TOPOGRAPHY AND ELEVATION

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Station 10- Topography and Elevation

Introduction

In the late 17th century, French finance minister Jean Baptiste Colbert hired surveyor, astronomer, and physician Jean Dominique Cassini for an ambitious project, the topographic mapping of France. After a century of work by Cassini, his son, grandson, and great-grandson, France was the proud owner of a complete set of topographic maps -- the first country to have produced such a prize. Since the 1600s, topographic mapping has become an integral part of a country's cartography. These maps (called topo maps for short) remain among the most valuable maps for government and the public alike. In the United States, the U.S. Geological Survey (USGS) is responsible for topographic mapping.

There are over 54,000 quadrangles (map sheets) that cover every inch of the United States. The USGS' primary scale for mapping topographic maps is 1:24,000. This means that one inch on the map equals 24,000 inches on the ground, the equivalent of 2000 feet. These quadrangles are called 7.5 minute quadrangles because they show an area that is 7.5 minutes of longitude wide by 7.5 minutes of latitude high. These paper sheets are approximately 29 inches high and 22 inches wide.

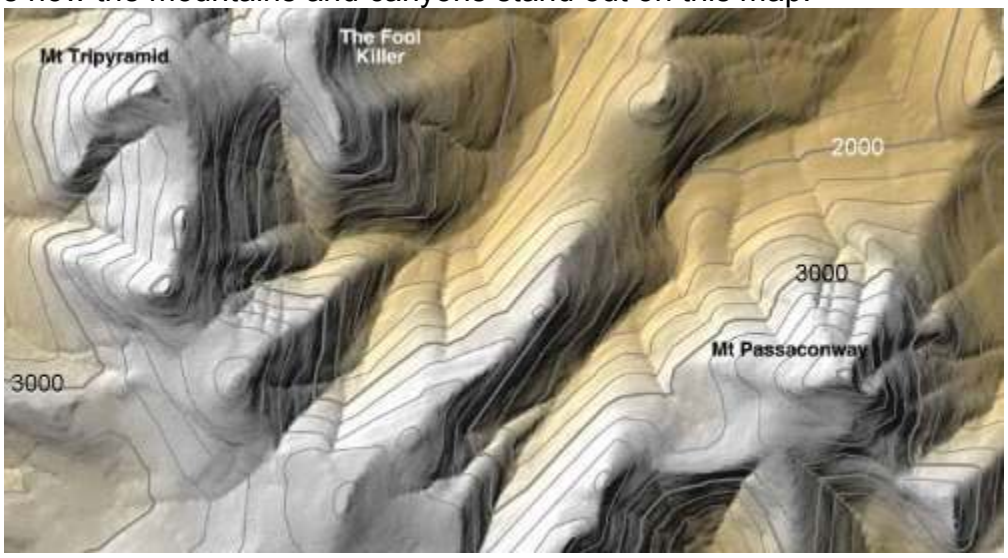
Topographic maps use a wide variety of symbols to represent human and physical features. Among the most striking are the topographic maps' display of the topography or terrain of the area. Contour lines are used to represent elevation by connecting points of equal elevation. These imaginary lines do a nice job of representing the terrain. As with all isolines, when contour lines lie close together, they represent a steep slope; lines far apart represent a gradual slope. Each quadrangle uses a contour interval (the distance in elevation between contour lines) appropriate for that area. While flat areas may be mapped with a five-foot contour interval, rugged terrain may have a 25-foot or more contour interval. Through the use of contour lines, an experienced topographic map reader can easily visualize the direction of stream flow and the shape of the terrain.

Most topographic maps are produced at a large enough scale to show individual buildings and all streets in cities. In urbanized areas, larger and specific important buildings are represented in black though the urbanized area surrounding them is represented with red shading. Some topographic maps also include features in purple. These quadrangles have been revised solely through aerial photographs and not by the typical field checking that are involved with the production of a topographic map. These revisions are shown in purple on the map and can represent newly urbanized areas, new roads, and even new lakes.

Topographic maps also use standardized cartographic conventions to represent additional features such as the color blue for water and green for forests. Several different coordinate systems are shown on topographic maps. In addition to latitude and longitude, the base coordinates for the map, these maps show UTM grids, township and range, and others.

