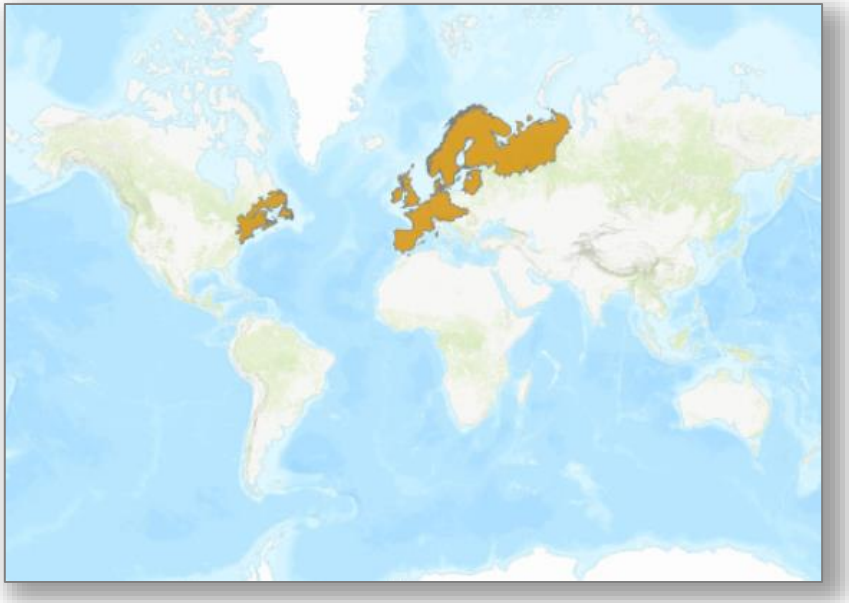
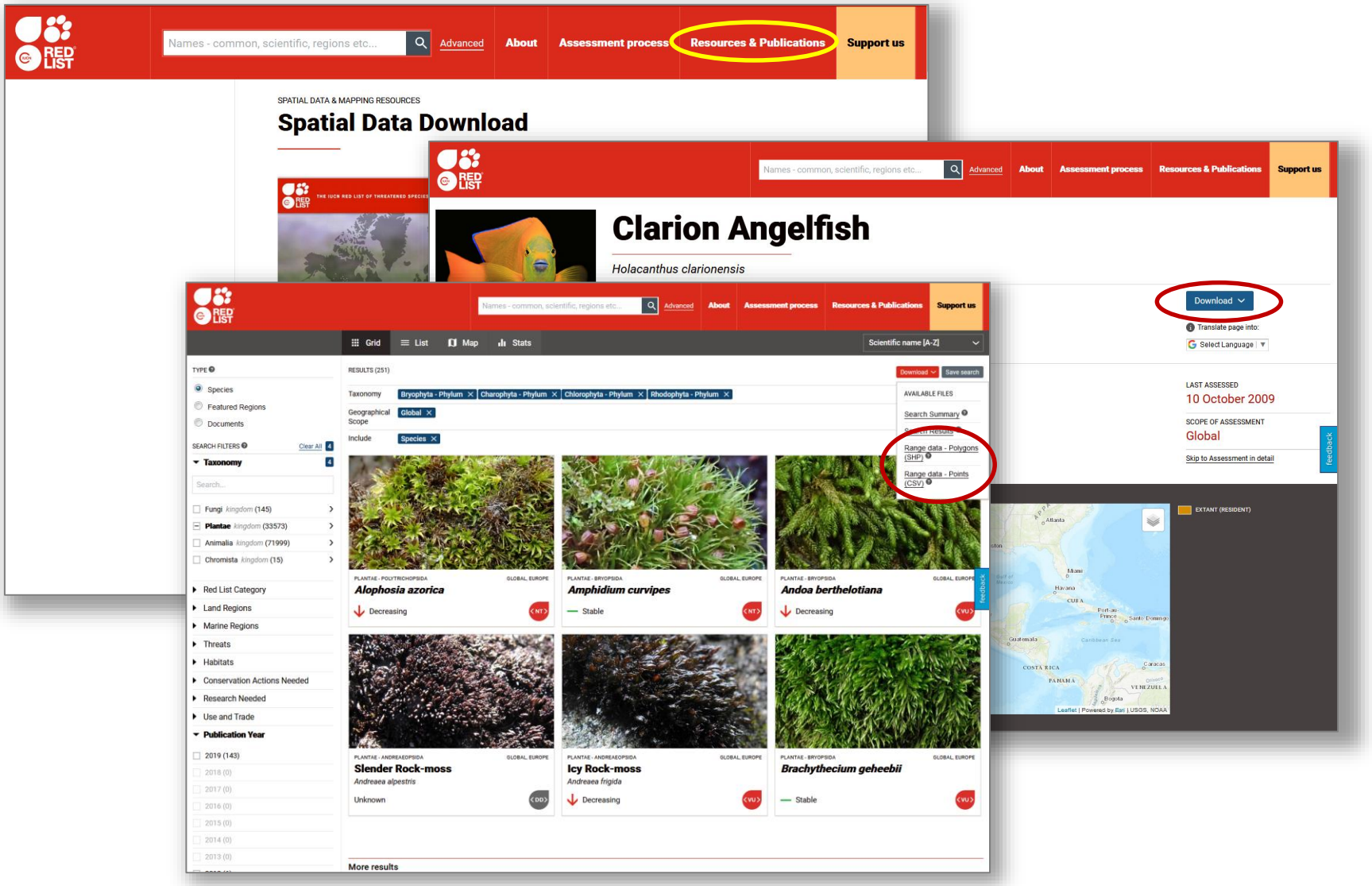
Mapping standards for IUCN Red List assessments



107,700+ species with spatial data on the IUCN Red List



Required distribution information for Red List assessments

- Text describing the taxon's geographic range.
- Countries of occurrence, coded by presence, origin and seasonality.
- Distribution map.

RANGE DESCRIPTION

This is a Holartic species, found in North America, Europe and through into Siberia. It has been declining throughout the European part of its range.

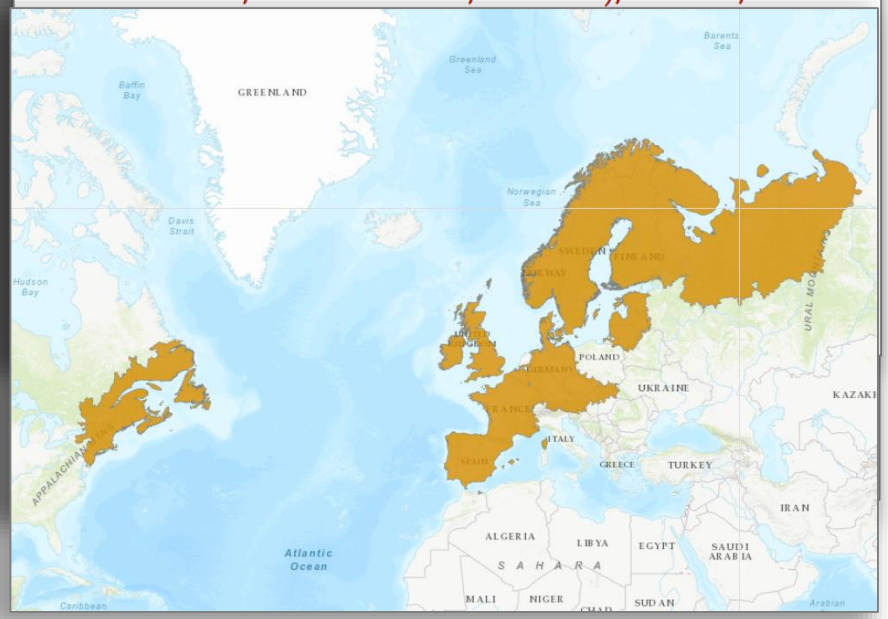
EUROPE

The following are the most recent revised estimates of current population status of *M. margaritifera* in Europe. The information is mainly from Geist (2005), and compiled by Geist partly based on data and references in Alvarez-Claudio *et al*. (2000), Araujo and

NATIVE

Extant (resident)

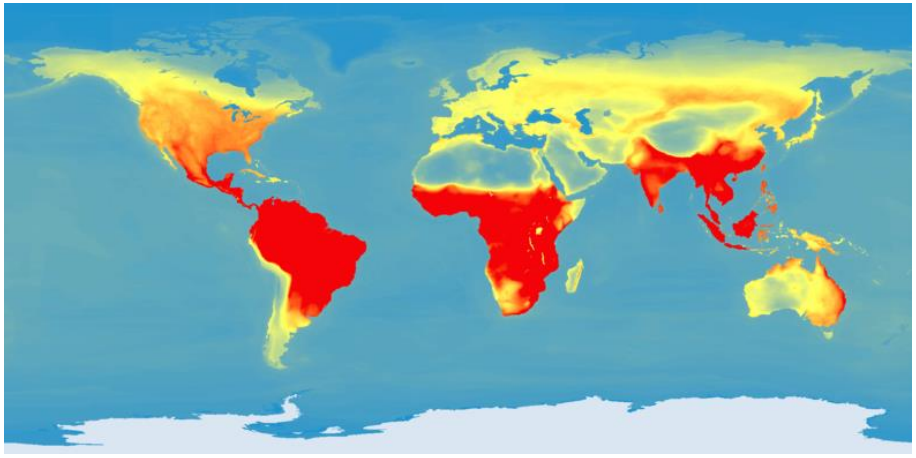
Austria; Belgium; Canada (Québec, Ontario, Nova Scotia, Newfoundland I, New Brunswick, Labrador); Czechia;



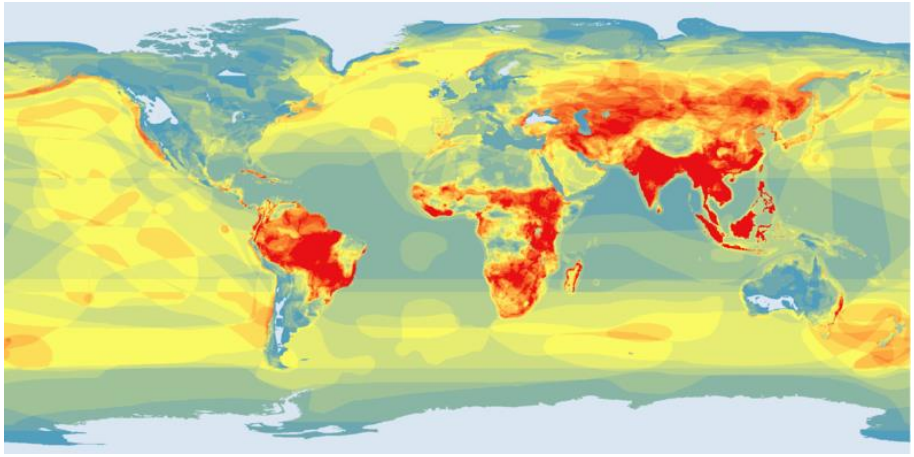
Purpose of distribution maps on the IUCN Red List

- Visual representation: individual species and groups of taxa.

Assessed amphibian, bird and mammal species richness

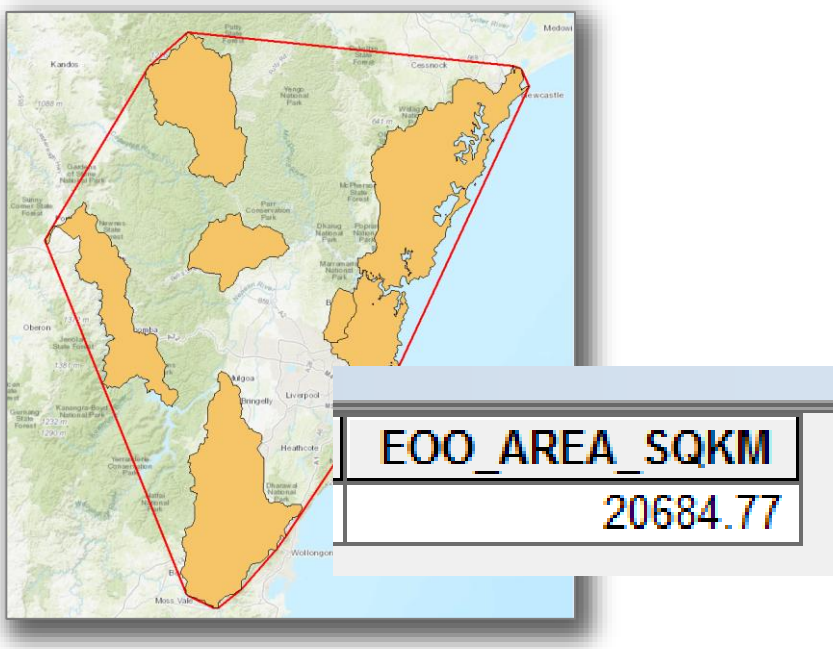


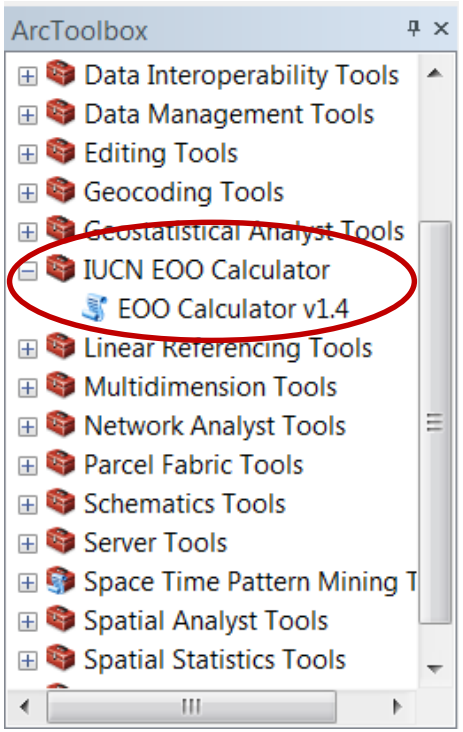
Threatened amphibian, bird and mammal species richness



Purpose of distribution maps on the Red List

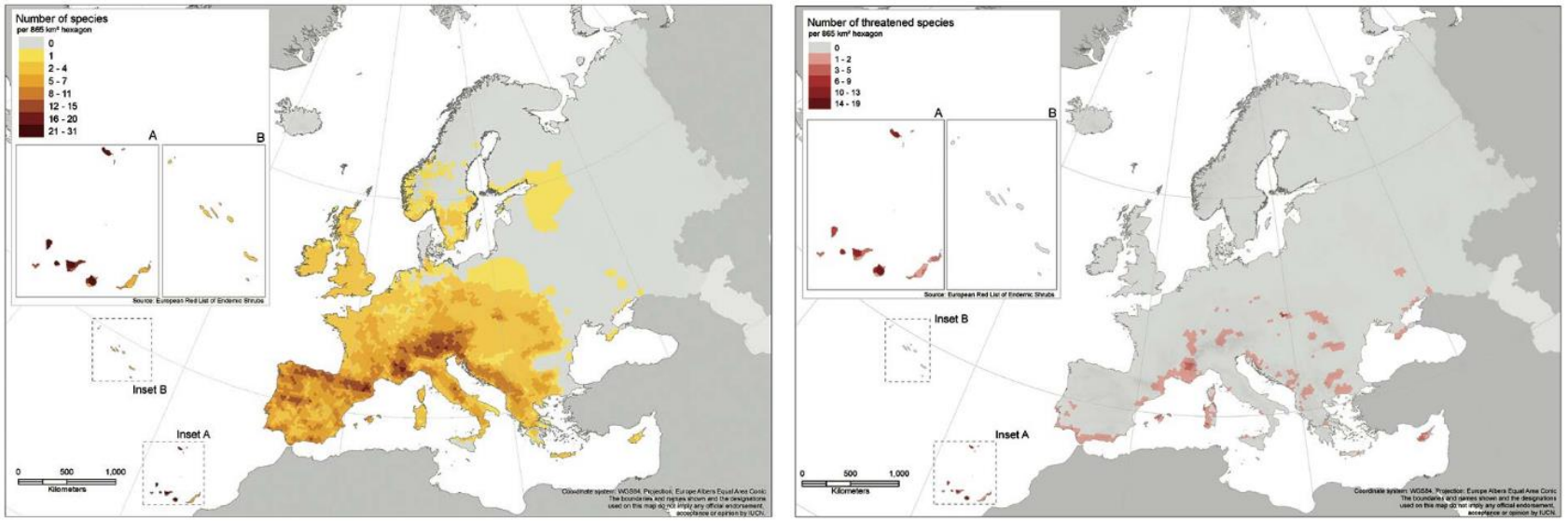
- Visual representation: individual species and groups of taxa.
- To inform Red List assessments





Purpose of distribution maps on the Red List

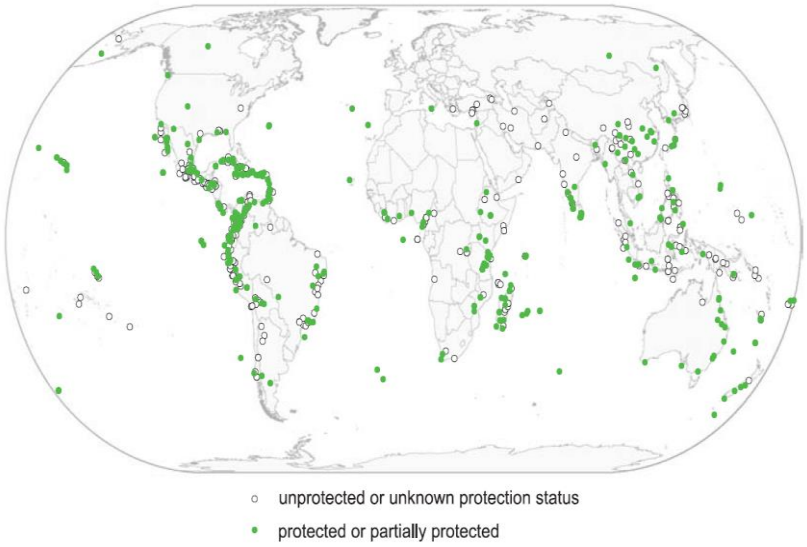
- Visual representation: individual species and groups of taxa.
- To inform Red List assessments.
- Data analyses.



