Lab 3. Introduction to GMT and Digitizing in ArcGIS

Purpose: To learn how to use GMT to make basic maps and learn basic digitizing techniques when collecting data from digital image sources.

To Do: Use GMT to create a map and use ArcGIS to digitize the outlines of features from a scanned photo described below. Create and turn maps.

Extensions Required: none

Data Source:
>   **Part I:** /home/GIS/GIS/
>   **Part II:** S:\GEY430_630_Spr04\digit

Part I:
Sometimes it is not necessary to create an ArcGIS map when all you need is a basic Basemap. Therefore know what other tools are available for making figures is necessary. In this part of the lab you will learn a free-ware software called GMT (Generic Mapping Tool). Other uses include creating seismic sections, velocity models, filtering gravity maps, plotting beach balls for earthquakes, well logs, and more. This software can run either in UNIX or LINUX (on a PC). We will use the UNIX version of the software. This software work in layers as well, you will need to pay close attention to this.

Before we get started with GMT lets go over some useful commands for UNIX.

>   **mkdir directory_name** - makes a directory with a given name.
>   **cd directory_name** - changes to the directory indicated.
>   **ls** - lists files by name from within the directory you are currently located.
>   **ls -a** - lists all files including hidden files by name from within the directory you are currently located.
>   **ll** - lists files by permission, size, date, and name from within the directory you are currently located. This is good to check the size of the files you are creating.
>   **mv file_name new_file_name or directory_name** - moves a file to either another file name or into a directory. Be careful this can not be undone!
>   **rm -i file_name** - removes the file specified.
>   **cp file_name new_file_name or directory_name** - copies a file to a new file name or a directory specified.
>   **chmod 775 file_name** - changes the mode for the files you are using and makes the file executable.
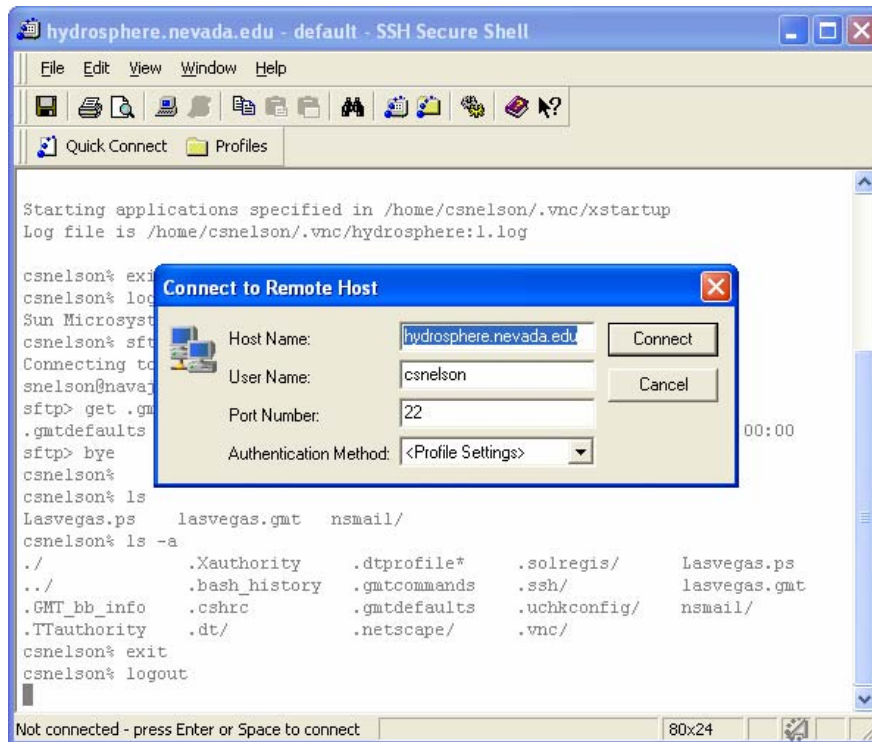
How to log into a UNIX Machine:

You will be using several types of software in order to use the UNIX machine. The UNIX machine you will be using is called **hydrosphere**. First you will need to set up the login.

1. launch the SSH Client and click on quick connect, type in the

host name   hydrosphere.nevada.edu

user name   your login

port number   don't change

click connect and enter your password.

2. at the command prompt type

vncserver

the first time you do this it will ask for a password, use the same as you have been using.

note the **desktop number** you are assigned. Should be something like:

New X' desktop is hydrosphere:1

3. Now go to edit, settings. Click on tunneling outgoing on the left side. Add an outgoing tunnel. The display name is VNC, the listen port and destination port will be 5900+the desktop number. So if you desktop number is 1 then the port will be 5901. The destination host is 127.0.0.1. Click ok and ok again. Click on Connection, make sure its set for password not public key. Click file, save settings.
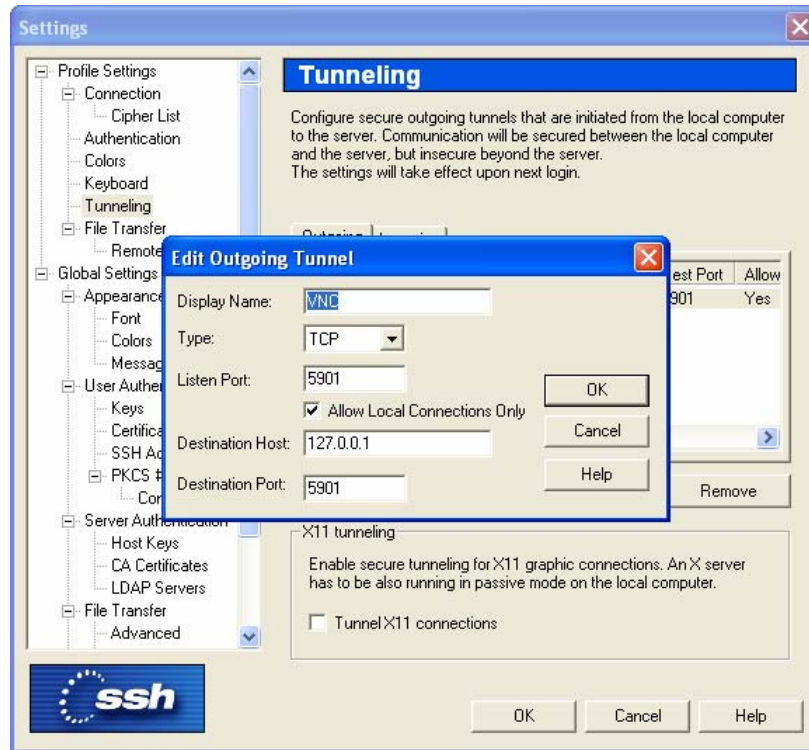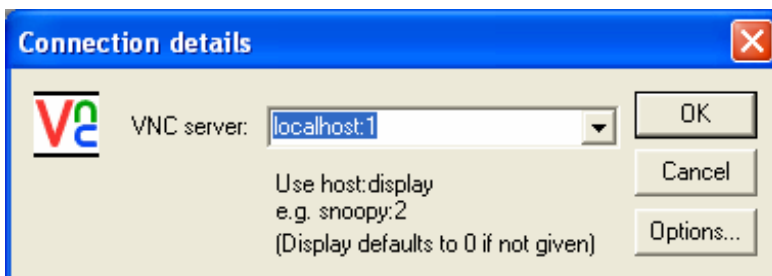

