



# IUCN EOO Calculator

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Version: 1.5

## Toolbox Instructions for IUCN EOO Calculator v1.5

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## I. Summary

The EOO Calculator tool calculates the Extent of occurrence (EOO) for one or more taxa in a shapefile or feature class. It requires an ArcMap Advanced license on ArcMap version 10.3 or above.

The EOO tool creates a minimum convex polygon around either points or polygons of a taxon and produces a feature class which contains the EOO polygon and a field containing the EOO calculation in square kilometres.

There is an option within the tool to filter the values of the IUCN attributes **presence**, **origin** and **seasonal** so that the only values used in the EOO calculation are:

- presence = 1 (“Extant”);
- origin = 1, 2 or 6 (“Native”, “Reintroduced”, “Assisted colonisation”);
- seasonal = 1, 2 or 3 (“Resident”, “Breeding season”, “Non-breeding season”).

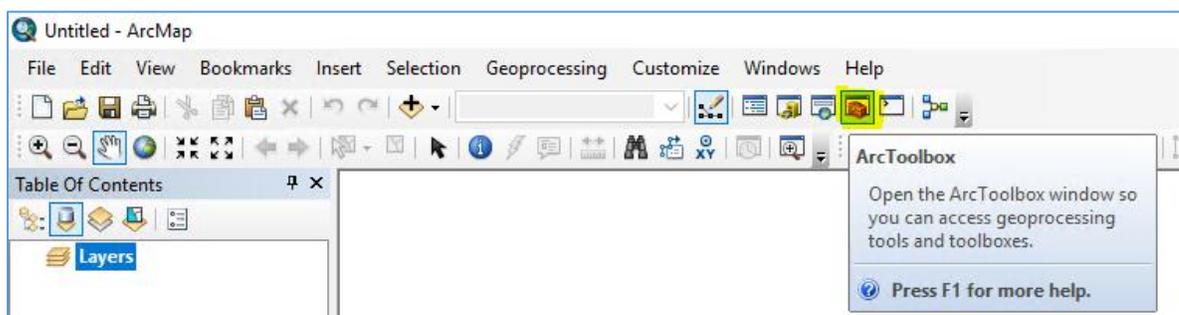
This complies with the IUCN Red List EOO calculation guidelines.

Notes:

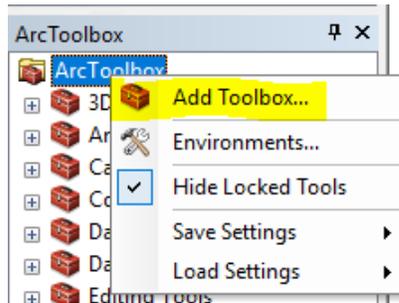
- If the input species file contains many species (over 100) or the species have large-ranging distributions the tool can take a long time to run.
- The tool cannot handle data for which the correct EOO crosses the antimeridian. This is a limitation of the ArcGIS tool used to create the minimum convex polygon.
- To facilitate analyses using older data, any species data with presence = 2 will be included in the EOO calculation as if presence = 1, however it is recommended that presence = 2 should be changed to a currently valid value (1 or 3-6). A warning message will be displayed for any species containing data with presence = 2.
- The screenshots in this document were taken in ArcMap 10.8.1.

## II. Adding the EOO Calculator Toolbox

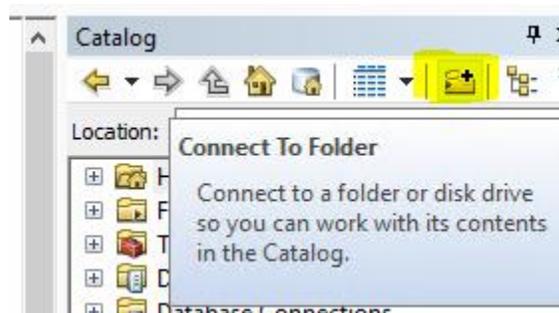
1. Download the IUCN Red List EOO Calculator ArcMap ToolBox from the [GIS Tools, Software and Recommended Base data](#) page on the IUCN Red List website page. Unzip the toolbox zip file into your chosen location.
2. In ArcMap add the EOO Calculator ToolBox in the Toolbox menu:
  - Open the ArcToolbox window;