Selected European endemic shrubs: maps showing species richness and distribution threatened species

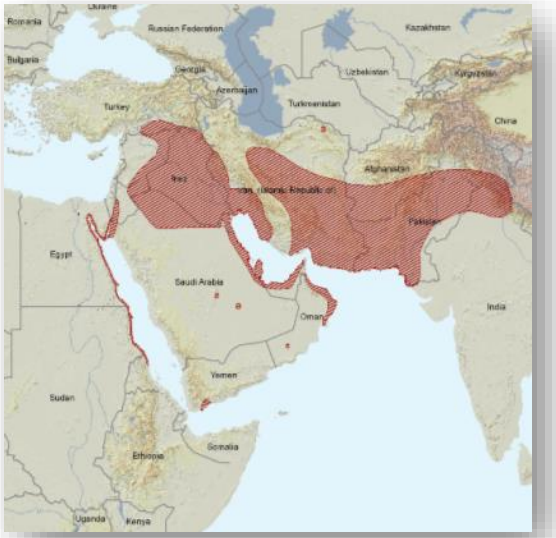
Purpose of distribution maps on the Red List

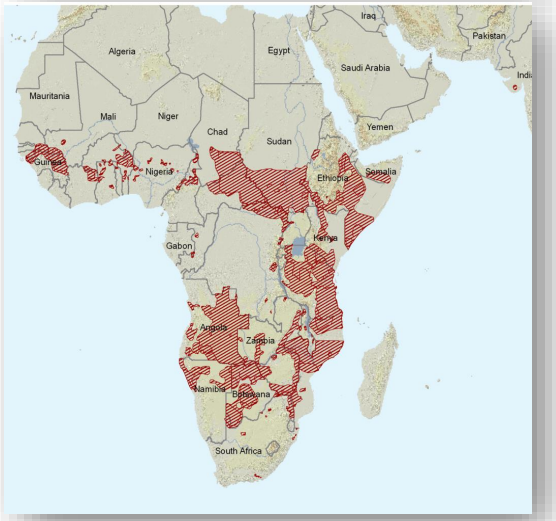
- Visual representation: individual species and groups of taxa.
- To inform Red List assessments.
- Data analyses.
- To identify conservation priorities



Protected and unprotected AZE sites

What are we mapping?

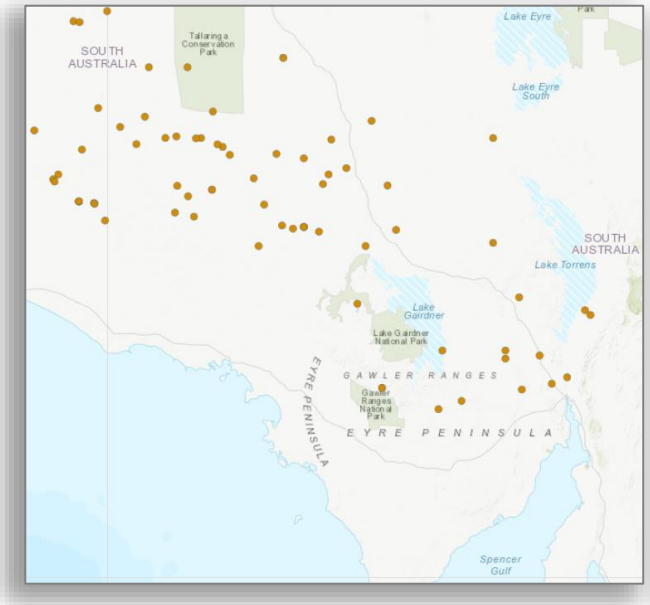




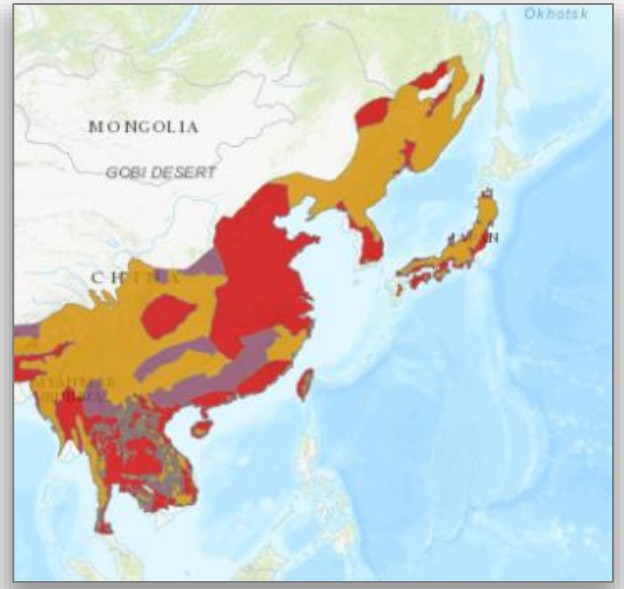
- Known or inferred limits of the species' distribution.
- Distribution depicted as points, polygons or a combination of points and polygons.
- **Polygons:**
  - The species probably only occurs within the polygons.
  - Does *not* mean species is distributed equally within the polygon or occurs everywhere in the polygon

Mapping Standards

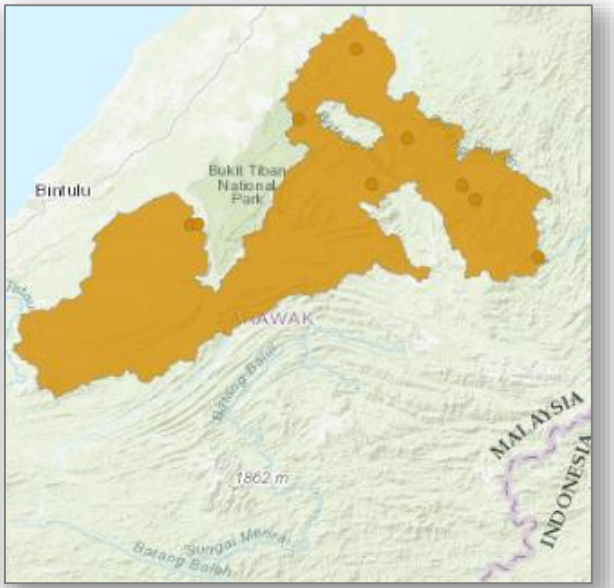
The preferred approach for preparing the map depends on the taxonomic group and the system in which the species occurs.



Plants



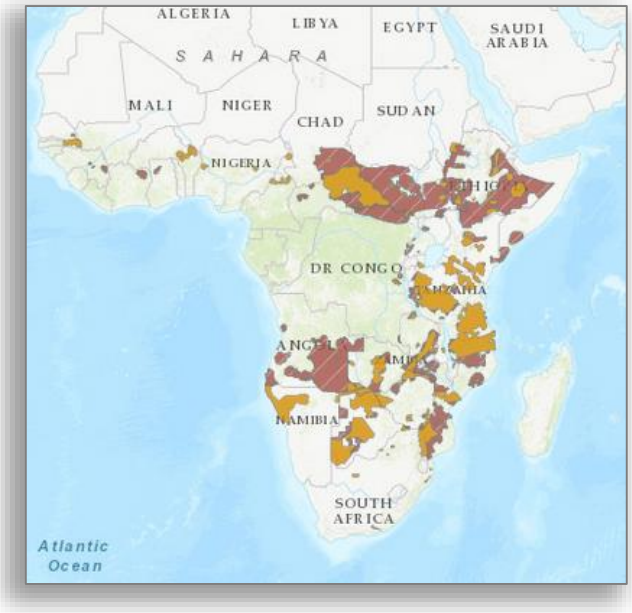
Vertebrates



Invertebrates

Mapping Standards

Preferred approaches for preparing maps for depends on the taxonomic group and the system in which the species occurs.



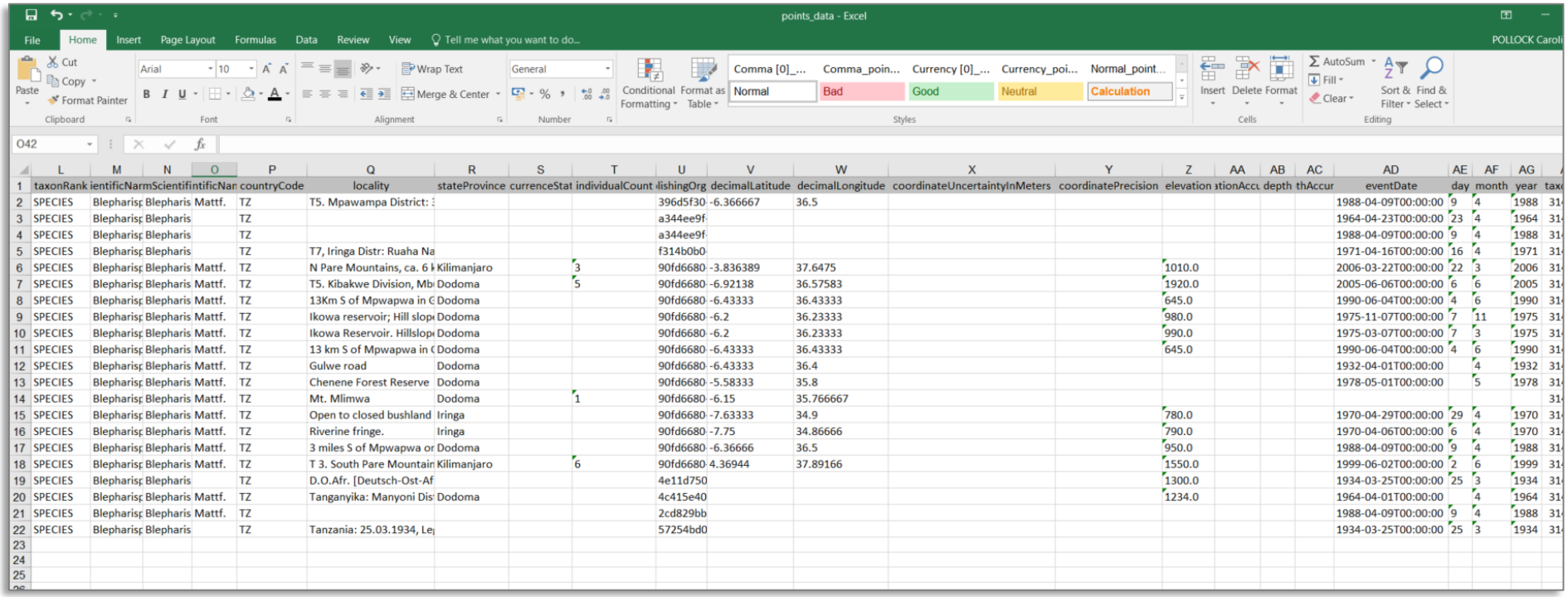
Terrestrial

Marine

Freshwater

Point maps

1. Collate all available point data from collection record databases, published and grey literature, GBIF, etc.

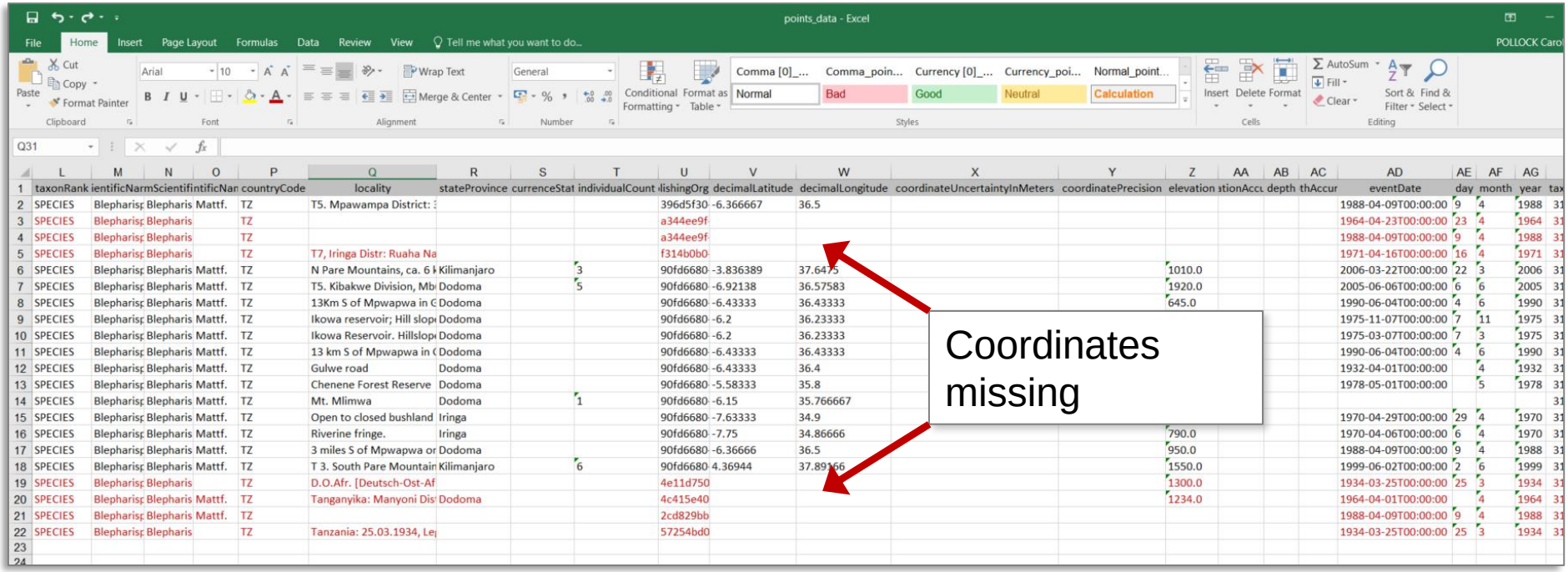


points_data - Excel

	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1	taxonRank	ientificNarm	Scientifintific	Nan	countryCode	locality	stateProvince	currenceStat	individualCount	lishingOrg	decimalLatitude	decimalLongitude	coordinateUncertaintyInMeters	coordinatePrecision	elevation	ationAccu	depth	thAccur	eventDate	day	month	year
2	SPECIES	Blepharis	Blepharis	Mattf.	TZ	T5. Mpawampa District:				396d5f30	-6.366667	36.5							1988-04-09T00:00:00	9	4	1988
3	SPECIES	Blepharis	Blepharis		TZ					a344ee9f									1964-04-23T00:00:00	23	4	1964
4	SPECIES	Blepharis	Blepharis		TZ					a344ee9f									1988-04-09T00:00:00	9	4	1988
5	SPECIES	Blepharis	Blepharis		TZ	T7, Iringa Distr: Ruaha Na				f314b0b0									1971-04-16T00:00:00	16	4	1971
6	SPECIES	Blepharis	Blepharis	Mattf.	TZ	N Pare Mountains, ca. 6 k	Kilimanjaro		3	90fd6680	-3.836389	37.6475			1010.0				2006-03-22T00:00:00	22	3	2006
7	SPECIES	Blepharis	Blepharis	Mattf.	TZ	T5. Kibakwe Division, Mb	Dodoma		5	90fd6680	-6.92138	36.57583			1920.0				2005-06-06T00:00:00	6	6	2005
8	SPECIES	Blepharis	Blepharis	Mattf.	TZ	13Km S of Mpwapwa in C	Dodoma			90fd6680	-6.43333	36.43333			645.0				1990-06-04T00:00:00	4	6	1990
9	SPECIES	Blepharis	Blepharis	Mattf.	TZ	Ikowa reservoir; Hill slop	Dodoma			90fd6680	-6.2	36.23333			980.0				1975-11-07T00:00:00	7	11	1975
10	SPECIES	Blepharis	Blepharis	Mattf.	TZ	Ikowa Reservoir. Hillslop	Dodoma			90fd6680	-6.2	36.23333			990.0				1975-03-07T00:00:00	7	3	1975
11	SPECIES	Blepharis	Blepharis	Mattf.	TZ	13 km S of Mpwapwa in C	Dodoma			90fd6680	-6.43333	36.43333			645.0				1990-06-04T00:00:00	4	6	1990
12	SPECIES	Blepharis	Blepharis	Mattf.	TZ	Gulwe road	Dodoma			90fd6680	-6.43333	36.4							1932-04-01T00:00:00		4	1932
13	SPECIES	Blepharis	Blepharis	Mattf.	TZ	Chenene Forest Reserve	Dodoma			90fd6680	-5.58333	35.8							1978-05-01T00:00:00		5	1978
14	SPECIES	Blepharis	Blepharis	Mattf.	TZ	Mt. Mlimwa	Dodoma		1	90fd6680	-6.15	35.766667										
15	SPECIES	Blepharis	Blepharis	Mattf.	TZ	Open to closed bushland	Iringa			90fd6680	-7.63333	34.9			780.0				1970-04-29T00:00:00	29	4	1970
16	SPECIES	Blepharis	Blepharis	Mattf.	TZ	Riverine fringe.	Iringa			90fd6680	-7.75	34.86666			790.0				1970-04-06T00:00:00	6	4	1970
17	SPECIES	Blepharis	Blepharis	Mattf.	TZ	3 miles S of Mpwapwa or	Dodoma			90fd6680	-6.36666	36.5			950.0				1988-04-09T00:00:00	9	4	1988
18	SPECIES	Blepharis	Blepharis	Mattf.	TZ	T 3. South Pare Mountain	Kilimanjaro		6	90fd6680	4.36944	37.89166			1550.0				1999-06-02T00:00:00	2	6	1999
19	SPECIES	Blepharis	Blepharis		TZ	D.O.Afr. [Deutsch-Ost-Af				4e11d750					1300.0				1934-03-25T00:00:00	25	3	1934
20	SPECIES	Blepharis	Blepharis	Mattf.	TZ	Tanganyika: Manyoni Dis	Dodoma			4c415e40					1234.0				1964-04-01T00:00:00		4	1964
21	SPECIES	Blepharis	Blepharis	Mattf.	TZ					2cd829bb									1988-04-09T00:00:00	9	4	1988
22	SPECIES	Blepharis	Blepharis		TZ	Tanzania: 25.03.1934, Le				57254bd0									1934-03-25T00:00:00	25	3	1934
23																						
24																						
25																						

