LAB E - INTRODUCTION TO GEOGRAPHIC TOOLS – TOPOGRAPHIC MAPS

Introduction

Topographic maps differ from the thematic and regional maps found in atlases in that they employ contour lines (isopleths), lines of equal elevation to depict relief (the vertical dimension) and to portray the shapes of features that make up the landscape. Topographic maps generally contain all eight pieces of key information discussed in Chapter 2 of the text: Title, Date, Scale, Location (Longitude and Latitude-Grid), Direction (North Arrow), Legend (Symbols-Colors), Data Source and Projection Type. Using the topographic maps provided by the instructor, answer the following questions.

Materials needed: atlas, ruler, calculator, pencil, length of string, topographic maps and United States Public land Survey System handout (provided by instructor)

Part I. Folsom, New Mexico Quadrangle

A. Title, Date, Projections and Sources (Marginal Data)

1. What is the title of the map? ______________________________________
2. What agency published the map? __________________________________
3. From what source was the topography of this area produced? __________
4. What is the date of this source? ________________________________
5. What other method was used to validate this map? __________________
6. When? ______________
7. What part of New Mexico does the map represent? ________________
8. What county of New Mexico does the map represent? ________________
9. What other map sheets (titles) would be required to proceed off of this sheet in the following directions?

   North __________       South __________    NW __________
   West __________       East __________     SW __________

10. How many adjacent map sheets surround this map? ________________

B. Scale and Distance

Distance is measured on a map using a variety of scales. The two most commonly used scales are the Representative Fraction and the Graphic Scale or Bar Graph (an example is located at the bottom of your map sheet). The Representative Fraction is stated in the form of a fraction or a ratio. For example 1:24,000 means that one unit (e.g. one inch) on the map represents 24,000 like units on the ground.
B. Scale and Distance (continued)

U.S. maps are usually expressed as inches to miles. To convert a map with a Representative Fraction of 1/24,000 from inches to miles, the following computations are performed:

We can use the conversion factor: 1 mile = 63,360 inches

**Step 1.** Divide 24,000 by 63,360 = 0.378

**Step 2.** Thus, one inch = 0.378 miles

1. **Representative Fraction Problems.** Calculate how many miles one inch equals for each of the following fractional scales:

<table>
<thead>
<tr>
<th>Scale</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/100,000</td>
<td>____________</td>
</tr>
<tr>
<td>1/500,000</td>
<td>____________</td>
</tr>
<tr>
<td>1/25,000</td>
<td>____________</td>
</tr>
</tbody>
</table>

2. Map scales are also classified by their relative size. Large scale maps show lots of detail of a small area and their Representative Fraction has a small denominator (1:75,000 or smaller). Medium scale maps (1:75,000 - 1:600,000) and small scale maps (greater than 1:600,000) show less detail, but of a larger area, and their Representative Fraction has a large denominator. Just remember: the smaller the denominator, the **larger the scale** or the larger the denominator, the smaller the scale. A Representative Fraction of 1:75,000 generally serves as the dividing point between large and medium scale maps. A Representative Fraction of 1:600,000 is the dividing point between medium and small scale maps.

a. Place in order (from **largest to smallest** scale), the following fractional scales: 1:24,000, 1:250,000, 1:62,500, 1:1,000,000.

<table>
<thead>
<tr>
<th>Largest</th>
<th>Large</th>
<th>Medium</th>
<th>Small</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. What is the <strong>scale</strong> of the map you are using? ____________</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Is this a large, medium or small scale map? ____________</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. What is the <strong>scale</strong> of the large map on the wall? ____________</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Is this a large, medium or small scale map? ____________</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
B. Scale and Distance (continued)

4. Graphic Scales: Topographic maps also include either a graphic scale or a bar graph, which is used to measure distances on the map. This bar graph represents the same relationship as expressed in the Representative Fraction and is measured in English units (miles and feet) and International System (SI) units (kilometers and meters). Using a narrow strip of paper as a measuring device (provided by instructor), complete the following problems:

   a. What is the distance (in miles) from the left margin to the right margin of the map sheet? __________ miles
   
   b. What is the distance (in miles) from the top margin to the bottom margin of the map sheet? __________ miles
   
   c. What is the distance (in km), as the crow flies, from the center of the crater of Capulin Mountain to the center of the crater of Baby Capulin? __________ km
   
   d. What is the distance along the secondary hard surface road (red and white) between BM 6556 (west of Folsom Cemetery) and BM 6933 (along the same hard surface road south of Capulin Mountain National Monument)? ______ miles

C. Location - Longitude, Latitude and Grid Systems

Look at the four corners of your map sheet. Each shows the latitudinal and longitudinal coordinates (degrees/minutes/seconds) of the map sheet. These coordinates are necessary if the map is to be linked to other larger or smaller scale maps, to a globe, and ultimately, to the Earth.

