

## Area Change Tool

### User's Guide

For ArcMap 9.2

Version 3.0.0

July 7, 2008





## Preface

---

The Area Change Tool (ACT) was developed in response to the need for a tool that could be used to help design and delineate fuel and vegetation prescriptions as well as edit raster layers to accurately portray treatment outcomes. These edited data can be used with fire behavior analysis systems such as FARSITE (Finney 1998) and FlamMap (Finney and others, 2006) to evaluate the effectiveness of proposed fuel or vegetation treatments. However, since ACT is simply a geographic information system (GIS) tool, its potential applications can include any GIS analysis that involves:

- Creating a new shapefile
- Editing an existing shapefile
- Converting the attributes of a shapefile into a raster
- Combining multiple rasters into a single raster
- Editing the value attribute table of a raster
- Converting edited attributes into a new raster
- Merging an edited raster layer into the original raster layer to create a new layer that incorporates the edits

Version 3.0.0 of the Area Change Tool was released in October, 2007. Future versions may incorporate additional features, so be sure to check the NIFTT website at [www.nifft.gov](http://www.nifft.gov) for tool updates and enhancements as well as associated updates to this user's guide.

## What's new in version 3.0.0?

Earlier versions of the Area Change Tool contained two user interfaces: a Wizard and Toolbar Interface. The Toolbar Interface has been eliminated to streamline use and to reduce complexity.

Some of the terminology used in the ACT dialog boxes has been changed with version 3.0.0 for added clarity.

## Prerequisites

Because ACT uses ArcGIS, as well as Microsoft Windows, Excel, and Access, a basic understanding of these programs is necessary for successful use of the Area Change Tool.

Specific computer requirements for operating the Area Change Tool are described in [Chapter 1](#) of this user's guide.

## Obtaining copies

To obtain additional copies of the Area Change Tool User's Guide or the Area Change Tool Tutorial, follow these steps:

1. Go to [www.nifft.gov](http://www.nifft.gov)
2. Under *NIFTT Quick Links* at the left side of the page, click on **NIFTT Tools and User Documents**.
3. At the center of the page under *NIFTT Tools and User Documents*, click on **NIFTT User Documents**.
4. Click on the material you wish to download (User's Guide or Tutorial).

Obtain the Area Change Tool Help Utility, ACT Installation Notes, or the latest version of the Area Change Tool, as follows:

1. Go to [www.nifft.gov](http://www.nifft.gov)
2. Under *NIFTT Quick Links* at the left side of the page, click on **NIFTT Tools and User Documents**.
3. At the center of the page under *NIFTT Tools and User Documents*, click on **NIFTT Tools**.
4. Click on the material you would like to download (Help Utility, Installation Notes, or the latest version of the Area Change Tool).

## Credits

ACT was developed for the National Interagency Fuels Technology Team (NIFTT) by Lee Hutter of Systems for Environmental Management (SEM), Missoula, Montana. Direction was provided by Jeff Jones and Wendel Hann from the USDA Forest Service and Marc Levesque of Acadia West, Silver City, New Mexico.

Support for the development of ACT was provided by the USDA Forest Service and the U.S. Department of Interior.

This Area Change Tool User's Guide was written by 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 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@nifft.gov](mailto:helpdesk@nifft.gov).



# Table of Contents

---

<b>Preface</b> .....	<b>2</b>
What's new in version 3.0.0?.....	2
Prerequisites .....	3
Obtaining copies .....	3
Credits .....	3
Your input .....	4
<b>Chapter 1: About the Area Change Tool (ACT) User's Guide</b> .....	<b>7</b>
1.1 Before you begin.....	7
1.2 How to use this guide .....	7
1.3 Computer requirements.....	7
<b>Chapter 2: ACT Function</b> .....	<b>9</b>
2.1 What does ACT do?.....	9
2.2 Applications of ACT .....	9
2.3 How does ACT work? .....	11
<b>Chapter 3: Installing the Area Change Tool</b> .....	<b>14</b>
3.1 General installation instructions .....	14
3.2 Area Change Tool installation .....	15
3.2.1 Downloading the Area Change Tool .....	15
3.2.2 Beginning the installation process.....	16
3.2.3 Obtaining the latest .NET Framework .....	17
3.2.4 Finishing installation.....	21
3.3 Troubleshooting ACT installation .....	23
<b>Chapter 4: Using the Area Change Tool</b> .....	<b>25</b>
4.1 Using the Area Change Tool .....	25
4.2 Starting ACT.....	26
4.3 Setting the editing task .....	29
4.4 Uniform Change editing .....	30
4.4.1 GIS functions.....	31
4.4.2 Creating a new shapefile .....	32
4.4.3 Editing an existing shapefile .....	35
4.4.4 Converting shapefile attributes to rasters.....	39
4.4.5 Merging edited rasters with original rasters .....	42
4.5 Variable Change editing .....	45
4.5.1 GIS functions.....	46
4.5.2 Creating a new shapefile .....	47
4.5.3 Editing an existing shapefile .....	51
4.5.4 Converting shapefile attributes to rasters.....	55
4.5.5 Combining rasters .....	57
4.5.6 Editing raster attribute tables.....	60
4.5.7 Convert raster attributes to new rasters .....	69
4.5.8 Merge edited rasters with original rasters .....	72

**Chapter 5: Troubleshooting ACT – Common Errors, Symptoms, and Solutions .....76**  
**Appendix A: References .....77**



# Chapter 1: About the Area Change Tool (ACT) User's Guide

---

- 1.1 Before you begin
- 1.2 How to use this guide
- 1.3 Computer requirements

## 1.1 Before you begin

ACT users must be familiar with Microsoft Windows and have at least a basic understanding of ArcGIS, including a working knowledge of ArcMap and the Spatial Analyst extension. If ACT is used for editing raster data, users must be capable of editing data in either Microsoft Excel or Microsoft Access. For additional information on using ArcGIS, refer to its help utility.

## 1.2 How to use this guide

It is not necessary to read the entire guide from beginning to end to carry out a specific task using ACT. Once you are familiar with the basic concepts, you can quickly locate common functions by referring to headings in the [Table of Contents](#). You can then go to the specific section that addresses your needs. Whenever possible, screen captures are used to illustrate necessary steps.

The Area Change Tool User's Guide is not intended to provide step-by-step guidance on the tool's operation; rather, it is intended to serve as a reference guide. The Area Change Tool Tutorial available at [www.niftt.gov](http://www.niftt.gov) provides basic step-by-step instructions.

## 1.3 Computer requirements

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

- ArcGIS 9.2
- Spatial Analyst extension of ArcGIS 9.2

- Microsoft Excel (2000 or higher)
- Microsoft Access (2000 or higher)

Although system requirements to run ArcGIS 9.2 will suffice to run NIFTT tools, at least 10 GB of free hard drive space and 2 GB of RAM are recommended. Generally, faster processors, more memory, and increased free hard drive space will improve performance. In addition, NIFTT tools were developed for Windows Operating Systems.

**Note:** Make sure that you have sufficient space and adequate permissions for storing Area Change Tool outputs on your computer.

**Note:** Make sure that the Area Change Tool version you are using correctly matches the version of ArcGIS on your computer. Use Area Change Tool Version 3.0.0 only with ArcGIS 9.2. Area Change Tool version 2.0.3 is compatible with ArcGIS 9.0 or 9.1.



# Chapter 2: ACT Function

---

- 2.1 What does ACT do?
- 2.2 Applications of ACT
- 2.3 How does ACT work?

## 2.1 What does ACT do?

ACT is a GIS tool that facilitates combining and editing raster data using ArcMap. It completes these tasks from the ArcMap platform and uses Microsoft Excel or Access to edit the attribute tables of raster layers. Moreover, ACT allows you to maintain logical relationships between raster layers by combining them first into a single layer so that multiple attributes can then be edited simultaneously.

ACT incorporates seven GIS functions that are commonly used for editing raster data. These include:

- Delineating new shapefiles (for example, identifying a project boundary)
- Editing shapefiles (for example, identifying various treatment units within a project boundary)
- Converting shapefile attributes to raster layers
- Combining multiple rasters into a single layer
- Editing the Value Attribute Table of a combined raster
- Creating a new raster layer from an attribute of an existing raster layer
- Merging edited values back into the original raster layer

## 2.2 Applications of ACT

In general, ACT is useful for GIS applications that involve:

- Editing incorrect raster layers
- Updating raster layers to reflect recent disturbances such as wildland fire, insects, disease, or weather
- Changing raster layers to reflect post-treatment outcomes
- Characterizing conditions at the pixel level based on multiple attributes

- Deriving a new thematic layer based on a combination of multiple existing layers
- Prioritizing treatment areas on the basis of layers created from a combination of attributes

Data layers such as biophysical settings, vegetation, and fuels are used as input into models across relatively large geographic areas. Users frequently modify these layers by refining them at a more local level. However, the process of editing raster layers can prove complicated. Even less-experienced users will be able to modify raster layers using the Area Change Tool. For instance, a fire behavior analyst may believe that an existing fuel model layer is limiting the ability to simulate observed fire behavior. The analyst can use ACT to modify the existing fuel model layer to more closely simulate actual observed fire behavior.

Ecosystems are dynamic, necessitating frequent updates to data. Wildland fires, wind storms, floods, insects, disease, and human-caused activities are constantly modifying vegetation structure and composition as well as landscape patterns. Data layers need to be updated on a continual basis to reflect changing conditions. Data can be updated to reflect post-disturbance conditions by using the ACT in combination with disturbance layers such as burn severity data.

ACT can be used to evaluate the effectiveness of proposed vegetation and fuel treatment prescriptions in meeting management objectives. Raster layers can be changed so that they portray proposed treatment outcomes. These edited layers can then be fed into modeling systems that predict potential fire behavior, wildlife habitat, ecosystem departure, or other layers of interest.

The Area Change Tool can help users derive or model a new thematic layer based on some combination of existing layers. By combining multiple raster layers into a single layer, data can be integrated at the pixel level. GIS modelers commonly produce a layer or theme based on the combination of a suite of layers. For example, some wildlife habitat layers may be derived on the basis of a spatial coincidence of elevation, aspect, cover type, diameter class, and canopy cover. ACT can be used to combine these layers and, subsequently, to classify the habitat of interest.

The integration of a suite of variables at the pixel level allows for rapid diagnosis of concerns, identification of opportunities, and development of general prescriptions. As many as 20 rasters can be combined to generate a Value Attribute Table in which each record (value) represents a unique combination of the input layers. Having information on up to 20 layers represented on every given pixel can be powerful. For instance, ACT can be used to characterize each pixel by biophysical setting, existing vegetation (cover type, size class, or canopy cover), existing fuels (fire behavior fuel model, canopy base height, canopy height, or canopy bulk density), and likely fire behavior given some combination

of environmental parameters (for example, fuel moisture and wind). The combined layer can then be used to identify treatment opportunities and can assist in designing treatment prescriptions.

ACT provides a means to edit the values of multiple layers simultaneously, thereby maintaining logical relationships between the layers. Predicting fire behavior using FlamMap (Finney and others 2006) and FARSITE (Finney 1998) requires a landscape area defined by the combination of elevation, slope, aspect, fire behavior fuel model, canopy base height, canopy height, and canopy cover. Fire behavior is then predicted on the basis of these combined layers. Since several of these themes are interrelated, it may be important to retain logical relationships among them. Therefore, if a user wants to model fire behavior but believes that the fire behavior fuel model layer needs refinement, it may be necessary to modify the canopy cover, canopy base height, and canopy bulk density layers so that they are logically consistent with the fuel model layer. In other words, a change in one variable, for example fire behavior fuel model, may require changes to other related variables such as cover type, size class, canopy base height, canopy cover, and canopy bulk density.

ACT can be used to develop spatial priorities by identifying areas where a combination of conditions occur. For example, fuel treatment polygons can be delineated around areas where passive or active crown fire would be likely in conjunction with specific fire behavior fuel models, canopy base height values, and canopy cover values. If managers are limited to using mechanized equipment to treat fuels and vegetation, the selection criteria could be further limited using thematic layers denoting slope and distance to open roads.

## 2.3 How does ACT work?

ACT guides the user through a sequential process for delineating vegetation and fuel treatment polygons, combining raster data layers that may need to be changed to reflect treatment objectives, editing the Value Attribute Table to reflect treatment outcomes, and creating new updated raster layers. Although the Area Change Tool uses a linear process that links multiple GIS processing steps together, that process need not be followed. Any of the GIS tasks can be selected at any time.

ACT contains two options for changing raster layers: Uniform Change and Variable Change. The Uniform Change is used when all values of a given layer within a polygon are changed to a single value ([fig. 2-1](#)). The Variable Change option is used when the desired edits would result in multiple values within a polygon ([fig. 2-2](#)). For example, suppose you have an existing fire behavior fuel model layer that follows Anderson (1982). After the fuel model layer was produced, you were provided with a detailed map of exotic annual grasses that

you believe should be classified as FBFM-1 (Short Grass Model). Consequently, you want to change all of the values in the existing fuel model layer that coincide with the polygons denoting exotic annual grasses to FBFM-1. In this example, these edits could be made easily using ACT's Uniform Change option since only one value is being assigned to the polygons ([fig. 2-1](#)). However, if you want to update a fuel model layer after a wildland fire on the basis of three classes of burn severity (for example, low, moderate, and high), then the Variable Change option could be used to assign different fuel models on the basis of pre-burn conditions and burn severity class ([fig. 2-2](#)).

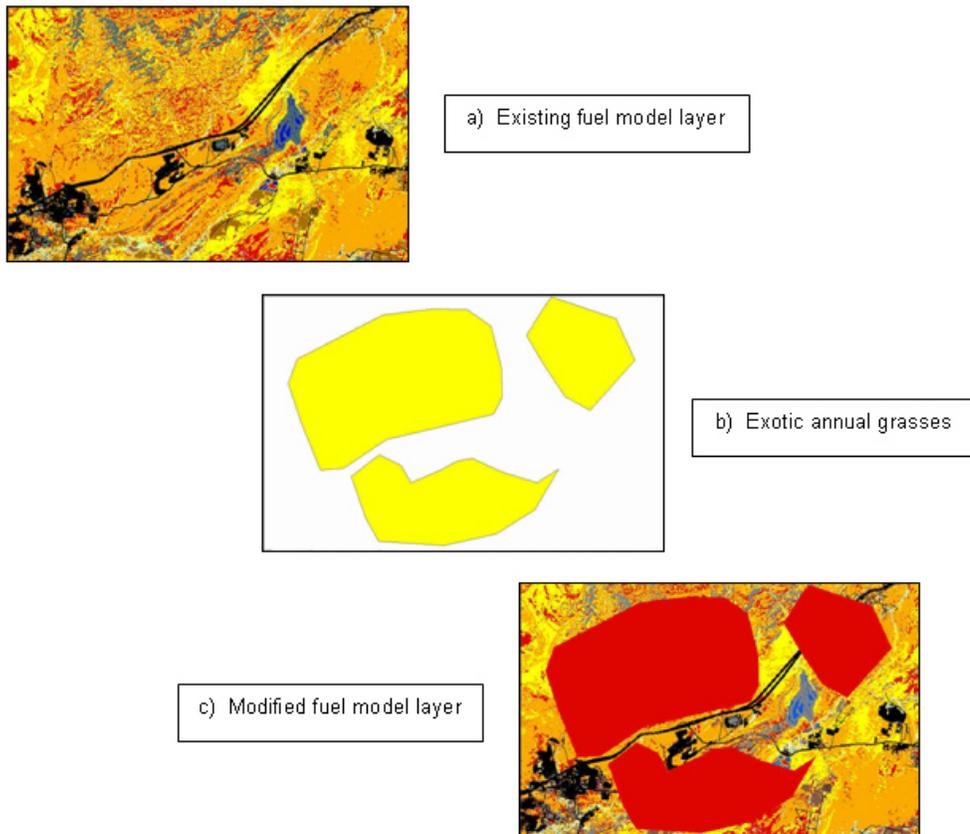


Figure 2-1. Using the Uniform Change option to change fire behavior fuel models based on areas mapped as exotic annual grasses.

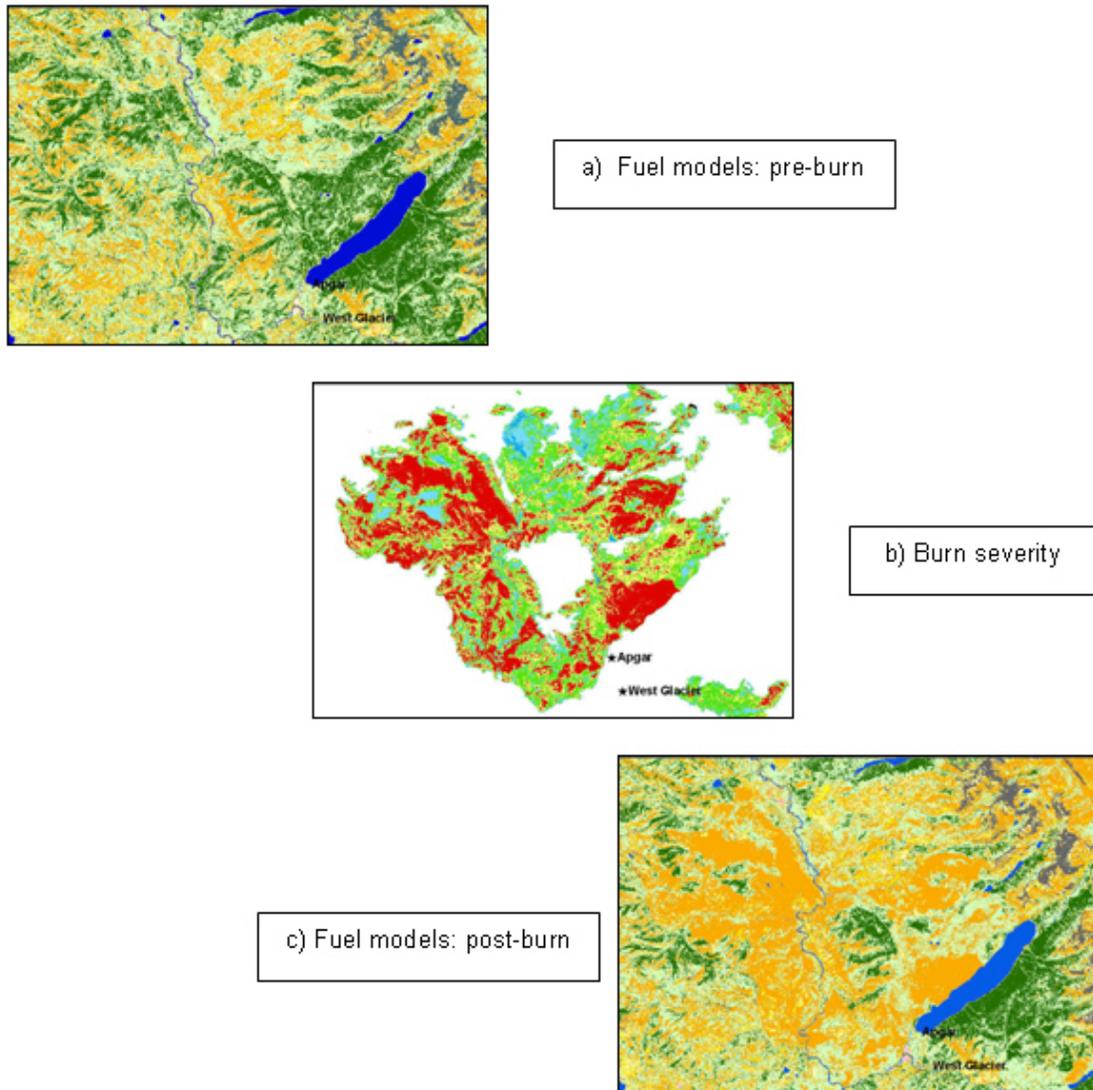


Figure 2-2. Using the Variable Change option to update a fuel model layer based on burn severity data.

ACT includes two options for editing a raster layer's attribute table when the Variable Change option is selected. Microsoft Excel can be used to edit relatively small or homogeneous areas when the number of unique values or records is low. However, combining multiple raster layers into a single layer may result in a Value Attribute Table with several thousand unique values. Using Excel to edit a table of this size can be very tedious. For these situations, edits can often be made more efficiently by using Microsoft Access, which uses queries to change hundreds of records simultaneously.

# Chapter 3: Installing the Area Change Tool

---

- 3.1 General installation instructions
- 3.2 Area Change Tool installation
  - 3.2.1 Downloading the Area Change Tool
  - 3.2.2 Beginning the installation process
  - 3.2.3 The .NET framework
  - 3.2.4 Finishing installation
- 3.3 Troubleshooting Area Change Tool installation

## 3.1 General installation instructions

All NIFTT tools, including the Area Change Tool, are now downloaded and installed as single tools. A complete or package install is no longer available for versions of NIFTT tools compatible with ArcMap 9.2.

**Note:** For the Area Change Tool version 3.0.0 to operate properly, you will need to verify that you are using ArcGIS 9.2.

**If you have an earlier version of the Area Change Tool installed on your computer, you will first need to uninstall it before proceeding with installation of the current version.**

To determine which version is currently installed on your computer, go to **Start > Control Panel > Add or Remove Programs** as shown below:

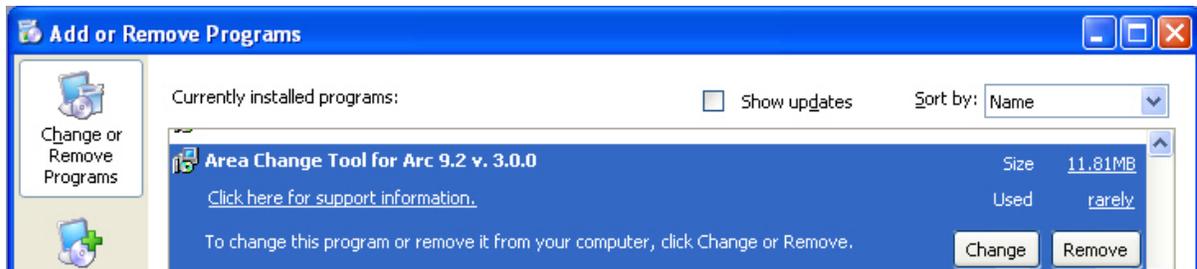


Figure 3- 1. Area Change Tool version 3.0.0.

**Note:** NIFTT naming conventions are as follows: ACT\_220\_071113 indicates that this “install” is version 2.2.0 and was completed on 11/13/2007.

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

## 3.2 Area Change Tool installation

### 3.2.1 Downloading the Area Change Tool

If you would like to install or reinstall the Area Change Tool follow these steps:

**Note:** If you have an earlier version of the ACT installed on your computer, you will first need to uninstall it before proceeding with installation of the current version. Refer to [section 3.1](#) for more information on this subject.

Download ACT from [www.nifft.gov](http://www.nifft.gov). Go to **NIFTT > Downloads** located at the left side of the page.

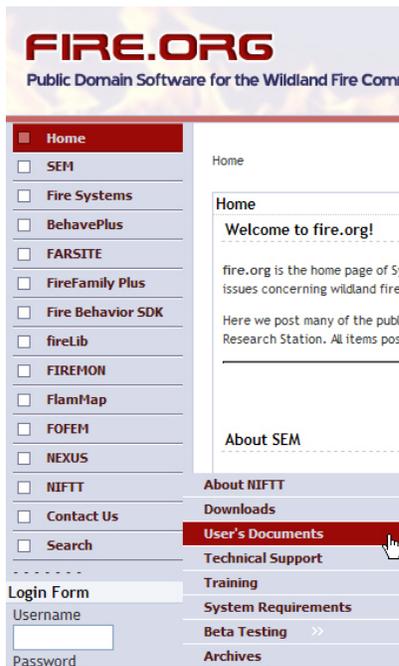


Figure 3- 2. Select **Downloads**.

Click on the **ACT Install File** from the table as shown below to begin the download.

<p>Individual Tool Install for:</p> <p>Area Change Tool (ACT)</p> <p>*Note: This tool is for use with ArcMap versions 9.0 or 9.1.</p> <p>Installation Notes (ACT)</p> <p>ACT Help Utility</p>	<p>February 2007</p> <p>Version 2.0.3</p>	<p>Download <b>ACT Install File</b></p> <p>Download <b>ACT Installation Notes</b></p> <p>Download <b>ACT Help Utility</b></p>
---	---	---

Figure 3- 3. Click on the ACT Install File.

