Data Analysis Workflow: Maxent

Executive Summary

Once the habitat modeling and species occurrence tables have been created, Maxent models are run to evaluate the relative impacts that each habitat variable may have on a given species presence. Those habitat variables with a large impact are cross referenced with a list of management actions to identify which actions would likely have a positive net effect on restoring habitat for the given species.

Below, we describe the workflow and scripts used to generate the inputs for the Maximum Entropy (MaxEnt) habitat suitability model, run the MaxEnt model, and interpret the results. We added each script as a tool in the EEP\_Analysis ArcGIS toolbox, and provided additional tool named “MaxEnt Workflow” that implements these tools/scripts in sequence for a given species.

Additional information for each process is provided within the respective Python script and the ArcMap tool documentation.

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🡪Create Maxent samples with data (SWD) File

[MAXENT\_CreateSWDFile.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/MAXENT_CreateSWDFile.py)

This script creates a MaxEnt input CSV file in SWD (species with data) format. This format includes a column listing the species/background along with columns for all the habitat modeling variables (i.e. environment layers). The records produced are limited to only catchments with recorded presences from any species in Endries occurrence data.

🡪Create Projection ASCII pseudo rasters

[MAXENT\_SWDtoProjectionASCIIs.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/MAXENT_SWDtoProjectionASCIIs.py)

To enable the projection of model results back to the catchment features (reflecting current or altered conditions), MaxEnt requires a set of ASCII raster layers on which its model prediction equations are applied. Normally, this is a set of raster datasets depicting alternate futures. However, as we are modeling habitat suitability at the catchment – not pixel – scale, we must produce projections “rasters” on which MaxEnt can use. These “pseudo ASCII” layers are simply the habitat variable attribute columns transposed into ASCII format: a single column dataset with a row for each catchment. (These are meaningless as rasters, but do allow MaxEnt to produce results that can be reverted back to a catchment attribute table).

This script creates this set of “pseudo ASCII” layers directly from the SWD data file created in the script above. The outputs include an ASCII file for each habitat variable included in the SWD file (columns 3 and on), each written to a folder provided as a script input. *This should be a folder called “prj” in the MaxEnt folder, which should be cleared of all contents before running this script.*

🡪Create MaxEnt batch file

[MAXENT\_CreateBatchFile.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/MAXENT_CreateBatchFile.py)

This script creates a batch file (.bat) used to run MaxEnt with the supplied files. The way this script is configured, the workspace must contain a MaxEnt folder (containing the MaxEnt.jar file) in the project's root folder. The inputs to the script include:

* The MaxEnt SWD file
* A semicolon-separated list of habitat attribute names to include in the model
* A semicolon-separated list of habitat attribute that should be set to categorical
* The name of the folder containing the projection files

Upon completion, the file “RunMe.bat” can be used to run MaxEnt.

🡪Projections to CSV file

[MAXENT\_projectionASCIItoCSV.py](https://github.com/Duke-NSOE/EEP/blob/master/Scripts/MAXENT_projectionASCIItoCSV.py)

This script reverts the MaxEnt model results projected into “pseudo ASCII” formats back into a CSV file that can be joined to the catchment features to display the predicted habitat likelihood for the modeled species. It requires the projection ASCII file, the SWD file used to produce it, and an output CSV file name. The output file lists each catchment by its GRIDCODE and the likelihood that that catchment will support the modelled species (0 = not likely; 1 = likely).

This file can be joined to the NHD+ catchment feature class or raster to enable mapped display of the results.