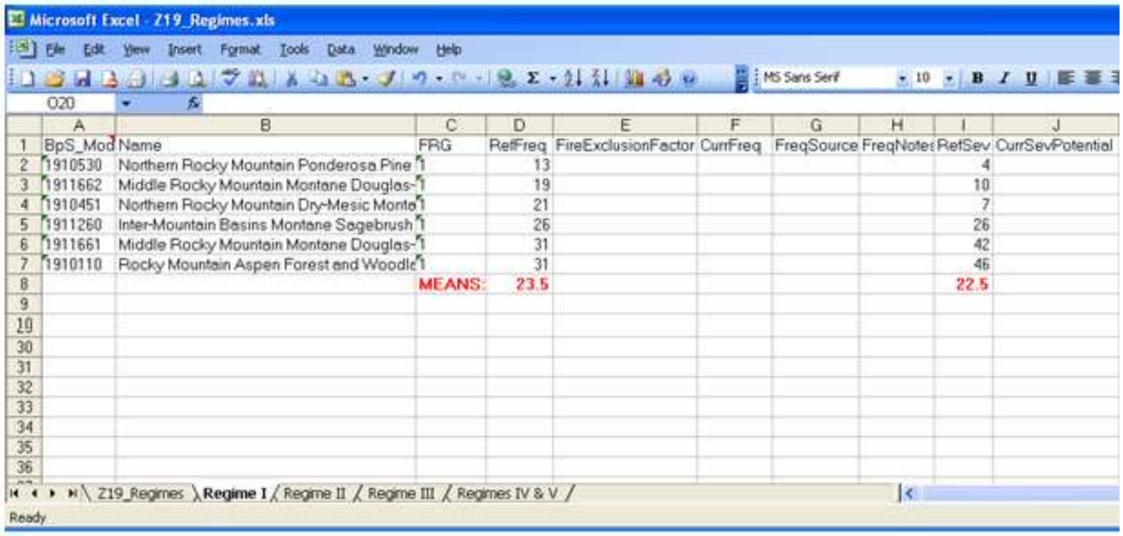
BpS_Model	Name	FRG	RefFreq	FireExclusionFactor	CurrFreq	FreqSource	FreqNotes	RefSev	CurrSevPotential	CurrSev	SevSource	SevNotes
1910530	Northern Rocky Mountain Ponderosa Pine Wo	1	13					4				
1911662	Middle Rocky Mountain Montane Douglas-fir F	1	19					10				
1910451	Northern Rocky Mountain Dry-Mesic Montane	1	21					7				
1911260	Inter-Mountain Basins Montane Sagebrush Ste	1	26					26				
1911661	Middle Rocky Mountain Montane Douglas-fir F	1	31					42				
1910110	Rocky Mountain Aspen Forest and Woodland	1	31					46				
1911390	Northern Rocky Mountain Lower Montane-Foo	2	17					100				
1911450	Rocky Mountain Subalpine-Montane Mesic M	2	32					80				
1910452	Northern Rocky Mountain Dry-Mesic Montane	3	40					20				
1911590	Rocky Mountain Montane Riparian Systems	3	50					50				
1911250	Inter-Mountain Basins Big Sagebrush Steppe	3	60					60				
1910620	Inter-Mountain Basins Curl-leaf Mountain Maho	3	69					24				
1910453	Northern Rocky Mountain Dry-Mesic Montane	3	69					31				
1910471	Northern Rocky Mountain Mesic Montane Mix	3	80					40				

Figure D-1. Sample data sheet created from an exported Reference Condition Table.

The next step is to locate the BpS models for your assessment area. You can identify the applicable model codes by first opening your ArcMap project and sorting on *BPS_MODEL* in the BpS attribute table. After locating the applicable models in your spreadsheet, delete all of the remaining models to make the spreadsheet more manageable.