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

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

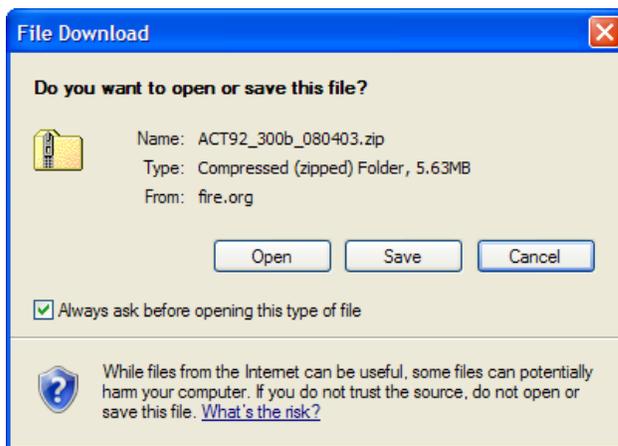


Figure 3- 4. Download and save installation file.

### 3.2.2 Beginning the installation process

Go to the file in which you stored the Area Change Tool zip file and right click on the file name. Select the option Extract to folder and choose either the default location (C:\NIFTT as shown in figure 3-5) or another location of your choice.

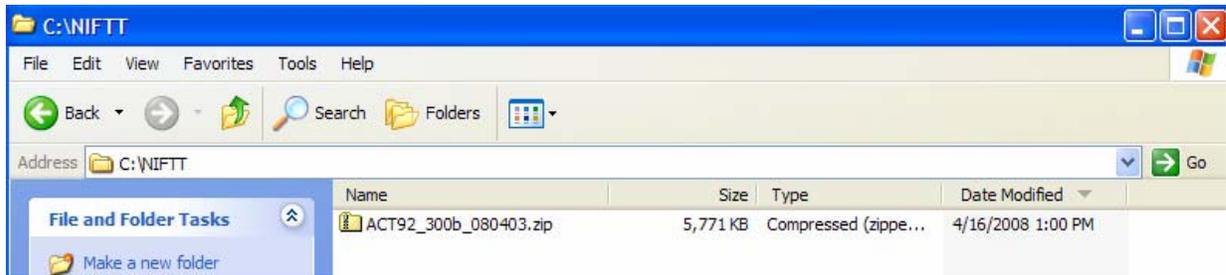


Figure 3- 5. Self-extracting ACT installation file has been downloaded and saved.

Next, navigate to the directory in which you have saved your extracted Area Change Tool files.

**Note:** Do not install the Area Change Tool or any other NIFTT tool to a path that may contain a space in the folder name such as “My Documents” or “Program Files.”

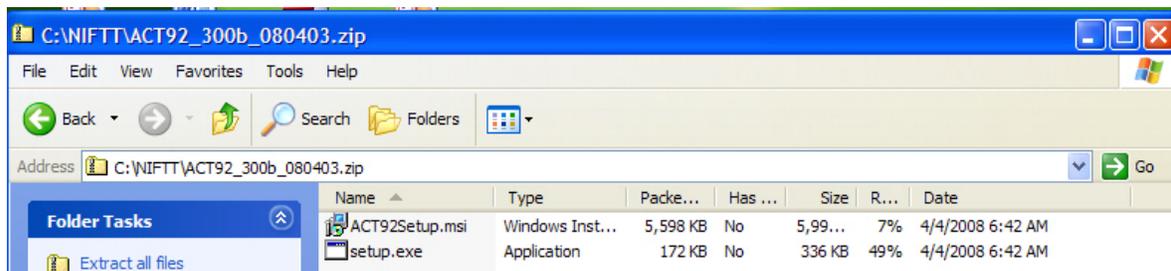


Figure 3- 6. Area Change Tool installation files.

Click on **setup.exe**.

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

If the setup.exe determines that you already have the proper .NET Framework (2.0) installed on your computer, the Area Change Tool zip file contains everything that you will need for installation. A series of dialog boxes will now open. Skip to [section 3.2.4](#) to continue installation.

### 3.2.3 Obtaining the latest .NET Framework

If the installer determines that the setup requires a .NET Framework that has not been previously installed on your computer, you will see a dialog

box similar to figure 3-7 instead of the first screen of the Area Change Tool Setup Wizard as shown in [figure 3-14](#).



Figure 3-7. Dialog box indicating the need to first install *.NET Framework* for installation to proceed.

Click on **Yes** and follow all prompts as directed. If the *.NET Framework 2.0* has not been previously installed on your computer, the setup will, at this point, direct you to a website where you will be able to download the appropriate file (See fig. 3-8).

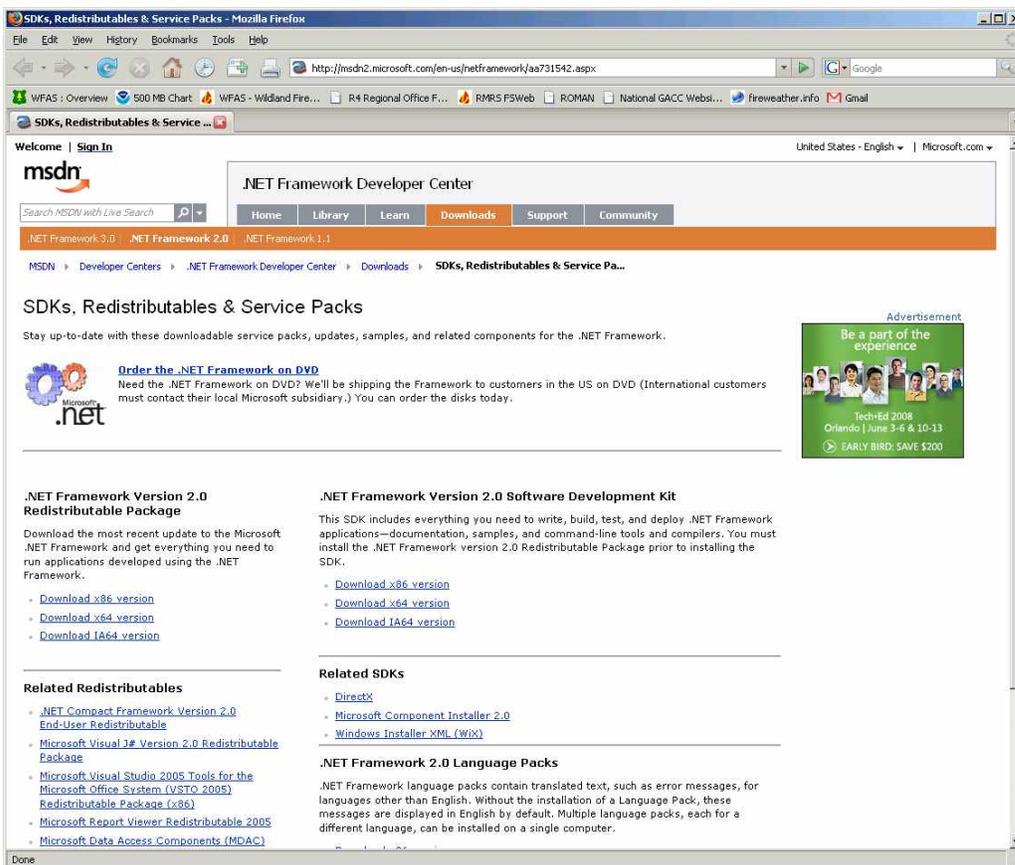


Figure 3-8. Website for downloading *.NET Framework 2.0*.

As shown in figure 3-9, you will need to specify which version of *.NET Framework* you would like to install on your computer. Select the *x86*

version if you have a Pentium (or other 32-bit) computer. Click on **Download x86 version**.

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

### .NET Framework Version 2.0 Redistributable Package

Download the most recent update to the Microsoft .NET Framework and get everything you need to run applications developed using the .NET Framework.

- [Download x86 version](#)
- [Download x64 version](#)
- [Download IA64 version](#)

Figure 3- 9. Select the correct version of .NET Framework.

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

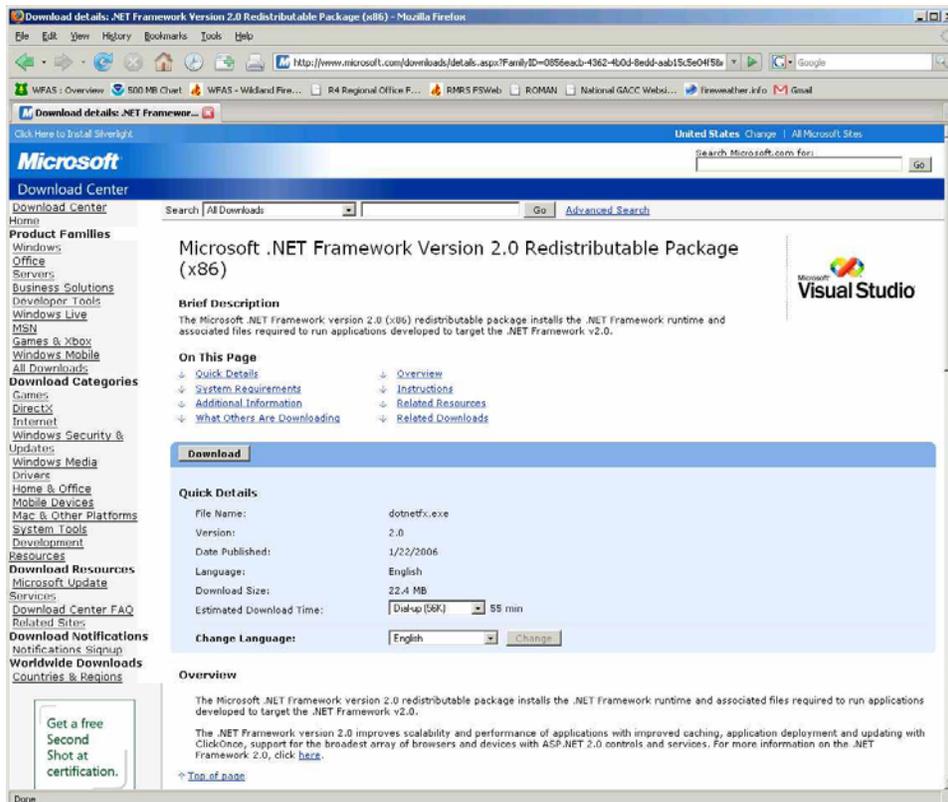


Figure 3-10. Microsoft .NET Framework Version 2.0 (x86) download page.

Browse to a location of your choice. Download and save the *dotnetfx.exe* file as shown in figure 3-11.

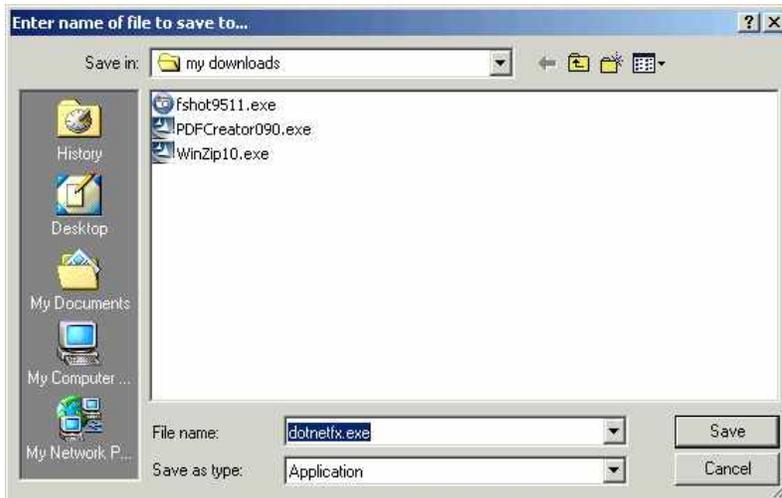


Figure 3-11. Save the file to a location of your choice.



Figure 3-12. Progress bar indicating *dotnetfx.exe* download.

The Microsoft .NET framework 2.0 will download, extract and install automatically as shown in figures 3-12 and 3-13.

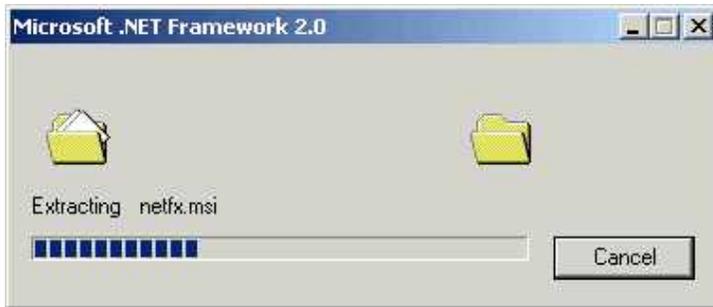


Figure 3-13. .NET Framework installation

Click on the setup.exe file as shown in [Figure 3-6](#) to initiate the setup wizard and to continue installation of the Area Change Tool.

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

### 3.2.4 Finishing installation

After clicking on the setup.exe file, the first in a series of Area Change Tool Setup Wizard dialog boxes will open. Follow instructions as directed by the dialog boxes in the Setup Wizard. During the installation process you may see a radio button asking you to specify whether the tool is to be installed for “Everyone” or “Just Me.” Select the “Everyone” option.

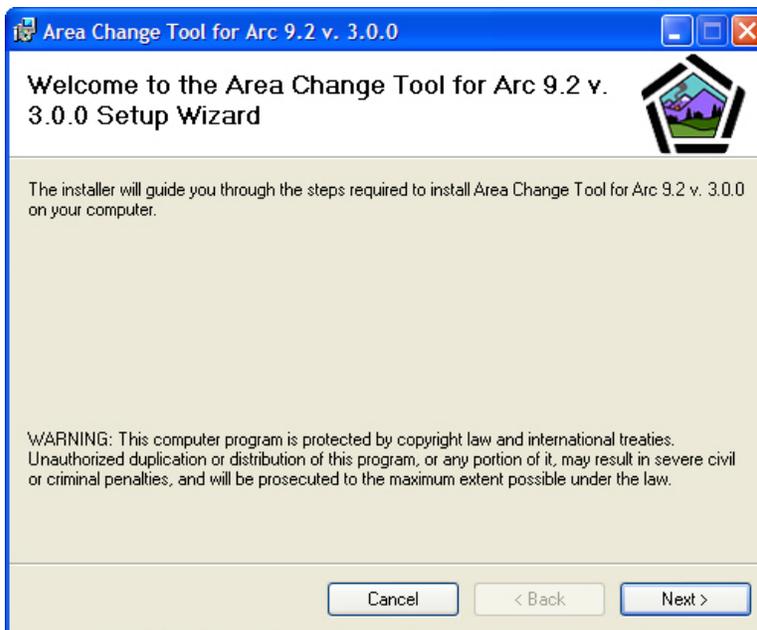


Figure 3- 14. First dialog box of the *Area Change Tool* setup wizard.

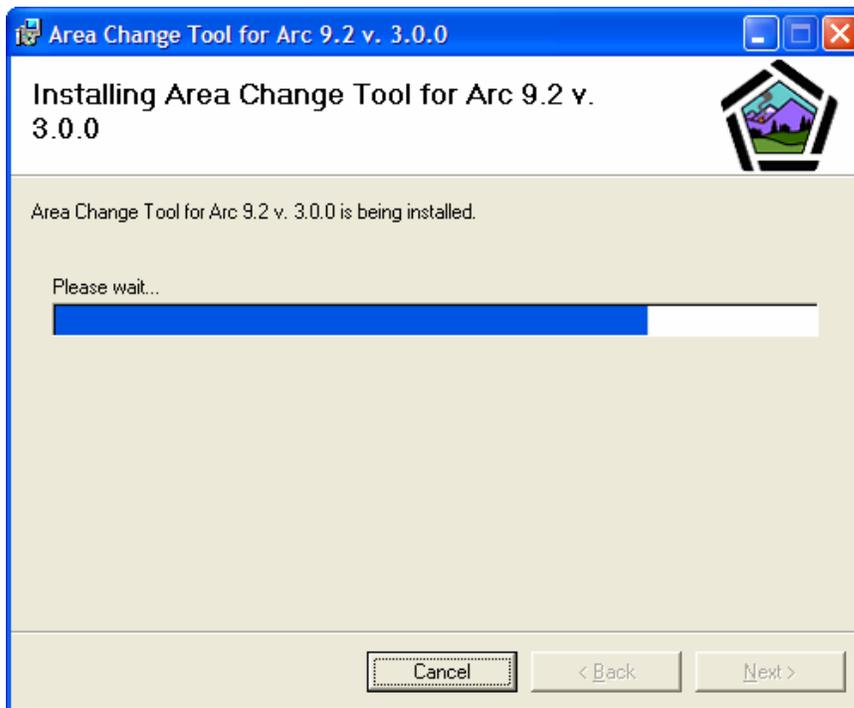


Figure 3- 15. Setup Wizard continues installation.

Click on **Finish** when the Area Change Tool installation is complete.

Open ArcMap and make sure that the Area Change Tool Toolbar  is visible.

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

**Tip:** For best results, make sure that you have installed the most recent ArcGIS service packs and patches. Go to [www.esri.com](http://www.esri.com) to verify that you have the most recent versions for 9.2 already installed on your computer. If you do not, download the newer service packs and patches as directed on the website.

## 3.3 Troubleshooting ACT installation

**Note:** Be sure that you do not have an earlier version of ACT installed on your computer before downloading any newer version of the product.

If the ACT Toolbar shown at right  does not appear automatically when you open ArcMap, select **View > Toolbars** and check the box to the left of Area Change Tool 3.0.0, if it is not already checked (fig. 3-16).

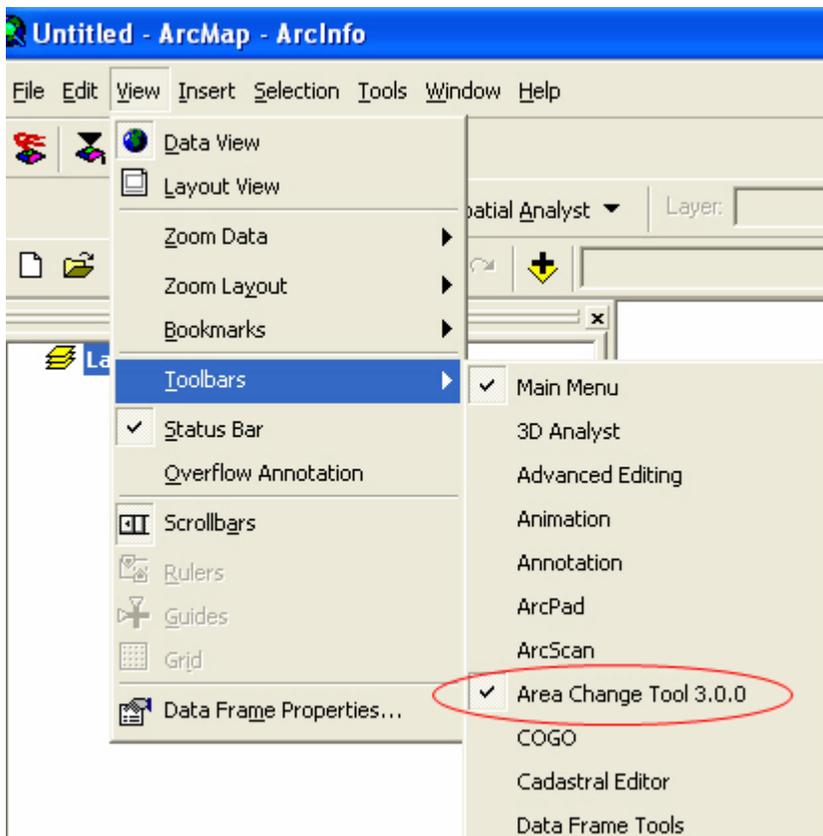


Figure 3-16. Verifying that the *Area Change Tool 3.0.0* is checked.

If you are still unable to view the ACT Toolbar, or if the Area Change Tool does not appear in the list, click on the *Tools* menu and select **Customize**. Make sure that both the Area Change Tool 3.0.0 and Spatial Analyst are checked and click on **Close** (fig. 3-17).

**Tip:** Just because you can view a Spatial Analyst Toolbar in ArcMap doesn't necessarily mean that the tool is installed and operational. You can verify that it is turned on by selecting **Tools > Extensions**. If Spatial Analyst is listed but not checked, check it now; if it is not listed, then you will need to obtain it now.

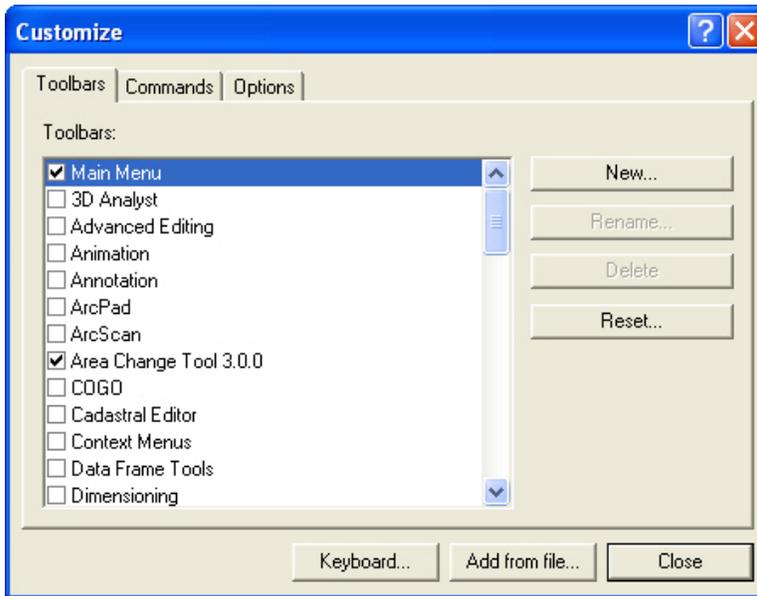


Figure 3-17. The Customize dialog box.

In ArcMap, again select the **View** menu and click on **Toolbars**. Verify that the Area Change Tool 3.0.0 is listed and checked and make sure that the Spatial Analyst Toolbar is installed and turned on.

**Note:** If you have any additional questions about tool installation, please contact the helpdesk at: [helpdesk@nifft.gov](mailto:helpdesk@nifft.gov).

# Chapter 4: Using the Area Change Tool

---

- 4.1 Using the Area Change Tool
- 4.2 Starting ACT
- 4.3 Setting the editing task
- 4.4 Uniform Change editing
  - 4.4.1 GIS functions
  - 4.4.2 Creating a new shapefile
  - 4.4.3 Editing an existing shapefile
  - 4.4.4 Converting shapefile attributes to new rasters
  - 4.4.5 Merging edited rasters with original rasters
- 4.5 Variable Change editing
  - 4.5.1 GIS functions
  - 4.5.2 Creating a new shapefile
  - 4.5.3 Editing an existing shapefile
  - 4.5.4 Converting shapefile attributes to rasters
  - 4.5.5 Combining rasters
  - 4.5.6 Editing raster attribute tables
  - 4.5.7 Converting raster attributes to rasters
  - 4.5.8 Merging edited rasters with original rasters

## 4.1 Using the Area Change Tool

ACT guides the user through a sequential process for delineating vegetation and fuel treatment polygons, combining raster data layers that need to be changed to reflect treatment objectives, editing the Value Attribute Table to reflect treatment outcomes, and creating new raster layers that depict treatment outcomes. Although ACT uses a linear process to link multiple GIS processing steps together, that sequential process need not be followed or completed. Instead, any of ACT's GIS tasks can be selected in any order, or used completely independently of each other.

ACT uses a suite of user-friendly dialog boxes to complete GIS processing. Each dialog box includes an overview as well as tool tips to help the user navigate within the box itself (fig. 4-1).