1. What is the latitude (in degrees, minutes and seconds) of the lower (south) and upper (north) borders of the map sheet? ________________ to _______________
   
   2. How many minutes of latitude separates the two borders? _____________
   
   3. What distance does this represent? _______________ miles (see B.4.b. above)
   
   4. What is the longitude (in degrees, minutes and seconds) of the right (east) and left (west) borders of the map sheet? ________________ to ______________
   
   5. How many minutes of longitude does this represent? ________________
   
   6. What distance does this represent? ________________ miles (see B.4.a. above)
C. Location - Longitude, Latitude and Grid Systems (continued)

7. Given your answers to questions C. 1.-6. on the previous page,
   (a) Are the minutes of latitude and longitude the same on the map? _______________
   (b) Are the distances represented the same? ________________________
   (c) Explain the differences. ______________________________________________
   _______________________________________________________________________

D. Other Grid Systems – Township and Range

Review the Handout provided by the instructor concerning The U.S. Public Land Survey System (Township and Range). This system, designed primarily to divide the public lands east of the Mississippi River and south of the Great Lakes (except Florida) after the Treaty of Paris in 1783, parallels the concept of the geographic grid introduced earlier in the course. **Baselines** and **Principal Meridians** serve the same function as latitude and longitude, allowing this land division system to serve as a means of locating features on many topographic maps. Following your review of the handout material and additional comments by the instructor, return to the Folsom, New Mexico Quadrangle and answer the following questions:

1. What are the **dimensions** of a Township (in miles)? ______________

2. How many **sections** are in a Township? _______________________

3. How many **complete** (Congressional) Townships does the Folsom map sheet contain? ___________. How many **partial** Townships? _______________

4. Using the USPLS system, describe the location of Twin Mountain to the nearest quarter section. ________________________________________________________________

E. Legend, Colors and Symbols

Appendix II of the textbook contains a complete listing of topographic map symbols and colors used on United States Geological Survey (U.S.G.S.) topographic maps. Using **Appendix II** and the map, answer the following questions:

1. What do the following **colors** represent?
   a. Brown: _____________________________________________________________
   b. Blue: _____________________________________________________________
   c. Black: _____________________________________________________________
   d. Green: _____________________________________________________________
   e. Red: _____________________________________________________________
   f. Red Tint: _____________________________________________________________

2. How is a **perennial** stream differentiated from an intermittent stream? (Describe or draw a picture)
   ______________________________________________________________________
E. Legend, Colors and Symbols (continued)

3. How is an intermittent lake/pond shown? ________________________________

4. There are a number of large intermittent lakes/ponds in the southeast corner of the map. How many? ________________________________

5. What is the symbol and color used to depict a quarry or open pit mine? ________________________________

6. What do the fine, red dashed lines on your map indicate? ________________
(Hint: see lower left corner margin of map sheet)

7. What economic activity do these lines probably represent? ________________

8. What do the brown lines represent? ________________

9. What do the dark brown lines represent? ________________

10. What is the interval between the light brown lines _______ ft. What is the interval between the dark brown lines? _______ ft.

Part II. Glendale, Arizona Quadrangle

Complete the following questions using a topographic map of “your own backyard”. If you have difficulty, review your earlier responses or the procedures employed with the Folsom, New Mexico map sheet.

1. What is the name of the map sheet required to proceed three miles directly north of Thunderbird Road? ________________

2. What length of U.S. Highway 60 is depicted on this map sheet? 
   _______ miles _______ km

3. Using the USPLS system, describe the location of the Glendale Community College campus to the nearest quarter section.
   ________________

4. What ethnic group has a cemetery located in Section 12, Township 2N, Range 1E? 
   ________________

5. All of the man-made features in purple have been constructed since _______ (year)

6. What is the dominant land use in the southwestern portion of Section 17, Township 3N, Range 2E? ________________
7. What **educational institution** is located **closest to** latitude 33°32'30"N and longitude 112°10'W? _____________________________

8. Judging from the man-made features on the map sheet, what **major crop** was grown west and north of the City of Glendale? **Hint:** The United States is the second largest producer of this crop, producing 20.9 percent of the world’s supply (Source: Goode’s Atlas 20th edition, page 46) ________________________________

9. What **railroad** parallels Grand Avenue (U.S. Highway 60)? __________________________

10. How many **miles** separate Thunderbird Road from Bethany Home Road? _____ miles.

11. How many **sections** separate these two roads? ______

12. Thunderbird - The American Graduate School of International Management is located at Section 8, Township 3N, Range 2E. What was the name of this college in 1982? ________________________________

13. What is the latitude & longitude for the college in question 12 (to the nearest **minute**)?
Latitude = _______________________; Longitude = _________________________