4. Type exit at the command line. Re-connect with quick connect. Login and leaving yourself logged in on the SSH client. Now launch **VNC**. In the connection details type:

localhost:desktop number

so if you desktop number is 1 then you would type

localhost:1

A screen will pop up, you are now logged into hydrosphere. If you type pwd you will see that the machine tells you what directory you are in. You should be in /home/GIS/yourname.

5. Now copy the files you will need for this exercise. Type the following to get those files:

    cp /home/GIS/GIS/*.gmt .

    this will copy a file called lasvegas.gmt to your account.

6. Lets take a look at the file. Type:

    more lasvegas.gmt

    here you will see a series of commands, we would have gone over what these mean in lecture. You may need to pull out your notes to see what it all means.

7. Lets make a map. Type the following to run the script:

    sh lasvegas.gmt

8. A box will pop on the screen, move you cursor to a position on the screen and click with your left mouse button. You will see a map pop up like the one below. Once you have viewed the file, click file quit.
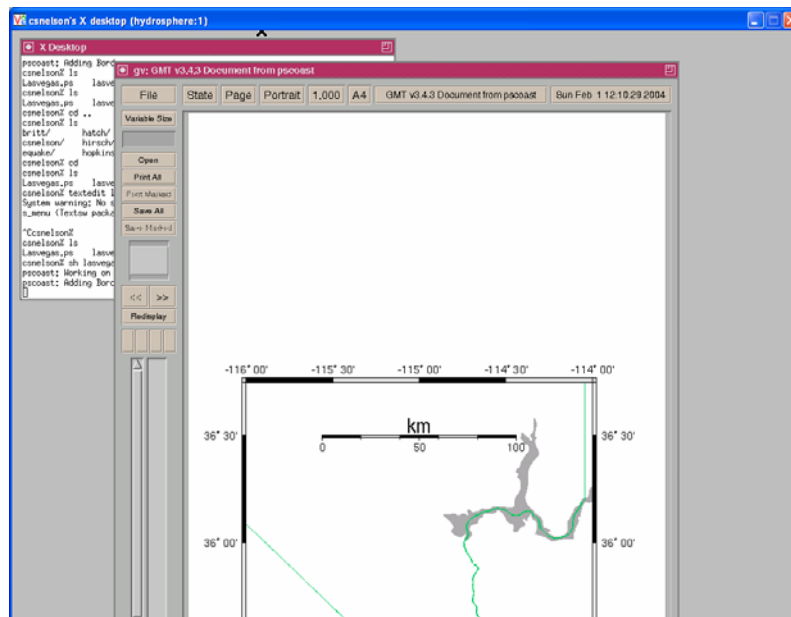
if you ls in this directory you will see you created a file called Lasvegas.ps. This is you map that you created.

9. Now add a symbol for the city of Las Vegas. To open the file to edit it, type:

    textedit lasvegas.gmt

    This will bring up a box, decide where you want and click. Here is the text file of
    your script. You will need to add three lines of code to make a symbol show up on
    the map. You should have this in your notes from class. The long and lat for Vegas
    is:

    -115.14115 36.01835

    the map should look something like this:

10. Now make your own. Choose an area you would like a make a map of and plot at
    least one symbol of a city or object on your map. Once you have made you map then
    you can log out. Just close the X in the upper right-hand corner on VNC. Don't log
    out of SSH yet.

11. Now you will need to transfer your map to the PC you are working on. Click on
    window, new file transfer. You should see on the left side if the PC file system and
    the right side is your UNIX account. You want to move your .ps file to you PC

account. Highlight the .ps and click on the down arrow. Navigate to your DATADRIVE area and click download. That's it. Now disconnect.

12. You need to clean up the map a little and attach labels. You should have noticed that in GMT you have graticules telling you the lat and long of the map, you should also have a scale on your map. The last step before you are completed with this map is to add a label for the symbol you have on the map as well as add a title and your name. To do this launch Adobe Illustrator. Open the file you just transferred. Annotate anything on the map that would require further explanation.