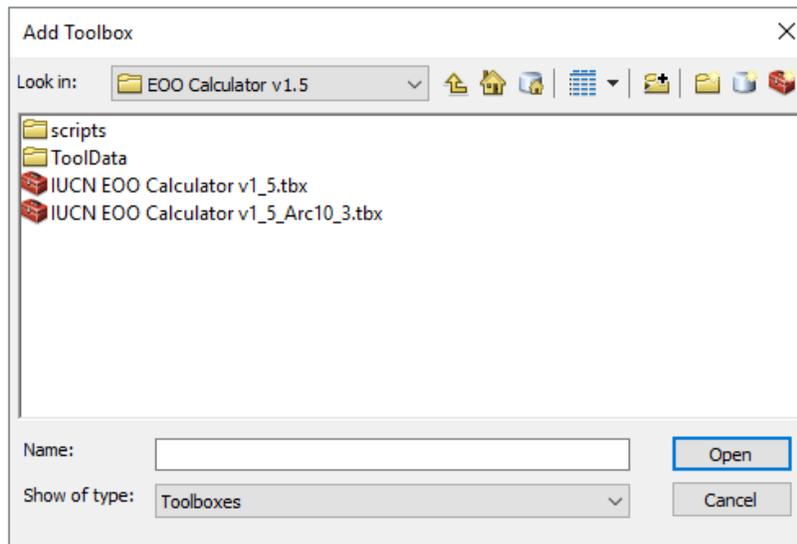
- Right-click on ArcToolbox and select “Add Toolbox”;



3. If the folder containing the toolbox is not already connected in ArcMap, connect to the folder using “Connect To Folder” at the top of the Catalog window:



4. Navigate to the IUCN EOO Calculator toolbox and select “Open”:



If you are on ArcMap 10.8.1 or above, select ‘IUCN EOO Calculator v1\_5.tbx’, or select ‘IUCN EOO Calculator v1\_5\_Arc10\_3.tbx’ to work with an earlier version of ArcMap

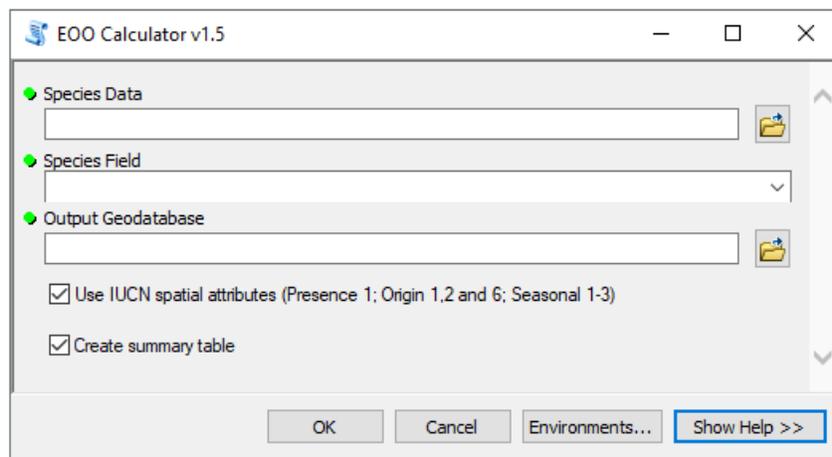
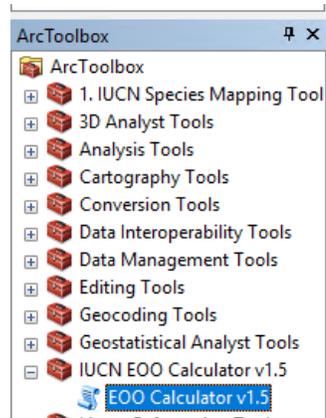
### III. Contents of the EOO Calculator folder

The toolbox folder contains:

- i. [scripts \(folder\)](#)  
The python scripts used by the EOO Calculator tool.
- ii. [ToolData \(folder\)](#)
  - [eoo\\_geodatabase.gdb](#) - empty geodatabase
  - [Cylindrical Equal Area \(world\).prj](#) – projection file for area calculation
  - [Cylindrical Equal Area \(world\) \(180\).prj](#) – projection file centred on 180° (not currently used)
- iii. [IUCN EOO Calculator v1\\_5.tbx \(toolbox\)](#)  
Toolbox containing the EOO Calculator tool. Updated from v1.4 in ArcMap 10.8.1.
- iv. [IUCN EOO Calculator v1\\_5\\_Arc10\\_3.tbx \(toolbox\)](#)  
Toolbox containing the EOO Calculator tool. Saved as an ArcGIS version 10.3 toolbox to allow use in ArcMap version 10.3 onwards.

