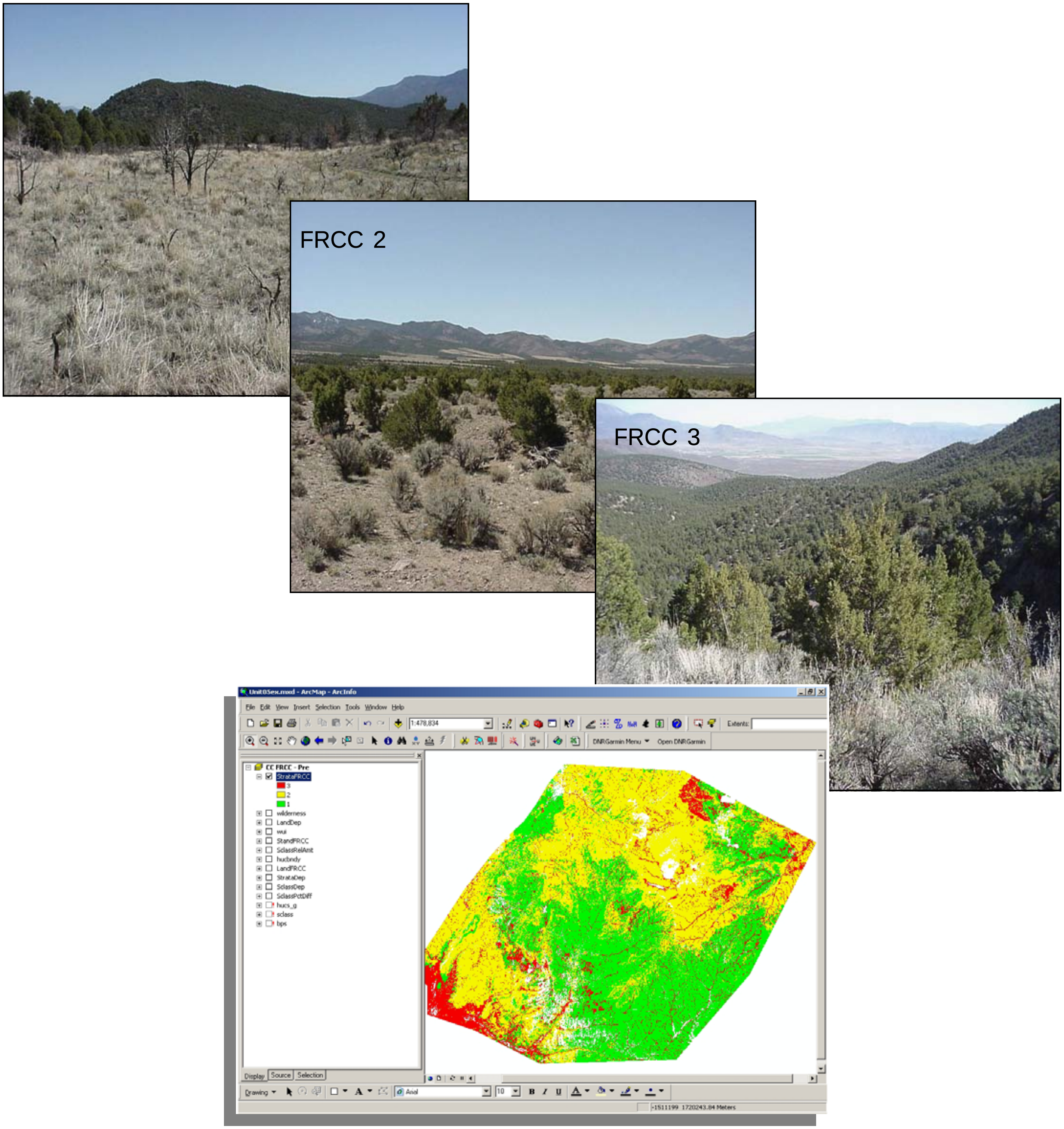


Fire Regime Condition Class Mapping Tool

User's Guide

Version 2.1.0

**National Interagency
Fuels Coordination Group**

Preface

Many federal land management agencies have been directed to manage their 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 the underlying processes of the system to be managed, not against them. Several important scientific concepts have been developed to help managers address sustainability by the assessment of 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, ecological departure, fire regime condition class (FRCC), and FRCC versus fire hazard.

Historical range of variation

Recent federal forest policy has identified the need to consider current ecosystem condition in the context of historical variation (USDA 2000a, 2000b). Historical range of variation (HRV) provides context and guidance for ecosystem management. Furthermore, disturbance-driven spatial and temporal variation is a vital attribute of nearly all ecosystems (Landres and others 1999). Landres and others (1999) suggest that a primary objective in characterizing HRV 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. Vegetation patterns resulting from historical fire regimes are a critical component for characterizing HRV in fire-adapted ecosystems.

Ecological departure

The historical range of variation can be used as a reference condition for understanding and evaluating change (Morgan and others 1994; Hessburg and others 1999; Swetnam and others 1999), as well as for evaluating current and future management goals (Hann and others 1997). For example, historical conditions have been used to assess the impact of altered fire regimes on the structure and composition of forest ecosystems (Skinner and Chang 1996; Hann and others 1997) and for assessing the effectiveness of wildland fire use programs (Brown and others 1994).

Certain photos courtesy of Fire Management Today

The amount of change or departure from reference disturbance regimes can be derived by comparing the condition of existing or future ecosystems to the historical range of variation. An understanding of ecosystem departure provides the context necessary for managing sustainable ecosystems. That is, managers need to understand how ecosystem processes and functions have changed before they can develop strategies for sustaining those systems through time. In addition, the departure from historical fire regimes may serve as a useful ecological proxy of the potential for uncharacteristic fire effects. Several recent land management initiatives have addressed these important concepts with respect to fire and call for spatially explicit maps of historical fire regimes as well as an estimate of fire regime departure (or condition class) (USDA 2000a; USDA 2000b; Healthy Forests Initiative: W House 2002; Healthy Forests Restoration Act: U.S. Congress 2003).

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 (Hann and others 2004). Three classes corresponding to low, moderate, and high departure have been defined (Hardy and others 2001; Schmidt and others 2002) (see Appendix B). 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).

FRCC is derived by comparing current conditions to an estimate of the historical range that existed prior to substantial Euro-American settlement. Departure of current conditions from an historical baseline can be used as a proxy for potential uncharacteristic fire effects and serves an important role in addressing risks to the sustainability of fire-adapted ecosystems. In applying the condition class concept (Schmidt and others 2002), we assume that historical fire regimes represent the conditions under which ecosystem components of fire-adapted ecosystems have evolved and 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 those of historical conditions, we would 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 would be affected as well.

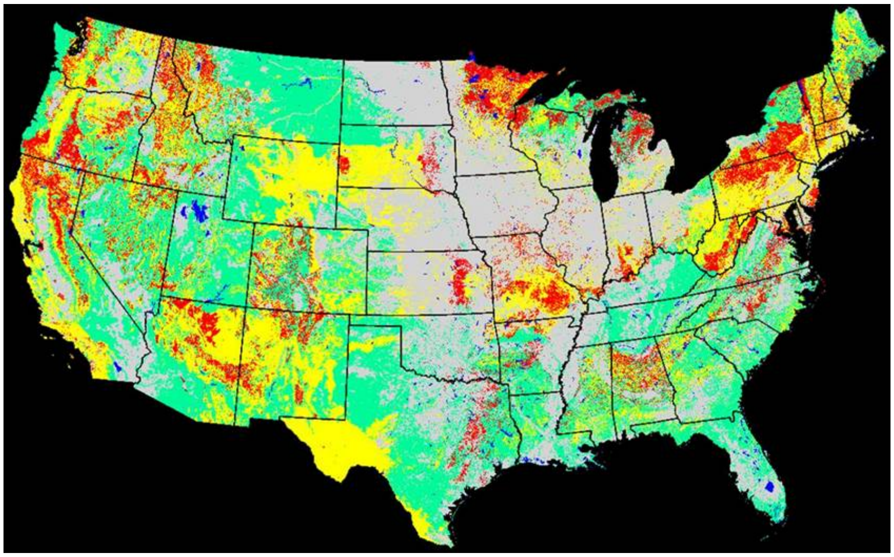
FRCC versus fire hazard

Fire regime condition class should not be used to indicate fire hazard potential since the relationships between condition class and fire behavior are inconsistent at best. For example, in some cases, low departure areas may have very active fire behavior, whereas in other cases, the fire behavior could be relatively benign. The opposite is also true: some high departure areas may have fire behavior ranging from benign to very active. In addition, fire behavior and FRCC are derived at different scales. FRCC is a landscape metric, whereas fire behavior is typically analyzed on a stand basis (such as a homogeneous patch characterized by uniform topography and fuels). Since FRCC is derived according to the composition of succession classes (for example, stands) within a given landscape, it is quite possible that some succession classes would have characteristics that may result in a low fire behavior hazard (such as in early seral stands), whereas others may have a high hazard (such as in late seral stands).

The FRCC Mapping Tool

The FRCC Mapping Tool quantifies the departure of vegetation conditions from a set of reference conditions that represents the historical range of variation. The tool, which operates from the ArcMap platform, derives several metrics of departure by comparing the composition of successional states representing current vegetation to the composition of successional states representing the reference conditions. FRCC Mapping Tool outputs can be used to develop management plans and treatment strategies aimed at restoring vegetation conditions.

This version of the FRCC Mapping Tool (version 2.1.0) was released in January of 2007. Future versions may incorporate additional features, so be sure to check the NIFTT website (www.niftt.gov) for possible updates and enhancements as well as associated updates to this user's guide.



What's new in version 2.1.0?

→Changes in terminology and concepts

Some terms and concepts related to the FRCC Mapping Tool have changed considerably since earlier versions of this software were made available. The term potential natural vegetation group, or PNVG, which was widely used in earlier versions of FRCC material, has been replaced by the term biophysical setting (commonly abbreviated as BpS). Another earlier term, vegetation-fuel class, has been replaced by the term succession class (S-Class) in this user's guide and in other current material related to the FRCC Mapping Tool.

→Changes to inputs

The design of the FRCC Mapping Tool's user interface (dialog boxes) has been improved for ease of use. In addition, the structure of the Reference Condition Table has changed, as have some field names; these changes were intended to make the Reference Condition Table more robust and thereby reduce common errors. Moreover, reference condition tables from the LANDFIRE Rapid Assessment are now included with the installation package. Lastly, the FRCC Mapping Tool can now modify BpS and S-Class grids even if they do not coincide with the Reference Condition Table.

→Changes to outputs

Two new output layers have been added: Landscape FRCC and Stand Departure. (Chapter 5 provides information on these new layers). In addition, the Management Report has been renamed Summary Report and several new fields have been added.

Prerequisites

FRCC Mapping Tool users should be familiar with the FRCC assessment process. As a minimum, users should review the Interagency Fire Regime Condition Class Guidebook (Hann and others 2004) prior to working with the FRCC Mapping Tool. We also recommend that potential users complete online FRCC training available at www.frcc.gov. Since the FRCC Mapping Tool is a GIS application, users must also have a working knowledge of ArcMap. Lastly, because the FRCC Mapping Tool incorporates some applications of Microsoft Access and Excel, users should have at least some basic working knowledge of these programs. Specific hardware and software requirements are detailed in Chapter 1 of this guide.

Obtaining copies

To obtain additional copies of the FRCC Mapping Tool User's Guide or Tutorial (available spring 2008), go to the NIFTT website at www.niftt.gov. Click on **NIFTT Tools & User Documents** in the menu. Select **NIFTT User Documents**, and you will then be routed to www.fire.org where NIFTT tools and associated documents are housed.

Credits

A beta version of the FRCC Mapping Tool was developed for the National Interagency Fuels Technology Team (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 Systems for Environmental Management (SEM) under the auspices of NIFTT.

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

This FRCC Mapping Tool User's Guide was written by NIFTT members Jeff Jones of the USDA Forest Service and Deb Tirmenstein of Systems for Environmental Management.

Lastly, we thank Christine Frame of Systems for Environmental Management (and NIFTT member) for her editorial proficiency.

Your input

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

Table of Contents

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

1.1 Before you begin

This user's guide describes the basic operation of the FRCC Mapping Tool, which quantifies the departure of vegetation conditions from a set of reference conditions.

We recommend that FRCC Mapping Tool users understand the concepts and methods presented in the Interagency FRCC Guidebook (Hann and others 2004) prior to working with the FRCC Mapping Tool. This user's guide will review many of the concepts, definitions, and methods contained within the Interagency FRCC Guidebook, but will not repeat detailed discussions.

Lastly, FRCC Mapping Tool users must be familiar with Microsoft Windows and basic ArcGIS/ArcMap functions.

1.2 How to use this guide

You need not 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 appropriate, screen captures are used to illustrate the steps required to complete a task.

Note that the FRCC Mapping Tool User's Guide is not intended to provide step-by-step guidance on the tool's operation using specific examples; rather, it is intended to serve as a reference guide. The FRCC Mapping Tool tutorial, available in spring of 2008 through www.niftt.gov, will provide such step-by-step instructions for applying the tool to a specific management scenario.

1.3 System requirements

1.3.1 Computer hardware

Your choice of hardware will greatly affect the FRCC Mapping Tool's performance. In general, computers having faster processors, more memory, and more free hard drive space will process data faster. A computer system having the minimum requirements identified in table 1-1 will likely suffice for applications involving relatively small analysis areas, such as tens of thousands of acres. However, a computer system should have the recommended requirements (table 1-1) if users will be frequently processing relatively large analysis areas, such as hundreds of thousands of acres.

Table 1-1. Minimum and recommended computer specifications for FRCC MT.

	Minimum	Recommended
Windows operating system	2000/XP	2000/XP
Memory	1GB	At least 1.5GB
Processor: P4 or equivalent	1.0GHz	At least 2.0GHz
Free hard drive space	5GB	At least 10GB
Display resolution	800 x 600	At least 1280 x 1024
Mouse or pointer	Required	Required

1.3.2 Computer software

Users of the FRCC Mapping Tool need to have the following programs installed: ArcMap versions 9.0 or 9.1 with the Spatial Analyst extension, Microsoft Excel (2000 or higher), and Microsoft Access (2000 or higher).

> **Note**: *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 it operates

The FRCC Mapping Tool works within ArcMap to spatially assess the departure of vegetation conditions from a set of reference conditions. These reference conditions represent the midpoint of the historical range of variation (see the preface to this guide). The tool generates a suite of metrics that characterizes vegetation 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 metric(s) that best addresses the specific analysis question.

The FRCC Mapping Tool uses protocols and algorithms outlined in the Interagency FRCC Guidebook (Hann and others 2004) to derive FRCC and related departure metrics. However, unlike the FRCC field assessment technique, the tool does not estimate departure of fire frequency and severity. All departure metrics produced by the FRCC Mapping Tool are based solely on vegetation conditions.

2.2 Processing steps

The FRCC Mapping Tool integrates the ArcMap and Access applications. ArcMap combines the spatial landscape, biophysical setting, and succession class layers so that each value in the resulting raster layer denotes a unique combination of values from the three input layers. A series of queries is then made in an Access database to derive the composition of succession classes (S-Class) for every biophysical setting (BpS) within each landscape. The S-Class composition is then compared to the reference conditions contained within another Access database, known as the Reference Condition Database. 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 Excel where the difference between current and reference conditions is calculated. The Excel worksheet displays the amount of change in the area necessary to restore or maintain landscapes according to their reference condition.

2.3 Applications

Outputs from the FRCC Mapping Tool can be used to develop management plans and treatment strategies to improve the sustainability of fire-adapted ecosystems. That is, the FRCC Mapping Tool can help to spatially identify restoration opportunities. Outputs can determine the amount of change that is needed across a landscape if restoring fire-adapted ecosystems is a management goal. Furthermore, the tool can help evaluate the effectiveness of proposed treatments in regards to restoring departed landscapes. The FRCC Mapping Tool can be used for broad- to fine-scale planning; however, careful consideration should be given to the spatial resolution, thematic specificity, and accuracy of the input data (spatial layers and reference conditions) when designing and interpreting FRCC Mapping Tool applications.

Chapter 3: Input Data

3.1 Description of input data

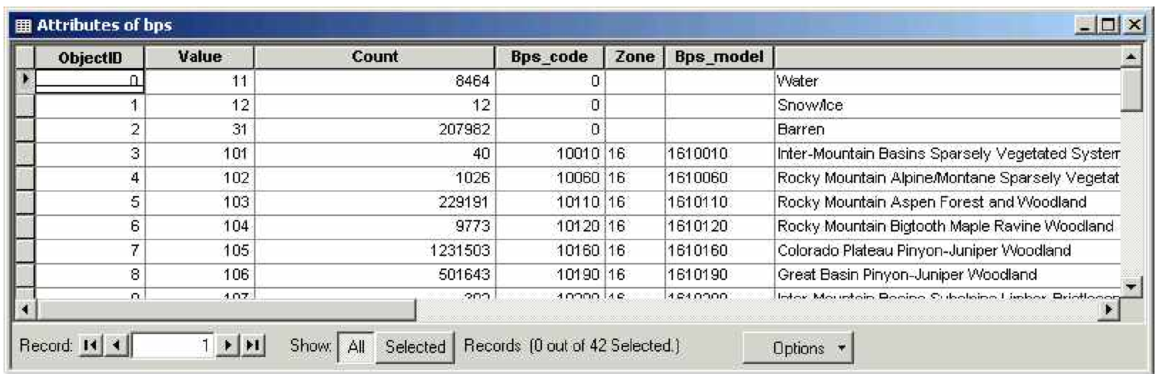
The FRCC Mapping Tool requires three kinds of spatial information in ArcGRID format: a layer (or attribute) depicting biophysical settings (BpS); a layer depicting succession classes (S-Class), and a layer depicting the landscape units (such as reporting units) within which the composition of succession classes is derived. This spatial information can be provided by a single layer having BpS, S-Class, and landscape levels as attributes, or the information can be provided by three unique layers which characterize BpS, S-Class, and landscape units separately. If multiple layers are used, all 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 a Microsoft Access database. Each of the inputs will be discussed in this user's guide, but readers are encouraged to refer to the Interagency FRCC Guidebook (Hann and others 2004) for a more detailed discussion of concepts pertaining to biophysical settings, succession classes, and reference conditions.

3.1.1 Biophysical Settings (BpS) layer

Biophysical settings reflect the integration of soils, climate, and topography which define native disturbance regimes and the composition of resulting plant communities. Biophysical settings are the taxonomic units used to characterize reference conditions. The natural composition of succession classes has been 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).

The FRCC Mapping Tool derives departure values, and subsequently fire regime condition classes, for each BpS within the analysis area. Therefore, the BpS layer must contain attributes with codes that coincide with BpS codes in the Reference Condition Table. 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 comprises 10 percent of a landscape, the composition of succession classes is determined from the remaining 90 percent of that landscape.

The BpS layer must contain an attribute that coincides with the BpS codes used in the Reference Condition Table. In the example Value Attribute Table displayed in figure 3-1, the attribute denoted as **Bps_model** coincides with the field named BpS_model in the Reference Condition Table (fig. 3-5).


Attributes of bps

ObjectID	Value	Count	Bps_code	Zone	Bps_model	
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 Systen
4	102	1026	10060	16	1610060	Rocky Mountain Alpine/Montane Sparsely Vegetat
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

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

Figure 3-1. Example of a value attribute table from a BpS layer produced by the LANDFIRE Project.

> ***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.*

3.1.2 Succession Classes (S-Class) layer

The Succession Classes (S-Class) layer identifies the successional states within each BpS. 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 (in other words, early-, mid-, or late-seral) and structure (in other words, open or closed canopy) and are generally derived from a characterization of species composition (such as cover type), diameter and/or height classes, and density or cover.

The current version of the FRCC Mapping Tool can accommodate up to six succession classes for a given BpS, including five natural states (for example, early-seral, mid-seral closed, mid-seral open, late-seral open, late-seral closed), and one "uncharacteristic" state or vegetation class that would not have been found within the natural or historical range of variation, such as invasive weeds and timber or grazing management that doesn't emulate the natural regime. These states are commonly denoted by **A, B, C, D, E**, and **U**, respectively. However, it is important to note that not all biophysical settings are characterized by five natural states and that 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.

The FRCC Mapping Tool computes the existing composition of succession classes for each BpS within a given landscape (fig. 3-2). 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, mines, agriculture, urban, and 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,** or **U** (fig. 3-2) so that the layer can be associated with the Reference Condition Table. In the following example, the attribute **Label** relates the S-Class layer to the succession classes in the Reference Condition Table (fig. 3-5). Succession classes identified by anything other than **A, B, C, D, E** or **U** 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.*

Attributes of sclass

ObjectID	Value	Count	Label	Description
0	1	470721	A	Succession Class A
1	2	680937	B	Succession Class B
2	3	887368	C	Succession Class C
3	4	1041533	D	Succession Class D
4	5	916252	E	Succession Class E
5	6	151870	U	Uncharacteristic Vegetation Cover / Structur
6	111	8464	Water	Water
7	112	12	Snow / Ice	Snow / Ice
8	120	16511	Urban	Urban
9	131	207982	Barren	Barren
10	132	1066	Sparsely Vegetated	Sparsely Vegetated
11	180	18872	Agriculture	Agriculture

Record: 1 Show: All Selected Records (0 out of 12 Selected.) Options

Figure 3-2. Example of a value attribute table derived from an S-Class layer produced by the LANDFIRE Project. Note – the S-Class layer produced by LANDFIRE may have two uncharacteristic classes: "UE" depicts an uncharacteristic condition due to exotics, where as "UN" depicts an uncharacteristic condition due to unnatural structure.

3.1.3 Landscape layer

The Landscape layer identifies a geographic area 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. Consequently, results will differ as the landscape used to report those results changes in size and/or shape. It is therefore highly important that landscapes of an appropriate size are selected when using the FRCC Mapping Tool.

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). Thus, 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. Erroneous estimates of departure may occur if these small slivers are not incorporated into the larger, adjacent landscapes. In some instances, it may be advantageous to extend the assessment area to incorporate entire landscapes extending beyond a project area's boundary.*

A nested hierarchy of up to three landscape levels (small, medium, and large) can be used by the FRCC Mapping Tool 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 low-severity fire regimes (in other words, regimes resulting in fine-grained vegetation patterns); the mid-sized landscape level could be used to assess biophysical settings dominated by mixed-severity regimes (regimes resulting in both fine- and coarse-grained vegetation patterns); and the largest landscape level could by used to assess biophysical settings dominated by high-severity 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 such as 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), landtype associations (medium), and landtypes (small). Figures 3-3 and 3-4 demonstrate examples of a nested landscape layer comprised of watersheds and the associated value attribute table, respectively.