To Turn In:
Produce one map to turn in the printed annotated version. On this and all maps you need to include your name, title, and scale bar. This is due one-week after assignment, at the start of lab.
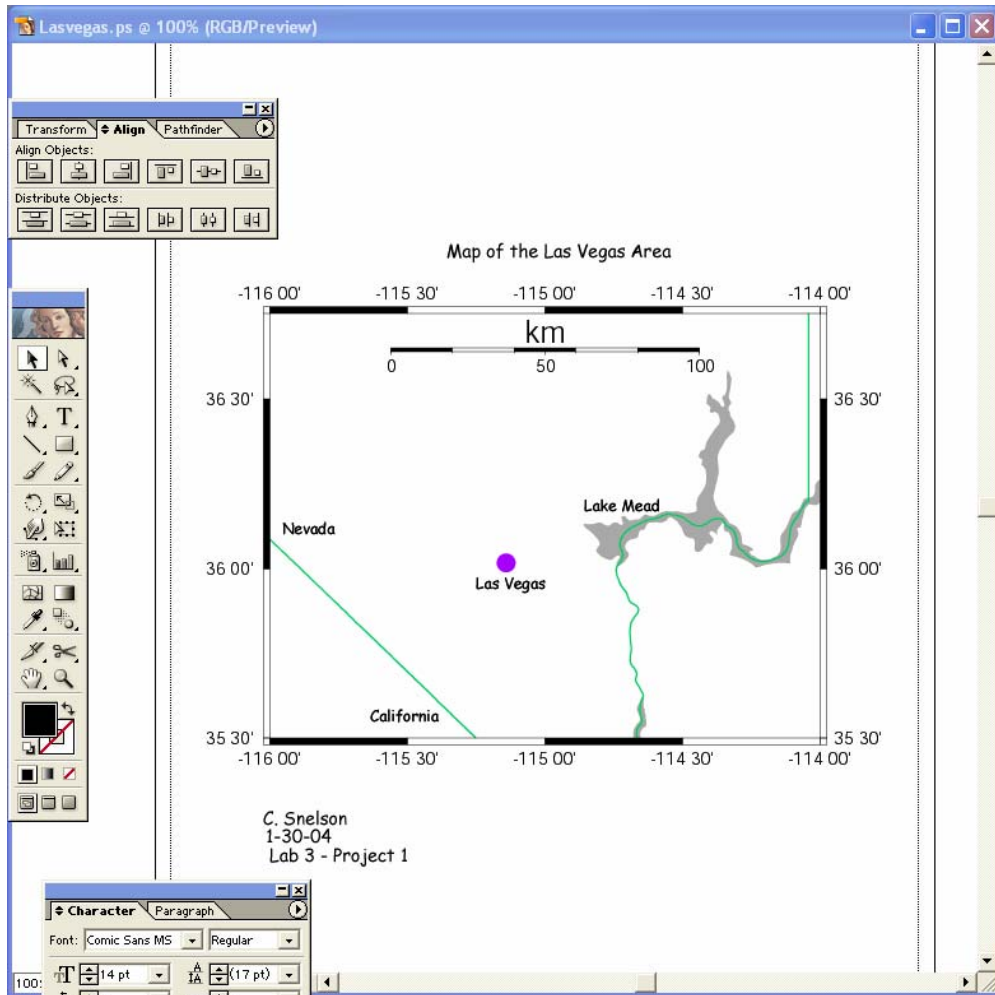
Part II:
Digitizing is the process of converting paper map or image data to vector digital data. In manual vector digitizing you trace the lines or points from the source media. You control a cursor, usually with a mouse or digitizing puck, and sample vertices to define the point, line, or polygonal features you wish to capture. The source media may be hardcopy, e.g., maps taped to a digitizing table, or softcopy, e.g., a digital image or scanned map. ESRI software allows us to digitize using either hardcopy or softcopy sources.

On Screen Digitizing in ArcGIS
Our practice exercise will involve digitizing a set of features from a scanned photo. Flatbed scanners and digital cameras are common, so softcopy digitizing is a standard procedure. Scanned photos have some geometric distortion. However, this distortion may not be too great, depending on our error specifications, and how the photo was taken (flying height, focal length of camera, etc.). Digital orthophotoquads (DOQs) are scanned photos for which most of these errors have been removed. DOQs and are being developed for the entire U.S. by the US Geological Survey (USGS). DOQs are a common data source for resource management agencies.

GIS data are also commonly entered from scanned photos, both because scanners are cheap, often smaller and at least as accurate as coordinate digitizers, and if you scan a photo you can zoom in on the image, often reducing both interpretation and positional error. Digitizing directly on screen is sometimes called "heads-up" or softcopy digitizing.
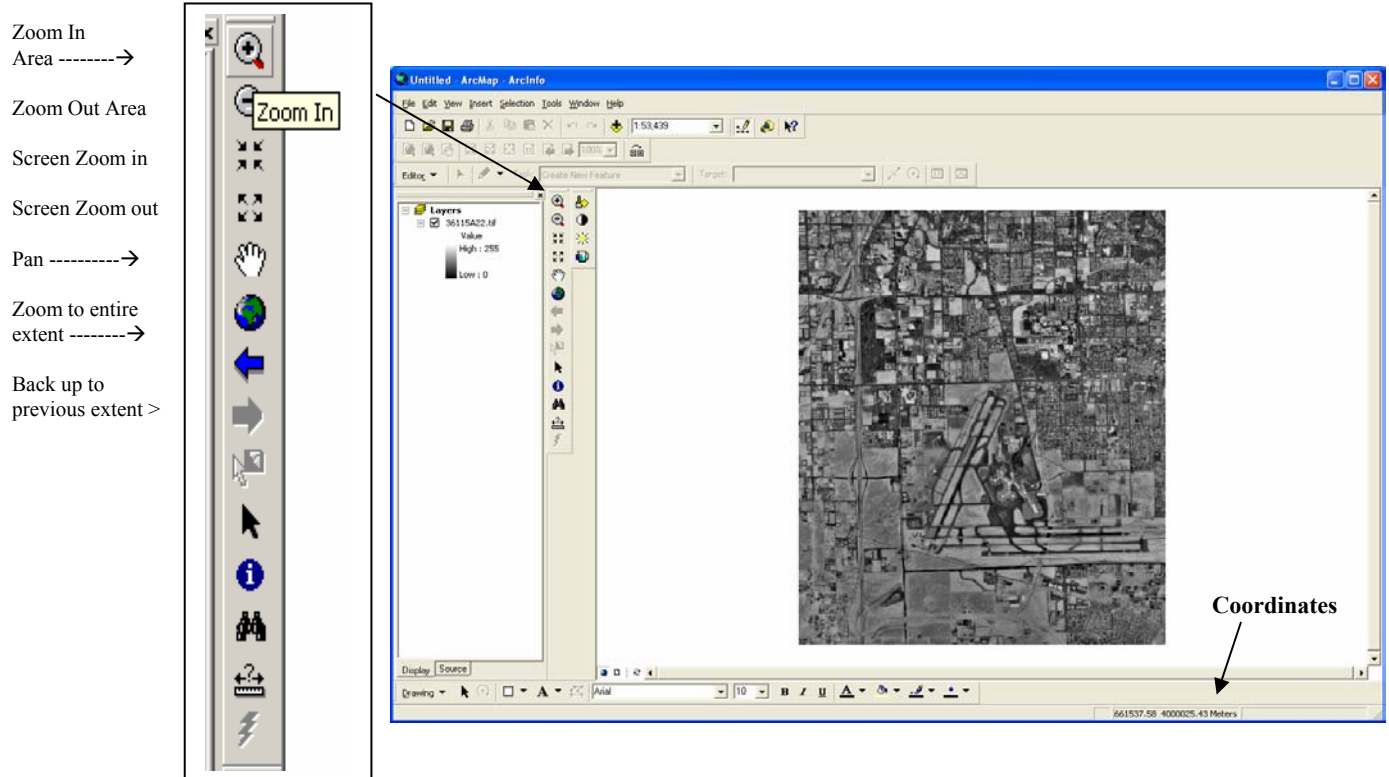
First make sure you've copied the files to your working directory. Use Windows Explorer to copy the directory name S:\GEY430_630_Spr04\digit to your area.