Save your revised spreadsheet before proceeding. The next step is to conduct a multiple sort to organize the data according to fire regime group and related variables. First, highlight the entire spreadsheet by clicking on the small square on the upper left side of the table (next to column A). Next, click on *Data* in the toolbar and then select *Sort* from the drop-down menu. Sort on fire regime group (*FRG*) first, then on reference fire frequency (*RefFreq*), and then on reference fire severity (*RefSev*) while using the *Sort Ascending* option for all three categories. Click OK and verify that your spreadsheet has been sorted according to fire regime, fire frequency, and so on.

The final preparation step (which is optional but recommended) is to create a separate spreadsheet for each fire regime group or combinations of ecologically similar ones, such as regimes IV and V. Doing so makes it easier to summarize the reference condition values and also is useful for making global assignments of current values when merited (discussed below). First, insert new worksheets and label the tabs according to the fire regime group. Next, copy and paste into each worksheet the column headings in row 1. Finally, copy and paste into each new spreadsheet the applicable BpS models, which are identifiable by the data in the *FRG* column. The example below in Figure D-2 (which has been cropped to save space) shows the six models in the Regime I spreadsheet, along with the mean values that were calculated for the frequency and severity data. Also notice the worksheet tabs at the bottom that identify the locations of our original worksheet, and the worksheets for each fire regime group.



	A	B	C	D	E	F	G	H	I	J
1	BpS_Mod	Name	FRG	RefFreq	FireExclusionFactor	CurrFreq	FreqSource	FreqNotes	RefSev	CurrSevPotential
2	1910530	Northern Rocky Mountain Ponderosa Pine	1	13					4	
3	1911662	Middle Rocky Mountain Montane Douglas-	1	19					10	
4	1910451	Northern Rocky Mountain Dry-Mesic Monta	1	21					7	
5	1911260	Inter-Mountain Basins Montane Sagebrush	1	26					26	
6	1911661	Middle Rocky Mountain Montane Douglas-	1	31					42	
7	1910110	Rocky Mountain Aspen Forest and Woodla	1	31					46	
8			MEANS:	23.5					22.5	

Figure D-2. The six models in the Regime I spreadsheet, along with the mean values calculated for the frequency and severity data.

Estimating current fire frequency

In general, we suggest completing the fire frequency estimates before proceeding to the fire severity columns. Doing so might help inform your subsequent interpretations about potential changes in fuels and associated stand replacement potential for each BpS. Attributing one column at a time can also help you identify any opportunities for global assignments; that is, when merited, use the same fire frequency or severity value for a given group of ecologically similar biophysical settings.

To begin, hide all of the fire severity-related columns to simplify the worksheet.

- **Step 1. Making Initial Estimates (optional).** You might find it useful to make initial broad interpretations about BpS fire frequency using expert opinion as generated by your analysis team or by a knowledgeable individual. For example, you can use the *FireExclusionFactor* column to rate the probable effects of attempted fire exclusion according to a general scale ranging from low (*L*), to moderate (*M*), to high (*H*). And if current fire frequency is actually higher than during the reference period, such as in cheatgrass-dominated areas, use a code such as L-A to signify accelerated fire frequency.

- **Step 2. Making Final Estimates.** The next step is to make refined estimates based on one or more of the following methods, which are listed in descending order from most to least defensible. Also remember to use the *FreqSource* and *FreqNotes* columns to document your data sources and any other helpful information. For example, the following codes might be useful for the *FreqSource* column:

FA: Fire Atlas data summary
FR: Formal research (fire history or other professional research)
FO: Field observations (such as informal fire history sampling and fuels interpretations.)
IE: Individual expert opinion (cite person & basis)
TE: Team expert opinion consensus (cite persons & basis)
DR: Default reference value used for current
OS: Other data source (list)

- **Analyzing Fire Atlas Data**: If you have at least 50 years' worth of comprehensive fire atlas data to document fire locations and sizes in the assessment area, you can compare modern versus reference fire cycles for the various BpS types. Note that the atlas should list both wildfires and all prescribed fires. Analysis conducted in a Geographic Information System is always the preferred approach, but even hand-drawn maps can be used for estimating modern burned acres. Non-spatial (tabular) fire atlas data also can be helpful, but local knowledge of the approximate fire locations, sizes, and burned BpS types must be available to assist your interpretations. The first step is to estimate total burned acres per BpS during the fire atlas period. Then, if desired, expert opinion can be used to develop a *correction factor* to account for an average proportion of unburned terrain that typically occurs within local fire perimeters. Notice, for example, that the following hypothetical summary uses a correction factor of 80 percent in the "Acre Totals" category:

