



Rocky Mountain Mapping Center

Downloading Images and Digitizing Features Using a GIS

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Lesson: Thus far in this course, you have downloaded pre-made maps and databases to analyze. While you have already created new information from the existing maps and databases, sometimes you will need to create the original map and databases.

This week, you will have the opportunity to do so using buildings on the Sinte Gleska University campus.

First, you need a basemap on top of which you can create the map and database for the buildings.

To obtain the basemap, you will download and import a topographic map and an aerial photograph into ArcView GIS.

Next, you will create a map of buildings on the SGU campus, and create and populate a table of attributes associated with the buildings.

Skills Involved:

- 1) Downloading and formatting topographic maps and digital aerial photographs for a local area into a GIS.
- 2) Digitizing new features onto a map in a GIS environment.
- 3) Creating a table in a GIS and populating it with data.

Data Management

Create a folder for this exercise and name it *sgucampus*.

As you know from previous lessons, it is best to name the folder without any spaces in the name. You do not need to download any data this lab exercise from these web pages; you will download it from the site where the data resides.

Stemming originally from a USGS agreement with Microsoft, USGS topographic maps and digital aerial photographs are available for free download from an Internet site called "Terraserver."

The TerraServer Web site is one of the world's largest online databases, providing free public access to a vast data store of maps and aerial photographs of the United States. TerraServer is designed to work with commonly available computer systems and Web browsers over slow speed communications links.

The TerraServer name is a play on words, with 'Terra' referring to the 'earth' or 'land' and also to the terabytes of images stored on the site.

The maps and aerial photographs can be printed or read on screen.

The maps available on the site are USGS topographic maps at the following scales: 1:24,000, 1:100,000, and 1:250,000 (Alaska and Hawaii at other scales).

The site allows for zooming in on the maps to a resolution of 2 meters.

The aerial photographs available on the site are USGS aerial photographs flown at 1:40,000 scale.

The site allows for zooming in on the photographs to a resolution of 1 meter.

Coverage: The maps are available for the entire United States.

The photographs are available for approximately 85% of the United States.

Units: The maps and photographs are provided in the UTM (Universal Transverse Mercator) coordinate system.

Procedures:

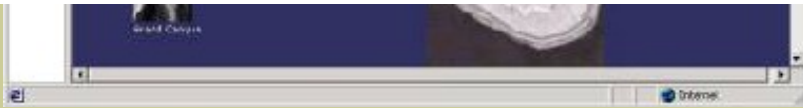
1. Go to the following web site:

<http://www.terraserver-usa.com>

Upon accessing the site, you will see a screen similar to that below.

Type in Antelope (without a state name) and press "Go."

