

Firewise Community Assessment School Project

Lesson Plan – Level 1 Assessment

INTRODUCTION

Objectives

- 1) Learn how to use GIS in a practical setting
- 2) Learn how to assess property for wildland fire hazard
- 3) Learn how to influence change in your community

Materials Needed

- 1) Computer with minimum: Windows 98, 2 GB Harddrive, 128mb RAM, CD Rom
- 2) EPIC 2001 Software – available from Minnesota DNR-Forestry – 651-772-7931
- 3) Community Study Area CD with DOQ & EPIC update

Background:

Wild land fire destroyed homes near Princeton in May 2000 , in Linwood Township in Anoka County in October 2000 and near Brainerd in May 2002. As more wild land is converted into housing developments “in the woods”, local fire departments will be less able to protect homes from wild land fire. This is due to not only the lack of resources fire departments have available to protect numerous homes in the woods, but also the unsafe conditions firefighters would be subjected to in order to protect those homes.



To mitigate this problem, the Minnesota Department of Natural Resources has adopted a national program called Firewise Communities. This program is designed to help communities reduce the fire risk of homes in the wildland/urban interface (the woods).

Mitigation activities may include building fire breaks around high risk neighborhoods, improving access for fire department equipment and evacuation, reduction of flammable fuels near homes and improving building structures to make them less fire prone.

The first step in a Firewise Community Program is the assessment. Assessment determines the extent of the fire prone property in a community and helps to identify the highest risk neighborhoods to target for mitigation activities.

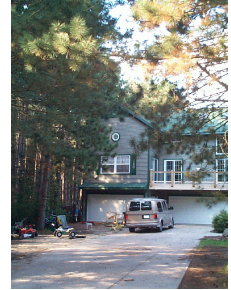
High-risk neighborhoods can be identified by three factors: access, site and structure.

Access is determined by the ability of a fire truck to safely reach a home to protect it from fire. Neighborhoods with a single entrance, or narrow, steep, and winding roads are typical of high-risk neighborhoods. It is difficult for fire department vehicles to negotiate these roads, especially while homeowners are trying to evacuate. The very nature of this difficult access put the firefighters at risk of being overrun by the fire. Similarly, driveways

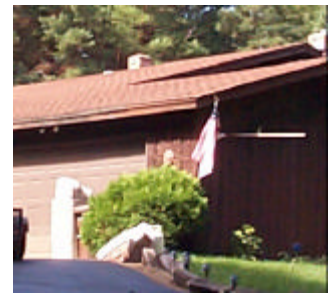


that are long, narrow, steep and without a turnaround at the building are extremely difficult for fire vehicles to negotiate.

A high-risk site is identified by fuel and defensible space. Fuel is the vegetation that carries a wild land fire. Evergreens, especially pine, are very flammable and can create intense fires under windy conditions. Grass, brush and dead branches that create a continuous fuel layer or ladder for a fire to go from the ground to the crowns of the trees will allow wildland fire to become a crown fire, which is extremely intense and difficult to control. If these fuels are within 30 feet of a home, the fire intensity under dry, windy conditions will render a home impossible to protect with fire fighting resources. A fire under these conditions will quickly ignite a home.



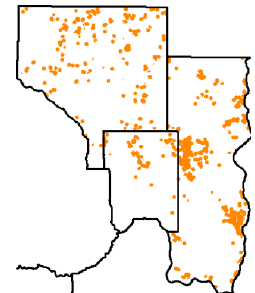
A high risk structure is a home, garage or other building that has exposed flammable materials such as open decks, wood shingles or firewood piled adjacent to it. Intense fires create a condition called spotting, which is when firebrands from the fire are thrown hundreds of feet ahead of the fire. These firebrands can ignite dry grass, a woodpile or wood shakes that will start the building on fire.



Methodology

A Firewise Community Assessment consists of three phases– a GIS assessment, a ground assessment and data analysis.

For the Geographic Information System (GIS) assessment, we will use a GIS software program called EPIC. EPIC is a program developed by the Minnesota Land Management Information Center (LMIC) and is available free to communities. 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.



For this project, we will be using several tools of the EPIC program. We will be using the analysis tools to help identify which areas in a community to concentrate efforts in. We will also use a digitizing tool called a tag editor to create a new data layer that rates the potential risk of structures in an area. This is called the Level 1 Assessment.