## IV. EOO Calculator Tool Input Parameters

Double-click on the IUCN EOO Calculator tool to open it:



### i. Species Data

A shapefile or feature class containing polygon or point data for a single taxon or for multiple taxa.

### ii. Species Field

The field within the Species Data file which contains the taxon name(s). This is selected from a drop down list of the fields in the Species Data file.

### iii. Output Geodatabase

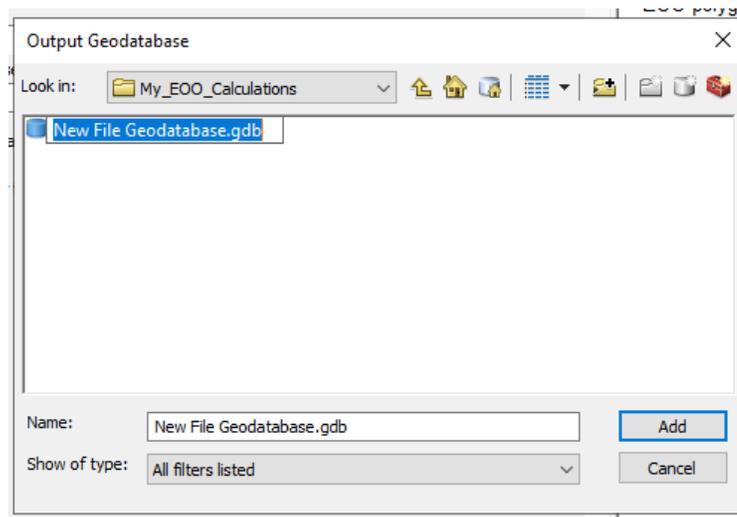
The [EOO polygon\(s\)](#) for each input taxon and the [summary table](#), if selected, will be saved in the specified geodatabase.

Notes:

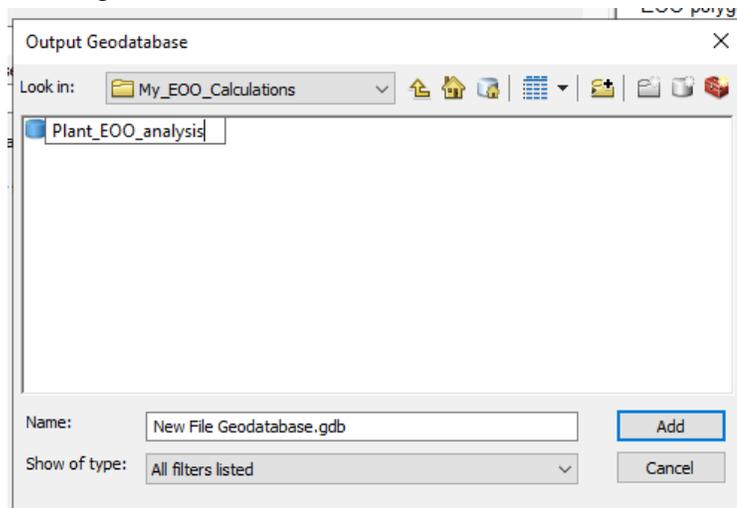
- Any feature classes in the geodatabase with the same names as the EOO polygons created by the tool (i.e. EOO polygons previously created for the same taxa) or the summary table ('SpeciesEOOSummary') will be overwritten.
- Any EOO polygons from previous analyses which are already in the output geodatabase and not replaced (i.e. for taxa not in the input Species Data file) will be included in the summary table.

A new **geodatabase** can be created to avoid overwriting any existing data

- EITHER From within the tool dialogue:  
Navigate to the folder in which you want to create the new geodatabase and click on the 'New File Geodatabase' option:



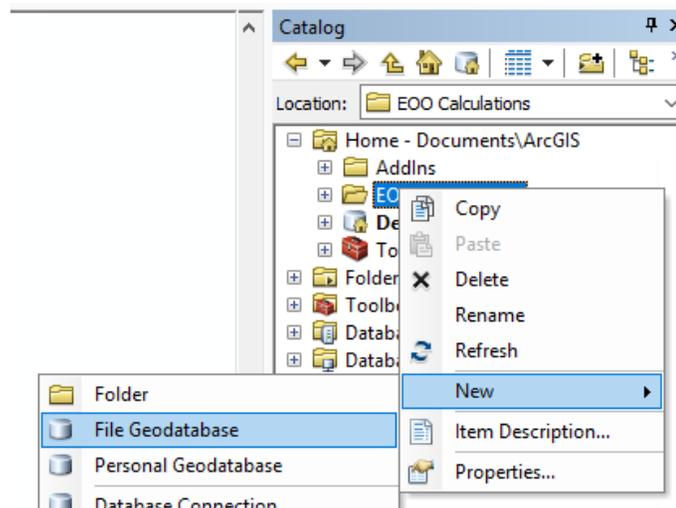
Type in a name for the new geodatabase,



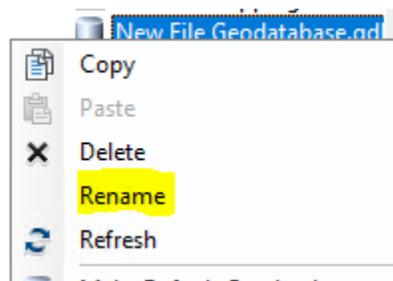
press <Enter> and then click on the name to select it.

When the new geodatabase name is displayed in the 'Name:' box, select 'Add'.

- OR Within the 'Catalog' window:  
Right-click on the folder in which you want to create the new geodatabase and select "New" -> "File Geodatabase":



Right-click on the "New File Geodatabase.gdb" and select Rename:



Type in a name (you do not need to put the ".gdb" at the end, this will be added automatically) and press <Enter>.

#### iv. Use IUCN spatial attributes

Default: 'true'

Select this option to filter the input data, restricting it to polygons or points with attribute values:

- presence = 1 ("Extant");
- origin = 1, 2 or 6 ("Native", "Reintroduced", "Assisted colonisation");
- seasonal = 1, 2 or 3 ("Resident", "Breeding season", "Non-breeding season").

The EOO tool will calculate the breeding area (seasonal = 1 or 2) and non-breeding area (seasonal = 1 or 3) separately for any taxa which have those values.

#### v. Create summary table

Default: 'true'

Create a table listing each taxon with the calculated EOO area (or areas, if the IUCN spatial attributes have been used and both Breeding and Non-breeding data exists for the taxon).

The table is created in the specified Output Geodatabase and is called 'SpeciesEOOSummary'.

Notes:

- The summary table will include all polygon feature classes within the specified output geodatabase which have “\_EOO\_” in the name. Therefore if you have EOO polygons in the geodatabase from previous analyses, they will be included in the new summary table.
- If you already have a table 'SpeciesEOOSummary' in the Output Geodatabase, it will be overwritten unless you rename it.

## V. EOO Calculator Tool Outputs

When the tool has finished, the outputs are within the specified [output geodatabase](#).

### i. EOO polygon feature classes

For each taxon:

If '[Use IUCN spatial attributes](#)' has **not** been selected:

- <taxon\_name>\_EOO\_proj

If '[Use IUCN spatial attributes](#)' **has** been selected:

- <taxon\_name>\_EOO\_proj
  - if the taxon has any data with presence = 1, origin = 1, 2 or 6, **seasonal = 1 or 2**
- <taxon\_name>\_EOO\_NB\_proj
  - if the taxon has a non-breeding range (**seasonal = 3**, presence = 1, origin = 1, 2 or 6)
  - the EOO\_NB polygon will include (seasonal = 1 or 3, presence = 1, origin = 1, 2 or 6)

### ii. Summary Table

If "[Create summary table](#)" was selected:

- A summary table called "SpeciesEOOSummary" will be created in the [Output Geodatabase](#) along with the EOO polygon feature classes.
- If "[Use IUCN spatial attributes](#)" was not selected, or the taxon has no non-breeding range (seasonal = 3), "SpeciesEOOSummary" will contain the fields:
  - OBJECTID – system created unique row identifier;
  - <[Species Field](#)> - the specified field containing the taxon names (in this example "sci\_name");
  - MIN\_EOO\_AREA\_SQKM – the calculated area in square kilometres.

SpeciesEOOSummary		
OBJECTID *	sci_name	MIN_EOO_AREA_SQKM
1	4	23517.540000

- If "[Use IUCN spatial attributes](#)" was selected, and there are taxa with a non-breeding range (seasonal = 3), "SpeciesEOOSummary" will contain the fields:
  - OBJECTID – system created unique row identifier;
  - <[Species Field](#)> - the specified field containing the taxon names (in this example "sci\_name");
  - MIN\_EOO\_AREA\_SQKM – the calculated breeding EOO area in square kilometres;
  - MIN\_EOO\_NB\_SQKM – the calculated non\_breeding EOO area in square kilometres (this will be null for any taxon without a non-breeding area).

