

# MANAGING COMMON OREGON MAP PROJECTIONS IN ARC MAP

## I. Common Map Projections Used in the State of Oregon

The following text blocks provide a listing of the critical parameters for UTM Zone10 N, StatePlane North, and Oregon Custom Lambert. These will be the primary projections we will be using for work on Oregon GIS in our neighborhood.

### **UTM Zone 10 N NAD1927**

Units: meters  
False Easting: 500000  
False Northing 0  
Prime Meridian: Greenwich  
Transverse Mercator  
Central Meridian: -123  
Central Parallel: 0  
Scale Factor: 0.9996  
Ellipsoid (spheroid): Clarke 1866

### **UTM Zone 11 N NAD1927**

Units: meters  
False Easting: 500000  
False Northing 0  
Prime Meridian: Greenwich  
Transverse Mercator  
Central Meridian: -117  
Central Parallel: 0  
Scale Factor: 0.9996  
Ellipsoid (spheroid): Clarke 1866

### **Oregon State Plane North - NAD 1983 – Feet International**

Units: feet  
False Easting: 2500000  
False Northing 0  
Prime Meridian: Greenwich  
Lambert Conformal Conic  
Central Meridian: -120.5  
Central Parallel: 43.6666  
Standard Parallel 1: 44.333333  
Standard Parallel 2: 46  
Ellipsoid (spheroid): GRS 1980

### **Oregon State Plane South - NAD 1983 – Feet International**

Units: feet  
False Easting: 1500000  
False Northing 0  
Prime Meridian: Greenwich  
Lambert Conformal Conic  
Central Meridian: -120.5  
Central Parallel: 41.6666  
Standard Parallel 1: 42.333333  
Standard Parallel 2: 44  
Ellipsoid (spheroid): GRS 1980

## **Oregon Custom Lambert Projection (Statewide Lambert – Feet International)**

Geographic Datum: 1983\_NAD

Units: Foot (international 1 ft - 0.3048 m)

Geographic Coordinate System: GCS\_North\_American\_1983

False Easting: 1312335.958

False Northing: 0.0

Prime Meridian: Greenwich

Base Projection: Lambert\_Conformal\_Conic

Central Meridian: -120.5

Central Parallel (Latitude of Origin): 41.75

Standard Parallel 1: 43

Standard Parallel 2: 45.5

## **II. DEFINING PROJECTIONS FOR UNKNOWN DATA SOURCES**

Arc Toolbox provides tools for converting and defining projections for vector and raster data files. “Defining projections” creates a \*.prj file that helps ArcMap complete “on-the-fly” projection transformations. The “project” tool, takes map data of a known projection, and reprojects into a completely new file format with a new projection system.

“Define” projection tool simply designates a projection

“Project” tool – transforms the data into a new coordinate system.

***NOTE: IT IS IMPERATIVE THAT YOU USE THE “DEFINE” AND “PROJECT” TOOLS IN ARCTOOL BOX FROM THE ARC-CATALOG PLATFORM (NOT IN ARCMAP)***

- A. Defining projections** for feature data sets with unknown source (creating \*.prj files)
- a. **Open the ArcCatalog Software Environment (do not use projection tools in ArcMap; the “on-the-fly” projection routines in ArcMap can cause confusion and run-time errors)**
  - b. Open Arctoolbox – pull down “Data Management” tools Menu
    - i. Pull down Projections and Transformations menu
      1. Pull down Features menu (for vector projections)
      2. Pull down Raster menu (for images and grids)
      3. Locate the “Define” projection tool on the list below features and rasters

Examine the tools available for managing vector and raster-based data files and related projections. Explore the collective functions using the help menu to familiarize yourself with the objectives of the tools.

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## **B. In-Class Exercise – Defining Projections for Data Source Files in Oregon / Monmouth Area**

Step 1. Download Class Exercise Data From Website and Save to Your Local Drive (H:/student folder)

A) go to web site, look under the Lab Data Section - Map Projection Exercise

- i) sequentially click on the monmouth quad geology, roads, vegetation, and DRG \*.zip files
- ii) save them to your network H:/ student folder
- iii) Use WinZip to Extract the Compressed Files

a) use my computer - H:/ folder - click on \*.zip file to extract

**NOTE:** All of these map themes are from the Monmouth 7.5' Quadrangle.

**Step 2. Activate ArcMap Software**

A) In the "Table of Contents", add the following "feature data source" shape files to the data frame: mongeo.shp, roads.shp, stateveg.shp

B) 1 by 1, examine each theme, checking them on / off, rt-click and zoom to the active layer

C) Check all themes on the table of contents, zoom to full extents.