The Level 2 or ground assessment is an on-site visit of neighborhoods that have been identified using the GIS analysis. This assessment consists of filling out an assessment sheet for each property (home) in the neighborhood. This information is entered into a database. This database will help refine the GIS analysis by importing the ground assessment data into EPIC and creating a community assessment profile.

From this profile reports can be created that explains the assessment process, identifies and prioritizes the high-risk neighborhoods, and gives recommendations for mitigation activities.



INITIAL COMMUNITY FIREWISE ASSESSMENT USING GIS

Phase I: Initial Home Risk Assessment using Aerial Photos

Purpose: To create an initial GIS layer of homes, classified by values that indicate potential fire prone property. Values relate to the home’s defensible space. This is a quick and easy way to 1) locate the homes in a community, 2) give them an initial rating.

Criteria: Each home will be classified as potentially:

1 – No risk – Home is in a development with few trees in or around it

2 – Low risk – Home is in a development with trees, but is at least 30 feet (width of house) from tree canopy edge.

3 – Moderate risk – Tree canopy edge is within 30 feet of the home

4 – High risk – Outline of home is obscured on at least one side by tree canopy.

5 – Extreme risk – Outline of home is obscured on the south or west side or more than one side by tree canopy.



Step-by-Step Instructions:

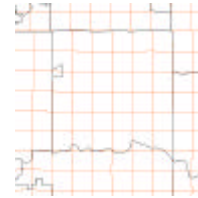
- 1) Install EPIC2001 from the CD (insert CD, if it doesn’t autostart, click start-run-browse to the CD drive-click setup-click ok)
- 2) Insert the Teacher Resources CD. First we need to upgrade EPIC2001 to the latest version. Open “My computer” twice with one window showing the contents of the update folder on the CD (e:\update) and the other showing the contents of c:\EPIC2001 folder. Highlight all the files in the update folder and drag them to c:\EPIC2001. It will ask if you want to overwrite files, click yes to all.
- 3) In order for the DOQ’s to load correctly, change the c:\EPIC2001 window to c:\EPIC2001\data. Now drag the file bw256.clr from the CD to the data folder.
- 4) Open EPIC2001 – Double click on the EPIC2001 Icon. EPIC should now say “version 4” in the top blue bar.
- 5) First we need to load the study area of the Township you will be working on:

Loading a Community Study Area

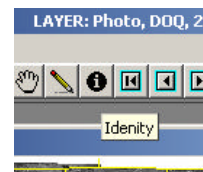
- 1) Insert your community CD (this may be the same as the teacher resources CD)
- 2) Open “My computer” twice with one window showing the contents of the CD and the other showing the contents of c:\EPIC2001 folder. Drag the *community name* zip file from the CD to the EPIC2001 folder.
- 3) Open EPIC if you haven’t already done so.
- 4) Click “file>load>area(single zip file)
- 5) Click the browse button in the load area window of EPIC
- 6) Locate the *community name* zip file in the EPIC2001 folder, click on it and click open
- 7) The left pane of the load area window will now be filled with layer names. Click the double arrow between the panes (>>) to move all the layers to the right pane.
- 8) Click okay. A new study area will be created in your study area list in EPIC with the community name.

- 6) Now we can start the assessment...
- 7) Click File – Open and look for a study area titled with your community name.
- 8) Open your new study area – File – Open area/layer – click on the new study area (Community name). Click the “FIREWISE, Level 1 tags” layer. Click “ok”. This will open a window with an outline of your community. This should also have yellow section lines (square grid pattern) over it. If not, follow the procedures below, otherwise go to step 9.

- a. To overlay section lines, click view – overlay – vector. Select PLS, Section Numbers from the Available Vector Overlays window and click the single arrow (>) button. This layer should now appear in the Displayed Vector Overlay window. Select this layer and click the “line color” button. Click on a yellow square and then okay. Then click ok again. This will overlay the photo with yellow section lines.