SpeciesEOOSummary			
OBJECTID *	sci_name	MIN_EOO_AREA_SQKM	MIN_EOO_NB_SQKM
1	4	23517.540000	23517.540000

This enables comparison of the breeding EOO area with the non-breeding EOO area.

Note: The summary table will include all polygon feature classes within the specified output geodatabase which have "\_EOO\_" in the name.

## VI. Troubleshooting

### Undefined coordinate system

If the coordinate system is undefined, the species data cannot be projected to Cylindrical Equal Area for the area calculation. The tool will fail with an error message:

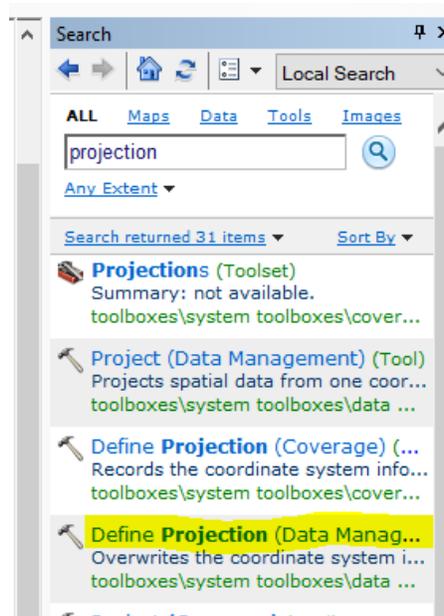
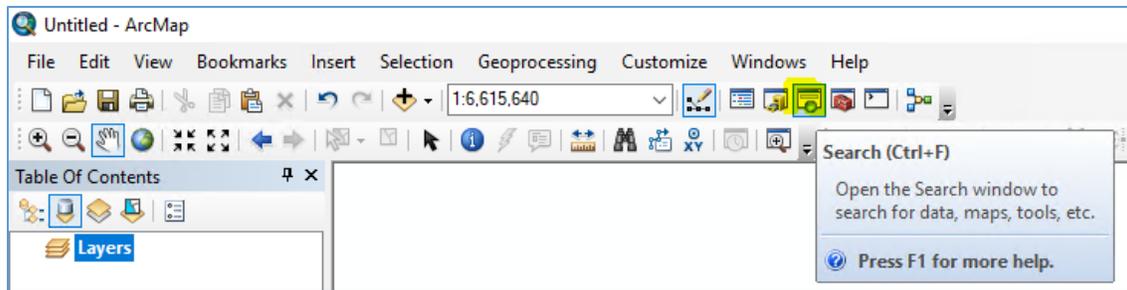
```
Running script EOOCalculatorv1.5...  
No coordinate system for input dataset.  
Please check!  
Data should be in GCS_WGS_1984  
Completed script EOOCalculatorv1.5...  
Failed to execute (EOOCalculatorv1.5).
```

This may happen if the .prj file has been missed when copying the files for a shapefile or has been accidentally deleted.

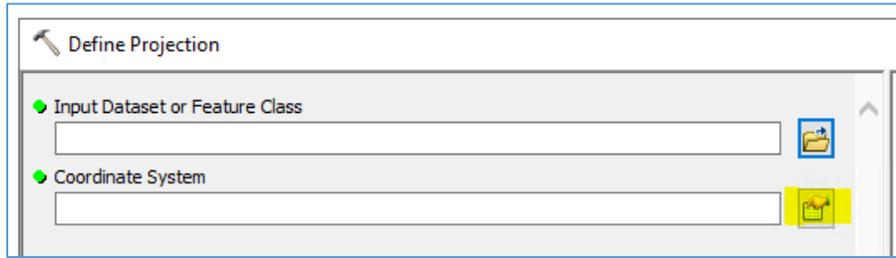
Check the coordinate reference system with the originator of the data. In most cases this will be “GCS\_WGS\_1984”.

To set the projection of the dataset:

Open the Search window and type in ‘projection’ to locate the “**Define Projection (Data Management)**” tool:



Select or enter the name of your species dataset and click on the button by the 'Coordinate System' box.



Select WGS 1984. The quickest way to do this is to type 4326 in the search box and press <Enter>. Check that the 'Current coordinate system' now says WKID: 4326 and select 'OK' in both dialogue boxes.

