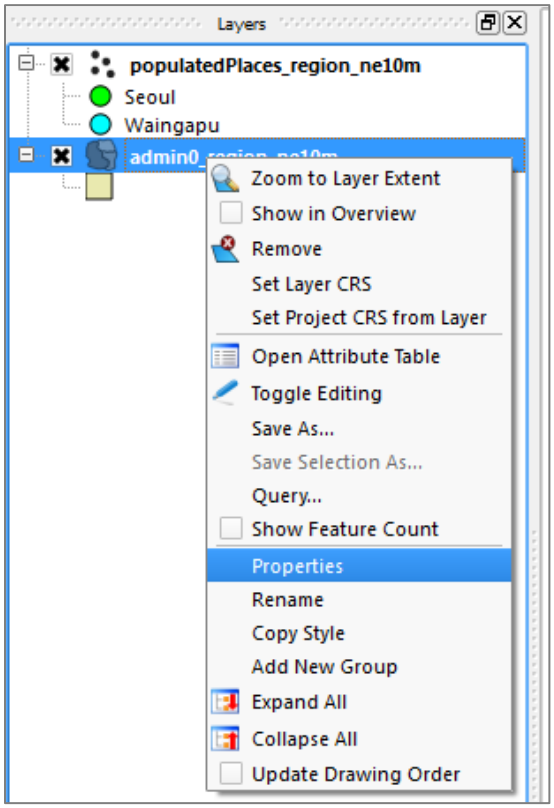
Exercise 6: Coordinate Systems

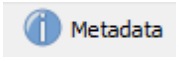
This exercise will teach you the fundamentals of Coordinate Systems within QGIS. In this exercise you will learn:

- How to determine the coordinate system of a layer
- How the projection of your map affects distance measures
- How to choose the best Projected Coordinate System for your map

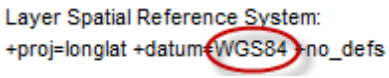
Section 1: Determining the Coordinate Reference System (CRS) of a Layer

1. Open the folder
   \\Vietnam_Training\04_Exercises\Project_Files
2. Double click on the QGIS file called VNM_Coordinate_Systems.qgs
3. Right click on the *Admin0_region_ne10* layer and select *Properties*

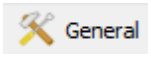


4. Click on the *Metadata*  tab

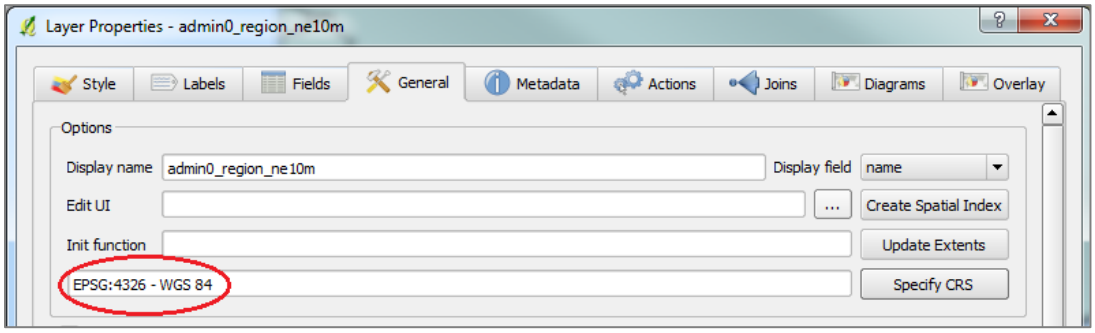
5. Look to the bottom of the window for information on the CRS listed under *Layer Spatial Reference System*. The coordinate system of the layer is circled in red below; it shows that the layer is in the WGS 84 CRS



Now you will use a different method to look at the CRS information for the layer.