- 9) Place section numbers in the background – View – background. Select PLS, Section Numbers from the Layers window and click the single arrow (>) button. This layer should now appear in the Background Layers window. Click ok.
- 10) Find the first section you want to work in (we suggest starting with section 1 in the upper right corner of your map). – Click the Identity (i) button, then click inside one of the yellow squares (sections) on the photo. A screen will pop up with a line:



PLS, Section Numbers: EPPL7 CLASS VALUE = 10

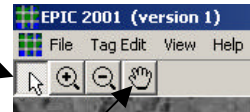
This indicates that the section you selected is section 10. Close the “Look” window and try another section on the photo until you find the correct section. Section numbers are numbered in a zig-zag pattern starting with “1” in the northeast corner (upper right) and ending with “36” in the southeast.

- 11) Find your section and click the zoom-in icon (magnifying glass with a +), click just outside your selected section and drag across the section so that the yellow square of your section is entirely within the selected area.
- 12) Now click the DOQ button near the top of the EPIC window. Make sure your community CD is still in the CD drive. It will bring up an information window saying you will need data from one of the following counties. Just click okay.

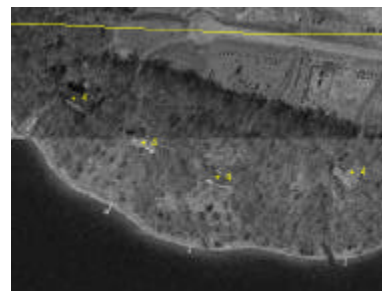


Subsequent windows will open indicating it is finding and loading the DOQ. If a “file not found” window comes up, make sure you have the right CD in and it has spun up and stopped making noise (meaning it is ready). Then click try again and okay. If the window appears again. Click “browse, the data is elsewhere” and okay. Search for the file name that appears in the file name box on the CD. It will be under the “data” folder. Click any of the file names with the same number (but different extension), then click open.

- 13) An aerial photo of your section will appear in a new window. Now click “file>open label file”. A window will come up saying “Label file does not exist. Generate one automatically?” Click yes.
- 14) Start systematically – further zoom into the northwest corner of the section by clicking and dragging the zoom box on the photo until you can see the rooftops of homes clearly.
- 15) At the first house you find, look closely at it and evaluate it using the criteria found on page 3. Click on the arrow button, then click in the center of the house. A dialog box will pop up that prompts you to “Enter Label Text”. Type in the appropriate number 1 thru 5 and click ok. (This number is found by comparing the home you are looking at to the criteria listed on page 3) Repeat this procedure systematically around your section until all homes have been rated.



- a. You can move around the photo by clicking on the hand icon and dragging the photo in the direction you want to go. Remember to click back on the arrow button to continue the home assessment.
- b. To help you see which houses you have assessed, click “Tag edit” then “Label Color”. Select the yellow color box and click ok. Your labels will show up now in yellow.
- c. If you make a mistake, click “Tag edit” then “Delete Tag”. Now double-click on the incorrect label, it will prompt you to delete it. Click yes. You can also click and drag on the label to move it, or double click on it when in change text mode (under Tag edit) and the “Enter new text” window will pop up for you to change the value.
- d. Some homes may be difficult to find. Look for clues that there may be a building in the woods. Some of these clues will be driveways and docks.



- 16) Once you have completed your section, or need to do something else, click “File” – Save. Then click File – Close. Close EPIC using File-Exit or the upper right X.
- 17) At the end of each session, you should archive your work to a floppy disk. Open Windows explorer and find the file:
c:\EPIC2001\COMMUNITYNAME\FWTAGS\FWTAGS.TAG
Copy that to a floppy disk. This can be used to restore your work if it is lost. A copy of this file should also be submitted to your DNR Firewise contact when the phase 1 assessment is complete. (dave.Schuller@dnr.state.mn.us)