- Start ArcGIS,.
- Select a NEW blank document.
- Select the add Data button, it looks like a plus sign over a   box.
- Navigate the folders in the Add Theme box to display the working directory that contains your data DATADRIVE:\digit). You should now see a file named LasVegas_SW.tif in the display of the Add Theme box.
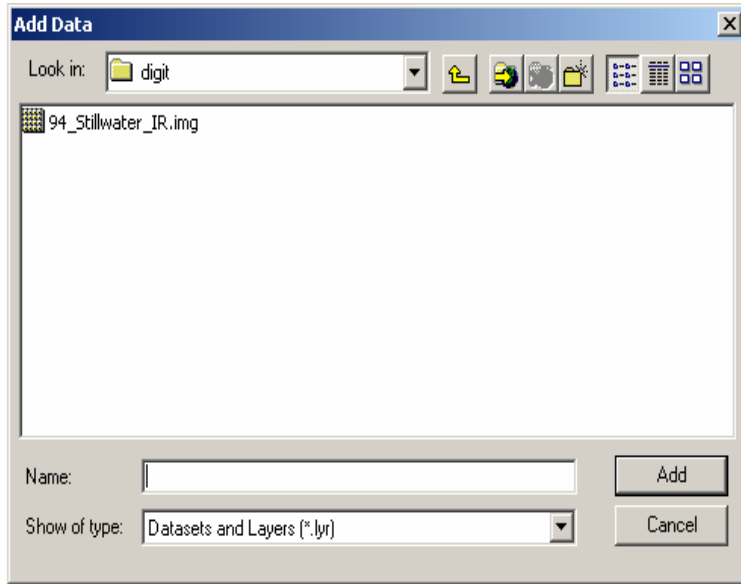
Highlight the
LasVegas_SW.tif file and
click the ADD button. You
should get an image of the
south-central Las Vegas up on
your screen.

This is a scanned aerial photograph of the type often used for land cover and vegetation
mapping. Notice how the coordinates change in the lower right corner of the ArcGIS window
whenever you move the mouse. These are the coordinates for the view, and they have been
established from the image data. Also note and practice the zoom and pan utilities, activated by
the magnifying glass and hand icons on the toolbar (see figure below).

Zoom In
Area -------->

Zoom Out Area

Screen Zoom in

Screen Zoom out

Pan ---------->

Zoom to entire
extent -------->

Back up to
previous extent >

Coordinates

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You can change the brightness, contrast, and transparency of the image by clicking on the Tool Bar. To add this tool bar, click View, toolbars, effects.
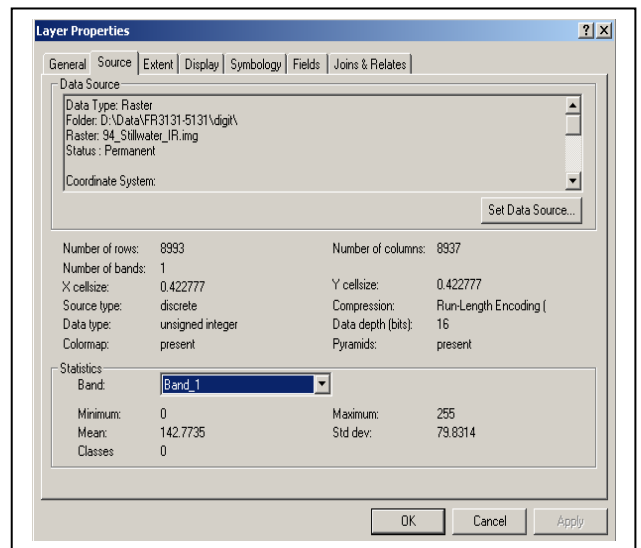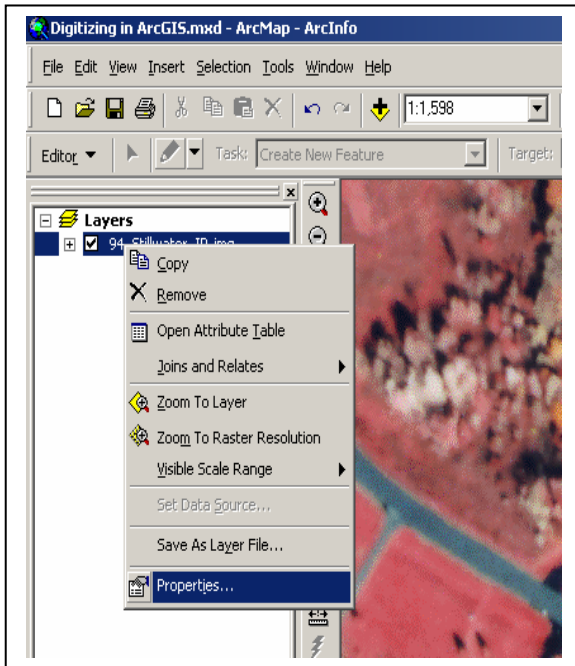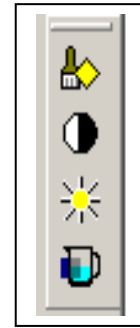
The image is a raster that is a grid or checkerboard with a value in each cell. The values are the shades each of gray. These values are used to display (or analyze) the image. Use the identity cursor to examine the image. Click on the 🛈 then click on a part of the image. The results box will tell you what values are stored in that cell. What is the cell size? (see the above box)