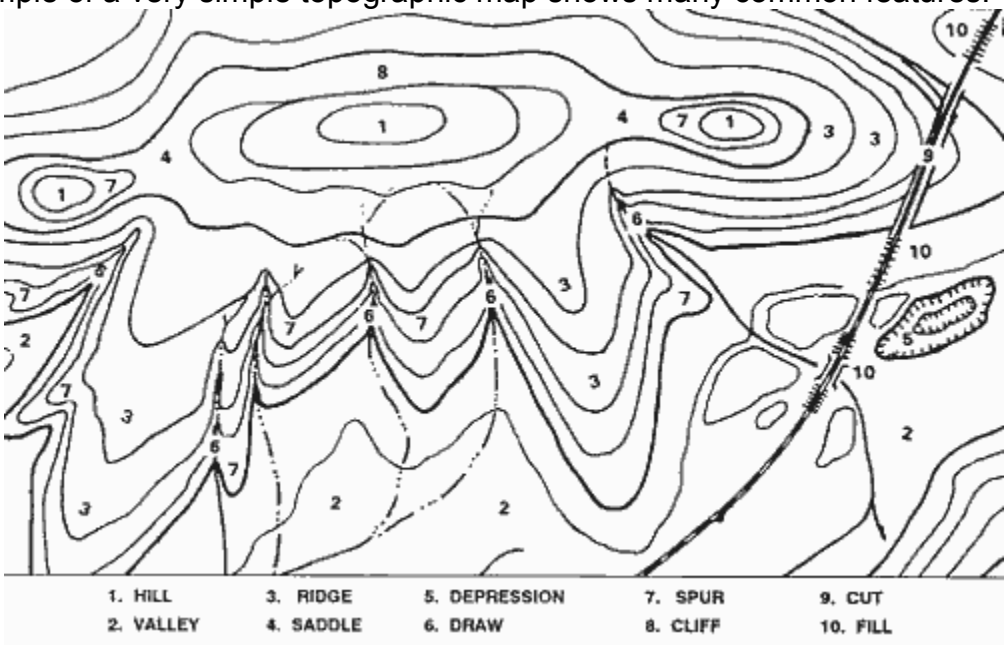
http://geography.about.com/od/topographicmaps/a/topographicmaps.htm

For example, see how the mountains and canyons stand out on this map:

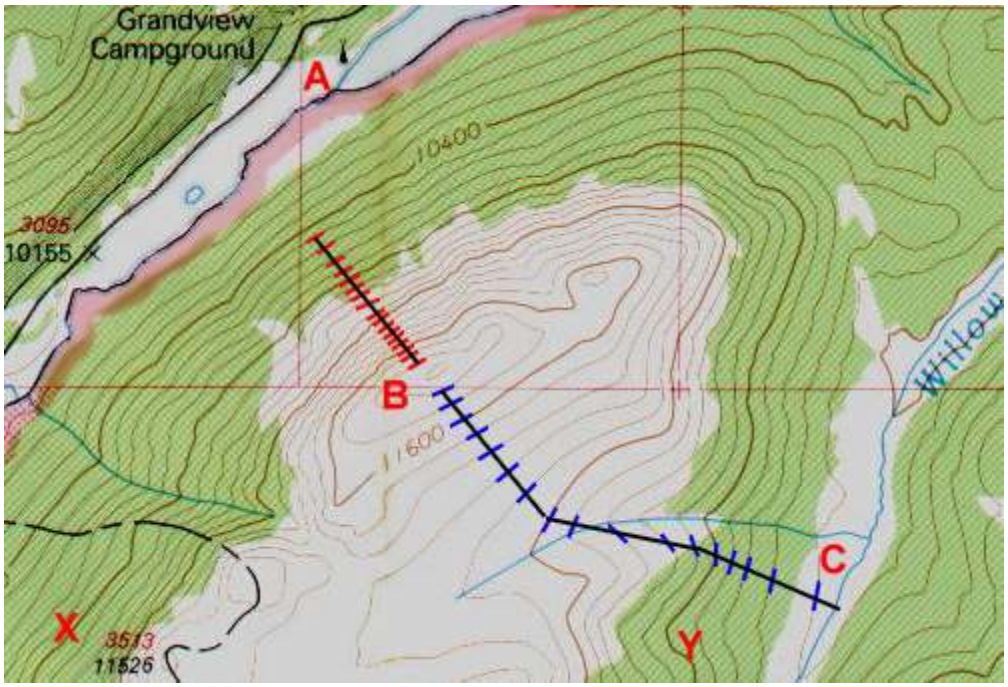


The closest Index contour line for both peaks is 3,000 feet. Another Index line is at 2,000 feet. There are 4 Intermediate lines between 2000 and 3000 so each intermediate line represents a 200 foot change in elevation. Counting up from 3,000 feet, there is 3200, 3400, 3600, 3800, and the top line is 4000 (actually the next index line). So, both peaks are over 4000 feet and it looks like Mt. Tripyramid is possibly almost 4200 feet high.