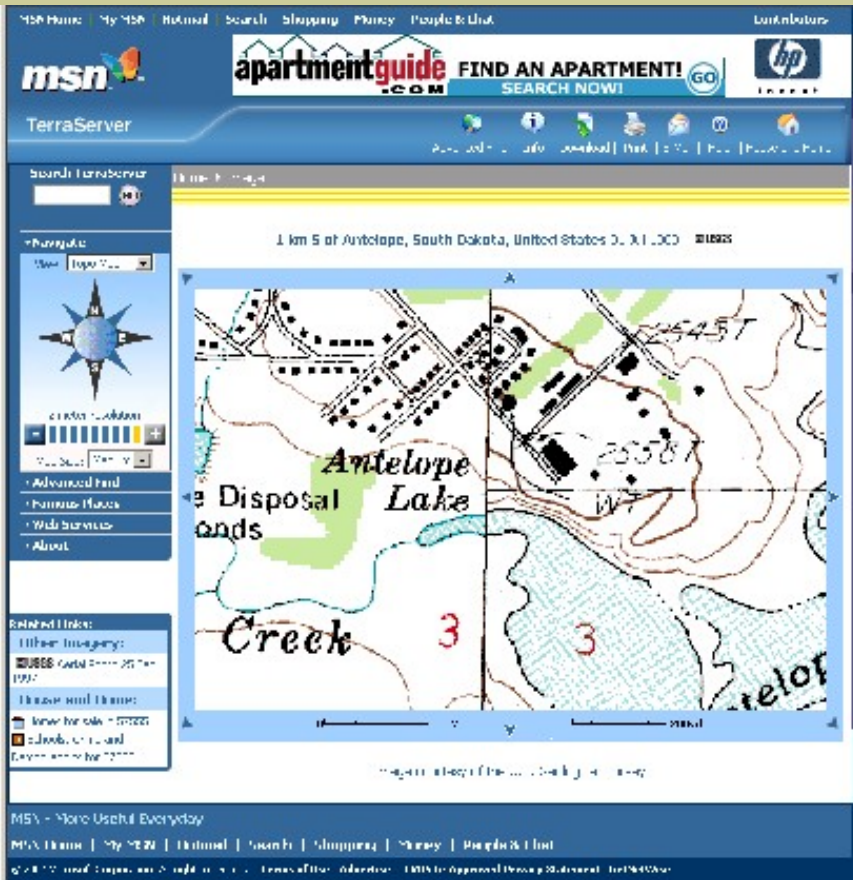




2. Select Antelope South Dakota TOPOGRAPHIC MAP from the list that appears.
3. When you see Antelope in your view, start zooming and panning until the area of the campus just north of the lake is in the view.

Make the image size LARGE using the button left of the map.

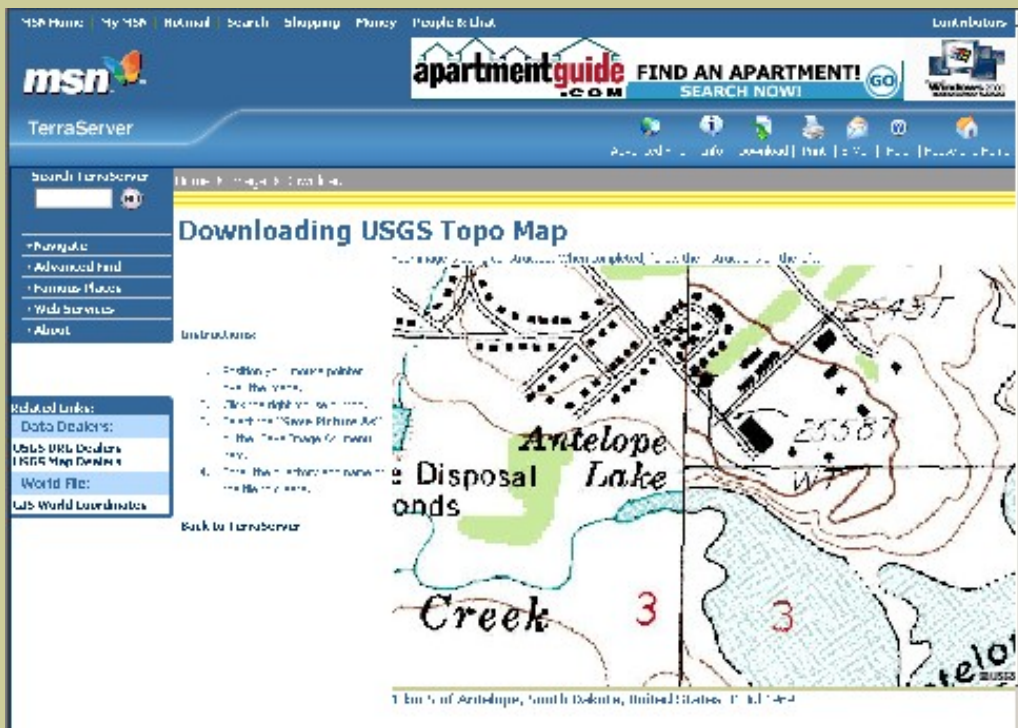
Zoom in until the zoom factor is 2 meters, as in the example below.



4. Select DOWNLOAD in the upper right hand corner of the image.

1) What is the date of the topographic map?

You will see a screen similar to that below. Click on the FREE DOWNLOAD arrow to redraw the image.