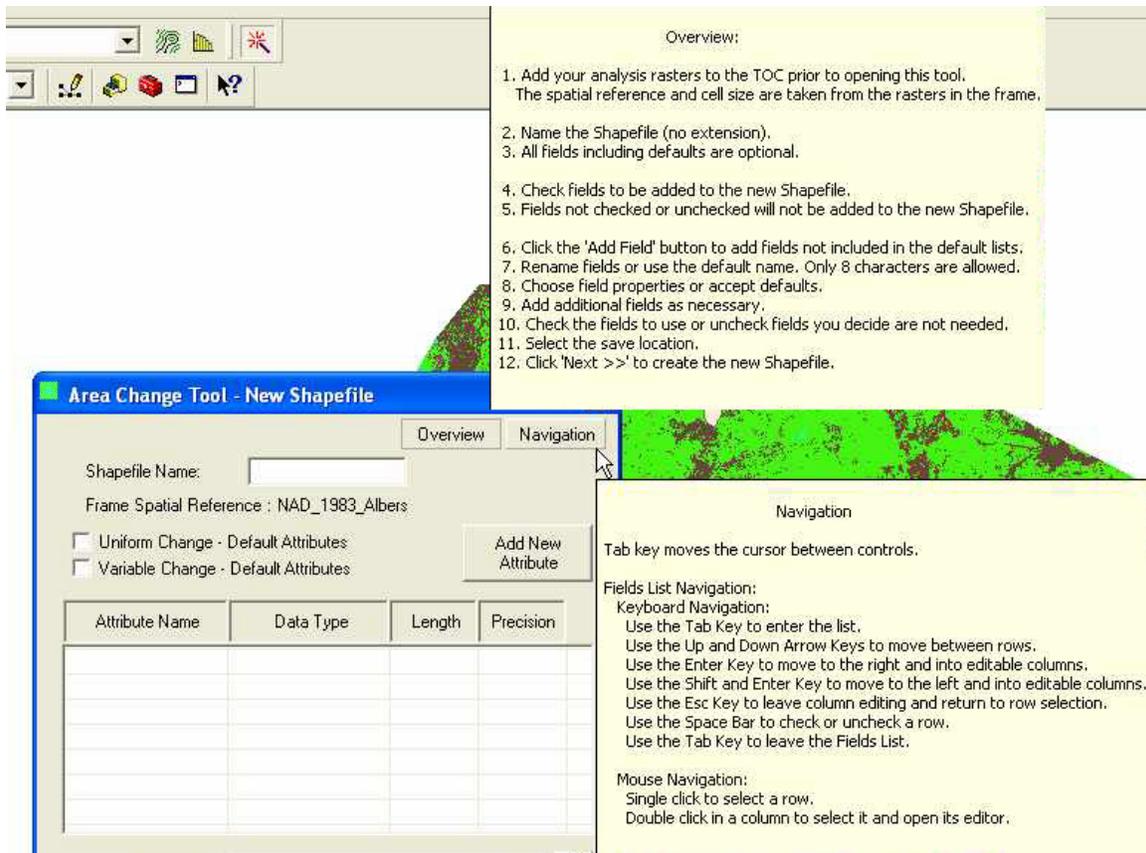


Figure 4-1. Overview and Navigation tips.

## 4.2 Starting ACT

Because ACT operates from an ArcGIS platform, ArcMap must be opened before ACT can be initiated. A toolbar consisting of a single icon should be visible after you open an ArcMap project (fig. 4-2).



Figure 4-2. The ACT Toolbar.

1. First start ArcMap and create a new project by selecting **A new empty map** as shown in figure 4-3:

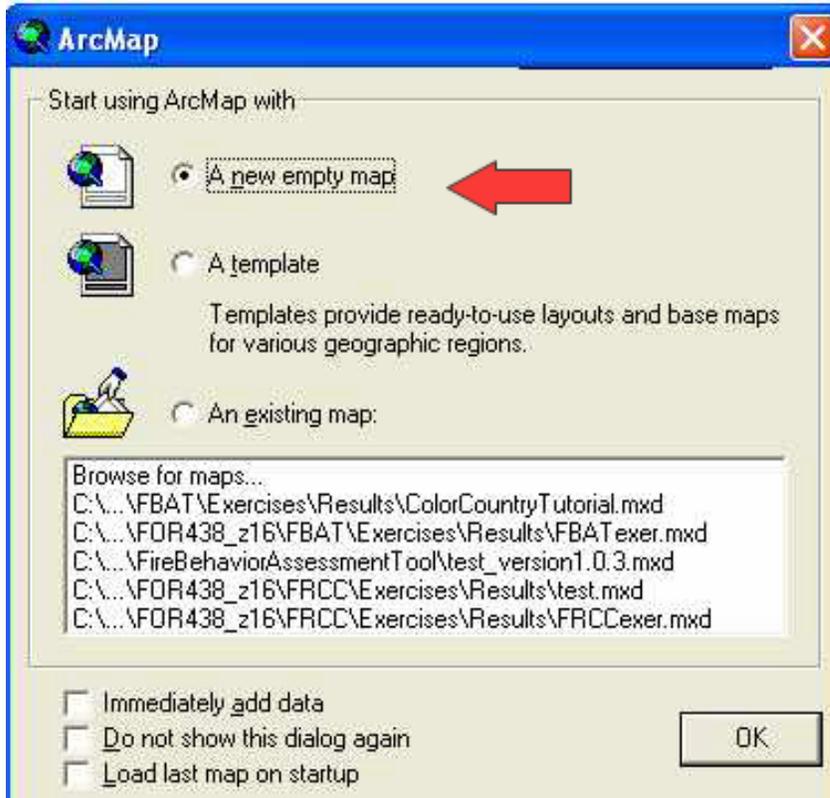


Figure 4-3. Creating a new project in ArcMap.

2. Next, load input layers into your ArcMap project by clicking on the **Add Data** icon (fig. 4.4):

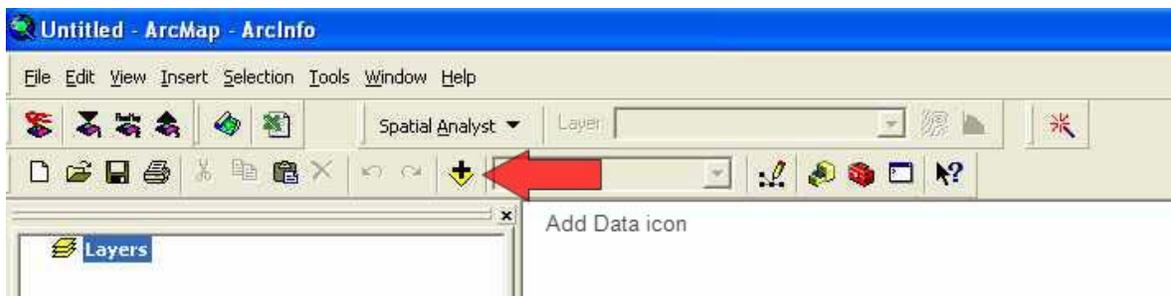


Figure 4-4. Loading input layers.

3. Navigate to the directory where your data layers are stored and add input layers.

**Tip:** At this point, you may see several “Create pyramids” dialog boxes similar to the box shown in figure 4-5. Click No to speed up processing. If you do not want to see this box again, put a check in the lower left-hand corner to disable it.

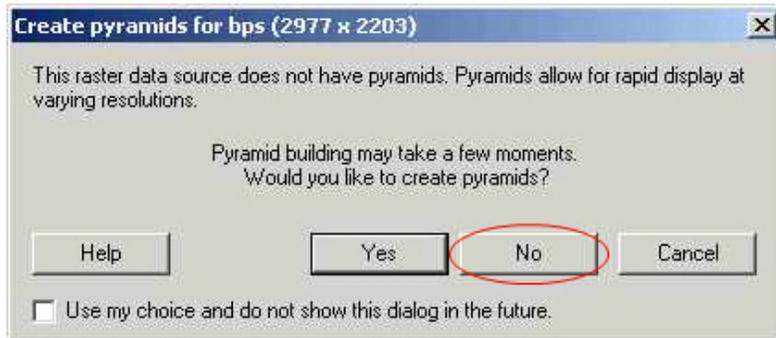


Figure 4-5. Create pyramids dialog box.

4. Click on the ACT Toolbar (fig. 4-2) to open the main dialog box (fig. 4-6). All applications of ACT must begin with the *Area Change Tool* dialog box, which is used to specify the Editing Task, to identify where to store outputs, and to select the GIS task to be performed.

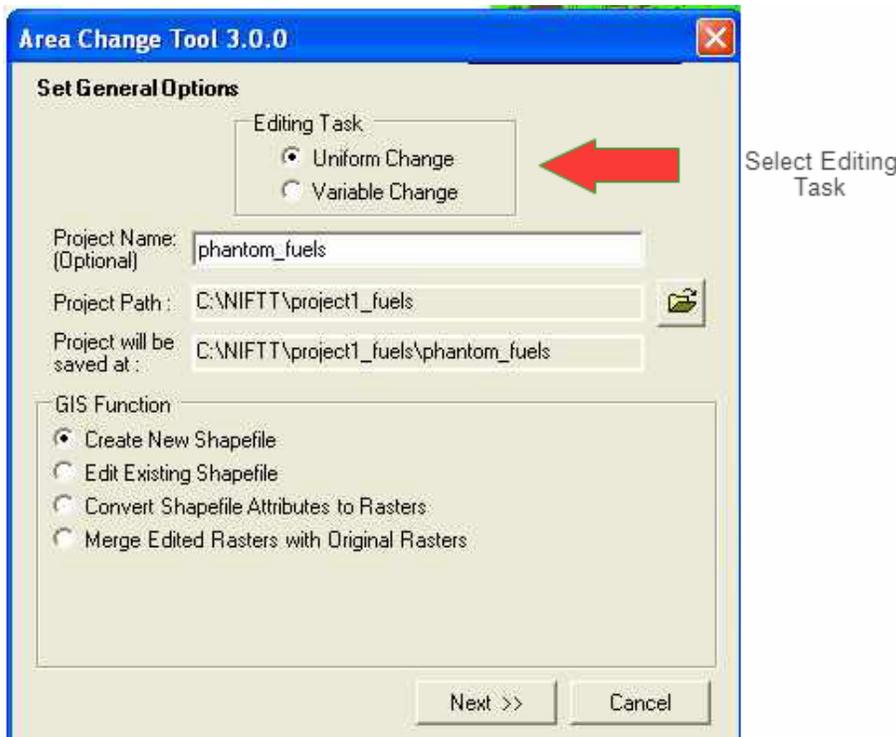


Figure 4-6. Selecting the *Editing Task*.

## 4.3 Setting the editing task

Two types of editing can be accomplished using ACT. The Uniform Change option will alter all raster values within a polygon to a single value that is specified by the user (in other words, a many-to-one change). The Variable Change option allows you to change raster values within a polygon to many different values. It represents a non-uniform change in which you can define rules that will include multiple changes to many attributes (or, a many-to-many change). This option can also include changes to multiple data layers.

A Uniform Change might include creating a treatment area that would change one or more grid values to a single value. For example, a prescribed fire might change the fire behavior fuel model, canopy base height, and canopy cover so that each is represented by a single value (for example, FBFM 2; 15-foot canopy base height, and 30 percent canopy cover). All other values outside of the burn perimeter would remain unchanged.

Uniform Change edits are generally useful only when dealing with very homogenous environments. However, vegetation and fuel prescriptions typically vary according to complex conditions (slope, aspect, biophysical setting, cover type, size class, canopy cover, surface fuels, and canopy fuels) or according to management objectives (such as habitat objectives, visual objectives, or air quality objectives). The Variable Change editing process is generally most useful for real-world GIS challenges.

A Variable Change involves altering many different values within a polygon to many other values. Typically, the values to be changed are assigned on the basis of a combination of attributes. For example, since fire behavior varies with weather, fuels, and topography, it is not surprising that fuel treatment prescriptions might vary according to attributes such as slope, aspect, elevation, surface fuels, and canopy fuels.

A **Uniform Change** allows you to change all pixels in an area to the same value.

A **Variable Change** will allow you to change pixels within an area in a non-uniform way to multiple values.

## 4.4 Uniform Change editing

Remember that the objective of the Uniform Change is to change all of the current values of one or more layers that intersect a polygon to a single value.

**Note:** Skip to [Variable Change](#) editing if you are interested in changing raster values in a polygon to many different values (a “many-to-many change”).

The following describes how to edit data using the Uniform Change option.

1. Select the **Uniform Change** radio button as shown ([fig. 4-6](#)).
2. Enter a name of your choice in the *Project Name* window ([fig. 4-7](#)). (This step is optional).
3. Next specify a *Project Path* by clicking on the browse button to navigate to a folder where outputs are stored. (This step is required).

ACT will automatically fill in the Project will be saved at window if a name and a path was specified for the project. If a Project Name was not selected, no information will appear. It is not necessary to enter any information.

**Tip:** Once a project path or location for the project to be stored is entered, it cannot be edited. Therefore, if you make an error, you will need to start over with this dialog box.

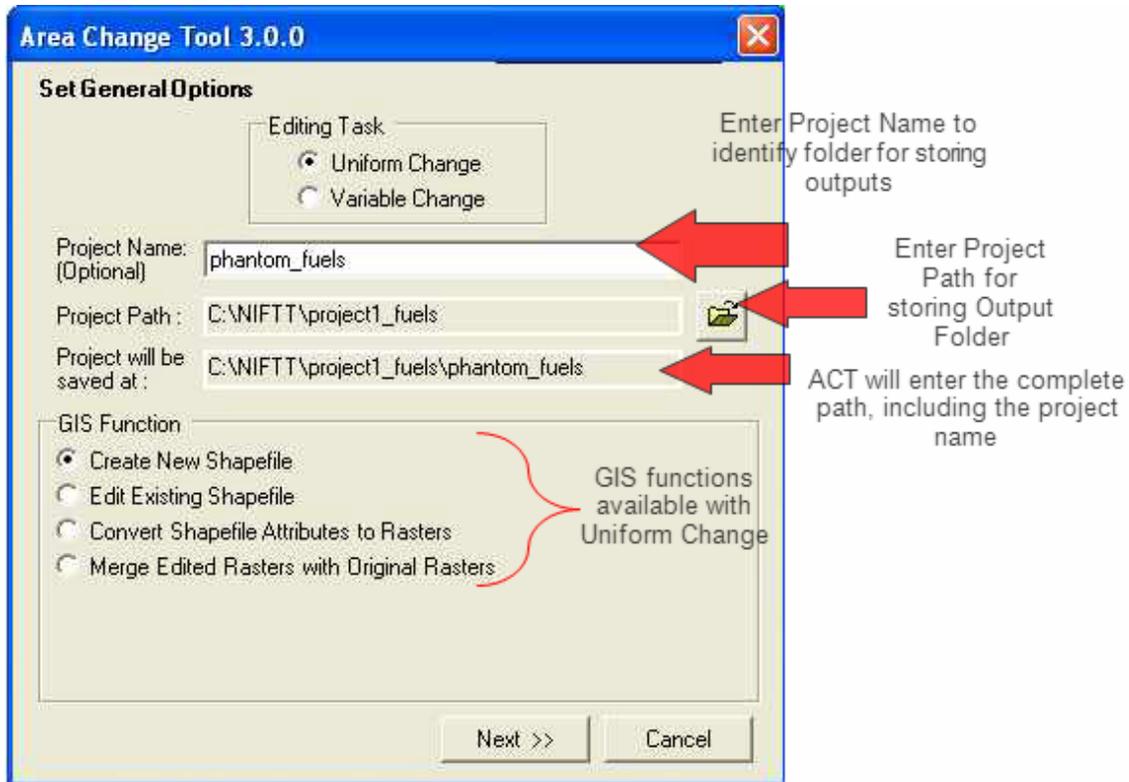


Figure 4-7. Providing inputs to the *Area Change Tool* dialog box.

### 4.4.1 GIS functions

The following GIS functions are available when the Uniform Change option is selected:

- Create a new shapefile – The shapefile is used to delineate polygons where edits are to occur. When this option is selected, the *Next* button will take you to the *New Shapefile* interface.
- Edit an existing shapefile – The *Next* button will close ACT and open ESRI's Editor Toolbar which can be used to modify an existing shapefile. When edits are complete, once again select the Area Change Tool dialog box to continue.
- Convert shapefile attributes to rasters – When this option is selected, clicking on the *Next* button opens the *Shapefile Attributes to New Rasters* dialog box. This allows you to convert any

numerical attribute contained within the shapefile to a new raster layer.

- Merge edited rasters with original rasters – When this utility is selected, the *Next* button opens the *Merge Edited Rasters* dialog box, which is used to “burn-in” the values from an edited layer into the original layer. Thus, a new layer is created by adding the edited values to the original values.

## 4.4.2 Creating a new shapefile

Creating a new shapefile involves drawing polygons and providing attributes for these polygons.

1. Select the radio button **Create New Shapefile** in the GIS Function box shown in figure 4-8. This feature allows you to create an empty shapefile having either default or user-defined attributes that can be edited.

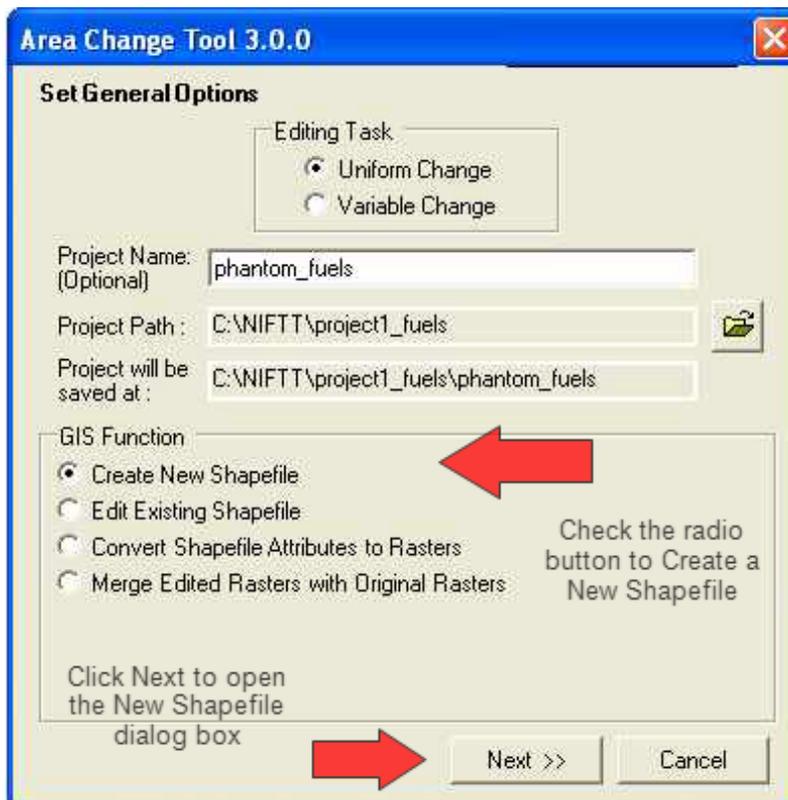


Figure 4-8. Using ACT to create a new shapefile.

2. Click **Next** to open the *New Shapefile* dialog box. This dialog box is used to name the shapefile and to identify any attributes to be included in the shapefile. Attributes should be added to the shapefile if values in the original raster layer may be changed.

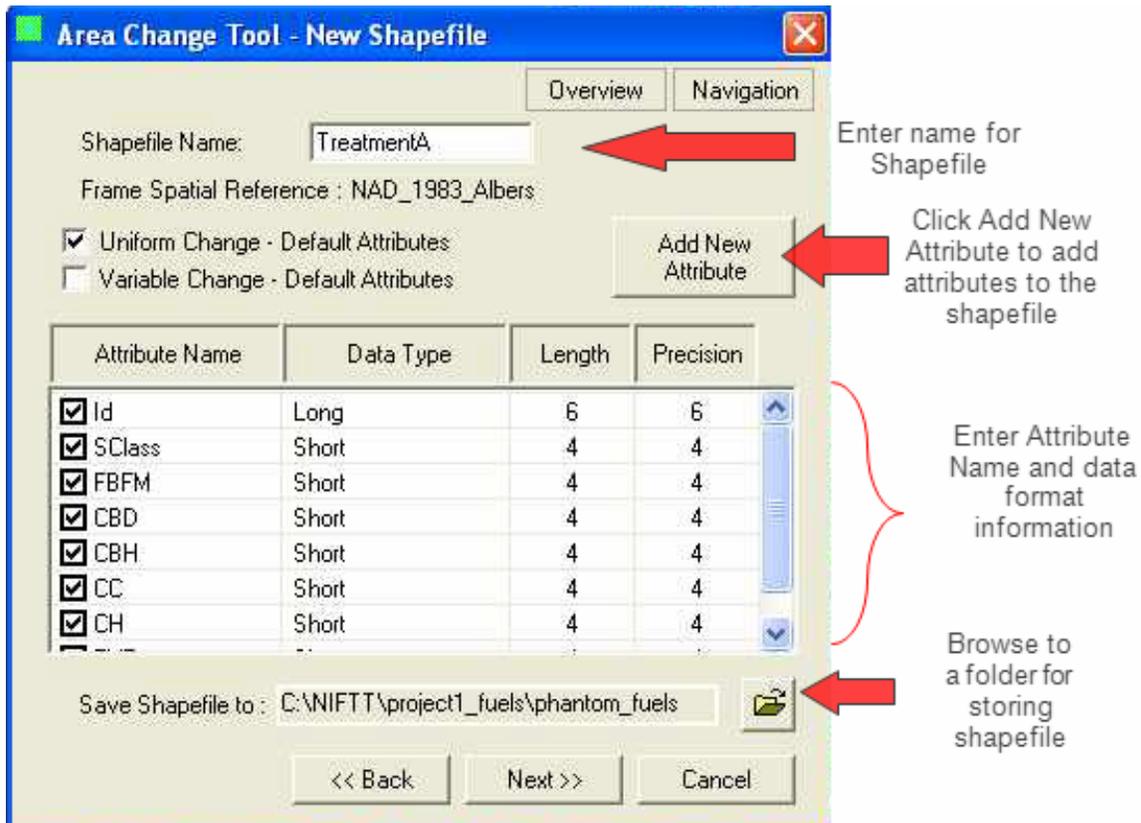


Figure 4-9. The *New Shapefile* dialog box.

3. Enter a name for the shapefile in the *New Shapefile* dialog box as shown (fig. 4-9). Remember that you do not need to add an extension, and the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters ( ~! @\$%^()-+= { } ] \ ? / : ; ' " < > , . ).

Any attribute can be added to the shapefile by clicking Add New Attribute and entering a Name, Data Type, Length, and Precision (number of decimal places). If the shapefile contains multiple polygons, we recommend including an identifier as an attribute to keep track of the

specific polygons. Notice that ACT can add default attributes to the shapefile, if desired. Simply check the Uniform Change - Default Attributes box. The default attributes were established for those interested in editing surface and canopy fuel and succession class layers, which are used to derive fire regime condition class (fig. 4-10). The default attributes are shown in table 4-1.

Table 4-1. Default attributes available for the Uniform Change option.

Attribute Name	Attribute Description
Id	Polygon identifier
S-Class	Succession class
FBFM	Fire behavior fuel model
CC	Canopy cover
CH	Canopy height
CBH	Canopy base height
CBD	Canopy bulk density

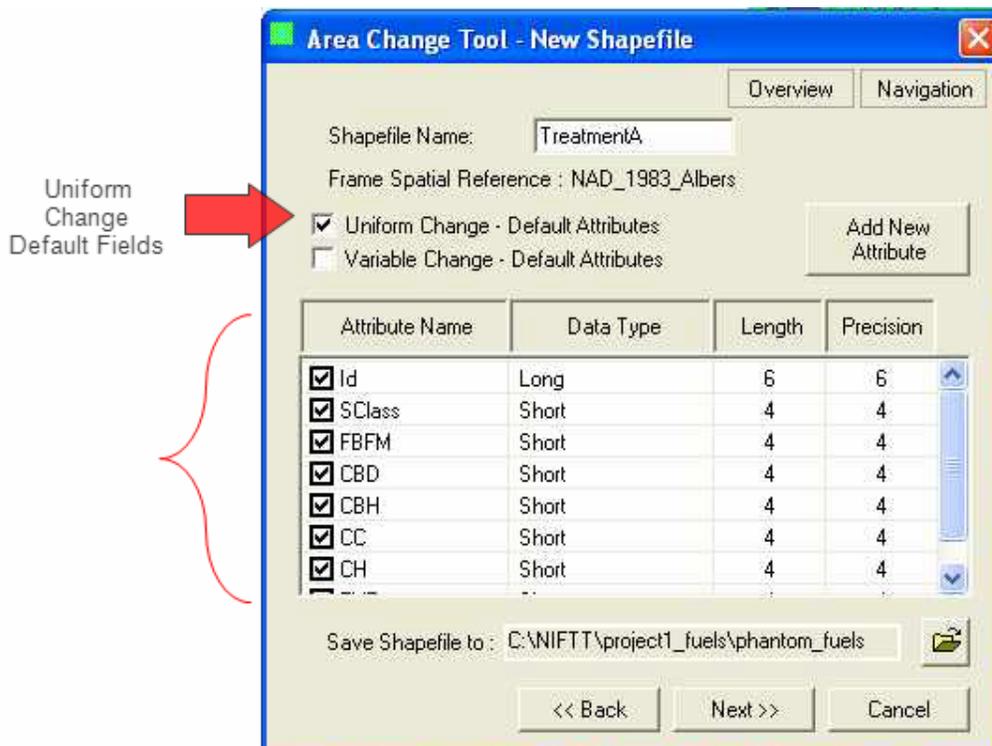


Figure 4-10. Selecting the default attributes for a Uniform Change.