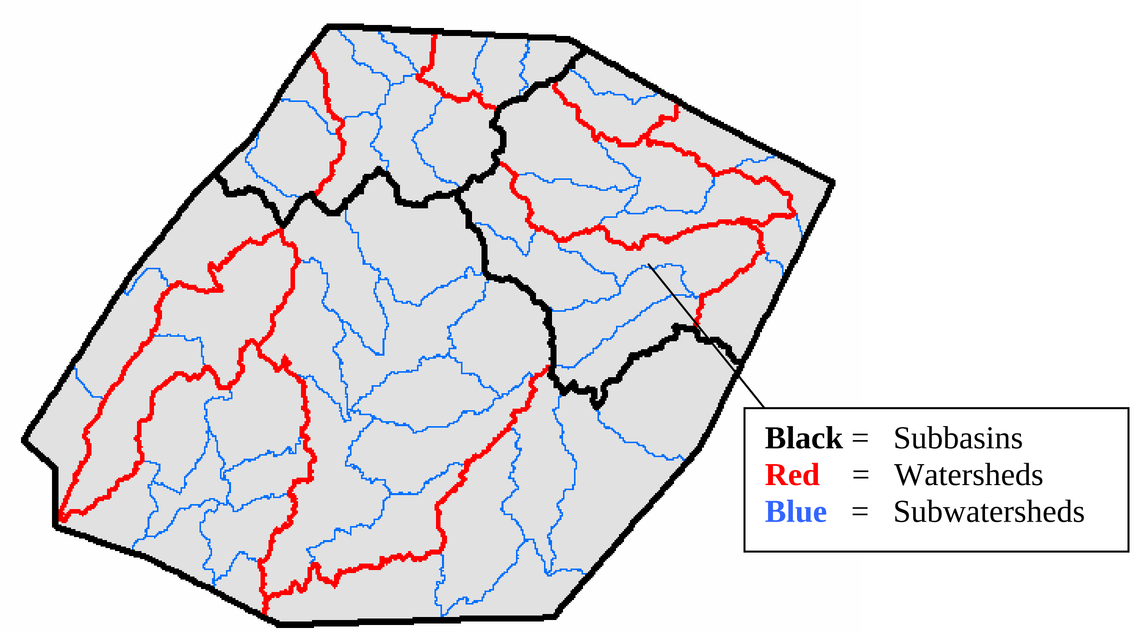
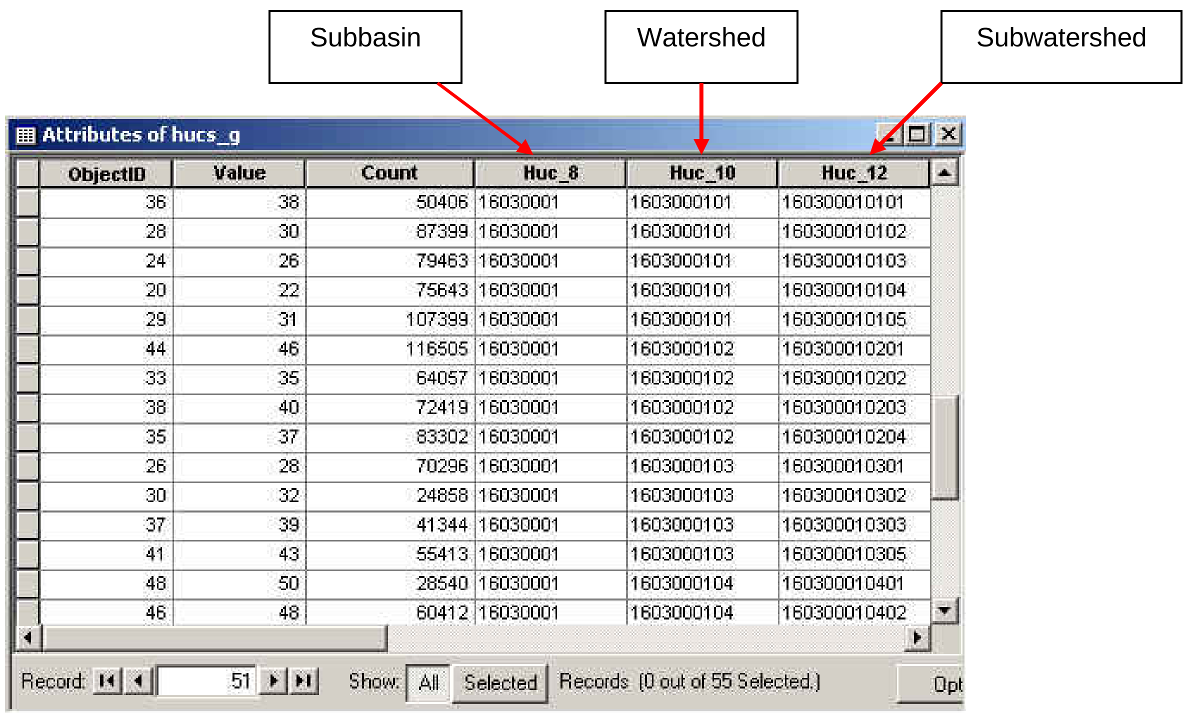


Figure 3-3. Example of nested landscapes comprised of subbasins, watersheds, and subwatersheds.



ObjectID	Value	Count	Huc_8	Huc_10	Huc_12
36	38	50406	16030001	1603000101	160300010101
28	30	87399	16030001	1603000101	160300010102
24	26	79463	16030001	1603000101	160300010103
20	22	75643	16030001	1603000101	160300010104
29	31	107399	16030001	1603000101	160300010105
44	46	116505	16030001	1603000102	160300010201
33	35	64057	16030001	1603000102	160300010202
38	40	72419	16030001	1603000102	160300010203
35	37	83302	16030001	1603000102	160300010204
26	28	70296	16030001	1603000103	160300010301
30	32	24858	16030001	1603000103	160300010302
37	39	41344	16030001	1603000103	160300010303
41	43	55413	16030001	1603000103	160300010305
48	50	28540	16030001	1603000104	160300010401
46	48	60412	16030001	1603000104	160300010402

Figure 3-4. Example of a value attribute table from a Landscape layer comprised of nested watersheds.

Although the FRCC Mapping Tool can use three hierarchical levels of landscapes for assessing departure, it is not necessary to use all three. For example, using only one level may be appropriate if the analysis area is dominated by a single fire regime group. Similarly, for a small analysis area dominated by a single fire regime group, it might be appropriate to have a single landscape (analysis area boundary). In this instance, the landscape layer would contain only a single value (for example, one subwatershed).

3.1.4 Reference Condition Table

The Reference Condition Table provides three key pieces of information for use with the FRCC Mapping Tool: 1) a list of biophysical settings that occur within a particular analysis area, 2) the succession classes and corresponding reference condition for each BpS, and 3) the dominant historical fire regime group. Select one or more landscape levels according to the fire regime group(s) to compute the composition of the existing succession classes. Reference conditions are typically derived by a vegetation succession and disturbance model such as VDDT (ESSA Technologies Ltd. 2005b), 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 identifies the proportional distribution of succession classes (expressed as a mid-point) within each BpS that would likely occur across a landscape as a result of the historical disturbance regime.

The Reference Condition Table (fig. 3-5) must be formatted so that it can be associated with 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**, correspond to the S-Class and provide percent composition within a particular BpS. The field headings must coincide 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 C) 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.

Two fields in the Reference Condition Table, **Name** and **FRG**, are optional and are not directly used by the FRCC Mapping Tool. 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 for a description of the Summary Report).

Reference condition tables can be found in an Access database called **refcon.mdb**, which is located in **c:\NIFTT\FRCC Mapping Tool 2.1.0\Reference Conditions Database** (provided the recommended default pathways were used during the installation procedure). Five default reference condition tables are included when the FRCC Mapping Tool is installed. Three – **GB_Alaska**, **GB_East**, and **GB_West** – were adapted from the Interagency FRCC Guidebook (Hann and others 2004), and two – **RA_East** and **RA_West** – were adapted from the Rapid Assessment phase of the LANDFIRE Project.

> ***Note**: Users of the default reference condition tables should review the **FRG** and **LandscapeLevel** fields to verify that values are reasonable for the specific assessment area (unreasonable values should be changed).*

ra_WestUS : Table

BpS_Model	Name	A	B	C	D	E	U	FRG	LandscapeLevel
R#ABAMlw	Pacific Silver Fir--Low Elevation	15	20	3	10	52	0	3	2
R#ABAMup	Pacific Silver Fir--High Elevation	10	25	2	3	60	0	5	3
R#ABLA	Subalpine Fir	15	20	2	3	60	0	4	3
R#AGSP	Bluebunch Wheatgrass	5	70	25	0	0	0	1	1
R#ALME	Alpine and Subalpine Meadows and Grasslands	5	90	5	0	0	0	5	3
R#DFHEdy	Douglas-fir Hemlock-Dry Mesic	5	15	5	15	60	0	3	2
R#DFHEwt	Douglas-fir Hemlock-Wet Mesic	5	15	1	4	75	0	5	3
R#DFWV	Douglas-fir Willamatte Valley Foothills	15	15	10	30	30	0	1	1
R#JUPIse	Western Juniper Pumice	3	12	15	10	60	0	5	3
R#MCONdy	Mixed Conifer - Eastside Dry	15	1	30	40	14	0	1	1
R#MCONms	Mixed Conifer - Eastside Mesic	15	40	15	10	20	0	3	2
R#MCONsw	Mixed Conifer - Southwest Oregon	15	5	10	50	20	0	1	1
R#MEVG	California Mixed Evergreen North	15	10	50	20	5	0	1	1
R#MGRA	Idaho Fescue Grasslands	10	70	20	0	0	0	2	1
R#MTHE	Mountain Hemlock	10	10	15	10	55	0	5	3
R#OAPI	Oregon White Oak/Ponderosa Pine	25	5	20	47	3	0	1	1
R#OWOA	Oregon White Oak	10	1	20	64	5	0	1	1
R#PICOpu	Lodgepole Pine - Pumice Soils	20	15	50	10	5	0	4	3
R#PIJEsp	Pine Savannah - Ultramafic	15	45	40	0	0	0	1	1
R#PIPOm	Dry Ponderosa Pine - Mesic	10	10	35	40	5	0	1	1
R#PIPOxe	Ponderosa Pine - Xeric	25	5	25	40	5	0	3	2
R#REFI	Red Fir	10	20	15	20	35	0	3	2
R#SAWD	Subalpine Woodland	25	20	55	0	0	0	3	2
R#SBDWlw	Low Sagebrush	35	15	50	0	0	0	3	2
R#SBMT	Mountain Big Sagebrush (Cool Sagebrush)	20	10	35	30	5	0	2	1
R#SPFI	Spruce - Fir	3	22	25	20	30	0	4	3

Record: 1 of 148

Figure 3-5. Example Reference Condition Table from the Rapid Assessment phase of the LANDFIRE Project. **BpS_Model** = the BpS code; **Name** = BpS name; **A** thru **U** = succession classes; **FRG** = Fire regime group; **LandscapeLevel** = the appropriate level at which to assess each BpS.

Some general guidelines for creating a reference condition table in Access are as follows:

1. The name of the Reference Condition Table cannot contain spaces or special characters (such as `~! @#$^()-+={ }[ ]|\?/:;'"< >, .) and should be between three and eight characters long.
2. The **Name** and **FRG** fields are optional and need not contain any values. They are included within the Reference Condition Table for user convenience only.
3. The S-Class fields **A** through **U** cannot contain missing values (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.
4. 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 a user prefers to use only 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.
5. The total path length for the location of the FRCC Mapping Tool software, and consequently the Reference Condition Table, must be less than 80 characters in length.
6. The FRCC Mapping Tool can use only a reference condition table in an Access database labeled as **refcon.mdb**. This database is created during the software installation process. If the default pathway was selected during the installation process, then the refcon.mdb will reside in **c:\NIFTT\FRCC** Mapping Tool 2.1.0\Reference Conditions Database. (The pathway cannot contain any folders with spaces such as **Program Files, My Documents**, or **Documents and Settings**).
7. Removing the FRCC Mapping Tool software will also remove any customized reference condition tables that you may have developed. We therefore recommend that, prior to removing the software, you make a backup copy of the **refcon.mdb** if it contains any customized reference condition tables.

The design or structure of the Reference Condition Table is critically important for successful execution of the FRCC Mapping Tool. The appropriate design of the Reference Condition Table is displayed in table 3-1. An empty table called **Custom** (provided with the installation of the software) has the appropriate design specifications, and users wishing to create their own reference condition table are encouraged to use this **Custom** table as a template. An alternative approach for creating a customized reference condition tables is to copy one of the default tables included with installation, paste it with a new name within the database and then edit those values of interest.

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
BpS_Model	Text	16		Yes	No		Yes (No duplicates)	Yes	No Cntrl.	None
Name	Text	128		No	Yes		No	Yes	No Cntrl.	None
A	Number	Double	Auto	Yes		0	No			
B	Number	Double	Auto	Yes		0	No			
C	Number	Double	Auto	Yes		0	No			
D	Number	Double	Auto	Yes		0	No			
E	Number	Double	Auto	Yes		0	No			
U	Number	Double	Auto	Yes		0	No			
FRG	Text	4		Yes	No		No	Yes	No Cntrl.	None
Landscape Level	Number	Long Integer	Auto	Yes		1	No			

Chapter 4: Obtaining Input Data

4.1 Spatial input layers

LANDFIRE is an interagency project producing consistent and comprehensive maps and data describing vegetation, wildland fuel, and fire regimes across the United States. LANDFIRE data layers representing biophysical settings and succession classes can be downloaded from the LANDFIRE website at www.landfire.gov for many areas of the United States. Layers developed by the LANDFIRE Rapid Assessment phase of the project are currently available for the entire continental United States. LANDFIRE National data products are being delivered across the nation on an incremental basis, and layers are currently available for the western United States. The National phase of the LANDFIRE Project is scheduled to complete coverage for the entire nation, including Alaska and Hawaii, by the end of 2009. BpS and S-Class layers produced by the LANDFIRE National effort will be more refined than those produced by the Rapid Assessment phase of the LANDFIRE Project.

> ***Note****: The LANDFIRE Rapid Assessment uses older terminology and refers to the BpS layer as PNVG (potential natural vegetation group). The S-Class layer produced by LANDIRE National contains two uncharacteristic classes ("UE" and "UN", depicting uncharacteristic exotics, and uncharacteristic natural, respectively). These two classes will need to be combined into a single uncharacteristic class denoted as "U" prior to use in the FRCC Mapping Tool.*

4.1.1 Steps for obtaining the layers

1. Navigate to www.landfire.gov and click on **Data Products**.

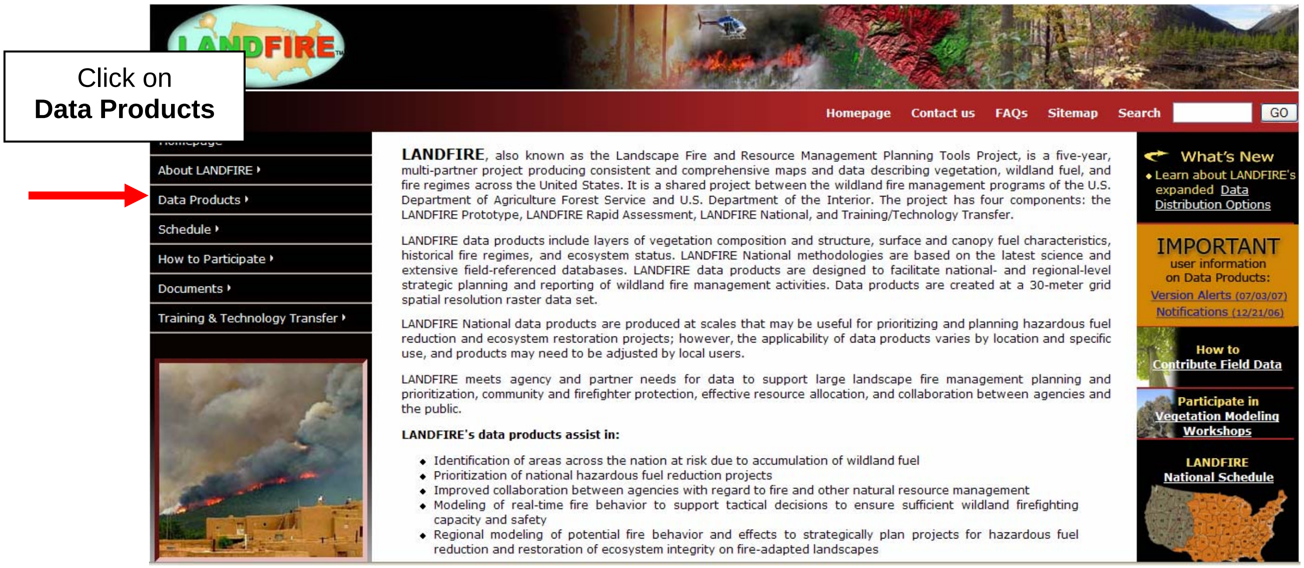


Figure 4-1. LANDFIRE website homepage.

2. Under the Data Product Access menu item, you will see an overview followed by four options for downloading LANDFIRE data (shown below in fig. 4-2). Note these are also located in the right-hand column of the page. The first option links to the National Map LANDFIRE, LANDFIRE'S data dissemination website managed by the U.S. Geological Survey. The second option allows you to download the LANDFIRE Data Access Tool, which is run from ArcMap and can be used to download data layers (see http://www.landfire.gov/datatool.php). The third option provides information on how to obtain the latest LANDFIRE data via DVD, and the fourth explains how to access the data from an ftp site (note: this option is reserved for rare, time-sensitive situations – see website for details).

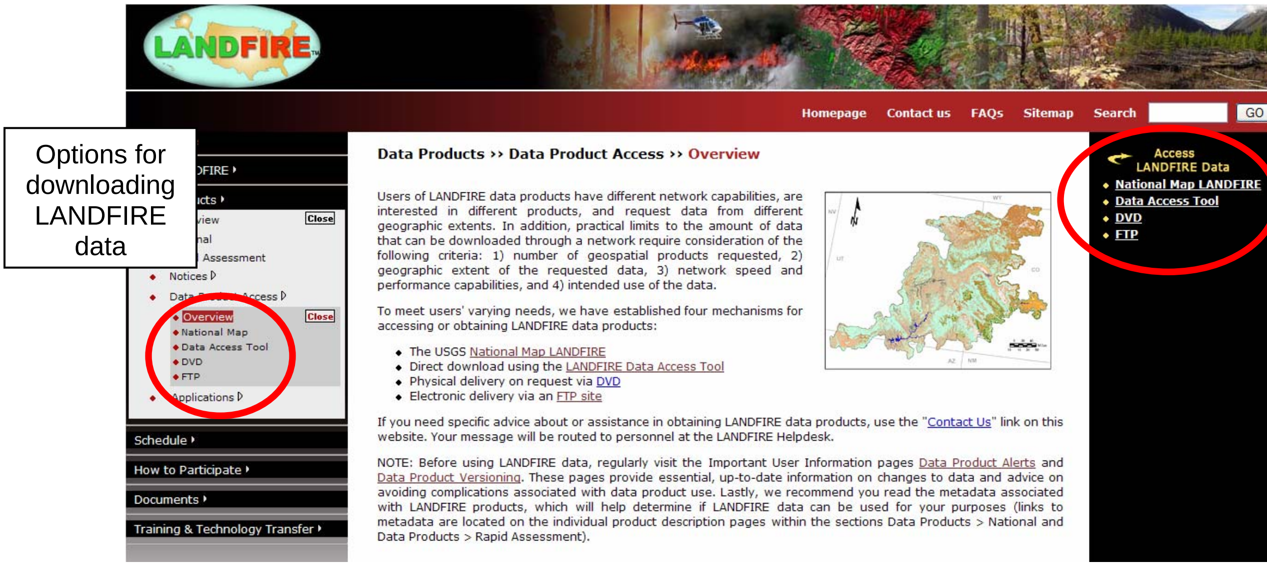


Figure 4-2. LANDFIRE data product access options.

The following steps will detail the process necessary for downloading data directly from the National Map LANDFIRE.

3. Click on **National Map LANDFIRE** for a description of the data dissemination site and then click on the link in the right-hand column of that page to link to the National Map LANDFIRE. You can also access the National Map LANDFIRE website directly at http://landfire.cr.usgs.gov/viewer/.

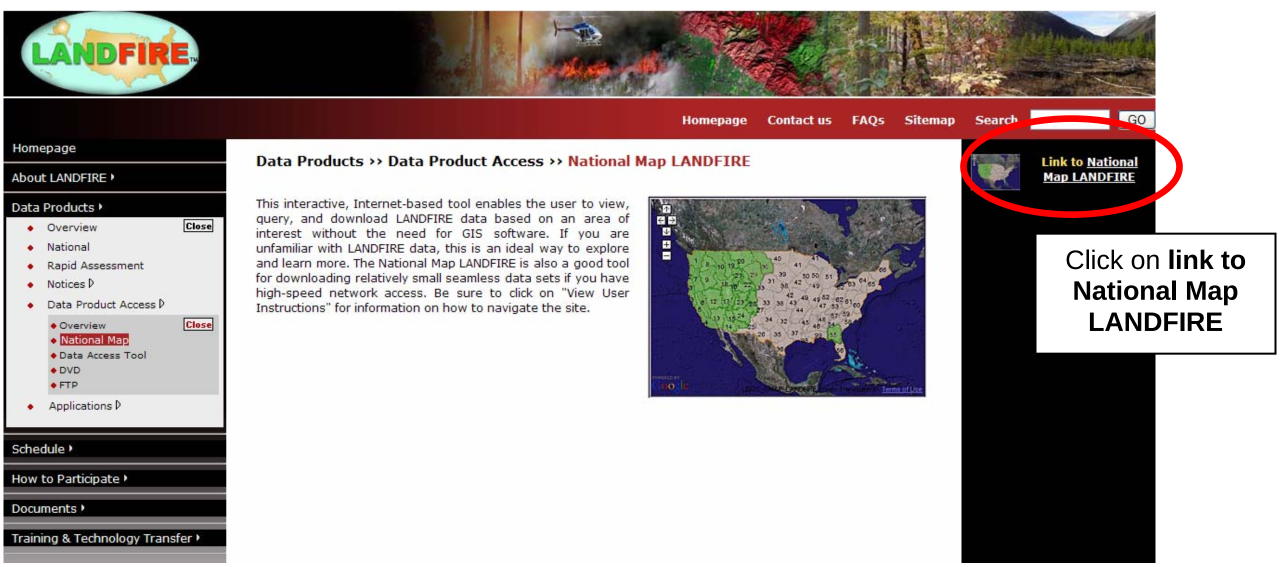


Figure 4-3. Link to National Map on LANDFIRE website.

4. Click on **View User Instructions** to open a page with tips for using the map interface. After reviewing, click on the approximate geographic location of your assessment area.

   ***Note**: Layers are available for all mapping zones colored green on the website's front page (visit the National Map LANDFIRE for current mapping status).*

Figure 4-4. National Map LANDFIRE front page.

5. The next web page will display a shaded relief map of the approximate geographic location that you selected in the previous step. At this point, you can zoom in, zoom out, and pan until the specific area of interest is within view. Note also that under the Display tab, you can access the Places and Boundaries menus to help locate your area of interest.

