# EPIC & Wildfire Risk Tutorial – Student Guide

Objectives
1) Learn how to use the GIS software EPIC
2) Perform a simple GIS analysis related to wildfire risk

Introduction
For the Geographic Information System (GIS) assessment, this project will use a GIS software program called EPIC. EPIC is a raster-based program that identifies geographic features by giving a geographic grid of an area different values for each cell or pixel of the grid. The geographic data is represented by layers. Each layer identifies characteristics on the landscape. For example, a pine layer may show where all the pine is in a community by coloring various pixels red, for pine. This means that the majority of the area defined by that pixel (or square) is covered in pine trees.
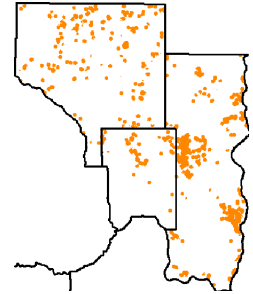
There are several powerful tools in the EPIC program. There are analysis tools to help identify which areas in a community to concentrate their efforts in. There is also a digitizing tool called a tag editor that allows you to create your own data based on characteristics of points on the landscape.

## Lesson 1 – Getting to know EPIC

1) Start up the EPIC program by double clicking the EPIC icon on the desktop
2) Navigating the EPIC program

- **Tools** The words highlighted in black are the options available to you (**File** Analysis Report View Map **Window Help)**

- **Speed buttons.** Below are Icons we call speed buttons. More appear as you open a map. These buttons access almost all of the Menu options above.

- Select **File** to Look at data: To look at what data is available select the Tool **FILE** (click it) and click "Open Area/Layer. Two lists appear on the screen. All EPIC data is organized by layers inside the study area. On the left there are study areas. Your PC has **Metro30** and **Statewide (MGC100)**

- **Select a Study area:** Using the mouse click the **MGC100 study area**. It turns blue and a list of data layers appears on the right. If I click on the Metro30 study area a different list of data layers appears on the right.

- Select the **MGC100 study area** and move the **cursor to the list on the right**, scroll to select a layer to view. EPIC2001 has over 700 data layers available on the CD. You will see only some of the data today.

- **Press (L)** moves you down to the **LAND** data layers. Epic2001 can select layers by 1st and 2nd characters **(EC)**

- Select **Land, Land Use Composite, LMIC, 29 Class Integrated 2001** it will change to (blue)
- Now press **(OK).**

3) How to View a Map
   - **EPIC2001 draws the map**.
   - A map appears on the left with a legend on the right. Both can be moved and resized to fit your preferences.
   - More speed buttons appear to zoom in
   - **Click** the Magnifier glass with **(+)**
   - Select a part of the map **(Beltrami County)** and **click the left** mouse key. The map enlarges to fit the screen.
   - You can zoom back out with the **left-arrow button.**
   - Move down to the northern corner of Anoka County **hold the left mouse key down and drag the mouse to the lower right corner** of Dakota County by Hastings and release the mouse key. It will zoom in and give you an enlarged view of that area.

4) How to Add Overlays

   - Click on the Icon with the green (**V**) inside.
   - You have two lists: the left shows all possible overlays and on the right are the overlays that are selected already.
   - Every overlay's **line, style, width and color** can be changed.
   - Select a vector overlay from the left. (**scroll to the bottom**) Select ADMIN**, County, Admin, Communities** and **ROAD, Federal and state Highway** and move each over to the right (**>**)
   - **Highlight the ROAD, Federal and state Highway overlay** and then change its color from **black** to **Red** and **line width 2** wide. Highlight county and change the line width to 2. Highlight communities and set the scale at 800000 maximum. Click **(OK).**   Viewing your map you will now see roads & county lines. As you zoom in, you'll notice the community boundaries show up.
   - Close the map by clicking on the **(X)** in the upper right corner of the map. NOT the upper right corner of the screen, this X will close the program.
   - The **(globe)** speed button opens the map.

5) How to Select a New Study Area

   - Use the yellow door button in the upper left of your screen under the FILE tool. This will open the study area.
   - Again two lists: Left has the **AREA** and the right lists the **LAYERS**.
   - Select **Metro30-meter LAND, Integrated land use and cover**
   - Select **(OK)** this makes the selection and draws an additional map.