6. Click on the *General*  tab

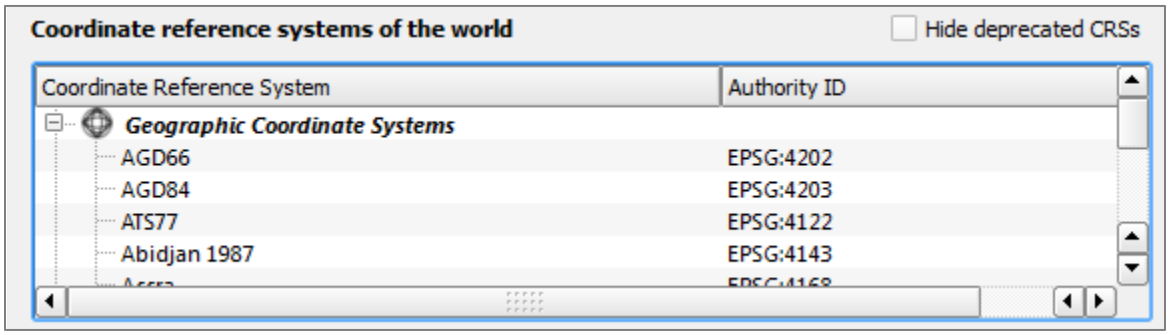
The coordinate system of the layer is circled in red below. It shows that the layer is in the WGS 84 CRS.



7. Click the *Specify CRS* button to view more information about the coordinate system

When the *Coordinate Reference System Selector* window opens, the WGS 84 row is highlighted.

8. Scroll all the way to the top to determine which type of coordinate system WGS 84 is. You see that WGS 84 falls under the Geographic Coordinate System classification



Note: If the CRS of a layer is a Geographic Coordinate System the units of the layer will be in decimal degrees or degrees, minutes, seconds. There will be only 1-3 digits to the left of the decimal point.

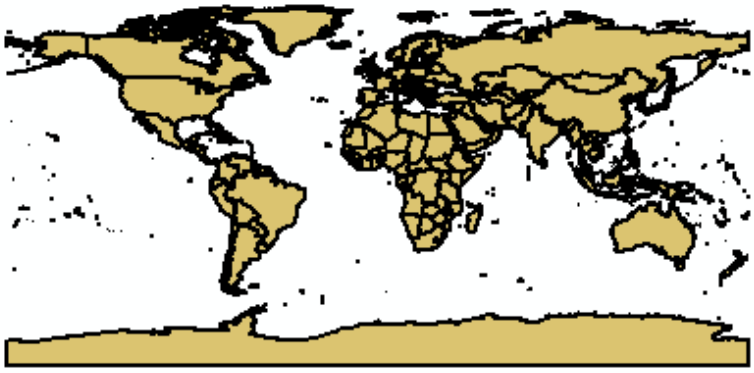
Note: If the CRS of a layer is a Projected Coordinate System the units of the layer will be in meters or feet. There will be 6-8 digits to the left of the decimal point.

Section 2: A Projection's Effect on Distance Measurements

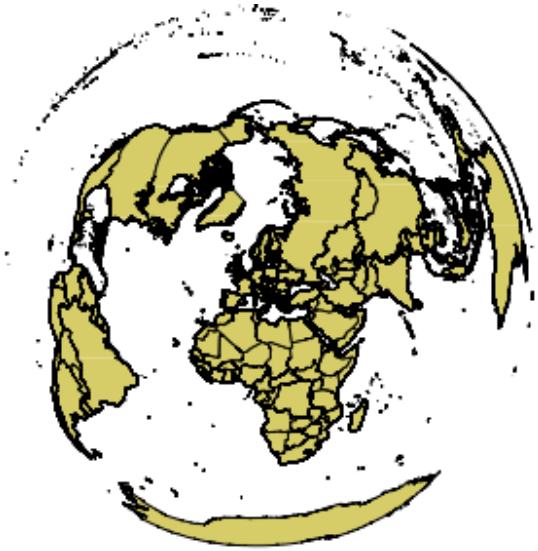
A Projected Coordinate System transforms the earth's surface to a two dimensional grid with units of either meters or feet. Because the earth is not actually a flat grid, no projection is a completely accurate representation. There are many different map projections that are designed to preserve either shape, distance, or area of land (or a combination of these).