**QUESTION:** Why don't the themes overlay one another? Why is the full extent map view so screwy?

D) Remove / delete all of the above themes from the table of contents / data frame.

**Step 3.** add the following "image data source" file: monmouth.tif; add the following "feature data source" mongeo.shp (monmouth geology)

A) Check both themes in the table of contents. Explore the data in both themes by zooming, overlaying, inquiring.

**QUESTIONS:** What type of data is associated with the mongeo.shp map theme?

**Do both of these themes overlay one another properly in geospace?**

B) Now try adding the other vegetation and roads themes, do they properly line up in geospace?

**What is the problem with this set of data?**

**Step 4.** Your first goal is to define the projections for the Monmouth.tif, mongeo.shp, roads.shp and stateveg.shp files, and create related \*.prj files

A) Use "my computer" and click on the following text files to examine the metadata for these map themes: road\_meta.txt, mongeo\_meta.txt, and stateveg\_meta.txt (these are metadata text files that provide information on the projections for each of the files)

**Task:** list and the discuss the map projections used for each of the map layers, fill in the table below:

<b>File Name</b>	<b>Projection</b>	<b>Datum</b>
monmouth.tif	_____	_____
mongeo.shp	_____	_____
roads.shp	_____	_____
stateveg.shp	_____	_____

B) Now in your main project folder on the "H:\\" drive, create the following 3 subfolders to organize your data according to projection type:

- a. UTM
- b. State\_Plane
- c. Oregon\_Lambert

Sort, Organize / cut and paste the 4 data files into their respective folders according to projection, as you determined in 4A above.

Step 5 – Download and save feature data sources of the state of Oregon, with known projections. You will use these now and in the future as calibrated, known “projection checks” for Oregon data in which you are unsure of the projection.

A) go to web site, look under the Lab Data Section - Map Projection Exercise; locate the following links:

- [Shape File of Oregon Counties in UTM \(use as projection check\)](#)
- [Shape File of Oregon Counties in Custom Oregon Lambert \(use as projection check\)](#)
- [Shape File of Oregon Counties in State Plane \(North\) \(use as projection check\)](#)

i) sequentially save the above \*.zip files, and extract them into the appropriate project subfolders on your H:\ drive (i.e. UTM, State Plane, OR\_Lambert)

iii) Extract the Compressed Files

a) use my computer - H:/ folder - click on \*.zip file to extract

**NOTE:** All of these map themes show outlines of the state of Oregon with county boundaries. You will be able to use these shape files as projections checks if you have feature data sources of unknown projection. **THESE WILL BE IMPORTANT TO USE WITH WORK ON YOUR FINAL CLASS PROJECT.**

iv) you should now have the following files in your respective folders:

UTM folder\ utm\_state.shp  
 StatePlane folder\ spcounty.shp  
 OR\_Lambert folder\ orcounty.shp

v) use ArcMap or ArcCatalog to view the above shapes files to familiarize yourself with their characteristics

**Step 6 – CLOSE ARCMAP AND OPEN ARC-CATALOG:** Use the “Define Projection” Tool in ArcToolbox to properly delineate the projections for all of the data files that you have downloaded and saved as part of this exercise:

UTM (NAD1927 meters):	utm_state.shp, mongeo.shp, Monmouth.tif
State Plane North (NAD1983 feet International):	roads.shp, spcounty.shp
OR_Lambert (NAD1983 feet International):	vegetation.shp, orcounty.shp

**Currently all of your data that you’ve downloaded does not have defined projection files associated with them (i.e. there are not \*.prj files that accompany your data).**

Your goal will be to use Arc Toolbox via ArcCatalog to create \*.prj files for the above data layers.  
**NOTE: the UTM, State Plane, and Statewide Oregon Lambert projection protocols in ArcToolbox are known standards and are shipped as part of the default software package.**

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**\*\*\*NOTE: In the ArcToolbox projection lists, be sure to select the following:**

**State Systems – Oregon Statewide Lambert NAD1983 – Feet Intn'l  
State Plane – State Plane Oregon North NAD1983 – Feet Intn'l**

*There are other state system and state plane options that will cause projection errors.*

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Let's start with the UTM and State Plane files first, then we'll worry about the Oregon Custom Lambert.