Select Classified
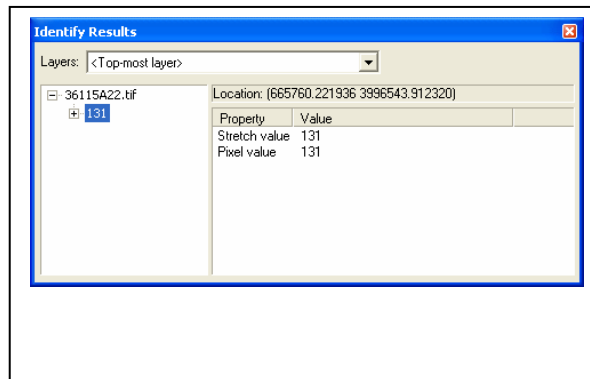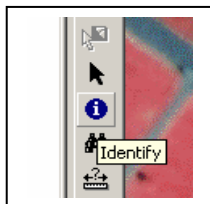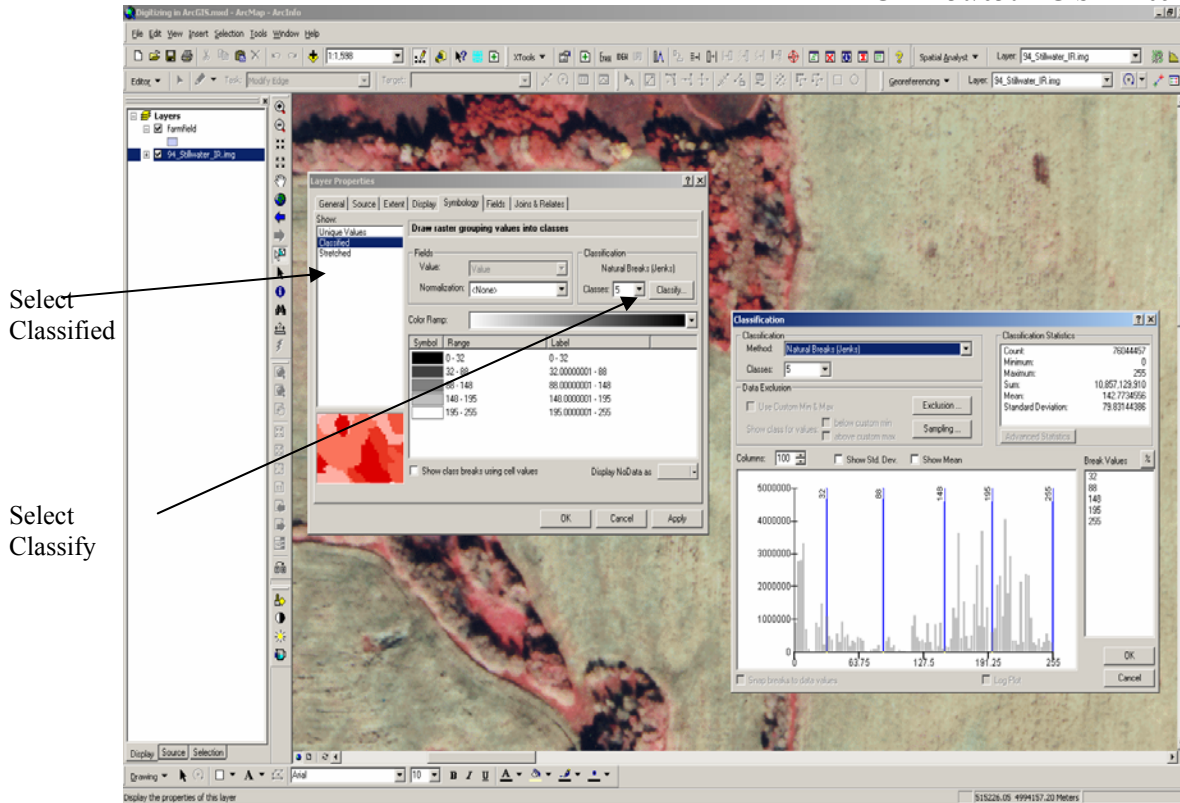
Select Classify

Select the LasVegas_SW layer, right click to select Properties, select Symbology, then select Classified (on the left of the Layer Properties box). Notice this groups the values into 5 categories based on the "Natural Breaks" in the data. Finally create a new classification by clicking on the Classify button on the mid-right of the Layer Properties box)

This will show you a histogram of all the cell values. Notice you can add the Standard Deviations or Mean to the histogram with the check boxes. Think about what this information tells you about the raster image.

First we'll digitize at least UNLV buildings locations, as points. Look at the map at the back of this lab, and notice the locations of the buildings. We'll get their exact locations from the image by digitizing. To digitize a new layer you:

- Create a new shapefile. First launch ArcCatalog from ArcMap, click tools, arccatalog. From ArcCatalog navigate thru the tree to your folder. Right click on the folder, new shapefile.
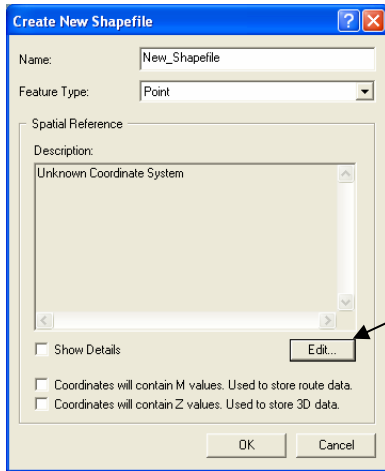
Click on edit.

