Section 16: Raster GIS Tools for Site Suitability Assessment

Section Objective

Using classification images and the ERDAS IMAGINE GIS tools, students will identify suitable locations on the ground for positioning various military units and activities. They will use a set of specific positioning criteria to build layers and perform spatial analysis.

Tools Used

Raster GIS Tools

Objective:

Students will use a terrain categorization (TERCAT) in conjunction with other data laters, to produce a tool for Decision Support.
Our Product will be an overlay of possible depot sites located within an Area of Operations.

Site Selection Criteria – Proposed sites must be:

- Within 2000 meters from a major road
- Within 1000 meters from a rail line
- Located on; Vegetation or Grass
- Not be in an area susceptible to flooding
- Encompass an area greater than or equal to 0.25 sq km

Task 1: Preparing Data Layers

1. From the Home Tab, click **Add Views > Display Four Views**
2. From the **Raster GIS** folder, display ***flood.img, railroads.img, TERCAT.img*** and ***major_roads.img***; one in each view
3. Compare the input files to the Site Selection Criteria found above
4. View the attributes for each file by selecting **Table Tab > Show Attributes** 

   Take a few moments to familiarize yourself with the different files and their attributes

The railroads.img, major_roads.img and flood.img all have two classes, one is the background (0) and the other is the class of interset, either rails, roads or the areas susceptible to flooding.

The TERCAT.img contains several classes

Task 2: Buffering the Search Distance

The first criterion is to be within 2000 metres of a major road. We will search the roads image and identify all the areas within 2000 metres and then we will recode the selection criteria areas with a value of 1.

1. From the **Raster** tab, select **Thematic**  **> Search**

2. Select ***major_roads.img*** as the Input Image or Vector

3. For the Output Image File, navigate to your outputs directory and type ***roads_buf.img***

4. In the **Classes** textbox, input **1**

   The Distance to search (in pixels) must now be calculated. This is the 2000 metre buffer size in pixels. To input this correctly, you must first know the spatial resolution of the image, and the desired buffer distance

5. From the ERDAS IMAGINE menu, select **Tools > Image Information** and display ***major_roads.img***.

   This is done in order to determine the resolution of this file

   To create a buffer within 2000 m of a major road, what value will you enter for the distance to search pixels?

Depending on the resolution of your file and the distance you wish to search, you may have to set a distance to search slightly higher than the value. You cannot enter a value of 3.33, it must be an integer.

6. Input the value for **Distance to search** and then click **OK**
7. In a Viewer, display **roads_buf.img** in **Pseudo Color**

How many classes are in this file?

Task 3: Recoding Values

We will now to recode this file to have values of 0 – 1

1. From the Raster tab, click **Thematic**  **> Recode**.

   The Recode dialog displays

2. In the Recode dialog, select ***roads_buf.img*** for the **Input File**, and for the **Output File**, type the name ***roads_criteria.img***
3. Click the **Setup Recode** button.
4. To setup the Recode, highlight the rows to be changed and set the **New Value**, then click the **Change Selected Rows** button in order to apply the new value. You will recode everything within the buffer zone (values **0-67**) to **1** and recode all other classes to **0**
5. When you have finished changing the new values click **OK**
6. In the Recode dialog, click **OK** to begin the process
7. When the process is complete, display ***roads_criteria.img*** in **Pseudo Color** in a Viewer.
8. From the **Table** tab, select **Show Attributes** and change the **Row 1** color by clicking the color patch and then selecting a new colour

   We now need to repeat the previous buffer and recode steps to accomplish a similar process with ***railroads.img***