4. Check the box to the left of the attribute name after adding all of the attributes to be edited. Only those attributes that have been checked will be included in the shapefile. Simply check or uncheck selections to add or remove them from your new shapefile.

**Tip:** The “Data Type” drop-down menu allows you to select “Long Integer,” “String,” etc., or you can accept the default values. The “Length” field gives the expected number of characters in a string and the “Precision” field specifies the number of decimal places.

The data format can be modified as needed. Refer to ArcGIS Help for further information on data type.

5. Click **Next** when the dialog box is complete to open the Editor Toolbar and close ACT.

### 4.4.3 Editing an existing shapefile

1. Select the **Edit Existing Shapefile** radio button in the *GIS Function* box if you want to edit an existing shapefile rather than create a new shapefile from scratch (fig. 4-11).

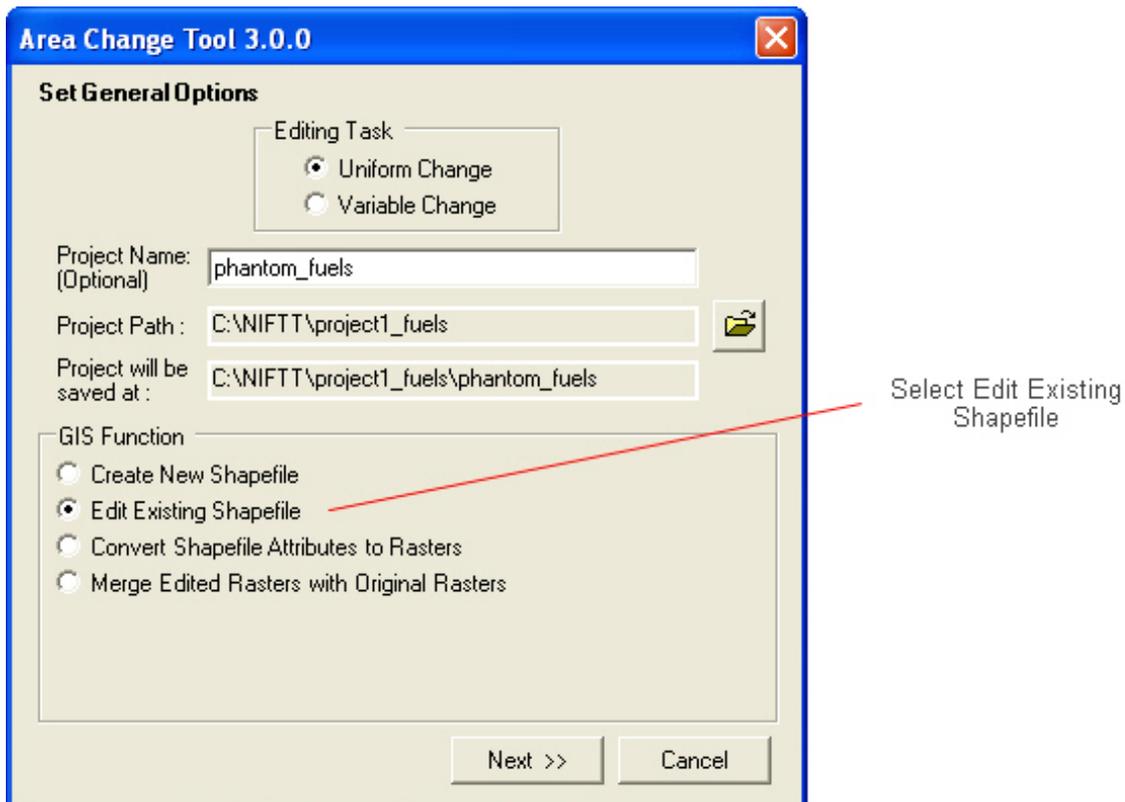


Figure 4-11. Selecting the Edit Existing Shapefile GIS Function from the Area Change Tool dialog box.

2. Click **Next** to open the Editor Toolbar. The Editor Toolbar used by ACT (fig. 4-12) is the same as the Editor Toolbar available in ArcMap and is used to create or edit shapefiles.

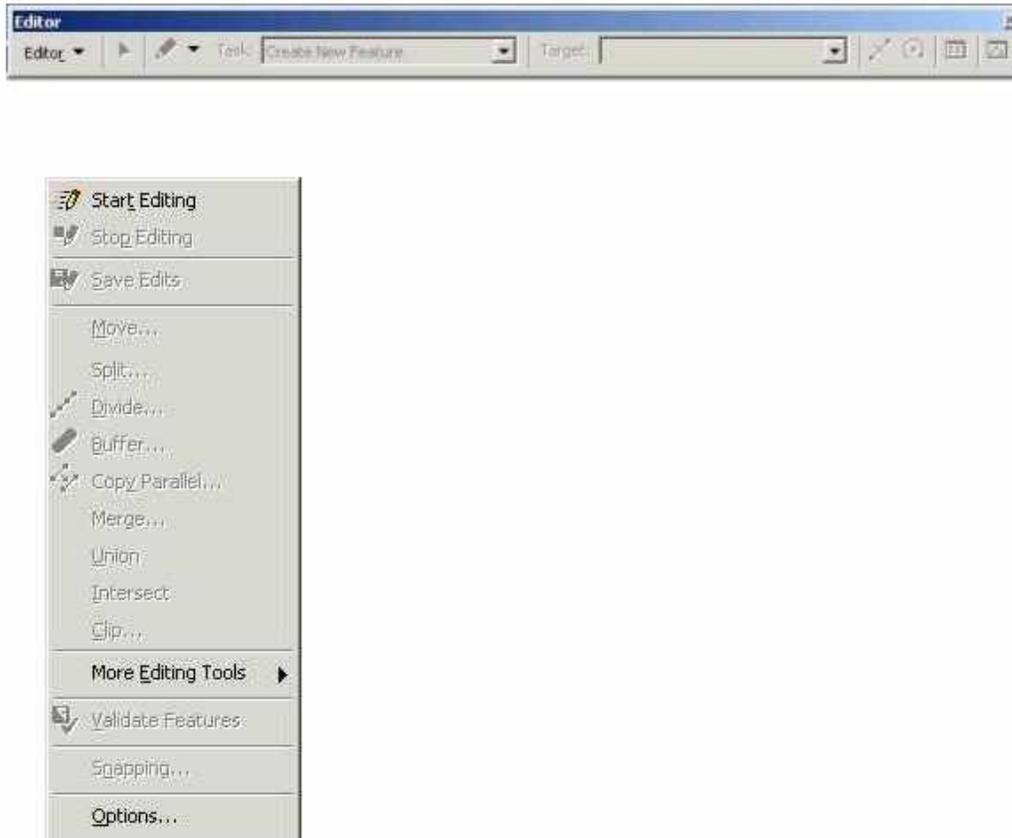


Figure 4-12. Editor Toolbar and Editor drop-down menu.

**Tip:** When editing is complete, return to the Area Change Tool by clicking on the ACT Toolbar.

3. Click on the **Editor** drop-down list and select **Start Editing** as shown in figure 4-12. Select the path that contains the target shapefile. A *Start Editing* dialog box, which is used to select the appropriate path containing the shapefile to be edited, will appear (fig. 4-13)

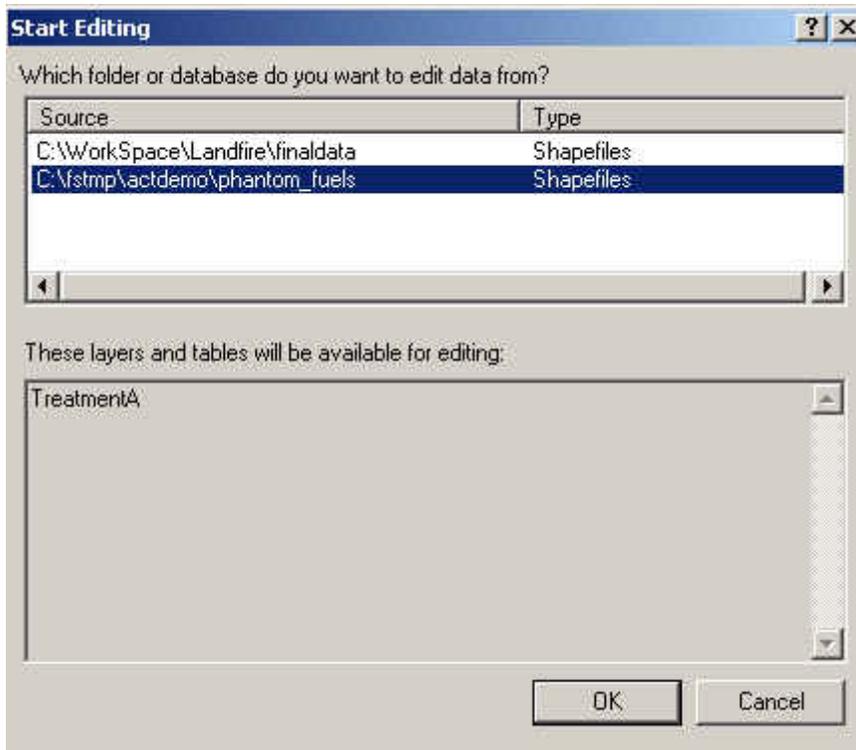


Figure 4-13. The *Start Editing* dialog box indicates layers available for editing.

4. After identifying the path, select an editing task from the *Task* drop-down menu on the Editor Toolbar (fig. 4-14).

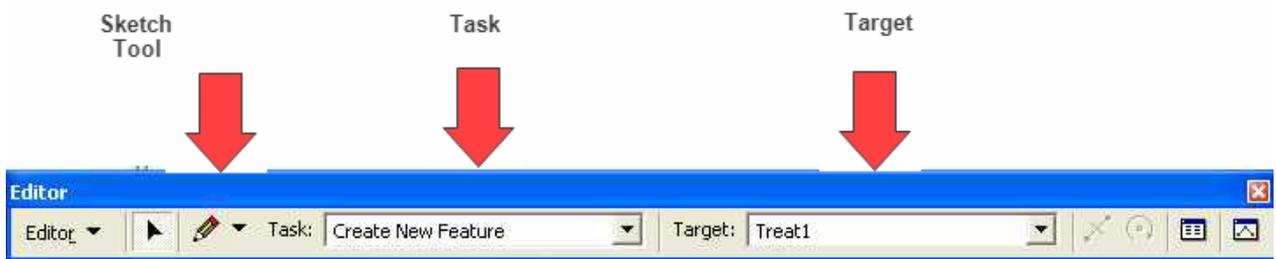


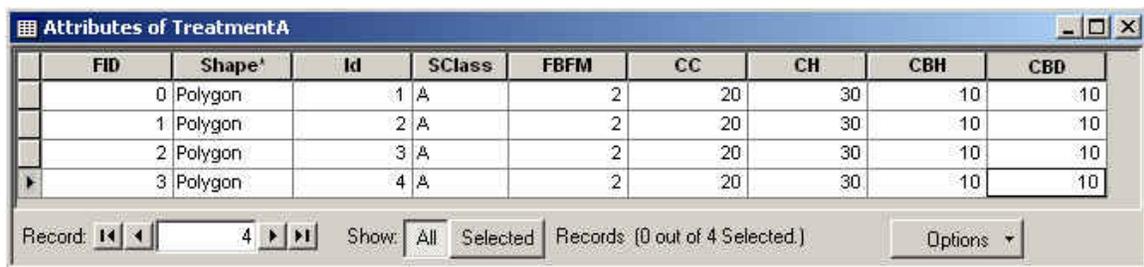
Figure 4-14. Editor Toolbar showing the Sketch Tool, Task, and Target drop-down menus with the shapefile "TreatmentA" selected.

5. Select **Create New Feature** if your objective is to add polygons. Select **Reshape Feature** if your objective is to change the shape of existing polygons. If your objective is to modify values in the attribute table, simply open the attribute table and change the values.

6. Finally you will need to select the appropriate shapefile from the *Target* drop-down menu on the Editor Toolbar.
7. Click on the *Sketch Tool* icon and begin drawing a polygon. Consult ArcMap's Help utility for more information on creating and editing polygons. We recommend that you save your edits frequently (for example, after you have completed each polygon). When you have finished drawing all polygons within your shapefile, be sure to select **Save Edits**.

**Tip:** If you happen to make a mistake in your drawing, it may be easier to delete the polygon and start over rather than trying to edit an existing polygon.

8. Next, you need to provide appropriate values for the attributes within the shapefile. Open the attribute table of the shapefile you have created by right clicking on the new shapefile in ArcMap's Table of Contents and select **Open Attribute Table** (fig. 4-15).



FID	Shape*	Id	SClass	FBFM	CC	CH	CBH	CBD
0	Polygon	1	A	2	20	30	10	10
1	Polygon	2	A	2	20	30	10	10
2	Polygon	3	A	2	20	30	10	10
3	Polygon	4	A	2	20	30	10	10

Figure 4-15. Example attribute table of a shapefile with four polygons containing the following attributes: *Id* = polygon identifier, *S-Class* = succession class, *FBFM* = fire behavior fuel model, *CC* = canopy cover, *CH* = canopy height, *CBH* = canopy base height, and *CBD* = canopy bulk density.

9. Enter the values that you wish to use in the appropriate cells of your attribute table. When finished, select **Editor > Stop Editing** and follow the prompt to save your work. Close the Editor Toolbar and the attribute table.

**Tip:** Be sure to press **Enter** after adding the last value and then close the attribute table before continuing.

10. When finished editing, select **Editor > Stop Editing** and follow the prompt to save your work. Close the Editor Toolbar and the attribute table.

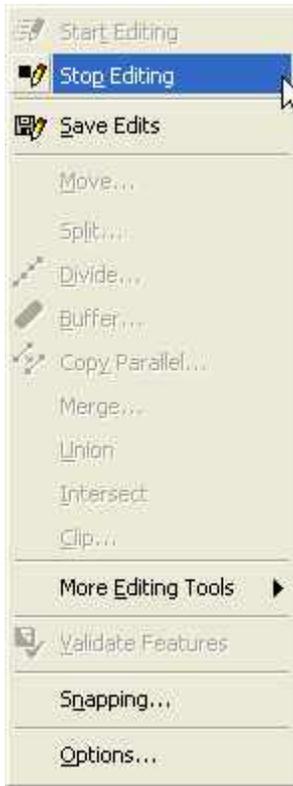


Figure 4-16. Stop editing.

#### 4.4.4 Converting shapefile attributes to rasters

The next step in the Uniform Change process is to convert a shapefile's attributes of interest to new raster layers. The GIS function *Convert Shapefile Attributes to Rasters* enables the user to convert every attribute of a shapefile to a new raster layer.

1. Re-start ACT by clicking on the toolbar.
2. ACT will automatically open to the *Convert Shapefile Attributes to Rasters* dialog box. Click **Next** (fig. 4-17).

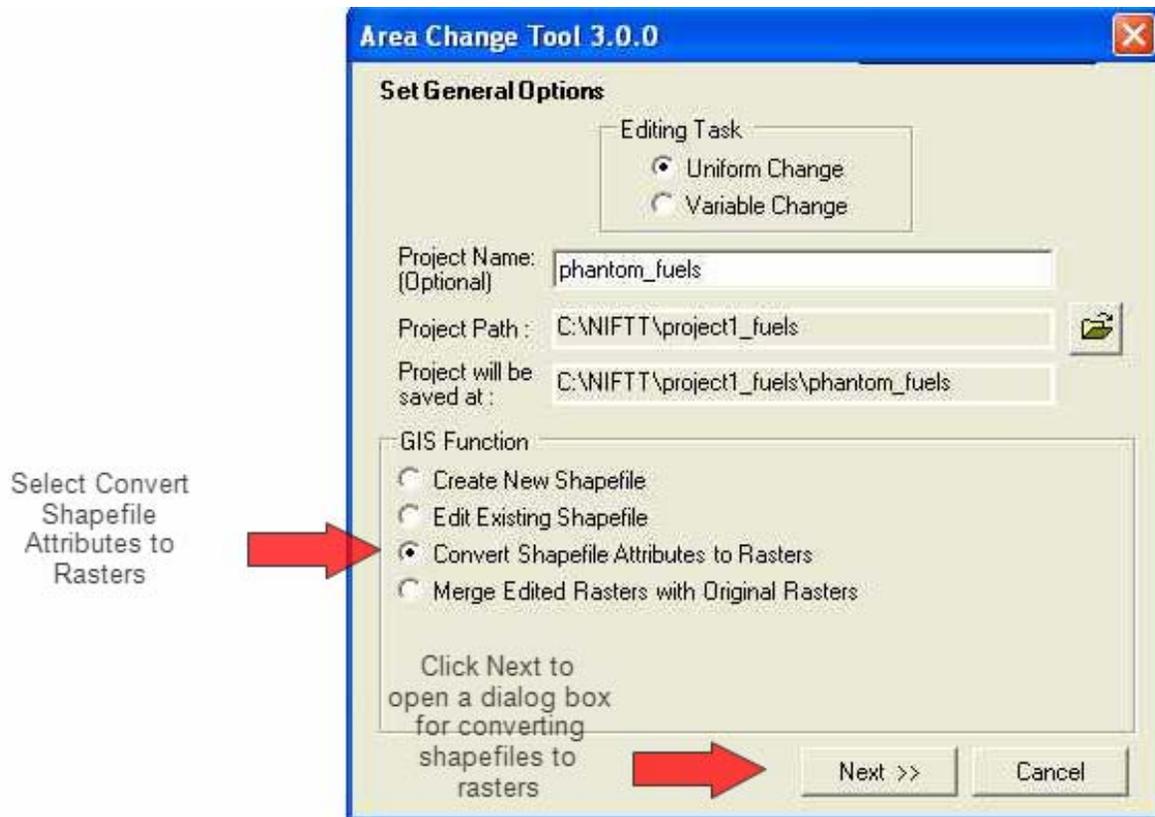


Figure 4-17. Selecting Convert Shapefile Attributes to Rasters function.

3. The following dialog box will open (fig. 4-18):

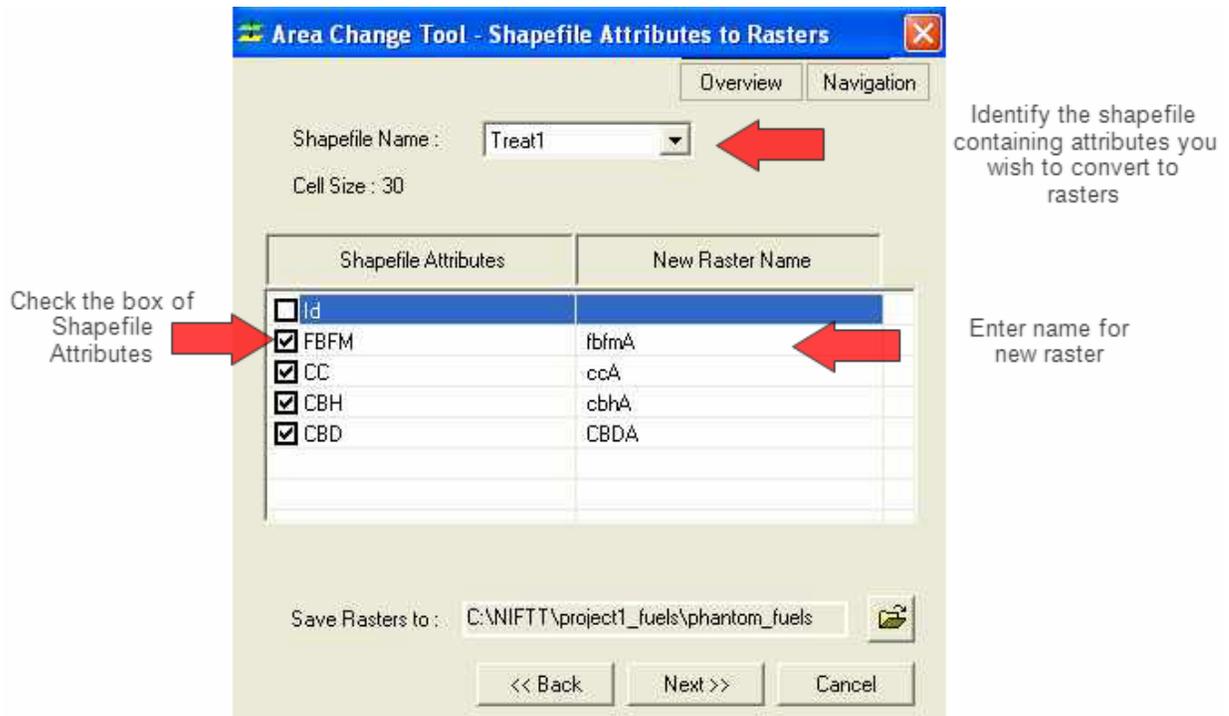


Figure 4-18. *Shapefile Attributes to New Rasters* dialog box. In this example, the shapefile contains seven attributes: *id* = polygon identifier, *S-Class* = succession class, *FBFM* = fire behavior fuel model, *CC* = canopy cover, *CH* = canopy height, *CBH* = canopy base height and *CBD* = canopy bulk density.

**Note:** The target shapefile must be present in ArcMap's Table of Contents before its attributes can be converted to new rasters.

4. Select the shapefile containing the attributes to be converted to rasters by using the drop-down menu near the top of the dialog box (fig. 4-18). Enter a name for each new raster by double-clicking in the box under *New Raster Name*. Once you have entered a new raster name, the box to the left of each attribute's name is enabled, and you can check the attributes you want to convert. Only attributes that are checked will be converted to a new raster.

**Note:** Remember that you do not need to add an extension, and the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters (`~! @$^()-+={}[]\?/:;"'<>.,`).

**Tip:** You will not be able to check boxes in the "Shapefile Attributes" window until you double-click in the corresponding "New Raster Name" cell and enter a name.

5. If you have chosen a Project, the path will be automatically selected. Click **Next** to begin the conversion process. The new raster layers will automatically be added to the ArcMap Table of Contents.

**Note:** A progress bar located at the bottom of the dialog box indicates that conversion is proceeding.

#### 4.4.5 Merging edited rasters with original rasters

The last step in the Uniform Change process is to merge the newly created rasters into the original or target rasters, thereby creating a new raster that covers the full extent of the analysis area and that reflects the completed edits.

1. First make sure that the Edited Rasters and Target Rasters are available in your ArcMap project. Only those layers shown in the Table of Contents will be available for you to select in the *Merge Change Raster* dialog box.
2. ACT will automatically open the *Merge Edited Rasters with Original Rasters* dialog box (fig. 4-19) to merge the Edited and Target rasters.

