

Tutorial for Preparing WorldClim Files For Use in MaxEnt

I. Introduction

MaxEnt uses two file type to perform its calculations: Comma-Separated Values (.csv), and ESRI ASCII GIS (.asc) files. Comma-Separated Values files are created by the user and contain the locality data for whatever taxa are being analyzed. Global climate data is downloaded from www.WorldClim.org, but it is not provided in the .asc format. In order to use these data in MaxEnt, they must first be converted to the proper format. For this purpose we will use a free program called DIVA GIS, downloaded from www.diva-gis.org.

II. Donload Software and WorldClim Data

1. Download MaxEnt

Go to <http://www.cs.princeton.edu/~schapire/maxent/> and follow the instructions to download and extract MaxEnt to the directory of your choice.

2. Download DIVA GIS

Go to <http://www.diva-gis.org/download> and download and extract the DIVA GIS setup file. Run the setup program and follow the instructions to install DIVA GIS.

3. Download WorldClim Data

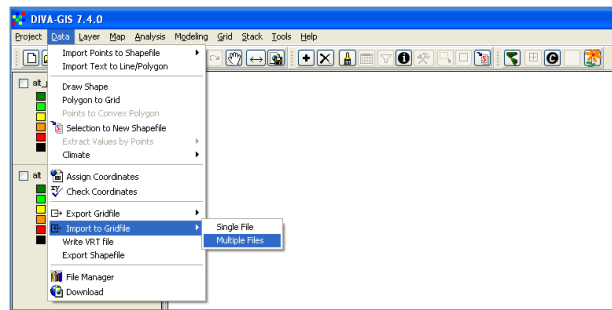
Go to <http://www.worldclim.org/> and follow the links to your dataset of interest. For this example we are using current global climate data, so we would follow the "Current" link (<http://www.worldclim.org/current/>). Data are available for Maximum, Mean, and Minimum Monthly Temperatures, Monthly Average Precipitation, Altitude, and "Bioclimatic Data" which include 18 separate measures of bioclimatic information (i.e. quarterly rainfall averages, seasonality, etc. For a complete explanation of bioclimatic data from WorldClim, visit <http://www.worldclim.org/bioclim/>). World Clim data are also available at a variety of resolutions, ranging from 30 arc-seconds to 10 arc-minutes. The highest resolution files are very large, so be sure to have a lot of free hard disk space (at least 200GB) if you plan on using them. For this example we will be utilizing the bioclim and altitude datasets at the 2m30s resolution in the "Generic grids" format. Download these files and extract them to a folder where you can easily access them.

(Note: Even though the format we want is called ESRI, don't download the ESRI files from WorldClim. They are made for use in ArcGIS.)

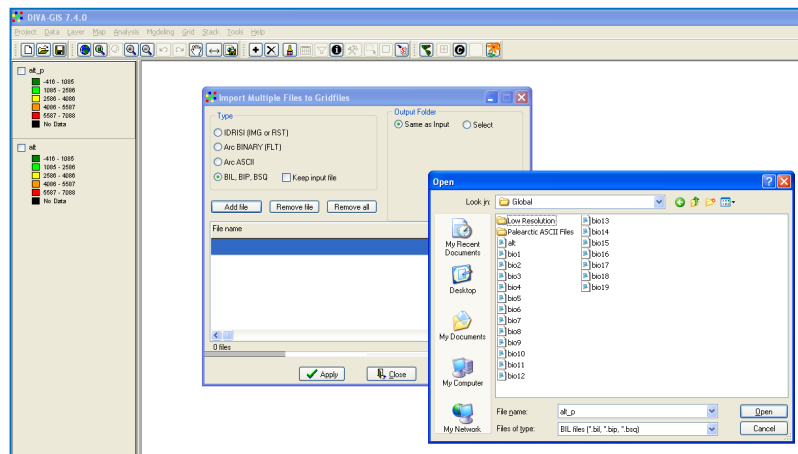
III. Convert WorldClim files to .asc Format

1. Open DIVA GIS

- Click on "Data" and select "Import to Gridfile > Multiple Files" from the dropdown menu:

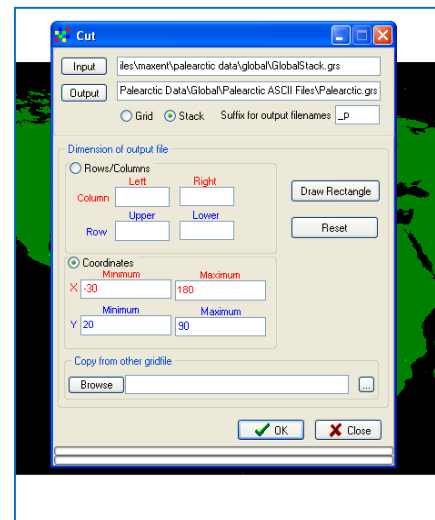


- Under "Type" select "BIL, BIP, BSQ" then click "Add File" and navigate to the WorldClim files that you extracted. Select all of the files by holding SHIFT when clicking on them, then click "Open" and then "Apply." The program will begin converting the files (this could take a few minutes) :