   The second criterion states: Site is within 1000 meters from a rail line

9. Using ***railroads.img*** as the **Input Image** to buffer, you will repeat the buffering and recode procedures.

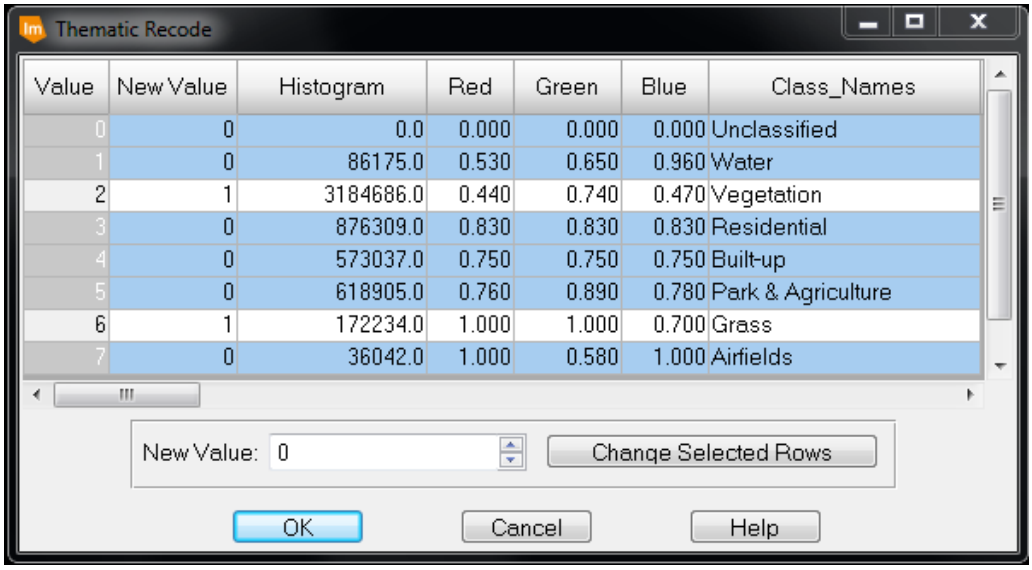
   What is the spatial resolution for railroads.img?

10. Calculate the **Buffer distance** to be equal to **1000 meters** in pixels and use the name ***rails_buf.img*** for the Output File. Click **OK** to run the process
11. Recode the file values to **0** and **1**, with the value of 1 representing all areas within **1000 metres**
12. Type **rails_criteria.img** as the recoded final Output File name.

Task 4: Identify Landcover Type

The next criterion states the sites need to be located on vegetation or grass. We wil use TERCAT.img to identify the areas meeting our criterion

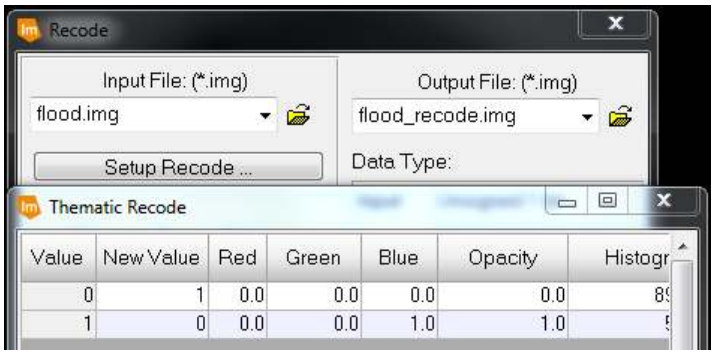
1. Using the Recode dialog, create a file with **Vegetation** or **Grass** having a **New Value** of **1**. All other classes should be set to a **New Value** of **0**



2. Type ***landcover.img*** as the Output File name

We will now recode the flood.img image. Currently areas with a value of 1 have been identified as susceptible to flooding

3. Since we are interested in the areas that will stay dry, you will need to recode ***flood.img*** so that **Class 0** equals **1** and **Class 1** equals **0**



