



Rocky Mountain Mapping Center

Locating Study Sites for *Stipa Comata* Using GIS

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Lesson: Projecting, Querying, Intersecting, and Study Site Selection

Skills Involved:

- 1) Changing legends.
- 2) Creating a layout.
- 3) Tabular sort and query.
- 4) Spatial sort and query.
- 5) Changing map projections.
- 6) Intersecting themes.
- 7) Solving a problem based on spatial analysis.

Data Management

Create a folder for this exercise and name it sd, for "South Dakota." Again, it is best to name the folder without any spaces in the name.

Click [here to download the data](#) that you will need for this lab exercise.

This file is named stipacomatasdlesson.zip and totals approximately 16 MB.

After downloading, unzip the file using the Winzip program.

You now should have the following 29 files:

Landown.dbf
Landown.shp
Landown.shx
Layers.prj.txt
Prec-ann.dbf
Prec-ann.shp
Prec-ann.shx
Rivers.dbf
Rivers.shp
Rivers.shx
Sd_city.dbf
Sd_city.shp
Sd_city.shx
Sd_coal.dbf
Sd_coal.shp

Sd_coal.shx
Sd_county.dbf
Sd_county.shp
Sd_county.shx
Sd_geol.shp
Sd_geol.prj
Sd_geol.shp
Sd_geol.shx
Soils.dbf
Soils.shp
Soils.shx
Watershed.dbf
Watershed.shp
Watershed.shx

Start ArcView with a new project and a new view.

Add all of the themes to your view EXCEPT sd_geol.

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

Move the mouse on the view to the southwest corner of South Dakota and examine the coordinates in the upper right of the view.

1) What coordinates are given for the southwest corner of the state?

Minimize ArcView but keep it running. Outside of ArcView, examine the file layers.prj.txt in a word processor or text editor.

2) This file indicates the PROJECTION of all the map layers except for geology. What is the projection?

Write down the values for the Central Meridian, the Reference Latitude, the Standard Parallel 1, and the Standard Parallel 2. You will need these numbers to be able to project your geology data to be in the same projection as the other data.

Add the sd_geol theme to examine geology. Move it to the top of the list of themes in the table of contents. Make it visible (check mark).

3) What is the problem with this theme in relation to the others?

Make the sd_geol theme active and select the zoom to Active Theme button.

Move the mouse on the view and look at the coordinates in the upper right.

4) What do the numbers indicate for the southwest corner of the state?

Do these coordinates match those that you indicated for the other themes in this view?

The geology layer is in a different map projection from the rest of the data. In order to analyze it along with your other data, you'll need to project it to the same coordinate system as the rest of the data.

Data in latitude-longitude coordinates is said to be in the geographic coordinate system. It is not in any map projection.

Access the ArcView projection wizard by selecting: File —> Extensions.

Turn on (make a check in the box) next to "ArcView Projection Utility."

The projection utility is now active. You should now have an additional choice on the File menu entitled: ArcView projection utility

Select the ArcView Projection Utility from the File menu. This will take you through several steps.

Step 1

Select the sd_geol.shp file.

Step 2

Current coordinate system: Geographic

Step 3

Indicate Projected Coordinate System and Show Advanced Options.

Name = Custom

Use the Parameters Tab and select "Albers" for your projection. This is the Albers Equal Area Conic Map Projection.

Central Meridian. Write down the number you indicated above when you examined the .prj file:

5) _____

Make sure this is negative. Why?

6) Enter the number for the following values below and in the dialogue box on your screen:

Reference Latitude = _____

Standard Parallel 1 = _____

Standard Parallel 2 = _____

After entering these values, select **Next**.

If you receive a dialog box that asks if you want to go back to select a different datum, click "No."

Step 4.

Give your new file a name: sd_geol_alb.shp and place it in the same folder as your other data. Select Next and Finish.

Print the summary. This is your metadata file.

In Windows Explorer, examine the sd_geol_alb.prj in WordPad or a word processor.

7) What information does this file contain?

How does it compare to the layers.prj.txt file that you examined earlier?

Save your project and name it "South Dakota," placing it into the appropriate directory.