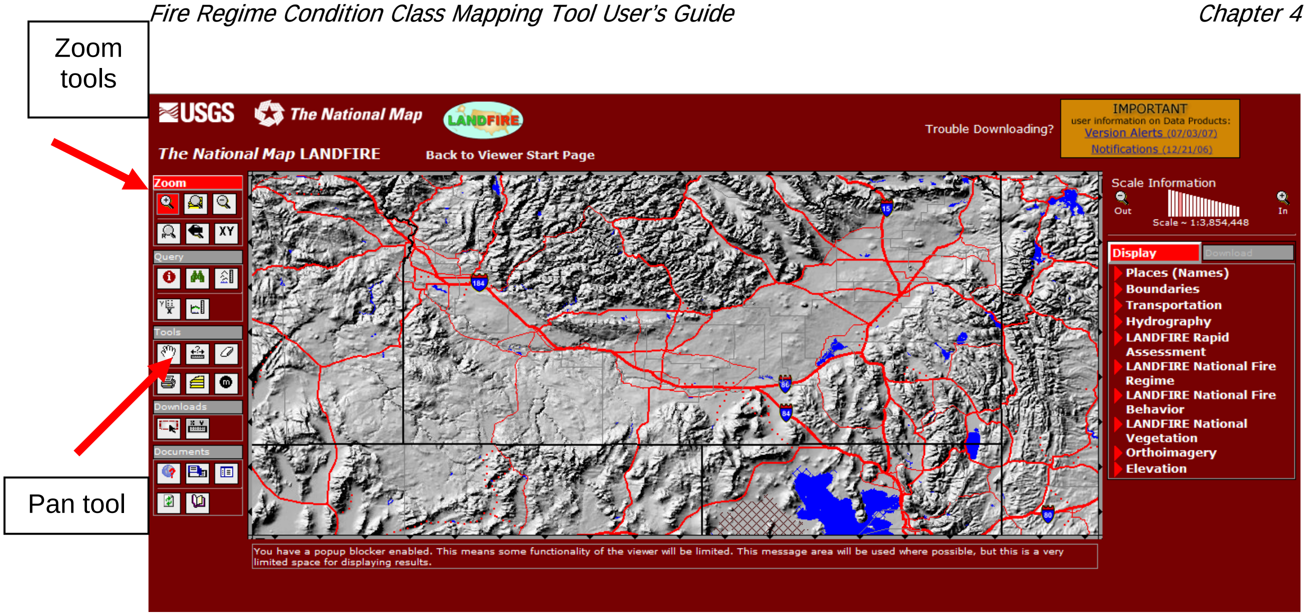


Figure 4-5. Data viewer page displaying area of interest.

6. Click on the **Download** tab to identify the LANDFIRE layers that you wish to download. Check all of the layers to be downloaded.

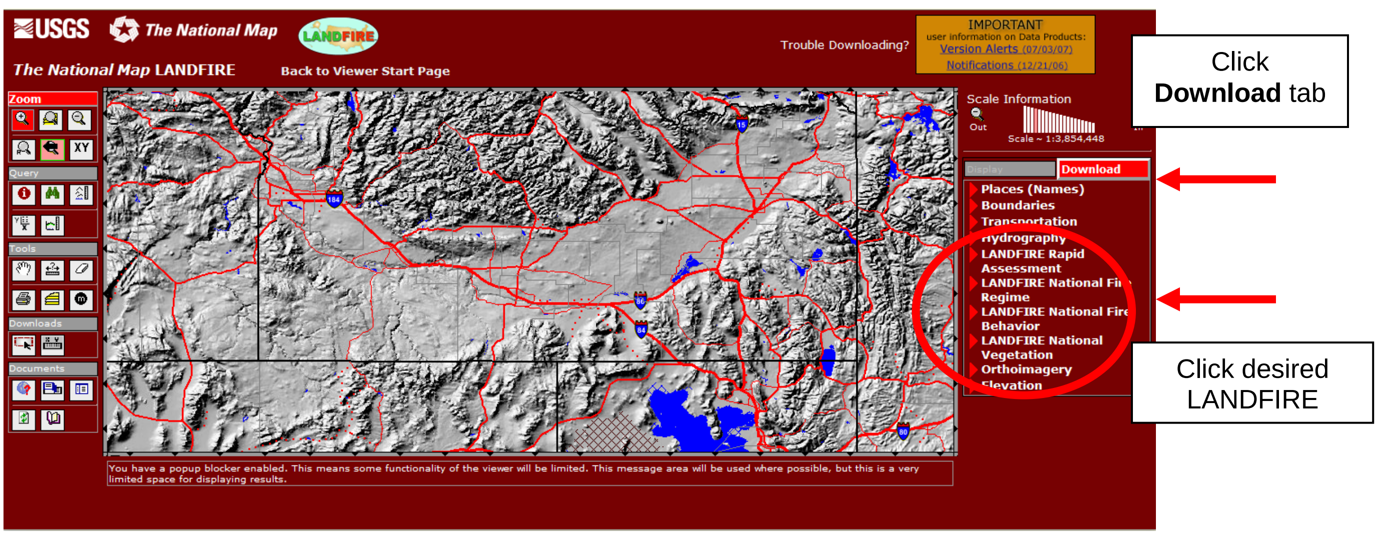


Figure 4-6. Data download tab and LANDFIRE menu options.

7. Under **Downloads** in the left-hand column, click on either of the two download options: Define Rectangular Download Area or Define Download Area by Coordinates.

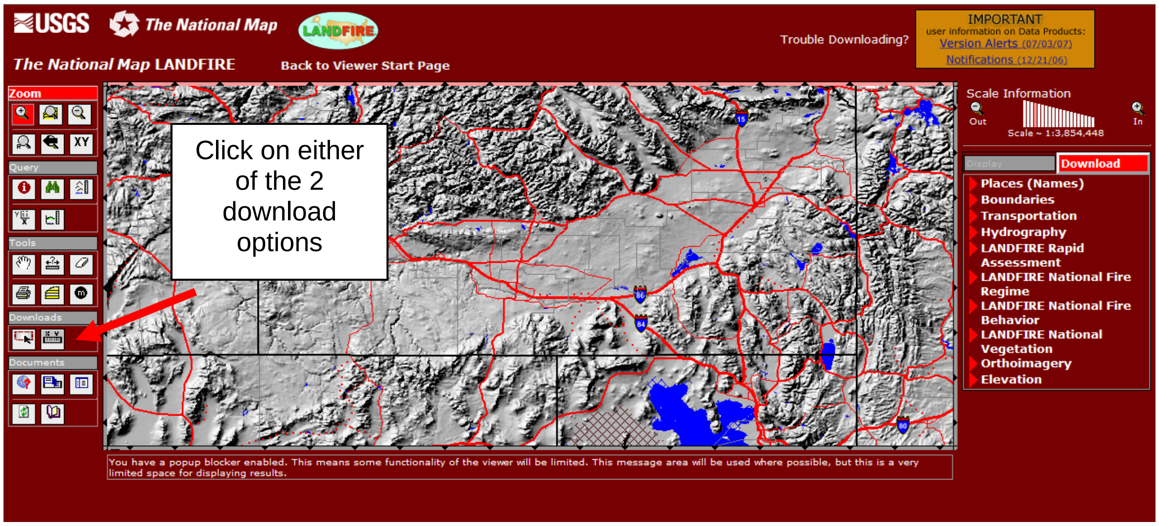


Figure 4-7. Data viewer download tools.

8. When you have finished drawing a rectangle or selecting coordinates, a summary page identifying all layers selected for download will appear. The data format default is ArcGRID_with_attib. However, in the event that you want to download additional layers with the existing selection or you have forgotten to select layers from the download tab, you can use the Modify Data Request option (found at the top of the Request Summary Page).

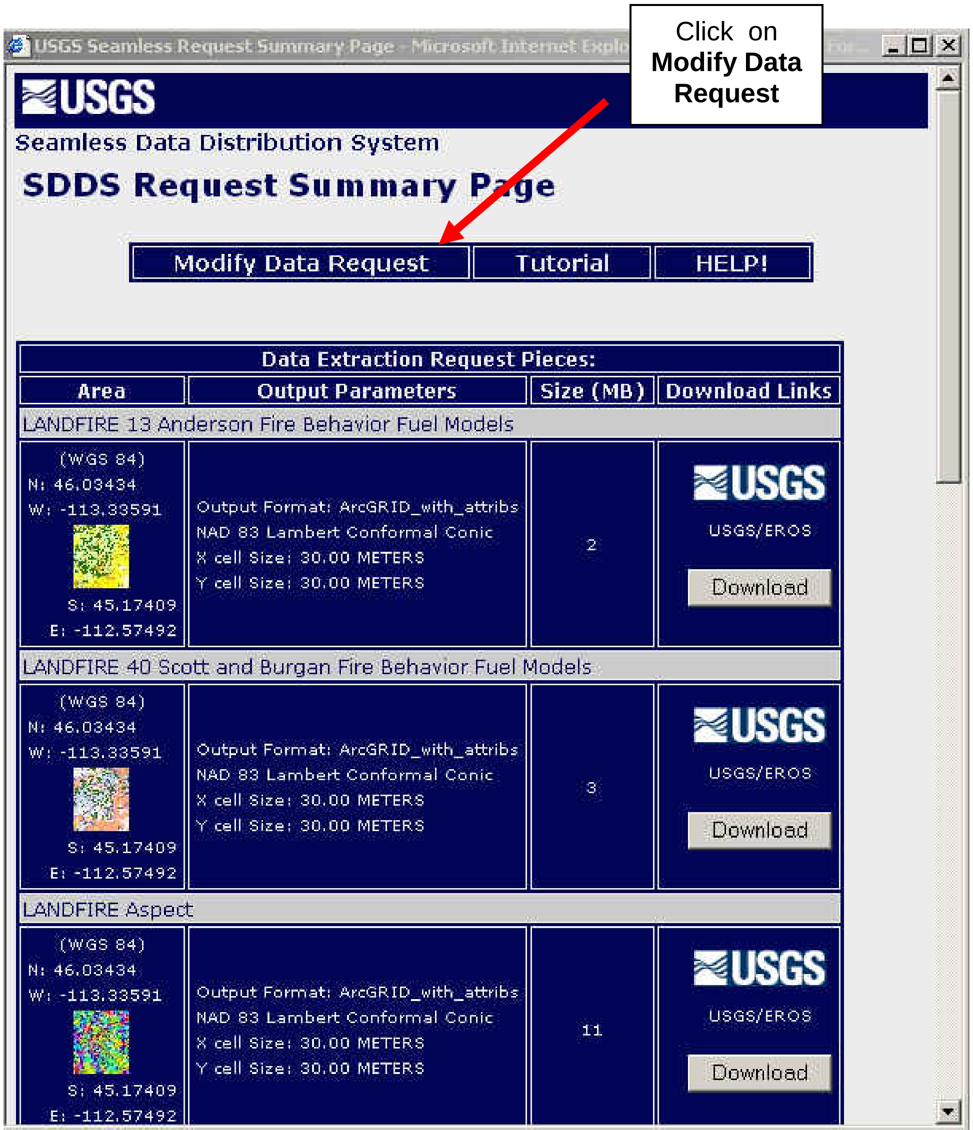


Figure 4-8. Modifying data request.

9. First, select the additional grids by checking the box next to the layer name. Then, click on the dropdown menu next to each data layer you have chosen and select ArcGRID_with_attribs. Notice that ArcGRID (no attributes) is the default format.

10. Click the Save Changes and Return to Summary button at the bottom of the page, which will bring you back to the Request Summary Page. You are now ready to continue downloading your data.

11. Once you have selected the desired layers, click on the **Download** button for the first layer in your summary report. The file will download as a .zip file with a random numeric name. The .zip file will contain a grid identified by the same random number as the .zip file. We recommend that you change

the name of the grid in ArcCatalog to reflect the thematic nature of the layer.

***Tip**: Users should regularly check www.landfire.gov for data versioning alerts – notices that appear when layers have been updated – and data notifications that identify known issues with specific data layers (fig. 4-9).*

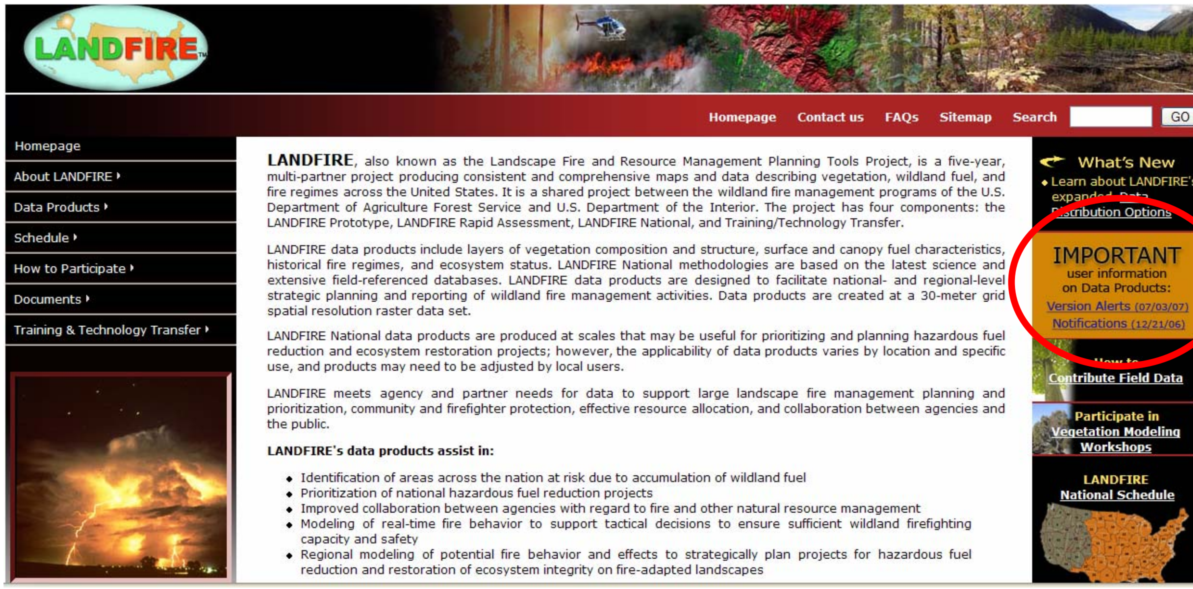


Figure 4-9. Link on LANDFIRE website homepage to important user information pages: Data Versioning Alerts and Data Notifications.

***Note**: LANDFIRE does not provide landscape layers; therefore, the user needs to investigate the availability of these layers in his/her local area. For example, local hydrologists, ecologists, and/or GIS managers will likely be direct you to available, appropriately scaled landscape layers. Note also that watershed layers are being produced under the auspices of the National Resource Conservation Service (NRCS); check their website at http://datagateway.nrcs.usda.gov/ for the availability of watershed layers in your local area.*

4.2 Reference conditions

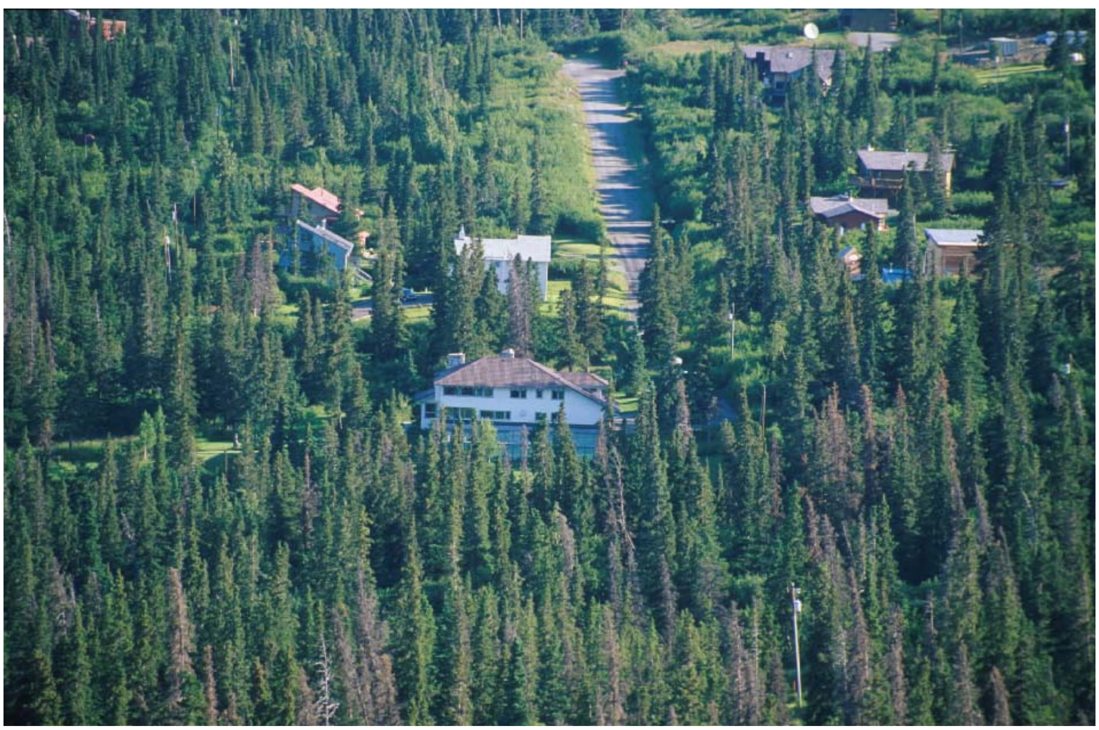
Two sets of reference conditions are included with the installation of the FRCC Mapping Tool version 2.1.0. One set includes the first iteration of relatively coarse biophysical settings occurring across the continental United States and Alaska; these are published in tables in the Interagency FRCC Guidebook (Hann and others 2004; see www.frcc.gov). These biophysical settings were later refined for the continental United

States through the LANDFIRE Rapid Assessment phase of the LANDFIRE Project (see www.landfire.gov) and constitute a second set of reference conditions.

The three reference condition tables published in the FRCC Guidebook (Hann and others 2004) are denoted in the software as **gb_West, gb_East,** and **gb_Alaska** for the western U.S, eastern U.S., and Alaska, respectively. The two reference condition tables developed for the LANDFIRE Rapid Assessment project are denoted as **ra_West** and **ra_East** for the western U.S. and eastern U.S., respectively.

The LANDFIRE National Project provides two additional sets of reference conditions in database format. One set is derived non-spatially from the VDDT models produced for the LANDFIRE National Project and are available for the western U.S. at www.fire.org (NIFTT > Reference Conditions). Another reference condition data set derived using the LANDSUM spatial vegetation succession and disturbance model has been completed for the western U.S. This data set reflects the influence of local topography and contagion upon fire frequency and therefore may be more refined than reference conditions derived from non-spatial applications. Contact helpdesk@landfire.gov to request the LANDSUM-derived reference conditions for your area.

> ***Note**: Although these data are currently available only for the western U.S., data for the eastern U.S. should be available by 2009 and data for Alaska and Hawaii should be available by 2010.*



Chapter 5: Output Data

The FRCC Mapping Tool derives a suite of departure metrics from the BpS, S-Class, and Landscape input layer(s) (table 5-1). A suite of outputs was designed so that managers would have a variety of layers to meet their local analysis objectives. Thus, not all outputs will be useful to all users. Identifying which output layers are potentially useful depends largely on the management questions and necessary thematic detail.

Output layers are available to address management questions at the landscape level, the BpS level, and the S-Class level. It is important to note that some output layers simply provide a broader classification of other output layers. Thus, a user can determine the amount of detail needed to address the management questions and then select the appropriate output layers. In some instances, the level of detail desired depends upon the 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 5-1. Output layers produced by the FRCC Mapping Tool.

Layer description	Layer name	Analysis level	Thematic detail (number of potential values)
S-Class Percent Difference	SclassPctDiff	S-Class	Several hundred
S-Class Relative Amount	SclassRelAmt	S-Class	Six
S-Class Departure	SclassDep	S-Class	Several hundred
Stand FRCC	StandFRCC	S-Class	Four
Strata Departure	StrataDep	BpS	Several hundred
Strata FRCC	StrataFRCC	BpS	Four
Landscape Departure	LandDep	Landscape	Several hundred
Landscape FRCC	LandFRCC	Landscape	Four

The following section discusses each of the FRCC Mapping Tool outputs, including their derivation and potential applications.

5.1 Succession class (S-Class) outputs

5.1.1 S-Class Percent Difference (SclassPctDiff)

The Succession Class (S-Class) Percent Difference layer is analogous to "Veg-fuel Class Percent Difference" as defined by the Interagency FRCC Guidebook (Hann and others 2004). This layer characterizes the difference between the existing composition of succession classes within a BpS and the reference conditions for that BpS. The following algorithm is used to derive S-Class Percent Difference:

If Current% < Reference% Then
    SClassPctDiff = ((Current% - Reference%) /Reference%) *100
    Else
    SClassPctDiff = ((Current% - Reference%) /Current%) *100

Values range between -100 percent and +100 percent. A positive value indicates that a particular S-Class is overrepresented on the landscape (compared to the reference condition), whereas a negative value signifies that the S-Class is underrepresented. A value of -9999, representing NoData, indicates that the S-Class Percent Difference metric could not be calculated. This occurs when a BpS in the input layer lacks a reference condition (examples of such layers include barren, sparely vegetated, snow/ice, and water) or when an S-Class in the input layer is denoted as something other than A, B, C, D, E, or U (such as agriculture, rock/barren, urban, or water).

The S-Class Percent Difference layer provides the most detailed information on departure because, at the pixel level, every combination of S-Class, BpS, and Landscape layers can have a unique value ranging between -100 and +100 percent. Managers interested in the departure of succession classes could find this layer useful. However, this output layer can be cumbersome to use because there can be several hundreds of values in the Value Attribute Table. For many managers, this layer may provide too much detail to be useful. Note that the S-Class Relative Amount layer (see section 5.1.3 below), derived by classifying the S-Class Percent Difference, may be more useful for those managers that have no need for the amount of detail included in the S-Class Percent Difference layer.

5.1.2 S-Class Departure (SclassDep)

The S-Class Departure layer is derived from the S-Class Percent Difference layer and indicates those succession classes that are excessive relative to reference conditions. The only difference between the two layers is that all negative values of the S-Class Percent Difference layer have been truncated to 0 in the S-Class Departure layer (table 5-2). Thus, the values in the S-Class Departure layer represent a continuous variable with values ranging between 0 percent (no departure or underrepresented) and 100 percent (completely departed). Because we did not want to produce a floating point grid, we simply rounded the calculation of the S-Class Departure to two decimal places and then assigned each unique outcome to a unique value in the ArcGRID layer. (Note: a floating point grid is a layer whose 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.)

Regarding management implications, note that, 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.

5.1.3 S-Class Relative Amount (SClassRelAmt)

This output is analogous to "Veg-fuel Relative Amount" as defined by the Interagency FRCC Guidebook (Hann and others 2004; www.frcc.gov). As mentioned above, the S-Class Relative Amount layer is derived by grouping the S-Class Percent Difference layer into six classes (trace, underrepresented, similar, overrepresented, abundant and unclassified; table 5-2). Consequently, this layer also characterizes the relative departure of succession classes. It is easier to use than the S-Class Percent Difference layer because it has only six classes instead of the hundreds of potential values that could exist in the S-Class Percent Difference layer.