6) How to Print a Map

- The Button next to the Globe is to **print** a map.

- Just to show how easy it is to make a quick map.

- **Click on the print** button. You are given the option to print the windowed map on the screen to a file or directly to the printer your PC has set as its default.

- You can change printers by selecting **SETUP** and you can change the settings of the default printer. Select change printers. Any printer you have installed on your PC or on your school's network will work. For now click **Cancel.**
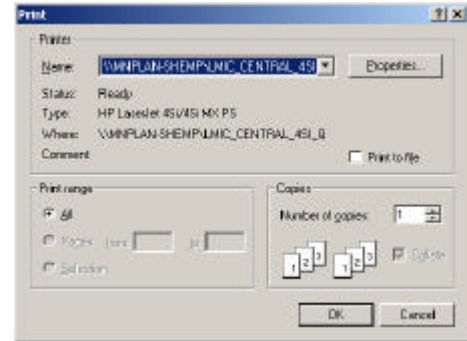
7) How to make a better map

- Another way is to use the menu **MAP** option on the top of the screen. This has several additional options to make a prettier map. **CREATE, OPTIONS, LEGEND FONT**.

- Choose: **CREATE**. EPIC shows a new set of options. On the top it shows the current layer.

- The bottom options are **PRINTER SETUP, PRINT, and PRINT TO BITMAP** or **CANCEL**. Above these there are two options **WINDOW** and **LEGEND**. The **WINDOW** will display the row/column UTM coordinates of the zoomed map you selected and the **LEGEND** can be on the same page, separate page or none at all.

- For now select **PRINT to BITMAP**. It will present another screen of options to select from. Just select **(OK)** and you will see a map.
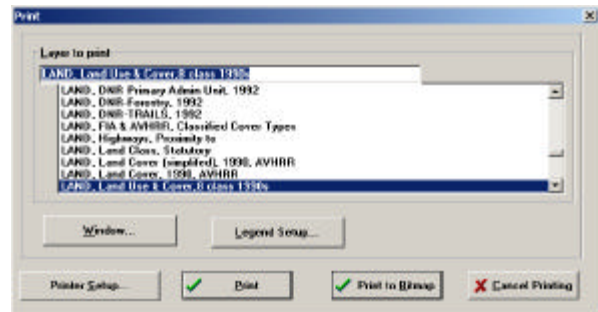
  - You can use the scale bars on the right and bottom of your screen to scroll through the map. If you like what you see the Bit map can be saved and incorporated into a report or PowerPoint presentation.

- To save a map select the **FILE** option on the top **SAVE** will allow you to select the name and where you want it
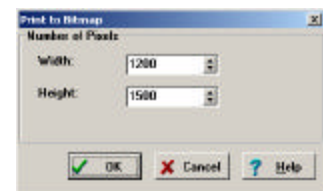
saved.   I will cover this in the next section. For now cancel the map by selecting **CANCEL** and or CLICK on the **(X)** in the upper right.
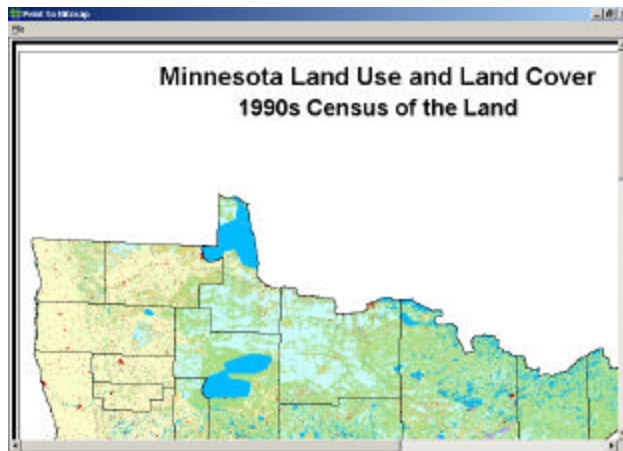