4. Name the Output File ***flood_recode.img***

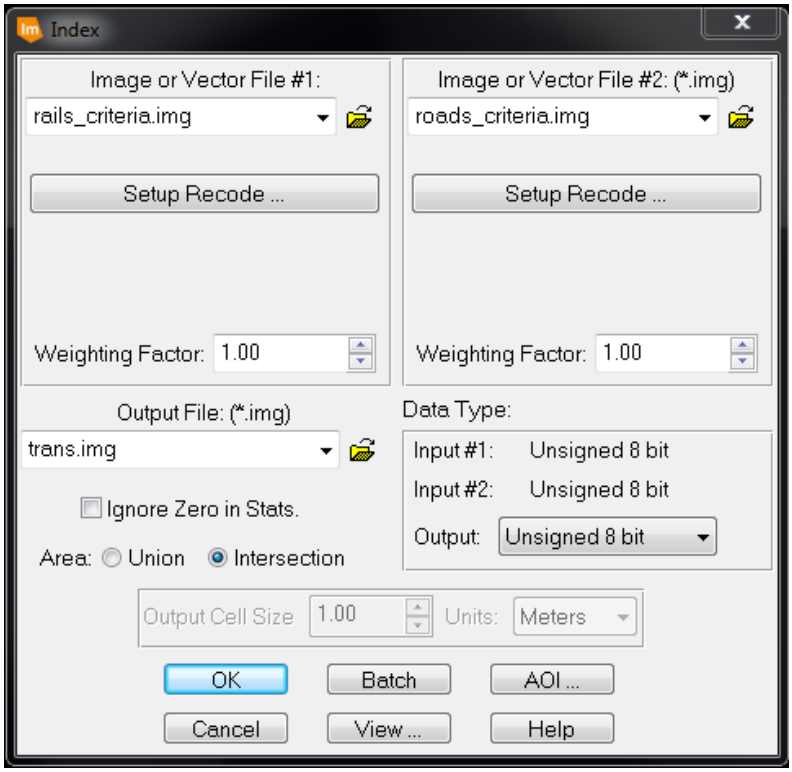
Task 5: Combining Data Layers

In the previous steps, you prepared the data for analysis. Now, we will take the individual data file and combine them to start identifying suitable locations for depot locations.

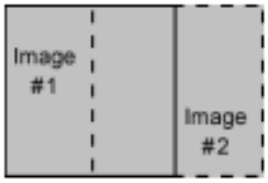
The first process will be to index roads_criteria.img and rails_criteria.img in order to create one file, showing areas meeting the buffer criteria for both features (areas which are within 1000m of a rail line and 2000 m of a major road).

The Index function creates a composite image created by adding the class values of the input files together.

1. From the Raster tab, click **Thematic**  > **Index by Weighted Sum** (in the Two-Layer Union Operators group). The Index dialog displays



2. The **image or Vector Files #1** and **#2** are ***rails_criteria.img and roads_criteria.img***, respectively
3. For the Output File name, type ***trans.img***
4. Set the Area radio button to **Intersection**



***Union** considers the entire image. Union will combine the image area of all input files.*

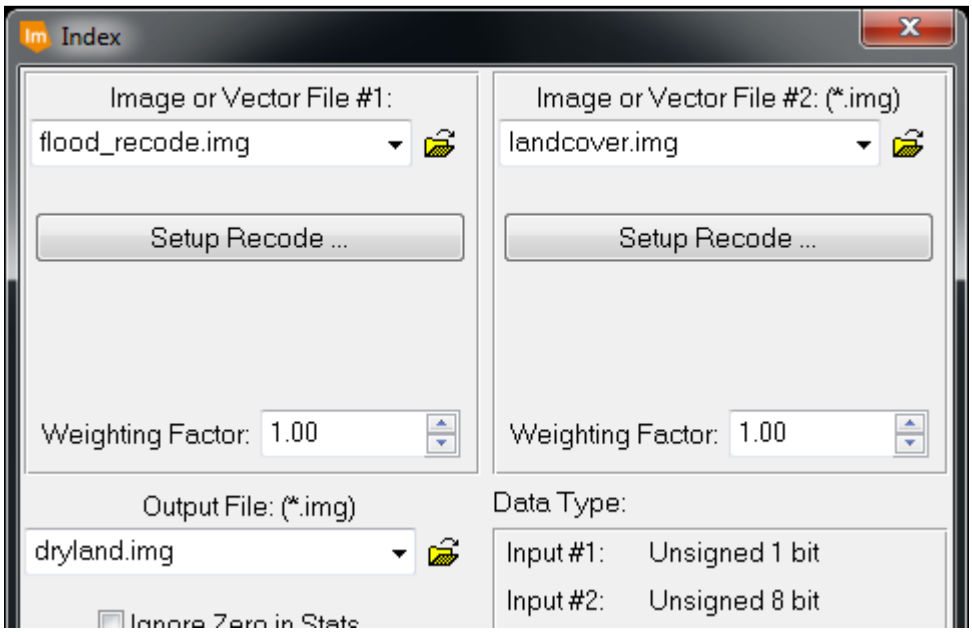
***Intersection** considers only the overlap area, when indexing. Intersection will combine only the image area that all files have in common.*