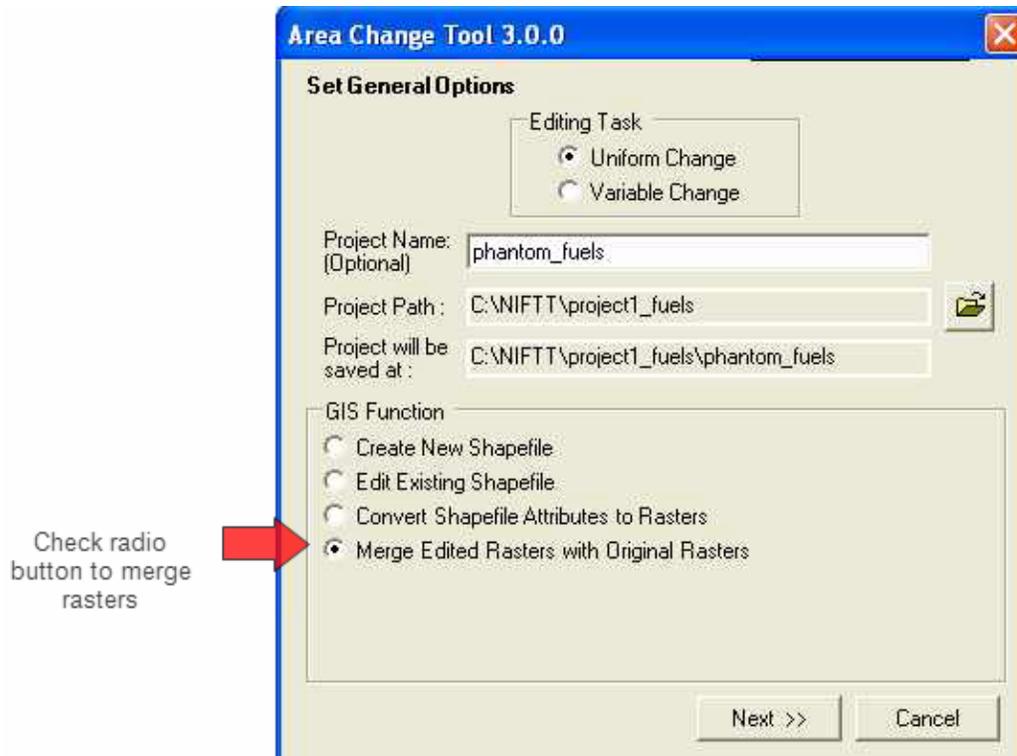


Figure 4-19. Selecting the *Merge Edited Rasters with Original Rasters* function from the Area Change Tool dialog box.

3. Click **Next** to open the following *Merge Rasters* dialog box:

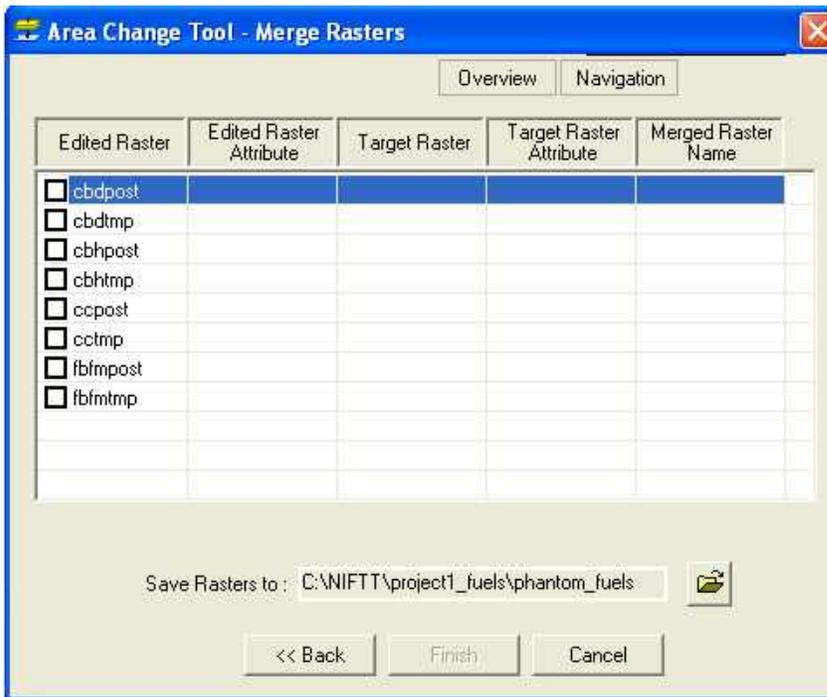


Figure 4-20. The *Merge Rasters* dialog box identifies the rasters and attributes to be merged.

The *Merge Rasters* dialog box (fig. 4-20) requires the following:

- Edited Raster – The raster created from the shapefile containing the edited information. The list of available rasters includes any raster currently in the ArcMap Table of Contents. The Edited Raster is merged into the original or target raster.
  - Edited Raster Attribute – The attribute in the Edited Raster that will be used to overwrite the corresponding attribute from the original or target raster. The drop-down menu includes all attributes in the Edited Raster.
  - Target Raster – The original or target raster that will be merged with the Edited Raster. The drop-down menu includes any raster that appears in the ArcMap Table of Contents.
  - Target Raster Attribute – The attribute from the target raster that will be overwritten by the attribute from the Edited Raster.
  - Merged Raster Name – The new raster created by merging the edited and original rasters together.
4. Highlight the row containing an Edited Raster that you wish to use to overwrite an existing raster. Press the **Enter** key to move your cursor to the next column labeled *Edited Raster Attribute*. The drop-down menu includes all attributes in the Edited Raster.
  5. Next, select the appropriate attribute and use **Enter** to advance the cursor to the next column (*Target Raster*). Select the target raster from a drop-down menu that includes every raster in the ArcMap Table of Contents. Again, press **Enter** to advance your cursor to the next column (*Target Raster Attribute*). Select the attribute of the target raster that will be overwritten by the Edited Raster. Use **Enter** to advance your cursor to the last column (*Merged Raster Name*) of the dialog box.
  6. Enter a name for the new raster that will result from merging the Edited Raster with the Target Raster. Lastly, place a check in the box associated with the Edited Raster in the first column.

**Note:** Remember that you do not need to add an extension, and the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters (`~! @#$%^&*+={}[]\|?/:;'"<>.,`).

If necessary, use the browse button located to the right of the Save Rasters to window to navigate to an appropriate folder for storing the newly created rasters.

7. Click **Finish** to initiate the processing of the new raster layers which will automatically be added to the ArcMap Table of Contents. The Uniform Change process is now complete, and ACT returns to the first dialog box.

**Tip:** Rest your cursor on the “Navigation” button located at the upper right corner of the dialog box for help in moving around the “Merge Rasters” dialog box.

Be sure to follow the usual naming conventions used with ACT.

## 4.5 Variable Change editing

The Variable Change editing process involves changing pixel values in a non-uniform manner. Frequently, the edits are made within polygons that denote a target area. However, these changes can also be made across the full extent of the data layer(s) without the use of polygons.

1. Open ArcMap to start the editing process, add all layers of interest, and then click on the ACT Toolbar - 
2. The Area Change Tool dialog box will open ([fig. 4-21](#)). Select the radio button in the *Editing Task* box to the left of *Variable Change*.
3. Enter a *Project Name* (optional) and *Project Path* as demonstrated in [figure 4-7](#). The project name will establish a unique folder for storing all outputs; leave this entry empty if a unique output folder is not desired.

### 4.5.1 GIS functions

There are seven GIS functions available when the Variable Change option is selected. These include:

1. Create a new shapefile – The shapefile is used to delineate polygons where edits are to occur. When this option is selected, the *Next* button opens the *New Shapefile* dialog box.
2. Edit an existing shapefile – When this option is selected, the *Next* button closes ACT and opens ESRI's Editor Toolbar. The *Editor* Toolbar can be used to modify an existing shapefile. When the edits are complete, once again open the main Area Change Tool dialog box to continue.
3. Convert shapefile attributes to rasters – When this option is selected, clicking on the *Next* button opens the *Shapefile Attributes to New Rasters* dialog box. This utility allows you to convert any numerical attribute contained within the shapefile to a new raster layer.
4. Combine rasters – This function is used to integrate multiple data layers by selecting attributes from rasters to join into a combine raster. Clicking on the *Next* button opens the *Combine Rasters* interface.
5. Edit the raster attribute table – When this option is selected, clicking on the *Next* button opens the *Edit Rasters Manager*. This dialog box can be used to transfer an attribute table to Excel, transfer edited data in Excel to an attribute table, transfer an attribute table to Access, or to transfer edited data in Access to an attribute table.
6. Convert raster attributes to rasters – This option allows you to create individual raster layers from the attributes of a combined layer. Clicking on the *Next* button opens the *Raster Attributes to Rasters* dialog box.
7. Merge edited rasters with original rasters – When this utility is selected, the *Next* button opens the *Merge Edited Rasters* dialog box. This function is used to “burn-in” the values from an edited layer into the original layer. Thus, a new layer is created by adding the edited values to the original values.

Although ACT was designed to follow a sequence of processing steps, it is not necessary to follow this sequence or to complete all of the steps. Each of the GIS functions can be used independently as a stand-alone process. For example, if you plan to make changes throughout the entire extent of your analysis area, there is probably no need to create a shapefile to constrain the changes to a limited area. In this instance, the editing process might actually begin with combining a suite of rasters.

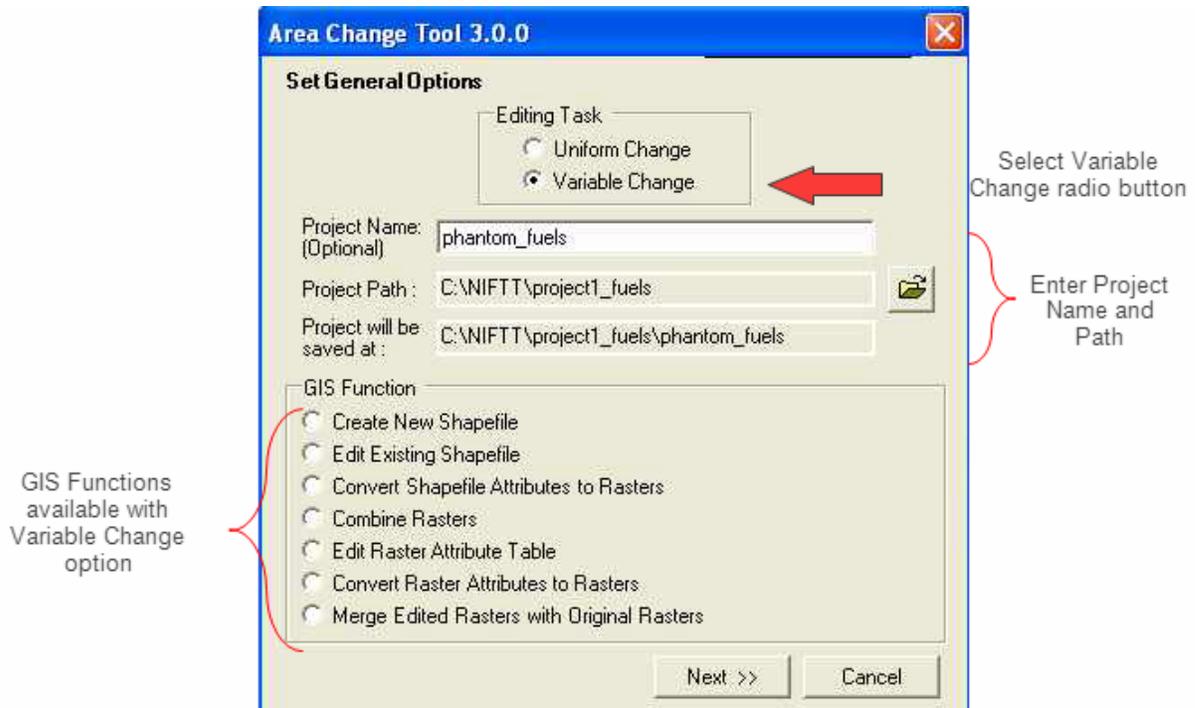


Figure 4-21. *Area Change Tool* dialog box showing the GIS functions available when conducting Variable Change edits.

## 4.5.2 Creating a new shapefile

The process for creating a new shapefile involves two steps. First the polygons are delineated. The second step involves attributing the polygons drawn in the first part of the process.

1. First, select the radio button *Create New Shapefile* in the GIS Function box as shown in figure 4-22. This feature allows you to create an empty shapefile having either default or user-defined attributes that can be used during the editing session.

2. Click **Next** to open the *New Shapefile* dialog box as shown in [figure 4-23](#). This dialog box is used to name the shapefile and to identify any attributes you wish to include. Attributes should be added to the shapefile if you intend to change their values in the original raster layer.

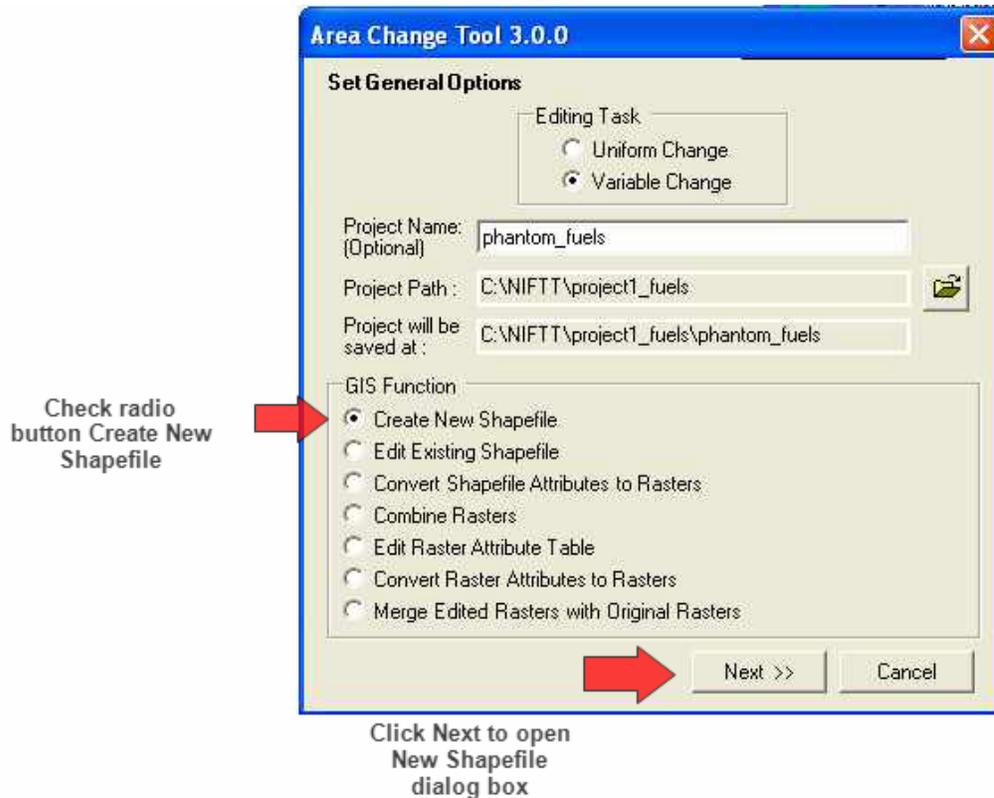


Figure 4-22. Using the *Area Change Tool* dialog box to create a new shapefile.

3. Enter a name for your shapefile (fig. 4-23). Remember that you do not need to add an extension, and the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters ( ` ~ ! @ # \$ % ^ ( ) - + = { } [ ] \ | ? / : ; ' " < > , . ) .

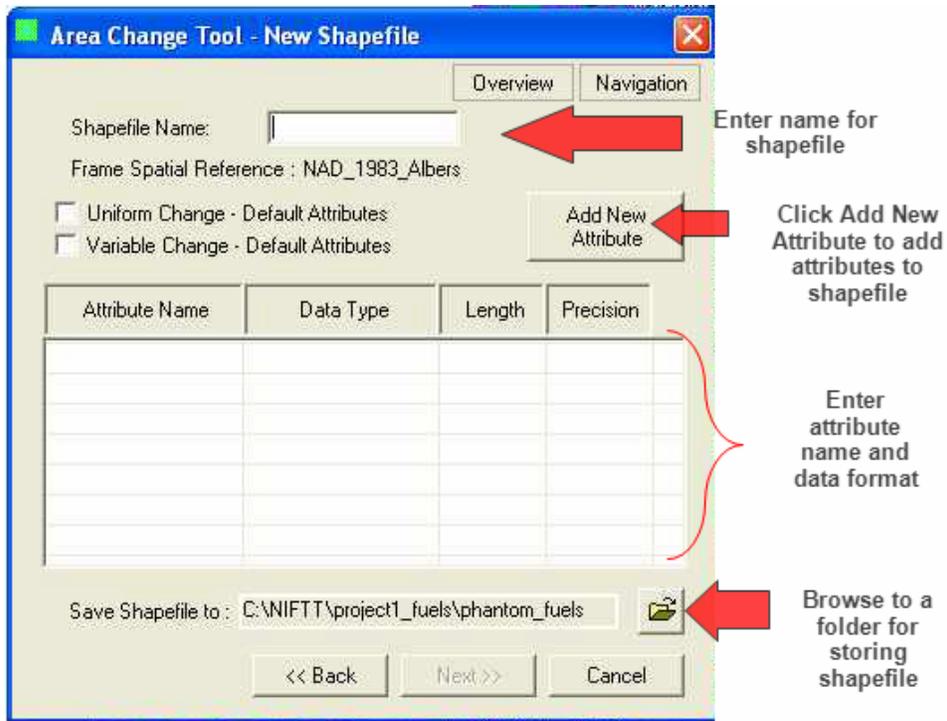


Figure 4-23. Creating a new shapefile.

You can add any attribute to the shapefile by clicking **Add New Attribute**. You will need to provide an Attribute Name, Data Type, Length, and Precision (number of decimal places). If the shapefile contains multiple polygons, we recommend that you include an identifier as an attribute to keep track of the specific polygons. Checking the *Variable Change - Default Attributes* box adds an identifier for individual polygons (fig. 4-24).

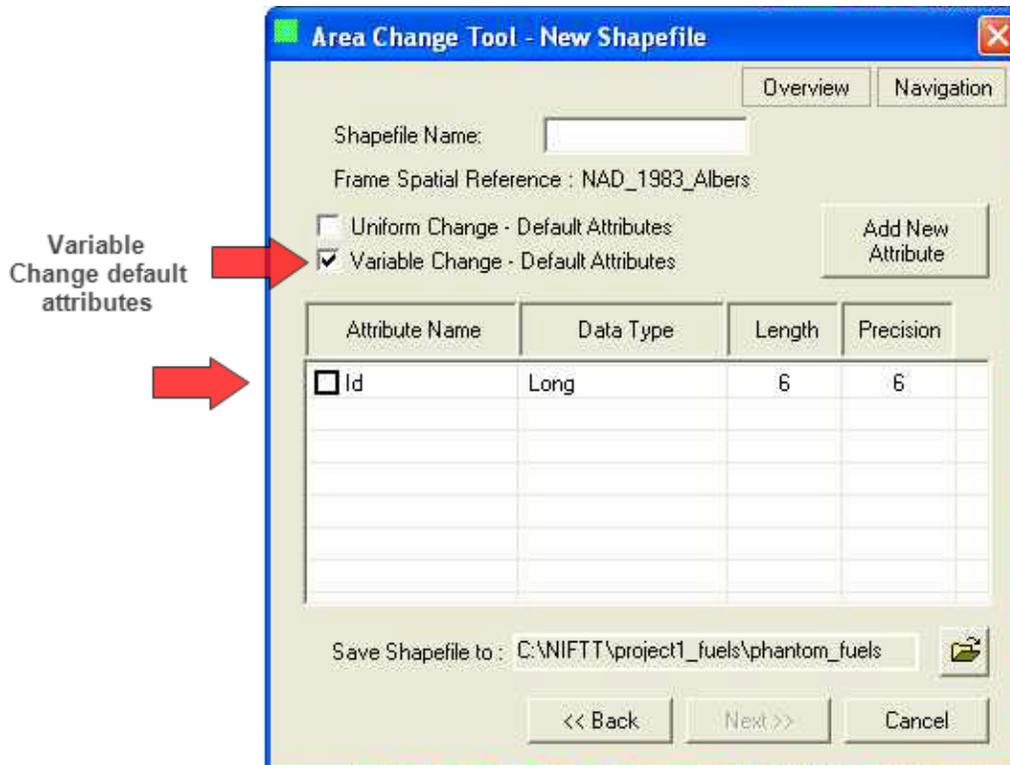


Figure 4-24. Selecting default attributes for *Variable Change*.

Be sure to check the box to the left of the *Attribute Name* after adding all attributes. Only those attributes that have been checked will be included in the shapefile. Simply check or uncheck selections to add or remove them.

**Tip:** Using the “Data Type” drop-down menu allows you to choose a data type such as “Long Integer,” “String,” etc. (or you can accept the default values). The “Length” field gives the expected number of characters in a string. The “Precision” field specifies the number of decimal places. The data format can be modified as needed. Refer to ArcGIS Help for further information.

4. Click **Next** when the dialog box is complete to open the Editor Toolbar and close the *Area Change Tool* dialog box.

### 4.5.3 Editing an existing shapefile

1. Select the **Edit Existing Shapefile** radio button in the *GIS Function* box if you want to edit an existing shapefile rather than create a new shapefile from scratch (fig. 4-25).

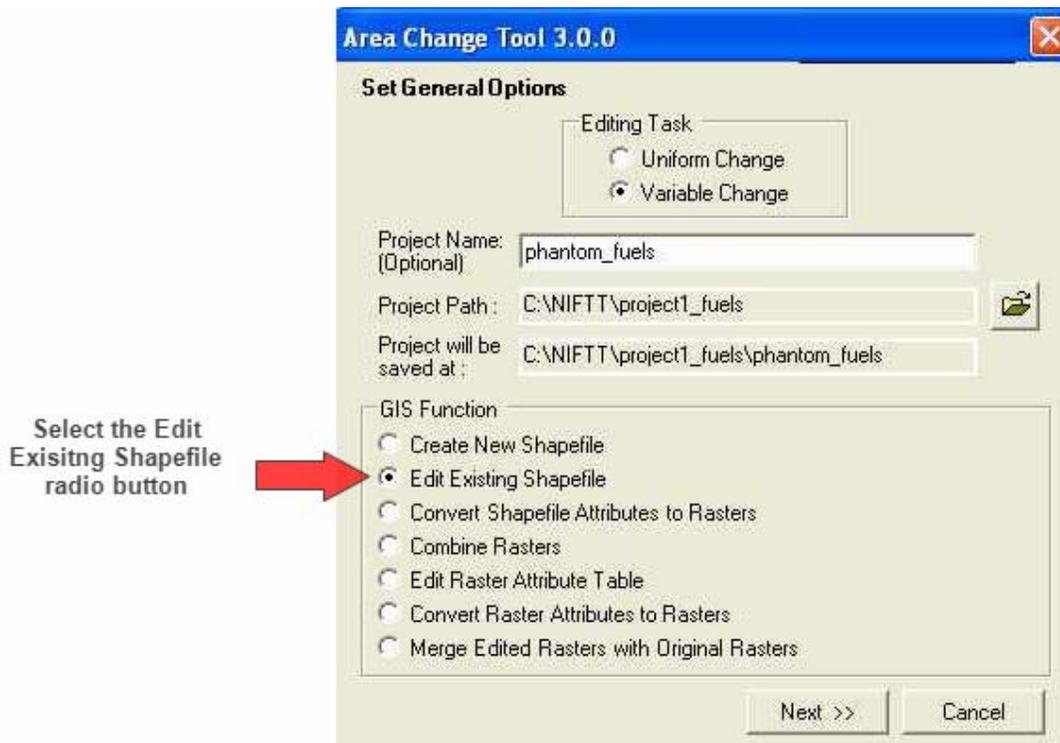


Figure 4-25. Use the *Edit Existing Shapefile* option to edit existing shapefiles.

2. Click **Next** to open the Editor Toolbar (fig. 4-26), which can be used to add new polygons or to modify the shape of existing polygons. In addition, select this option if you need to edit the values of an exiting shapefile's attribute table. The Editor Toolbar used by ACT is exactly the same as the Editor Toolbar available in ArcMap.



Figure 4-26. The *Editor* Toolbar.

To begin edits click on Editor and select Start Editing from drop-down menu



Figure 4-27. Drop-down Editor menu.

3. Click on the **Editor** drop-down list and select **Start Editing**, as shown in figure 4-27. As before, you will need to identify the path that contains the target shapefile. A *Start Editing* dialog box, which is used to select the appropriate path containing the shapefile to be edited, will appear (fig. 4-28).

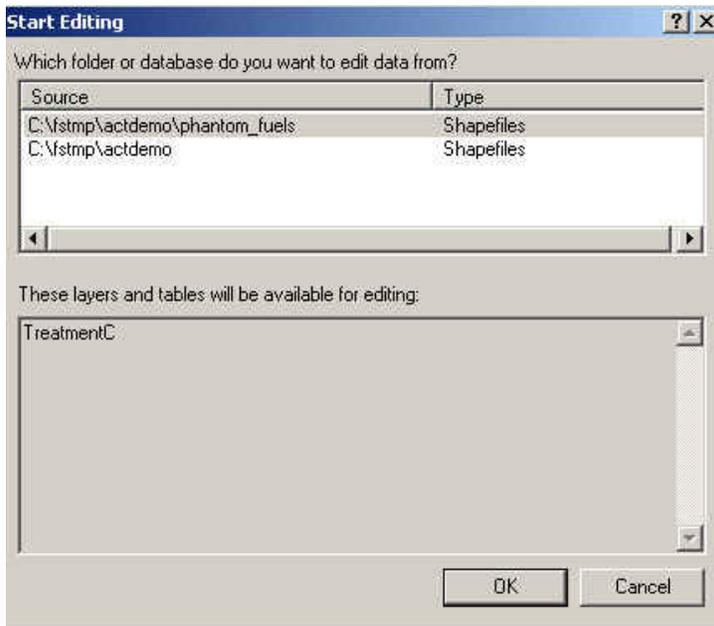


Figure 4-28. The *Start Editing* dialog box shows layers available for editing within the selected path.

