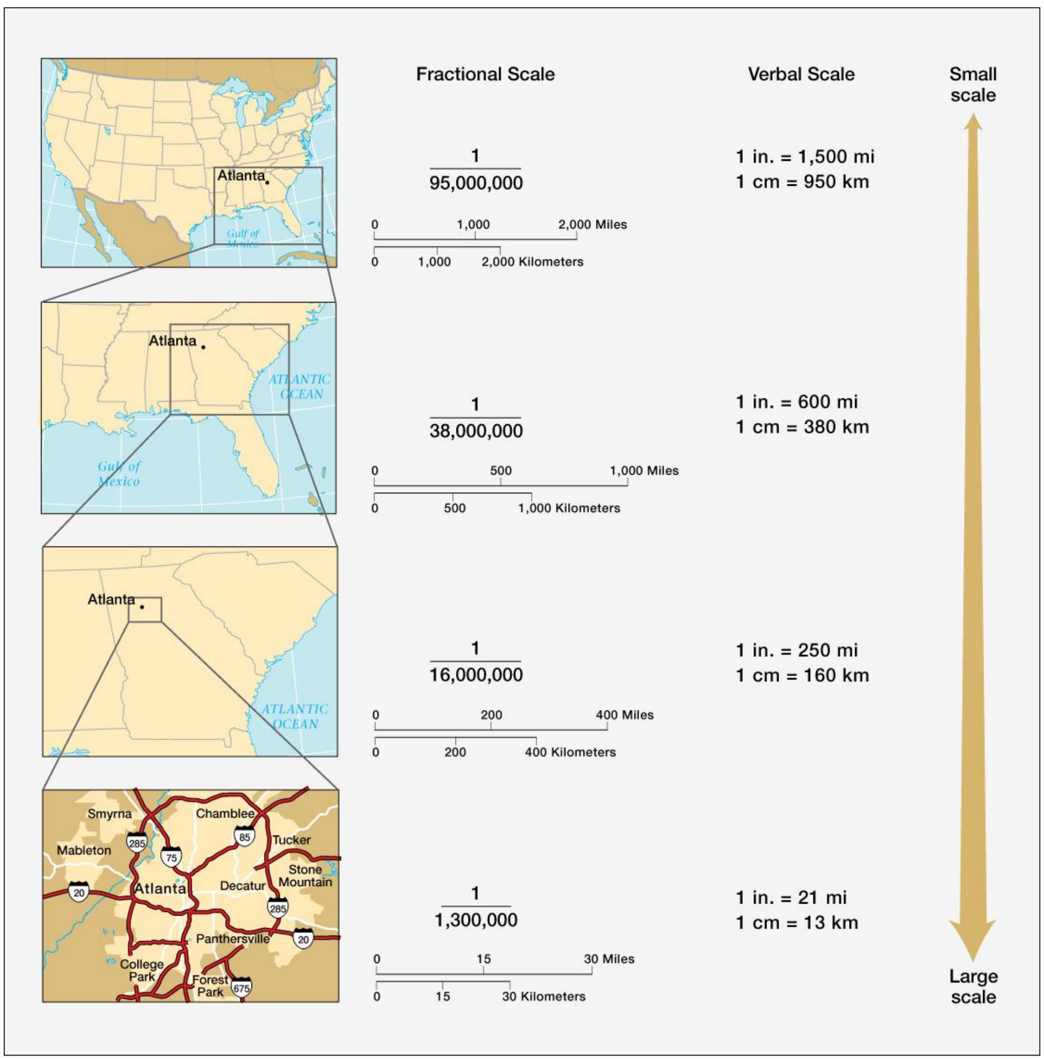
Cartography, maps, images, and portraying the earth

Here we examine depictions and methods to convey the features of the earth's surface.

Map Scale: A larger scale map shows a smaller area of the earth with more detail and a smaller scale map shows a larger area with less detail.

Map scale is represented as a fraction or fractional scale, e.g. 1:24,000 which includes maps we will examine in our first lab.