5. Click **OK** to index the files
6. Open ***trans.img***. The file contains three classes of: background (**0**), areas meeting one criterion (**1**) and areas meeting both criteria (**2**). We are interested in Class 2.

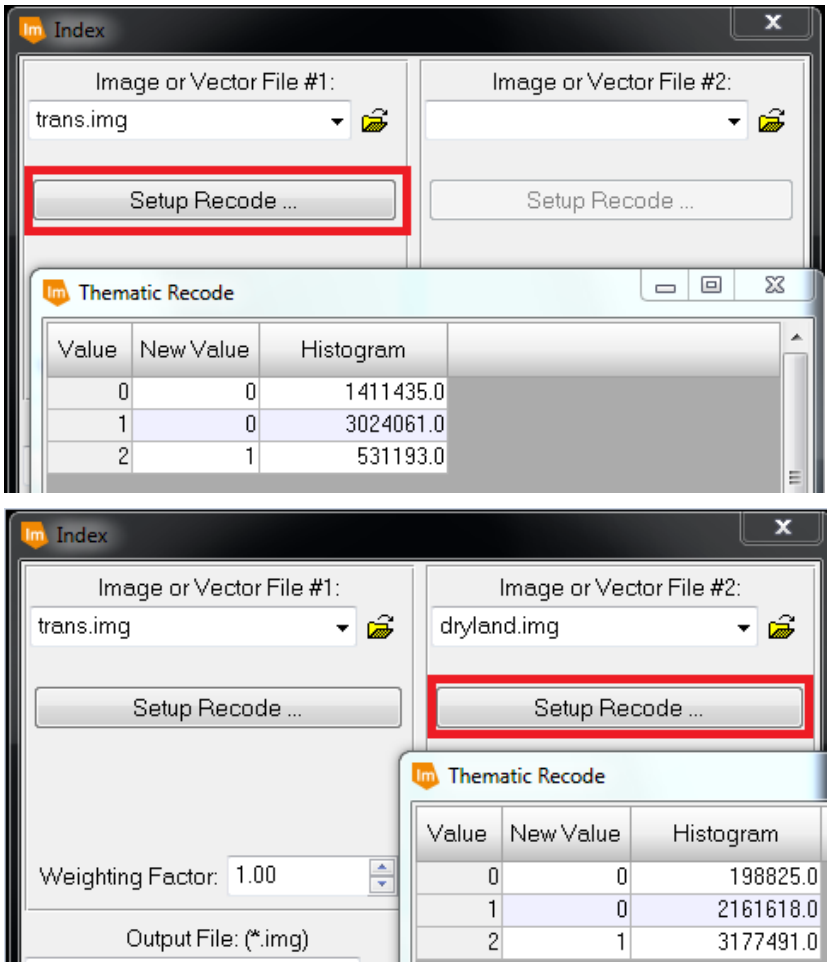
We now need to index the flood_recode.img and landcover.img images.

7. Index ***flood_recode.img*** and ***landcover.img***

   Use the previous steps to index these files and then name the Output file ***dryland.img***



8. Perform the index one last time to combine ***trans.img*** and ***dryland.img***. Both files will need to be recoded as you index (use the **Setup Recode** button). We are interested in the pixels with a class value of **2**. As you index the two files together give those values **1** and all else a value of **0**



9. Name the Output file ***depots.img*** and click **OK** to run the process
10. Open ***depots.img*** in a 2D View
11. In ***depots.img***, we are interested in all the pixels with a value of **2**. Recode this image giving the pixels of interest a value of **1** and everything else a value of **0**. Name the Output file ***depots_recode.img***
12. Open ***depots_recode.img*** in a View and displays the **Raster Attributes**. Change the color **Class 1** to a bright color