4. After identifying the path, select an editing task from the *Task* drop-down menu on the Editor Toolbar (fig. 4-29).

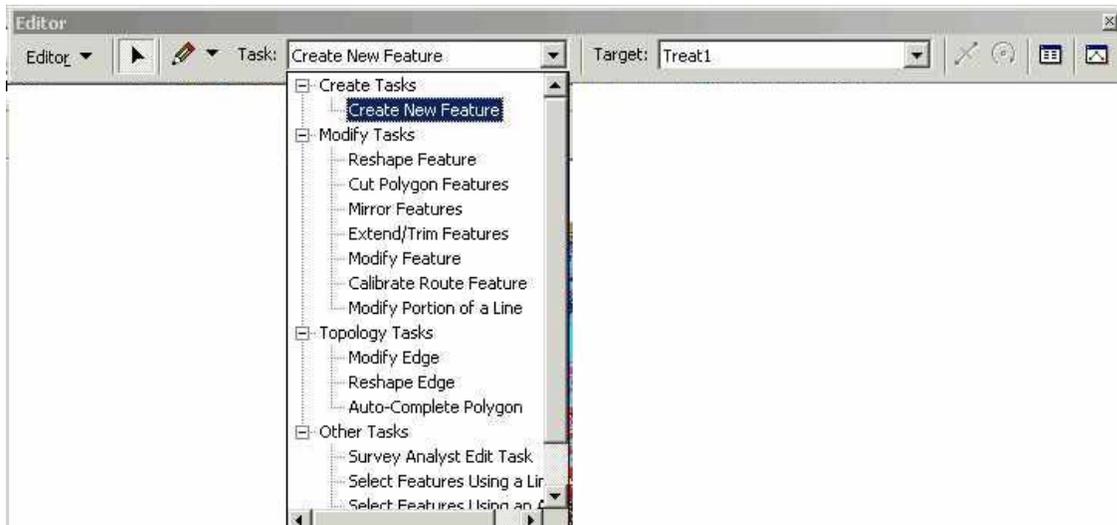


Figure 4-29. Selecting an editing *Task* from the Editor Toolbar.

5. Select **Create New Feature** if your objective is to add polygons. Select **Reshape Feature** if your objective is to change the shape of existing polygons. If your objective is to modify values in the attribute table, simply open the attribute table and change the values.
6. Finally, you will need to select the appropriate shapefile from the *Target* drop-down menu on the Editor Toolbar (fig. 4-30).

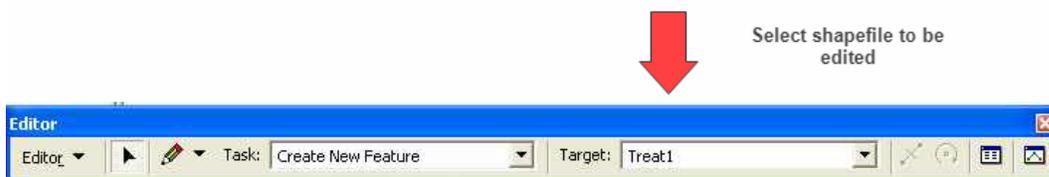


Figure 4-30. Use the *Target* drop-down menu on the *Editor* Toolbar to select an appropriate shapefile.

7. Select the **Sketch Tool** icon (fig. 4-31) to begin drawing a polygon. Consult ArcMap's Help utility to learn more about creating and editing polygons. We recommend that you save edits frequently

(for example, after completing each polygon). When you have finished editing, select **Editor > Stop Editing > Save Edits**.

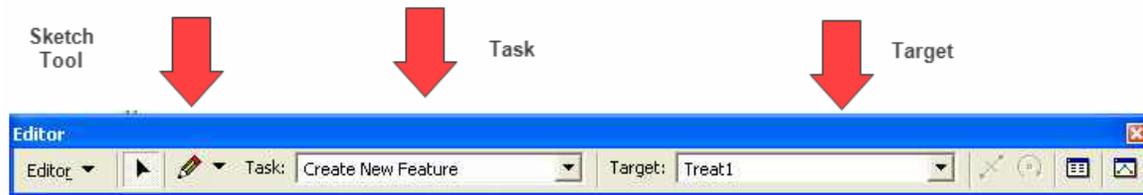


Figure 4-31. Editor Toolbar showing the *Sketch Tool*, *Task* (“*Create New Feature*”), and *Target* shapefile (“*TreatmentC*”).

**Tip:** If you happen to make a mistake in your drawing, it may be easier to delete the polygon and start over rather than trying to edit an existing polygon.

8. Now you will need to provide the appropriate values for the attributes within the shapefile. Open the attribute table of the shapefile you created by right clicking on the new shapefile in the ArcMap Table of Contents (fig. 4-32) and select **Open Attribute Table**.

FID	Shape*	Id	SClass	FBFM	CC	CH	CBH	CBD
0	Polygon	1	A	2	20	30	10	10
1	Polygon	2	A	2	20	30	10	10
2	Polygon	3	A	2	20	30	10	10
3	Polygon	4	A	2	20	30	10	10

Figure 4-32. Example attribute table of a shapefile with four polygons and containing the following attributes: *Id* = polygon identifier, *S-Class* = succession class, *FBFM* = fire behavior fuel model, *CC* = canopy cover, *CH* = canopy height, *CBH* = canopy base height, and *CBD* = canopy bulk density.

9. Enter the values that you wish to use in the appropriate cells of the attribute table.

**Note:** Be sure to press **Enter** after adding the last value and then close the attribute table before continuing.

- When you are finished, save your edits by selecting **Editor > Stop Editing > Save Edits**. Close the Editor Toolbar and the attribute table.

**Tip:** When you have finished editing, return to the Area Change Tool dialog box by clicking on the ACT Toolbar.

#### 4.5.4 Converting shapefile attributes to rasters

The next step in the Variable Change process is to convert the attributes of interest in a shapefile to new raster layers. The GIS function Convert Shapefile Attributes to Rasters enables the user to convert each attribute of a shapefile to a new raster layer. Select the radio button to the left of Convert Shapefile Attributes to Rasters and click Next (fig. 4-33).

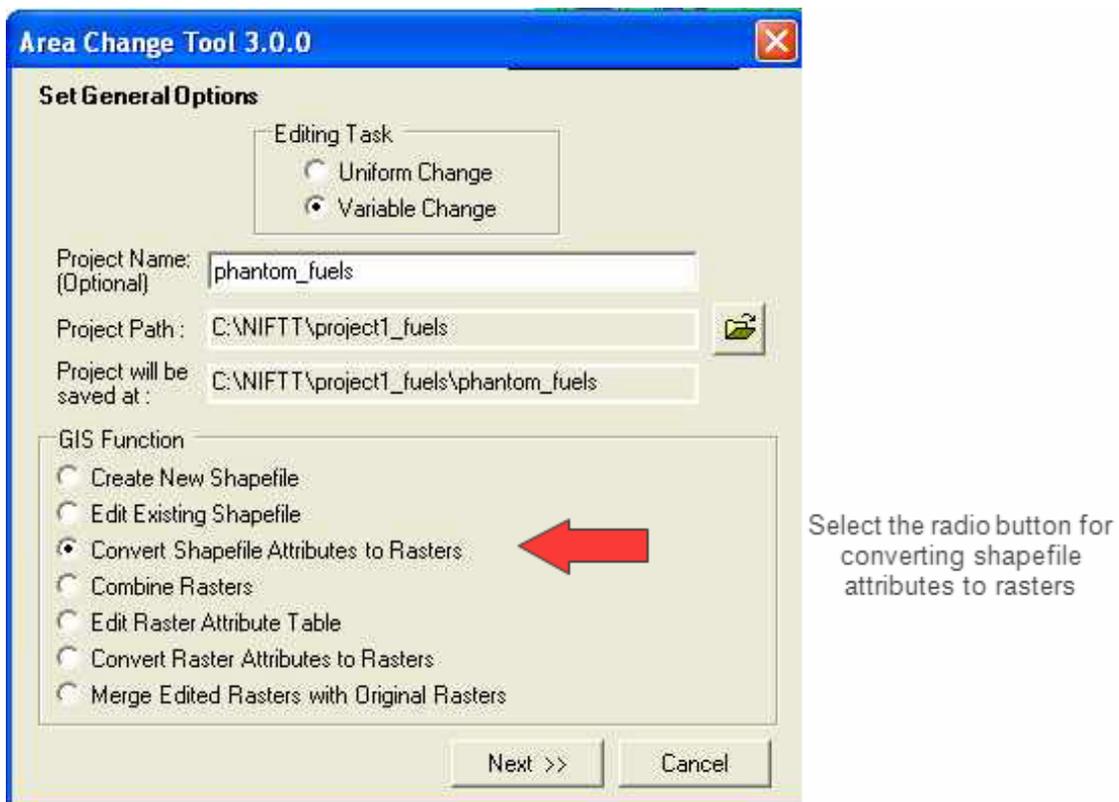


Figure 4-33. Converting shapefile attributes to rasters.

1. Click **Next** to open the following dialog box (fig. 4-34):

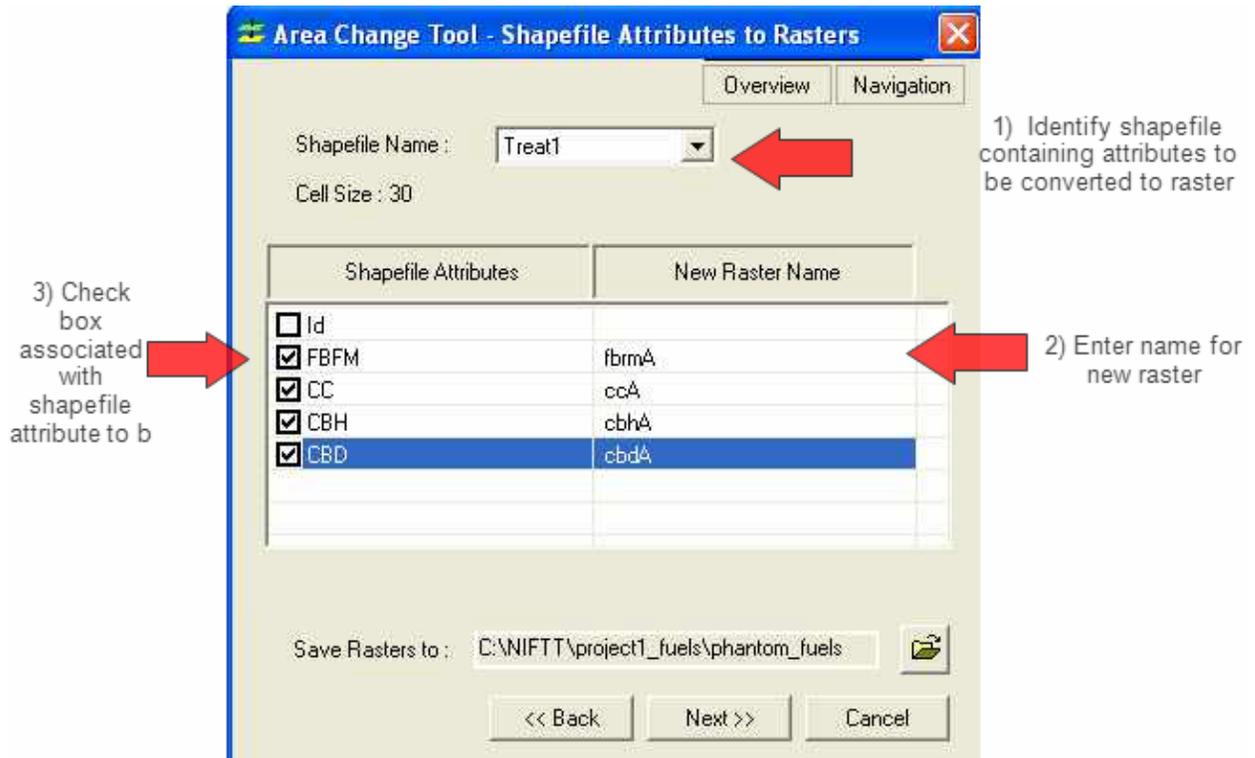


Figure 4-34. Shapefile Attributes to Rasters dialog box. In this example, the shapefile contains seven attributes: *Id* = polygon identifier, *S-Class* = succession class, *FBFM* = fire behavior fuel model, *CC* = canopy cover and *CH* = canopy height, *CBH* = canopy base height and *CBD* = canopy bulk density.

**Tip:** The target shapefile must exist in ArcMap's Table of Contents before attributes can be converted to new rasters.

2. Select the shapefile containing the attributes to be converted to rasters from the drop-down menu near the top of the dialog box (fig. 4-34). Name each new raster by double-clicking in the box under *New Raster Name* and enter a name. Once a new raster name has been entered, the box to the left of each attribute's name is enabled and you can then check the attributes to convert. Only attributes that are checked will be converted to a new raster.

**Note:** Remember that you do not need to add an extension, and the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters (~! @#\$%^()-+={}[]\?/:;'"< >,.).

**Tip:** You will not be able to check boxes in the “Shapefile Attributes” window until you double-click in the “New Raster Name” column and enter a name.

3. When you have completed the dialog box, use the browse button to identify the path and folder for storing the new rasters. Click **Next** to begin the conversion process. The new raster layers will automatically be added to the ArcMap Table of Contents.

**Note:** A progress bar located at the bottom of the dialog box indicates that conversion is proceeding.

### 4.5.5 Combining rasters

Combining rasters is an effective technique for integrating multiple data layers at the pixel level. When rasters are combined, each cell of the combined raster is assigned to one of the unique combinations of cell values from the input layers. The cell values of the input layers become attributes of the combined layer (see ArcGIS Help for a thorough discussion on combining raster layers).

The maximum number of grids that can be input into the ArcGIS Combine function varies with hardware platform. The combine function is also limited by the range of grid values in each layer. No more than 10 million unique combinations are possible. However, ArcGIS currently determines the number of potential combinations on the basis of maximum grid values in each of the layers to be combined. For example, if a layer has two unique values with grid values of 100 and 101, then ArcGIS assumes that there are actually 101 unique values in that layer. If this layer is combined with a similar layer, ArcGIS assumes that the combine function will result in 10,201 potential values even though in reality, there could be only four potential values representing the unique combinations of both layers.

**Tip:** If you receive an error message indicating that the “Combine” function will result in over 10 million unique combinations, you may be able to remedy the situation by:

- Dropping one or more of the input layers,
- Reclassifying the values of the input layers to decrease their maximum values,
- Classifying the values of the input layers to reduce the number of potential combinations, or

- Combining the layers in stages. For example, combine the first three layers in one step, the second three layers in another step, and then lastly combine the two combined layers.

All input layers to be combined must be added to your ArcMap project before initiating the Combine function. After adding all layers of interest to ArcMap, select the radio button to the left of *Combine Rasters* (fig. 4-35) and click the **Next** button to open the *Combine Rasters* dialog box.

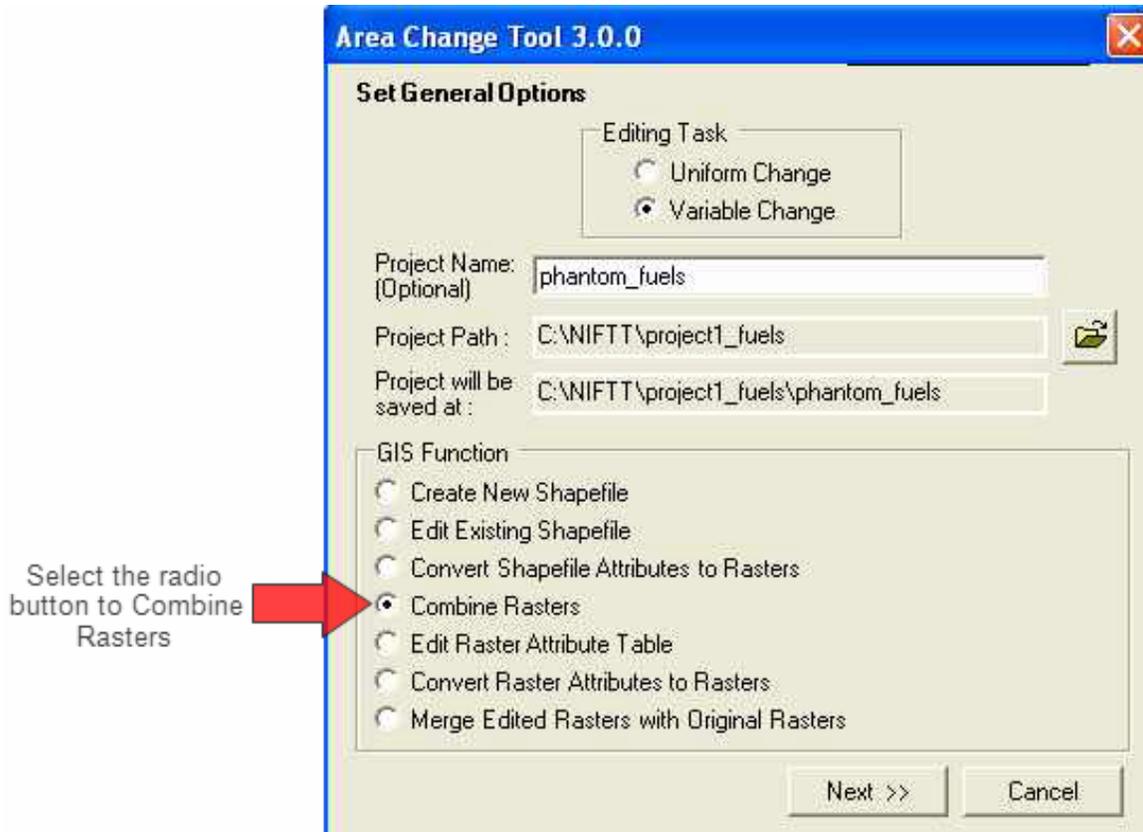


Figure 4-35. Selecting the *Combine Rasters* function.

The *Combine Rasters* dialog box (fig. 4-36) is used to name the new combined layer, to order layers as they will appear in the Value Attribute Table, and to identify additional attributes from the input layers that should be included in the Value Attribute Table of the combined layer. Complete the following:

1. First, provide a name for the Combine Raster in the box labeled *New Raster Name*.

**Note:** Remember that you do not need to add an extension, and the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters (~! @\$%^()-+={}[]\?/:;"'< >,.).

- Next, identify the rasters layers that are to be combined by placing a check in the box associated with any raster to be included. The *Rasters to Combine* column includes any rasters that have been loaded into your ArcMap project. The order in which rasters are checked will determine how they are arranged in the Value Attribute Table of the combined layer. The column labeled *Attrib Order* automatically displays the sequence in which layers are checked. The last column in the dialog box, *Join Attributes*, adds any ancillary attributes, such as descriptive labels of a layer, into the Value Attribute Table of the combined layer. To include an ancillary attribute, double-click on the appropriate cell and then check the boxes of the attributes to be included.

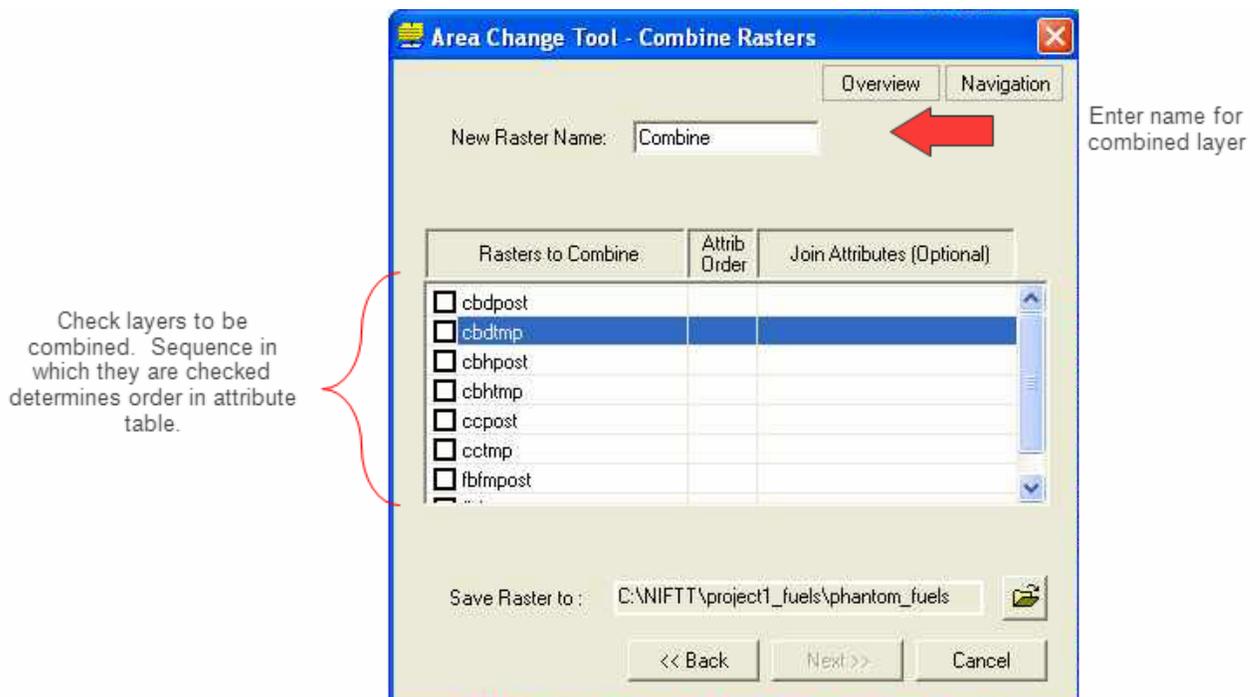


Figure 4-36. The *Combine Rasters* dialog box.

- When you have completed the dialog box by identifying the rasters (*Rasters to Combine*), specifying the appropriate order (*Attrib Order*), and adding important ancillary attributes (*Join Attributes*), use the browse button to navigate to the folder in which you wish to use to store the combined layer. You can accept the default path or choose a new location.

Click **Next** to create the new raster. The new raster is automatically added to the Table of Contents in ArcMap. Review the Value Attribute Table of the combined layer to ensure that the layer will meet your needs. The Value Attribute Table for this example is shown in figure 4-37.

Object	Value	Count	Sev_int	Ex_type_1	Fbfm3_1	Cbcls	Can_cov_1	Cbcls	Can_bt_1	Severity	Est_name	Fbfm3	Cc_percent	Ch_m_u_#
0	1	12	1	2045	10	25	85	5	175	NoBurn-Low	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM10	80 <= CC < 90	100 <= CH < 250
1	2	10	1	2045	8	25	75	5	175	NoBurn-Low	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM8	70 <= CC < 80	100 <= CH < 250
2	3	8	2	2045	10	25	85	5	175	Low	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM10	80 <= CC < 90	100 <= CH < 250
3	4	23	1	2045	10	25	85	15	175	NoBurn-Low	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM10	80 <= CC < 90	100 <= CH < 250
4	5	44	1	2227	8	15	85	15	175	NoBurn-Low	Pseudotsuga menziesii Forest Alliance	FBFM8	80 <= CC < 90	100 <= CH < 250
5	6	4	1	2227	8	25	75	5	175	NoBurn-Low	Pseudotsuga menziesii Forest Alliance	FBFM8	70 <= CC < 80	100 <= CH < 250
6	7	11	2	2045	8	25	75	5	175	Low	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM8	70 <= CC < 80	100 <= CH < 250
7	8	14	2	2227	8	25	85	5	175	Low	Pseudotsuga menziesii Forest Alliance	FBFM8	80 <= CC < 90	100 <= CH < 250
8	9	4	2	2227	8	25	75	5	175	Low	Pseudotsuga menziesii Forest Alliance	FBFM8	70 <= CC < 80	100 <= CH < 250
9	10	12	1	2227	8	15	75	15	175	NoBurn-Low	Pseudotsuga menziesii Forest Alliance	FBFM8	70 <= CC < 80	100 <= CH < 250
10	11	18	1	2227	8	25	85	15	175	NoBurn-Low	Pseudotsuga menziesii Forest Alliance	FBFM8	80 <= CC < 90	100 <= CH < 250

Figure 4-37. The attribute table of the combined layer showing the first of 2,491 records.