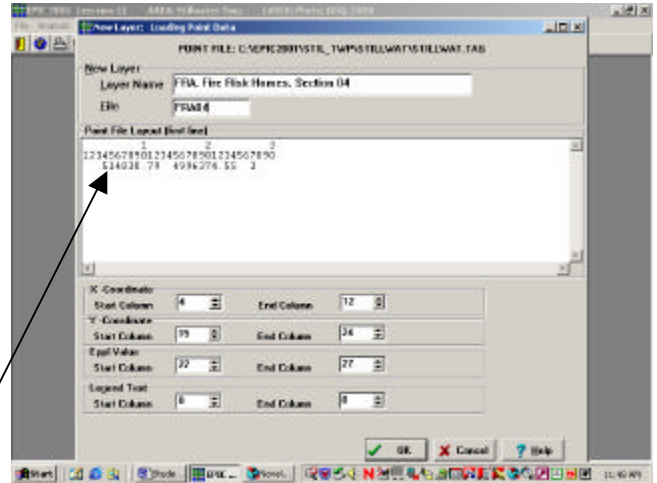
- 18) Final check – once you feel you have rated every home in your section, use the pan hand in the label editor window to pan around the section, making sure every building has a number value next to it. Once all the homes in the entire section have been rated, go on to the next section, repeating the above steps.
- 19) Once an entire community has been completed by the class, it will be necessary to compile the information. Chose one student to be the compiler. This student will compile all the data from other students into one file. Open notepad on the compiler's computer. Open the first file from a student. Save this file as "Final". Now open another session of notepad with the second student's tag file. Select the entire file (ctrl-A) and copy (ctrl-C). Now open the Final file and put the cursor at the end of this file. Hit enter to be at the start of the next line past the end of the text. Paste the information from the second student's file here (ctrl-v). Repeat this until all students' files have been copied into the Final file. Check the Final file to make sure all the columns of numbers line up. There should be three columns of numbers. Save the Final file and send a copy to the DNR (dave.Schuller@dnr.state.mn.us). Copy this final file to the computer you will be doing the analysis on. It should be placed in the folder "EPIC2001\communityname (or metrostu)\FWTags" If there is a FWTags.tag file on this computer in this location, copy it to a floppy disk then delete the file. Now rename the Final.tag file to FWTags.tag. To see what your assessment means, go on to the Analysis portion of these instructions.

The Analysis (Optional):

- 1) Once steps 1-19 have been completed for the community, you can now use the analysis capabilities of EPIC to look for areas of greatest potential fire risk. First we can print a map, or maps of the risk ratings. To do this
 - a. Open the FIREWISE, Level 1 tags (file-open-select FIREWISE, Level 1 tags).
 - b. Overlay your label file (View-Overlay-Label – FIREWISE, Level 1 tags) and make it visible
 - i. Click FIREWISE, Level 1 tags in the displayed label overlays window, select a + in the symbols selection window, change symbol font to black and change text font to black, then make sure the text placement is selected at right & center. Click OK
 - c. You should now see a + on every house and a number value next to it. You may also want to overlay section lines (see step 8 on page 4).
 - d. Print your map – if you have a large format plotter, you may be able to print the entire community on one map. If you can only print up to 11 X 17, zoom into one or two sections at a time and print these areas individually. Select the printer you want to use by clicking map-create-printer setup. You may want to or not want to print legends, titles, etc. Before printing, click map – options and check or uncheck the items you want or don't want. To print, click map-create-print.
 - e. These maps can be used if more specifics are needed on individual neighborhoods for planning purposes. Be cautious of distributing these

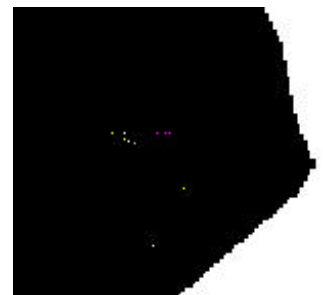
maps to the public, they are an initial analysis and don't show the entire picture. In many cases homes are rated higher using this analysis tool than on-the-ground assessments verify.

- 2) The usefulness of the Level 1 analysis will now be shown. In EPIC2001, load the tag file as a new layer: File-load-new layer – point file. Change the “files of type” to label (*.tag) and change the “Look in” box to the EPIC2001 directory on your hard drive and the communityname folder and the FIREWISE, Level 1 tags folder in there. Click on “FIREWISE, Level 1 tags” and open it. A Loading Point Data window will open.