This example of a very simple topographic map shows many common features.



Even without elevation numbers, clues that #1 is a hill include streams converging away from the hilltop, contour lines pointing sharply towards the hilltop (indicating draws), contour lines pointing widely away from the hilltop (indicating rounded ridges).



Using contour lines, you can tell a lot about the terrain, including steepness, ruggedness, and ground cover. On the image above, look at point **A**. There are no contour lines around this location so it is relatively flat here and a good place for a campground by the lake. You can tell from the elevation listed at marker 3095 that the campground is at 10155 feet.

You can also tell the elevation change between each contour line by looking at the Index lines. Notice that the Index line near point **B** is labeled 11600 feet and the one due north of it is labeled 10400 feet - that is a difference of 1200 feet. Between these two Index lines are two more Index lines so each index line represents a change in 400 feet of elevation - 10400, 10800, 11200, and 11600. Count the lines between two index lines and you should see there are 4 lines which cause the 400 feet between the two index lines to be divided into 5 intervals, each one being 80 feet in elevation. So, now we know that *on this map* every contour line represents 80 feet of elevation change.

If you follow a single contour line, your elevation remains constant. For example, starting at point **X** and following the Index line to the NorthEast, around, and down South to point **Y**, you would stay at about 10,800 feet.

When you cross contour lines, you are either hiking up or down. Look at the two routes to get to the peak at point **B** - the red route and the blue route. Each path reaches the top, but the blue route is three times as long as the red route. That means it covers more distance to gain the same elevation so it is a more gradual slope - and probably an easier hike. Going up the red route may require a lot of scrambling and hard work.

http://www.compassdude.com/topographic-maps.shtml

Topographic map of Sugar Creek Nature Park

Helpful Hints to Reading Topographic Maps

1. Thin brown lines represent contours or points of similar elevation. The closer together they are, the steeper the terrain.
2. Contour lines form "v" shapes in valleys or along stream beds. The point of the "v" points uphill.
3. Blue represents water.
4. Green represents orchards and forested areas.
5. Purple markings are those that have been "photorevised," or added to the map since the original map was published..
6. Red areas represent urban areas, although the maps will often indicate special buildings of significance within the urbanized area.
7. Roads and highways are represented in black and red.
8. The scale on 1:24,000 topographic maps means that one inch equals 2000 feet

http://geography.about.com/library/howto/httopo.htm

Activity suggestions before visiting the Nature Park

- Complete the activity found on http://www.ehow.com/how_4576327_make-topographic-maps.html (How to Make Topographic Maps). It guides learners though the process of making a topographic map

Activity suggestions during your visit to the Nature Park

- Take pictures and GPS coordinates of certain areas of the Nature Park.
- Measure elevation differences in parts of the Nature Park

Activity suggestions after visiting the Nature Park

- Create topographic maps of the areas students photographed at the Nature Park
- Analyze the differences of elevation near the creek, near the entrance to the Nature Park, near each of the Outdoor Classroom Stations.

- Create a topographic map of the school grounds. This can be easily done out of Styrofoam or clay. Here's a super simple map (it's a hill with a stream/canyon going up the left side) you can use. http://www.ucmp.berkeley.edu/fosrec/imag... You want to start with the outer-most countour line. Trace that onto your styrofoam and cut the shape out. Trace the next circle onto the styrofoam or clay and cut it out as well. Keep going until you get all the circles on the map cut out of they Styrofoam or clay. Then stack them up with the biggest on the bottom; you should place them in their correct positions on the map. Glue all the pieces together. When you get done, it should make a hill shape with a canyon down the side. Use extra Styrofoam or clay to smooth the edges to make it look more realistic.

Resources in the travelling trunk
GPS systems
How to Teach With Topographic Maps
GPS For Dummies
Outdoor Navigation With GPS

On-line resources
Visualizing Topography, http://reynolds.asu.edu/topo_gallery/intro_title.htm

USGS Topographic Maps, http://topomaps.usgs.gov/

Interactive Indiana Topographic Map, http://www.indiana.edu/~gisdata/topo.html

Indiana Topographic Maps (USGS Quad Topo Maps) & Aerial Photos,
http://www.topozone.com/states/Indiana.asp

http://www.msnucleus.org/membership/html/k-6/uc/geography/5/ucg5_1a.html