Your data sets are now ready to analyze.

First, let's examine the coal layer.

8) What part of the state is most of the coal in?

Make a unique value map of coal using field "Explanatio" as the value field.

Examine the table for coal. Select the bituminous coal.

9) What part of the state is the bituminous coal located in?

How many polygons of bituminous coal exist, according to this data set?

Next, let's examine geology, and pick up some additional GIS skills along the way.

Use Theme —> Properties to change the theme name from sd_geol_alb to Geology.

Open the theme table  for the geology theme.

10) Click in the different rows. As you do so, what happens to the map?

Say you wanted to select the first and second most prevalent geology types in South Dakota in terms of area of terrain.

11) Does the table indicate how large each unit of geology is?


Therefore, you need to add a field that holds the data for the areal extent of each polygon, or geologic unit.

Table—> Start editing.

Note: If the system's "start editing" choice is grayed out, you need to make sure the files are not "read-only" or archive files. To fix this, go to Windows Explorer, and highlight all of the files in your South Dakota folder. Go to File—> Properties, and take off any check marks that appear under "archive" or "read only."

In ArcView: Edit —> Add field.

Add a field named: Area. Make a numeric field with a width of 16 and 4 decimal places.

Make sure none of the rows are selected by pressing the clear selected button. 

Highlight your new field "area." It should appear in a darker gray than the other fields.

Press the calculate button.

Calculate the area field to be [Shape].ReturnArea

Type the field name exactly as appears above, with a period between [Shape] and ReturnArea.

12) What did this function do to each row?

13) Sort the table on the area field. What is the largest geologic unit in the state called?

Where in the state is this unit most dominant?

What is the second most predominant geologic unit?

Where in the state is this unit most dominant?

Go to Table—> Stop Editing. Save your edits.

Make the theme prec-ann, the annual precipitation, active. Classify this theme as a graduated color map.

14) What field do you need to select for a map of rainfall in the state?

In which part of the state is the highest rainfall polygon located?

Use the identify button. What is the value of this polygon?

Make the counties transparent.

Use Theme—> Auto Label to label the county names. Move the county theme on top of the rainfall theme.

15) In which county is the highest rainfall polygon located?


By using the procedures and functions you have just performed, answer the following question:

16) Describe the pattern and amount of rainfall in Todd County.

Make a Unique Value map of landown (land ownership) on the field "areaname".

17) Describe the result.

Open the table of landown.

Sort the acres field in descending order .

18) What is the classification of the largest piece of land in the state?

Does this piece of land include the land in Bennett County?

Why or why not?

19) What is the largest single polygon of Native American land in the state?

How large is this land in acres?

20) What ranking is the Rosebud land in the table?

Does this table include all of the Rosebud lands that are not in Todd County?

Make the county theme active. Remove labels under the Theme pull-down menu.


You are ready to use your data and existing GIS skills to examine a problem, while picking up more GIS skills along the way.

Problem: As a biologist, you need to select study sites for *Stipa comata*, needle grass. The grass has the following characteristics:

1. *Stipa comata* grows best along riparian areas; that is, along streams. You would like to study these grasses within 1 kilometer of streams.
2. You want to study *Stipa comata* that grows along streams that are on a certain slope, of at least .01.
3. The *Stipa comata* that you want to study has an organic matter, weighted average (omwa) of between 0 and .40.
4. The study site should be within 30 kilometers of your office in Mission, South Dakota, to reduce costs of transporting your field equipment.

To tackle this problem, you need to query the data and create a few new datasets that do not exist yet. The order that you perform the steps are, in this case, not necessarily important. First, create a map theme that includes all of the land within 1 kilometer of streams.

However, you do not want ALL of the streams, but only the ones that have a slope of .01 or greater.

Make rivers the active theme. Clear any selected rivers in the set. 

Access the query tool  and select rivers that have a slope of 0.01 or greater:

([Pslope] >= 0.01)

Select "New Set."

Look at the table.

21) How many rivers were selected?

Because you will be working with distances, set the **distance units** to kilometers under View—> Properties. Make sure that the **map units** are set to meters.