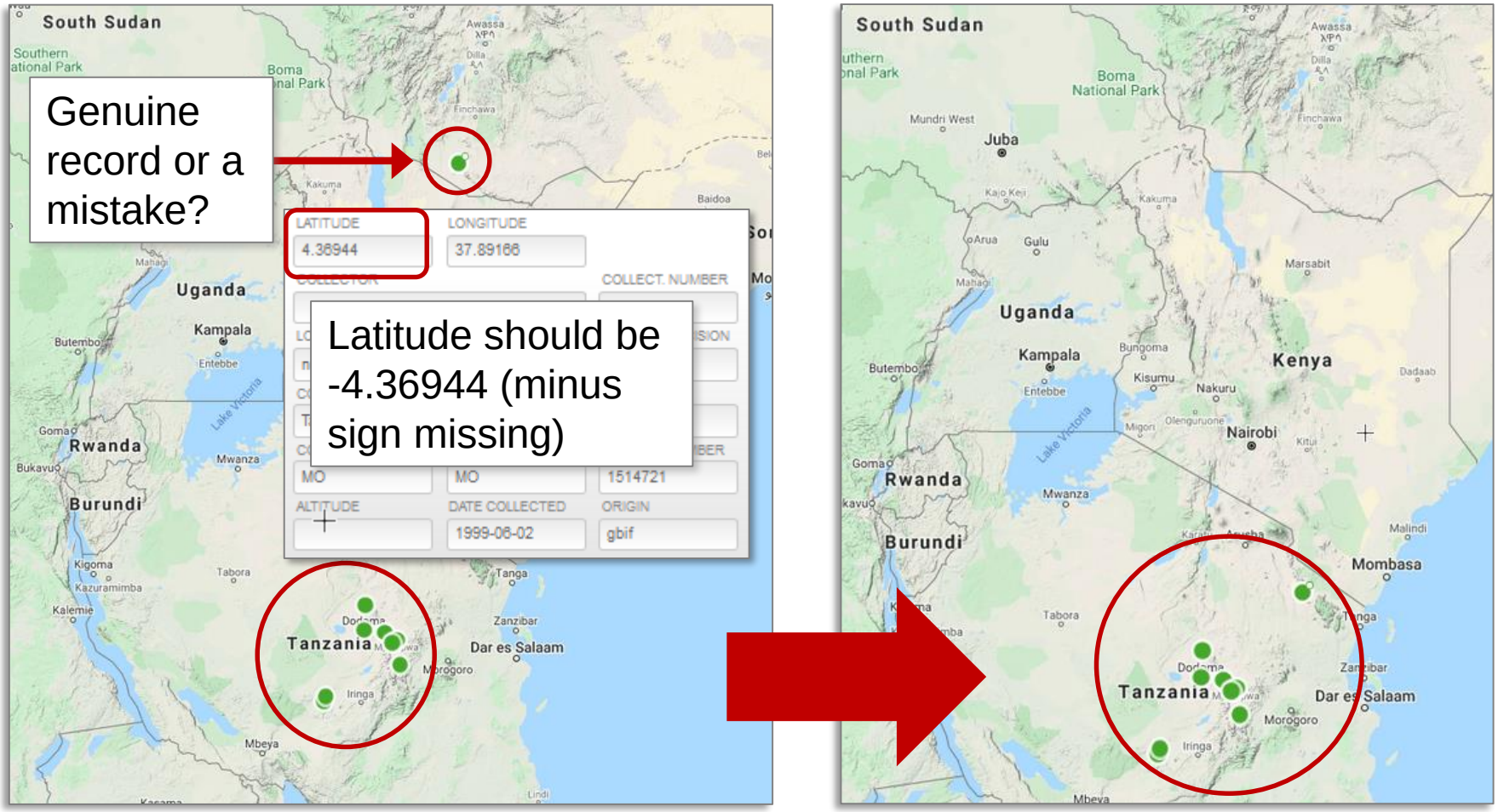
Point maps

2. Visually check the data.



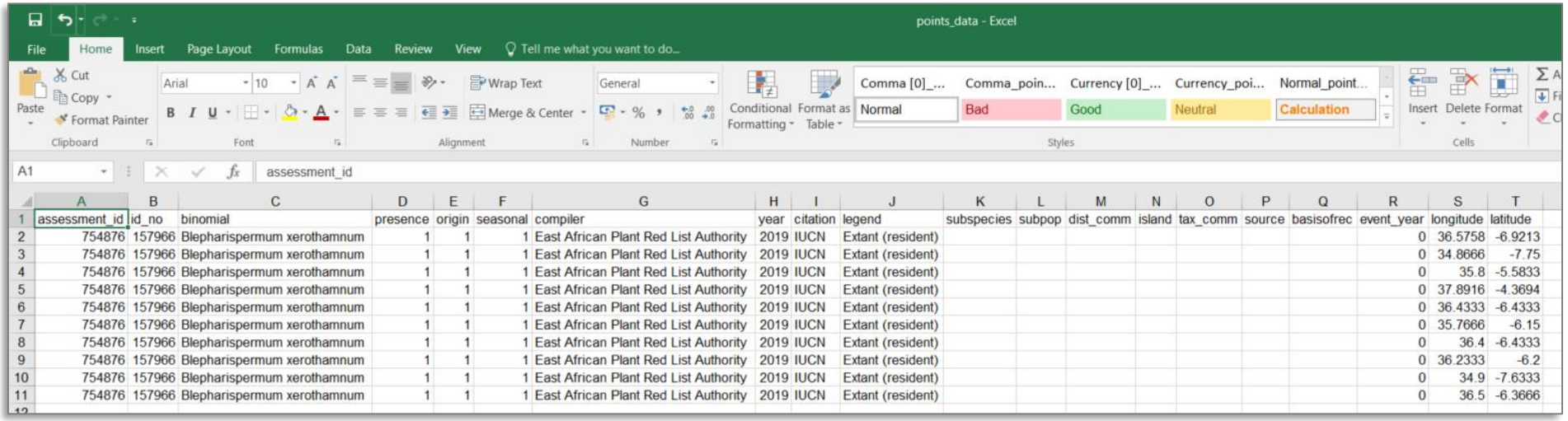
Point maps

3. Project the coordinates onto a base map to check they appear where they are supposed to.



Point maps

4. Format the data to match the IUCN Red List mapping standards.

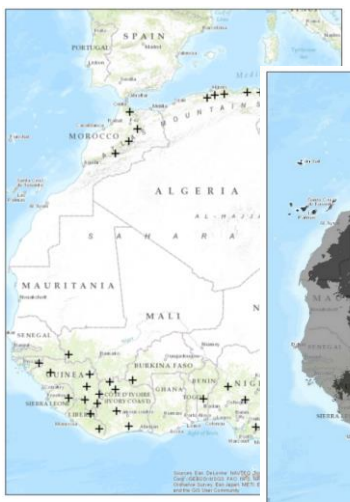


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	assessment_id	id_no	binomial	presence	origin	seasonal	compiler	year	citation	legend	subspecies	subpop	dist_comm	island	tax_comm	source	basisofrec	event_year	longitude	latitude
2	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	36.5758	-6.9213
3	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	34.8666	-7.75
4	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	35.8	-5.5833
5	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	37.8916	-4.3694
6	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	36.4333	-6.4333
7	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	35.7666	-6.15
8	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	36.4	-6.4333
9	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	36.2333	-6.2
10	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	34.9	-7.6333
11	754876	157966	Blepharispermum xerothamnum	1	1	1	East African Plant Red List Authority	2019	IUCN	Extant (resident)								0	36.5	-6.3666

Final csv or Excel file for point data (alternatively, you can save this as a point data shapefile)

Polygon maps

1. Plot observation and collection data points.
2. Create a polygon around the data points using information on habitat preferences, elevation limits, dispersal patterns, bathymetry (for marine taxa), and so on.
3. Refine the polygon, removing likely unoccupied areas (e.g., heavily degraded habitats, inappropriate altitudes, climate or temperature restrictions, etc.)



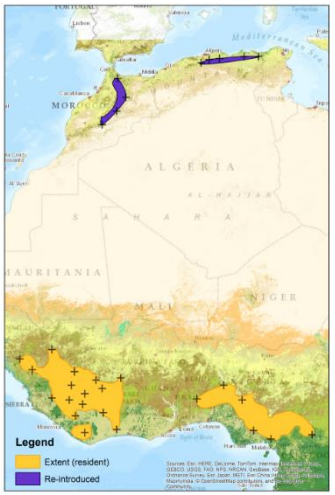
Point data

Habitat preferences, elevation limits, etc.

Biology and Ecology

Land Use

=

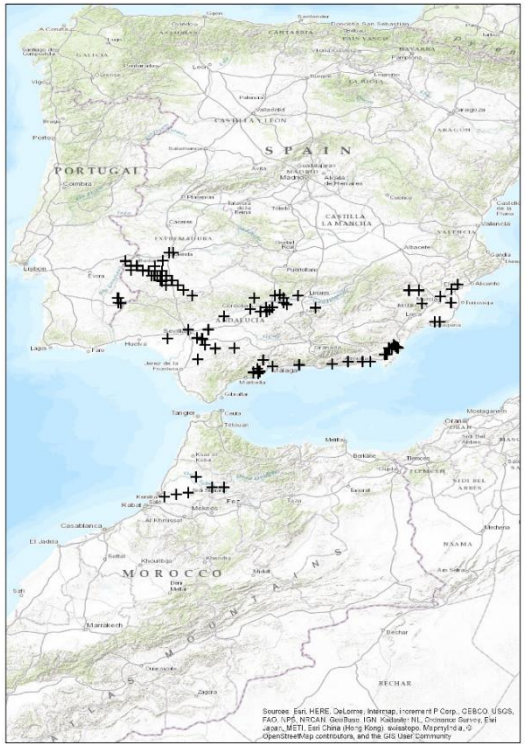


Final species distribution area

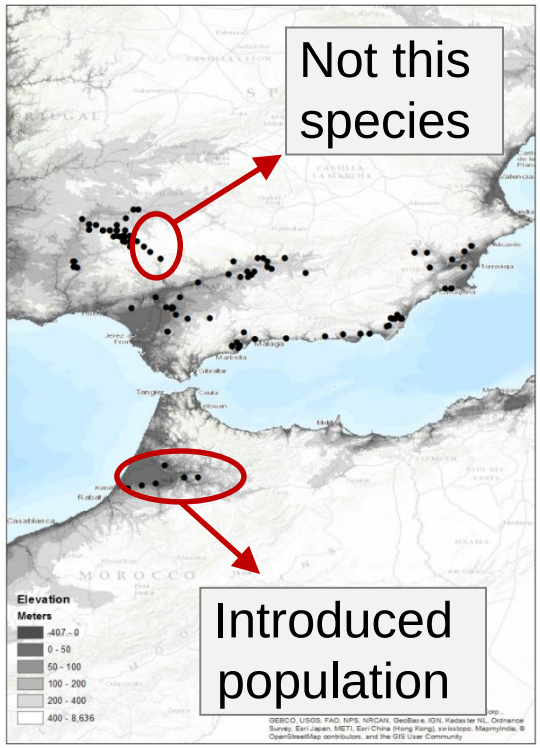
Polygon maps

species with elevation and ecology information

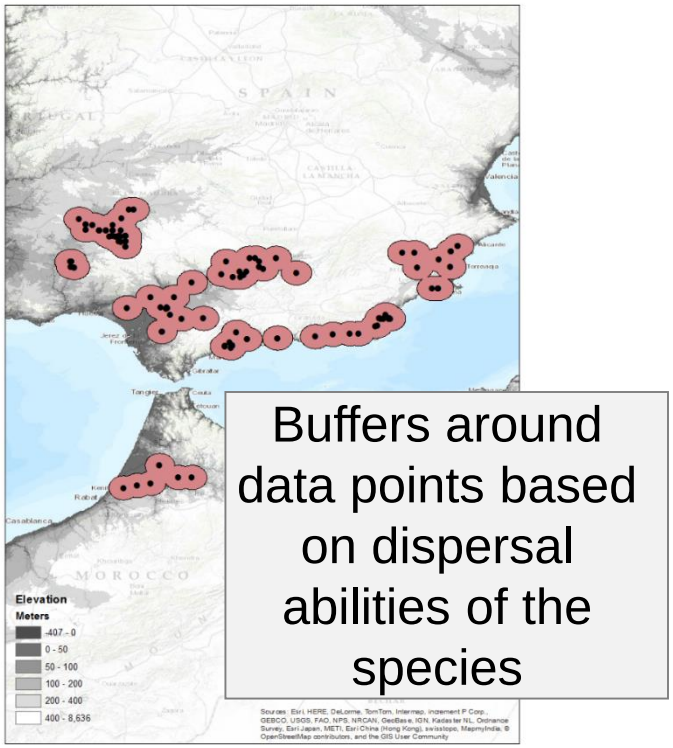
- Plot collection and observation records as data points.
- Check data points to identify current occurrences within the taxon's native range.
- Use information about the species to build and refine the polygon.



Point data



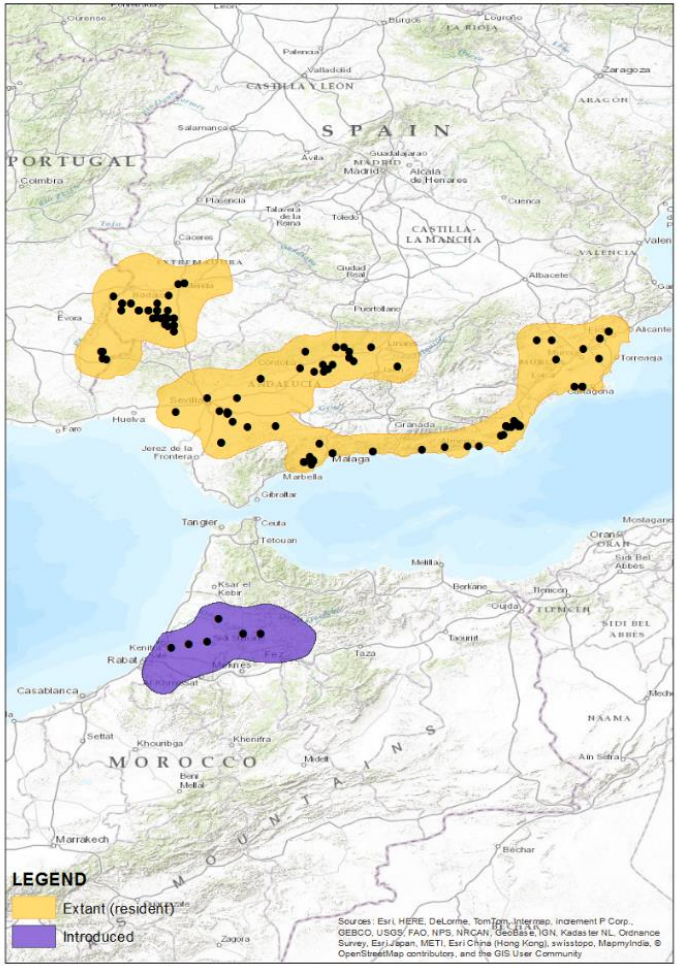
Altitude data



Buffered point data

Polygon maps

species with elevation and ecology information



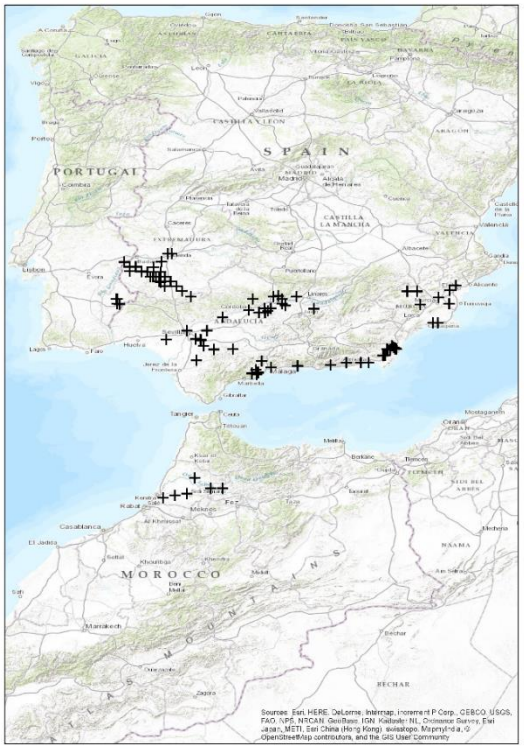
Polygon refined based on elevation and clipped to the coastline

Final polygon map

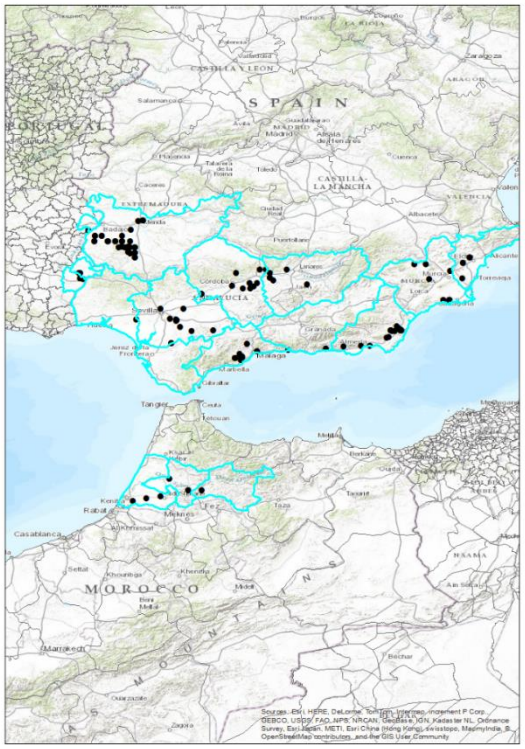
Polygon maps

species with no elevation, habitat or ecology information

Can prepare polygon maps based on administrative areas.