5. After the image has redrawn, **right-click** on the image and SAVE AS antelope_drg.jpg

In this example, "DRG" refers to "Digital Raster Graphic." This is a scanned, registered topographic map.

6. Click on the WORLD FILE link to open the registration file for the image in the browser window.

Go to FILE → SAVE AS antelope_drg.jgw

Be sure to save this as a TEXT file, not HTML.
Your GIS software will not recognize HTML.
It will only recognize text.

Be sure that the file does not have a .txt at the end of the name.

The "W" in JGW refers to the fact that this is a header, or "World" file.
This file tells the GIS software where the image file "sits on" or is registered to the Earth's surface.

The header files are named with the first letter and last letter of the image name with a "W" at the end

2) If you had a TIF image, what would the header file be named?.

7. Go back to the browser window where your topographic map is (before you downloaded it).

Click on IMAGE to see a DOQ of that same area. A DOQ is a Digital Orthophotoquad--a scanned, registered aerial photograph.

The procedures for the DOQ are similar to that for the DRGs that you followed above.
Make sure the image is **LARGE** and that you zoom in to **1 meter resolution**.

3) What is the date of the aerial photo (DOQ)?

8. Select **DOWNLOAD** in the upper right hand corner of the image.

You will see a screen similar to the one below. Click on the **FREE DOWNLOAD** arrow to redraw the image.

9. After the image has redrawn, right-click on the image and **SAVE AS antelope_doq.jpg**

The screen will look similar to that below:



10. Click on the **WORLD FILE** link to open the registration file for the image in the browser window.

Go to **FILE** → **SAVE AS antelope_doq.jgw**

Be sure to save this as a **TEXT** file, not **HTML**.

Be sure that the file does not have a **.txt** at the end of the name.

4) How many **JPG** files have you downloaded?

5) How many **JGW** files have you downloaded?

In WordPad, check the headers to make sure they do not have any **HTML** code.

6) Why is this important?

The header files should look similar to the following:

```
1.000000  
0.000000  
0.000000  
-1.000000  
367200.000000  
4796000.000000
```

The first and the fourth line indicate the resolution of the image across and down the screen.

The image for which the header is displayed above has a 1 meter resolution because lines 1 and 4 are 1.0000000:

Check your resolutions on your header files.

7) What is the resolution of your DRG topo map file?

8) What is the resolution of your DOQ aerial photo file?

Start ArcView with a new project and a new view.

11. In ArcView, turn on the JPG reader under File--> Extensions.

Add your images as IMAGE THEMES.

If the images do not appear in the list, be sure to check your file names on your system and make sure the headers are in text format.

Go to View—> Properties and name your view "SGU Campus."

Save your project and give it an appropriate name, placing it into the appropriate directory.

Set your view properties to meters for the map units and meters for the distance units.

Scroll your mouse on the screen and examine the coordinates in the upper right corner.

These should be in UTM coordinates--in hundreds of thousands for the easting, and over 4 million for the northing. If the units are small, then the images are not registered to real-world UTM coordinates. If the images are not in UTM, then you need to go back into Wordpad and make sure that your header files are in text format and look like the example above. You will need to delete the themes from the view, change the headers, and re-add the features to the view.

Your data sets are now ready to analyze.

9) Summarize any difficulties you had with the formatting of the images and header files and how you resolved the difficulties.

Examine the data by turning the themes off and on and adjusting their order in the list.

10) Which file covers a greater geographic area--the DOQ or the DRG?

Zoom in on the files.

11) Which file is a higher resolution--the DOQ or the DRG?

Save your project.

Zoom in to the SGU campus buildings just north of Antelope Reservoir.

12) Look in the upper right of the screen. What scale are you zoomed in to?

13) Can you click on individual buildings on the aerial photo or the topographic map and obtain information about them?

14) Why or why not?

15) Why are some buildings on the SGU campus missing from the aerial photograph and the topographic map?

Therefore, you will need to create a new theme containing the buildings. First, you will digitize in several polygons representing the buildings on campus--the "G" part of GIS. Second, you will create attribute, or tabular, data for these buildings in a table--the "I" part of GIS.