Theme—> Create Buffers.

Create buffers that are 1 km from features in the rivers.shp theme. Use only the selected features; the ones with a slope meeting your criteria, above.

Dissolve barriers between buffers, and save the result to a new theme entitled riverbuff.shp.

Move the rivers theme on top of the buffers theme.

Examine riverbuff.shp. Describe this data set.

22) Which streams contain buffer zones?

Zoom in on a buffer and measure it using the measure tool.

23) Is the buffer one kilometer across the entire buffer, or 1 kilometer on EACH side of the stream?

Next, select the soils that have an organic matter weighted average (omwa) of less than .40. Some of the soils are missing data in this category, and have an omwa listed as "0." This does not mean that they have NO organic matter, only that they are missing data. Therefore, exclude the soils with an omwa of 0 from your analysis. You will select soils with an organic matter that is more than 0 but less than or equal to .40.

Make soils the active theme.

Map soils as graduated symbol on the field "omwa."

24) In what part(s) of the state are the soil organic matter - weighted average the highest?

Examine the soils table. How many soils polygons are there in the data set?

Use the query tool to select soils meeting the criteria above:

$([Omwa] > 0)$ and $([Omwa] \leq 0.40)$

25) How many soils polygons are selected?

In which part(s) of the state are the potentially suitable soils for studying Stipa comata?

26) Review criteria 1 through 4 above. What is the criteria you have not considered yet?

Move the city theme to the top of the table of contents.

Use the query tool to select Mission from the South Dakota cities theme. The syntax should be as follows:

([Areaname] = "Mission city")

27) Examine the table. How many cities have you selected?

Zoom in on this city. Use the identify button and click on the city.

What is its population according to this table?

Create a buffer around the city using procedures similar to when you buffered rivers, above.

28) Given the criteria, what distance should the buffer be?

Name your buffer missionbuff.shp.

What is the shape of the buffer?

Change the symbology of the buffer by making it transparent, with a thick outline. Move it to the top of your table of contents.

Now that you have prepared your data, you are ready for the first data intersection. First you will combine (intersect) the suitable river areas and the suitable soils. Second, you will intersect the results of rivers and soils with areas near Mission. These intersections are accomplished with the "geoprocessing" extension.

File —> Extensions. Turn on the Geoprocessing extension.

View —> Geoprocessing Wizard.

Intersect your soils theme with your river buffer theme. Name your final result rivers_soils.

29) Why should you only use the selected soils in your intersection?

How many polygons resulted from the intersection?

30) Examine the table of your new theme and comment about the attributes there. Where did they come from?

Now that you have discovered the areas that are suitable in terms of soil organic matter and proximity to streams, you have only one more step to complete: You need to select only those areas within 30 km of your office in Mission.

Perform one more intersect function, as you did above.

31) This time, what are the two themes that you will intersect?

Name your final theme stipacomatasites.shp.

Examine your final theme that you just created.

32) How many study sites can you select from?

To maximize your efficiency in the field, you now would like to select the largest site in area of those in your final sites under consideration.

Examine the table. Sort on the field "area." Click in the site that contains what the table claims as the largest area. Now look at the map and observe the site selected. What is the problem?

When an intersection is run, the resulting polygons are correct, but the area needs to be recalculated. As you did earlier in this lesson, access the table and start editing the table. Calculate the field "area" to be [shape].returnarea.

Save edits. Sort again on area and select the largest polygon.

Use the label tool to label the rivers that these sites are along.

33) Along what river is the largest study site under consideration?

What direction is this site from Mission?

Use the measure tool to answer the following question:

How far is this site from Mission?

Select the second largest polygon under consideration.

34) Along what river is the largest study site under consideration?

What direction is this site from Mission?

How far is this site from Mission?

Save your project.

Create a layout for printing:

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 is showing.

Print the layout.

Save your project. Close your project and exit ArcView.

35) Summarize in a few sentences what you have learned about site selection in this lesson.

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

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URL: <http://rockyweb.cr.usgs.gov/public/outreach/sgu/stipacomatasdlesson.html>

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