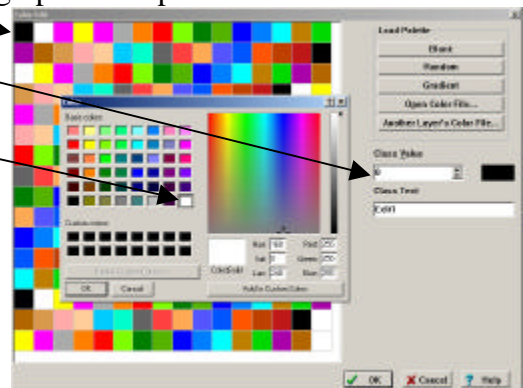
- a. Type into the Layer Name box: *FRA, Fire Risk Homes by Photo, Your community name.*
- b. Press the Tab key and a default name will be put in the file field (change this to FRABIN)
- c. Looking at the point file layout, enter the column numbers where the x and y coordinates start and stop. (eg. Start column x = 4, end = 12, start column y = 15, end = 24) Also enter the epl value start & stop column – both should be 27.
- d. Double-check your entries and click ok. The computer will process and give you a gridpoint report. Click “Done”

- 3) Now open *FRA, Fire Risk Homes by photo, YourCommunity* in Metro 30. The Pixels show up nicely if you zoom into your community.



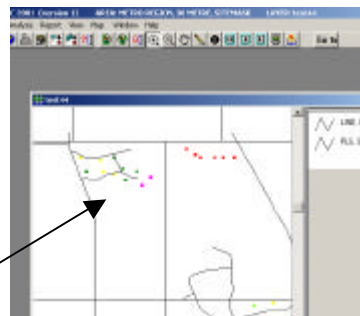
- 4) At this point you can create a risk map of your community (below) or you can go on to find the neighborhoods with the greatest concentration of risk homes (go to step 6).

- a. To better display the data, change the color palette – Click file – open color file. Double click on the colored box in the upper left corner (it should be black), this will bring up a color palette menu. Notice that the Class Value is 0, this is the background of the layer.

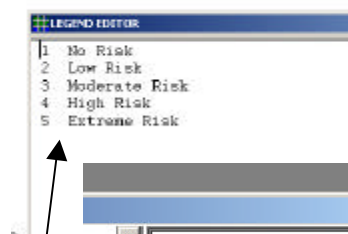
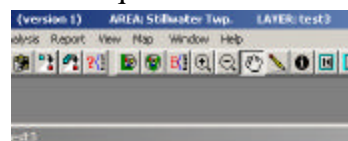


Select the white basic color in the lower right corner of the pop-up grid. Then click okay. Now double-click on the next colored box (White – Class value 1) and change its color to dark green. Repeat this for the following classifications: 1=dark green, 2= light green, 3=yellow, 4=red, 5=fuchsia. Then click okay. It will prompt you “Save changes?”, click yes.

- b. Add overlays – to see where you’re at, add the following overlays (View, Overlay, Vector): PLS, Section numbers & LINE, Roads, all.
- c. Now zoom into a section and look at it. You should begin to see small colored squares, these are the homes you rated. The more red the squares, the higher the risk.

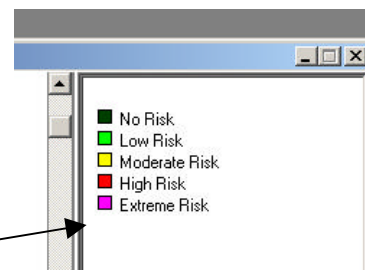


- d. Edit the legend – There may either be no legend telling you what the colored squares mean, or the legend may show colored squares with numbers next to them. To create a useful legend, click file – open legend file. You may get a “File Not Found” warning, just click OK. A legend editor will appear. If it is blank, just start typing (make sure there is no space before and only one space after the number):



