

Species Distribution Ensemble Modeling Tool

Table of Contents

1. Introduction.....	4
1.1. Why create ensemble models?	4
1.2. Structure of Manual	4
1.3. Supported import file types	4
1.4. Supported export file types.....	4
1.5. Supported image download file types	5
2. Load Model Predictions Tab.....	5
2.1. Load and Save App Environment.....	5
2.2. Load Model Predictions.....	5
2.3. Loaded Model Predictions.....	9
3. Overlay Model Predictions Tab	12
3.1. Load Study Area Polygon.....	12
3.2. Load Land Polygon	12
3.3. Loaded Model Predictions.....	13
3.4. Overlay Model Predictions	13
3.5. Preview of Base Grid.....	14
3.6. Preview of Overlaid Model Predictions	14
4. Create Ensemble Predictions Tab	14
4.1. Overlaid Model Predictions.....	14
4.2. Create Ensemble Predictions	14
4.3. Created Ensemble Predictions	14
5. Evaluation Metrics Tab.....	14
5.1. Select Predictions to Evaluate	14
5.2. Load Validation Data.....	14
5.3. Calculate Metrics	14
5.4. Metrics	14
5.5. Metric Descriptions and References.....	14
6. High Quality Maps Tab	15
6.1. Select Predictions to Plot.....	15
6.2. Plot Parameters	15
7. Export Predictions Tab	15
7.1. Select Predictions to Export	15
7.2. Export Predictions	15

8.	Manual Tab	15
9.	Submit Feedback Tab	15

Manual

Species distribution ensemble modeling tool

(beta version, Oct 2017)

1. Introduction

[Karin to write, based on original proposal]

1.1. Why create ensemble models?

[Karin to write, based on original proposal]

1.2. Structure of Manual

[Do this last]

1.3. Supported import file types

.CSV files

- [describe format]

Raster files

[describe format]

.SHP files

[describe format]

.Geodata files

[describe format]

1.4. Supported export file types

CSV files

[describe format]

.SHP files

[describe format]

KML files

[describe format]

1.5. Supported image download file types

.JPG files

[describe format]

.PDF files

[describe format]

.PNG files

[describe format]

2. Load Model Predictions Tab

2.1. Load and Save App Environment

Load and Save App Environment

Load saved app environment

Browse... No file selected

Filename with which to save environment

Ens_App_Save_Envir.RDATA

Save current app environment

- *Load saved app environment*
 - Browse to .RDATA file created using tool.
- *Filename with which to save environment*
 - Name of .RDATA file that will be downloaded if the user clicks ‘Save current app environment’.
- *Save current app environment*
 - Click to download an .RDATA file that stores files loaded in the current session of the ensemble modeling tool.
 - This file can be loaded using the ‘Load saved app environment’ and thus the user can functionally pick up where they left off in their last session.
 - Aspects of the app that are saved include but are not limited to: original model predictions, study area polygon, land polygon, overlaid model predictions, ensemble predictions, validation data, and calculated evaluation metrics.

2.2. Load Model Predictions

Load Model Predictions

Data file type

Excel csv file

Location of point in grid cell

Center

CSV data must be lat/long points that are equally spaced in decimal degrees.
 Select names of lat, long, and other applicable columns after uploading csv file.
 Then click the button to load model predictions

Please make sure that missing prediction values are one of the following: 'NA', 'NaN', 'N/A', n/a, 'na', blank, or a negative number.
 For 'Prediction value type', select 'Relative' if predictions are probabilities of occurrence

Upload .csv file

Browse...