Google Mercator is an example of a projection that preserves **shape** by ensuring that all latitude and longitude lines cross each other at 90 degree angles:

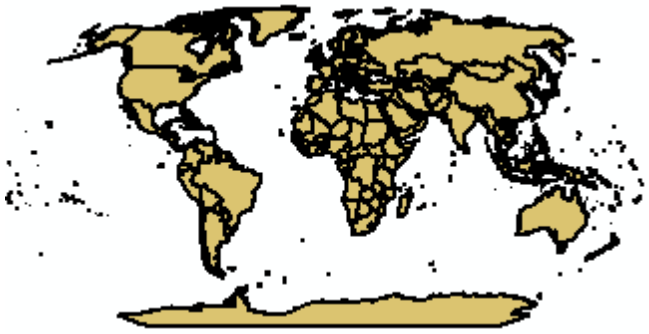
Lambert Plate Carree Equidistant Cylindrical is an example of a projection that preserves **distance**:



Lambert Azimuthal Equal Area is an example of a projection that preserves **area**:

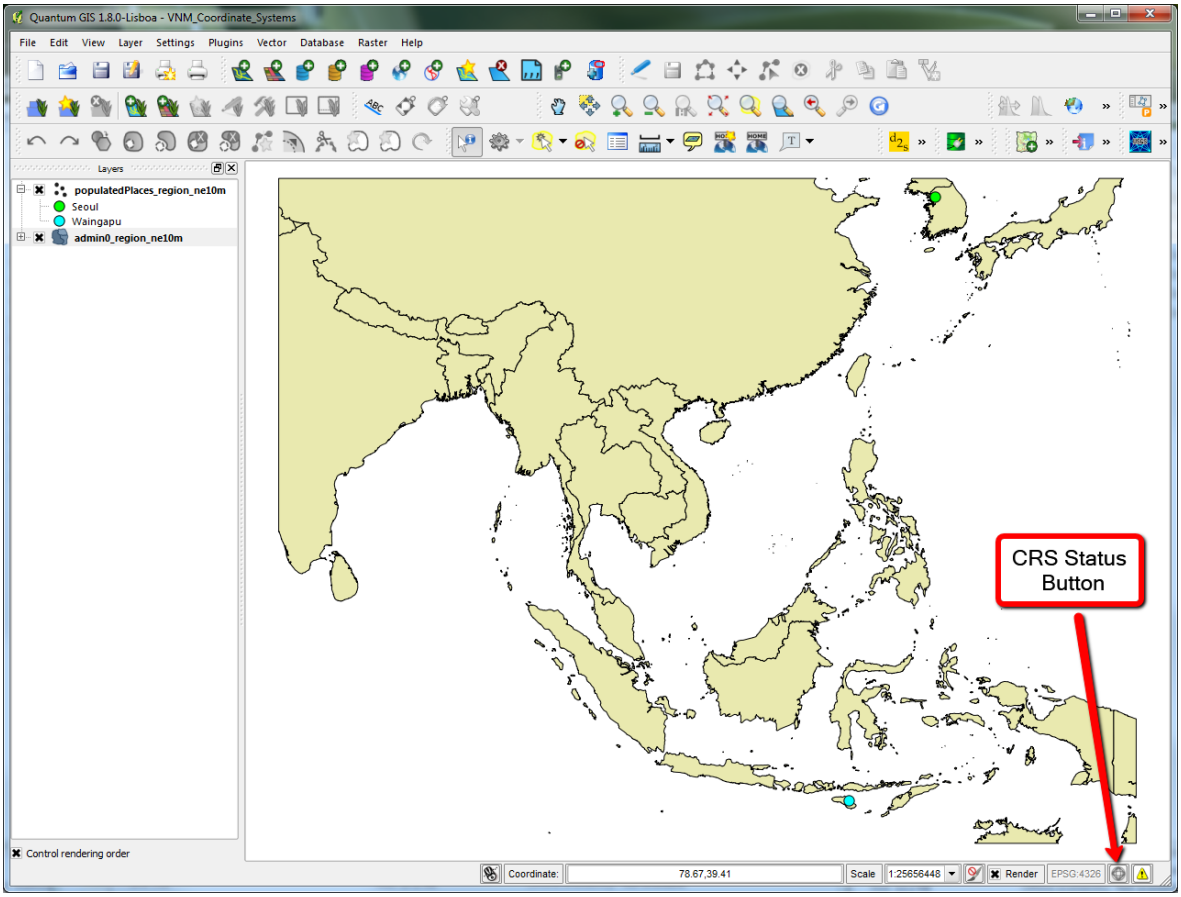


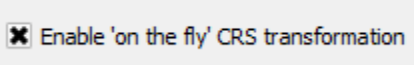
The Robinson is an example of a projection that is a **compromise** to preserve as much **shape**, **distance**, and **area** as possible:



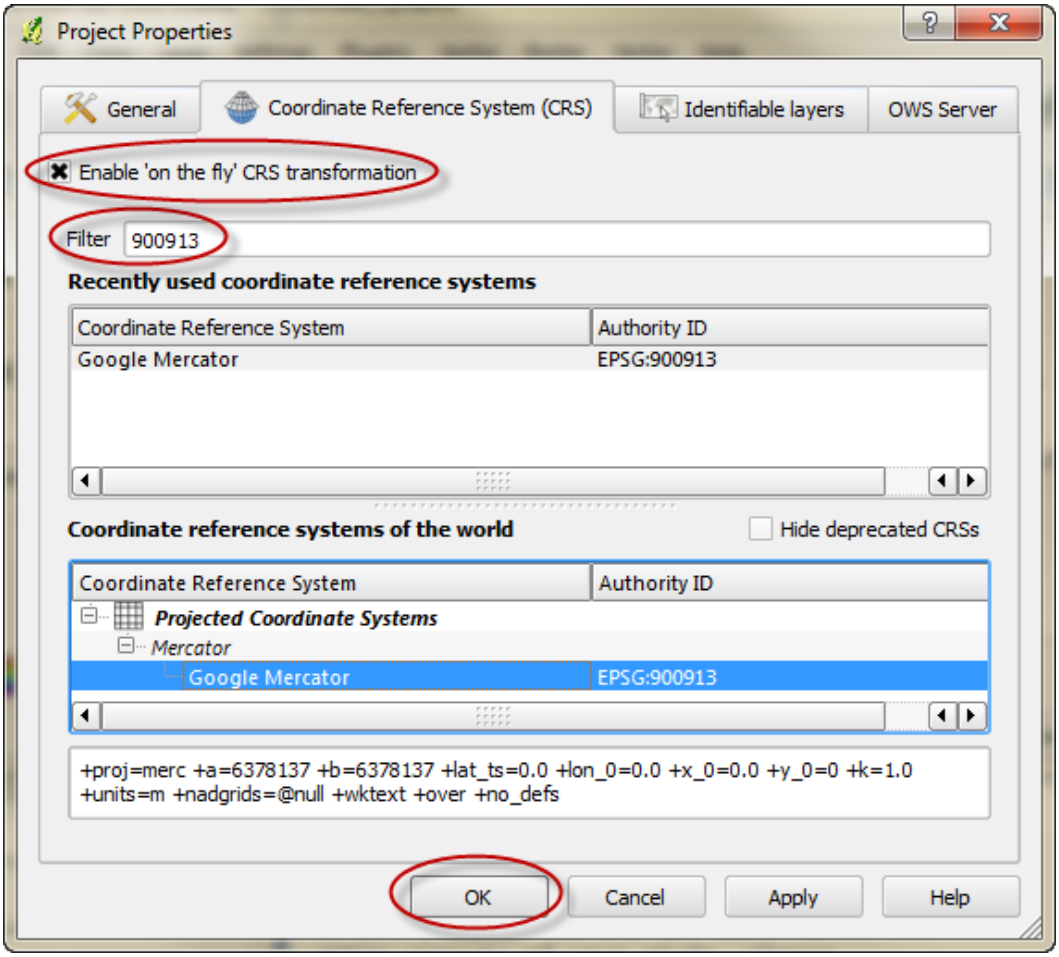
To observe the differences in projections, you will measure the distance between two cities using different projections and compare the results. Tunis, Tunisia and Cape Town, South Africa are shown as green and blue points on your map. In order for you to measure the distance in units of meters, a projected coordinate system that uses meters for units must be used. The Google Mercator projection, which will be used for this exercise, is one example of a projection that uses meters.