The S-Class Relative Amount layer can provide 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. 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 in land area.

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

5.1.4. Stand FRCC (StandFRCC)

The Stand FRCC layer is the final classification for the S-Class (stand) level of analysis. As used here, the term "stand" refers to all pixels having the same successional state within a given BpS. The Stand FRCC layer is derived by grouping the S-Class Relative Amount into four fire regime condition classes (table 5-2). 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 (in other words, Trace or Underrepresented) or that occurs in approximately the same proportion as the reference conditions (in other words, Similar).

The Stand FRCC layer can be used for various management purposes (table 5-2). For example, if emulating reference conditions is the management goal, then Stand FRCC 1 would suggest a maintenance or recruitment scenario, whereas Stand FRCC 2 and 3 would suggest that the areal extent of the S-Class should be reduced. The Stand FRCC layer may be useful in reporting systems that identify stand-level accomplishments (such as the National Fire Plan Operations and Reporting System or NFPORS).

Table 5-2. Relationship between S-Class Percent Difference, S-Class Departure, S-Class Relative Amount, and Stand FRCC.

S-Class Percent Difference	S-Class Departure	S-Class Relative Amount	Stand FRCC	Suggested Management Scenario[1]
(Value)	(Value)	(Class)	(Class)	
-9999 (Undetermined)	-9999 (Undetermined)	-99 (Unclassified)	-99 (Unclassified)	None
-100 to -66%	0	Trace	1	Maintain/Recruit
-66 to -33%	0	Underrepresented	1	Maintain/Recruit
-33 to 0%	0	Similar	1	Maintain/Recruit
0 to 33%	Same as	Similar	1	Maintain/Reduce

	Percent Difference			
33 to 66%	Same as Percent Difference	Overrepresented	2	Reduce
66 to 100%	Same as Percent Difference	Abundant	3	Reduce

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

5.2 Strata (BpS) outputs

5.2.1 Strata Departure (StrataDep)

Strata departure, defined by the Interagency FRCC Guidebook (Hann and others 2004) as "Veg-fuel Class 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 (Hann and others 2004). 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 Strata Departure value to two decimal places and then assigned each unique outcome to a unique value in the ArcGRID.

Managers can use the Strata Departure layer to identify those biophysical settings within given landscapes that exhibit the highest degree of departure. It is therefore useful for prioritizing biophysical settings for restoration. Although the Value Attribute Table could have hundreds of potential values, the default symbology uses a color ramp ranging from blue (low departure) to red (high departure) to facilitate interpretation. Users can further simplify the layer by changing the symbology and classifying values into user-defined categories designed to visually rank the biophysical settings by their level of departure.

5.2.2 Strata FRCC (StrataFRCC)

The Strata FRCC layer depicts biophysical settings that have a low, moderate, or high departure. It is derived by classifying the Strata Departure layer into three condition classes plus an unclassified category (table 5-3). Consequently, the Strata FRCC layer is not as informative as the Strata Departure layer, which may contain hundreds of values. On the other hand, it is much easier to interpret the Strata FRCC layer since it has only four values.

The Strata FRCC layer is analogous to "Vegetation Departure" as defined by the Interagency FRCC Guidebook (Hann and others 2004). At this time, the FRCC Mapping Tool does not derive a metric corresponding to departure of fire frequency and severity. Consequently, the Strata FRCC metric represents only the vegetation component of FRCC.

Because the Strata FRCC layer depicts biophysical settings that have been classified into low, moderate, or high degrees of departure, it is commonly used by managers to help identify areas that may have opportunities for restoration (such as those that fall into classes 2 and 3) or maintenance (class 1). However, the utility of the Strata FRCC layer is limited because it provides little insight on actual treatment objectives or management prescriptions. For example, although the Strata FRCC layer indicates relative departure, it does not indicate whether a landscape has too much or too little of a particular S-Class. Only the succession class outputs (detailed in section 5.1 above) provide enough information for managers to determine whether they should try to maintain, reduce, or recruit an S-Class in a particular landscape, provided the management goal is to mimic reference conditions.

Table 5-3. Derivation of the Strata FRCC layer.

Strata departure	Strata FRCC	Description
-9999 (not calculated)	-99 (not calculated	Unclassified
<34%	1	Low departure
34-66%	2	Moderate departure
>66%	3	High departure

5.3 Landscape outputs

5.3.1 Landscape Departure (LandFRCCDep)

The Landscape Departure layer is the coarsest characterization of departure produced by the FRCC Mapping Tool. It is derived by computing an area-weighted average of the Strata Departure values within the Level 1 Landscapes. 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 represents a watershed hierarchy comprised 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 have values ranging between 0 and 100 percent. Departure values are rounded to two decimal places and then assigned to a unique value in the Value Attribute Table of the ArcGRID. Consequently, the Landscape Departure layer could potentially contain hundreds of values.

Managers can use the Landscape Departure layer to prioritize entire landscapes based on their need for restoration. Although useful for broad-level decisions made at a landscape level, the Landscape Departure layer does not provide information regarding what is "wrong" with a particular landscape in terms of the composition of succession classes. Consequently, the FRCC Mapping Tool outputs at the succession class and strata (BpS) levels (sections 5.1 and 5.2 above) are more helpful for formulating restoration strategies.

5.3.2 Landscape FRCC (LandFRCC)

The Landscape FRCC layer is derived by classifying the Landscape Departure layer into three categories denoting low, moderate, and high departure (table 5-4). The class thresholds are the same as those used to classify Strata Departure for deriving the Strata FRCC layer.

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

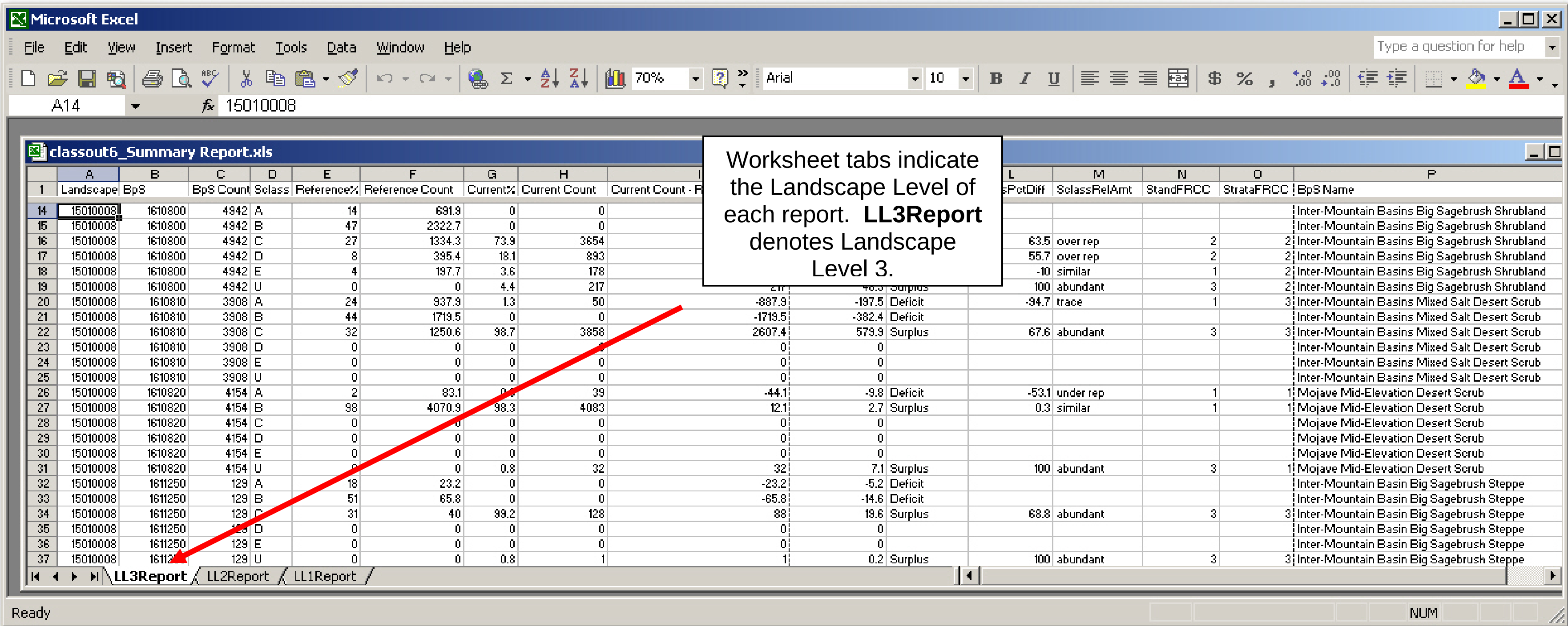
Landscape departure	Landscape FRCC	Description
-9999 (not calculated)	-99 (not calculated	Unclassified
<34%	1	Low departure
34-66%	2	Moderate departure
>66%	3	High departure

The Landscape FRCC layer has the least thematic detail and spatial resolution of the FRCC Mapping Tool metrics because data are summarized into four classes at the landscape level. The layer has the same limitations of the Landscape Departure layer in that it cannot be used to directly address issues pertaining to the BpS or S-Class. However, it can be useful for those wanting a very simple map with departure summarized at a landscape level.

5.4 Summary Report

Because the multiple output layers produced by the FRCC Mapping Tool do not provide information in a format that can be readily used to interpret the data and develop treatment strategies, the Summary Report was developed to facilitate the design of treatment prescriptions based on an ultimate objective of managing landscapes towards reference conditions. In essence, the Summary Report can be used as a diagnostic tool to identify what restorative actions are needed and where they need to occur across an assessment area.

The Summary Report is a Microsoft Excel file that contains an individual worksheet corresponding to each landscape level that was used to derive the departure layers (fig. 5-1). For example, three worksheets would be included automatically within the Excel file if three landscape levels were used in the analysis. The software will name these worksheets **LL1Report**, **LL2 Report**, and **LL3Report** corresponding to landscape levels 1, 2, and 3, respectively.



	Landscape	BpS	BpS Count	Sclass	Reference%	Reference Count	Current%	Current Count	Current Count - R...			...sPctDiff	SclassRelAmt	StandFRCC	StrataFRCC	BpS Name
14	15010008	1610800	4942	A	14	691.9	0	0	[illegible]	[illegible]	[illegible]					Inter-Mountain Basins Big Sagebrush Shrubland
15	15010008	1610800	4942	B	47	2322.7	0	0	[illegible]	[illegible]	[illegible]					Inter-Mountain Basins Big Sagebrush Shrubland
16	15010008	1610800	4942	C	27	1334.3	73.9	3654	[illegible]	[illegible]	[illegible]	63.5	over rep	2	2	Inter-Mountain Basins Big Sagebrush Shrubland
17	15010008	1610800	4942	D	8	395.4	18.1	893	[illegible]	[illegible]	[illegible]	55.7	over rep	2	2	Inter-Mountain Basins Big Sagebrush Shrubland
18	15010008	1610800	4942	E	4	197.7	3.6	178	[illegible]	[illegible]	[illegible]	-10	similar	1	2	Inter-Mountain Basins Big Sagebrush Shrubland
19	15010008	1610800	4942	U	0	0	4.4	217	217	[illegible]	Surplus	100	abundant	3	2	Inter-Mountain Basins Big Sagebrush Shrubland
20	15010008	1610810	3908	A	24	937.9	1.3	50	-887.9	-197.5	Deficit	-94.7	trace	1	3	Inter-Mountain Basins Mixed Salt Desert Scrub
21	15010008	1610810	3908	B	44	1719.5	0	0	-1719.5	-382.4	Deficit					Inter-Mountain Basins Mixed Salt Desert Scrub
22	15010008	1610810	3908	C	32	1250.6	98.7	3858	2607.4	579.9	Surplus	67.6	abundant	3	3	Inter-Mountain Basins Mixed Salt Desert Scrub
23	15010008	1610810	3908	D	0	0	0	0	0	0						Inter-Mountain Basins Mixed Salt Desert Scrub
24	15010008	1610810	3908	E	0	0	0	0	0	0						Inter-Mountain Basins Mixed Salt Desert Scrub
25	15010008	1610810	3908	U	0	0	0	0	0	0						Inter-Mountain Basins Mixed Salt Desert Scrub
26	15010008	1610820	4154	A	2	83.1	[illegible]	39	-44.1	-9.8	Deficit	-53.1	under rep	1	1	Mojave Mid-Elevation Desert Scrub
27	15010008	1610820	4154	B	98	4070.9	98.3	4083	12.1	2.7	Surplus	0.3	similar	1	1	Mojave Mid-Elevation Desert Scrub
28	15010008	1610820	4154	C	0	0	0	0	0	0						Mojave Mid-Elevation Desert Scrub
29	15010008	1610820	4154	D	0	0	0	0	0	0						Mojave Mid-Elevation Desert Scrub
30	15010008	1610820	4154	E	0	0	0	0	0	0						Mojave Mid-Elevation Desert Scrub
31	15010008	1610820	4154	U	0	0	0.8	32	32	7.1	Surplus	100	abundant	3	1	Mojave Mid-Elevation Desert Scrub
32	15010008	1611250	129	A	18	23.2	0	0	-23.2	-5.2	Deficit					Inter-Mountain Basin Big Sagebrush Steppe
33	15010008	1611250	129	B	51	65.8	0	0	-65.8	-14.6	Deficit					Inter-Mountain Basin Big Sagebrush Steppe
34	15010008	1611250	129	C	31	40	99.2	128	88	19.6	Surplus	68.8	abundant	3	3	Inter-Mountain Basin Big Sagebrush Steppe
35	15010008	1611250	[illegible]	D	0	0	0	0	0	0						Inter-Mountain Basin Big Sagebrush Steppe
36	15010008	1611250	129	E	0	0	0	0	0	0						Inter-Mountain Basin Big Sagebrush Steppe
37	15010008	[illegible]	129	U	0	0	0.8	1	1	0.2	Surplus	100	abundant	3	3	Inter-Mountain Basin Big Sagebrush Steppe

Figure 5-1. Example of a **Landscape Level 3** Summary Report (**LL3Report** tab). 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, Inter-Mountain Basins Mixed Salt Desert Scrub, Mojave Mid-Elevation Scrub, and Inter-Mountain Basin Big Sagebrush Steppe) occurring within a single landscape unit (Subbasin 1501008). (See table 5-5 for field descriptions).

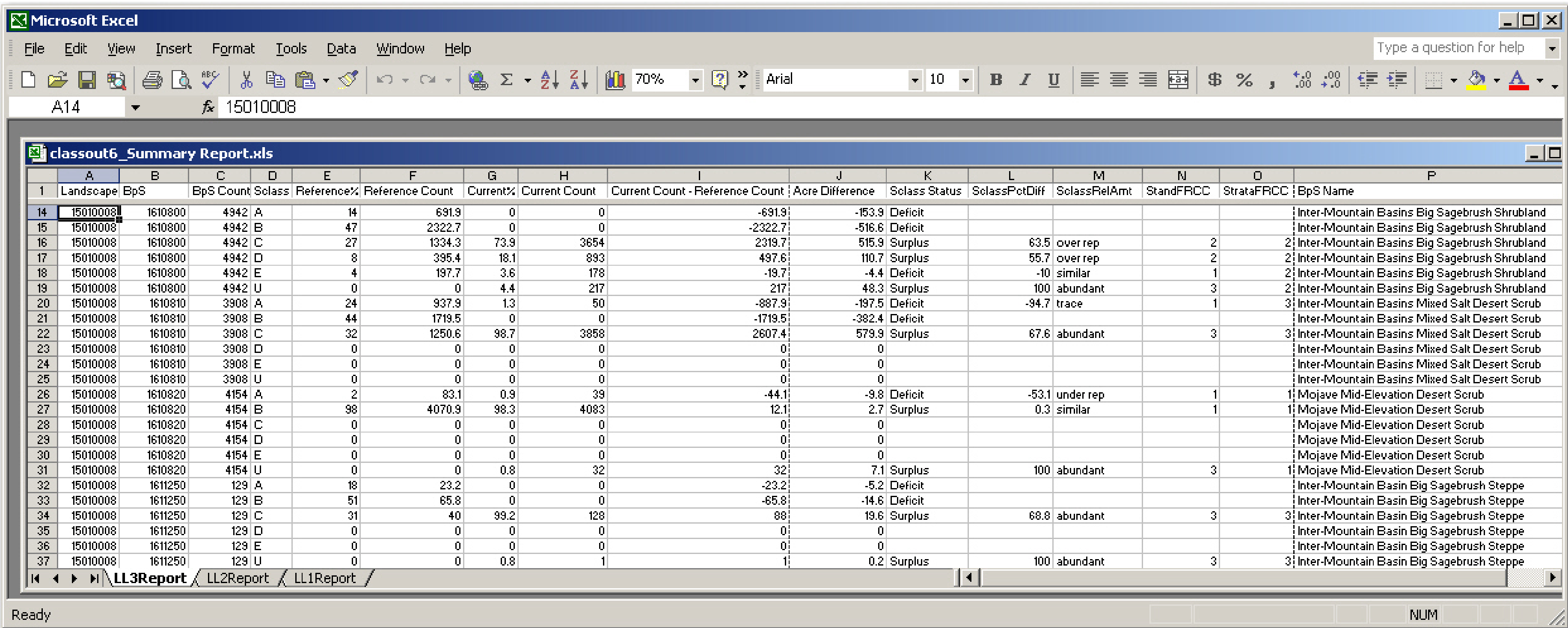
Table 5-5. Description of fields contained within the Summary Report.

Field	Description
Landscape	The landscape identifier contained in the landscape layer.
BpS	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 condition 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 condition 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 composition percentage is less than the reference composition percentage. Surplus denotes that the composition percentage exceeds the reference composition percentage.
SclassPctDiff	Characterizes the difference between the existing composition of succession classes within a BpS and the reference conditions for that BpS.
SclassRelAmt	Derived by grouping the S-Class Percent Difference layer into six classes (trace, underrepresented, similar, overrepresented, abundant, and unclassified).
StandFRCC	Final classification for the S-Class (stand) level of analysis; derived by grouping the S-Class Relative Amount into four fire regime condition classes.
StrataFRCC	Depicts biophysical settings that have a low, moderate, or high departure; derived by classifying the Strata 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 reports, which are sorted by landscape, BpS, and S-Class (table 5-5 above), 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 the current pixel count in each S-Class to the pixel count of reference conditions to derive the number of acres of a particular S-Class that needs to be maintained or converted to some other S-Class. Information pertaining to the S-Class Percent Difference, S-Class Relative Amount, Stand FRCC, and Strata FRCC are also included within the Summary Report.

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

The Summary Report can be useful in answering the following questions: *How much change is necessary to mimic the reference condition?* and *Which succession classes need to be treated?* The report identifies succession classes as being surplus or deficient, allowing managers to easily identify the status of succession classes within specific landscapes and biophysical settings. The Summary Report can therefore be used to identify the succession classes that need to be recruited by adding additional acres versus those that need to be reduced by decreasing their acreage, allowing for the development of a prescription. For example, if we focus on a single BpS and a single landscape as shown in figure 5-2, it appears that there are excess acres of the late-seral closed class (E), and deficient acreage in the mid-seral classes (B and C) and the late-seral open class (D).



	Landscape	BpS	BpS Count	Sclass	Reference%	Reference Count	Current%	Current Count	Current Count - Reference Count	Acre Difference	Sclass Status	SclassPctDiff	SclassRelAmt	StandFRCC	StrataFRCC	BpS Name
14	15010008	1610800	4942	A	14	691.9	0	0	-691.9	-153.9	Deficit					Inter-Mountain Basins Big Sagebrush Shrubland
15	15010008	1610800	4942	B	47	2322.7	0	0	-2322.7	-516.6	Deficit					Inter-Mountain Basins Big Sagebrush Shrubland
16	15010008	1610800	4942	C	27	1334.3	73.9	3654	2319.7	515.9	Surplus	63.5	over rep	2	2	Inter-Mountain Basins Big Sagebrush Shrubland
17	15010008	1610800	4942	D	8	395.4	18.1	893	497.6	110.7	Surplus	55.7	over rep	2	2	Inter-Mountain Basins Big Sagebrush Shrubland
18	15010008	1610800	4942	E	4	197.7	3.6	178	-19.7	-4.4	Deficit	-10	similar	1	2	Inter-Mountain Basins Big Sagebrush Shrubland
19	15010008	1610800	4942	U	0	0	4.4	217	217	48.3	Surplus	100	abundant	3	2	Inter-Mountain Basins Big Sagebrush Shrubland
20	15010008	1610810	3908	A	24	937.9	1.3	50	-887.9	-197.5	Deficit	-94.7	trace	1	3	Inter-Mountain Basins Mixed Salt Desert Scrub
21	15010008	1610810	3908	B	44	1719.5	0	0	-1719.5	-382.4	Deficit					Inter-Mountain Basins Mixed Salt Desert Scrub
22	15010008	1610810	3908	C	32	1250.6	98.7	3858	2607.4	579.9	Surplus	67.6	abundant	3	3	Inter-Mountain Basins Mixed Salt Desert Scrub
23	15010008	1610810	3908	D	0	0	0	0	0	0						Inter-Mountain Basins Mixed Salt Desert Scrub
24	15010008	1610810	3908	E	0	0	0	0	0	0						Inter-Mountain Basins Mixed Salt Desert Scrub
25	15010008	1610810	3908	U	0	0	0	0	0	0						Inter-Mountain Basins Mixed Salt Desert Scrub
26	15010008	1610820	4154	A	2	83.1	0.9	39	-44.1	-9.8	Deficit	-53.1	under rep	1	1	Mojave Mid-Elevation Desert Scrub
27	15010008	1610820	4154	B	98	4070.9	98.3	4083	12.1	2.7	Surplus	0.3	similar	1	1	Mojave Mid-Elevation Desert Scrub
28	15010008	1610820	4154	C	0	0	0	0	0	0						Mojave Mid-Elevation Desert Scrub
29	15010008	1610820	4154	D	0	0	0	0	0	0						Mojave Mid-Elevation Desert Scrub
30	15010008	1610820	4154	E	0	0	0	0	0	0						Mojave Mid-Elevation Desert Scrub
31	15010008	1610820	4154	U	0	0	0.8	32	32	7.1	Surplus	100	abundant	3	1	Mojave Mid-Elevation Desert Scrub
32	15010008	1611250	129	A	18	23.2	0	0	-23.2	-5.2	Deficit					Inter-Mountain Basin Big Sagebrush Steppe
33	15010008	1611250	129	B	51	65.8	0	0	-65.8	-14.6	Deficit					Inter-Mountain Basin Big Sagebrush Steppe
34	15010008	1611250	129	C	31	40	99.2	128	88	19.6	Surplus	68.8	abundant	3	3	Inter-Mountain Basin Big Sagebrush Steppe
35	15010008	1611250	129	D	0	0	0	0	0	0						Inter-Mountain Basin Big Sagebrush Steppe
36	15010008	1611250	129	E	0	0	0	0	0	0						Inter-Mountain Basin Big Sagebrush Steppe
37	15010008	1611250	129	U	0	0	0.8	1	1	0.2	Surplus	100	abundant	3	3	Inter-Mountain Basin Big Sagebrush Steppe

Figure 5-2. Example 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 Ponderosa Pine Savanna BpS appears to have an overabundance of the late-seral closed successional state (class E) and a lack of mid-seral and late-seral open successional states (classes B, C, and D). (See table 5-5 for descriptions of fields within the Summary Report).