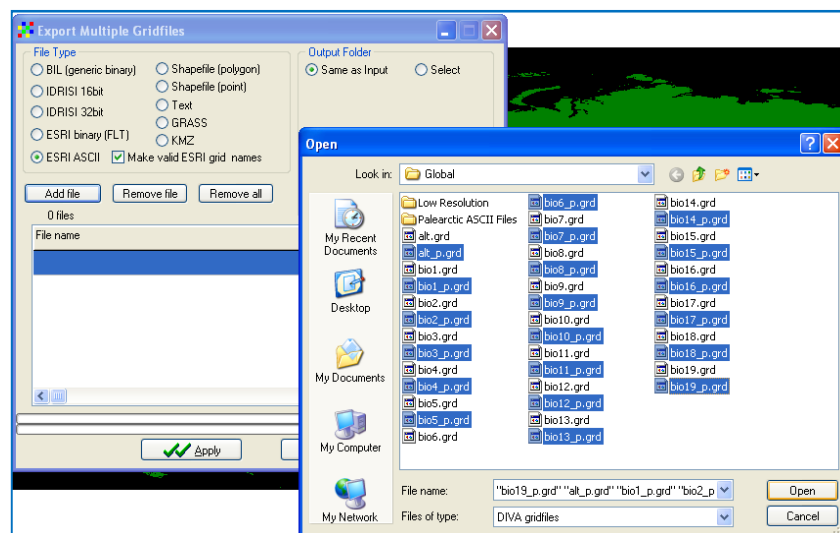
- The next step is to trim the data files, if needed. For this example we are interested in the Palearctic region, so we can edit our data files to include only this area. We can trim all of the files at once by first "Stacking" them, essentially telling the computer that we want to treat the files as a group. Click on "Stack > Make Stack" and select "Add Grid" in the box that comes up. Again, select all of your data files (this time they will be the .grid files that you just created) and click "Open." Click on "Filename," name your stack file (i.e. GlobalStack) and "Apply."

Now, to trim the stack click on "Grid > Cut." For the input file, select the stack file that you just created. For the output, just choose a name that describes the area you are selecting (i.e. 'Palearctic'). This file will simply be the stack file that describes the



trimmed files. The individual file names themselves (i.e. bio1) will be created by adding a user-defined suffix to the original filename. In the box next to “Suffix for output filenames:” input a short suffix that will help you remember the area contained within the file. In this example, we are selecting the Palearctic region, so “_p” is used as the suffix (the trimmed grid files will be named bio1_p, etc.) To select the area you would like to include you can either enter coordinates or select “Draw Rectangle” and highlight an area on the map. Select the area you wish to isolate and click “OK.” The program will begin creating the trimmed files – this can take a few minutes.

- The final step is to convert the trimmed grid files to the ESRI ASCII format. Click on “Data > Export Gridfile > Multiple Files.” Under “File Type” select “ESRI ASCII” and click the box next to “Make valid ESRI grid names.” Next, Click “Add File” and navigate to your trimmed grid files. Hold CTRL, select all of the trimmed grid files, and click “Open.”

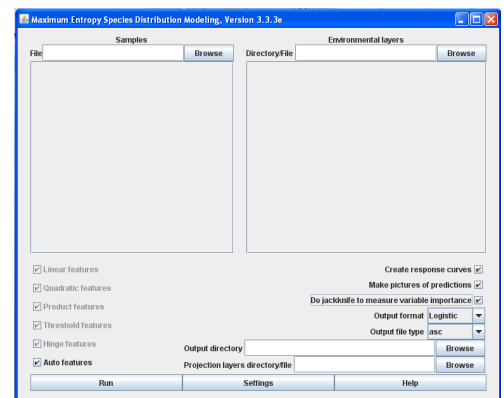


Click “Apply.” The program will begin converting the files – this may take several minutes. Your files are now ready for use in MaxEnt.

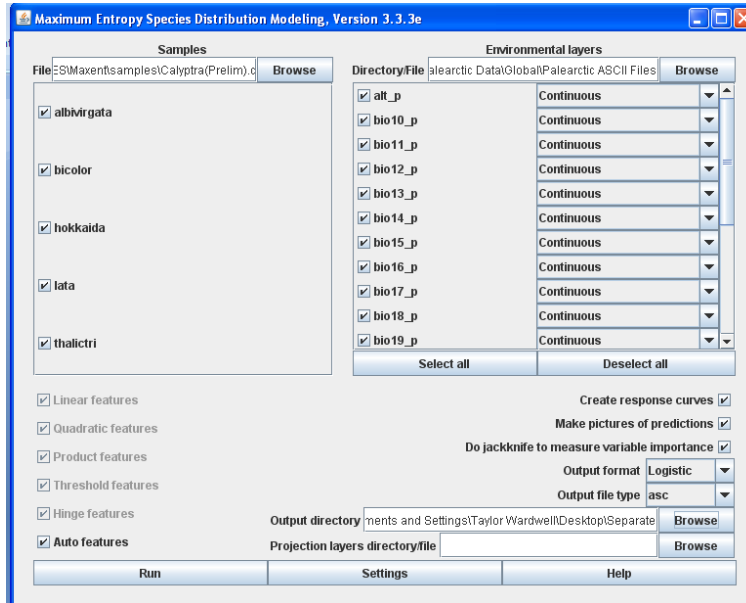
IV. Using MaxEnt

There is already a very helpful tutorial available for MaxEnt, so this section will be brief.

- Open MaxEnt
- Check the boxes next to “Create Response Curves,” “Make Pictures of Predictions,” and “Do Jackknife to measure Variable Importance.”
- Under “Samples” click “Browse” and open the .csv file containing your taxa locality data.



4. Under "Environmental Layers" click "Browse" and select the FOLDER containing your trimmed .asc files.
5. Create a new folder somewhere easy to find where your result files will be saved (I like to make a folder on the desktop). Under "Output Directory" click "Browse" and select the folder that you just created.
6. You should now have a screen that looks something like this:



7. Click "Run" and allow the program to process the information. The output files can be found in the folder that you created and selected as the output directory. The HTML file is the most informative, containing the image of the predicted distribution for each species in the analysis.