8) Making a Better Map
   - Under the **Map Tool,** click **Options**: All items checked are active. Notice that **Vector Key** is not checked. If it is not checked click on it. The other option you need to change is the **Information Line**. This allows you to print information on the bottom of the map. Move your cursor into the box and move down the list to see the options. The most common option is Current Date/Time. Another suggestion is Metadata or contact. *Later we will cover where EPIC looks for this information* On the right is **Margins** this allows you to position the map on a page. Example: If you want to place maps in a notebook add .5 to the **LEFT. Save current settings as default** will apply these to all maps you create.   When you are done click **OK.**
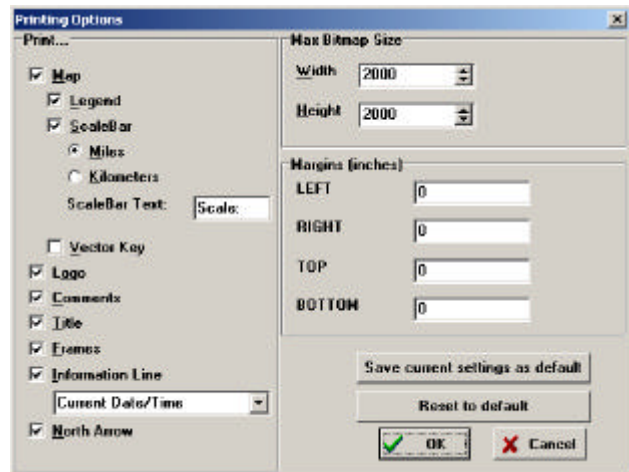
   - Under the **Map Tool** click **Legend**. There are 3 options. You will need to change this depending on the data that you are mapping**. No Legend**: DOQs and Shaded relief legends are meaningless. 0-255 with no real legend associated with any level.   **Legend on the Same Page** is the Default, this is the most common choice. **Legend on a Separate Page** is necessary for Data Layers like SOILS, NWI and Elevation. If you select this option you can specify the number of columns to divide the legend into for mapping on the separate page. Example, SOILS, Atlas data has 100 data levels. 5 would display 20 legend classes in each column. *Caution: You must change this back to 1 if you want the legend on the same page.* You can also change the

Height/width of the color patches. Save current settings as default will apply this to all maps you create. When you are done click **OK**.

- **FONT:** This menu option allows you to change the font, color and size of the Title, sub title, Comment, Legend, Scale Bar and Time. Select: Title You can change the title to any Font you have loaded on your PC. I suggest Arial, Bold and 24 size. You can also change the color. I suggest you stay with one Font for the title, sub title and legend any vary only the Size.
- Practice changing these options.
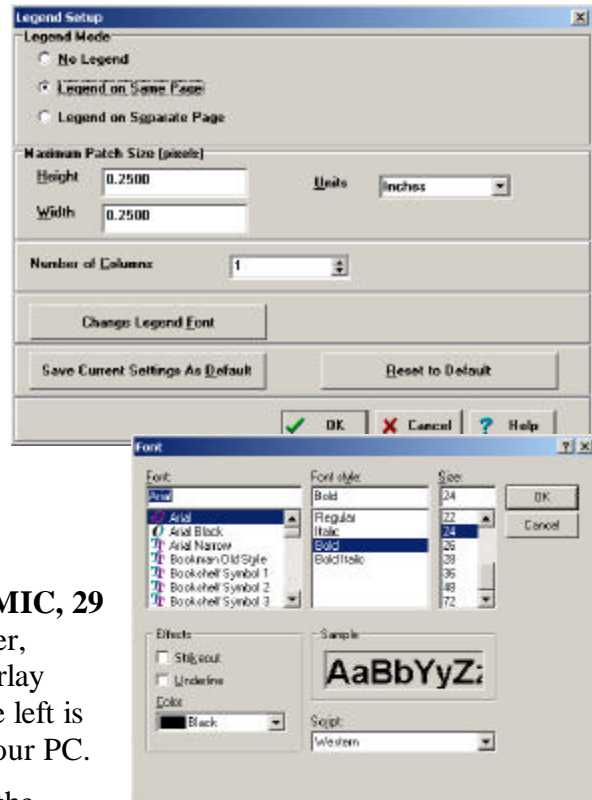
9) How to add background data
   - With **Land, Land Use Composite, LMIC, 29 Class Integrated 2001** as the data layer, select the speed button next to the overlay vector (**B=**). It looks like a list. On the left is a list of all the data layers loaded on your PC.

   - From the data layers on the left select the following data layers: **ADMIN, County and ADMIN, Community MCD 1990** use the (**>**) button to move them over to the right.