Graphic scale is a graphic depiction like a scale bar on the map. Verbal scale is a relationship between the earth and the map e.g., 1 inch on map equals 1 mile.



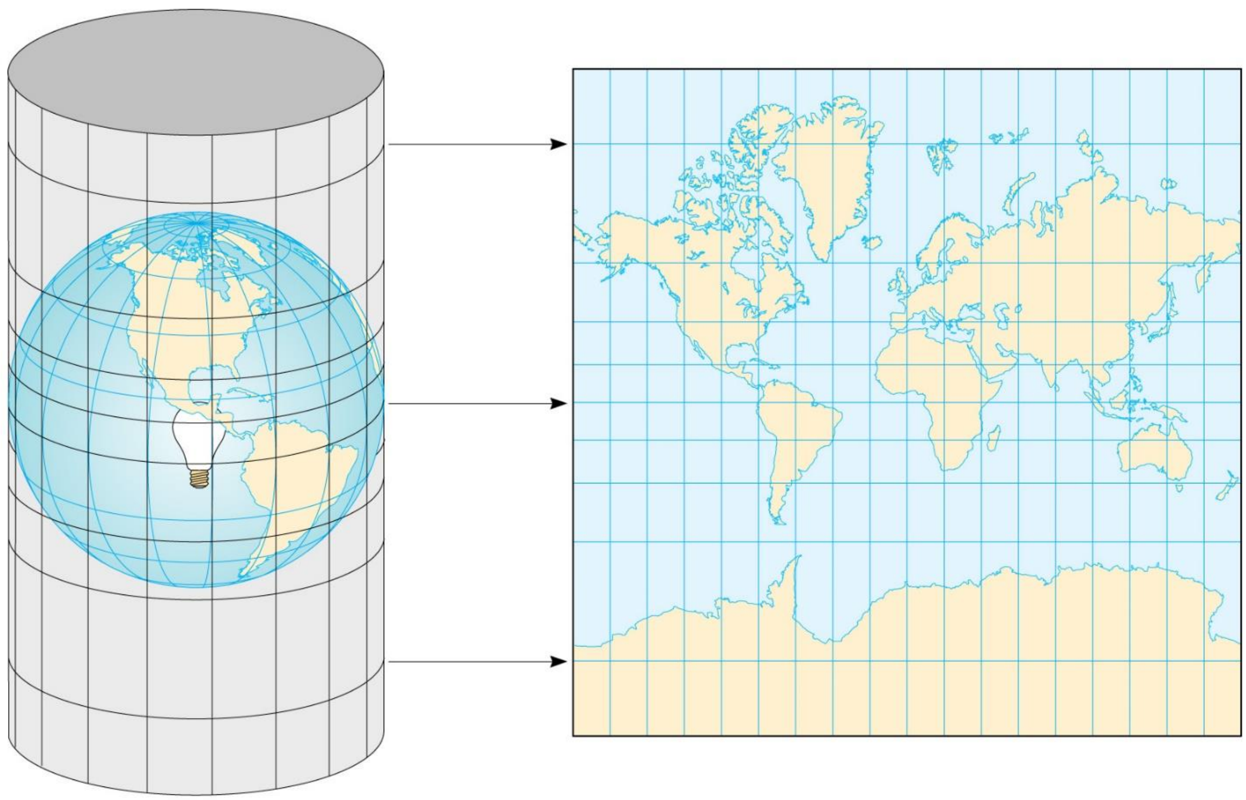
Map projections:

To display the spherical earth on a flat surface we may use a *conformal map projection*, where angular relationships are maintained. *Conformal maps* conserve shape and distort area on the map.

In contrast *equal area maps* conserve size equivalence on the map and distort shape.