16) At this scale, should the buildings be created as points, lines, or polygons?

To create a buildings map layer, or theme: View--> New Theme.

Make the new theme the type that you indicated by your answer, above.

There are 2 main methods to digitize. One is with a digitizing tablet, a smart table that is underlain with a fine mesh of wires, across which you would trace the outline of the features to add with a mouse. Another way is called "heads up" digitizing, where you are looking "up" at the screen, using a digital map or an aerial photograph to trace features on. This heads-up method is the one you will use in this lab.

To start digitizing buildings, click on the far right tool in the toolbar. This will expand to show you several

polygon tools. Select the polygon tool that is directly underneath the circle tool.

Zoom in on your aerial photo so that you can see the outline of two existing buildings. Start with the Technology Building. Single click on the building to create the outline of the building and double click when you are done with the building. Each click will create a vertex, or a "corner" of the building. It may take you awhile to feel comfortable with digitizing. You can touch the delete key on your keyboard to remove the polygon and start over. Or, you can experiment with the vertex edit tool (4th tool from the left on the toolbar, just to the left of the zoom in magnifier glass tool). In vertex edit, clicking on an existing vertex will allow you to *move* it. Clicking on a part of your polygon where no vertex exists will allow you to *add* a vertex, which you can then move.

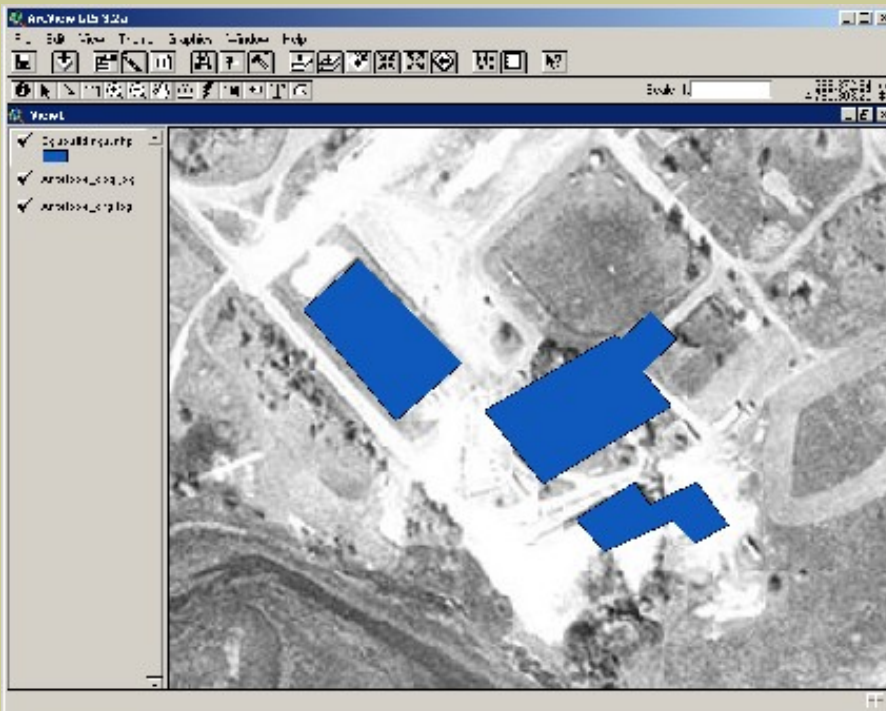
When you are finished with the technology building, digitize the large storage building adjacent to the road, about 130 meters northwest of the technology building.

17) Does the SGU Multipurpose Center, just north of the technology building, exist on the aerial photograph?

Therefore, you'll need to digitize this building without the aid of the photograph. Do the best you can to approximate the position and shape of this building.

When you are finished, select Theme--> Stop Editing. Save Edits.

You should have 3 buildings in your view that look similar to the following:



Open the table for the SGU Buildings theme.

18) How many records does the table contain?

19) Why?

20) Does the table contain information about what the buildings are used for?

Therefore, you need to add this information into the table. To begin, go to Table--> Start Editing.