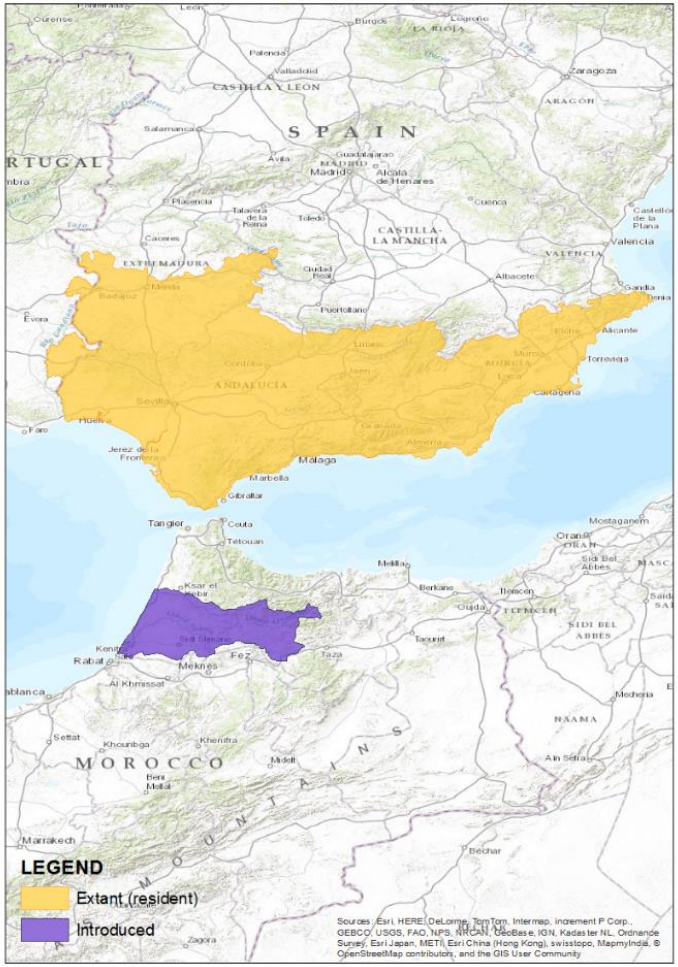
Point data



Selected administrative areas

Polygon maps

species with no elevation, habitat or ecology information



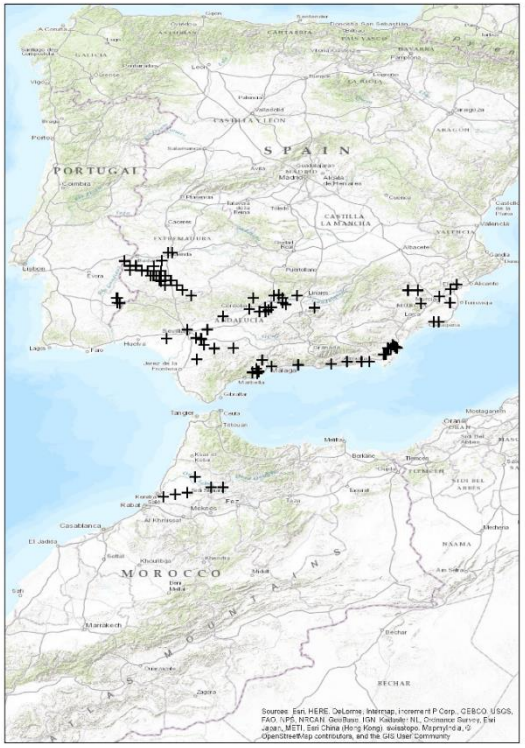
A very general polygon of administrative units within which the species occurs

Final polygon map

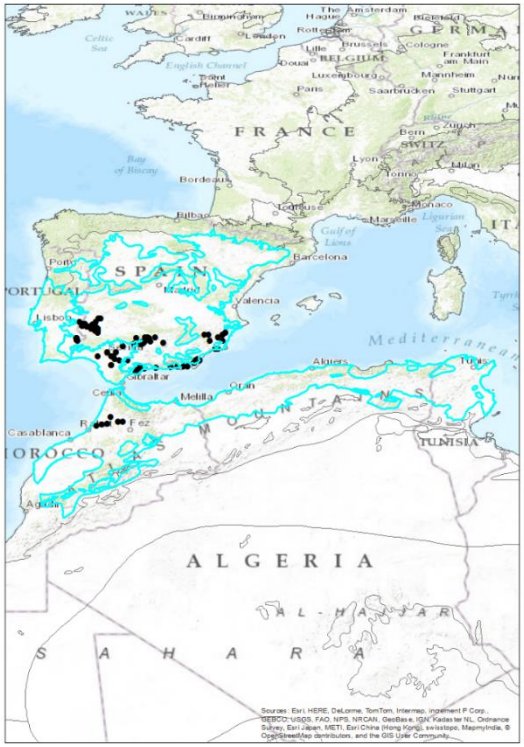
Polygon maps

species with habitat information

Polygons can also be based on Ecoregions.



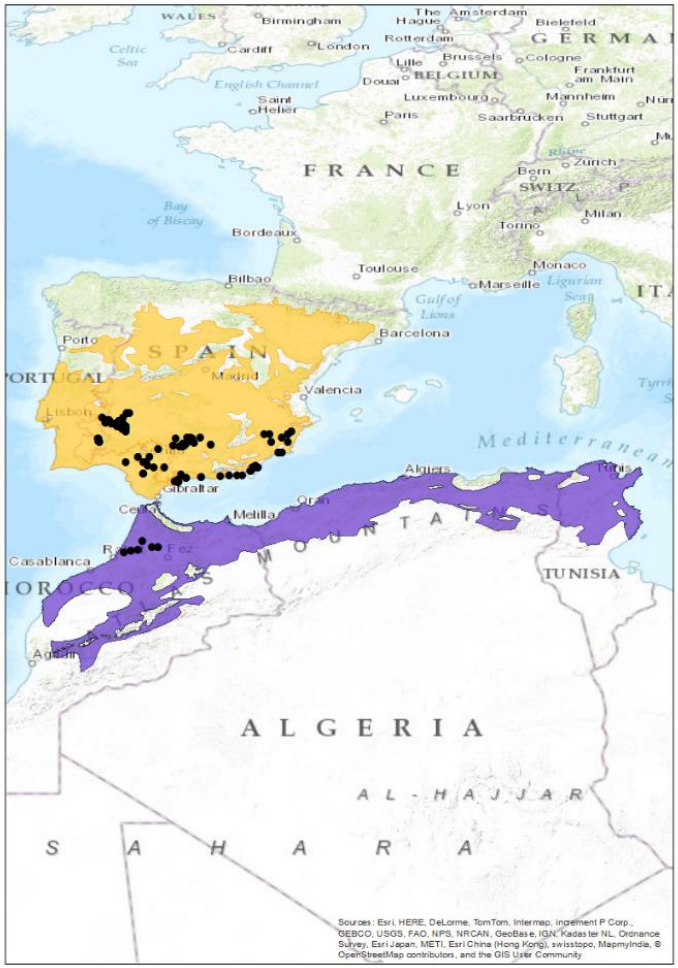
Point data



Selected habitat areas

Polygon maps

species with habitat information

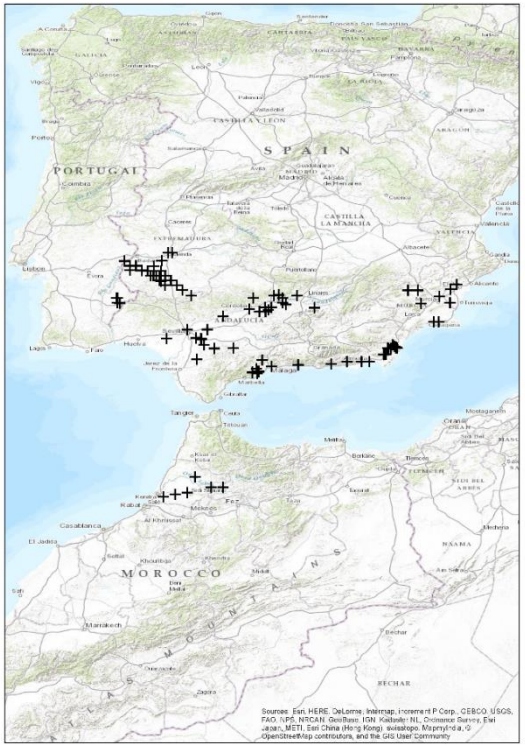


Final polygon map

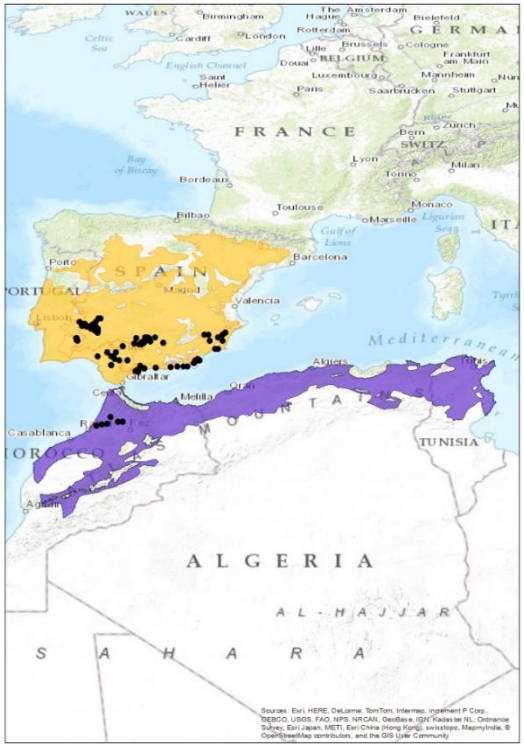
Polygon maps

species with elevation and habitat information

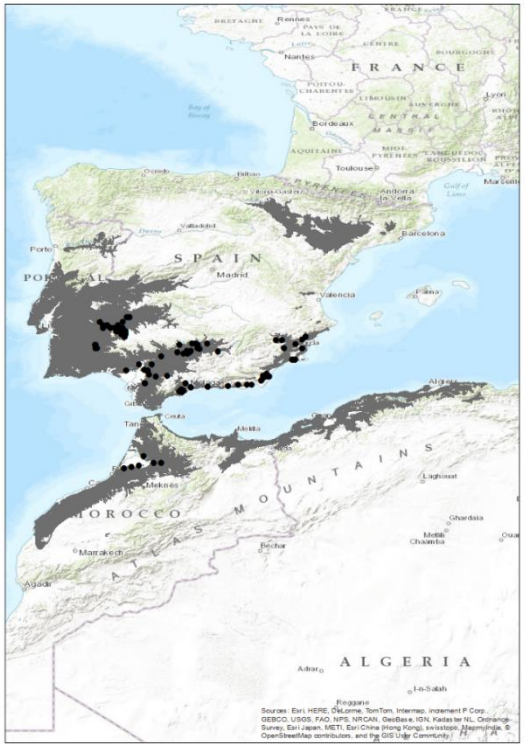
The more information you have about the species, the more refinements you can make to the polygons.



Point data



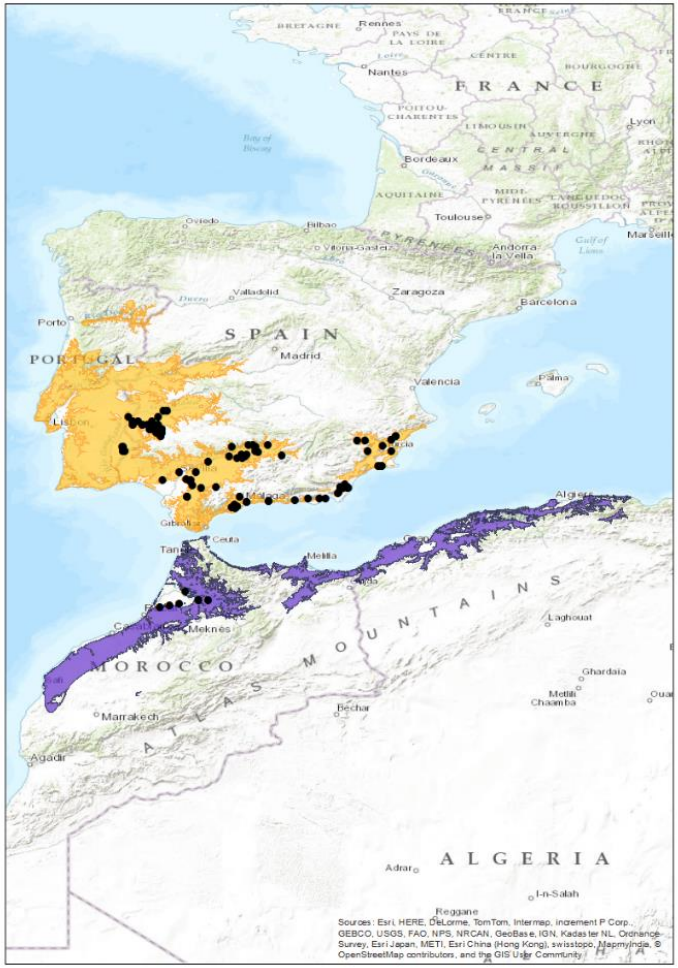
Selected habitat areas



Selected altitude range

Polygon maps

species with elevation and habitat information



With more information, the polygon can be refined further

Final polygon map

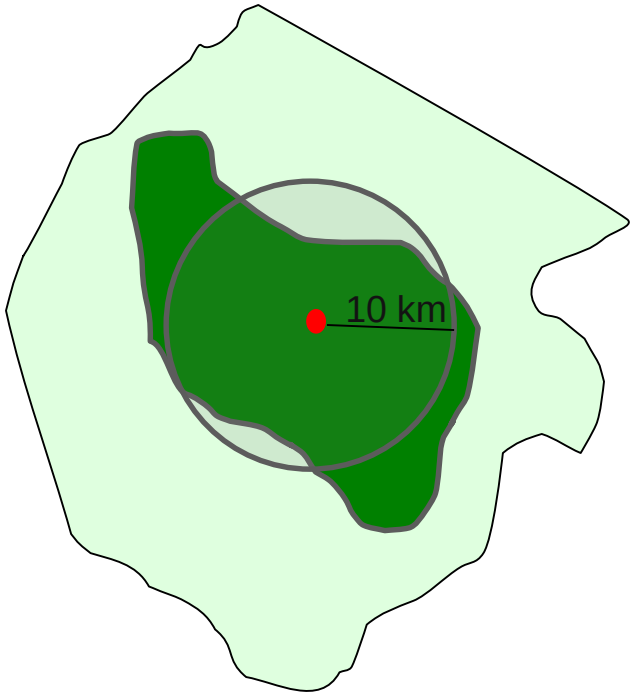
Polygon maps

species with fewer than 3 data points

- Use habitat and ecology information to create the polygon.

OR

- If no habitat or ecology data are available a 10 km radius circle can be drawn around data points.



- **For coastal terrestrial species**, clip the final polygon to the coastline (to exclude marine habitats).

Polygon maps

Freshwater species

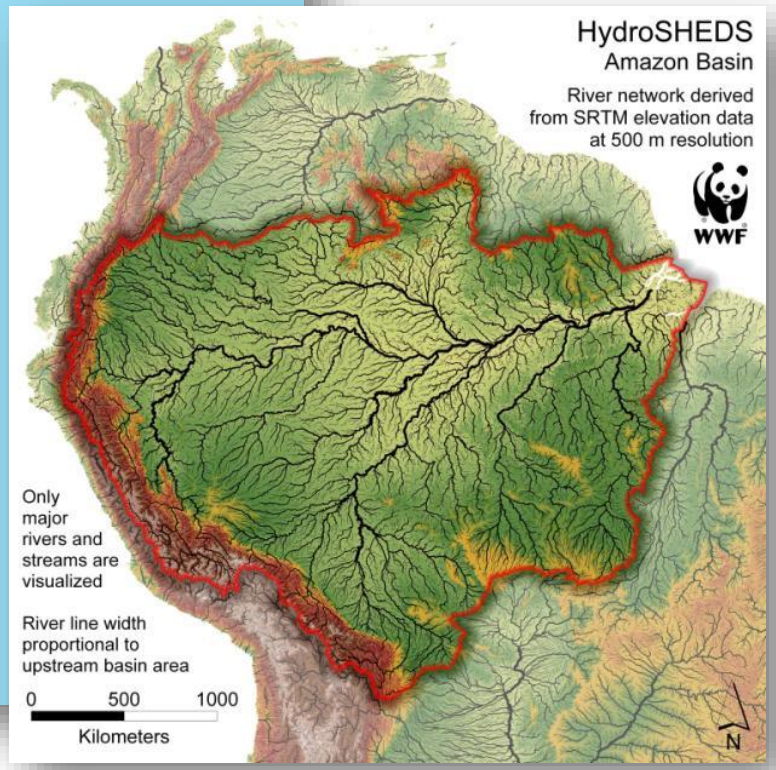
Freshwater species are mapped to catchments as these are considered to be the minimum management unit for freshwater conservation.