- a. Open the ArcToolbox Menu (the following first example is for defining the projection of the mongeo.shp file)
  - pull down "Data Management" tools Menu
  - ii. Pull down Projections and Transformations menu
  
- c. Click on the "Define Projection" tool (to define a projection for files of unknown sources; the product of this exercise will be a \*.prj file that defines the projection criteria, that ArcMap can then use for "on-the-fly projections" in the data frame.
  - i. Browse – select the **mongeo.shp** file in the input window
    1. note the status window indicating "coordinate system unknown"
  - ii. click on coordinate system icon (to right of window)
    1. select the X-Y Coordinate System Tab (don't worry about Z values)
    2. Select "pre-defined coordinate system"
    3. Open "projected" coordinate system folder
    4. browse to appropriate projection type (e.g. "UTM" or "State Plane") (note: the following procedures are for use in setting a "UTM" zone10 n projection)
      - a. Select UTM folder
    5. select NAD1927 folder
    6. select "NAD 1927 UTM Zone10 N" projection option
    7. click "ADD" – examine the default parameters associated with this projection in the display window to familiarize yourself with the settings
    8. click "Apply" and "OK"–
      - a. a log window will now open and show the results of the action – "completed" message will appear; close the log window
      - b. A **mongeo.prj** projection file is now created, and included in the source folder/directory. Use a text editor like Notepad or Word to open the **mongeo.prj** file and examine it's contents to familiarize yourself with the file structure. Compare the information presented in the \*.prj file with that provided on page 1 of this handout.

Note: the **mongeo.shp** vector file now has a defined projection, and ArcMap will be able to know how to manage it, and apply "on-the-fly" reprojection algorithms in the data frame environment.

Step 7. Repeat the above steps. Systematically define projections and create \*.prj for all

of the UTM and State Plane shape files in your exercise folder. When you finish with Step 6 and 7, you should have created the following projection definition files:

UTM: utm\_state.prj, mongeo.prj, monmouth.prj (all zone 10 N)  
State Plane: roads.prj, spcounty.prj(both in Oregon State Plane North Feet International)

Step 8. Now let's define projection files for the Oregon\_Lambert data.

a. Open the ArcToolbox Menu (the following first example is for defining the projection of the **stateveg.shp** file which is in the Oregon Custom Lambert Projection)

pull down "Data Management" tools Menu

iii. Pull down Projections and Transformations menu

d. Click on the "Define Projection" tool (to define a projection for files on unknown sources; product will be a \*.prj file that defines the projection criteria, that ArcMap will then use for "on-the-fly projections")

i. Browse – select the **stateveg.shp** file in the input window

1. note the status window indicating "coordinate system unknown"

ii. click on coordinate system icon (to right of window)

1. select the X-Y Coordinate System Tab (don't worry about Z values)

2. Select "pre-defined coordinate system"

3. Open "projected" coordinate system folder

4. browse to the "State Systems" folder

5. select "**NAD 1983 Oregon Statewide Lambert Feet Intl.prj**" option

6. click "ADD" – examine the default parameters associated with this projection in the display window to familiarize yourself with the settings

7. click "Apply" and "OK"–

a. a log window will now open and show the results of the action – "completed" message will appear; close the log window

b. A **stateveg.prj** projection file is now created, and included in the source folder/directory. Use a text editor like Notepad or Word to open the **stateveg.prj** file and examine it's contents to familiarize yourself with the file structure. Compare the information presented in the \*.prj file with that provided on page 1 of this handout.

Note: the **stateveg.shp** vector file now has a defined projection of Oregon Custom Lambert, and ArcMap will be able to know how to manage it, and apply "on-the-fly" reprojection algorithms in the data frame environment.