Becker_data.csv

Upload complete

Column with longitude data

m lon

Column with latitude data

m lat

Column with prediction data

Bm_ROMS_Aug_Nov_2001

Prediction value type

Relative density

Column with error data

N/A

Column with weight data

N/A

Load model predictions

No prediction values were classified as NA

- *Data file type*: “Excel csv file”
 - *Location of point in grid cell*:
 - Specifies whether the longitude and latitude coordinates in the file represent the center, top right, top left, bottom left, or bottom right of each grid cell.
 - *Upload .csv file*
 - Browse to and select the .csv file that contains the model prediction data you want to load into the app. This file must have headers, and an error message will appear if you select a file that is not a .csv file.
 - *Column with longitude data*
 - Select the name of the column with the longitude data.
 - *Column with latitude data*
 - Select the name of the column with the latitude data.
 - *Column with prediction data*
 - Select the name of the column with the prediction data.
 - *Prediction value type*

- Select “Absolute density” if the model predictions have had all necessary correction factors applied for the applicable study area, and thus can provide a true prediction of density. Select “Relative density” if the model prediction have **not** had all necessary correction factors applied for the applicable study area, and thus only accurately predict the density relative to the other model predictions
 - *Column with error data*
 - Select the name of the column with the prediction data. If you do not have error data for these model predictions, then select “N/A”. If you want to use error values as pixel-level spatial weights in a weighted ensemble, then use the ‘Column with weight data’ input. Currently there is no place within the app that this error data can be used, but a potential future use is creating maps of the error data.
 - *Column with weight data*
 - Select the name of the column with the prediction data. If you do not have weight data for these model predictions, then select “N/A”. Weight data can be used as pixel-level spatial weights in a weighted ensemble in the “Create Ensemble Predictions” tab.
 - *NA prediction values message*
 - A message detailing how many of the provided prediction values will be classified as NA. A prediction value will be classified as NA if the provided data is one of the following: 'NA', 'NaN', 'N/A', 'n/a', 'na', blank, or a negative number.
 - *Load model predictions*
 - Click to load model predictions from the loaded .csv file with the specified data into the app.
- *Data file type: “GIS raster”*
 - *Band number of prediction data*
 - The band number of the prediction data within the loaded raster .tif file.
 - *Upload raster .tif file*
 - Browse to and select the .tif file for the raster that contains the model prediction data you want to load into the app. An error message will appear if you select a file that is not a .tif file or if the selected raster does not have data at the provided band number.
 - *Prediction value type*
 - See [Prediction value type](#)
 - Select “Absolute density” if the model predictions have had all necessary correction factors applied for the applicable study area, and thus can provide a true prediction of density. Select “Relative density” if the model prediction have **not** had all necessary correction factors applied for the applicable study area, and thus only accurately predict the density relative to the other model predictions.
 - *NA prediction values message*
 - A detailing how many of the provided prediction values will be classified as NA. A prediction value will be classified as NA if the provided data is one of the following: 'NA', 'NaN', 'N/A', 'n/a', 'na', blank, or a negative

- number.
 - *Load model predictions*
 - Click to load model predictions from the loaded .tif file with the specified data into the app.
- *Data file type: “GIS shapefile”*
 - *Upload GIS shapefile files*
 - Browse to the folder that contains the shapefile you want to load, and then select all files that pertain to that shapefile. Although they will have different file extensions, these files will all have the same file name (this will be the name of the shapefile in ArcCatalog). An error message will appear if not all of the files of the desired shapefile are selected, or if extraneous files are selected.
 - *Column with prediction data*
 - Select the name of the column with the prediction data.
 - *Prediction value type*
 - See [Prediction value type](#)
 - Select “Absolute density” if the model predictions have had all necessary correction factors applied for the applicable study area, and thus can provide a true prediction of density. Select “Relative density” if the model prediction have **not** had all necessary correction factors applied for the applicable study area, and thus only accurately predict the density relative to the other model predictions.
 - *Column with error data*
 - Select the name of the column with the prediction data. If you do not have error data for these model predictions, then select “N/A”. If you want to use error values as pixel-level spatial weights in a weighted ensemble, then use the ‘Column with weight data’ input. Currently there is no place within the app that this error data can be used, but a potential future use is creating maps of the error data.
 - *Column with weight data*
 - Select the name of the column with the prediction data. If you do not have weight data for these model predictions, then select “N/A”. Weight data can be used as pixel-level spatial weights in a weighted ensemble in the “Create Ensemble Predictions” tab.
 - *NA prediction values message*
 - A message detailing how many of the provided prediction values will be classified as NA. A prediction value will be classified as NA if the provided data is one of the following: 'NA', 'NaN', 'N/A', 'n/a', 'na', blank, or a negative number.
 - *Load model predictions*
 - Click to load model predictions from the data columns specified in the loaded shapefile files into the app.
- *Data file type: “GIS file geodatabase (.gdb) file”*
 - *Path to .gdb folder*
 - Enter the full path up to and including the personal file geodatabase, which will have a ‘.gdb’ extension. Do not put anything more text, such as