   - Next move down the list to the **LAND** data layers. **Highlight** the first land use layer and by **holding shift key down** using the **Up** and **down key** you can highlight a group of data layers.

   - Select some then use the (**>**) button to add these to the data list on the right. Now select the (**OK**) button on the bottom.

   - The Map appears again. Click on the (**i**) speed tool. Move the cursor to a place on the map and **click the left button.** A report on the screen is a detailed report for a specific location in Minnesota. Notice the **UTM** coordinates at the top of the page. This is an active file. Every time you click on a place on the map a new report is added to the file. You can save this file using the **FILE** save option. Practice locating other points or adding more data layers.

   - When finish select the (**X**) button in the upper left portion of the map. This will close the view window.

10) How to make a report:
    - Use the **REPORT** TOOL on the top. EPIC can create 3 kinds of reports. Select **Frequency** Report and click the left mouse key. EPIC will

automatically tabulates the total acres and percent of Land use in each class. The list can be printed or saved. For now close the report **(X)** key.

- The speed button two to the right of the **PRINT button** also generates a frequency report.

11) How to use cross-tabulation:
- Select the next button: **CROSS-TAB REPORT**. Two lists appear. On the right is the active layer **Land Use.** I want to know how many acres of land use there is in a particular community. To do this highlight **ADMIN, Community**. Use the **(>)** button to move the layer to the right. Now **highlight** the **MCD layer** and use the priority button to move it up. *Why would I do this?(to make Land Use a subset of Community)*

- Click the **OK** at the bottom and the computer begins the cross tabulation.

- EPIC2001 asks if you want the entire area, or the windowed area. **Select the Windowed area.** EPIC can do up to a 5 way X-tab; EPPL can do up to 9 ways. Be careful. Complex analysis on large study areas may take a while. You can scroll down the list to a particular city. Again this is windows so you can copy the text to your clipboard.

- Define a window that is just bigger than a township area. Then repeat the cross-tab with 3 files. ADMIN, Community MCD, then Marshner then 1990 land use 8 class. This is a very simple task for EPIC yet it clearly identifies the impact of settlement on the wet prairie. How many acres are still Bog/marsh/fen in the window you selected?

12) More options to customize a map:
- Click on **FILE** in the upper left. A list of options appears.

- Highlight **Open Pedigree File** and click the left mouse key. The file displayed is EPIC's version of "**METADATA"**. Each layer in EPIC has a Pedigree file. It lists the source of the data, the projection, and the cell resolution. It is a vital file that must exist for each layer or else EPIC will not recognize the layer. Move all the way down the list and you will find if the layer can be used for BUFFER, Tile Structure. Close this file. **(OK)**

- Highlight **FILE** and select **Open Legend File**. A legend editor opens for you to change the legend text. Be careful! You are on a PC (a personal computer) anything you change is changed!   It's ok to practice changing a line then click the **(X).** It will ask **(YES)** or **(NO) Select (YES).** You will see the changed legend on the map.

- Highlight **FILE** and select **Open Color File**. You have a palette of colors available to you. Most of the time it is a **Random** palette. But you could choose **Blank or Gradient**.

- Use the arrow to highlight each of the color boxes on the top. As you move along the boxes the **legend** appears for each of the data levels that are in the

database. Some layers like Land Use has levels that are spread out from 0 to 99 levels. Select **level 1 Prairie** and change its color.

- Place the arrow on level 1 and double click the left mouse key. A new palette of colors appears. Select yellow and then move the right scale bar up or down to make the right color you want. Then hit **(OK)**. To exit the Color Editor click **(OK)** again. You are asked Save **Changes (YES).** The map changes to the color you selected.

- Close the View with the **(X)**

13) Three ways to add map graphics into a presentation:

1. Save a full map (title legend), to insert into a document
    - Use the menu **MAP** option on the top of the screen.
    - Use **CREATE,** and select the bitmap option to preview your map. This has several additional options to make a prettier map. Use the **OPTIONS, LEGEND** and **FONT to customize a map**. If the title line of your map is not right, Go to FILE, Open Pedigree to change the Title and Sub title. Also add comments at the bottom if you like.
    - To save a map select the **FILE** option. On the top **SAVE** will allow you to select a name, and where you want it saved. Remember where you have saved it!
    - To look at the file use Explorer or My Computer. Find the file and open it. The **PAINT** program is on all IBM PCs. It can be set to open a BMP file automatically. If you see any problems you can use PAINT program to correct the file. To save the file **select FILE, Save as a BMP** file. This file is best to insert into a Word document or send to the printer later. It is not a good file to insert into a PowerPoint presentation or to place it on the Web. It is a very large file (2 to 5 megabytes).