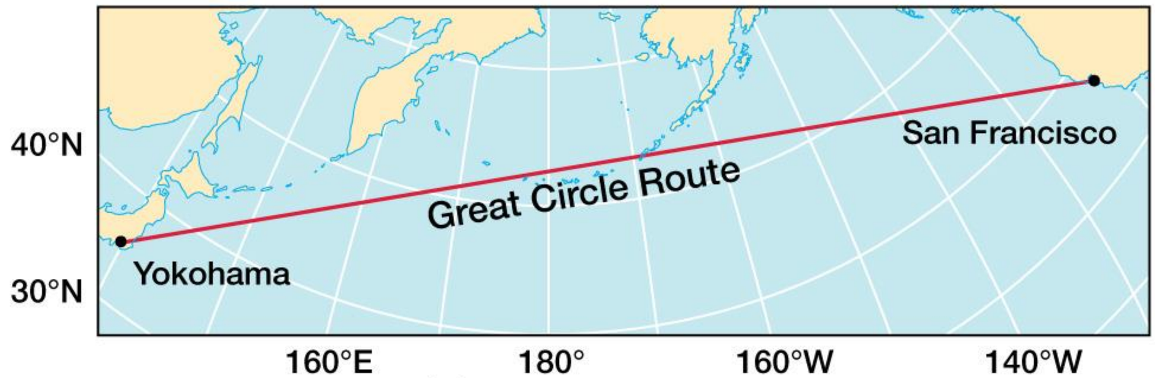
In physical geography, we will be using primarily conformal maps.

The map below is a Mercator projection, also known as a cylindrical projection.

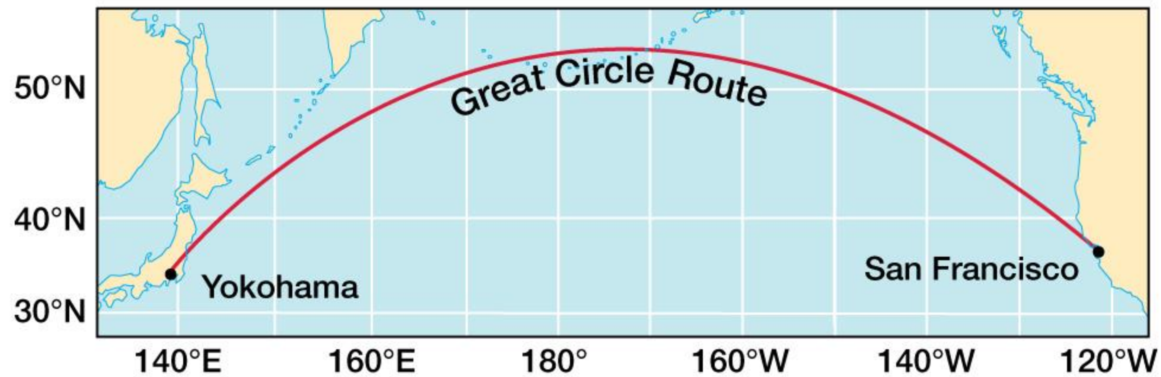


(a) (b)

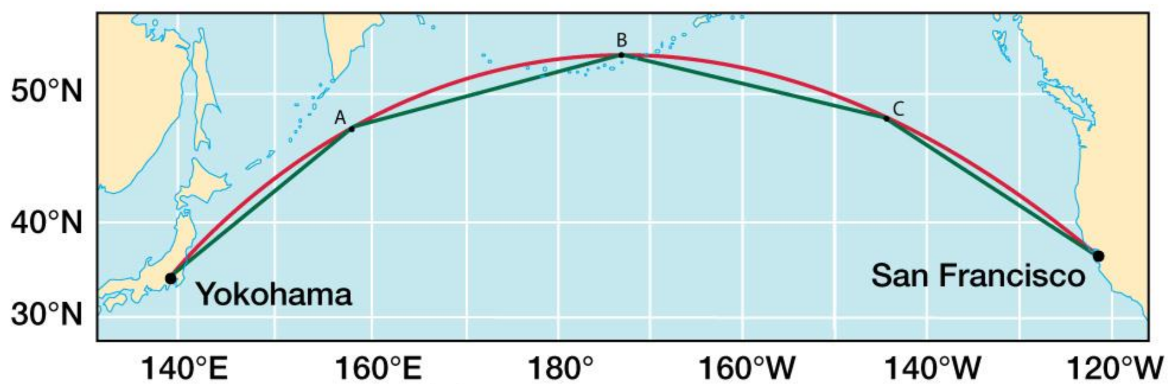
Note that lines of latitude and longitude are at 90 degrees to each other and with this projection of the world, distortion and enlargement of features increases toward the poles. On our globe, the shortest path between points is a great circle route. Note the depiction of a great circle route (shortest path) between San Francisco and Yokohama on a Mercator map (below).