1. Click on the *CRS Status* button at the bottom right corner of your QGIS window



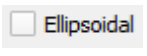
2. Check the box 

to allow your layers in the WGS 84 CRS to be automatically transformed and mapped in the new projection you will select for your map document
3. Type *900913* into the *Filter* section



4. Click on the *Google Mercator Projected* Coordinate System to select it
5. Click *OK*
6. Right click on the *Admin0_region_ne10m* layer
7. Select *Zoom to layer extent*

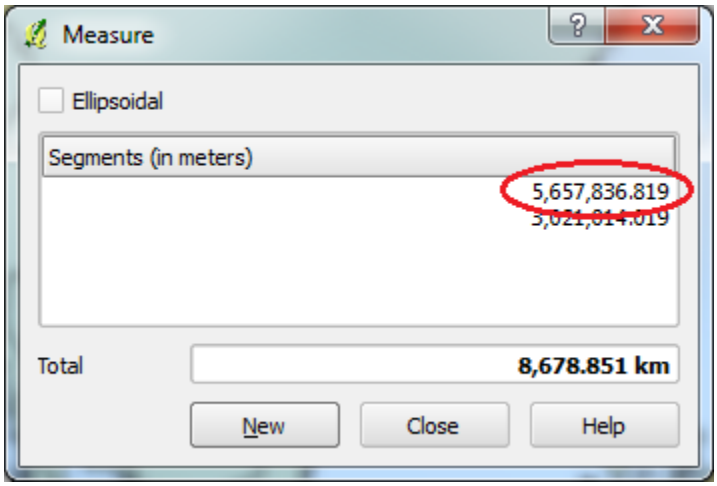
Now that a projection has been set, you will measure the distance between two points.

8. Click the *Measure Line*  button
9. Move the cursor directly over Seoul (the green point) and click once
10. Move the cursor over Waingapu (the blue point) and click once
11. Uncheck the 

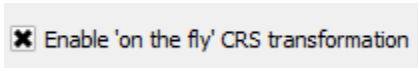
box

Note: Unchecking the ellipsoidal box means that the distances using the measure tool will be calculated based upon the projection. If the box is checked, the distances will be calculated based upon the WGS 84 ellipsoid. The box should be unchecked ONLY FOR THIS EXERCISE, which is to demonstrate the variation in distances calculated from the projections.

12. The distance in meters between the two cities will display as the first segment in the *Measure* window

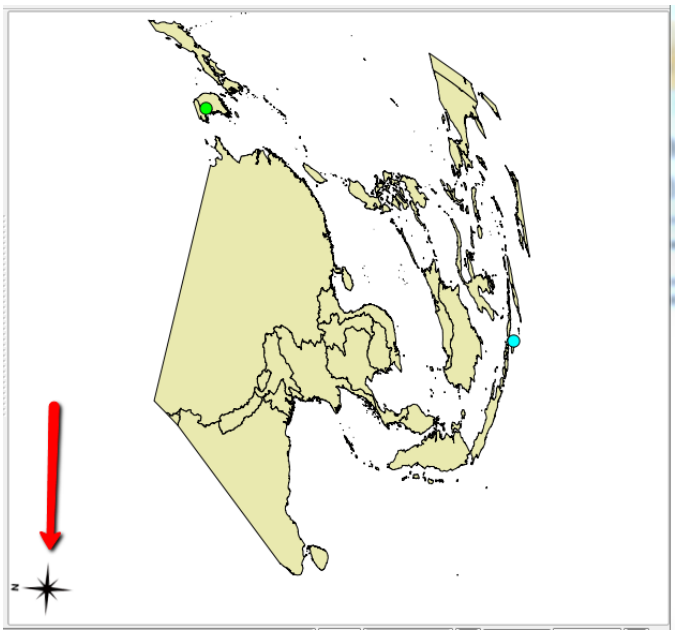


Note: It is OK if your distance is slightly different from this example

13. Write down the distance and label it Google Mercator
14. Close the *Measure* window
15. Click the *CRS Status* button at the bottom of your QGIS window
16. Make sure the 

box is checked
17. Type in 3035 into the *Filter* section
18. Select the *Lambert Azimuthal Equal Area > ETRS89 / ETRS-LAEA* Projected Coordinate System
19. Click *OK*
20. Right click on the *Admin0_region_ne10m* layer

Select *Zoom to layer extent*. Your map will be rotated. Note that North is no longer to the top of the screen.