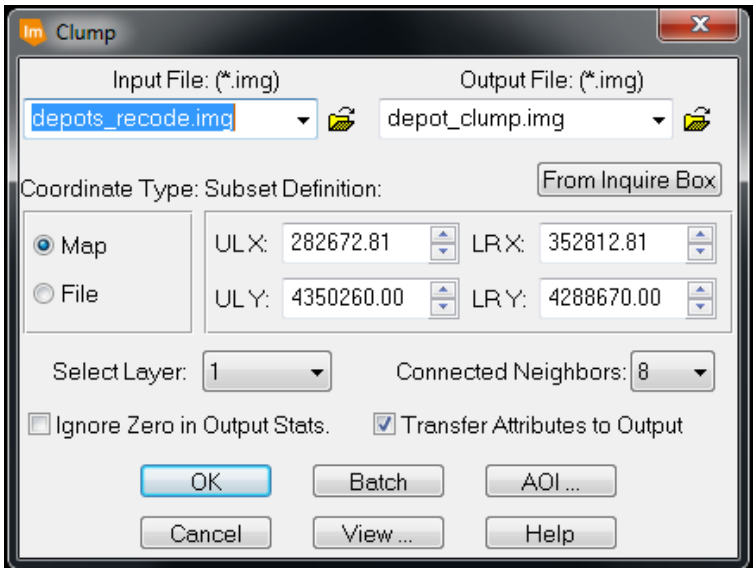
Task 6: Identifying Areas Meeting the Criteria

The last criterion is related to the size of the parcels of land. Not all pixels in depots_recode.img are suitable. We need to identify pixels that also meet the size criterion. To do this you must identify groups of contiguous pixels that represent an area 0.25 sq. km or larger. You will do this using the Clump and Sieve functions.

*The **Clump** function idenitifes contiguous groups of pixels in one thematic class.*

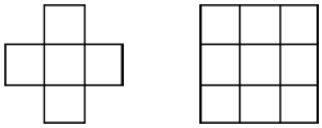
*The **Sieve** function eliminates clumps of data values that are smaller than a minimum size specified for the analysis.*

1. From the Raster tab, click **Thematic**  **> Clump**
2. Add ***depots_recode.img*** as the input file and name the Output File ***depots_clump.img***.



3. For the **Connected Neighbours** select **8** then click OK to being the process

4 will clump together only pixels that share a side and 8 will clump together pixels that share a side and a corner.

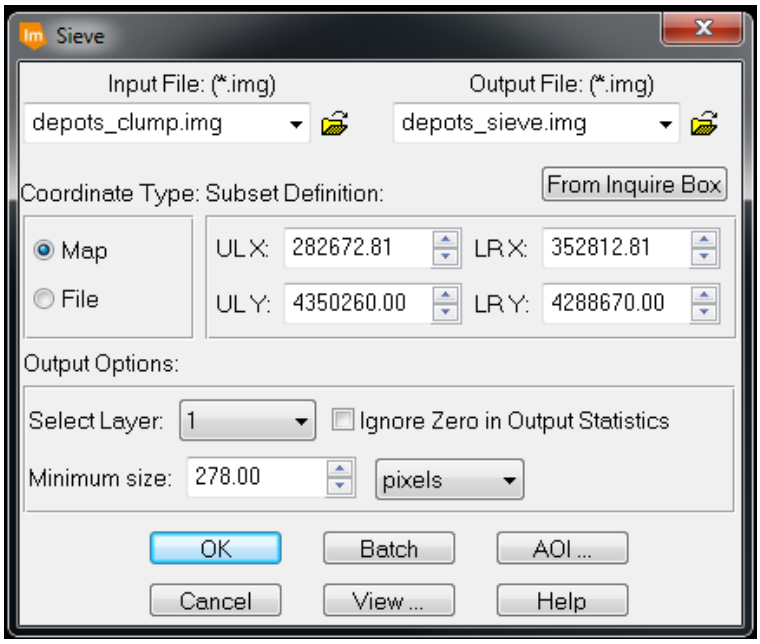


4. View ***depots_clump.img*** and open the Attribute Editor to determine how many clumps exist. Each clump is a separate class in the image

   How many clumps are in depots_clump.img?