- Plot known observation and collection data points.
- Intersect points with catchments to identify areas where the species currently occurs.
- Use publications and expert knowledge to expand range to other potentially occupied catchments, if necessary.

Polygon maps

Freshwater species

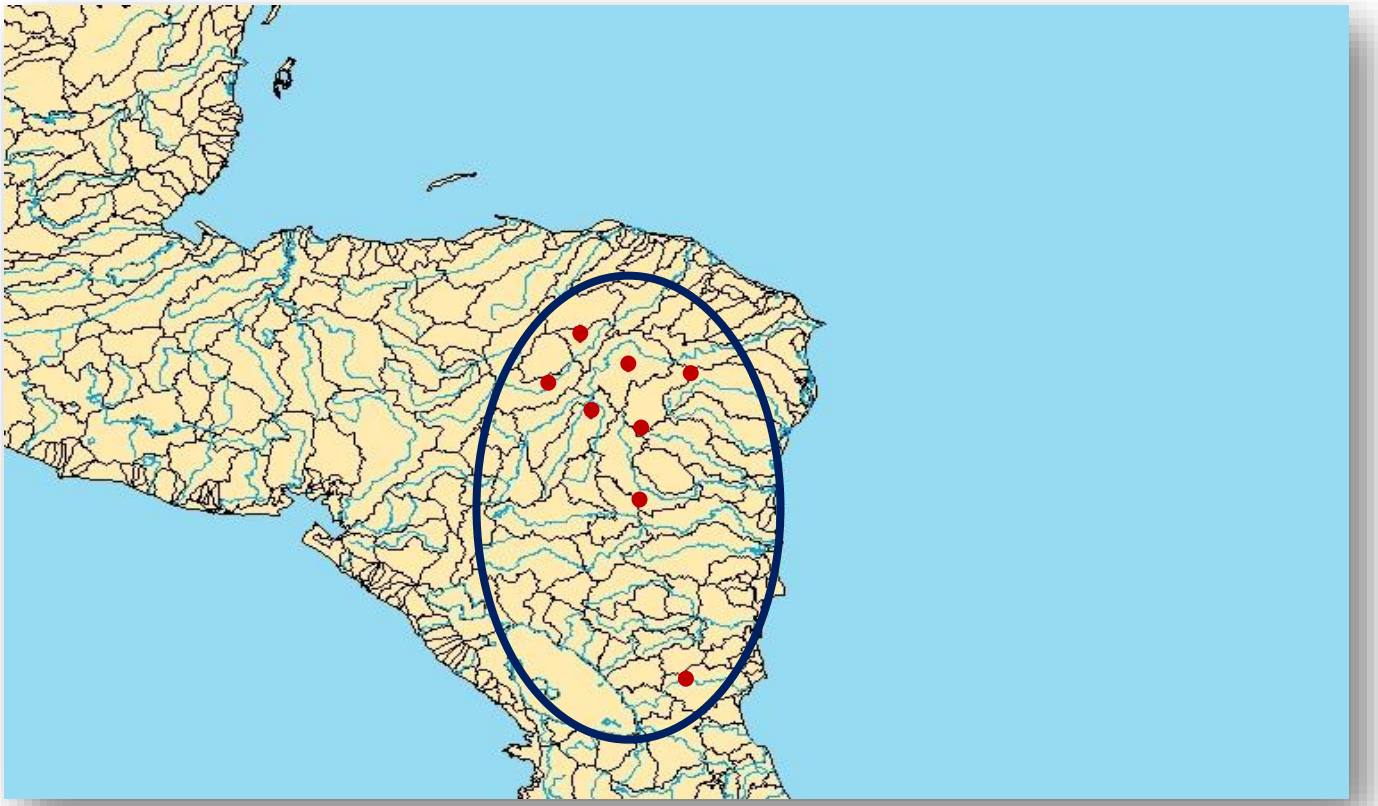
Base layer: HydroBASINS – a subset of the HydroSHEDS database developed by WWF https://hydrosheds.org (average basin size of 100 km^2).



Polygon maps

Freshwater species

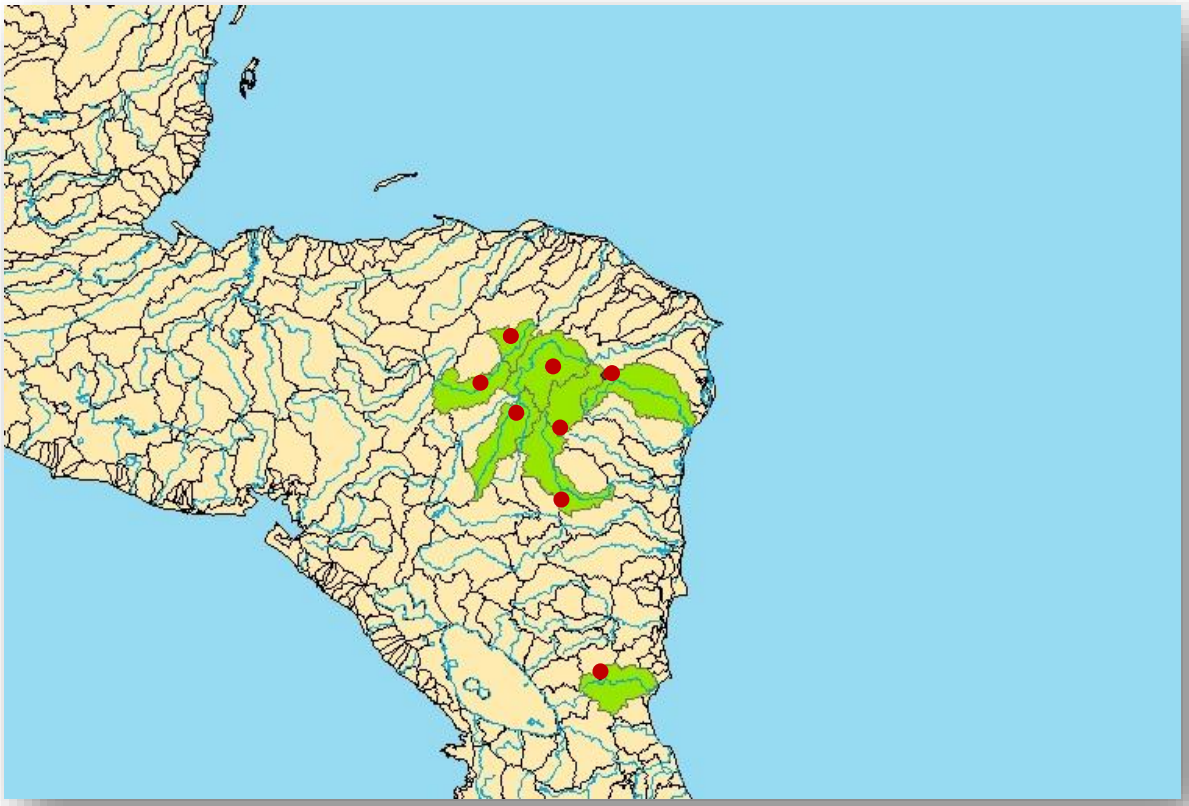
Plot observation and collection data points on the basins.



Polygon maps

Freshwater species

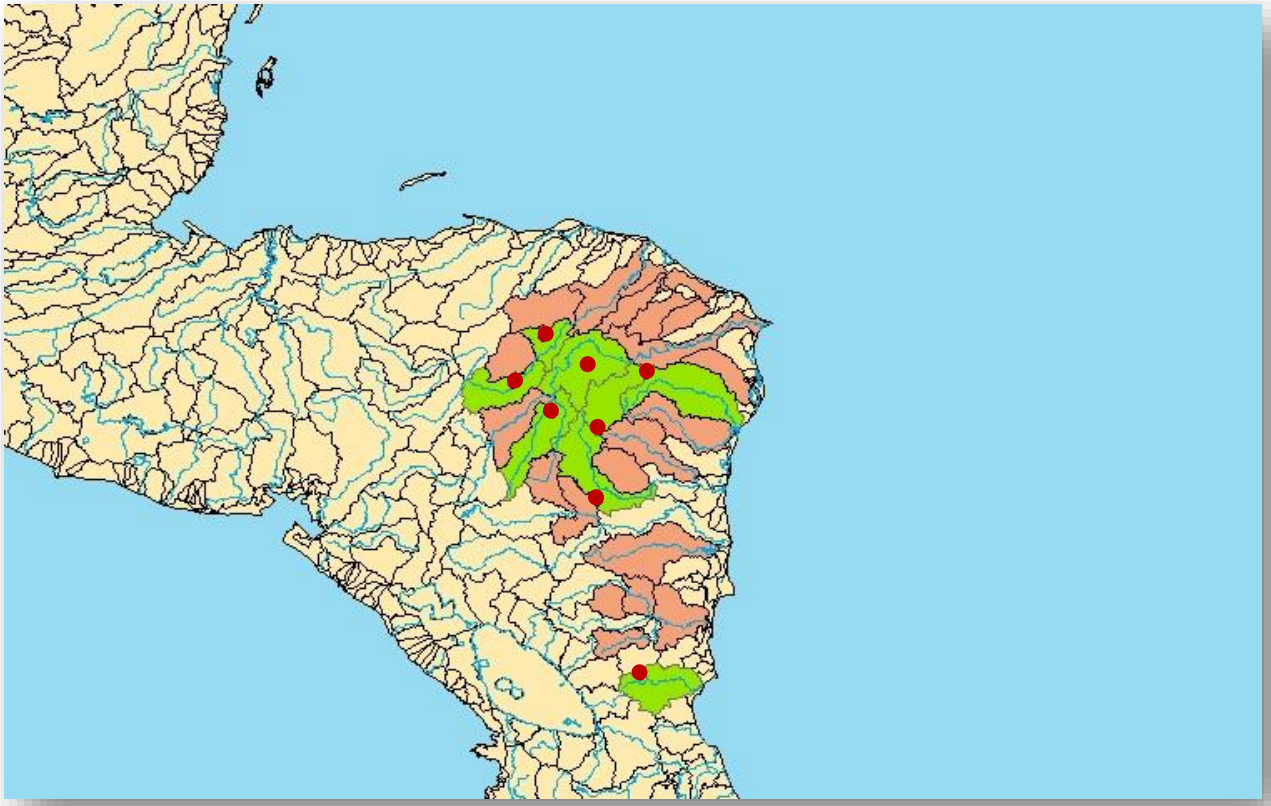
Select the HydroBASINs that intersect with the data points. These are the areas where the species is known to occur within.



Polygon maps

Freshwater species

Using publications and expert knowledge, add any HydroBASINs where the species has not yet been recorded but is likely to occur.

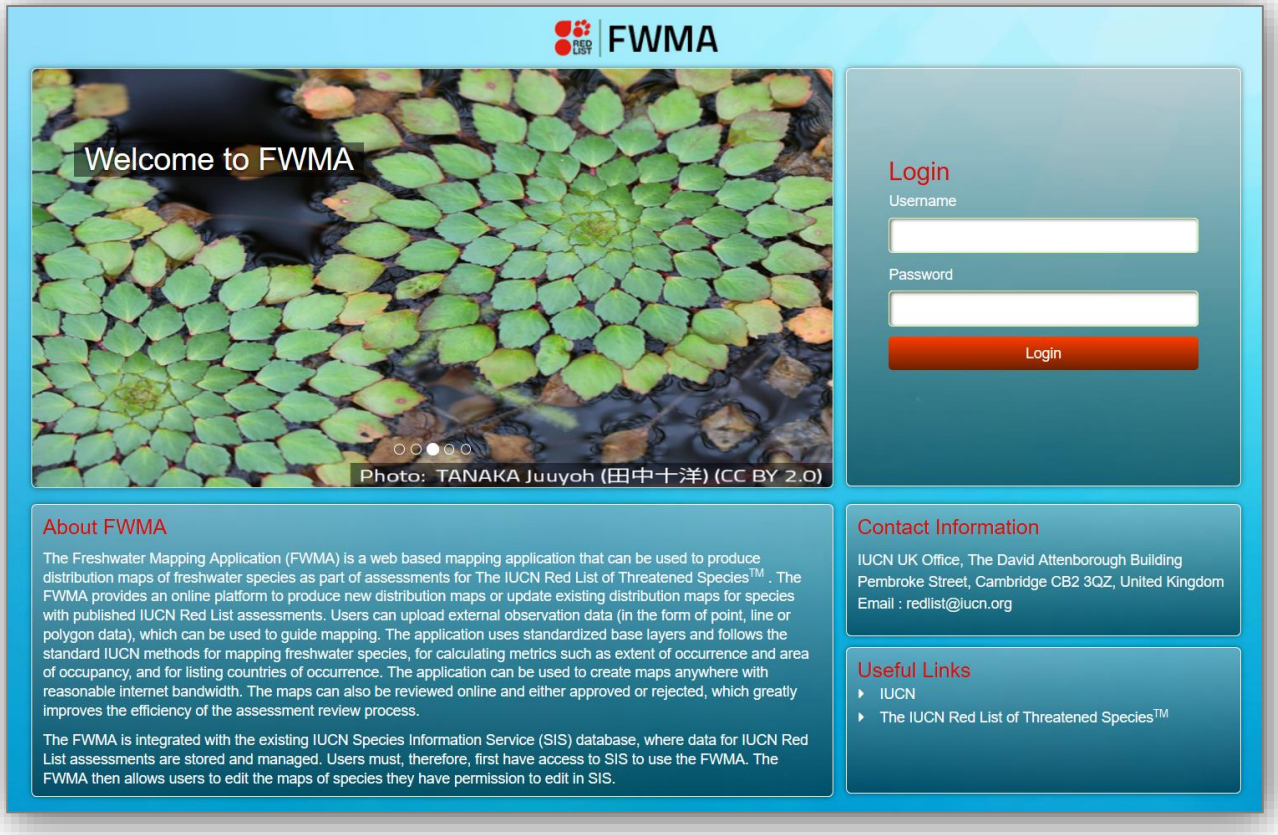


Final HydroBASIN map

Polygon maps

Freshwater species

The IUCN Freshwater Biodiversity Unit has developed a Freshwater Mapping Application (FWMA) for creating HydroBASIN maps.



http://mappingfw.iucnredlist.org/FWMA/

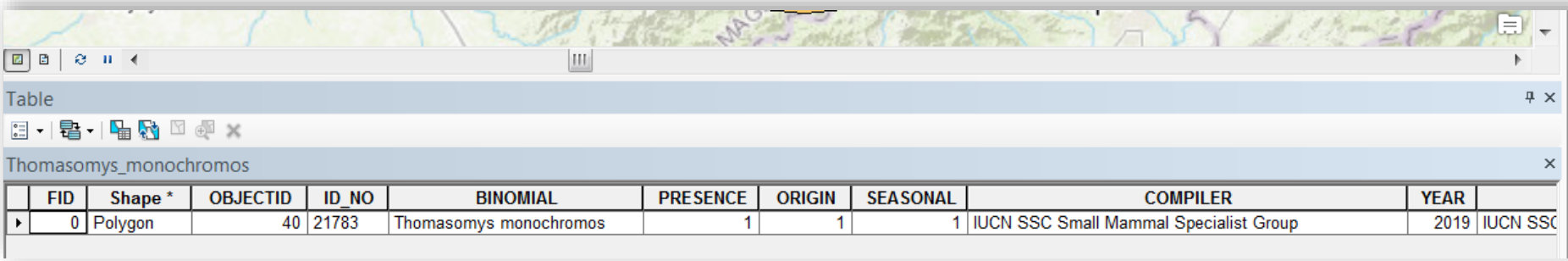
Species with sensitive spatial data

Some species should not have their exact locations published, but accurate spatial data must still be provided for analysis purposes. You can:

- withhold the map from the published assessment; **or**
- publish a generalised map that does not identify the exact location of the species.

Spatial Data Attributes

- **Attributes** = data attached to points and polygons.



FID	Shape *	OBJECTID	ID_NO	BINOMIAL	PRESENCE	ORIGIN	SEASONAL	COMPILER	YEAR	
0	Polygon	40	21783	Thomasomys monochromos	1	1	1	IUCN SSC Small Mammal Specialist Group	2019	IUCN SSC

- Attributes tell us:
  - the name of the species;
  - the exact location of the data point;
  - the identity of the HydroBASIN;
  - whether the species still exists in that area or if it is now extinct from there;
  - who compiled the data and when;
  - whether the species is data sensitive;
  - etc…
- There are minimum attribute requirements for maps supporting a Red List assessment.