Step 9 - Repeat the above steps for the Oregon County shapefile that is in your Oregon Custom Lambert Folder. When you finish with Step 9, you should have created the following projection definition files:

Oregon Lambert: stateveg.prj, orcounty.prj

## REPROJECTING DATA INTO NEW PROJECTIONS AND NEW DATA FILES

The “Project” tool can now be effectively used to reproject the map layers between different coordinate systems. This tool actively changes the X,Y coordinates and creates a new output data file in an entirely different projection.

Step 9. Open the ArcCatalog software environment (do NOT use the project tool in ArcMap)

a. Open the ArcToolbox Menu (the following first example is for defining the projection of the mongeo.shp file)

-pull down “Data Management” tools Menu

iii. Pull down Projections and Transformations menu

1. pull down the “feature” and “raster” tool tabs, examine the options

Note: we will be transforming projections between UTM Zone10 N 1927\_NAD, State Plane North 1983\_NAD, and Oregon Custom Lambert 1983\_NAD – Feet International. See step 2 below to make sure the software environment provides the necessary transformation tools to migrate between 1927\_NAD and 1983\_NAD

Step 10. Under the “Feature” option, open the “Project” tool dialogue window

a. Before we begin, we will need to set the software environment variable, to make sure it includes a 1927 to 1983 datum conversion option.

i. Click on the “environments” icon

1. pull down menu: “General Settings”

2. scroll down the list to “Geographic Transformations”

3. pull down the transformation list, scroll down and select the “NAD\_1927\_To\_NAD\_1983\_NADCON” option

a. This option should now be listed on the “Geographic Transformation Names” list below.

i. If you accidentally add the wrong item, the “X” will delete it from the list, and you can pick over.

4. Click OK – and return to the main “project tool” dialogue window

Now we have the environment variables set, let’s re-project a file into UTM. The tutorial below will guide you through re-projection of the State\_Plane\_NAD\_1983 “roads.shp” layer into a UTM\_NAD\_1927 projection.

b. On the “input file” pull down, browse to your State Plane\roads.shp file, and ADD

Note: since we already defined the \*.prj file, note that ArcToolbox automatically knows that the roads.shp file is in the state plane north projection (hence the “input coordinate system” window is grayed out / not active).

c. On the “output dataset” pull down, browse to the UTM\ folder, and name the new shape file that you will create: “roads\_utm.shp”

d. On the “output coordinate system” menu, pull down and click the following sequence...

a. X-Y Coordinate System - Select – Projected Coordinate Systems – UTM – NAD 1927 – NAD\_1927\_Zone10\_N.prj”

b. ADD – APPLY – OK

e. On the “Geographic Transformation (optional) pull down, select the

“NAD\_1927\_To\_NAD\_1983\_NADCON” option that you installed on the environment variables under Step 2-a-i-3 above.

f. Click OK

a. A log window will now open and provide you with feedback, if it ends with a “successfully completed” message, then you have completed the task.

Step 11 – Now check the results of your projection work in ArcMap – open ArcMap, browse to your “UTM” folder, and add the “roads\_utm.shp”, “mongeo.shp” and “Monmouth.tif” layers and make sure that they all align and that there are no projection errors.

Step 12 - Repeat steps 2b-2f and 3 above, for the “stateveg.shp” layer that is in the Oregon Custom Lambert folder.

- reproject the statveg.shp into UTM Zone 10N
- check the results of your work

Step 13 – print out your results. Once you have all of your files reprojected into UTM, add them into the dataframe in ArcMap and create the following layouts:

- |   |  |
|---|--|
| A. State Vegetation overlaying the Monmouth DRG | (include name, neatline, north arrow, scale) |
| B. Monmouth Geology overlaying the Monmouth DRG | (include name, neatline, north arrow, scale) |
| C. Roads overlaying the Monmouth DRG            | (include name, neatline, north arrow, scale) |
| D. Road overlaying the Monmouth Geology         | (include name, neatline, north arrow, scale) |

Step 14 – Go back to the beginning of this exercise and start it over from scratch. Download fresh \*.zip data files from the web site, and re-do the entire tutorial a total of 3 times. Once you have completed this by the third time, without looking at the notes.... **YOU ARE THERE!! YOU WILL THEN BE A CERTIFIED GIS PROJECTION GEEK!!!**