a '/', after the folder name. On a Windows machine, you can copy and paste the file path from the top bar of the Windows Explorer. You can also copy and paste the file path from the top bar of ArcCatalog after navigating to the desired file.

- *Filename within .gdb folder*
 - Enter the filename of the file you wish to load; this filename can be found in ArcCatalog. In ArcCatalog, the file will be listed as a 'File Geodatabase Feature Class'.
- *Load file from specified path*
 - Click to load the specified file from the specified path. An error message will appear if the app does not find a file with the specified name at the specified path.
- *Column with prediction data*
 - Select the name of the column with the prediction data.
- *Prediction value type*
 - See [Prediction value type](#)
 - Select "Absolute density" if the model predictions have had all necessary correction factors applied for the applicable study area, and thus can provide a true prediction of density. Select "Relative density" if the model prediction have **not** had all necessary correction factors applied for the applicable study area, and thus only accurately predict the density relative to the other model predictions.
- *Column with error data*
 - Select the name of the column with the prediction data. If you do not have error data for these model predictions, then select "N/A". If you want to use error values as pixel-level spatial weights in a weighted ensemble, then use the 'Column with weight data' input. Currently there is no place within the app that this error data can be used, but a potential future use is creating maps of the error data.
- *Column with weight data*
 - Select the name of the column with the prediction data. If you do not have weight data for these model predictions, then select "N/A". Weight data can be used as pixel-level spatial weights in a weighted ensemble in the "Create Ensemble Predictions" tab.
- *NA prediction values message*
 - A message detailing how many of the provided prediction values will be classified as NA. A prediction value will be classified as NA if the provided data is one of the following: 'NA', 'NaN', 'N/A', 'n/a', 'na', blank, or a negative number.
- *Load model predictions*
 - Click to load model predictions from the data columns specified in the loaded .gdb object into the app

2.3. Loaded Model Predictions

Loaded Model Predictions

	Model filename	Prediction	Error	Weight	Prediction type
Original 1	Becker_data.csv	Bm_ROMS			Absolute
Original 2	PredCCE_ModelCCE_shp	pred			Relative
Original 3	WW_data.csv	AveAllYears			Relative

☐ Display additional information

Click on row(s) to select model predictions to perform an action
If multiple rows are selected and the 'Preview' button is clicked, a multiplot of all selected predictions will be plotted

Select action to perform with selected model predictions

☒ Plot preview
☐ Download preview
☐ Remove from app

Action option(s)

Preview model predictions using

☒ Percentages
☐ Values

Preview selected model predictions

- Table of loaded model predictions
 - Select or deselect a set of model predictions by clicking on the row of that set of model predictions in the table. Multiple sets of model predictions can be selected at one time. A row is highlighted grey-blue if it is selected.
 - The first table (displayed above) is shown when *Display additional information* is unchecked and reports information specified when the model predictions were being loaded in. This information consists of: the name of the file that was loaded, the names of columns from which prediction, error, and weight data were loaded, and the specified prediction type. The ‘Error’ and ‘Weight’ columns are left blank if “N/A” was specified for those columns.
 - The second table is shown when *Display additional information* is checked and reports information about the loaded model predictions. This information consists of: the resolution of the predictions (see below for more details), the number of cells in the grid of model predictions, the count of the non-NA predictions, the predicted abundance (if the predictions are absolute densities), and the range of the model predictions.
 - ‘Resolution’ column: When model predictions are loaded into the app, the app attempts to determine the resolution at which the predictions were made, meaning the distance between the centroids of adjacent grid cells. The app only attempts to calculate the resolution in the native projection of the loaded model predictions, so if model predictions were generated on an equal area grid but were loaded into the app via a shapefile in WGS 84 geographic coordinates, then the app will not be able to calculate the resolution. This functionality is still in its infancy, so please check the reported resolution if you know the resolution of the loaded predictions.
- Action to perform with selected model predictions
 - Select the what you wish to do with the set(s) of model predictions selected in the table above. The options in the *Action option(s)* box will change depending on what is selected here.
- Action option(s) for “Plot preview” (see image above)