The Summary Report can also be used to monitor the effectiveness of proposed treatments in reducing vegetation departure if the overall objective is to manage for reference conditions. A manager could compare the Summary Reports representing pre-treatment and post-treatment conditions. The Summary Report could also be used to calculate the total acres that would have to be treated within an analysis area to mimic reference conditions. To determine the total acreage to be treated, a user must first total the acres (either positive or negative numbers – not both) in each landscape-level worksheet and then add those totals together to calculate an overall sum.

The user should note that larger analysis areas generate larger summary reports, which have a greater number of records and can be therefore unwieldy to work with in an Excel spreadsheet. For example, few managers would want to use a spreadsheet to process thousands of records in order to glean information that could be useful in formulating treatment prescriptions. For large assessment areas (in other words, those exceeding one million acres), users may find that the Summary Report is more useful if they import the worksheet(s) into an Access database, which is better equipped for summarizing large data sets. Moreover, Microsoft Excel has a limit of 65,536 records. If you find that the Summary Report worksheet has been truncated to 65,536 records, it suggests that some data have been lost and that your analysis area has too many landscapes and/or biophysical settings to export the entire report to Excel.

5.5 Access database

Most users of the FRCC Mapping Tool will not need to use this database because it's simply used to calculate departure metrics that are then used to create the output layers in ArcMap (as mentioned in Chapter 2). However, advanced users may find it useful for diagnosing data problems or for conducting some additional types of data summaries. There are 74 tables contained within this database. Many tables are empty and are created for a geodatabase (those containing a GDB prefix). Although there are other query-derived tables in the database for determining composition and departure metrics, they have little or no actual utility for most managers. The more useful tables are described in table 5-6.

The Access database is created within a user-specified folder for storing all of the outputs. The Access database will have the same name as the output folder (although the database will have an .mdb extension). Users wanting more detailed information about the Access database created by the FRCC Mapping Tool should contact helpdesk@landfire.gov.

Table 5-6. Primary tables of interest contained within the Access database created by the FRCC Mapping Tool.

Table name	Description
frcc_sclass_percent_difference	Identifies landscape, BpS, S-Class, and S-Class Percent Difference
frcc_sclass_relative_amount	Identifies landscape, BpS, S-Class, and S-Class Relative Amount
frcc_strata_departure	Identifies landscape, BpS, and Strata Departure
frcc_strata_frcc	Identifies landscape, BpS, and Strata FRCC
frcc_landscape_departure	Identifies the landscape and the Landscape Departure (area-weighted average of the Strata Departure)
frcc_join	Identifies landscape, BpS, S-Class, and all of the departure metrics

Chapter 6: Installing FRCC MT

6.1 Installation instructions

Currently, all NIFTT tools can be installed at once as a package. For most NIFTT tool users, the complete or package installation is most convenient.

> ***Note**: The following instructions apply to installation of the entire NIFTT package. Single tool installation will be addressed later in this chapter.*

Before you begin installation, it is important to note that both Microsoft .Net Framework 1.1 with Service Pack 1 are required for all of the NIFTT tools. If you have only Microsoft .Net Framework 1.1, you need to upgrade to Service Pack 1.

You can obtain Microsoft .Net Framework 1.1 from ftp://fire.org/dotnetfxsp1 or by searching at http://www.microsoft.com.

The folder **dotnetfxsp1** contains three required files, and they must be installed in the following order (the install programs provide help in the form of warnings):

1. **dotnetfx.exe** (Microsoft .Net Framework 1.1).
2. **NDP1.1sp1-KB867460-X86.exe** – (Microsoft .Net Framework 1.1 Service Pack 1).
3. **NDP1.1sp1-KB886903-X86.exe** - (Microsoft .Net Framework 1.1 Hotfix).

You will need to reboot after installation. However, only one reboot is necessary.

> ***Note**: To confirm that these programs are installed on your computer, check Add/Remove Programs. You should see the following if the necessary programs are present:*
>
> - Microsoft .Net Framework 1.1
> - Microsoft .Net Framework 1.1 Hotfix (886903)

6.1.1 Installing the complete NIFTT tool package

If you have earlier versions of any of the NIFTT tools (Area Change Tool [ACT], FRCC Mapping Tool [FRCC MT], Multi-scale Resource Integration Tool [MRIT], or Fire Behavior Assessment Tool [FBAT]) installed on your computer, you will first need to un-install these tools before proceeding with installation of the current versions.

To determine which version is currently installed on your computer, go to **Start > Control Panel > Add or Remove Programs**. View the version of the NIFTT tool you are interested in (fig. 6-1).

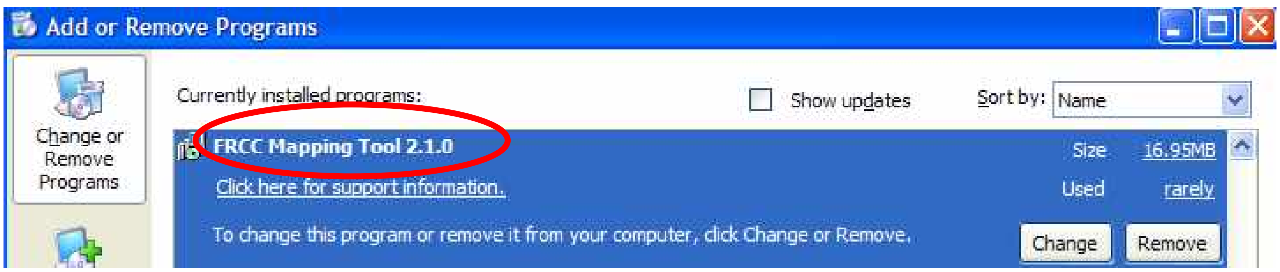


Figure 6-1. Version 2.1.0 of the FRCC Mapping Tool.

> ***Note**: NIFTT naming conventions are as follows: **FRCC_MT_ 210_061211** indicates that this "install" version 2.1.0 was completed on 12/11/2006.*

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

Follow these steps to install the complete NIFTT tool package:

1. From www.niftt.gov, click on **NIFTT Tools & User Documents** and then on **NIFTT Tools**. You will be routed to www.fire.org where the NIFTT tools are housed.
2. To download the self-extracting WinZip file, **NIFTT_Install_(date).exe**, select **NIFTT > Downloads** from the menu.
3. Click on the NIFTT Install Executable file as shown in figure 6-2:
   NIFTT Install Executable (FBAT, FRCC, MRIT and ACT)

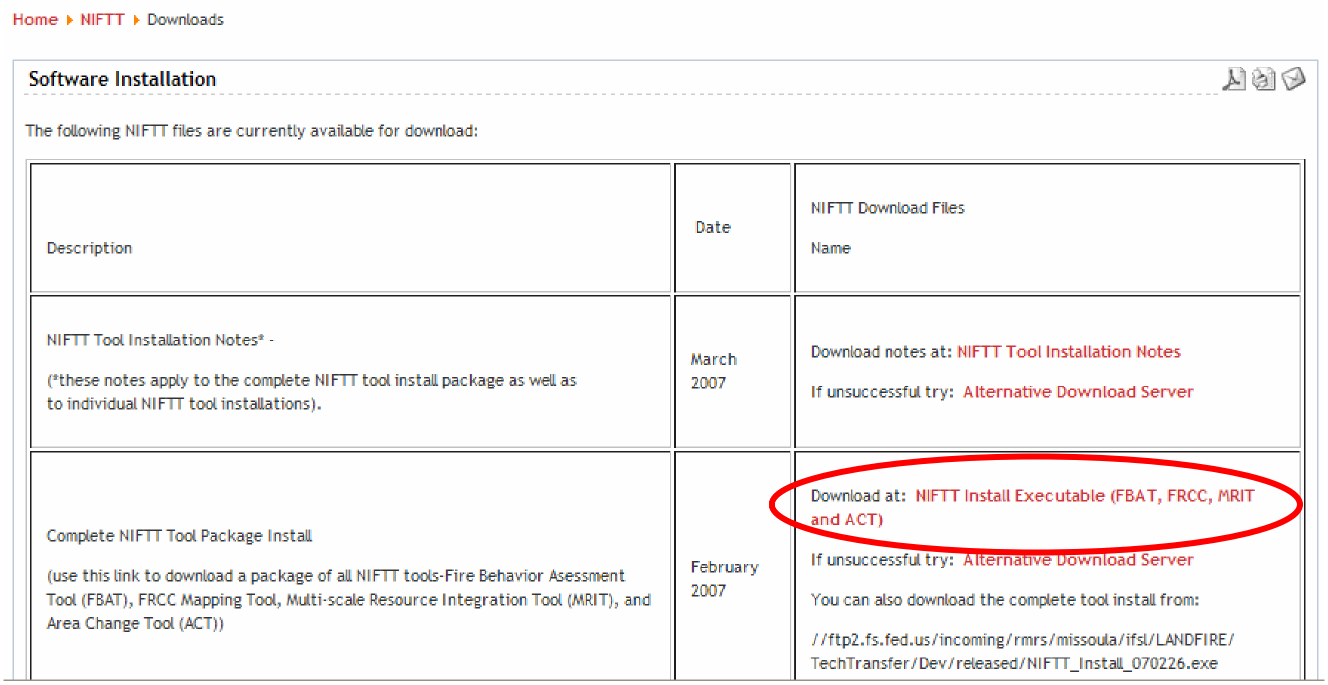


Figure 6-2. Downloading the complete NIFTT tool package.

4. Next, double-click on **NIFTT_Install_070226.exe** to begin downloading the most recent tool installation package (note that the date in the file name may have changed). You will see the dialog box shown in figure 6-3:

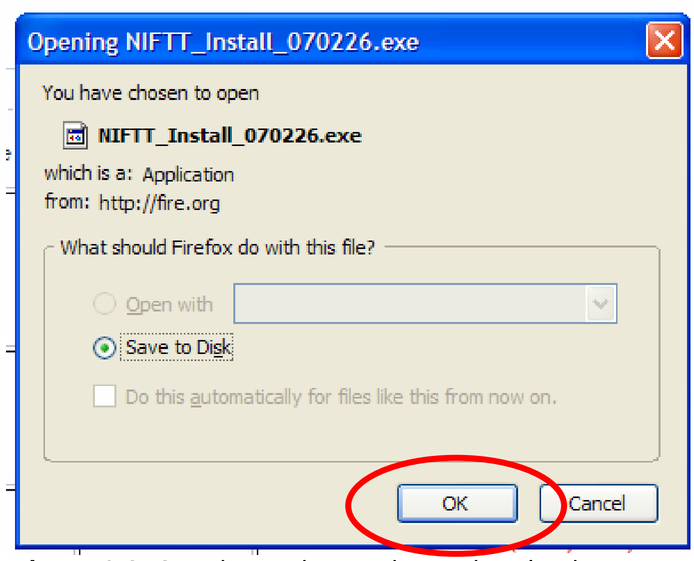


Figure 6-3. Opening and preparing to download package installation file.

5. Click **OK** to download the installation file and then save it to a convenient location on your computer.

   The following box will open as soon as the download is complete.

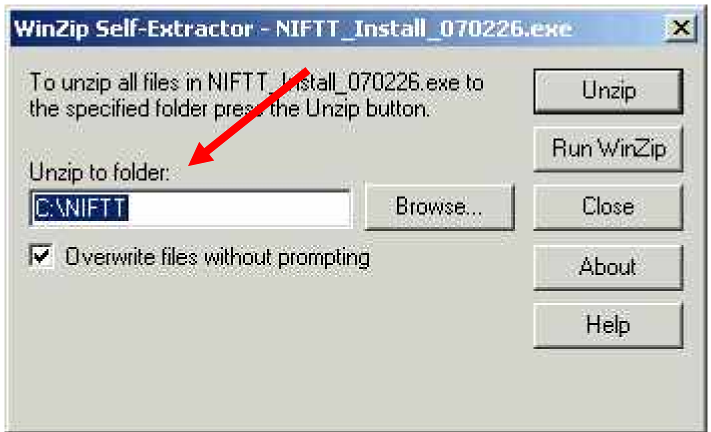


Figure 6-4. WinZip Self-Extractor NIFTT install dialog box.

6. Unzip the file to either the default location (**C:\NIFTT** as shown above in figure 6-4) or the location of your choice by selecting the **Browse** button.

   Note: *do not install the tools to any pathways that may contain a space in the folder name such as* ***My Documents*** *or* ***Program Files****.*

7. A folder labeled **NIFTT_Install_070226** will be created within the **NIFTT** (default) folder. Locate and then double click on the folder labeled **NIFTT_Install_070226** as shown in figure 6-5 to begin the installation process. (Again, dates in folder names may have changed.)

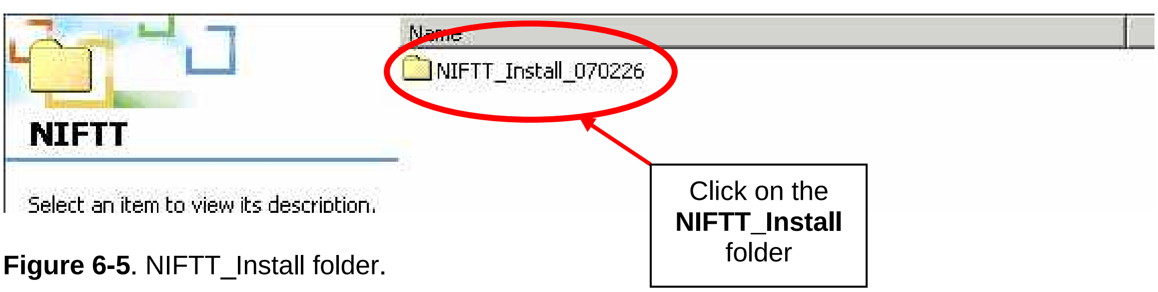


Figure 6-5. NIFTT_Install folder.

8. When the NIFTT_Install folder opens, you will see the following files. Next, double-click on the installation batch file **NIFTT_setup.bat**.

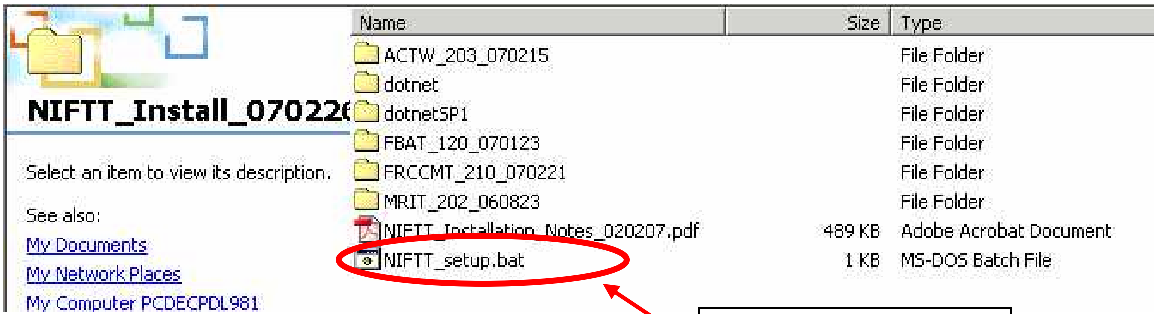


Figure 6-6. NIFTT Install folder contents.

9. You'll see a number of dialog boxes such as the one in figure 6-7. Click **Yes** to install the Microsoft.NET Framework package.

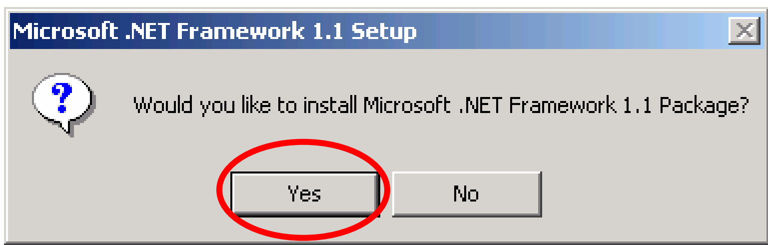


Figure 6-7. Microsoft Framework Setup dialog box.

Follow instructions as directed in a series of tool installation screens. Finally, you'll see the following dialog box:

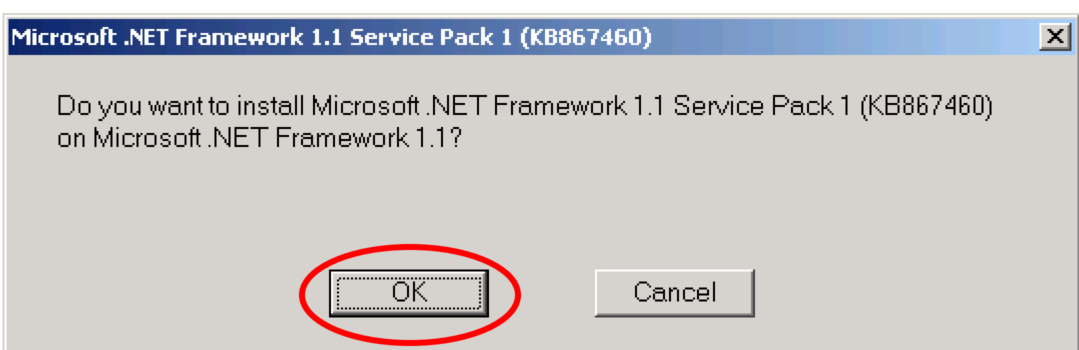


Figure 6-8. Microsoft Service Pack dialog box.

10. Click **OK** to install the **Microsoft.NET Framework Service Pack 1**, which is necessary for proper operation of the NIFTT tools.

11. You will be directed to reboot your computer after installation of each service pack. However, do not reboot the first time you see the following message box:

Figure 6-9. Microsoft .NET Framework dialog box.

When prompted a second time, click **Yes** to reboot.

> ***Note****: If for some reason you do not see a second message box asking if you want to reboot your computer, reboot your computer after the installation is complete.*
>
> *In addition, during installation of the MRIT tool, you may be asked to specify whether the tool is to be installed for* ***Everyone*** *or* ***Just Me****. Select the radio button next to the* ***Just Me*** *option.*

Installation of the NIFTT tool package should now be complete. The following NIFTT tools should now be installed on your computer:

- Area Change Tool (ACT)
- Fire Behavior Assessment Tool (FBAT)
- FRCC Mapping Tool (FRCC MT)
- Multi-scale Resource Integration Tool (MRIT)

Two other applications, Microsoft.NET Framework and the Microsoft.NET Framework1.1Service Pack 1, should now also be installed.

> ***Note****: For NIFTT tools to function properly, ensure the following:*
>
> - The Spatial Analyst Extension must be installed and activated
> - The Ethernet cable must be unplugged from your computer
> - The wireless network card (if you have one) must be turned off.

Now, open ArcMap and make sure that all of the NIFTT toolbars are visible as shown in figure 6-10:

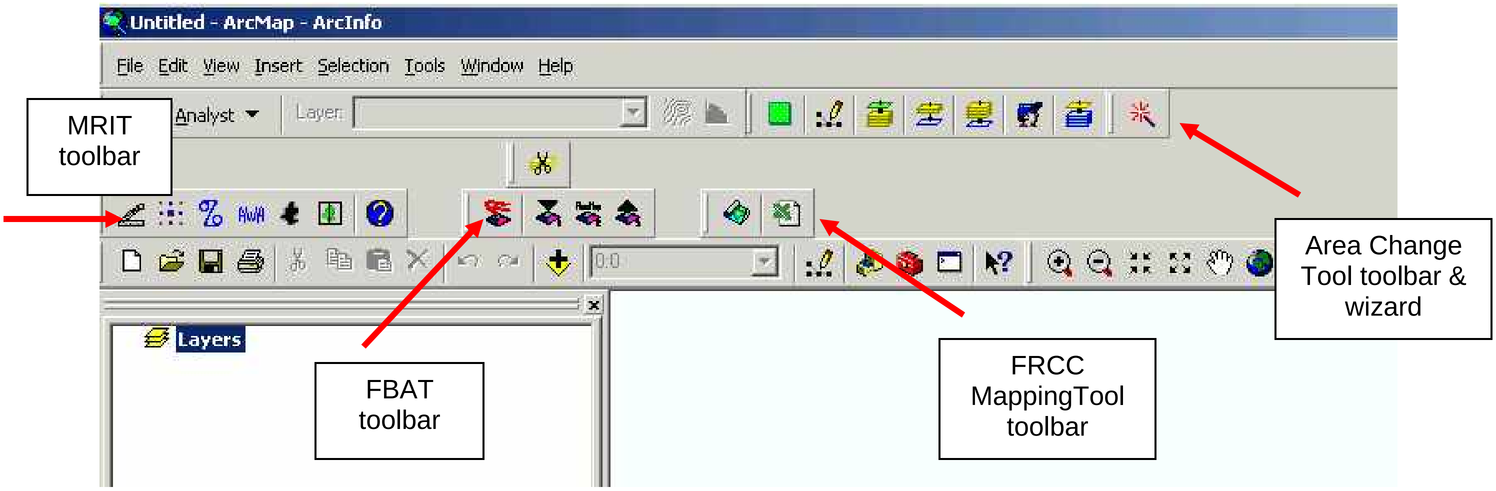


Figure 6-10. Arc Map showing NIFTT toolbars.