2. Save just the View Map from EPIC
    - EPIC2001 creates Windows bitmaps. **BMP** files can be inserted directly into a PowerPoint presentation. Here is how to do it.
    - Have a PowerPoint show open and have a preliminary slide ready to insert a graphic into it. Make a good-looking map.
    - Highlight the map **(the top bar is BLUE)** Right click on the map. A selection box will open, select "copy to clipboard". Now open the PAINT program on your computer. Click edit/paste or ctrl-v to paste the map into PAINT. Now click File, Save as… and type MAP2 into the File Name box. We want to save the file as a **JPG** file**.** Look at the bottom of the screen and **select JPG** format. Repeat the **SAVE AS** process and save the file this time as a **GIF. These two file formats are the easiest to insert into presentation or to place on the web.**
    - Maximize the PowerPoint show and select the option, insert **PICTURE From a file: Browse to EPIC2001 and select Map2.jpg.**

Here is the only tricky part; remember where and what you called the file so that you can insert it.

3. Do a screen capture
   - All computers allow you to copy the screen to the clipboard by using the **Print Screen key.**
   - **Minimize EPIC2001.** Open the **PAINT** program. Select **FILE, NEW** FILE. You have a blank workspace.
   - Restore EPIC2001 and compose a good-looking map on your screen and press the **Print Screen** Key. Minimize EPIC again.
   - With the Paint program open you can paste the screen captured image using **(Ctrl V)** or (**Right click on the mouse and** select **paste)** or (**EDIT, PASTE)** The same process works in Word or PowerPoint. Save the file with FILE, Save As, and name the file **MAP1**. **PAINT** automatically save the file as a BMP file.
   - **Remember what you called it and where you saved it.**

14) Analysis options available

EPIC shines in its analytical power. This is a brief overview of the options available in EPIC.
   - **BUFFER Command Options:**
     - **CREATE:** You can buffer 1500 feet from open water.
     - **COMBINE** (buffers): You can buffer 1000 ft from lakes and 300 ft from streams and add them together as one overlay.
     - **EVALUATE** (buffers)**:** For example, you can overlay a buffer on top of land use to tabulate the acres of land use within 2 miles of a land fill site.
   - **One-Way RECLASS:** Allow you to simplify complex data sets like land use, NWI or forest type maps. You can reclass all levels from a data layer or select only 1 level to highlight say open water from land use.
   - **Multi-Way RECLASS:** Two-way reclass allows you to create a complex models like identifying oak forest on sandy soil!
   - **PLS2MAP**: Any data listed by Township, Range, Section and 40 acre can be mapped. All that is needed is a simple ASCII file.
   - **INTERPOLATE:** Point data such as precipitation values entered by either GPS data points or from Weather monitoring stations can now generate a continuous map surface.
   - **DENSITY SURFACE:** Epic 2001 allows uses to conduct a reverse buffer. Using the EPPL7 moving window command Density Surface searches out a specified distance from every cell in a study area and counts the number of unique occurrences of a specified feature and assigns that value to the center cell.
   - **AVERAGE:** Epic 2001 allows uses to average rainfall data by watershed or by county.

Lesson 2: Performing a simple fire analysis using EPIC

From our Introduction to Firewise, we discovered that homes in proximity to evergreens, especially pines are at greatest risk to wildland fire. Homes within ¼ mile are at greatest risk. Given normal weather patterns in Minnesota, we also know that most fires spread from a westerly direction, due to wind. Given these factors, we want to find homes within ¼ mile east of pine in Minnesota.

1) If the following layers are not in your layers list under MGC100, load them from the EPIC CD.