- *Preview model predictions using*
 - Select “Percentages” to have the scale of the previewed prediction values be the prediction value relative to the other prediction values in the set of model predictions. For instance, the color scheme will delineate, among other ranges, the top 2% of prediction values, the prediction values in the top 2% to 5%, and the prediction values in the top 5% to 10% of all of the prediction values.
 - Select “Values” to have the scale of previewed prediction values be based on the numerical values of the model predictions
- *Preview selected model predictions*
 - Click to generate the preview in the “Preview” box. This can be a preview of a single set of model predictions or a multiplot of multiple sets of model predictions.
- *Action option(s) for “Download preview”*

Action option(s)

Units	Resolution	File format
<input checked="" type="radio"/> Percentages	<input type="radio"/> High (300 ppi)	<input type="radio"/> jpeg
<input type="radio"/> Values	<input checked="" type="radio"/> Low (72 ppi)	<input type="radio"/> pdf
		<input checked="" type="radio"/> png

Download

- *Units*
 - See *Preview model predictions using* under ‘Action option(s) for “Plot preview”’
 - Select “Percentages” to have the scale of the previewed prediction values be the prediction value relative to the other prediction values in the set of model predictions. For instance, the color scheme will delineate, among other ranges, the top 2% of prediction values, the prediction values in the top 2% to 5%, and the prediction values in the top 5% to 10% of all of the prediction values.
 - Select “Values” to have the scale of previewed prediction values be based on the numerical values of the model predictions
- *Resolution*
 - The resolution in which the preview will be downloaded. It is recommended to use the “High” resolution for multiplot previews.
- *File format*
 - The file format in which the preview will be downloaded.
- *Filename*
 - The filename of the download of the preview of selected set(s) of model predictions. This filename is reset to the default every time one of the options in the *Action option(s)* box is changed.
- *Download*
 - Click to download preview of selected set(s) of model predictions with the preview parameters and filename specified in the *Action option(s)* box.

- *Action option(s)* for “Remove from app”

Action option(s)

Remove selected model predictions

- *Remove selected model predictions*
 - Click to remove selected model predictions from the app.

3. Overlay Model Predictions Tab

3.1. Load Study Area Polygon

- Study area polygon description:
 - A study area polygon should be used if you have model predictions that cover a broad area, but you only want to create ensemble predictions of a specific region (study area) within the broader area. For instance, if you have model predictions that span the US west coast but only want ensemble predictions in the Southern California Bight, then you could upload a study area polygon that spans the Bight. If the study area boundary cuts through a prediction cell, then only the portion of the prediction cell that is within the boundary is kept during the overlay.
- *Use a study area polygon in the overlay process*
 - Check this box to have access to the tools to upload a study area polygon, and uncheck this box to remove a loaded study area polygon. Note that there will be a message next to one of the ‘Upload...’ options if a study area polygon is loaded.
- *File type: Excel csv file*
 - See [Upload .csv file](#)
 - . This file *format description*
- *File type: GIS shapefile*
 - See [Upload GIS shapefile files](#)
 - Format?
- *File type: GIS file geodatabase (.gdb) file*
 - See [Filename within .gdb folder](#)
 - See [Filename within .gdb folder](#)
 - See [Load file from specified path](#)
 - Format?

3.2. Load Land Polygon

- Land polygon description:
 - A land polygon should be used if you have model predictions for a strictly marine species
- *Use a land polygon in the overlay process*
 - Check this box to have access to the tools to upload a study area polygon, and uncheck this box to remove a loaded study area polygon. Note that there will be a

message next to one of the ‘Upload...’ options if a study area polygon is loaded.