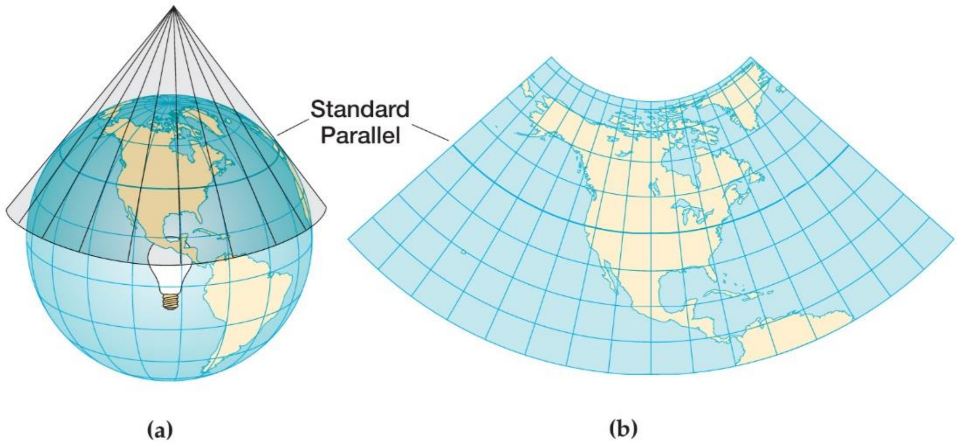
(a) Gnomonic Projection



(b) Mercator Projection

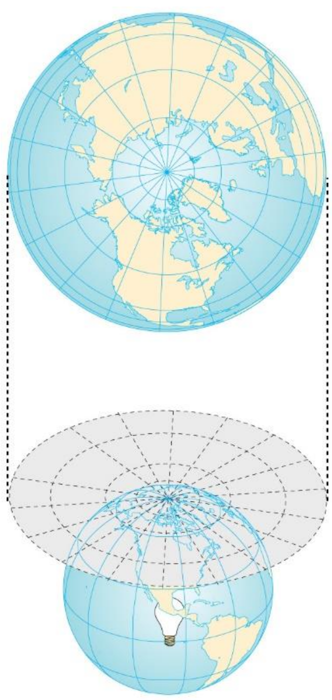


(c) Mercator Projection

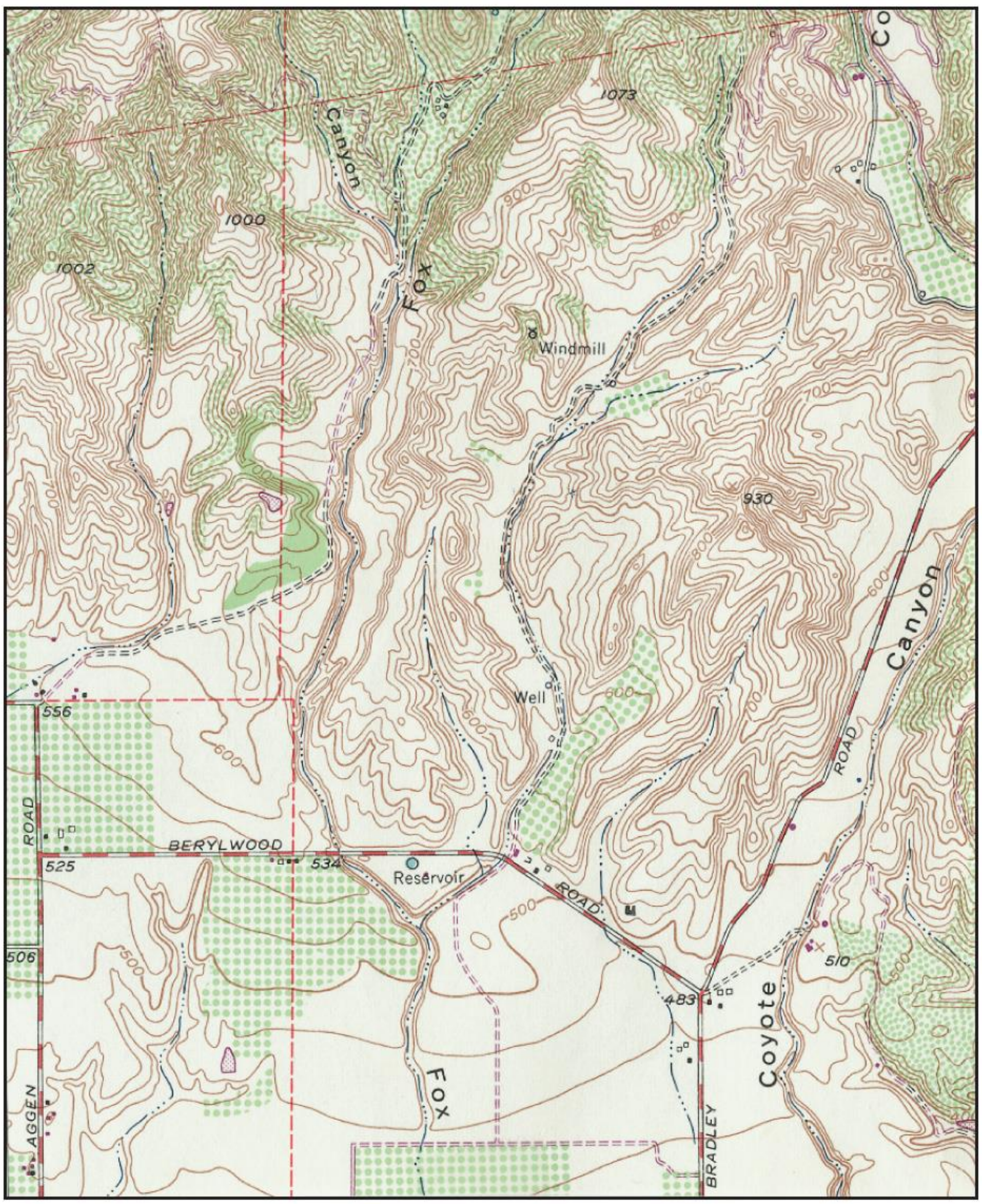


A conic projection projects the spherical surface to a cone which may produce a map with curved parallels of latitude as shown above. Conic projections or polyconic (multiple cones) are commonly used in the middle latitudes (like our region here).

A planar projection projects the spherical surface directly to a plane, as shown below. In this type of projection, the distortion is minimal in the middle of the map. This projection method is a good match for images from satellites, that view the earth from one point in space.