Fire Years (Acres)	P. Pine BpS % of Fire Area (Acres)	Aspen BpS % of Fire Area (Acres)	Sagebrush BpS % of Fire Area (Acres)	Spruce-Fir BpS % of Fire Area (Acres)
1935 (15,000 ac.)	70 (10,500)	30 (4500)	0 (0)	0 (0)
1949 (5000 ac.)	0 (0)	0 (0)	100 (5000)	0 (0)
1961 (20,000 ac.)	65 (13,000)	25 (5000)	0 (0)	10 (2000)
1980 (1000 ac.)	0 (0)	10 (100)	0 (0)	90 (900)
Acre Totals:	**23,500 x 0.8 = 18,800**	**9600 x 0.8 = 7680**	**5000 x 0.8 = 4000**	**2900 x 0.8 = 2320**

After totaling the modern burned acreage, the next step is to determine current mean annual burned acreage by dividing the total acreage for each BpS by the fire atlas time period (for example: 5000 burned acres / 50 yr = 100 mean annual burned acres). Next, determine the mean annual burned acreage for the reference era by dividing the total acres occupied by each BpS by its reference mean fire interval. (*Example*: 10,000 acres of ponderosa pine with a reference MFRI of 20 years leads to the following calculation: 10,000 acres / 20 years = 500 mean annual burned acres.) Finally, compute the current MFRI by comparing the current versus reference mean annual burned acre values and determining the applicable multiplication factor. Using our example, since a fivefold reduction in mean annual burned acreage has occurred; the current MFRI would be 100 years (that is, reference MFRI of 20 x 5 = 100).

Note: *Fire atlases generally cannot be used to infer current fire frequency for BpS types in Fire Regime Groups IV and V because the natural fire intervals are typically much longer than the maximum potential span of fire atlases. Instead, we recommend using the reference MFRIs to represent the current MFRI values (see instructions below).*

- **Interpreting Fire History**: Fire history interpretations can also be used to estimate current fire frequency when fire atlas data are lacking for one or more BpS types. If comprehensive fire history data are available (such as from formal research), current fire frequency can usually be extracted directly from the associated reports. Otherwise, field observations supplemented by data sources such as timber stand inventories can be used to derive general estimates. When the interpretation for a given BpS is based on an informal estimate (for example, expert opinion) rather than on comprehensive empirical measurements, you can avoid creating an illusion of estimation precision by rounding. If desired, you can also estimate according to interval ranges, as shown below, and then enter the midpoint values on your data sheet:

MFRI Range (years)	Midpoint Value
0-20	10
21-40	30
41-60	50
61-80	70
81-100	90
100+	* Use 100 yr. default for short- to moderately long-interval regimes. ** Use reference MFRI for long-interval regimes.

Regardless of which field based estimation technique you use, remember that the goal is to characterize current fire frequency for the *entire* BpS – not for small and possibly unrepresentative sites. You can account for intra-BpS variation by computing an area-weighted value. Let's consider an example of a BpS with a reference MFRI of 15 years: If 20 percent of the area is still on a natural cycle, and the remaining 80 percent has not burned in 100 years, then the area-weighted value for current fire frequency would be 83 years based on the following computation:

$$(0.20 * 15) + (0.80 * 100) = 83 \text{ MFRI.}$$

Assigning Defaults: Notice the instructions marked by asterisks in the preceding table. In certain cases it might be advisable to use the following default values to represent current fire frequency. When field surveys and other data sources suggest that little or no fire activity has occurred during the past century or longer, you can assign a default value of 100 years to the short-interval BpS types in regimes I, II, and III. This will indicate that the fire frequency for these systems is highly departed.

For any long-interval types in regimes III, IV, and V where fire has been absent for a century, you can use the reference MFRI to represent current fire frequency. Doing so will signify no departure from reference frequency. Do not use the 100-year default for long-interval types because that would signify an increase in fire frequency and, hence, frequency departure.