### 4.5.6 Editing raster attribute tables

ACT provides two options for editing attribute tables of raster layers: Microsoft Excel or Access. In many instances, the choice of software depends largely on your own experience level. Although Excel may be easier to use, it can be more tedious and inappropriate for large editing projects. Attribute tables of a combined layer commonly contain thousands of records, which may prove problematic when using Excel since Excel has a limit of 65,560 records. Using Access is typically more efficient for large editing projects since queries can update hundreds of records simultaneously.

If not already active, select the **Edit Raster Attribute Table** radio button in the *Area Change Tool* dialog box (fig. 4-38) and click **Next** to open the *Edit Raster Manager* dialog box (fig. 4-39).

**Tip:** ACT automatically advances to this dialog box after the *Combine Rasters* operation is finished.

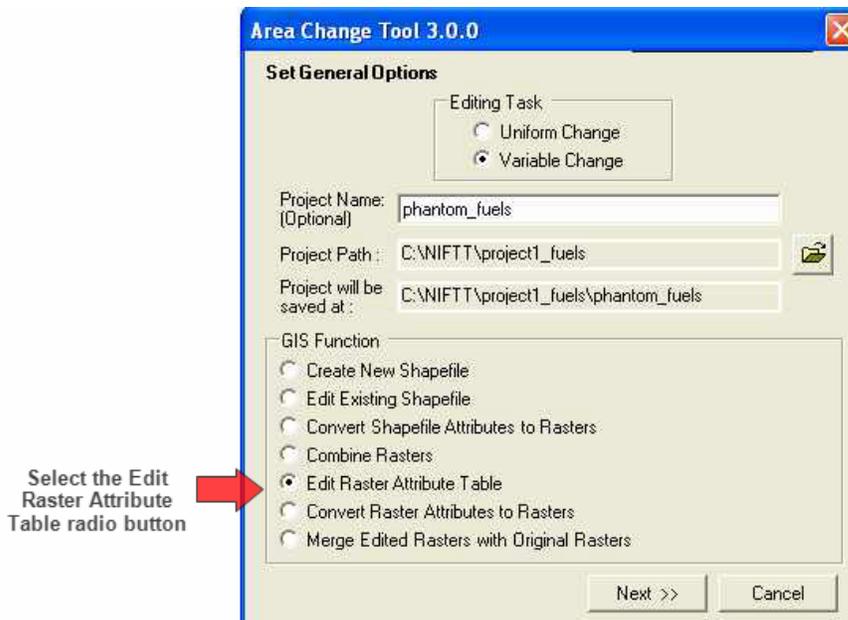


Figure 4-38. Selecting the *GIS function* to edit a raster attribute table.

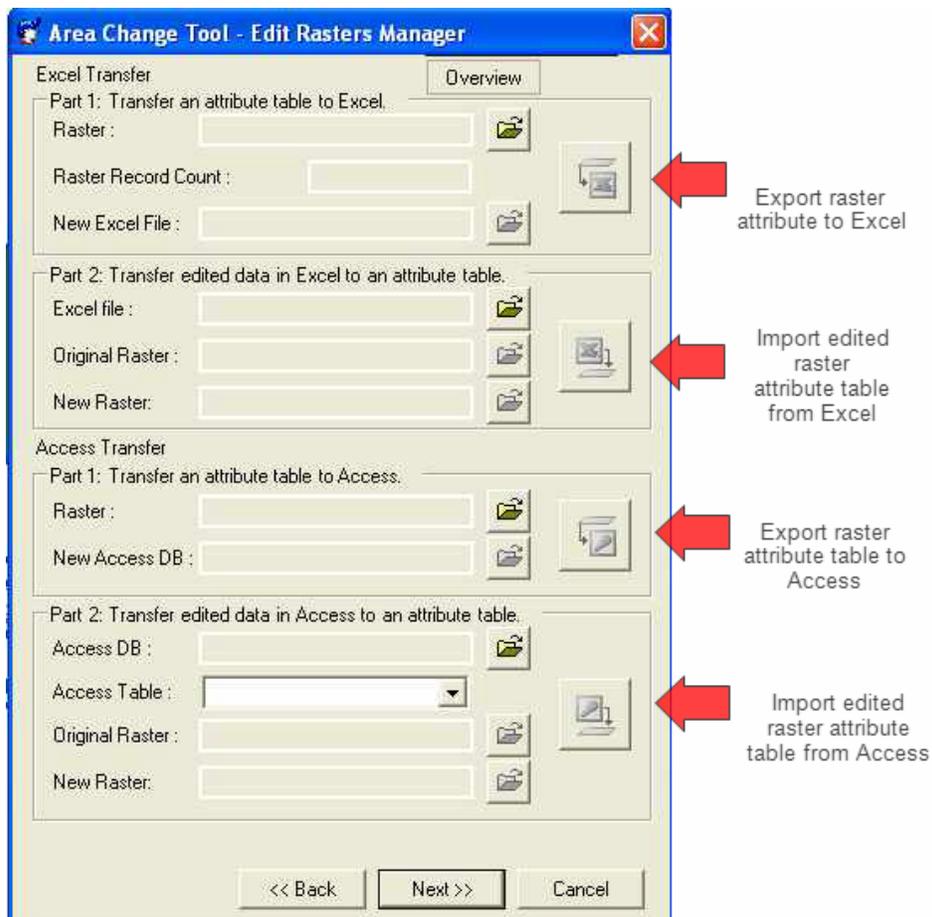


Figure 4-39. The *Edit Rasters Manager* dialog box.

The *Edit Rasters Manager* dialog box (fig. 4-39) is used to transfer Value Attribute Tables to either Excel or Access for editing and subsequently to transfer the edited Excel/Access data to a Value Attribute Table of a new raster layer. The upper portion of the *Edit Rasters Manager* dialog box pertains to Excel and the lower half to Access.

## Excel Transfer

### Part 1: Transfer an attribute table to Excel

Three steps are required to export an attribute table to an Excel spreadsheet for editing (fig. 4-40).

1. First, identify the raster to be edited by clicking on the browse button to the right of the *Raster* box.
2. Create an Excel spreadsheet by clicking on the browse button to the right of *New Excel File*.
3. Lastly, export the raster attribute table to Excel by clicking on the large icon (*Export a raster attribute table to Excel*) at the right of the *Excel Transfer Part 1* box. During exporting, the record count of the raster will appear in the dialog box. This feature is useful for determining if the raster has more than 65,560 records, which will exceed the capacity of Excel. Excel opens automatically when exporting is complete ([fig. 4-41](#)).

**Tip:** *If the record count exceeds the limit of Excel (65,560 records), a warning message appears and the Excel transfer will stop.*

**Note:** *A progress bar at the bottom of the dialog box indicates that the transfer is proceeding. Processing may take several minutes for rasters with large numbers of records and/or attributes.*

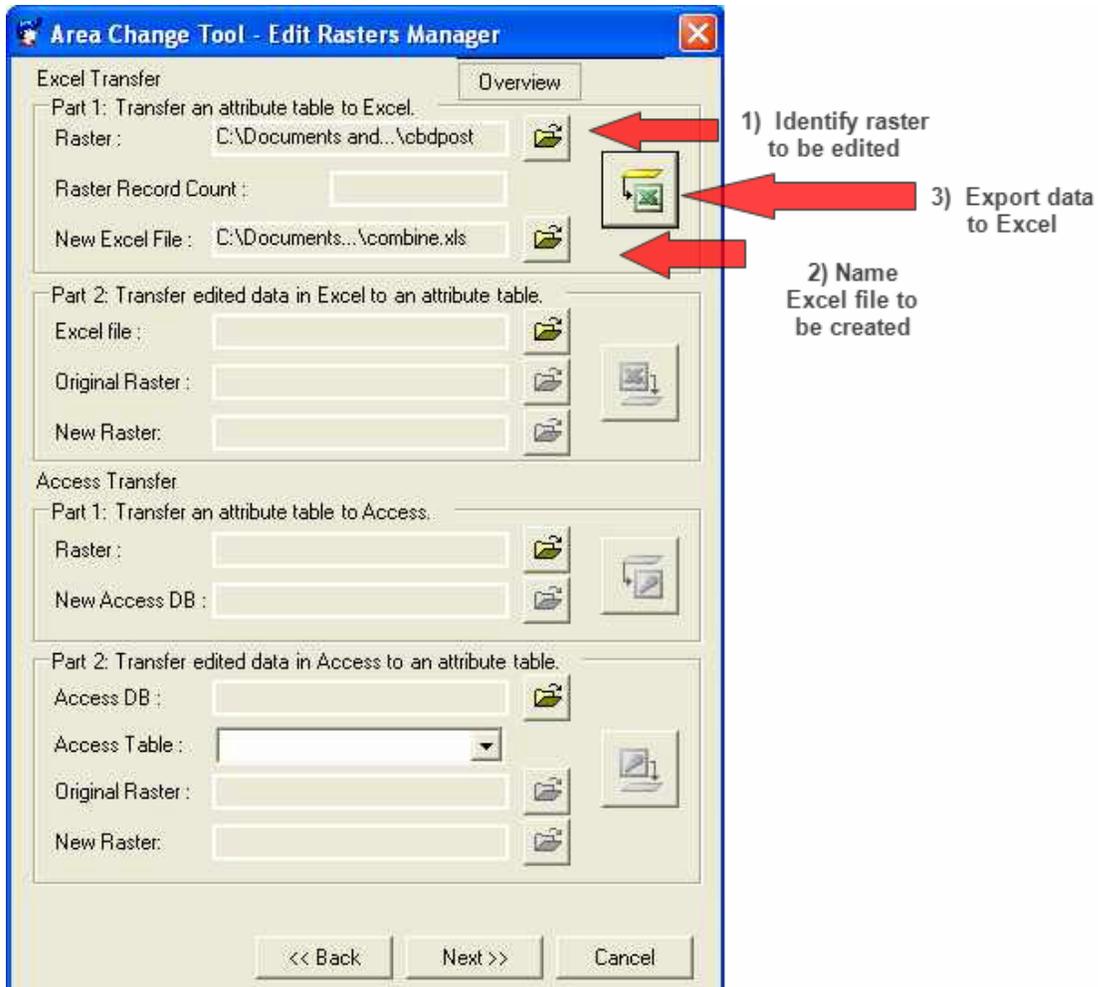


Figure 4-40. Use the *Edit Rasters Manager* dialog box to export a raster attribute table to Excel.

ObjectID	Value	Count	Sev_fnl	Ev_type	Fbfmt3_1	Cbhdcls	Can_cov_1	Cbhdcls	Can_ht_1	Severity	Evt_name	Fbfmt3	Cc_percent	Ch_m_x_10
1	1	1	12	1	2045	10	25	85	5	175 NoBurn-Lo	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer	FBFM10	80 <= CC < 90	100 <= CH < 250
2	2	2	10	1	2045	8	25	75	5	175 NoBurn-Lo	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer	FBFM8	70 <= CC < 80	100 <= CH < 250
3	3	3	8	2	2045	10	25	85	5	175 Low	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer	FBFM10	80 <= CC < 90	100 <= CH < 250
4	4	4	23	1	2045	10	25	85	15	175 NoBurn-Lo	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer	FBFM10	80 <= CC < 90	100 <= CH < 250
5	5	5	44	1	2227	8	15	85	15	175 NoBurn-Lo	Pseudotsuga menziesii Forest Alliance	FBFM8	80 <= CC < 90	100 <= CH < 250
6	6	6	4	1	2227	8	25	75	5	175 NoBurn-Lo	Pseudotsuga menziesii Forest Alliance	FBFM8	70 <= CC < 80	100 <= CH < 250
7	7	7	11	2	2045	8	25	75	5	175 Low	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer	FBFM8	70 <= CC < 80	100 <= CH < 250
8	8	8	14	2	2227	8	25	85	5	175 Low	Pseudotsuga menziesii Forest Alliance	FBFM8	80 <= CC < 90	100 <= CH < 250
9	9	9	4	2	2227	8	25	75	5	175 Low	Pseudotsuga menziesii Forest Alliance	FBFM8	70 <= CC < 80	100 <= CH < 250
10	10	10	12	1	2227	8	15	75	15	175 NoBurn-Lo	Pseudotsuga menziesii Forest Alliance	FBFM8	70 <= CC < 80	100 <= CH < 250

Figure 4-41. An Excel spreadsheet derived from the Value Attribute Table.

**Tips::**

- *Make a backup copy of the spreadsheet prior to changing any values. If mistakes are made, an original copy will still be available.*
- *Never change values in the ObjectID, Value, or Count fields of a combined raster. Instead, edit only the attributes of that raster.*

- *Never delete any records.*
- *Sort spreadsheets with care – data can be easily scrambled beyond repair. Be sure to sort the entire spreadsheet and not just a subset of fields. Always return the spreadsheet to its original form before transferring data to an attribute table by sorting the entire spreadsheet using the Value field.*

Use *SaveAs* to save your worksheet when edits are complete. Close Excel and save your ArcMap project. This will bring you back to the ACT Edit Raster dialog box.

## **Part 2: Transfer edited data in Excel to an attribute table**

This feature of ACT is used to create a new raster from the edited version of an Excel worksheet. Open the *Area Change Tool* dialog box and select the **Edit Raster Attribute Table** radio button. The following steps are required to import a spreadsheet into an attribute table ([fig. 4-42](#)).

1. Identify the Excel spreadsheet that contains the edited data by clicking on the browse button to the right of the Excel file box.
2. Identify the Original Raster that was used to create the Excel spreadsheet. ACT will usually provide this information automatically, but make sure that this information is correct before continuing.
3. Enter a name and path for the New Raster by clicking on the browse button to the right of the *New Raster* box. Remember that the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters ( ` ~! @\$%^()-+= { } [ ] \ / ? / : ; , " ' < > , . ).
4. Create the new raster by clicking on the large icon (*Import an edited attribute table in Excel*) at the far right of *Excel Transfer, Part 2*.

The new raster will be added automatically to the Table of Contents in ArcMap. Save your ArcMap project.

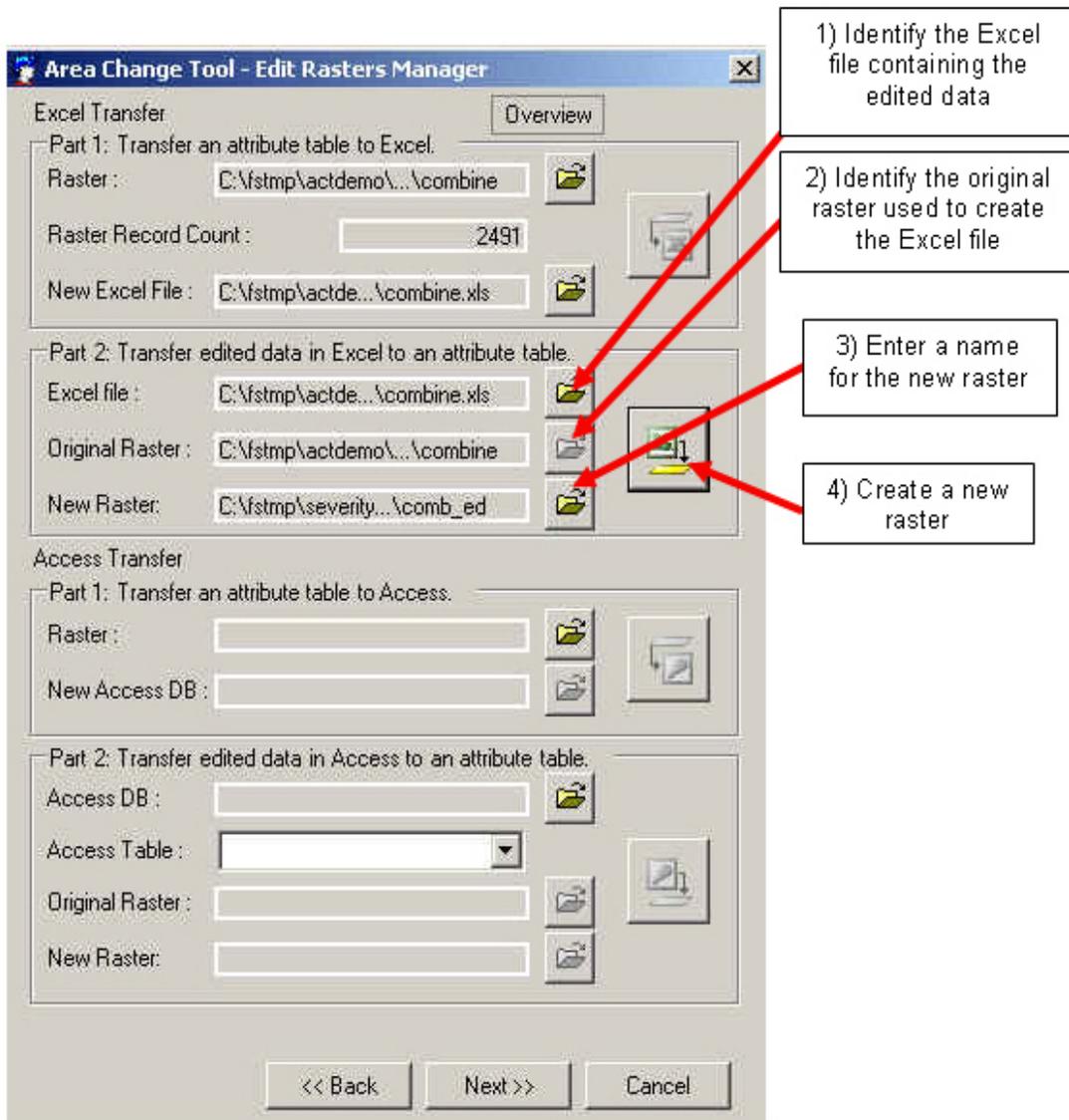


Figure 4-42. Use the *Edit Rasters Manager* dialog box to create a new raster from an edited Excel spreadsheet.

## Access Transfer

### Part 1: Transfer an attribute table to Access

Open the *Edit Rasters Manager* dialog box by selecting the **Edit Raster Attribute Table** radio button. The bottom portion of the *Edit Rasters Manager* dialog box pertains to using Access to edit the attribute table of an existing raster.

Exporting a Value Attribute Table to Access is a simple process ([fig. 4-43](#)).

1. Identify the raster to be edited by clicking on the browse button to the right of the *Raster* box.
2. Name the Access database by clicking on the browse button to the right of the *New Access DB* box.
3. Click on the large icon to the far right of the *Access Transfer, Part 1* box to export the Value Attribute Table to an Access database. The Access database will open automatically when the transfer process is complete and contains a table with the same name as the database ([fig. 4-44](#)). Open the table and begin editing.

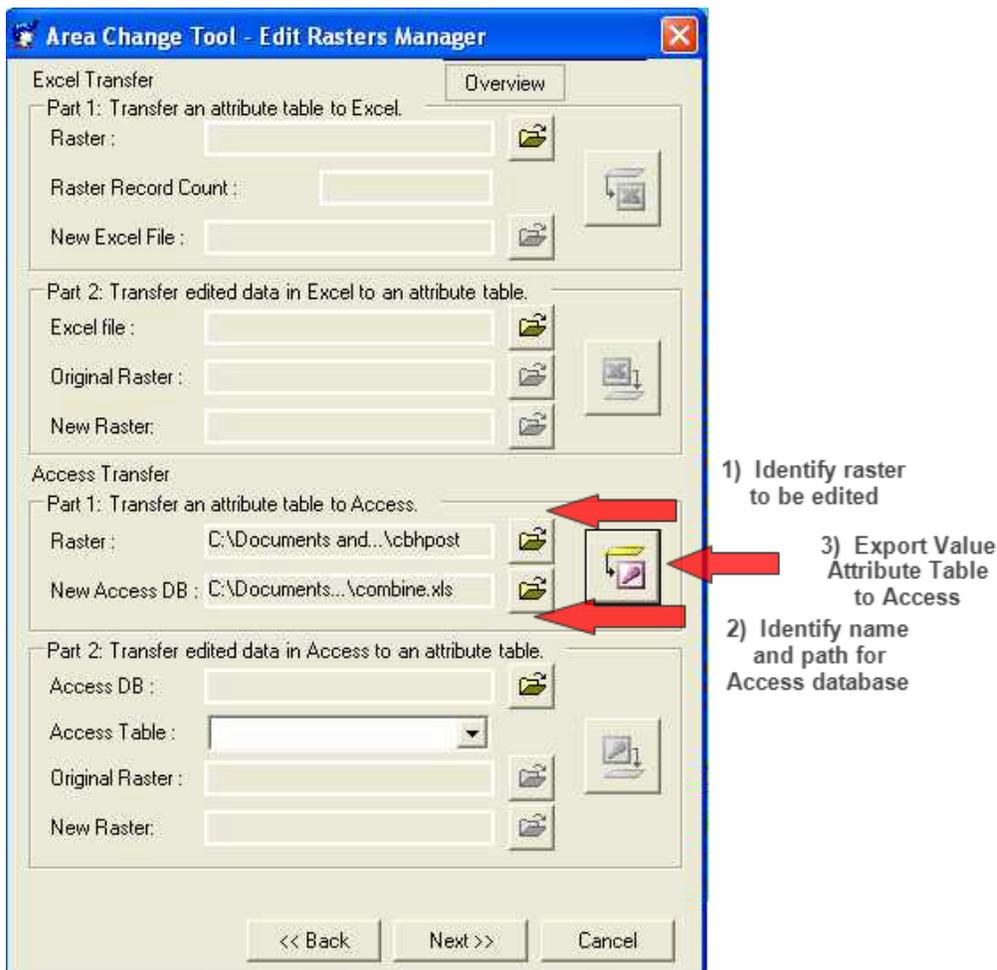


Figure 4-43. Use the *Edit Rasters Manager* dialog box to transfer a Value Attribute Table to an Access database.

OBJECTID	Value	Count	Sev_fri	Ev_Type_1	Fbfr13_1	Cbhdcls	Can_cov_1	Cbhdcls	Can_ht_1	Severity	Evt_name	Fbfr13	Cc_percent	Ch_m_x_10
1	1	12	1	2045	10	25	85	5	175	NoBurn-Lo	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM10	80 <= CC < 90	100 <= CH < 250
2	2	10	1	2045	8	25	75	5	175	NoBurn-Lo	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM8	70 <= CC < 80	100 <= CH < 250
3	3	8	2	2045	10	25	85	5	175	Low	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM10	80 <= CC < 90	100 <= CH < 250
4	4	23	1	2045	10	25	85	15	175	NoBurn-Lo	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM10	80 <= CC < 90	100 <= CH < 250
5	5	44	1	2227	8	15	85	15	175	NoBurn-Lo	Pseudotsuga menziesii Forest Alliance	FBFM8	80 <= CC < 90	100 <= CH < 250
6	6	4	1	2227	8	25	75	5	175	NoBurn-Lo	Pseudotsuga menziesii Forest Alliance	FBFM8	70 <= CC < 80	100 <= CH < 250
7	7	11	2	2045	8	25	75	5	175	Low	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	FBFM8	70 <= CC < 80	100 <= CH < 250
8	8	14	2	2227	8	25	85	5	175	Low	Pseudotsuga menziesii Forest Alliance	FBFM8	80 <= CC < 90	100 <= CH < 250
9	9	4	2	2227	8	25	75	5	175	Low	Pseudotsuga menziesii Forest Alliance	FBFM8	70 <= CC < 80	100 <= CH < 250
10	10	12	1	2227	8	15	75	15	175	NoBurn-Lo	Pseudotsuga menziesii Forest Alliance	FBFM8	70 <= CC < 80	100 <= CH < 250

Figure 4-44. An Access table derived from the Value Attribute Table.

**Tips:**

- Create a backup table before any changes are made. If mistakes are made, an original copy will still be available.
- Never change values within the “OBJECTID,” “Value,” or “Count” attributes of a combined raster. Change data only in fields corresponding to layer attributes.
- Never delete any records.
- Save any updated queries used for editing. Saved queries can be useful for identifying errors and for making consistent changes in subsequent editing sessions.