Required Data Attributes

Field	Description	Polygons / Basins	Points
sci_name	Scientific name for the taxon	✓	✓
hybas_id	HydroBASIN ID **(only if mapping HydroBASINs)**	✓	
presence	Codes identifying whether the species is currently present in the area	✓	✓
origin	Codes identifying whether the species is native to the area	✓	✓
seasonal	Codes identifying which season(s) the species is present in the area	✓	✓

Required Data Attributes

Field	Description	Polygons / Basins	Points
compiler	Name of individual(s) or institution responsible for creating the map	✓	✓
yrcompiled	Year in which the map was created or last modified	✓	✓
citation	Name of individual(s)/institution responsible for providing the data	✓	✓
dec_lat	Geographical latitude, in decimal degrees (between -90 and 90)		✓
dec_long	Geographical longitude, in decimal degrees (between -180 and 180)		✓
spatialref	Ellipsoid, geodetic datum or spatial reference system upon which the geographic coordinates are based (WGS84 preferred)		✓

Required Data Attributes

Field	Description	Polygons / Basins	Points
subspecies	Subspecies name **(only if a subspecies is being mapped)**	✓	✓
subpop	Subpopulation name **(only if a subpopulation is being mapped)**	✓	✓
data_sens	Used to flag species with sensitive spatial data. Tells the Red List Unit to withhold the point or polygon from the web site.	✓	✓
sens_comm	Comments on why the data are considered sensitive **(required if DATA_SENS = "1")**	✓	✓

Recommended Data Attributes

Field	Definition	Polygon / Basin	Point
event_year	Year the observation was recorded or the specimen was collected.		✓
source	Primary source of the data	✓	✓
catalog_no	An identifier (preferably unique) for the record within a larger dataset or collection		✓
dist_comm	Distribution comments, referring directly to the polygon or point	✓	✓
island	Name of the island the point or polygon is on	✓	✓

Recommended Data Attributes

Field	Definition	Polygon / Basin	Point
tax_comm	Ta d	✓	✓
generalisd	Ir g m se	✓	
basisofrec	Sp (r		✓

Accepted values for the BasisOfRec field
PreservedSpecimen
FossilSpecimen
LivingSpecimen
HumanObservation
MachineObservation
StillImage
MovingImage
SoundRecording

Codes for Presence, Origin and Seasonality

Code	Presence
1	Extant
2	~~Probably Extant~~
3	Possibly Extant
4	Possibly Extinct
5	Extinct (post 1500)
6	Presence uncertain

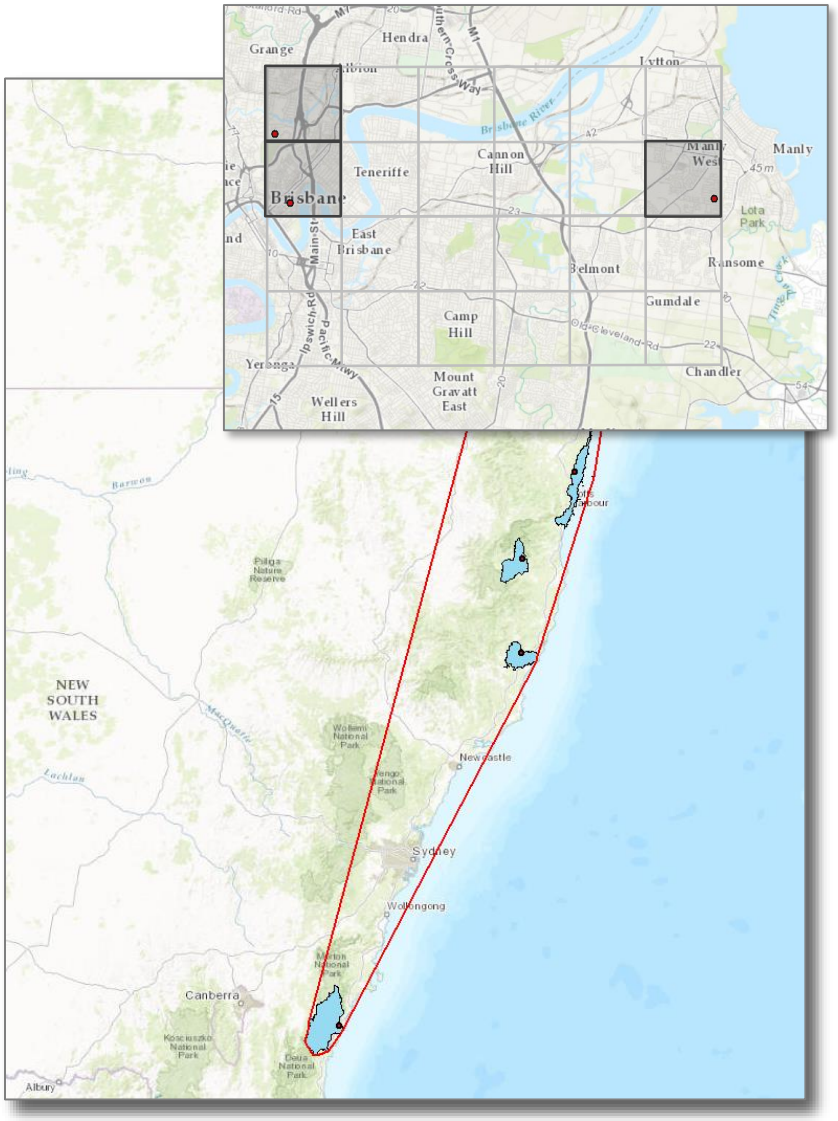
Code	Origin
1	Native
2	Reintroduced
3	Introduced
4	Vagrant
5	Origin Uncertain
6	Assisted Colonisation

Code	Seasonality
1	Resident
2	Breeding Season
3	Non-breeding Season
4	Passage
5	Seasonal Occurrence Uncertain

Check that “presence”, “origin” and “seasonal” codes used in the map match up with the codes used in the countries of occurrence in the assessment.

Map versus EOO and AOO

- **Distribution map**
  - Data points (red dots)
  - Limits to distribution (blue polygons)
- **Extent of occurrence (EOO)**
  - Entire area within the minimum convex polygon
- **Area of occupancy (AOO)**
  - Total occupied 2x2 km grid cells

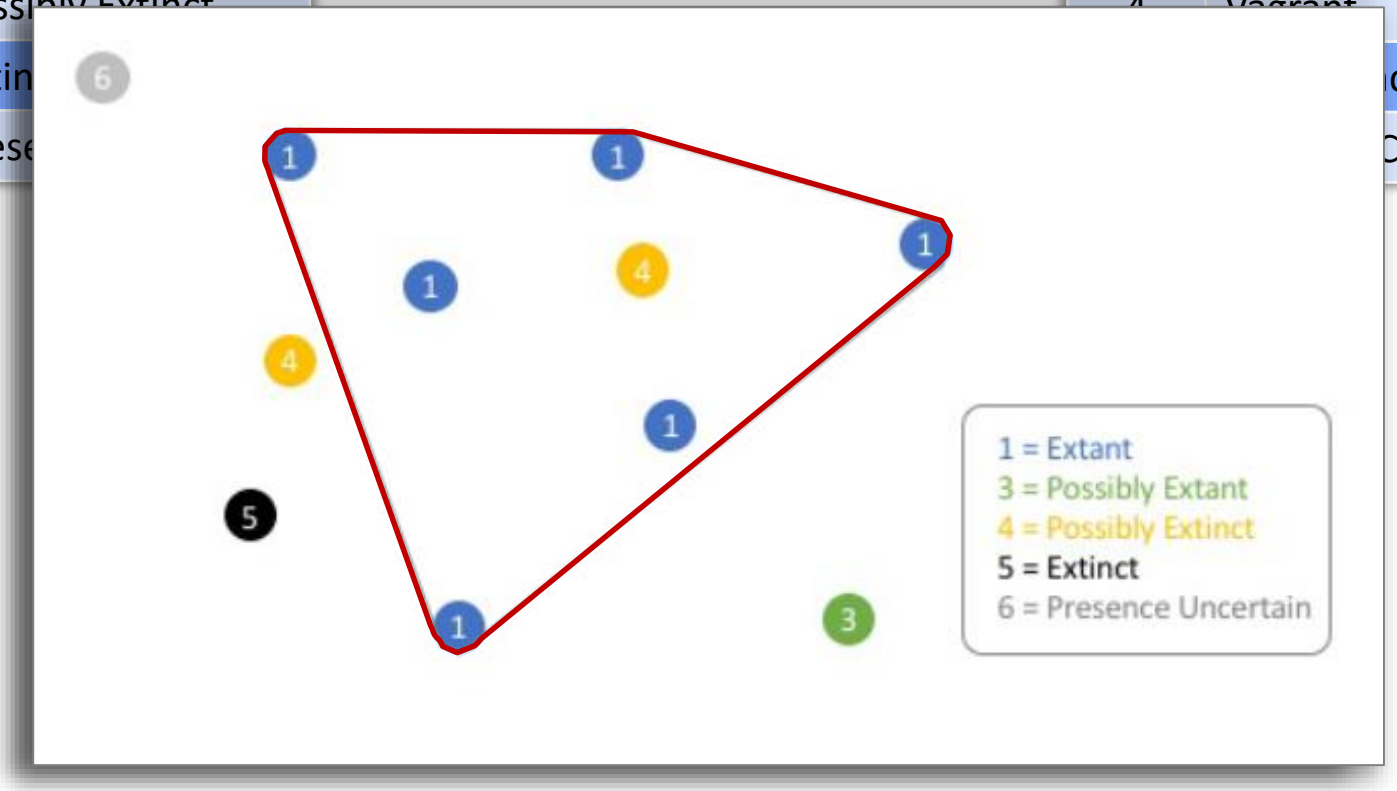


Presence/origin codes and EOO

Code	Presence
1	Extant
2	~~Probably Extant~~
3	Possibly Extant
4	Possibly Extinct
5	Extinct
6	Presence Uncertain

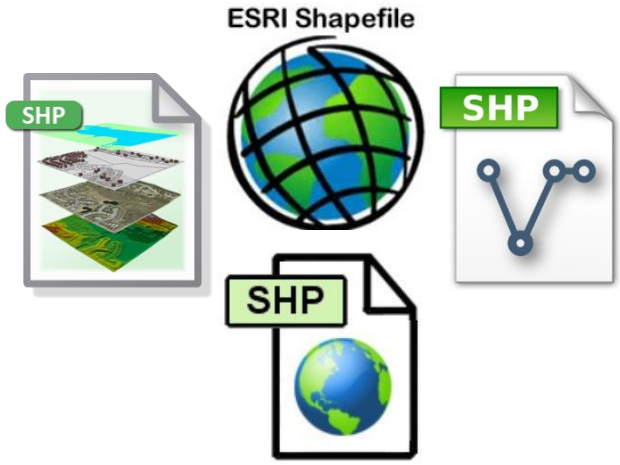
EOO calculator tool

Code	Origin
1	Native
2	Reintroduced
3	Introduced
4	Vagrant
5	Uncertain
6	Colonisation



Submitting distribution maps for Red List assessments

- **Format**
  - **Polygons**: Shapefile.
  - **Points**: CSV, Excel file, or shapefile.
  - Assessed subspecies, subpopulations: include in the species file AND provide separate maps.
  - Multiple species combined into one file, or can submit species files individually.
  - Ensure all required attributes are included.



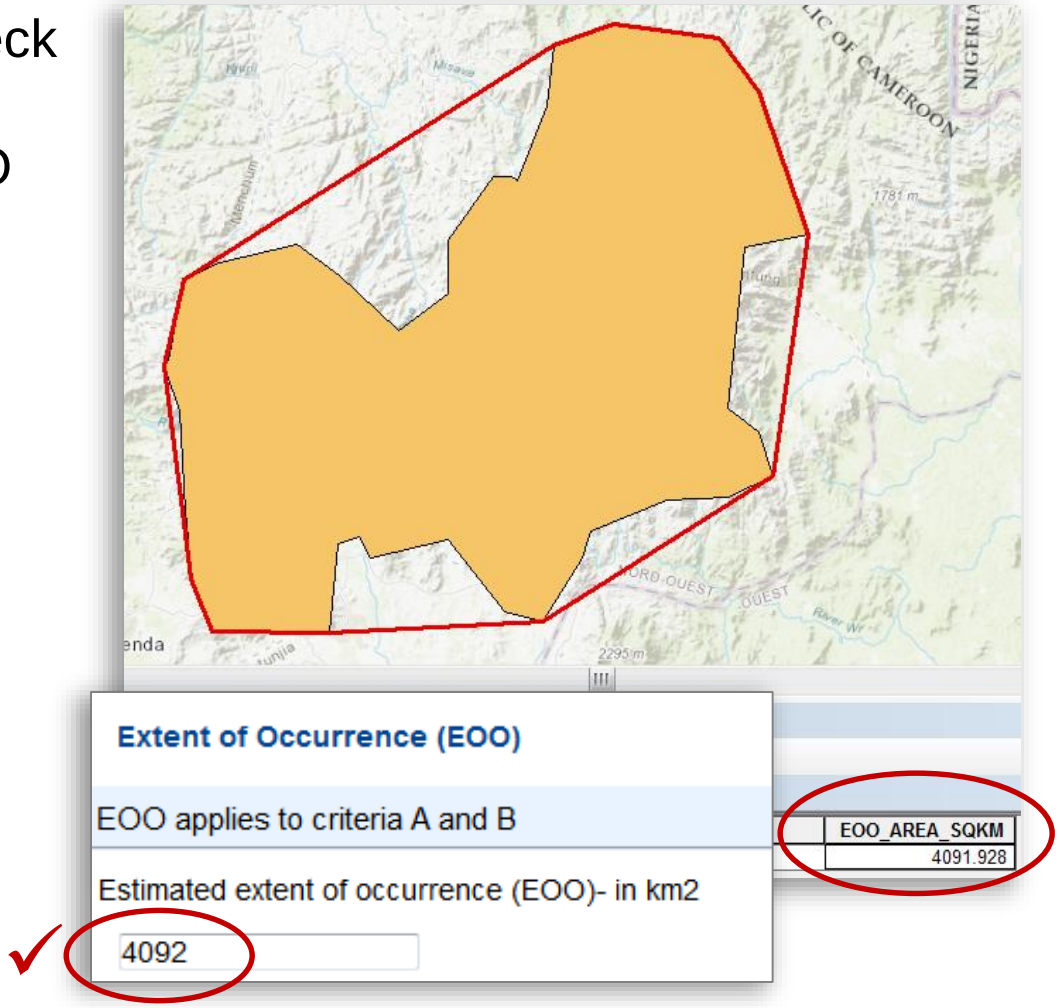
ID_NO	BINOMIAL	PRESENCE	ORIGIN	SEASONAL	COMPILER	YRCOMPILED	CITATION	DEC_LAT	DEC_LONG	SPATIALREF	SUBSPECIES	SUBPOP	DATA_SENS	SENS_COMM
44392674	Carex bulbostylis	1	1	1	Aubrey Robbit	2019	IUCN	34.2265	-91.9	WGS84			N	
44392674	Carex bulbostylis	1	1	1	Aubrey Robbit	2019	IUCN	33.26666667	-93.6	WGS84			N	
44392674	Carex bulbostylis	1	1	1	Aubrey Robbit	2019	IUCN	33.28333333	-93.9	WGS84			N	
44392674	Carex bulbostylis	1	1	1	Aubrey Robbit	2019	IUCN	34.76666667	-91.88333333	WGS84			N	
44392674	Carex bulbostylis	3	1	1	Aubrey Robbit	2019	IUCN	33.7	-94.23333333	WGS84			N	
44392674	Carex bulbostylis	3	1	1	Aubrey Robbit	2019	IUCN	35.96666667	-94.23333333	WGS84			N	
44392674	Carex bulbostylis	5	1	1	Aubrey Robbit	2019	IUCN	35.75016667	-91.56666667	WGS84			N	
44392674	Carex bulbostylis	6	1	1	Aubrey Robbit	2019	IUCN	35.00016667	-93.41666667	WGS84			N	
44392674	Carex bulbostylis	1	1	1	Aubrey Robbit	2019	IUCN	33.98333333	-94.21683333	WGS84			N	
44392674	Carex bulbostylis	6	1	1	Aubrey Robbit	2019	IUCN	35.18333333	-91.23333333	WGS84			N	
44392674	Carex bulbostylis	1	1	1	Aubrey Robbit	2019	IUCN	35.85	-92.18333333	WGS84			N	
44392674	Carex bulbostylis	1	1	1	Aubrey Robbit	2019	IUCN	33.11666667	-91.25	WGS84			N	
44392674	Carex bulbostylis	1	3	1	Aubrey Robbit	2019	IUCN	31.76666667	-93.13333333	WGS84			N	
136532836	Icuria dunensis	1	1	1	Burt Carden	2018	IUCN	-16.231236	39.931543	WGS84			N	
136532836	Icuria dunensis	1	1	1	Burt Carden	2018	IUCN	-17.017748	38.792048	WGS84			N	

Submitting distribution maps for Red List assessments

- **Submission of spatial data**
  - Currently, submit map files to Red List Unit staff via an online file sharing mechanism such as WeTransfer, Google Drive, Dropbox or similar.
  - Can attach files directly to assessments in SIS; please **avoid this** if submitting lots of species maps at the same time.
  - Avoid email for large files; these may be undelivered and can get lost.
  - Development of a standard map data submissions system is being scoped out for future submissions.

What happens to spatial data after submission to the Red List?

- Red List Unit may need to check that the EOO used in the assessment matches the EOO calculation on the map.