> ***Note**: Toolbars may be "floating" and you may need to anchor them in convenient locations by dragging them to toolbars at the top of your screen.*

6.1.2 Single tool (FRCC MT) installation

If you wish to install or reinstall the FRCC Mapping Tool as a single tool without the entire NIFTT package, follow these steps:

1. Download the individual tool (FRCC MT) from the website at www.fire.org. Go to **NIFTT > Downloads** located at the left margin of the screen and select **FRCC Mapping Tool** from the table as shown in figure 6-11:

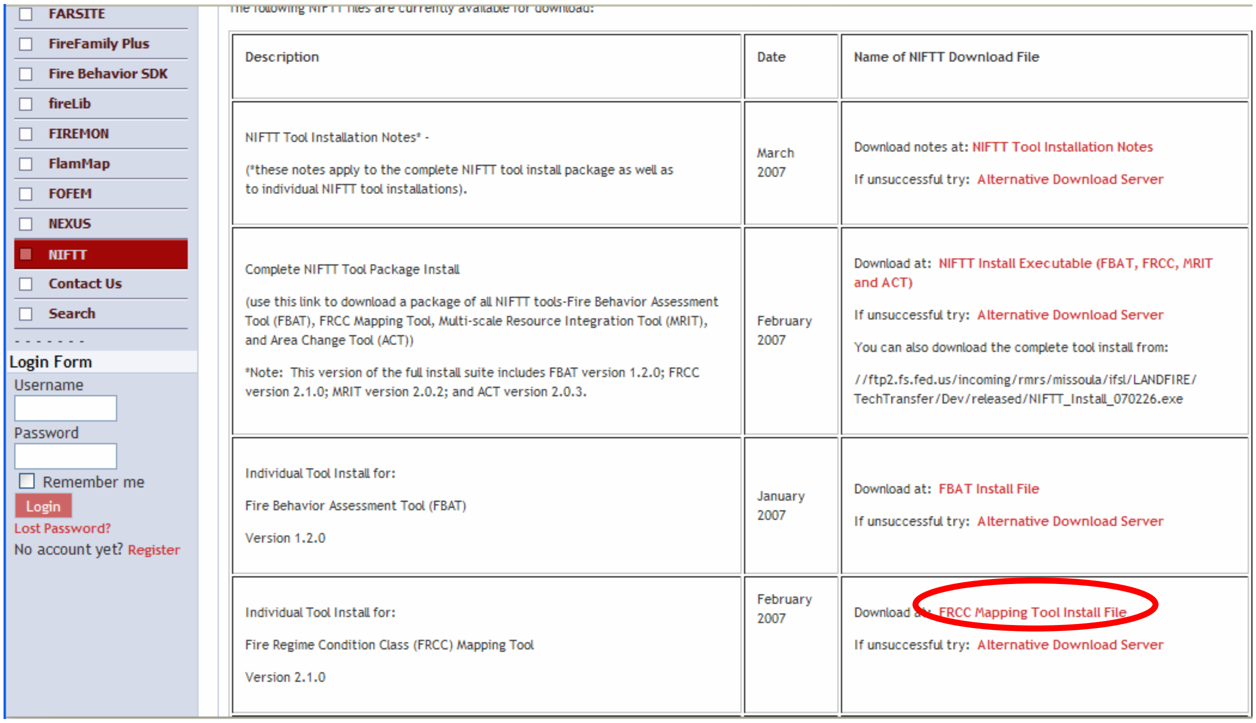


Figure 6-11. Downloading individual FRCC Mapping Tool.

2. Navigate to the directory in which you have copied NIFTT tool files and downloaded FRCC MT (see figs. 6-4 and 6-5).

3. If the installer determines a previous version of FRCC MT is already installed, go to the **Control Panel (Start > Settings > Control Panel)** and select **Add/Remove Programs**. Uninstall the FRCC Mapping Tool and then rerun **Setup.exe**.

4. If the installer determines that Microsoft Data Access Components (MDAC) are not up-to-date, run **mdac_type.exe** from the distribution source and rerun **Setup.exe**.

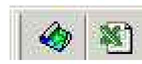
5. If the installer determines the setup needs the **.NET Framework**, double click on the **dotnetfx.exe** file and follow the prompts. When complete, double click **Setup.exe** to continue.

   Tip: *If the* ***dotnetfx.exe*** *file is already present on your computer, the downloaded .zip file will contain everything needed to install FRCC MT on your computer. If it is not already installed, you must download and install* ***dotnetfx.exe***.

6. Once the installation begins, choose to install FRCC MT for a single user (**Just Me**) and then select your install location. Follow the defaults and then select **Close**.

7. Open ArcMap with your desired map document. Go to the **Tools** menu and select **Extensions**. Make sure that the Fire Behavior Assessment Tool **Extension** and **Spatial Analyst** are checked and select **Close**. Next, go to the **View** menu and select **Toolbars**. Make sure that the **FRCC Mapping Tool** toolbar is checked and visible.

6.2 Troubleshooting FRCC MT installation

If the FRCC Mapping Tool toolbar as shown to the right,  does not install automatically, you may need to select Tools > Customize and check the box to the left of **FRCC Mapping Tool 2.1.0** as shown below:

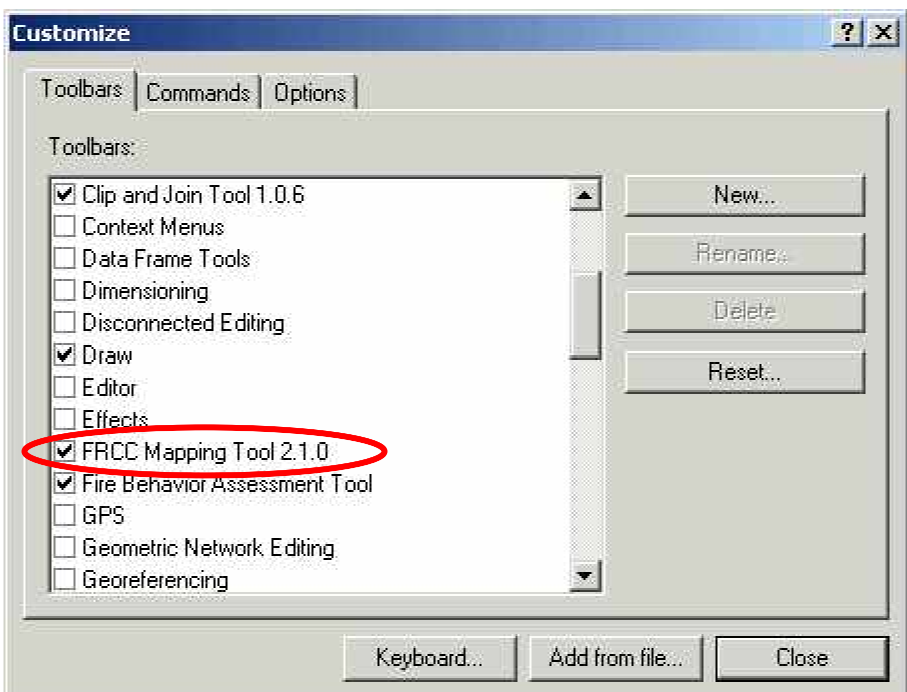


Figure 6-12. Selecting the FRCC MT toolbar.

Chapter 7: Using the FRCC Mapping Tool

7.1 The FRCC MT 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 MT toolbar.

The **FRCC Mapping Tool 2.1.0** icon opens the FRCC Mapping Tool. The command opens a dialog box used to select inputs and outputs.

The **Open Summary Report** icon simply opens the Summary Report, an Excel spreadsheet designed to help summarize and present data obtained from an FRCC Mapping Tool run.

7.2 How to run FRCC MT

7.2.1 Creating a new project

Start ArcMap and create a new project by selecting **A new empty map** as shown below in figure 7-2:

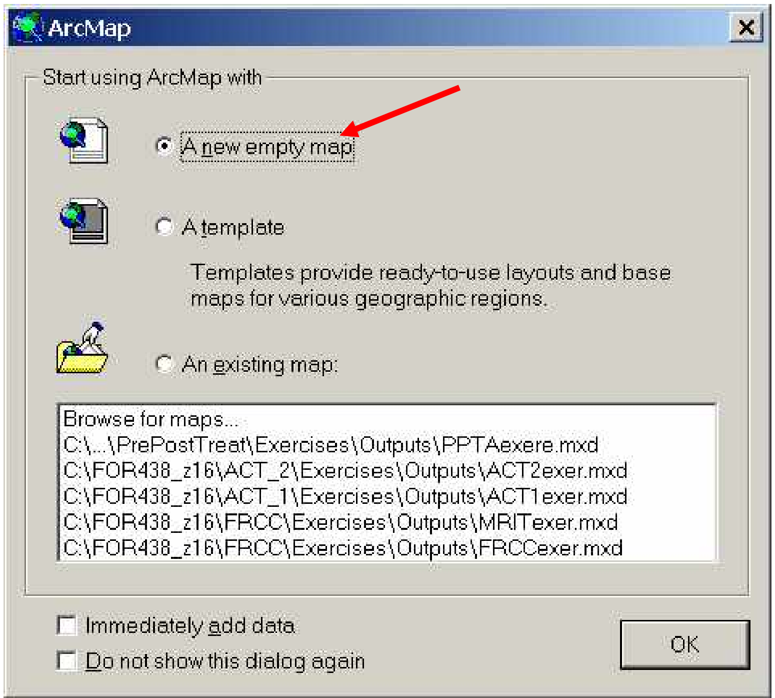


Figure 7-2. Creating a new project.

7.2.2 Loading data

Click on the add data icon to load input layers.

Figure 7-3. Loading data.

Add the three required input layers, BpS, S-Class, and landscape, as shown in figure 7-3. You can also add any desired ancillary layers such as cities, roads, and wildland-urban interface. Navigate to the directory where your data layers are stored and select the appropriate layers to add.

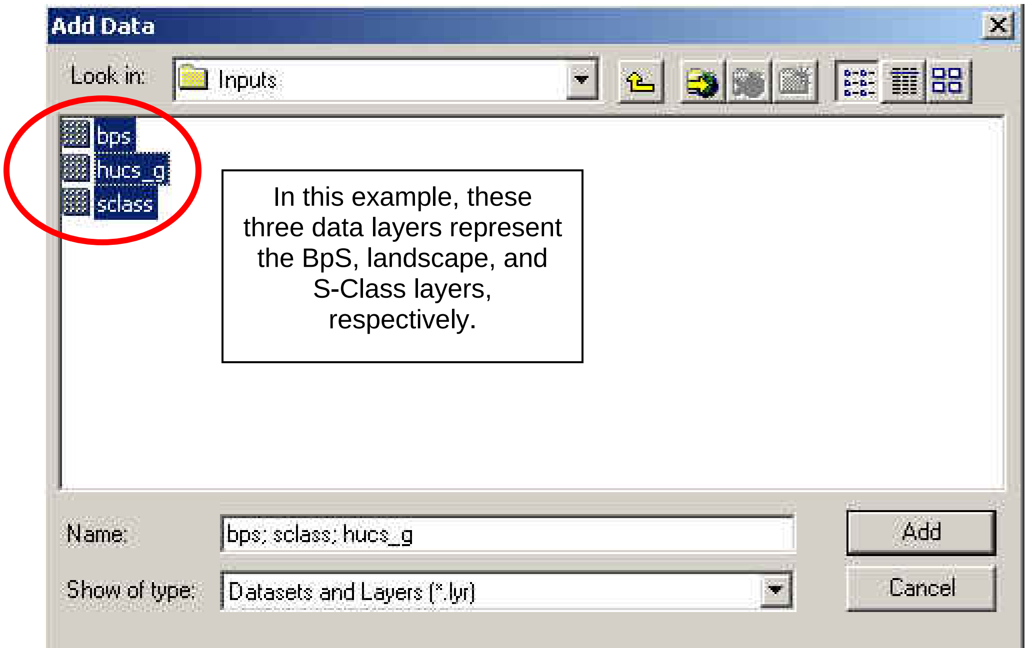


Figure 7-4. Adding required input layers.

Select appropriate input from the **Add Data** dialog box.

> ***Tip**: You may see the following **Create pyramids** box at this point. If you see one or more of these dialog boxes, click **No** to expedite processing.*

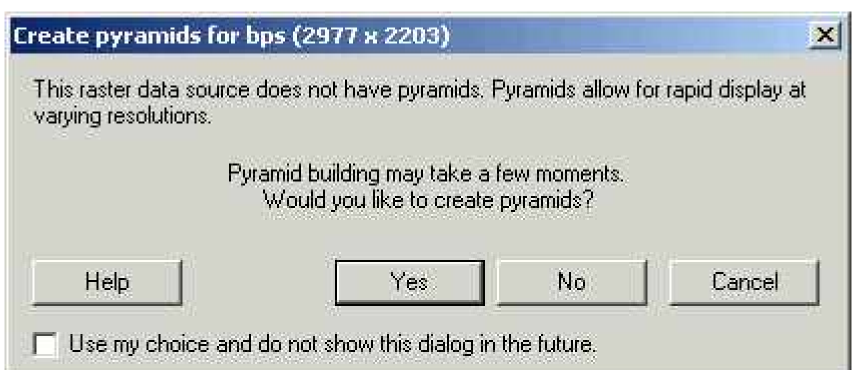


Figure 7-5. Create pyramids dialog box.

> ***Note**: For ArcMap to run, the pathway and folder name containing your input layers should not exceed ten characters in length and should not contain any spaces, leading numbers, or special characters (such as `~! @#$^()-+={ }[ ]|\?/:;'"< >, .)*

Save your project and, if desired, rename the data frame to a more intuitive name for your project by clicking the icon as shown in figure 7-6:

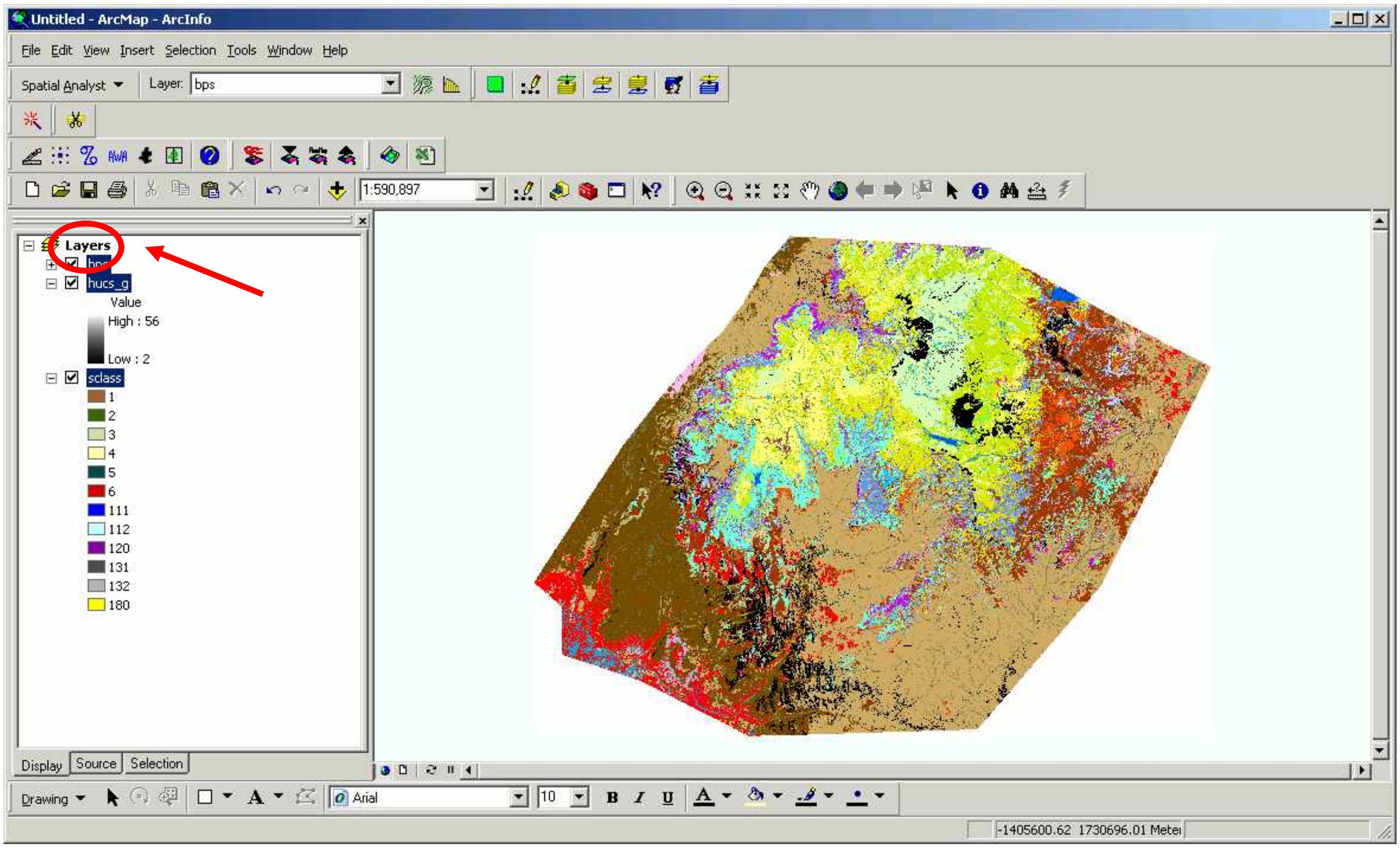


Figure 7-6. Rename project by clicking the Layers icon.

Save your ArcMap project with a file name of your choice.

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

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

Click on the **Open FRCC Mapping Tool 2.1.0** icon from the FRCC Mapping Tool toolbar as shown in figure 7-7:

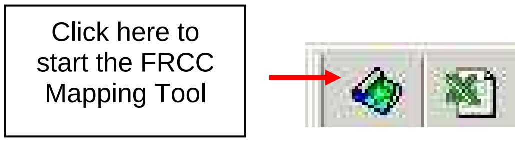


Figure 7-7. Launching the FRCC Mapping Tool.

The following dialog box (showing default selections) will appear after the FRCC Mapping Tool has been launched:

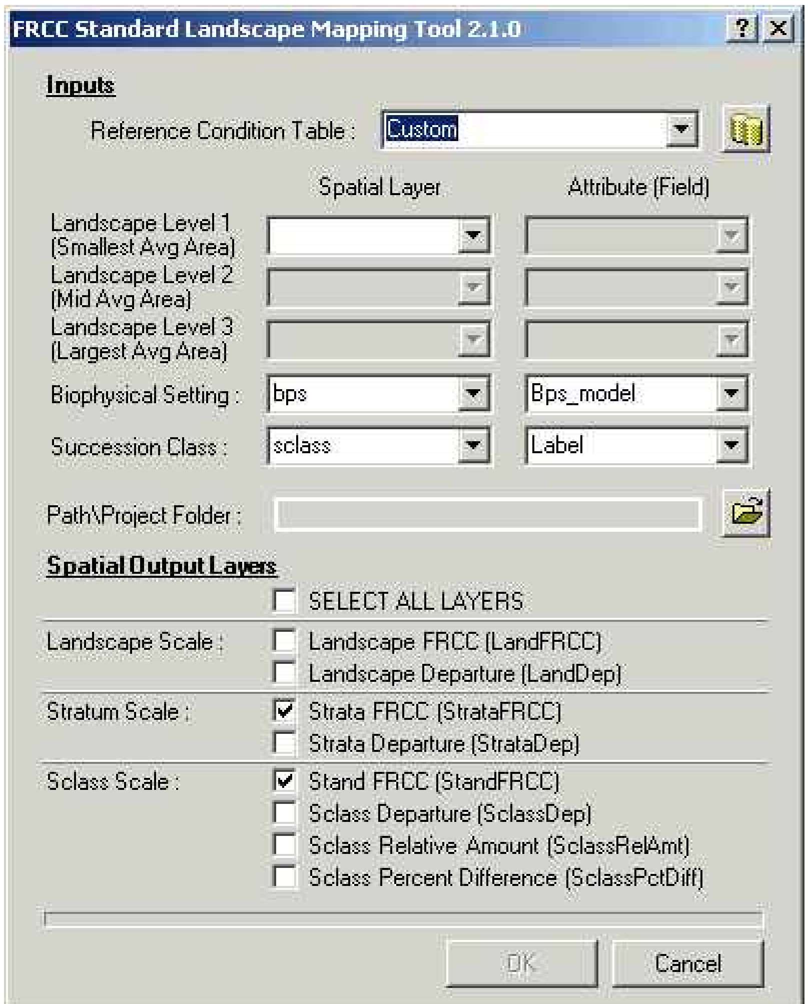


Figure 7-8. FRCC Mapping Tool dialog box showing default selections.

This dialog box contains information necessary for:

- Selecting the appropriate reference condition table

- Selecting the input layers and associated attributes that FRCC MT will use for conducting the analysis
- Identifying the pathway and folder for the outputs of the run
- Selecting the desired output from among eight available output layers in the **Spatial Output Layers** menu

7.2.3. Selecting a reference condition table

First select the appropriate reference condition table from the drop-down list as shown in figure 7-9 below. Two sets of reference condition tables are included when the FRCC Mapping Tool is installed. The first set **(gb_Alaska, gb_EastUS**, and **gb_WestUS**) was developed for the Interagency FRCC Guidebook (Hann and others 2004). The second set (**ra_East** and **ra_West**) was developed for the Rapid Assessment phase of the LANDFIRE Project. Any customized reference condition tables that have been developed locally must first be imported into the FRCC Mapping Tool (details follow).

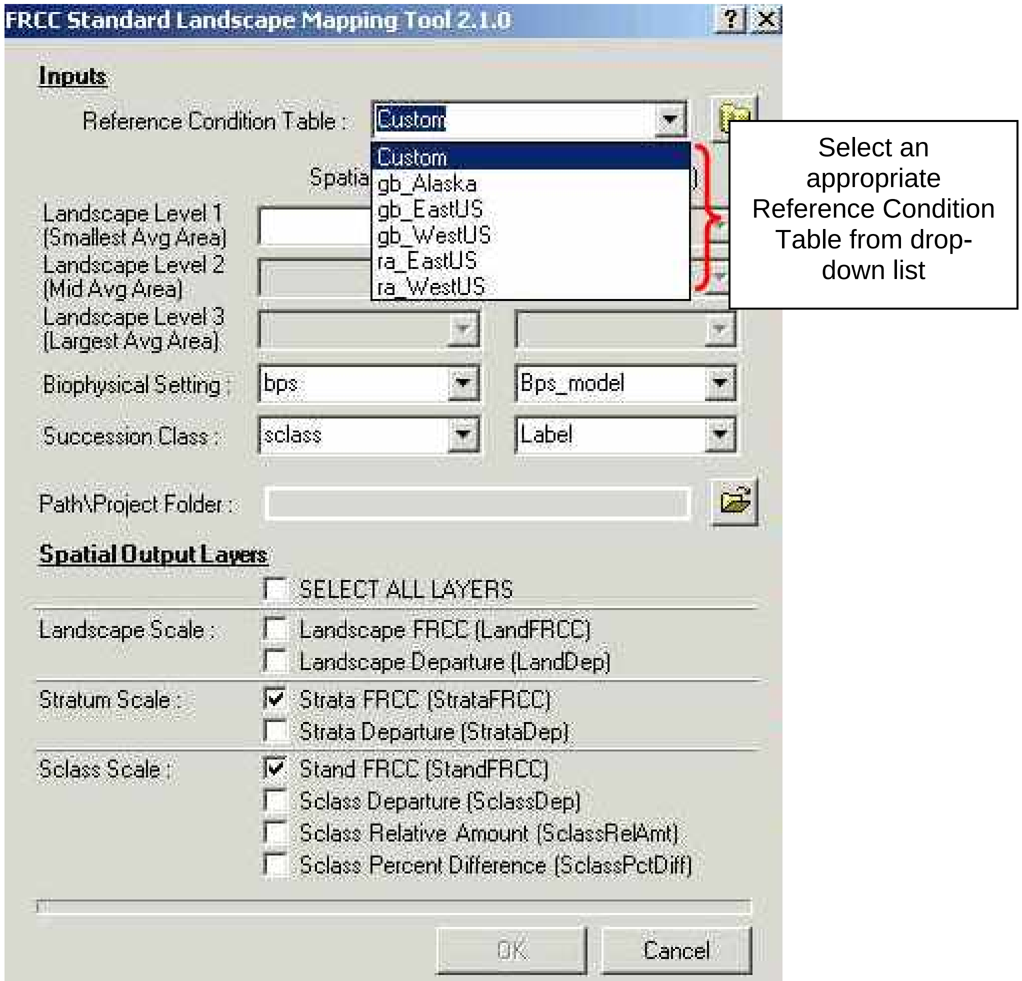


Figure 7-9. Selecting a reference condition table.