   - Land, Land Use Composite-LMIC, 29 class integrated 2001

   - FIA, Forest Covers, AVHRR, 1993

   Insert the EPIC CD. Open any layer in MGC100. Click File, Load, Layer. In the **drives** box of the **load layers window** that opens, select the CD drive. A list of available layers will come up in the left screen. Click in this screen and type **L**, then scroll down to the **Land, Land Use Composite-LMIC, 29 class integrated 2001** Layer. Arrow this (>) over to the right-hand screen. Repeat this for the **FIA, Forest Covers** layer. Click **OK.** After some processing time, these two layers should now appear when you open the MGC 100 study area.
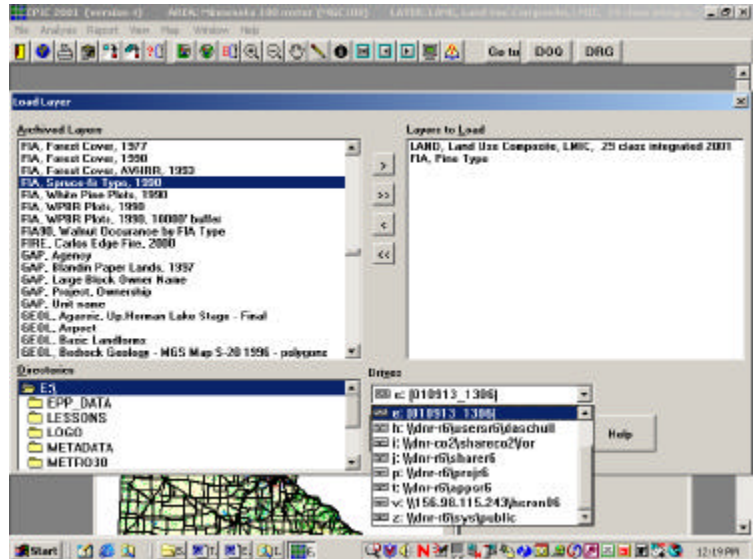
2) Open the **Land, Land Use Composite-LMIC, 29 class integrated 2001** layer. Click **Analysis, reclass.** A window will open with layers on the left. Select the Land, Land Use Composite-LMIC, 29 class integrated 2001 layer and arrow it to the right side. Type in the layer name box "Homes". Hit the tab bar, "Homes" should appear in the file name box. Click next. A one-way reclass box will appear. On the left is a window that has a list of characteristics starting with "Single Family Residential". Click **Single Family Residential** to highlight it in blue. Holding the control key (Ctrl) down, scroll through the list and also select **Multi Family Residential, Low Density Residential, Other Rural**
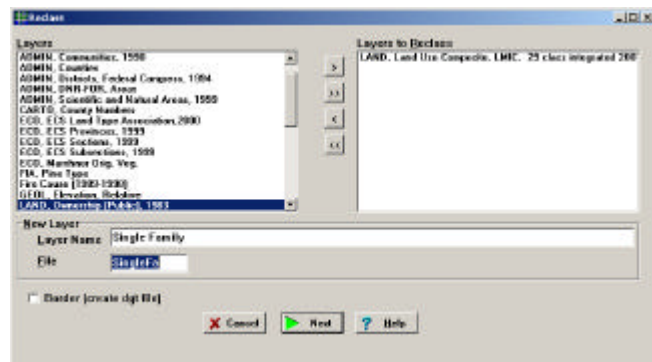
Development and Urban Mixed Development. Type "Homes" in the New Description box. Now click the apply button. Click the box "unused combinations=0" so that a check mark appears. Click create.

3) We need to do a similar reclass with the **FIA, Forest Covers AVHRR, 1993** layer. Here you will want your new layer name to be **Pine Type**, 1993 and select **1 Pine:white, red, jack, 13 Pine: ponderosa and 15 Pine: lodgepole**, with a new description of "Pine" and unused combinations =0.

