Detailed Data Preparation Procedures

The following outline covers the detailed steps used in ArcGIS Pro and ClimateWNA (cWNA) for the preliminary data processing of the MaxEnt inputs. The same processing was used for both the 30m and 800m resolutions and for both the main California study area as well as the Utah prediction area

All data in GCS North American 1983 unless otherwise noted.

1. Create new project and geodatabase (GDB)
    1.1. Set basemap to GCS North American 1983
2. Presence Data
    2.1. Import cleansed GBIF presence data from either a CSV or Excel file. Data is in WGS84 projection.
    2.2. XY Table to Points to create point feature class
    2.3. Project point feature class to NAD83
    2.4. Select bristlecone pine locations in the study area
    2.5. Copy the selection to new feature class
3. Study Area
    3.1. Create empty feature class
    3.2. Using the edit tools, manually create polygon of study area
4. PRISM Stations
    4.1. Import PRISM station location CSV files for the precipitation and temperature into the project
    4.2. Use XY Table To Point to create feature classes for temp and precip station locations

4.3. Use an intersection of the two to determine dual purpose stations

5. DEM Preparation

5.1. Import the USGS 30m DEMs and PRISM 800m elevation BIL file into the project

5.1.1. California USGS 30m DEMs used:

5.1.1.1. N37 W118

5.1.1.2. N37 W119

5.1.1.3. N38 W118

5.1.1.4. N38 W119

5.1.1.5. N39 W119

5.1.2. Utah USGS 30m DEMs used:

5.1.2.1. N38 W112

5.1.2.2. N38 W113

5.1.2.3. N38 W114

5.2. Add the metadata grids for the DEMs to the project and set the symbology. (Info only for the thesis report.)

5.3. Combine the USGS 30m DEMs with Mosaic To New Raster (not required for PRISM 800m data)

5.4. Extract By Mask to crop the mosaic to the study area polygon

6. ClimateWNA Input Preparation

6.1. Raster To Multipoint to create a point feature class from the study area DEM

6.2. Multipart to Singlepart to insure points are disaggregated

6.3. Add Geometry Attributes and add the XYZ coordinates as attributes to the point feature class just created

6.4. Table To Table to create CSV file for cWNA input

6.4.1. Fields used: OBJECTID, ORIG_FID, POINT_X, POINT_Y, POINT_Z

6.4.2. Rename last three fields above to long, lat, el (naming required by cWNA)

6.4.3. Move lat ahead of long in field order (cWNA order must be lat, long, el after any two fields in the first and second column)

6.4.4. Output a CSV file to a folder, not the project GDB

7. Run cWNA

7.1. Select 30-yr Normal desired

7.2. Use CSV generated above as input

7.3. Set output file location and file name

7.4. When run, cWNA interpolates climate attributes at each point, using elevation as part of the interpolation

7.5. cWNA returns a CSV with climate attributes added to each point

8. Process Climate Data From cWNA CSV

8.1. Add cWNA CSV to the project

8.2. XY Table to Points

8.2.1. X = Longitude field

8.2.2. Y = Latitude field

8.2.3. Coordinate system = GCS_North_American_1983

8.2.4. Z = Elevation field of CSV

8.2.5. Ignore warning about "No vertical coordinate system defined"

8.3. Add MAT_adjusted, MWMT_adjusted, and MCMT_adjusted fields to attribute table of the point feature class

8.4. Use Calculate Field to subtract 1.5C from each of the corresponding fields for the adjusted attributes

9. Create climate covariate rasters using Point To Raster
    9.1. Used point feature class with the climate data attributes
    9.2. Cell assignment type = mean
    9.3. Set Environment
        9.3.1. Output Coordinate System = GCS North American 1983
        9.3.2. Extent, Snap Raster, and Cell Size set to match the study area DEM
    9.4. Created rasters for each climate variable
        9.4.1. MAT (from adjusted attribute)
        9.4.2. MWMT (from adjusted attribute)
        9.4.3. MCMT (from adjusted attribute)
        9.4.4. DD0
        9.4.5. Elevation (from cWNA return data)
10. Project study area and species locations to UTM PCS
11. Create species input file for MaxEnt
    11.1. Use Add Geometry Attribute to add easting and northing coordinate attributes to bristlecone location feature class in the UTM PCS
    11.2. Table To Table to create CSV file in an output folder, not the GDB
12. Create aligned UTM layers of climate covariates
    12.1. Extract By Mask for each raster
    12.2. Use study area for the mask data
    12.3. Environment settings

12.3.1. Output coordinate system = NAD_1983_UTM_Zone_11N for the California area, 12N for the Utah area.

12.3.2. Extent, Snap Raster, Cell Size = DEM projected to UTM

12.4. All the UTM rasters are now be aligned and ready to generate ASCII files for MaxEnt

13. Create curvature and aspect covariate rasters

13.1. In each tool, set the Environment

13.1.1. Coordinate system, extent, snap raster, cell size set to match UTM DEM

13.1.2. Mask set to the study area feature class

13.2. Curvature tool used to create surface

13.3. Aspect tool used to create initial surface

13.4. Raster Calculator to create a Northness raster from aspect: cos(Aspect)

13.5. Raster Calculator to create a Eastness raster from aspect: sin(Aspect)

14. For each of the climate and DEM covariate rasters created, use Raster To ASCII to generate MaxEnt input files