- The feature type will initially come up point, but you could also select line or polygon types.

- Select point, remembering to save everything to your DATAFILE, and name it something descriptive, e.g., UNLV Buildings. The default is "New Shapefile.shp", if you don't name and place it, you may save your shape file to this generic name and have difficulty tracking it down later.
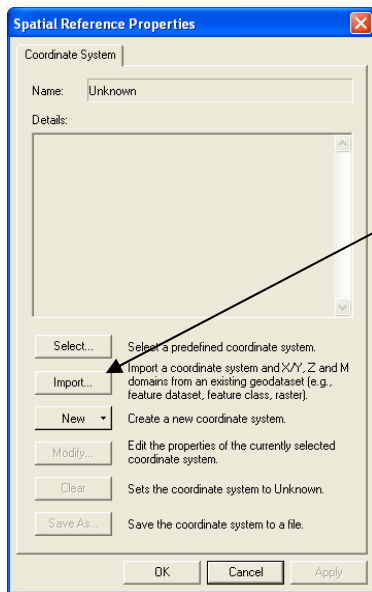
Select Projection and Import a Projection definition from the other layer in the Map that is LasVegas_SW.tif.
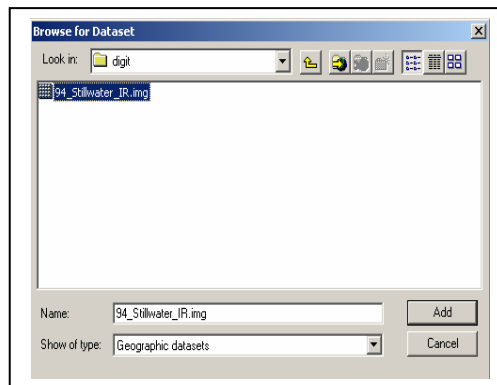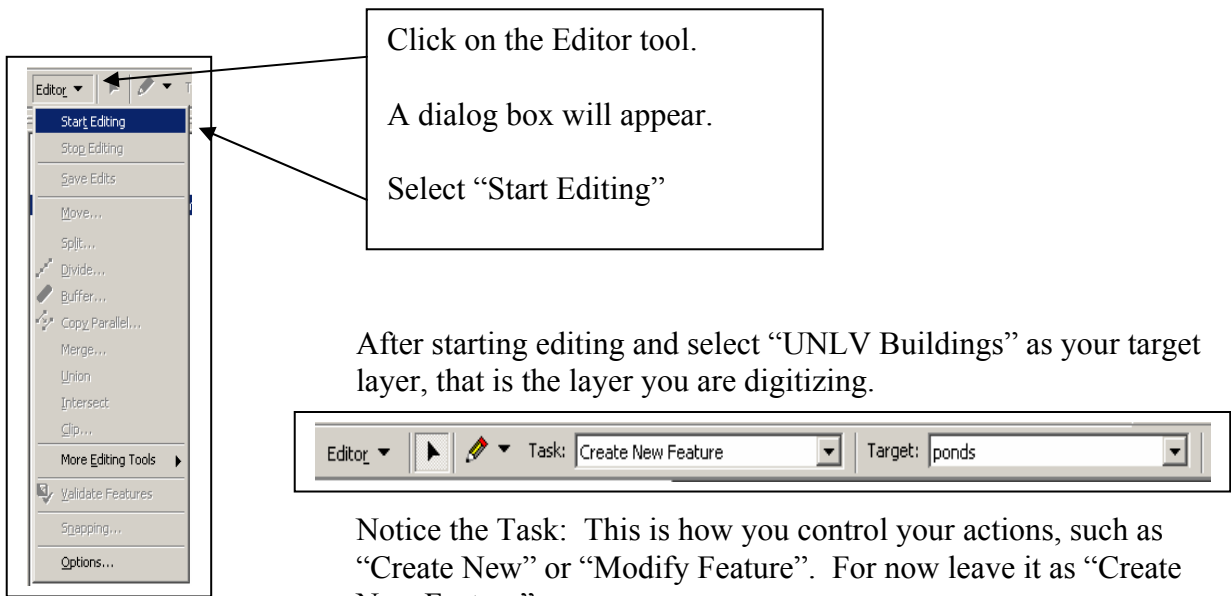
Click Add

The projection information is now added to the Spatial Reference Properties. Click Apply to add the projection information then OK to complete the dialog. Finally lick on OK to create the new building layer.

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- Your goal is to digitize points (UNLV Buildings), lines (major Roads), and polygons (selected Vacant land) from this image. See the map at the back of this document labeled "Features to digitize from Las Vegas photograph". You'll need to zoom in and pan around to get all the features on the map.

- Since we will be digitizing Roads and Vacant land, create a layer for each. Repeat the same process for each new layer. Remember Roads will be **polylines** and Vacant land will be **polygons.**

To begin digitizing you must first add the shapefile then you can start editing, pick a layer, and select a edit function

Click on the Editor tool.

A dialog box will appear.

Select "Start Editing"

After starting editing and select "UNLV Buildings" as your target layer, that is the layer you are digitizing.

Notice the Task: This is how you control your actions, such as "Create New" or "Modify Feature". For now leave it as "Create New Feature".

- Select the draw tool, . This changes your cursor for digitizing. You cursor is now a cross and when you left click a point will be added to the building layer (your Target).

To digitize points move the cursor over the image. Place the cursor over a UNLV building, and left-click. Use the map at the back as a guide to locate the UNLV Buildings, and put a point near the center of each pond. If you don't like the symbol color (perhaps it is too dark and you can't tell which you've done) you can change the color by double clicking on the legend entry, as you would for any theme.