4) Now we need to buffer the **Pine Type** to create an area ¼ mile to the east of and including the pine type. First we need to enable the Pine Type to be buffered. Open the **Pine Type**. Click file, open pedigree file. Find the line that is titled buffer. Type in the word **YES over the word NO, and click OK**. Click Analysis, buffer, create. Select **Pine Type**. In the new layer name box, type **Buffer, Pine.** Tab to create the file name. Change the cell units to feet, and type in 1320 in the radius box. Change the buffer direction end angle to 180. This gives us a ¼ mile buffer to the east. Click ok.

| Comment 5	
Buffer	YES
Tile Structure	YES
16 to 8 bit	
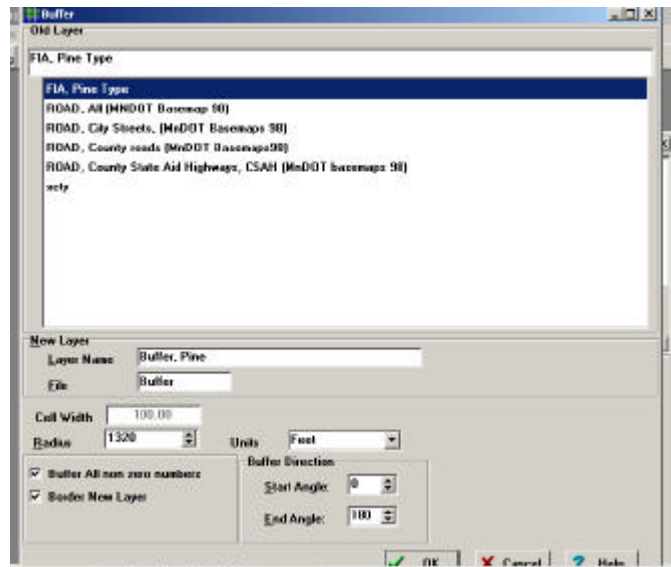
5) Now we will do a two-way reclass. Click Analysis, reclass and select your two new layers (Buffer, Pine and Homes). Both layers should show up in the right hand box. Name this new layer "Hazard zone" and tab to create a file name. Click next. In the new window, on one side will be "Homes" and the other side
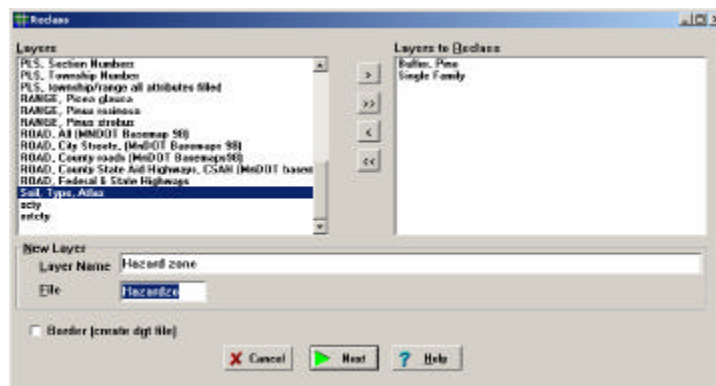
"inside buffer". Highlight both of these (Homes and Inside Buffer). Make sure the "And" is selected between them. Type "High Risk Homes" in the description line. Click apply. Check the box "Unused combinations=0" and click "create".
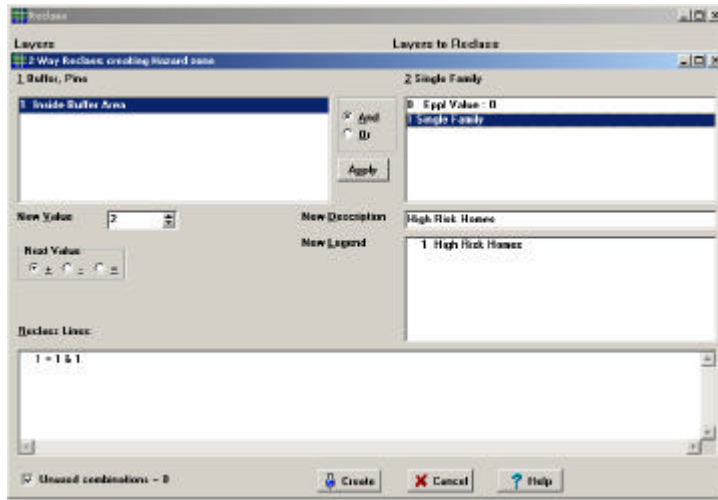
This new layer will be locations where the ¼ mile buffer to the east of the pine coincides with homes. Open this layer. Change the color palette to your preference. Add county and community vector overlays. Zoom into your community. Are there high-risk homes here? Do you recognize the neighborhoods? Change the pedigree "title for output" to something meaningful and print a map. You now have a map of high-risk homes in Minnesota.