> ***Note***: *Reference condition tables are stored within the Reference Condition Database, which is an Access database called* ***refcon.mdb***. *The database is located within the directory containing the FRCC Mapping Tool that was selected during the installation process. If the default directory was selected as recommended, the Access database can be found in* ***C:\NIFTT\FRCC Mapping Tool 2.1.0\Reference Conditions Database\refcon.mdb***. *Navigate to* ***C:\NIFTT\FRCC Mapping Tool 2.1.0\Reference Conditions Database*** *and double click on* ***refcon.mdb*** *to display the default reference condition tables as shown above in figure 7-9.*

If you do not wish to use the default tables, then you must import your own customized reference condition table as follows:

1. Click on the **Select Reference Condition Table** drop-down list shown in figure 7-10:

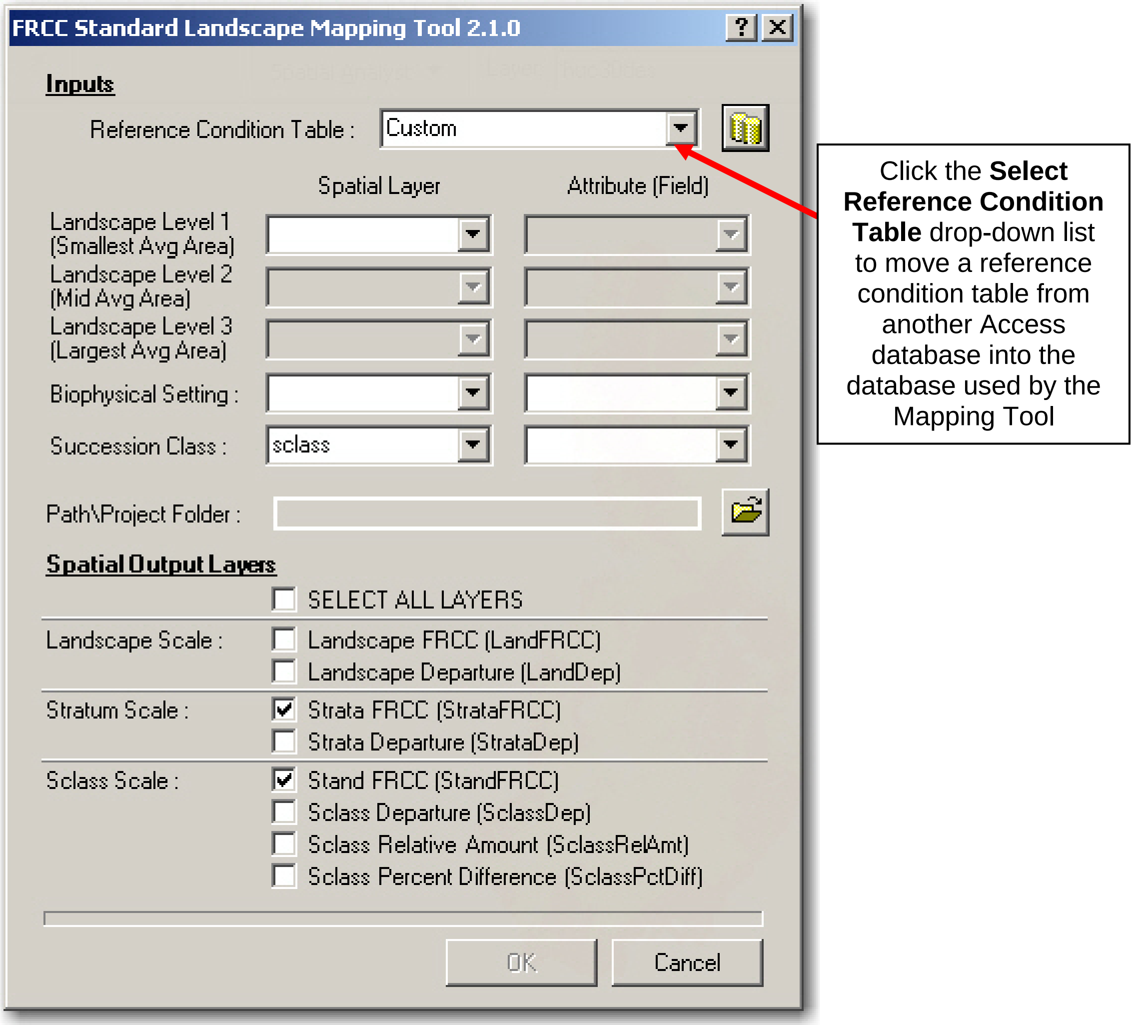


Figure 7-10. Selecting a customized reference condition table.

2. When the following dialog box appears, click on the browse button to the right of the **Import table from** box and navigate to the Access database that contains the desired table. Use the drop-down button to the right of the Import Table box to select the appropriate table contained within that database. Click **OK**.

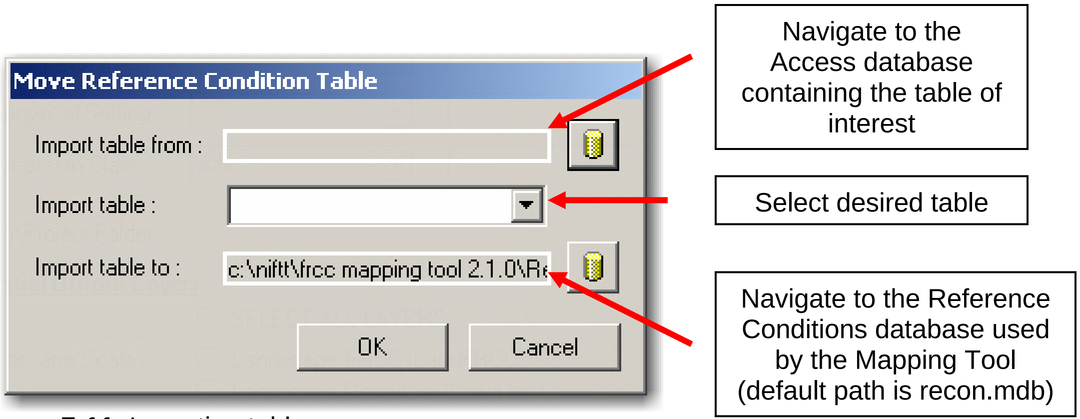


Figure 7-11. Importing tables.

You can rename the table when finished and your changes will be saved automatically. You do not need to include a file extension when you name the table. However, the name should not exceed ten characters in length and should not contain any spaces, leading numbers, or special characters (such as `~! @#$^()-+={ }[ ]|\?/:;'"< >, .)

> ***Note**: If a Microsoft Security Warning appears, just click **Open** to proceed. Then click **OK** to load the table into the FRCC Mapping Tool Reference Condition Database. After a few seconds, you should see a pop-up message indicating that the table was successfully loaded into the Reference Condition Database. When you see that message, click **OK** again to finish the process. The Reference Condition Database should be installed into a directory to which the user has write access; that is, the directory should not be "read only". Users will not be able to import a new reference condition table if the directory is read only.*

7.2.4 Selecting input layers

Next, you will need to specify the landscape levels that you will be using. Remember that these landscape levels correspond to the nested hierarchy (for example, a layer containing subwatershed, watershed, and subbasin units) that you are using in your analysis. The number of landscape levels used in the run must match the **LandscapeLevel** field in the reference condition table that you selected. For example, if three different levels are represented in the **LandscapeLevel** field of your selected reference condition table, then you must use three levels when you make your run. 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".

ra_WestUS : Table

BpS_Model	Name	A	B	C	D	E	U	FRG	LandscapeLevel
R#ABAMlw	Pacific Silver Fir--Low Elevation	15	20	3	10	52	0	3	2
R#ABAMup	Pacific Silver Fir--High Elevation	10	25	2	3	60	0	5	3
R#ABLA	Subalpine Fir	15	20	2	3	60	0	4	3
R#AGSP	Bluebunch Wheatgrass	5	70	25	0	0	0	1	1
R#ALME	Alpine and Subalpine Meadows and Grasslands	5	90	5	0	0	0	5	3

Figure 7-12. Landscape-level field in the Reference Condition Table.

You must also select the appropriate layer and attribute to the right of **Landscape Level 1** in the dialog box. No entries are made for **Landscape Level 2** and **Landscape Level 3** in the dialog box if only one landscape level is used in the analysis. Remember that the landscape levels used in the analysis must match those in the **LandscapeLevel** field in the Reference Condition Table. Refer to Chapter 3 for more information on landscape levels.

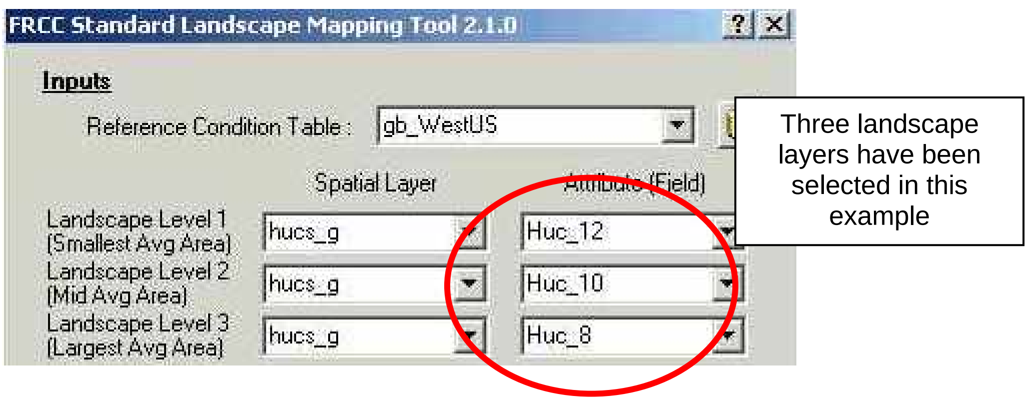


Figure 7-13. Dialog box with three landscape layers selected.

Both the **Spatial Layer** and **Attribute (Field)** drop-down boxes must be populated as displayed below in figure 7-14. Remember that these **Landscape Levels** correspond to the hierarchies you are using in your analysis. You may use all three levels, but it is not necessary. There may be instances in which only one or two levels may apply (see Chapter 3 for more information).

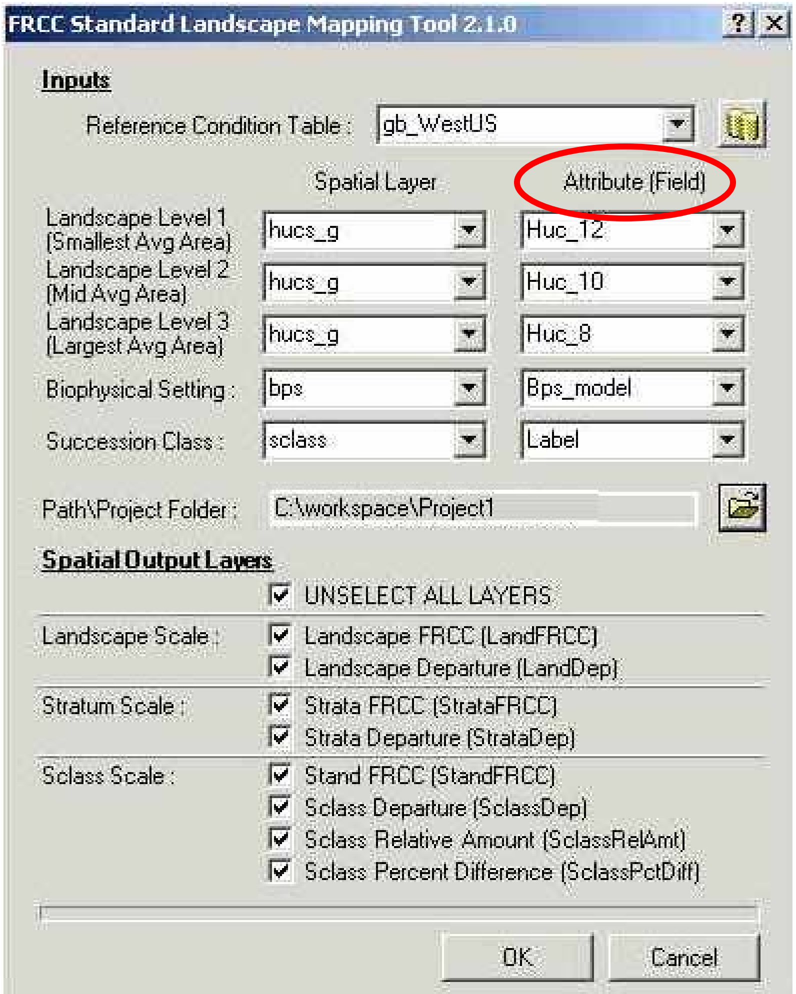


Figure 7-14. Example of populated dialog box.

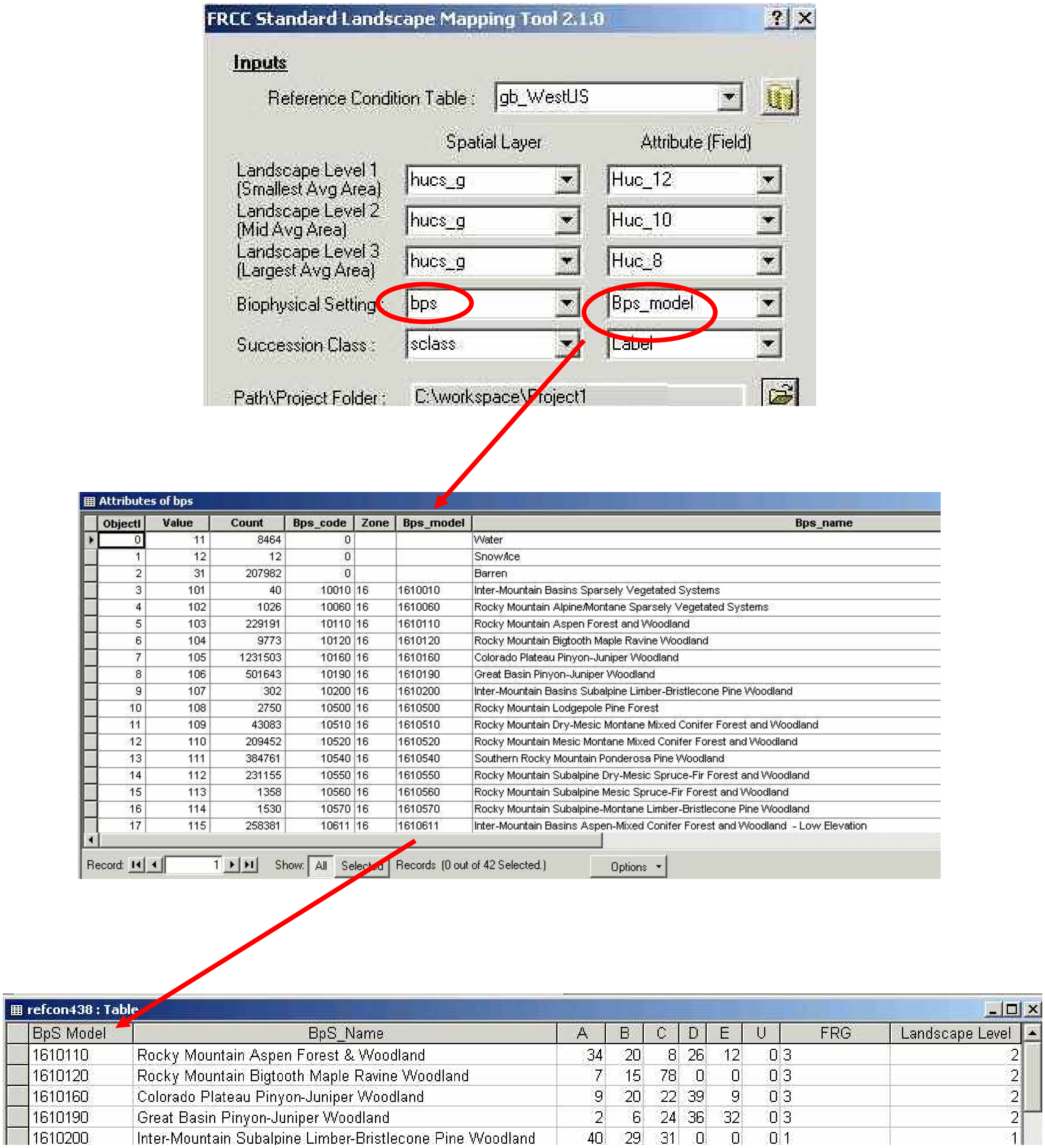
In this example, three Landscape Levels have been selected because we are working with a tri-level nested hierarchy of landscape units, ranging from multiple subwatersheds to a single subbasin encompassing the entire analysis area. Only one spatial layer has been chosen for the analysis (**hucs_g**). However, the selected layer (**hucs_g**) 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 layers to denote each of the landscape levels used in the analysis. Note, however, that this approach can sometimes lead to problems resulting from limitations of ArcMap. When ArcMap attempts to combine the five layers (in this example, **Huc_12, Huc_10, Huc_8, SClass**, 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 is commonly misleading as there may not actually be 10 million possible combinations between the five layers. This inconsistency results from the fact that the software test is based largely on grid values rather than on the actual number of unique values.

For example, assume that an analysis area has three landscapes with values of **1000, 2000**, and **3000**. The software will determine that there are actually 3,000 landscapes instead of three landscapes. The likelihood of this problem occurring is substantially reduced by using a single layer containing individual attributes for the landscape levels. Furthermore, using a single layer will ensure that the multiple landscape levels are nested. Consequently, we recommend using a single layer that contains multiple attributes to denote the different landscape levels (see fig. 7-12).

> ***Note**: We strongly recommend storing all input layers on the computer's local hard drive. Performance time is slowed down substantially if layers are stored on a network drive.*

Next select the appropriate BpS layer (labeled as **Biophysical Setting** and displayed under **Spatial Layer**) and associated **Attribute (Field)** from the drop-down boxes as displayed in figure 7-15 below.

> ***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 defined in the dialog box and the Reference Condition Table.*



ObjectI	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
11	109	43083	10510	16	1610510	Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland
12	110	209452	10520	16	1610520	Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland
13	111	384761	10540	16	1610540	Southern Rocky Mountain Ponderosa Pine Woodland
14	112	231155	10550	16	1610550	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
15	113	1358	10560	16	1610560	Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
16	114	1530	10570	16	1610570	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland
17	115	258381	10611	16	1610611	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland - Low Elevation

BpS Model	BpS_Name	A	B	C	D	E	U	FRG	Landscape Level
1610110	Rocky Mountain Aspen Forest & Woodland	34	20	8	26	12	0	3	2
1610120	Rocky Mountain Bigtooth Maple Ravine Woodland	7	15	78	0	0	0	3	2
1610160	Colorado Plateau Pinyon-Juniper Woodland	9	20	22	39	9	0	3	2
1610190	Great Basin Pinyon-Juniper Woodland	2	6	24	36	32	0	3	2
1610200	Inter-Mountain Subalpine Limber-Bristlecone Pine Woodland	40	29	31	0	0	0	1	1

Figure 7-15. Relationships between the dialog box, the value attribute table of the BpS layer, and the Reference Condition Table.

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

Next, select the S-Class layer and attribute from the drop-down boxes as displayed below in figure 7-16. In this example, the attribute **Label** contains the S-Class codes **A, B, C, D, E,** and **U**, which the Mapping Tool then links to the selected reference condition table.

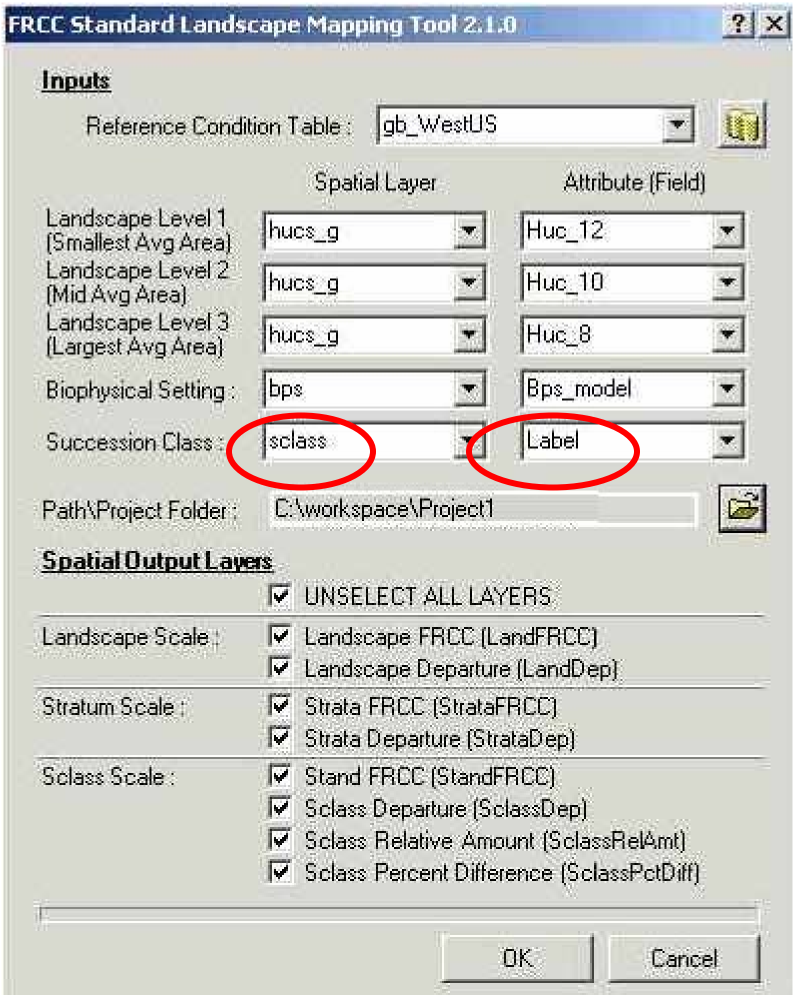


Figure 7-16. Selecting S-Class layer and associated attribute.

7.2.5 Selecting output layers

The next step is to select an output path and an appropriate folder name for storing the outputs of your run. The folder will be located within the pathway identified under the **Path\Project Folder** as shown below in figure 7-17.