To find all the *UNLV Buildings* you need to move around the image. Digitize at least 10 buildings

Remember the Pan cursor Use it to move around on the image.

What about scale? Can you see the *UNLV Buildings* when you are zoomed out to 1:20,000? (Remember the Scale Tool, you can type a number in to zoom to that scale or use the Zoom Cursor, as mentioned above). Scale is very important when digitizing. If you digitize at 1:20000 you will only generally get the position of the building, road or vacant land. If you digitize at 1:1000 you will be very accurate but you will be panning on the screen forever. The best scale depends on the nature of your project, what level of accuracy you need to correspond with the other data layers. If you right click on the LasVegas_SW theme you will see "Zoom to Raster Resolution", click on it. Notice you now zoomed to 1:3,780 that is one unit on the screen relates to 3,780 units on the ground. Because you are at the raster resolution (the dots per inch the image was scanned at) each pixel on the screen represents one meter on the ground. Now for our lab project even this scale is too fine, so lets settle on digitizing at 1:6,000, that is a good compromise.

Find all the *UNLV Buildings* and put a point in the center of each pond. (See the example at the end of the exercise if you are having trouble deciding what is a pond; shadows can easily confuse you)

Remember to use the Pan cursor to move around or the Scroll Bar arrows at the bottom or right side of you screen.   You can also use the scroll wheel on your mouse to roll up or down. Practice moving around, you'll need to be good at this for the next steps.

When you are done with *UNLV Buildings*, save the edits by click on the Editor button and Save Edits.

Notice that the last point you digitized may be yellow or some different color from the rest of the points. Don't worry about this, it only means the point is the current "active" point. To de-select it, go to the top Selection Menu and select Clear Selected Features. The color should now match the rest of the features digitized.

Now switch to digitize the roads layer. You should digitize at least 10 major roads. From the Edit Toolbar select the Roads layer as the Target. Make sure you are using the Task "Create a New Feature". Select the draw tool, .   Move the cursor to the start of the road you wish to digitize, and left click. Move along the line, left-clicking when you need a vertex. Double click to end a line. If the entire line segment you wish to digitize is not in the view, navigate around the image as described above. Notice that if you are drawing a road line you can use the Scroll

bars to move the image with out changing your draw cursor.   (hint; if your screen does not

refresh after Scrolling click on the [↻] refresh button at the bottom of the screen)

Try and draw the roads on the centerline of the roads on the image.
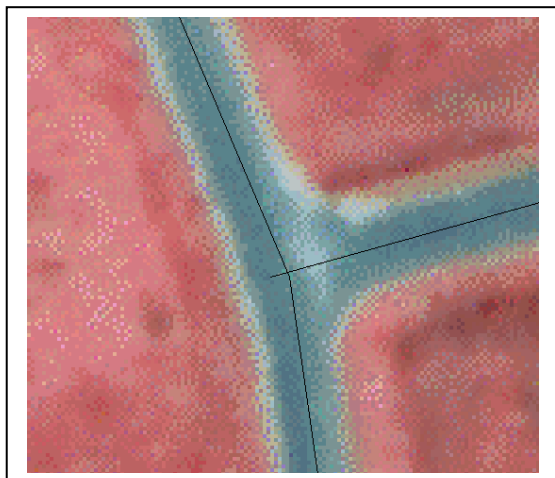Mistakes? What if you goof? Put the cross of the cursor on you mistake vertex and right click.
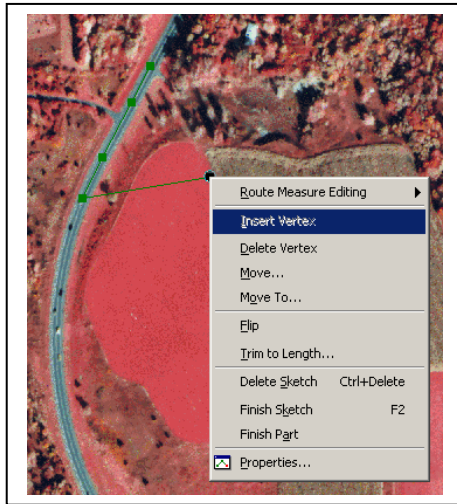
You can use this to delete the last point
entered if you make a mistake digitizing. If
you need to you can also delete the entire
sketch and start again.


Draw a two road segments. Like this

Then zoom in on the point where they seem to intersect. (use the Magnify tool to zoom in)

At 1:6000 the roads seem to meet but
you can see at 1:600 the really don't.
One road overshot the other. You fix
this by setting Options to Snap one layer
to anther when you are digitizing.

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To correct all you future work use the drop arrow in the Edit Toolbar and select Snapping
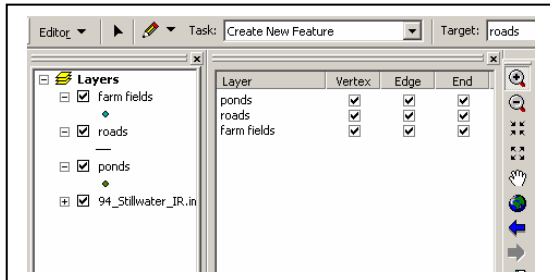

A box will open next to your Layers. Select Snapping of all vertex, edges and ends. Close the Snapping box with the X in the upper corner.

This will force your features to "snap" together.

Next select Edit Toolbar then select Options and set the Snapping Tolerance to 10 pixels.
This tells ArcMap how close the features should be to "snap them together" Don't set this too high or features will snap incorrectly to adjacent features.
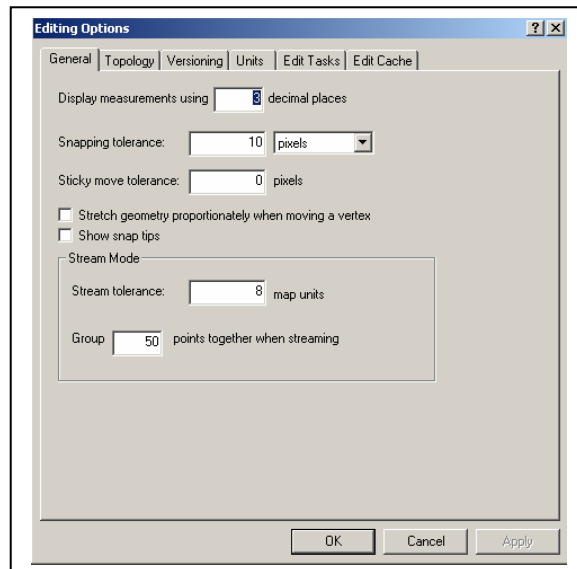
Continue until all indicated roads are digitized, and then Save Edits.