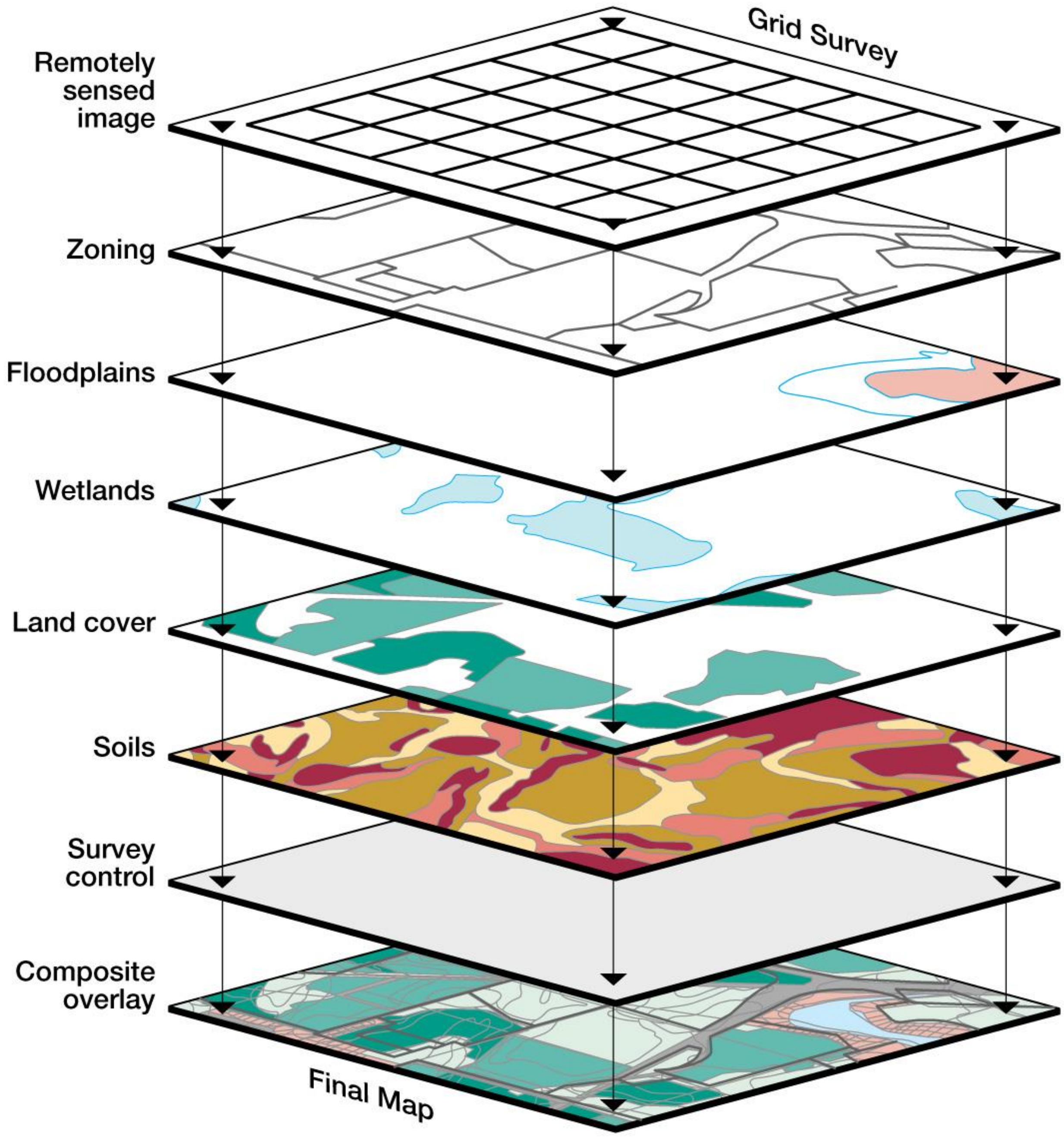
Isoline maps use lines that represent equal values, e.g., isotherms for equal temperature, isobars for equal barometric pressure, isohyets for equal precipitation, or topographic contour lines for equal elevation (as below). Elevation contour maps can be converted to digital elevation models such as the ones displayed for Mt. St. Helens in the text.



USGS 7.5 minute topographic map

We will make use of various types of images in the next few weeks such as this Landsat MSS (multispectral scanner) false color image (infrared) of the Mississippi River (below).

We will also look at Global positioning systems (GPS) with satellites, concepts of Geographic information systems (GIS) to store and convey map information digitally, using vector files (points, lines, and enclosed areas or polygons), and raster files (images).



With GIS we can use overlay analysis with the use of two or more layers or themes to study the relationship between map element or features. An example might be using a map of soil types, water saturation (e.g., wetlands as above), and topography or terrain steepness to highlight areas of potential landslide risk.

A GIS system is used to provide regularly updated map view of wildfires in the Pacific northwest during our fire season.

We can also look at patterns that progress over time on maps and modeling future scenarios, e.g. to help in planning for natural disasters. All different types of information can be stored and retrieved with the map format.

A big lab for us toward the end of the term will have us applying a systematic geographic approach to land use planning (note feature by K. Clarke of UCSB at the end of chapter 2 in 12^{th} ed of text).