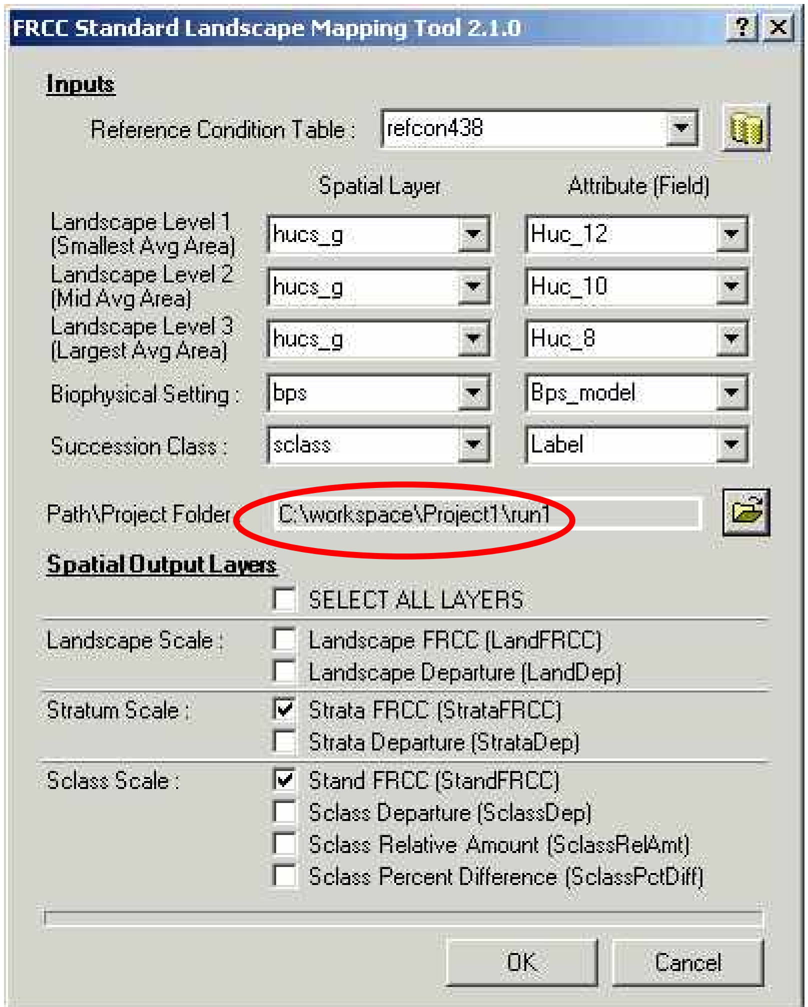


Figure 7-17. Selecting output path and folder name.

> ***Tip**: Make sure there are no spaces in the path, as shown above.*

In this example, all outputs will be stored within a folder labeled run1 that will be located in **C:\WorkSpace\Project1**. In addition to the output grids, the FRCC Mapping Tool will create at least one and potentially three folders within the output folder. A folder denoted as **RasterLayers** contains layer files for each of the output grids. A layer file maintains an assigned legend when loaded into an ArcMap project. Two additional folders are created if the Mapping Tool creates new BpS or S-Class grids by deleting classes that do not correspond to the Reference Condition Table. These new grids are stored in a folder labeled **CleanRasters**. 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**: Clean rasters can be saved and used in place of the original BpS and S-Class rasters.*

> ***Note**: We strongly recommend that users store their outputs on their local hard drives. The following problems may occur when users try to store their outputs on a network server:*
>
> - Performance (runtime) will be substantially slower
> - The server may time out preventing file transport
> - Permission problems will prevent file transport
> - Overly long paths may exceed ESRI's limitation
> - Special characters (e.g., ~`@#$%^&*()-+={}[]'":;|\/,.? , etc.) , leading numbers, or spaces in the path will cause run failure
>
> ***Note**: The name of the output folder should not exceed ten characters in length and should not contain any spaces, leading numbers, or special characters (such as `~! @#$^()-+={ }[ ]|\?/:;'"< >, .)*

Finally, you will need to select the desired spatial output layers. Simply check the boxes to the left of the output layers that you would like to analyze as shown below in figure 7-18. Two output layers, **StrataFRCC** and **StandFRCC**, are checked by default since they seem to be of greatest interest to users. See Chapter 5 for more information about output layers.

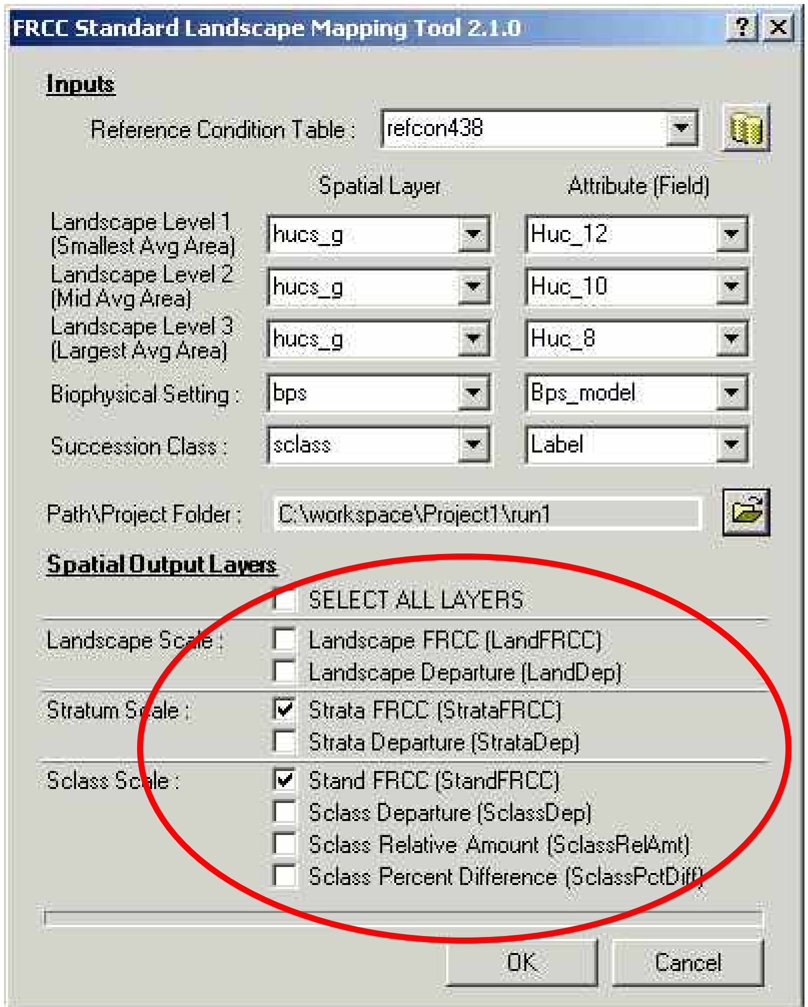


Figure 7-18. Check the boxes to the left of the output layers that you would like to analyze.

7.2.6 Running the tool

When finished with your selections, click **OK** and wait for the run to complete. You will see an active progress bar at the bottom of the dialog box (fig. 7-19) indicating that your run is in progress. The run may take a few minutes.

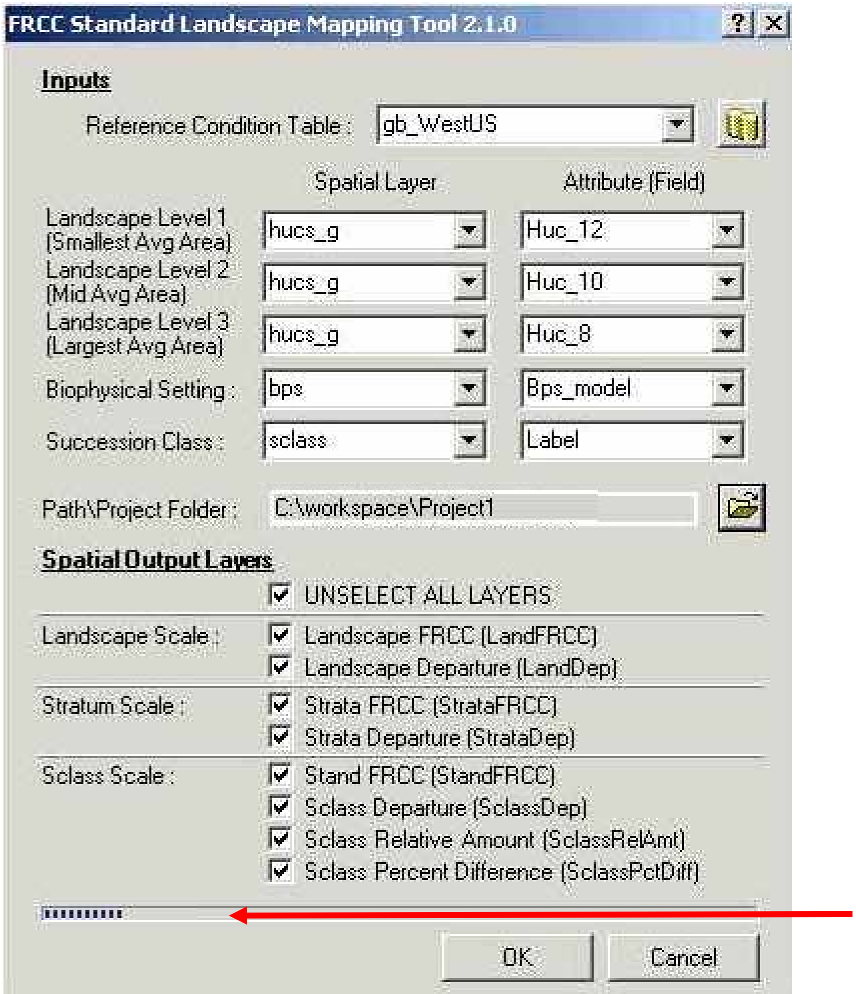


Figure 7-19. Progress bar indicate that software is running.

After all selections have been made, the FRCC Mapping Tool performs an error checking routine to identify any discrepancies between the biophysical settings in the Spatial Layer and biophysical settings in the Reference Condition Table.

The pop-up window in figure 7-20 will appear when none of the biophysical settings in the BpS layer coincide with those in the Reference Condition Table. This may occur if you inadvertently selected the wrong reference condition table, selected an incorrect attribute for the BpS layer, or if the reference condition table is structured incorrectly.

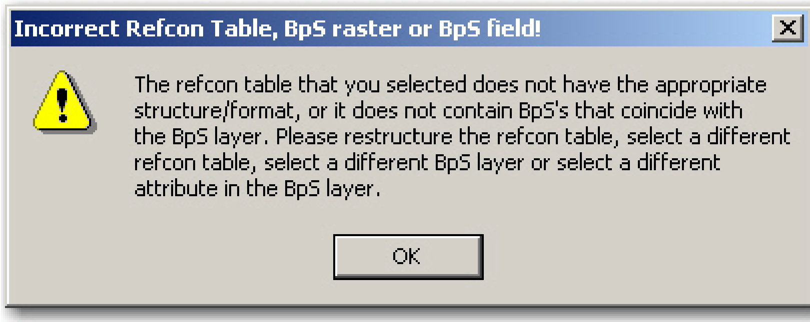


Figure 7-20. Error message indicating that none of the biophysical settings in the BpS layer correspond with those in the reference condition table.

If only a few biophysical settings in the Spatial Layer do not match those in the Reference Condition Table, then the following pop-up window (fig. 7-21) will appear. Follow the instructions in the dialog box and click on **OK** if you want the Mapping Tool to create a new BpS grid. This process will create a new grid in which the biophysical settings that do not correspond to biophysical settings in the Reference Condition Table have been removed. The new BpS grid will have the same name as the original BpS grid with the addition of a "_**c**" at the end. The Mapping Tool will then use the new grid as the BpS input layer and continue the run. Click **Cancel** if you want to stop the run and manually edit the BpS layer or Reference Condition Table.

.

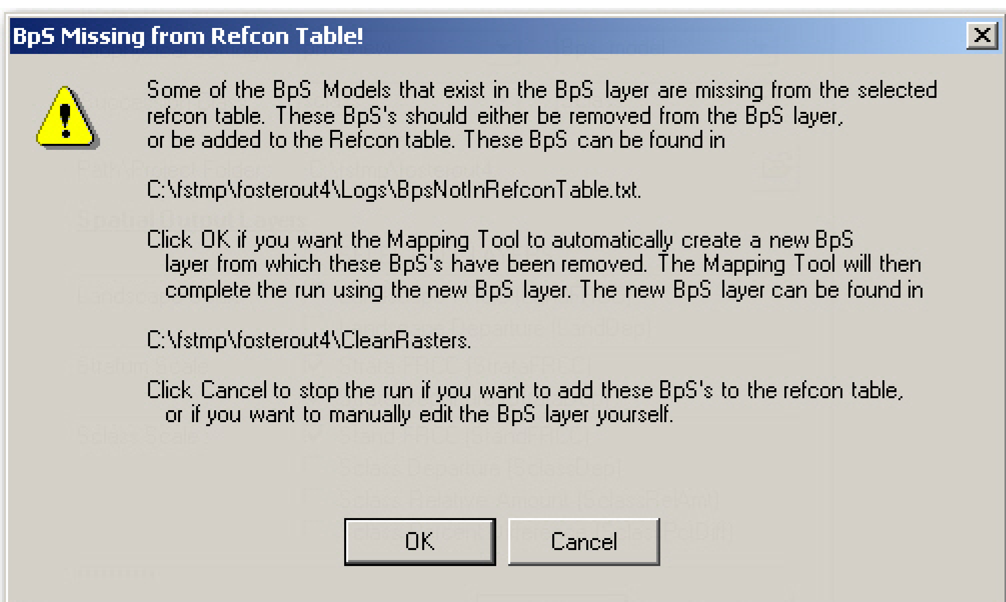


Figure 7-21. Error message indicating that some of the biophysical settings in the BpS layer do not correspond with those in the reference condition table.

The error message displayed above commonly occurs when there are biophysical settings within the BpS layer that lack reference conditions. Typically, these are anthropogenic classes, such as agricultural and urban types, but they may include natural types, such as sparsely vegetated areas, rock, barren, water, and snow/ice.

The following error message will appear after clicking on **OK** if the selected attribute in the S-Class layer includes any classes other than **A, B, C, D, E**, or **U**:

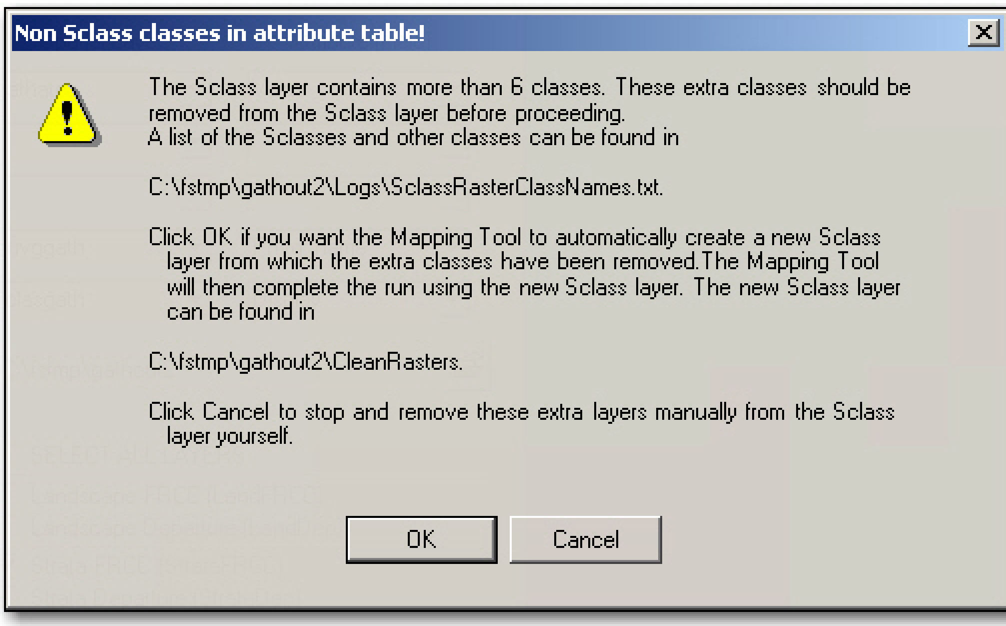


Figure 7-22. Error message indicating that layers other than the six succession classes (A, B, C, D, E, U) have been included.

The error shown above typically occurs when the S-Class layer includes anthropogenic classes (such as agriculture and urban) or naturally occurring classes that do not necessarily reflect the state of succession (such as sparsely vegetated, rock, barren, water, snow/ice). Click **OK** if you want the Mapping Tool to create a new S-Class layer that contains only classes denoted as **A, B, C, D, E,** and **U**. The new S-Class layer will have the same name as the original S-Class layer with the addition of "_c" at the end of the name. The Mapping Tool will then use the newly created S-Class layer as an input and will continue to process the run. Click **Cancel** if you want to cancel the run and edit the S-Class layer.

As your run progresses, each selected output layer will be added automatically to your ArcMap project and will be visible in ArcMap's Table of Contents. In addition, several tables from the Access database will be loaded into your Table of Contents. However, you must click on the **Source** tab located at the bottom of the Table of Contents to view the tables. These output tables may prove useful for diagnosing some data problems. To open the table, right click on the table's name and select **Open** from the context menu.

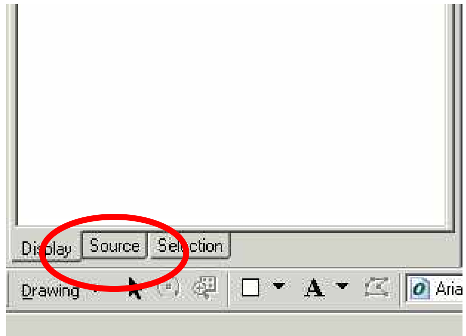


Figure 7-23. Click on Source tab to view tables.

These same tables are included in the Access database located in the output folder and are used to derive the spatial outputs.

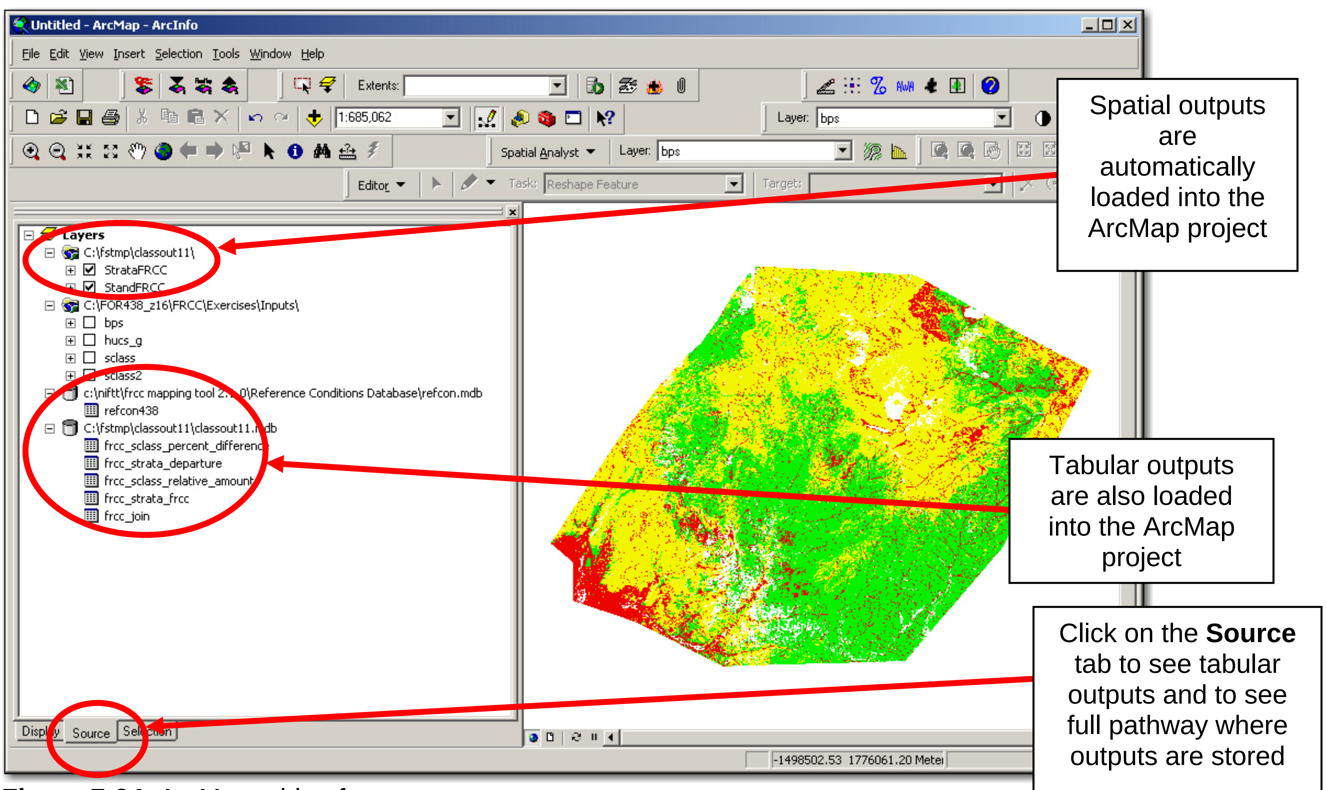


Figure 7-24. ArcMap table of contents.

When the Mapping Tool run has finished, the dialog box will automatically close and the new output layers will appear in the Table of Contents.

Save your results.

Chapter 8: Troubleshooting FRCC MT – Common Errors, Symptoms, and Solutions

8.1 Data quality

The output layers derived by the FRCC Mapping Tool 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 to date with FRCC MT suggests that there are four primary sources of output error:

1. The S-Class layer does not adequately reflect conditions on the ground
2. The BpS Class layer does not adequately reflect conditions on the ground
3. The Reference Condition Table does not adequately reflect the BpS model, or the BpS model does not adequately 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

8.1.1 Output error related to the S-Class layer

FRCC MT outputs seem to be 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 the 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 limits 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.

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

8.1.2 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. For example, if the S-Class layer seems unreasonable, the problem may be attributed to the canopy cover layer that was used to classify succession classes. An inaccurate canopy cover layer can result in an inaccurate S-Class layer, which can, in turn, result in an inaccurate departure layer. 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.

8.1.3 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 while transcribing model outputs to the Reference Condition Table, especially if the information is entered manually (for example, typographical errors). 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. Those using the FRCC Mapping Tool should have a thorough understanding of the BpS models.

8.1.4 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. (As reporting units get smaller and smaller, the probability of detecting the optimum S-Class composition decreases). Conversely, 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 FRCC MT 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.

8.2 Landscape patterns

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

8.3 Naming conventions

Several problems associated with the FRCC Mapping Tool 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 pathways used for data inputs and outputs as well as to Access databases and tables.

8.4 Reference Condition Database

The most common problems encountered while using the FRCC Mapping Tool are typically associated with the Reference Condition Database. Most errors are related to the following:

- The design of the Reference Condition Table must match the criteria specified in Chapter 3 table 3-1
- The name of the Reference Condition Table cannot contain spaces or special characters and should be ten characters or fewer 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.

Appendix A: References

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Appendix B: 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 severity as well as landscape patterns. Vegetation attributes have been substantially altered.

Appendix C: Fire Regime Groups

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