**Part 2: Transfer edited data from Access to a value attribute table**

This feature is used to create a new raster from the edited version of an Access database table. Open the *Area Change Tool* dialog box and then select the *Edit Raster Attribute Table* radio button to open the *Edit Rasters Manager* dialog box. To import a database into an attribute table, complete the following steps (fig. 4-45).

1. Select the Access database that contains the table to be converted to an attribute table. Click on the browse button to the right of the *Access DB* box to navigate to your database.
2. Select the appropriate table in the database by using the drop-down menu to the right of the *Access Table* box.
3. If necessary, identify the original raster layer using the browse button associated with *Original Raster*. ACT will usually complete this step automatically once the Access table is identified. However, make sure that the Area Change Tool has identified the correct raster layer before proceeding.
4. Identify a name and path for the new raster layer by clicking on the browse button to the right of the *New Raster* box. Remember that

the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters ( ~! @\$%^()-+= { } [ ] \ / : ; ' " < > , . ).

5. Create the new raster by clicking on the large icon labeled *Import an edited raster attribute table from Access* at the right of the dialog box. The new raster containing the edited information will appear automatically in the ArcMap Table of Contents.

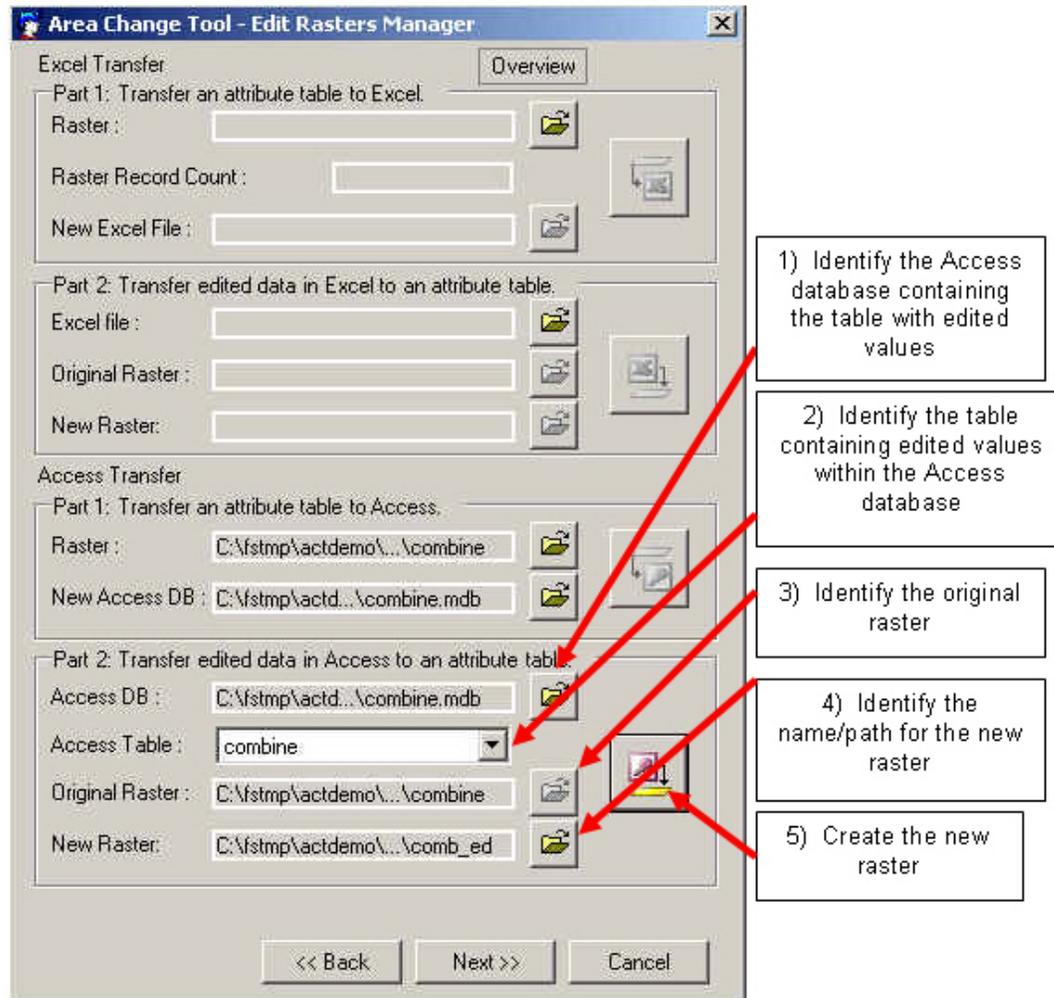


Figure 4-45. Converting Access database table to a new raster layer.

From the drop-down menu to the right of Access Table, select the table to import from Access. If the original raster is located, its path and name will be displayed in the box to the right of *Original Raster*. However, if it is not found, the browse button to the right of the box will be enabled, and you will need to use it to browse to the original raster. Once a valid original raster has been entered, the browse button to the right of *New Raster* is

enabled. Click on this icon and enter a name and path for your new raster. Next, click on the large icon **Import an edited raster attribute table from Access**. The new raster layer will be created and added to ArcMap's Table of Contents.

### 4.5.7 Convert raster attributes to new rasters

This ACT feature is used to create individual raster layers from the attributes of a combined layer. Open the *Area Change Tool* dialog box and select the **Convert Raster Attributes to Rasters** radio button (fig. 4-46) or click the **Next** button on the *Edit Rasters* dialog box.

**Tip:** The raster of interest must be present in your ArcMap project before raster attributes can be converted to new rasters.

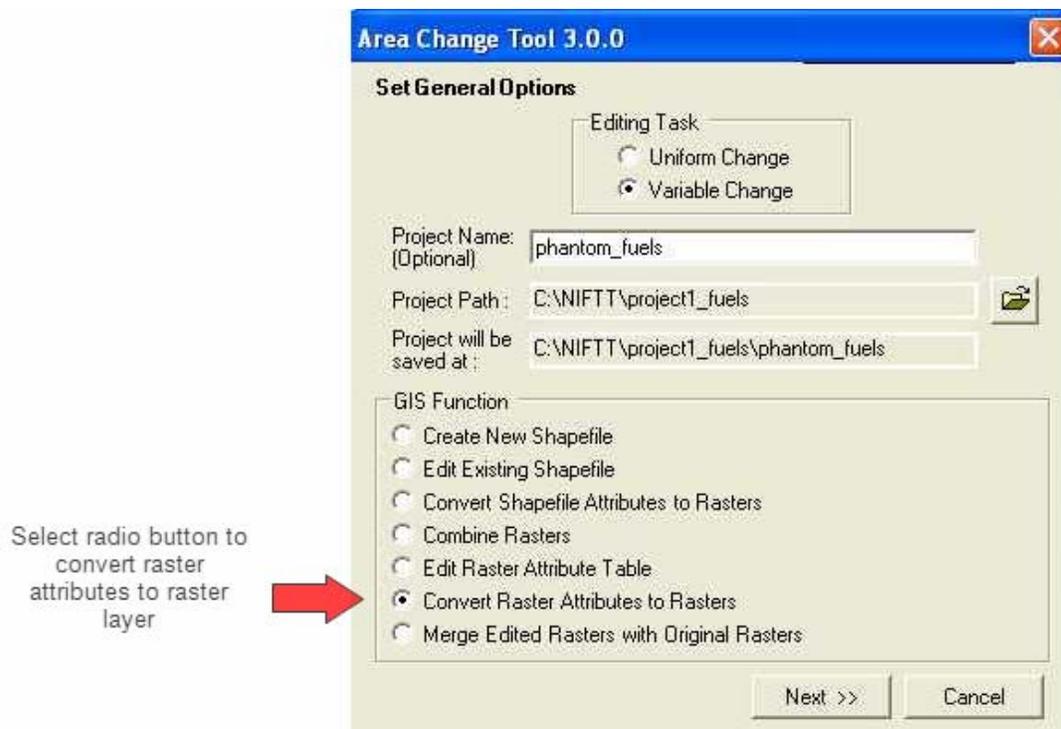


Figure 4-46. Converting raster attributes to raster layers.

The *Raster Attributes to Rasters* dialog box will open ([fig.4-47](#)).

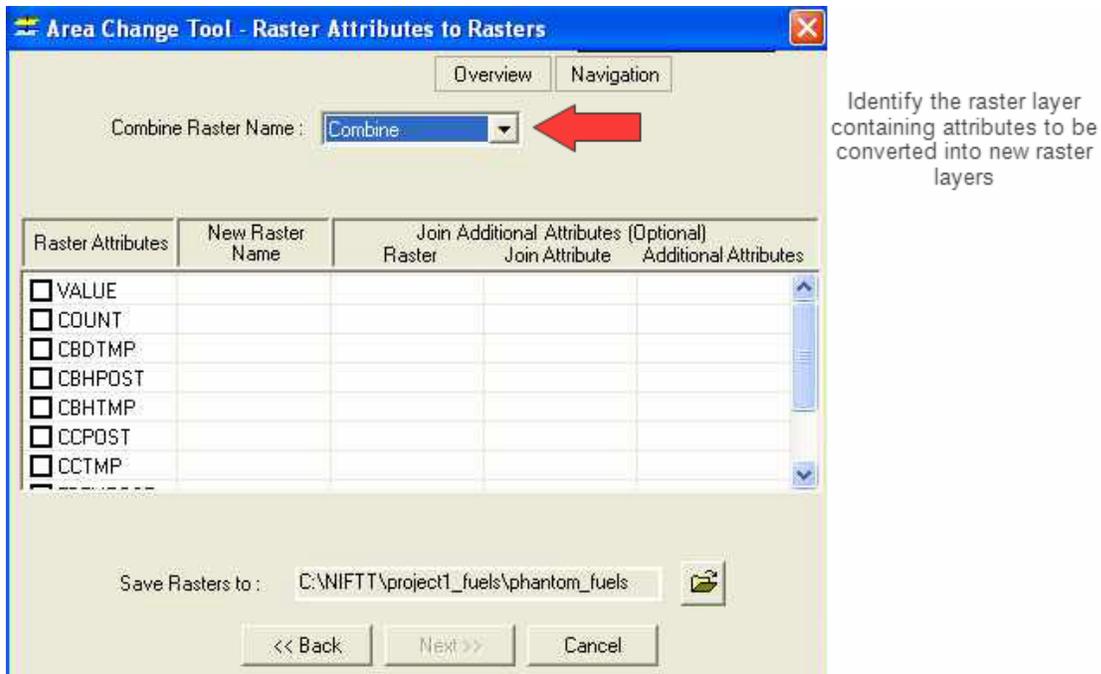


Figure 4-47. The *Raster Fields to New Rasters* dialog box is used to convert raster attributes to individual raster layers.

The dialog box for converting raster attributes to raster layers (fig. 4-47) is used to identify the combined raster and attributes to be converted to individual layers. To carry out this function, complete the following:

1. Select a raster containing the attributes that you would like to convert to new raster layers (this will generally be a combined raster). Use the drop-down menu to the right of *Combine Raster Name* to select the combined raster. All attributes contained within the combined raster will then appear in the lower portion of the dialog box ([fig. 4-48](#)).
2. Enter a *New Raster Name* in the appropriate cell of the second column that corresponds to the attribute of interest as shown in [figure 4-48](#).

**Note:** Remember that the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters (^ ~! @#\$%^()-+= { } [ ] \ / ? : ; ' " < > , .).

3. The remaining three columns of the dialog box (*Raster*, *Join Raster*, and *Join Additional Attributes*) are optional and can be used to join any additional attributes to the new raster layer. Typically, these are ancillary attributes that are used for descriptive purposes, such as a descriptive name that corresponds to a particular raster

value. These additional attributes are generally included in the combined layer or in a layer that was used to create the combined layer. To join additional attributes to the new raster layer, double-click in the cell under *Raster*. Select the raster layer containing the appropriate attributes from the drop-down menu (fig. 4-48).

**Tip:** The raster must exist within your ArcMap project before it appears in the drop-down menu.

4. Double-click in the cell under *Join Attribute* and select the appropriate field from the drop-down menu that will be used to join the attributes to the new raster layer. This entry must correspond to the value of the new raster layer (fig. 4-48).
5. Double-click in the cell under *Additional Attributes*. Select all attributes from the drop-down menu by putting a check in the box corresponding to the necessary attributes. After entering all information for a particular row of the dialog box, return to the first column and check the box.

**Tip:** New raster layers will be created only for Raster Attributes that are checked.

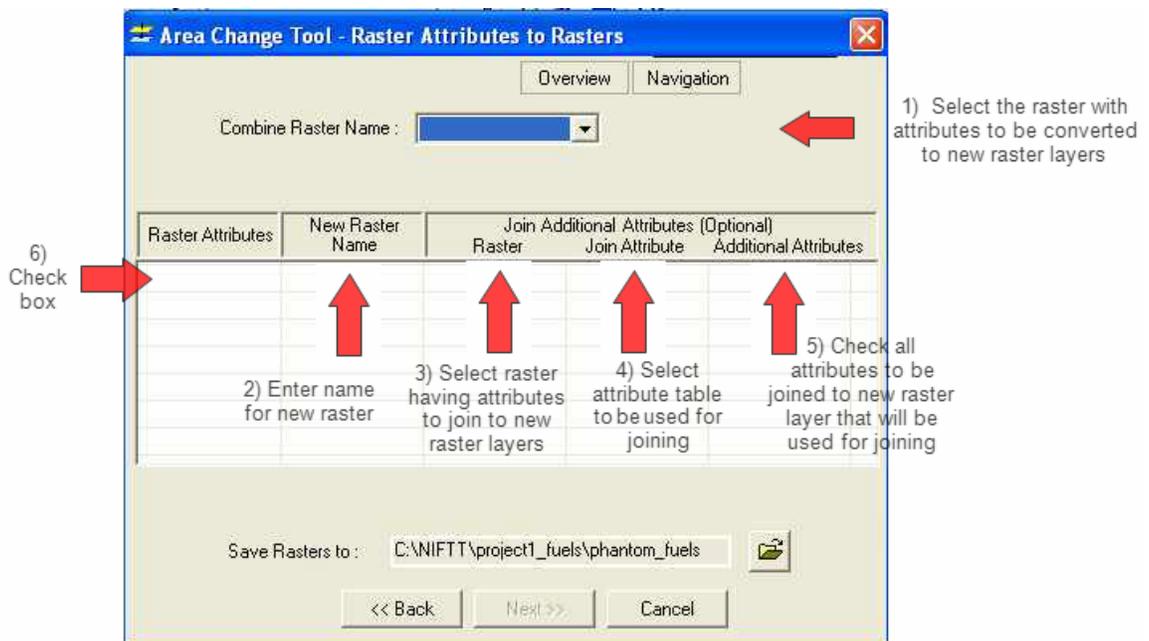


Figure 4-48. The *Raster Fields to New Rasters* dialog box. In this example, a new raster named *evtnew* is created from the *Ev\_type\_1* attribute from the Combine layer. The new raster layer will include an attribute labeled *Evt\_name* which originates from the raster layer “*ev\_type\_1*.”

6. Next save your work by clicking on the browse button to the right of the *Save Rasters to* box (fig. 4-47). You can select a new location or accept the default value that appears in the window. Click **Next** to create the new rasters. After processing is complete, the new raster layers will appear in ArcMap's Table of Contents.

At this point, you may decide to merge these treatment rasters BACK into their original counterparts. This will create new input layers that you can run in FBAT or in the FRCC Mapping Tool to observe the effect of changes you have made.

#### 4.5.8 Merge edited rasters with original rasters

The Merge Edited Rasters with Original Rasters function is used to create a new raster layer made up of edited and non-edited data. In other words, the edited data is “burned into” the non-edited data. For example, post-burn data might be used to overwrite pre-burn data.

*Note: The raster layers to be merged must exist in your ArcMap project before you can use this GIS function.*

1. Open the *Area Change Tool* dialog box and select the **Merge Edited Rasters with Original Rasters** radio button (fig. 4-49).

**Tip:** ACT automatically advances to this dialog box after the previous operation.

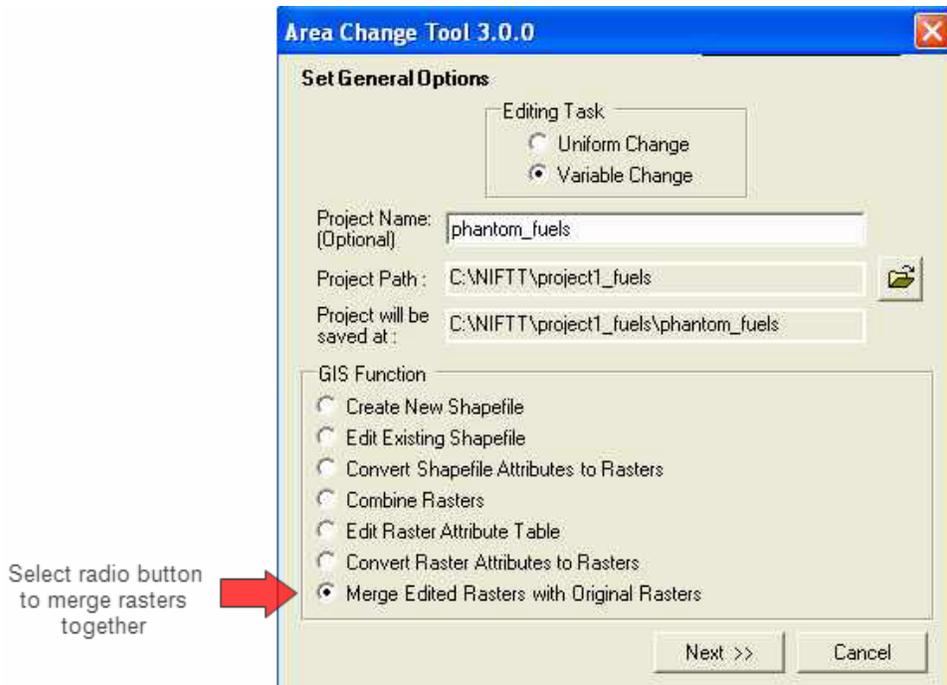


Figure 4-49. Use the *Merge Edited Rasters with Original Rasters* radio button to open the *Merge Edited Rasters* dialog box and merge rasters.

2. Click **Next** to open the *Merge Rasters* dialog box (fig. 4-50).

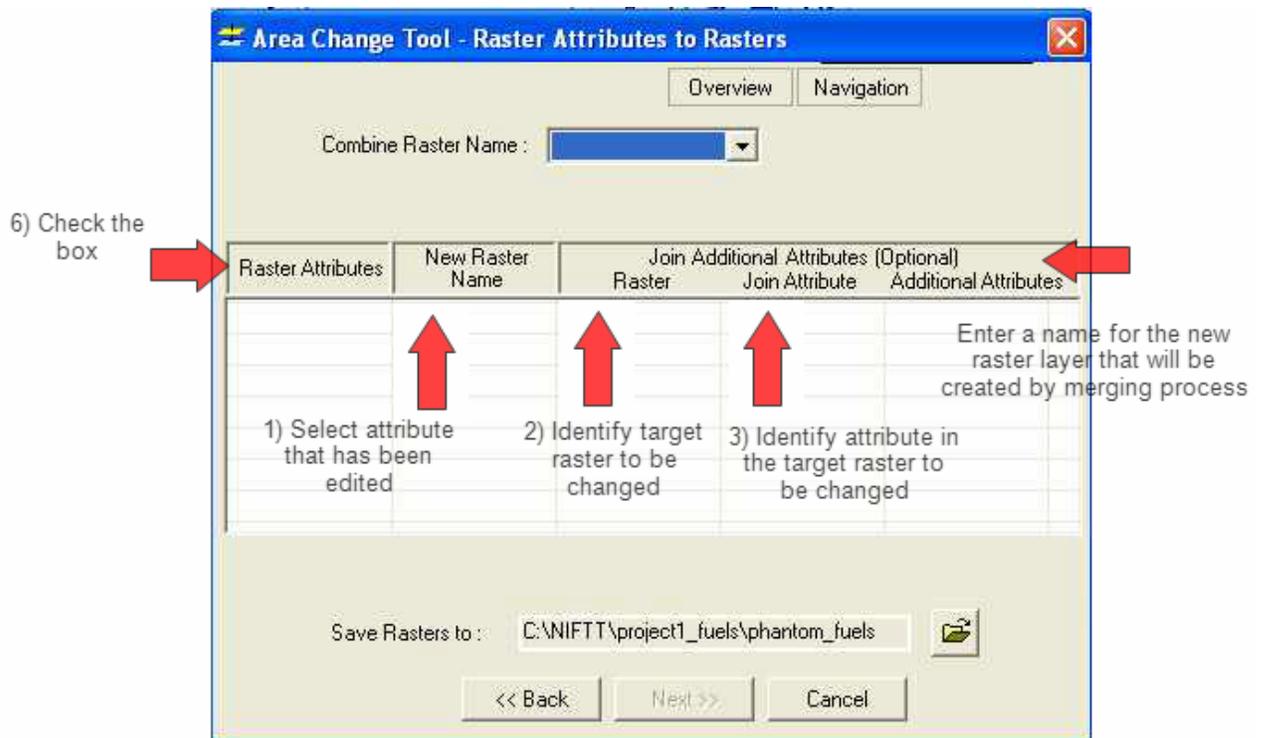


Figure 4-50. The *Merge Edited Rasters* dialog box. In this example, the edited raster name *evtnew* is merged with the original raster named *ev\_type\_1* to produce a new raster named *evtnl*.

3. Identify a raster that contains edited values from the *Edited Raster* column by double-clicking in the adjacent cell in the column labeled *Edited Raster Attribute*. The *Edited Raster Attribute* column identifies the attribute that was edited; that is, it identifies the attribute that will be used to overwrite the attribute in the *Target Raster*. Select the appropriate attribute contained within the *Edited Raster* box by using the associated drop-down menu.
4. Identify the *Target Raster* layer from the drop-down menu by double-clicking in the cell in the *Target Raster* column. The target raster is the layer that will be changed by “burning in” the values from the Edited Raster.
5. Select the *Target Raster Attribute* from the target raster that will be changed by the Edited Raster. Double-click the cell in the *Target Raster* column and select the appropriate attribute from the drop-down menu.

**Tip:** Typically, “Target Raster Attributes” must match the “Edited Raster Attributes.”

6. Enter a name in the *Merged Raster Name* column.

**Note:** Remember that the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters ( ` ~ ! @ # \$ % ^ & \* - + = { } [ ] \ / ? : ; ' " < > , . ). Do not include an extension.

7. After entering a *Merged Raster Name*, return to the first column and check the box associated with the Edited Rasters of interest. Complete the same process for each set of raster layers that you want to merge.
8. Specify an output folder for storing the new raster layers by using the browse button to the right of the *Save Rasters to* box. Navigate to the directory of your choice and create a new folder.
9. Lastly, click **Finish**. The new raster layers will appear automatically in the ArcMap Table of Contents.

Save your ArcMap project at this time. We recommend that you zoom in to those pixels with values that were changed during the editing process. Are the changes evident in each of the output layers? Toggle back and

forth between the pre- and post-change raster layers to compare pixel values that should have changed (be sure to use identical legends).

**Tip:** *The output from the Merge Rasters operation will not carry the descriptive attributes as the intermediary outputs have because there is no associated "Join" option.*



# Chapter 5: Troubleshooting ACT – Common Errors, Symptoms, and Solutions

---

If ACT fails to produce a new raster layer, consider the following:

## Naming Conventions

Remember that you do not need to add an extension, and the name is limited to eight characters or less. In addition, the file name you select should not contain any spaces, leading numbers, or special characters ( `~! @\$%^()-+= { } [ ] \ / ? / : ; ' " < > , . ).

## Output Path

The total length of the output path is limited to 80 characters. In addition, names of folders within the path cannot contain spaces or special characters (such as `~! @\$%^()-+= { } [ ] \ / ? / : ; ' " < > , . ).

To report a bug, please contact [helpdesk@niftt.gov](mailto:helpdesk@niftt.gov).



## Appendix A: References

---

Anderson, H. E. 1982. Aids to determining fuel models for estimating fire behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 22 p.

Finney, M. A. 1998. FARSITE: fire area simulator; model development and evaluation. Res. Pap. RMRS-RP-4. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 47 p.

Finney, M. A.; Brittain, S.; Seli, R. 2006. FlamMap version 3.0. [Online]. Available: <http://fire.org>.