- *Land polygon source: “Use provided”*
 - Use one of the land polygons provided with the app. The provided land polygons were downloaded from the Global Self-consistent, Hierarchical, High-resolution Geography (GSHHG) Database. See the GSHHG website for more information about these land polygons.
 - *Resolution of land polygon*
 - The resolution options are “full”, “high”, “intermediate”, “low”, and “crude”. Each resolution option is an approximately 80% reduction in size and quality from the previous resolution option.
 - *Load provided land polygon*
 - Load the GSHHG land polygon with the specified resolution
- *Land polygon source: “Load personal”*
 - *File type: Excel csv file*
 - See [Upload .csv file](#)
 - . This file *format description*
 - *File type: GIS shapefile*
 - See *Upload GIS shapefile files* (crossreference)
 - Format?
 - *File type: GIS file geodatabase (.gdb) file*
 - See *Filename within .gdb folder*
 - See *Filename within .gdb folder*
 - See *Load file from specified path*
 - Format?

3.3. Loaded Model Predictions

- Table of loaded model predictions (Overlay tab)
 - Select a row in order to use the grid of the corresponding set of model predictions as the base grid in the overlay process (see ** for a description of the overlay process). See [Table of loaded model predictions](#)
 - for descriptions of the data contained in each column and the *Display additional information* checkbox.

3.4. Overlay Model Predictions

- *Overlay projection options*
 - *Perform overlay in lat/long WGS 84 geographic coordinates*
 -
 - *Use the selected model predictions' projection during the overlay process*
 - This option appears if *Perform overlay in lat/long WGS 84 geographic coordinates* is not checked. The overlay process will be performed in the projection of whichever set of model prediction is selected.
- *Overlay percent overlap options*
- *Overlay all predictions onto specified base grid*
 - Click this button to perform the overlay process on all of the sets of model predictions. See *appendix something* for a detailed description of the overlay

process.

3.5. Preview of Base Grid

- *Preview*
 - Click to generate a preview of the base grid. This preview will include loaded study area and land polygons, although the preview will not be generated if *Use a study area polygon in the overlay process* is checked and no study area polygon is loaded or if *Use a land polygon in the overlay process* is checked and no land polygon is loaded. Note that if the model predictions selected to be the base grid were made at a high resolution, then the base grid in the preview may appear to be completely black because of the small grid cell size.

3.6. Preview of Overlaid Model Predictions

- *Overlaid model predictions to preview*
 - Select the set(s) of overlaid model predictions to be previewed. The sets of overlaid model predictions will be listed as “Overlaid 1”, “Overlaid 2”, etc. These numbers correspond to the “Original 1”, “Original 2”, etc., entries in the far left column of the table of overlaid model predictions, meaning that the “Overlaid 1” set of model predictions is the “Original 1” model predictions overlaid onto the base grid.
- *Preview*
 - Click to generate a preview of the selected set(s) of overlaid model predictions. This can be a preview of a single set of overlaid model predictions or a multiplot of multiple sets of overlaid model predictions. The preview(s) may be generated at a coarser resolution than the actual overlaid model predictions for the sake of quickly generating the preview(s).

4. Create Ensemble Predictions Tab

4.1. Overlaid Model Predictions

4.2. Create Ensemble Predictions

4.3. Created Ensemble Predictions

5. Evaluation Metrics Tab

5.1. Select Predictions to Evaluate

5.2. Load Validation Data

5.3. Calculate Metrics

5.4. Metrics

5.5. Metric Descriptions and References

6. High Quality Maps Tab

6.1. Select Predictions to Plot

6.2. Plot Parameters

6.2.1. Map range

6.2.2. Title and axis labels

6.2.3. Tick marks and tick labels

6.2.4. Color scheme of predictions

7. Export Predictions Tab

7.1. Select Predictions to Export

7.2. Export Predictions

8. Manual Tab

- Contains this manual

9. Submit Feedback Tab

- Fill out this Google form to:
 - Report errors in the tool. Please provide as much detail as possible
 - Describe functionality you would like to see in future releases
 - Comment on any facet of the tool