Estimating current fire severity

Before starting to estimate current fire severity, it might be helpful to arrange your spreadsheet as follows. First, "unhide" all of the severity-related columns and then hide all frequency columns except for *CurrFreq* and *FreqSource*. Doing so may provide a useful perspective for this portion of the analysis.

- **Step 1. Making Initial Estimates (optional).** As with the fire frequency estimates, making initial broad interpretations about current severity potential based on team or individual expert opinion might be a useful first step. For example, use the *CurrSevPotential* column to rate the probable stand replacement severity potential according to a general scale ranging from low (*L*), to moderate (*M*), to high (*H*).

- **Step 2. Making Final Estimates.** The next step is to make refined estimates based on one or more of the following methods, which are listed in descending order from most to least defensible. Also remember to use the *SevSource* and *SevNotes* columns to document your data sources and any other helpful information. For example, the following codes might be useful for the *FreqSource* column:

FB: GIS-based Fire Behavior modeling
IE: Individual expert opinion (cite person & basis)
TE: Team expert opinion consensus (cite persons & basis)
FR: Formal research (fire history or other professional research)
DR: Default reference value used for current
OS: Other data source (list)

Caveat: Regardless of which estimation technique listed below is used, bear in mind that the goal is to characterize average stand replacement potential for the entire BpS (based on 90th percentile conditions during a 24-hour burning period). That is, you'll need to compute an area-weighted value if substantial variation exists with the BpS. *Example*: Assume a BpS with a reference severity value of 40 percent; if 20 percent of the area still exhibits a severity potential of approximately 40 percent, and the remaining 80 percent exhibits 90 percent stand replacement severity potential, then the area-weighted value for current fire severity would be 80 percent, as shown by the following computation:

(0.20 * 0.40) + (0.80 * 0.90) = 80% severity.

- **GIS-based Method.** You may be able to use a Geographic Information System (GIS) to estimate current fire severity (if your fuel input layers are sufficiently up to date). For example, the Wildland Fire Assessment Tool (WFAT) can generate outputs such as the Keane Fire Severity Index (Keane and Karau 2010) for forested systems. Evaluating such data in conjunction with the BpS layer might provide a basis for interpreting whether current severity potential generally is low, medium, or high. The GIS data can then be supplemented by team or individual expert opinion derived from observations of recent fire behavior.

  ***Note**: Rather than attempting to derive precise severity estimates, the lookup table below can be used to estimate according to severity ranges and midpoints.*

- **Expert Opinion Method**. When the interpretation for a given BpS must be based totally on informal estimates (that is, expert opinion alone rather than being supplemented by empirical GIS data), we recommend estimating according severity ranges, as shown below. That is, once an applicable range has been determined, enter the approximate (rounded) midpoints into your data sheet:

Fire Severity Range (Pct. Replacemt.)	Midpoint Value
0-25	15
26-50	40
51-75	60
76-100	90

***Note**: In some cases, you may be able to use the reference values as defaults for your current fire severity estimates. For example, fire severity potential likely hasn't changed appreciably in many grasslands, shrublands, and unlogged forests with inherently heavy fuels (such as in*

Regimes IV and V). In such cases, simply use the reference data to represent the current severity values.

Checking and validating your estimates

The last step before entering your data into the Fire Frequency and Severity Editor tool is to "unhide" all worksheet columns and conduct a visual check of your frequency and severity assignments in tandem with one another. Doing so might help you identify additional editing opportunities, as well as any typographical errors. When you're satisfied with your assignments, the data can then be entered into the Fire Frequency and Severity Editor's data form. (The data entry process can be facilitated by sorting your data by BpS model number to match the order of input for the Editor.) After using the Fire Frequency and Severity Editor to generate ArcMap layers, the final editing step is to spatially validate the current frequency and severity outputs by having local experts conduct visual checks of the GIS map display. If substantial inaccuracies are found, you may wish to re-do some of your estimates before regenerating the layers and using them as inputs to the FRCC Mapping Tool.