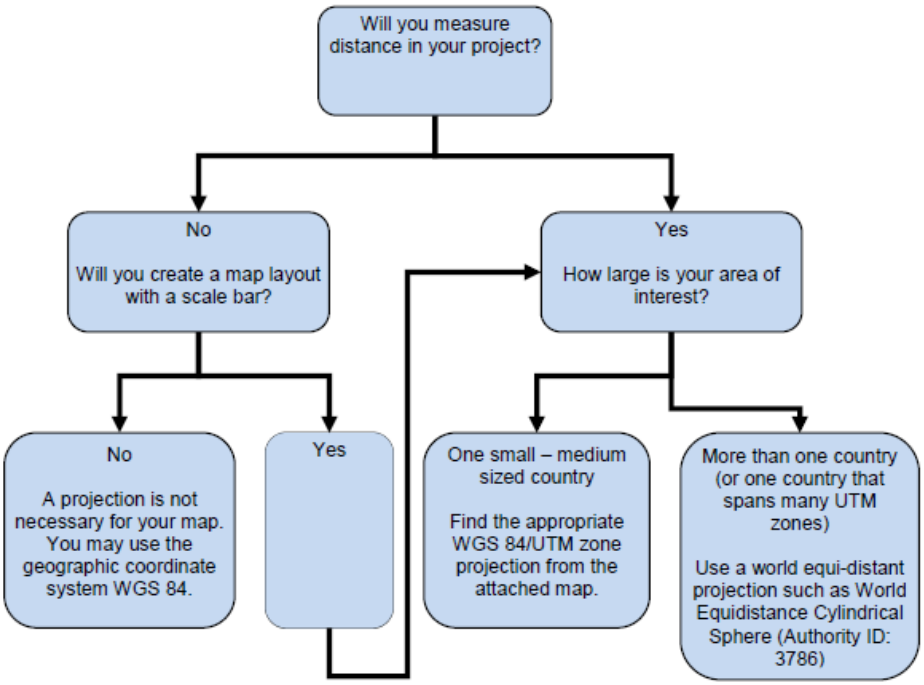


Now that a different projection has been set, you will measure the distance between the same two points as a comparison.

21. Click the *Measure Line*  button
22. Move the cursor directly over Seoul (green point) and click once
23. Move the cursor over Waingapu (blue point) and click once
24. The distance in meters between the two cities will display as the first segment in the *Measure* window
25. Record the distance and label it Lambert Azimuthal Equal Area
26. Close the *Measure* window
27. Calculate the difference for the distance between the two cities under the *Google Mercator* and the *Lambert Azimuthal Equal Area* projections

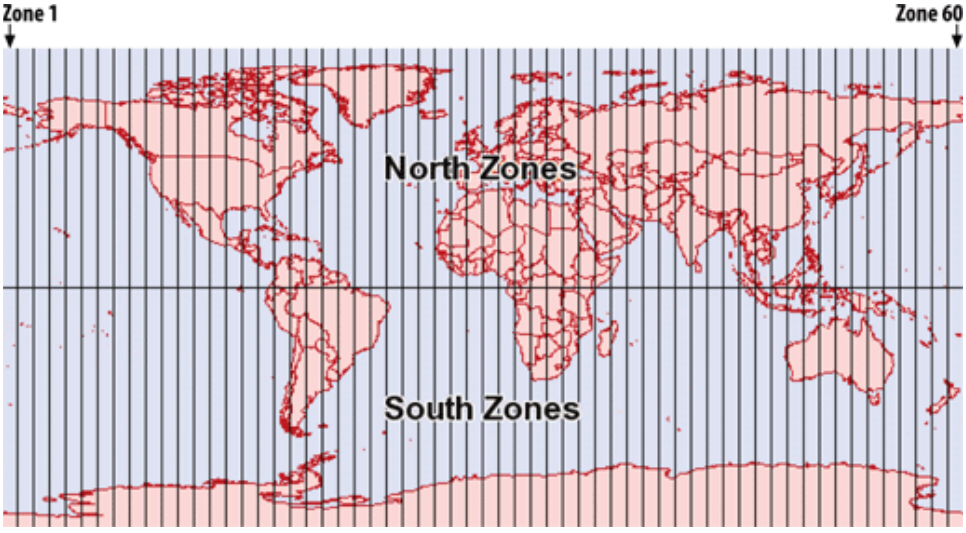
Section 3: Choosing the Proper Projection

Section 2 showed the difference in distances across projections. That variation makes it important to choose the proper projection for your analysis. This section provides a flow chart to help you select the best Projected Coordinate System for your project.



If you have gone through the flow chart and it tells you to select a WGS 84 / UTM zone, follow the steps below.