Then: Edit--> Add Field. Name the new field "Name", and make it a string field with a width of 30.

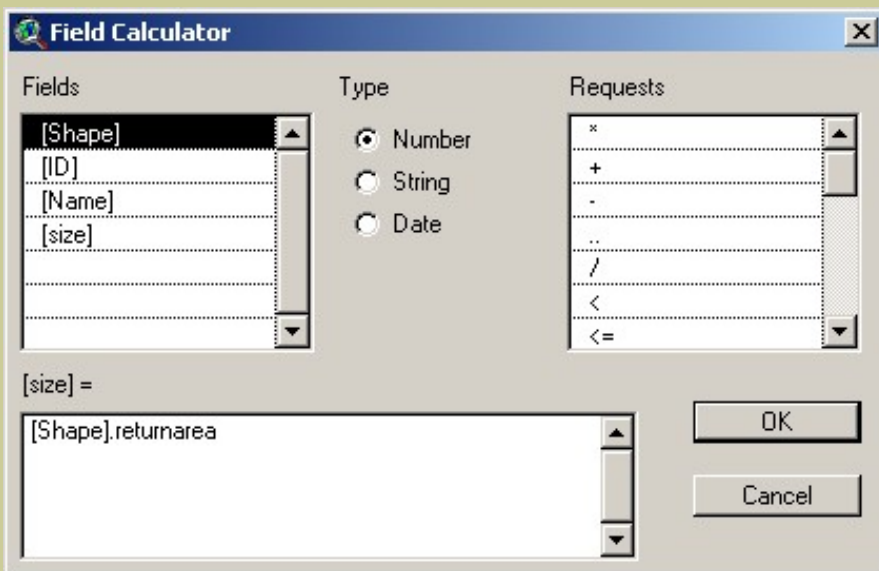
Access the text edit tool, the middle button in the following toolbox:



Enter the text for the three buildings: Technology Building, Multipurpose Center, and Storage Building, as appropriate. You might have to select the buildings in your view to highlight them in the table, so you will know which row in the table corresponds to the correct building.

Next, you want to compute the ground area covered by each building. Add another field named "size" as a number with a width of 16 with 2 decimal places. You do not need to calculate all of the building sizes by hand. Remember, everything in a GIS is referenced to real-world coordinates. You can let the GIS calculate how large the buildings are.

Go to the "calculate" button (or go to Field--> Calculate) and calculate the values in this field for all three buildings. Then, type in [Shape].returnarea in the large box as shown below. This function calculates the areal size for map features.



21) What UNITS are these areas in?

22) What building is largest?

23) What is its value?

When completed, go to Table--> Stop Editing, and Save Edits.

24) How many fields did you add?

25) How many fields did ArcView automatically add when you digitized the features?

All of the buildings are currently displayed in the same color. Access the map legend for the new buildings theme so you can create a map with a different color for each building. Create a unique value map.

26) What field name do you need to select in the legend editor so that each building is symbolized based on the building name?

Next, label each building according to the names you typed into the table. First, go to Theme--> Properties and select "labels" in the left panel. Indicate that the polygons will be labeled using the field "Name" that you created. Second, go to the map view. Using the label button in the view, click on each building and label your buildings on the map.

You have downloaded base maps for your project and added a new set of features--buildings. Let's say you want to add some roads in the area.

27) What category would roads need to be digitized as: point, line, or polygon?

28) Name and describe each step necessary if you were to add and symbolize roads.

29) How are these procedures similar to the procedures you completed for buildings?

30) How are these procedures different from the procedures you completed for buildings?

Create your new roads theme using the procedures you have described above.

31) How many roads did you create?

32) What attributes did you place on the roads--such as name, pavement type, width, or other attribute?

Create a layout for printing that contains the results of your work.

View —> Layout. Create your layout. With the text tool, add your name, date, and change the title of the map to something that reflects what the map displays.

Print the layout.

Save your project. Close your project and exit ArcView.

33) Summarize in a few sentences what you have learned about imagery, in this lesson.

34) Summarize in a few sentences what you have learned about GIS in this lesson.

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