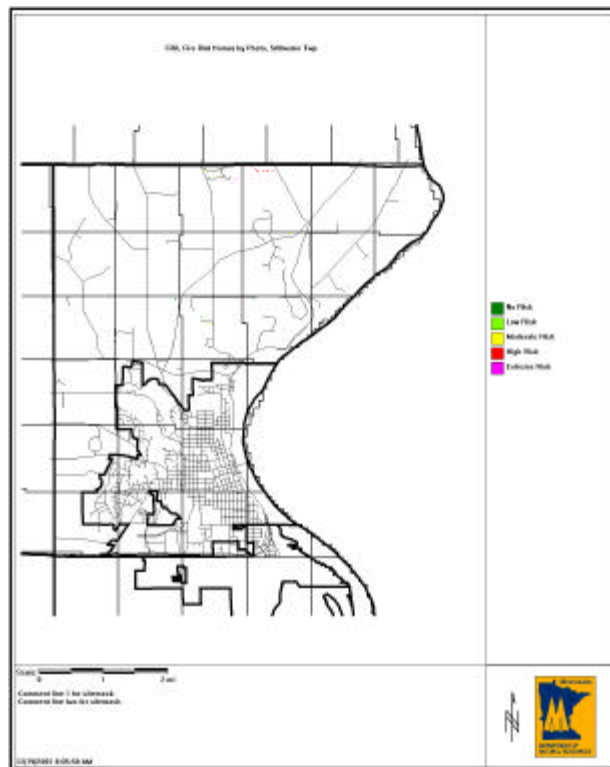
- 1 No Risk
- 2 Low Risk
- 3 Moderate Risk
- 4 High Risk
- 5 Extreme Risk

If there is already a legend, edit it so it looks like this:



Close and save the legend. Now you should have a legend that looks like this:

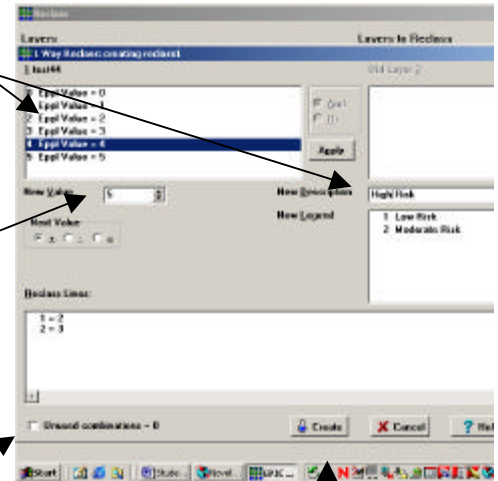
- e. Now you may want to print the results. To do this, zoom to an area just larger than your community. Now click map-create-print (hopefully a color printer is selected as your default, otherwise you will need to change this prior to selecting “print” by clicking “printer setup...”).
- f. Your final printed product should look something like this:



Locating areas of potential risk concentration:

- 5) The analysis we have done so far is little more than making dots on a map. We might be able to visualize concentrations of red and fuchsia dots, but then again, not. EPIC has two very powerful analysis tools – Reclass and Density Surface Model. First we will reclassify our final layer.
- 6) Reclass – Open Metro30. Click Analysis – reclass. Select the layer *FRA, Fire Risk Homes by photo, YourCommunity* in the layers window. Arrow this layer over to the layers to reclass window. Enter a layer name of *FRA, Fire Risk Homes by photo, YourCommunity – reclass*, tab and change the File name to reclass1. Click next.

- 7) Now we will weight the risk values. Since we really are not interested in the no risk value, we'll skip to the low risk value of 2. Click on 2-Low Risk, Type in a new description of “Low Risk”, then click apply. We want to weight moderate risk a little higher than low risk, so click on 3 – Moderate Risk, Type in the description “Moderate Risk”, then click apply. Notice the number in the “new value” window is 2, twice as large as the “1” we assigned to Low Risk. High risk is significantly greater of a concern than moderate, so we want to up the weighting. Click on 4-High Risk, type in High Risk, and change the “new value” to 5 and click apply. Now let's repeat this for Extreme Risk, and give it a new value of 10. Now, make sure you click the box beside “Unused combinations=0” (it should show a check mark) so those no risk homes and sites without homes are not counted in the evaluation. Click on the create button. Close any windows that might result.



- 8) We now want to run a density surface model over this new layer. Click Analysis – Density Surface Model in the main EPIC window. Highlight the layer name you created in #3 (*FRA, Fire Risk Homes by photo, YourCommunity – reclass*). Enter a new layer name such as *DSM, 1*. We want to use a search radius of 1000 feet, since that is the effective distance of a fire engine for protecting a structure from fire. This new layer will look something like this. The bright red spots on the map indicate where the greatest concentrations of high risk homes are.
- 9) The Density Surface Model shows us where the concentrations of fire risk homes are. You may want to redo steps 2-4 with different values until you end up with a map that shows 2 or 3 concentrations of high risk homes. These will be the neighborhoods where you will want to begin the Level 2 assessment.