   Now, you will filter clumps not meeting the criterion using the Sieve function

5. From the Raster tab, click **Thematic**  **> Sieve**



6. Add ***depots_clump.img*** as the Input File. Name the Output File ***depots_sieve.img***

7. Under the Output Options we will set the sieve size. Any smaller clumps will be discarded. The Minimum size is **278** pixels

Minimum size is calculated as:

0.25 sq. km = 250,000 sq. m

1 pixel = 30 x 30 = 900 sq. m

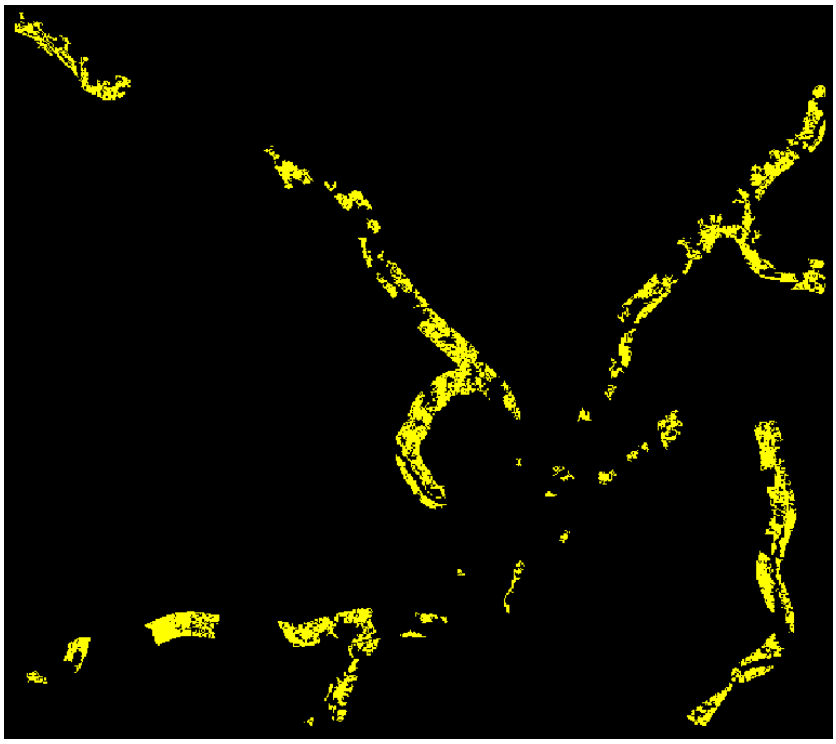
Minimum Size (pixels) = 250,000/900 = 278 pixels

8. Accept all other defaults and click **OK**

9. Open ***depots_sieve.img*** and view the Attributes. We now have a much smaller set of classes

How many clumps meet all the criteria for depot site location?

10. Perform one last **recod**e to set all the clump meeting the criteria to a value of **1** and everything else a value of **0**. Name the Output file ***depots_final.img***. Set the Output Data Type to **Unsigned 1 bit**



Task 7: Overlay Files

The objective of this task is to create a composite image by combining input files. We will overlay files one on top of another. As we overlay the files we will recode them.