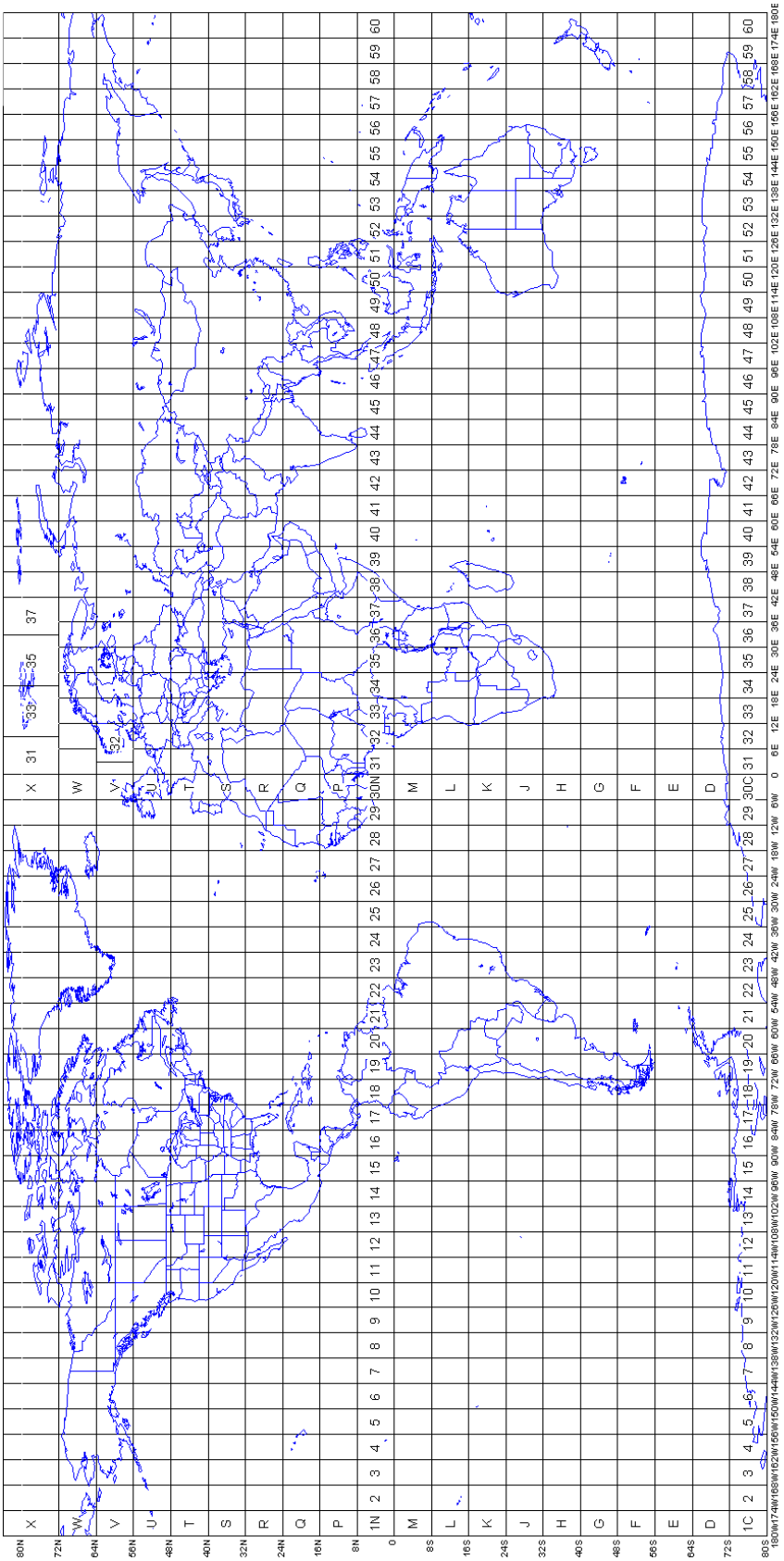
1. Determine whether your area of interest falls into the northern or southern zones. The dividing line between the zones is the equator



2. Determine which zone number your area of interest is in by looking at the image on the next page

   Note: You may also use an interactive map to zoom in to your area of interest and see which UTM zone to use. The map is available online at: http://whatutmzoneamiin.blogspot.com/p/map.html

UTM Zones



End Exercise.

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