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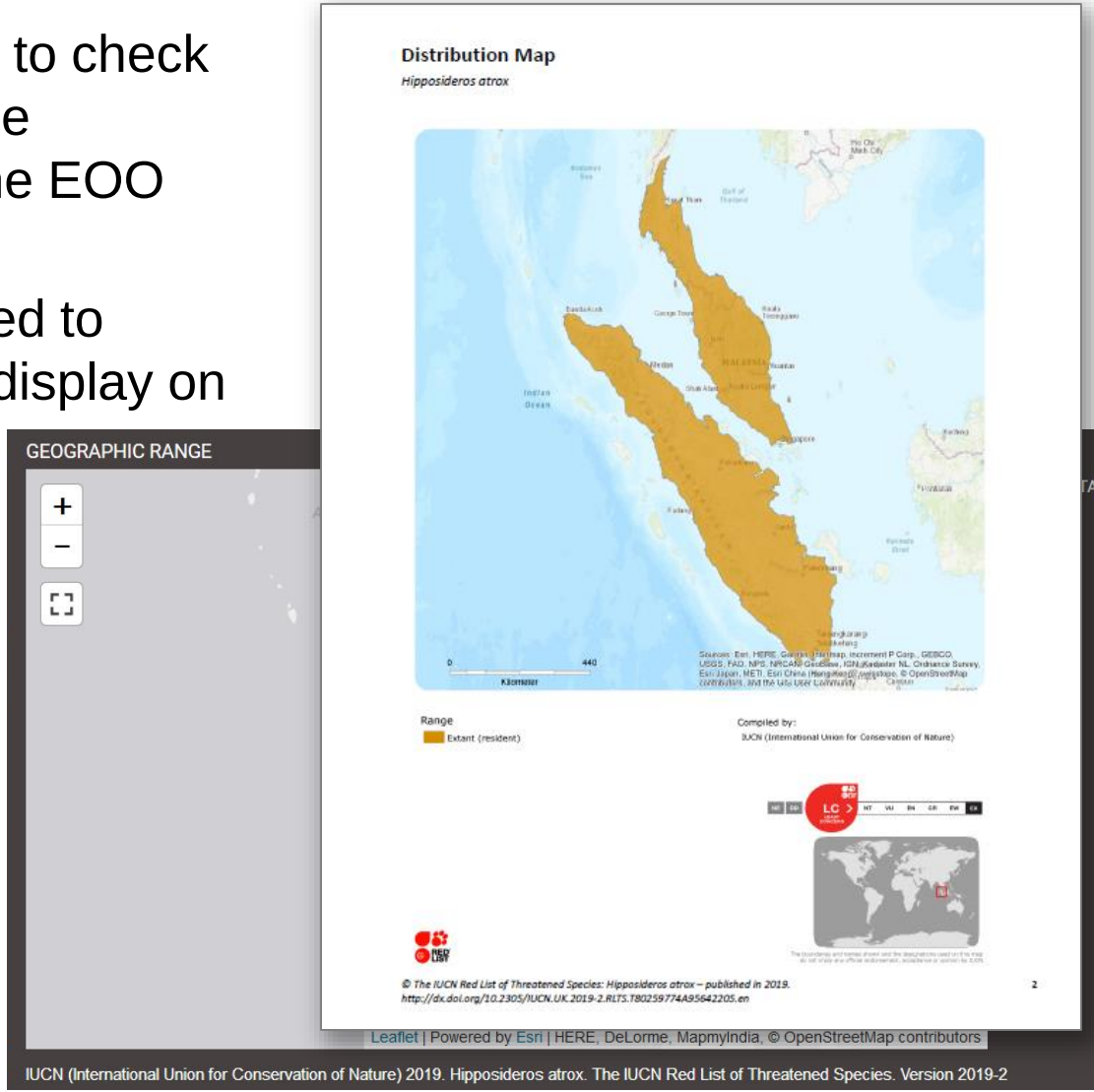

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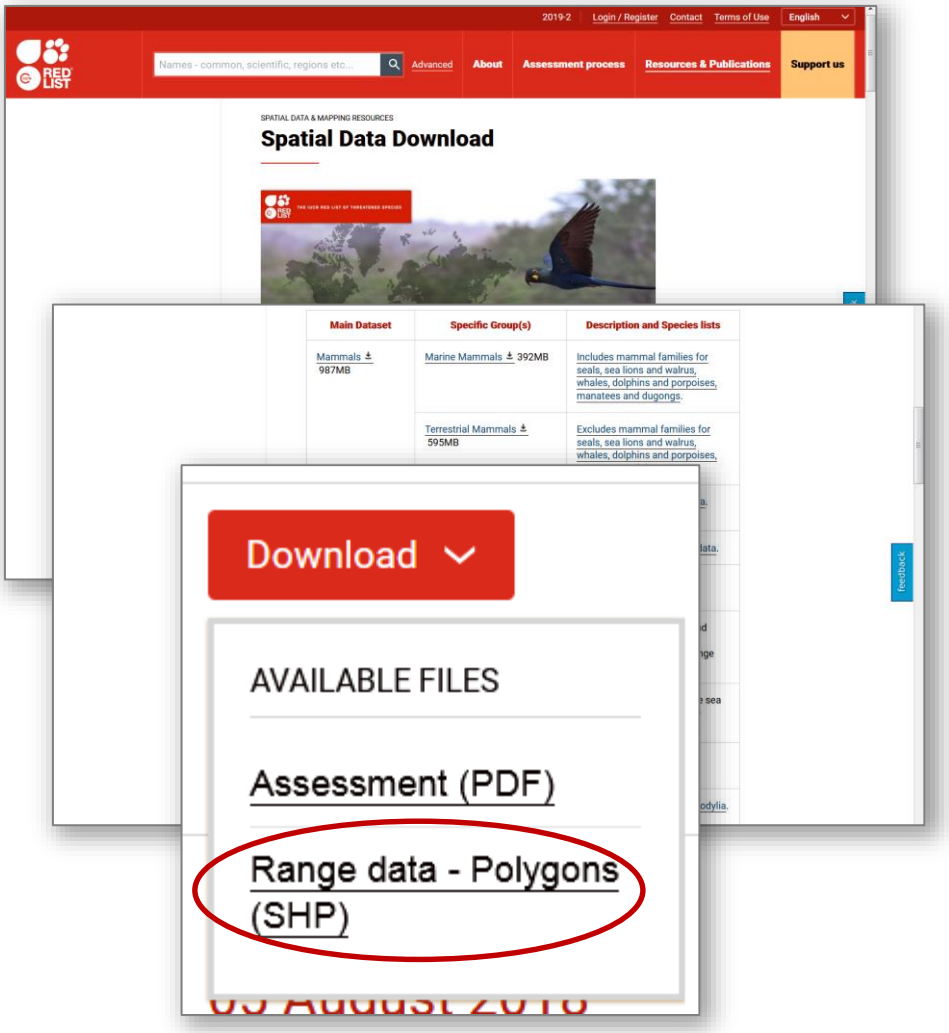

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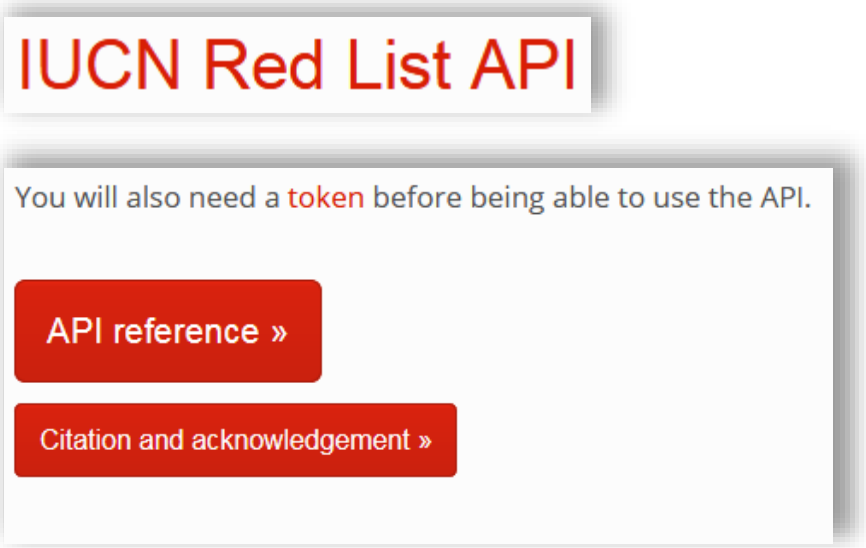
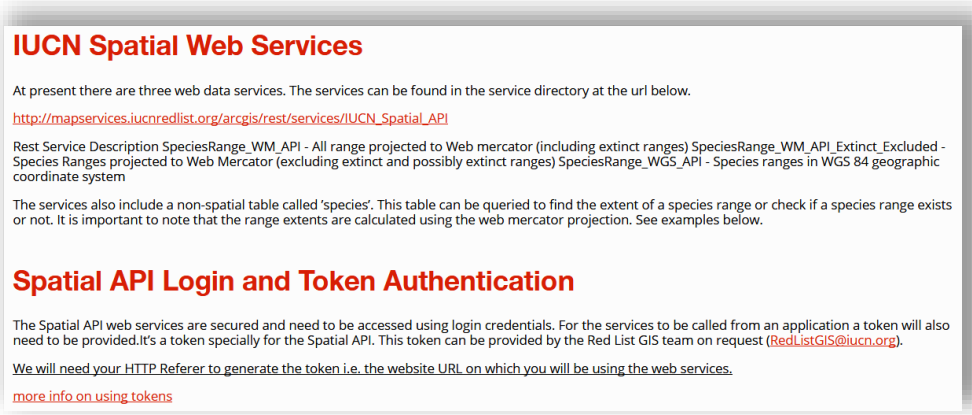
- Spatial data are also available via the Red List API





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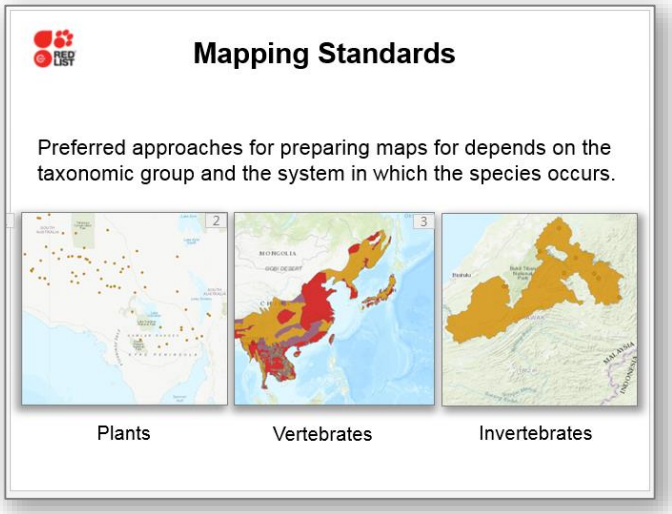
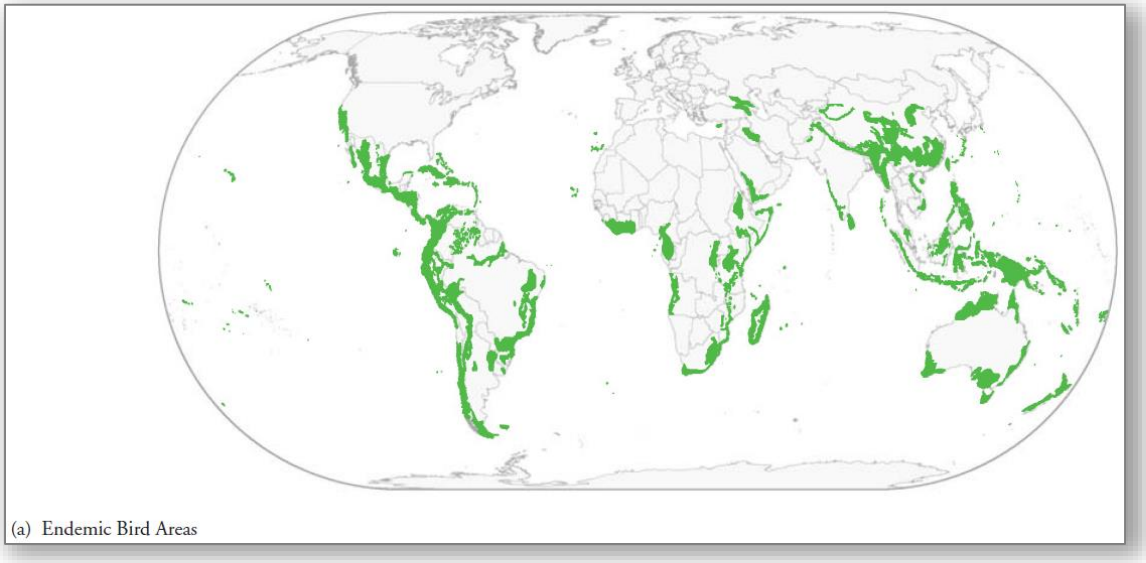
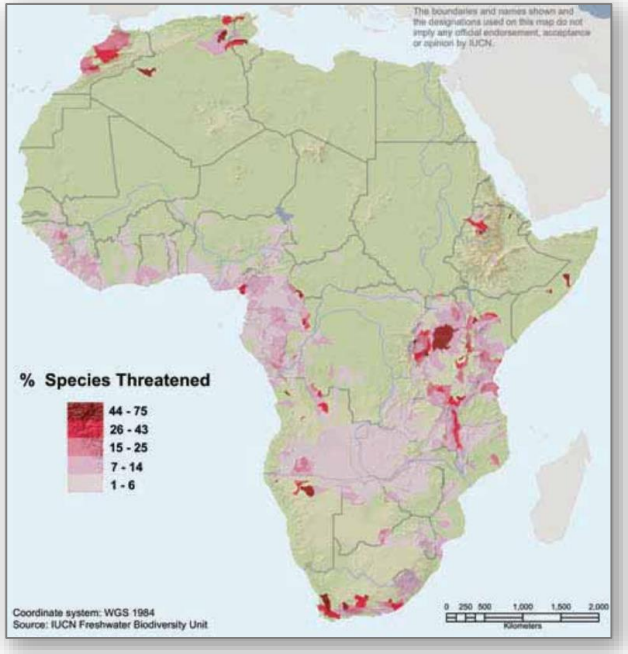
- The data are made available to download from the web site (for non-commercial use).
- Spatial data are also available via the Red List API
- IUCN staff may use the map images for training materials, workshops, presentations, etc.



What happens to spatial data after submission to the Red List?

- The data are used in a wide range of analyses (species richness maps, climate change vulnerability projections, etc.)





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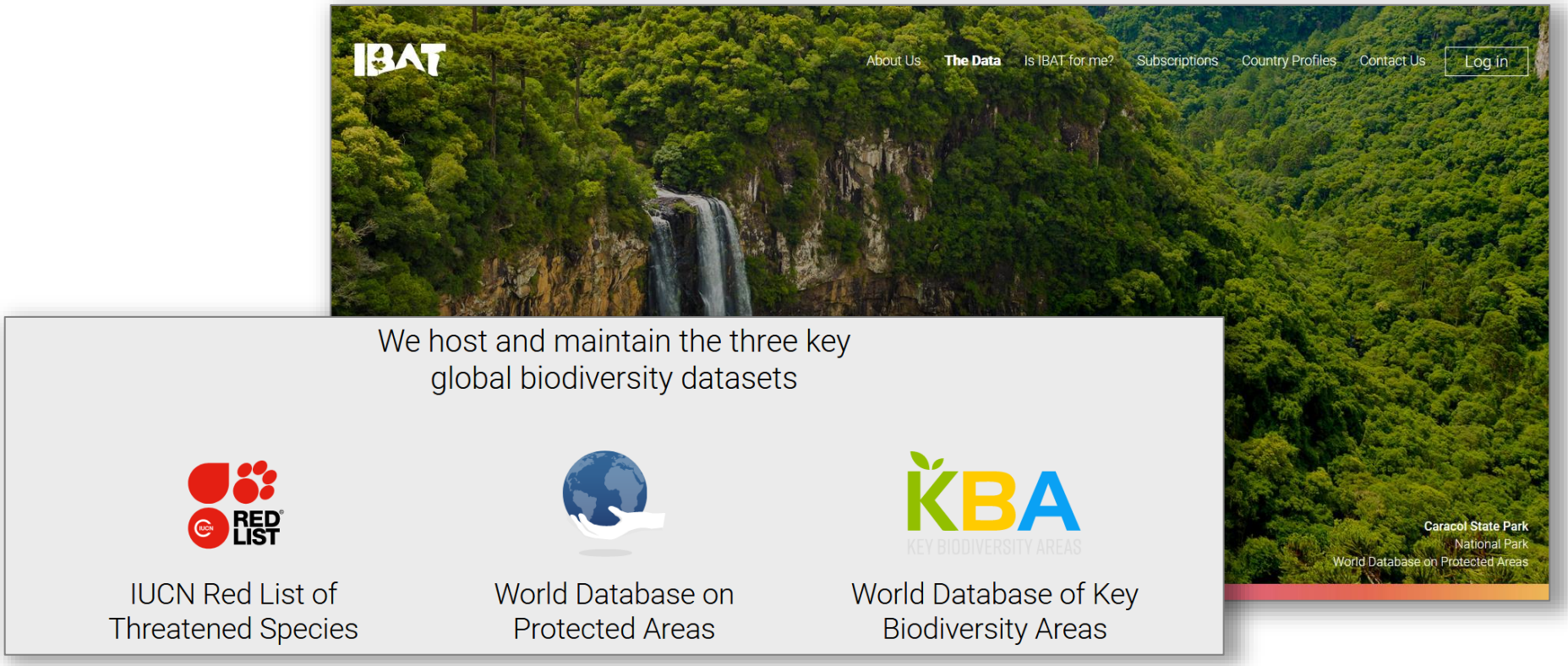
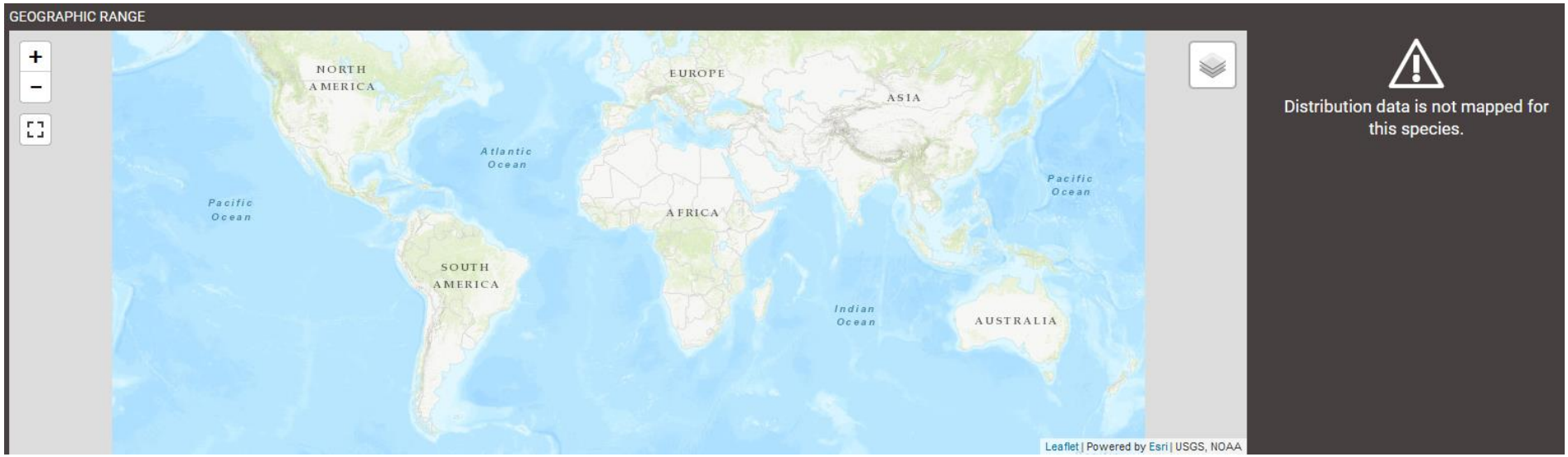
- The spatial data are also submitted to IBAT, which provides a basic risk screening on biodiversity.