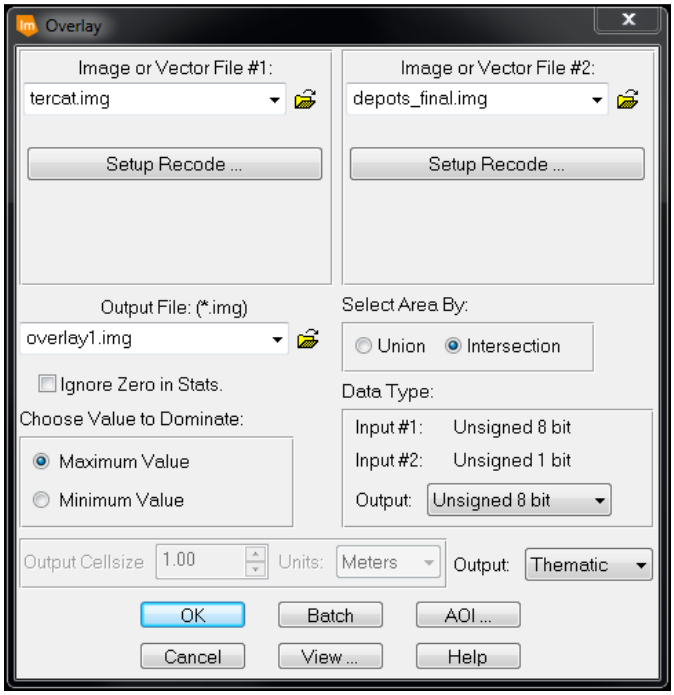
One of the option in Overlay is: Maximum value dominates. The class with the highest value will overlay all other data. Knowing this allows us to determine our recode accordingly.

1. Determine which files to overlay to create the final image composite. In this case we will overlay ***railroads.img, major_roads.img, TERCAT.img*** and ***depots_final.img***

   The data layer that you want to dominate should be the last file you overlay. In our case the TERCAT will serve as the base. We will then overlay depots, rails and roads respectively

2. **Clear** all open Views

3. From the Raster tab, select **Thematic**  **> Overlay by Min or Max**



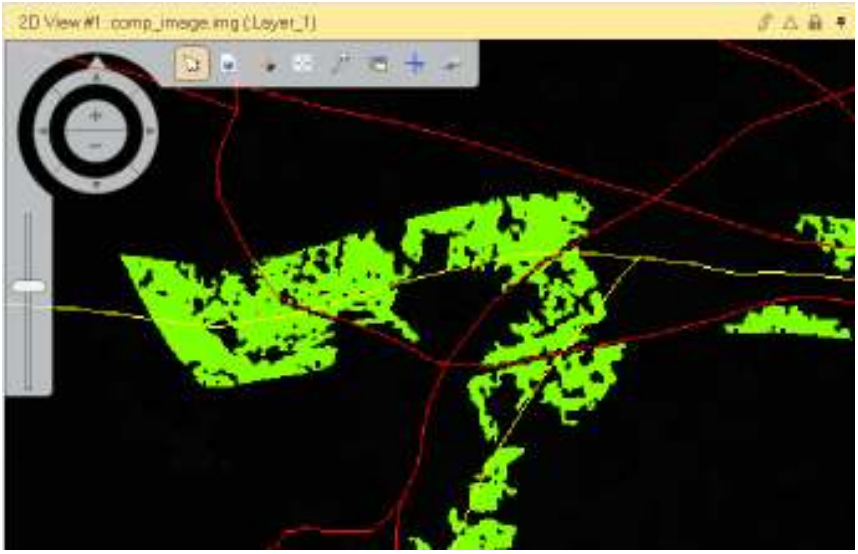
4. The Input Files are ***TERCAT.img*** and ***depots_final.img***

5. Under ***depots_final.img*** click **Setup Recode** and assign a class value of **8** to the suitable sites and to all else use a **0** value

6. In the Thematic Recode dialog, click **OK**
7. Name the Output File ***overlay1.img*** and set the Select Area By to **Intersection** and Choose Value to Dominate to **Maximum Value**
8. Set the Output Data Type to **Unsigned 8 bit**
9. Ensure that the Output type is set to **Thematic** and then click **OK**

   The Overlay function will be repeated on two more files
10. Next, combine ***railroads.img*** with ***overlay1.img*** and set the value for the **railroads** to **9**. The output filename will be ***overlay2.img***. Ensure the Output type is set to **Thematic** and then click **OK**
11. The last file to overlay with ***overlay2.img*** is ***major_roads.img***. Recode roads to **10** and other classes to **0**
12. Name the final image ***comp_image.img***
13. Ensure the Output type is set to **Thematic** and then click **OK**
14. In a Viewer, open ***comp_imgage.img*** using **Pseudo Color**
15. View the **Raster Attributes** and then assign colors and class names to the final image.

    In an effort to maintain the original color scheme from the TERCAT, how would you quickly copy this information?



Class Notes