To digitize the Vacant land, change your target to *Vacant land*, and select drawing tool. Locate Vacant land around UNLV that could be used for future building for the campus. Move the cursor to a border of the polygon boundary (the field you wish to map) and left-click the mouse. This starts a new polygon. Each time you left-click, you will be placing a vertex for a polygon, until you double click, which closes the polygon. Notice once you've double clicked, the polygon has selection handles, a set of boxes around the corner and midpoints of a rectangle encompassing the polygon. This indicates the polygon is selected. Move the cursor to the next field, and repeat the digitizing process. As with points and lines, you can also change the color to Hollow to allow you to see the field. (double click on the color in the Theme Legend)
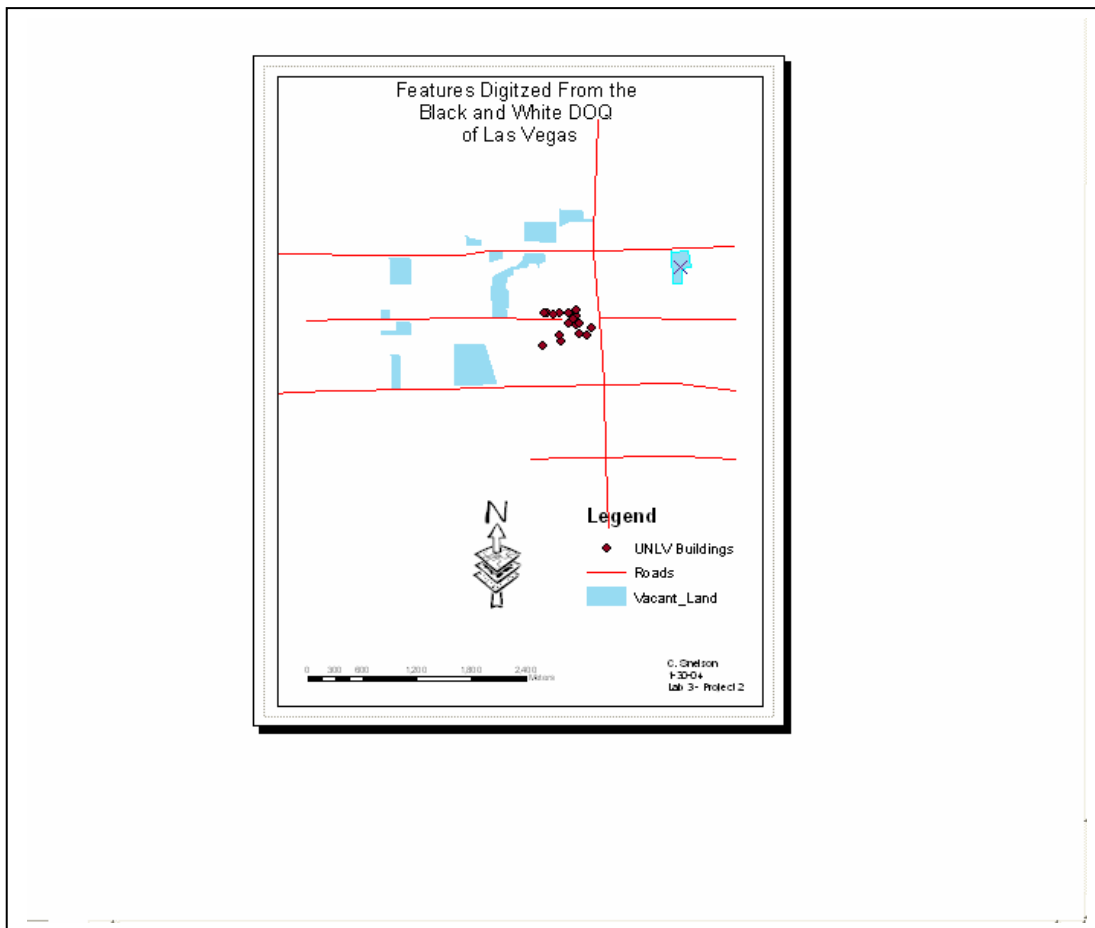

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If you make a mistake, use the Select Feature cursor to select the error polygon and press the Delete key.

Continue digitizing features, <u>at least the ones in the sample key</u>. Feel free to do as many Vacant land and roads as you wish. Save frequently using the Save Edits selection. During the course of this lab, you may have to leave before finishing. You can save your intermediate work, and stop editing. Save and Close the Map, and leave. When you come back, you will open the project back up. You will have to Start Editing again to continue.

To Turn In:
Produce one map to turn in which contains all three digitized layers. On this and all maps you need to include your name, title, legend, north arrow, and scale bar. This is due one-week after assignment, at the start of lab. To make the Map easier to read don't display the background image. Uncheck the display box for LasVegas_SW. Chose colors or shapes for the UNLV Buildings, roads and Vacant land with show up on the black and white printer. Colors will be display differently on non color printers.

Features Digitzed From the
Black and White DOQ
of Las Vegas

N

Legend
◆ UNLV Buildings
— Roads
▮ Vacant_Land

0 300 600 1,200 1,800 2,400
Meters

C. Snelson
1-30-04
Lab 3- Project 2

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Name:

Suggestions for Improvement: On Screen Digitizing Lab

Please help me improve this lab. As incentive, any improvements incorporated (or major errors removed) will gain you a point on your final grade total.

What didn't work in this lab, and how would you fix it?

What was the best part of this lab exercise?