What happens to spatial data after submission to the Red List?

- The data are used in a wide range of analyses (species richness maps, climate change vulnerability projections, etc).
- The spatial data are also submitted to IBAT, which provides a basic risk screening on biodiversity.
- Spatial data flagged as data sensitive (data_sens = “1”) are not displayed or made available without prior permission from the data provider.

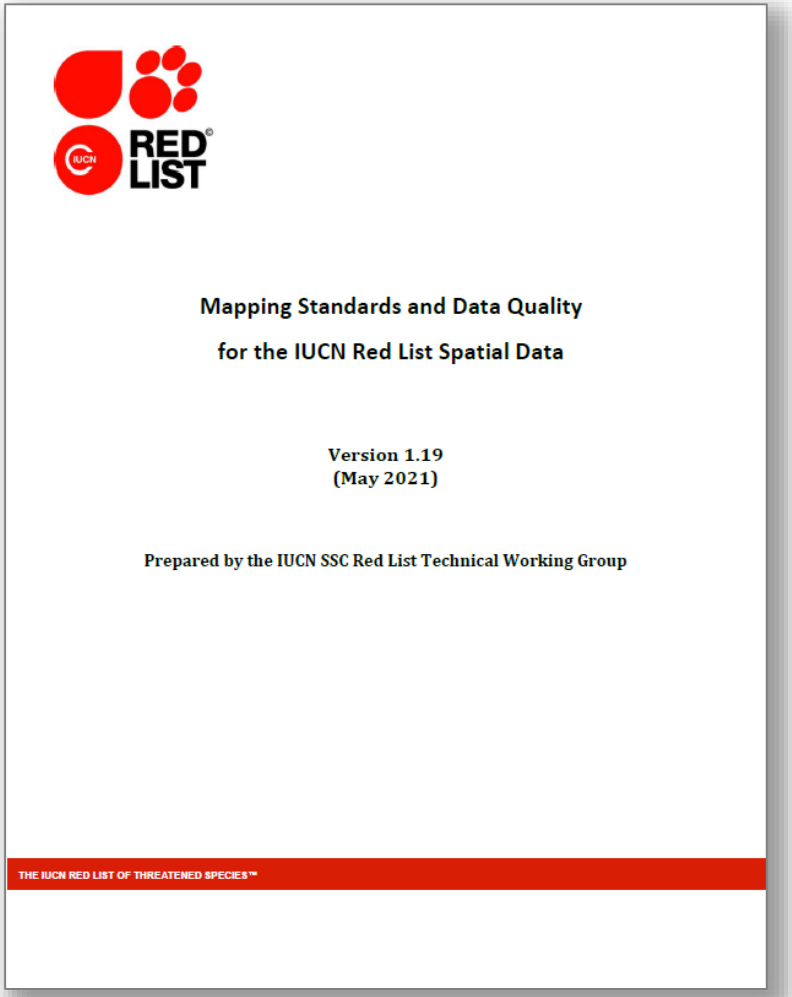


Mapping tools and resources

There are several ways in which maps can be generated for Red List assessments. The preference is always for **digital** maps:

- **ArcGIS desktop**. IUCN can provide a license for this, under strict terms of use.
- **QGIS** (free open source software).
- **Google Earth Pro** (free software).
- **Google My Maps in Google Drive** (free software).

Mapping tools and resources



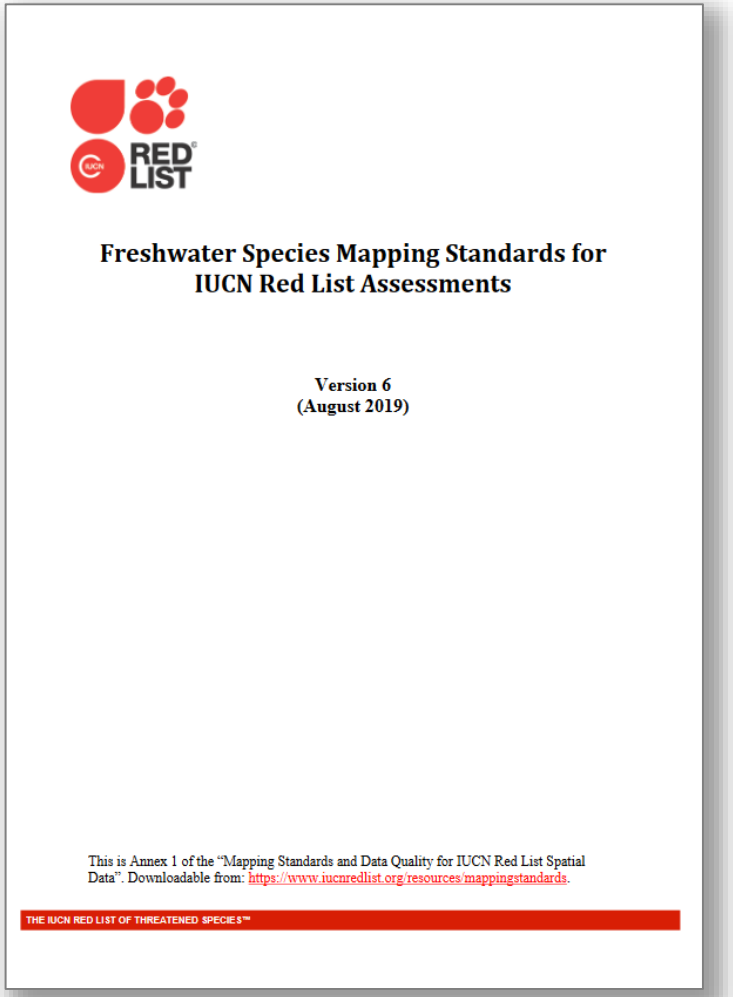
Mapping Standards and Data Quality

for the IUCN Red List Spatial Data

Version 1.19
(May 2021)

Prepared by the IUCN SSC Red List Technical Working Group

THE IUCN RED LIST OF THREATENED SPECIES™



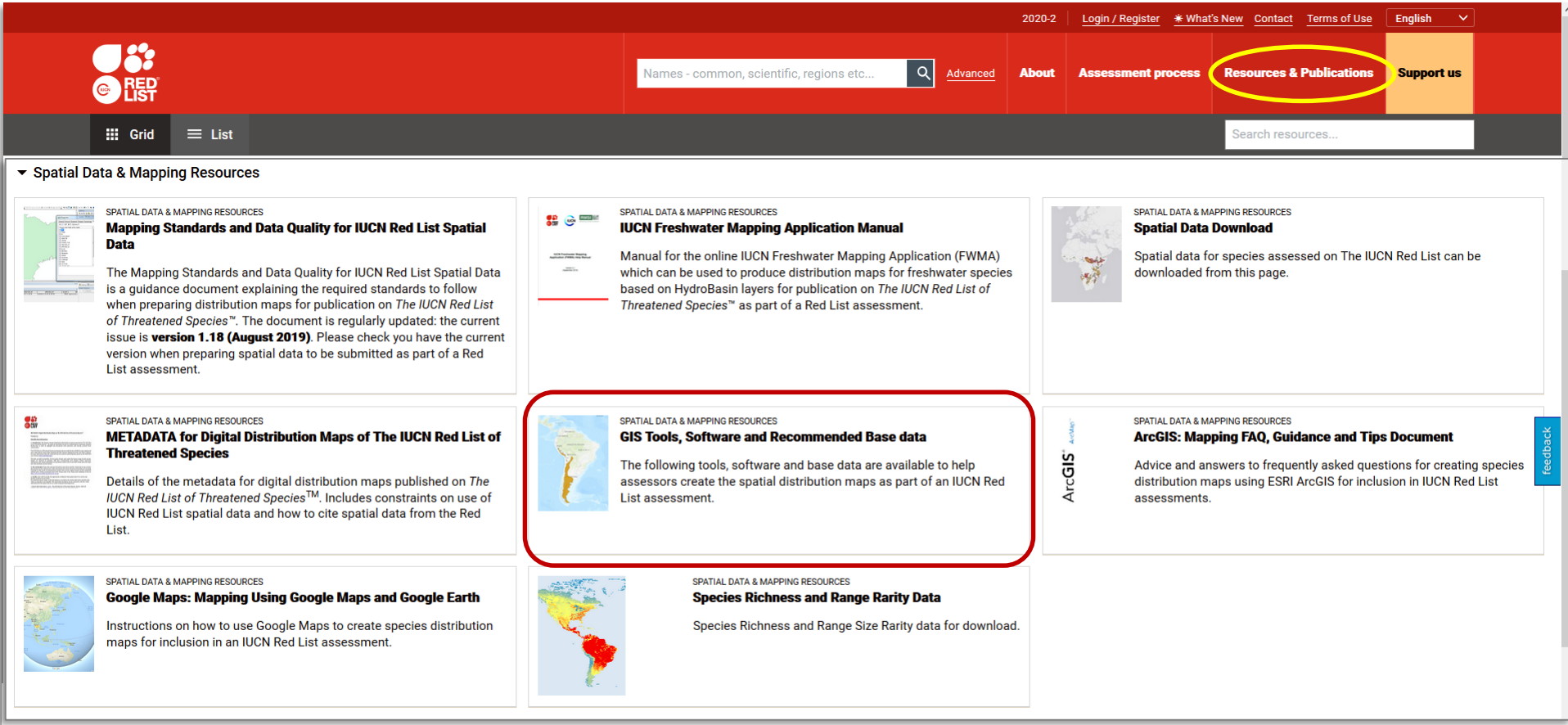
Freshwater Species Mapping Standards for
IUCN Red List Assessments

Version 6
(August 2019)

This is Annex 1 of the "Mapping Standards and Data Quality for IUCN Red List Spatial Data". Downloadable from: https://www.iucnredlist.org/resources/mappingstandards.

THE IUCN RED LIST OF THREATENED SPECIES™

Mapping tools and resources



Mapping tools and resources

GIS tools and recommended base data		
IUCN Red List Toolbox for ArcMap (607 MB)	The ArcGIS IUCN Red List Species Mapping Toolbox.	

Red List Toolbox – for ArcGIS Desktop. Includes:

- ArcToolbox
  - 1. IUCN Species Mapping Tools
    - 1. Create Point Feature Class
    - 1a. Add Point Attribute Fields
    - 2. Create Species Polygon
    - 2a. Add Polygon Attribute Fields
    - 3. Create Polygon Shapefile via Text file
    - 4. Fill Binomial Field with shapefile name
    - 5. Check Fields
    - 6. Split Layer By Species Name
    - 7. Fill Legend Field
    - 8. Species Richness Count
    - 9. Refine Species To Altitude
    - 9a. Refine Species To Bathymetry
    - Add XY Coordinates
    - Clip
    - Define Projection
    - Delete Field
    - Dissolve
    - Erase
    - Merge
    - Project
    - Smooth Polygon

Mapping tools and resources

GIS tools and recommended base data		
EOO Calculator (53 KB)	Creates a minmum convex polygon to calculate extent of occurrence (EOO). For ArcMap 10.1 and above.	

EOO Calculator – automatically draws the minimum convex polygon and calculates EOO based on the mapped points and polygons.

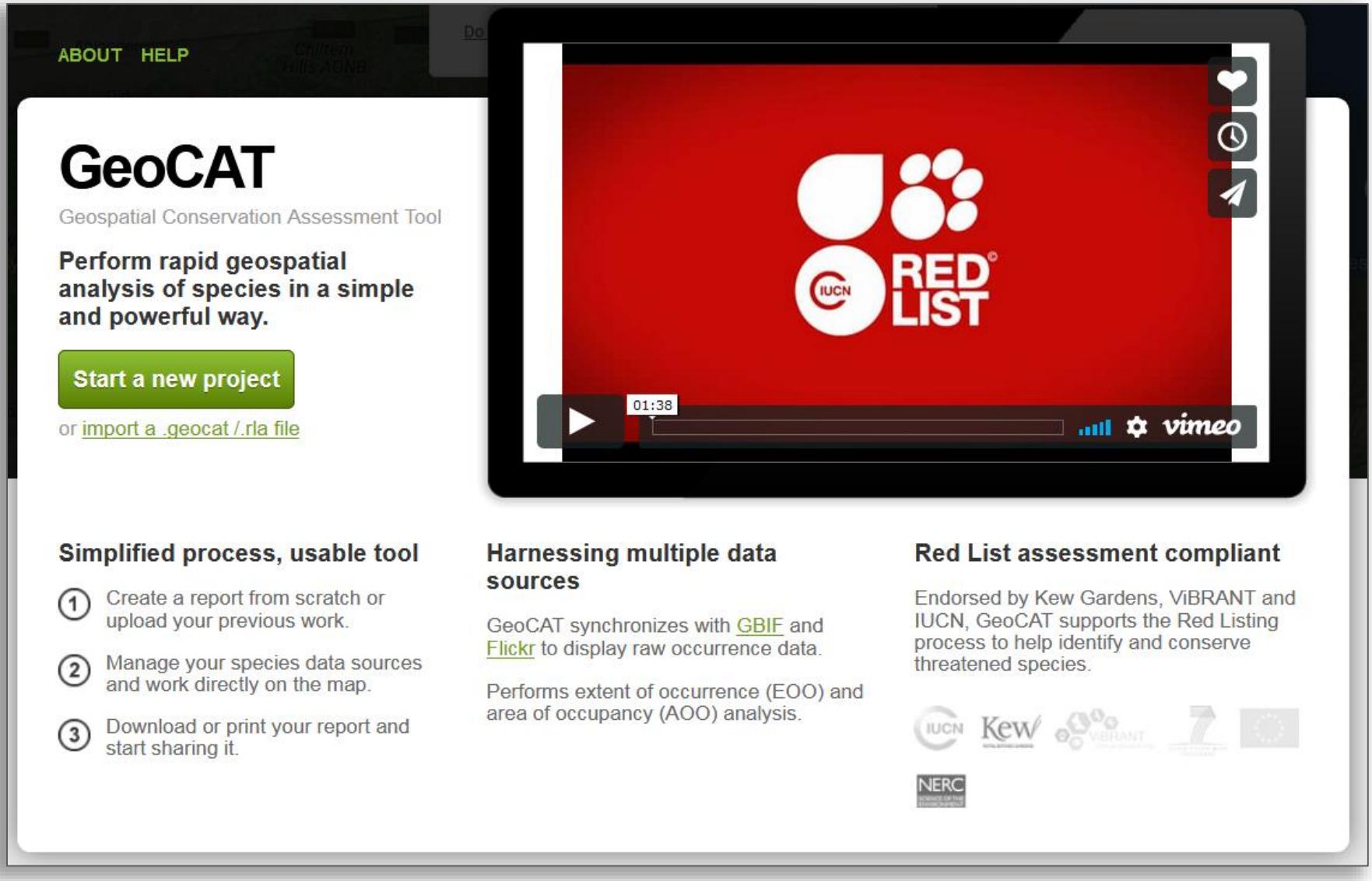
Mapping tools and resources

Freshwater Mapping Application (FWMA)	A free, online mapping application developed to help users create distribution maps for inland water species, highlighting occurrence in HydroBASIN areas.
Freshwater Mapping Application User Manual	Guidance on how to use the FWMA. PDF document.

Freshwater Mapping Application

Mapping tools and resources

Software and online mapping tools	
GeoCAT	GeoCAT is a free online tool for mapping distributions using point data. Developed by RBG Kew.

GeoCAT – Free mapping tool developed by RBG Kew to create point data maps.

Mapping tools and resources