

Tutorial on using QGIS for KBA Identification and Delineation

Version 1.0



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Version 1.1

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Cover image: Screen grab from QGIS showing the northern border of Mozambique.

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Topic 1: Welcome

Welcome to this tutorial on *Using QGIS for KBA Identification and Delineation*. This tutorial is designed to provide new users with a practical task-focused guide to using a Geographic Information System (GIS) for KBA identification and delineation.

This tutorial is not a comprehensive GIS primer. There are many excellent GIS training resources available online, designed for various levels of experience and learning styles — we encourage you to check those out.

We chose to focus on QGIS for this tutorial as it provides the functionality needed for KBA identification and delineation, is freely available, and widely used in the conservation community. KBA Proposers are welcome to use any other GIS software that meets their needs, with the proviso that final KBA boundaries and spatial data on the distribution of trigger biodiversity elements must be submitted as ESRI shapefiles.

Please see the [KBA Standard](#), the [KBA Guidelines](#), the [KBA Proposal Process guidance](#) and the KBA e-learning course [link to follow] for general guidance on KBA identification, delineation, documentation and mapping. This tutorial is a complementary resource, focused on the GIS tasks commonly used in KBA identification and delineation, not a substitute for the KBA Standard or KBA Guidelines.

Learning objectives

By following the steps in this tutorial you will be able to:

- Understand key concepts and terms used in GIS
- Install QGIS on your computer
- Set up a new QGIS project
- Add high-resolution satellite imagery as a base map
- Add national borders and boundaries of existing KBAs and protected areas
- Merge several spatial layers into a single spatial layer
- Download locality data from the IUCN Red List and add to a project as a spatial layer
- Install the GBIF plugin and add GBIF occurrence data to a project
- Download a range polygon from the IUCN Red List and add it to a project as a spatial layer
- Download an ecosystem distribution map from the Red List of Ecosystems
- Digitise a new polygon on-screen and create a new spatial layer

- Adjust or refine an existing polygon on-screen
- Dissolve multiple features into a single feature
- Calculate the area of a polygon feature and store it in the attribute table
- Intersect a range or extent polygon with a site polygon to calculate the area of biodiversity element in a proposed site
- Add attribute data to a spatial layer and edit attribute data
- Export a spatial layer using a standard template for inclusion in a KBA proposal

Topic 2: The importance of projection

In this topic, we'll cover some useful background information on the importance of projection and explain the difference between geographic and projected coordinate reference systems.

This is the only theoretical topic in the tutorial — it is essential background for successfully using GIS in KBA identification and delineation. It draws heavily on material originally developed by [USFWS](#).

The Earth is not a sphere

While we often think of the Earth as a sphere, the circumference at the Equator is actually slightly greater than the circumference at the poles. This shape is represented in GIS by an ellipsoid, i.e. a smooth sphere that has been vertically compressed.



The Earth represented as an ellipsoid (scale is greatly exaggerated). Source: [USFWS](#)

Various models of the true shape of the Earth have been developed, including the widely used WGS 84 ellipsoid that is optimised for global use. The precise location of a point on the surface of an ellipsoid can be described using a standard reference system or datum. The standard datum for the WGS 84 ellipsoid is called WGS 84. Other examples of datums include NAD27 and NAD83, both based on ellipsoids optimised for North America.

Geographic Coordinate Reference Systems (CRS)

The coordinates (e.g., latitude and longitude) of a particular point on the Earth's surface vary, depending on the ellipsoid and datum used. The position of a point on the Earth's surface can be simply and adequately described (or "georeferenced") by recording the coordinates plus datum. This is a geographic coordinate reference system (CRS). The geographic CRS of latitude and longitude (decimal degrees) combined with the WGS 84 datum is referenced by the code "EPSG:4326" in QGIS and "GCS_WGS_1984" in ArcGIS.

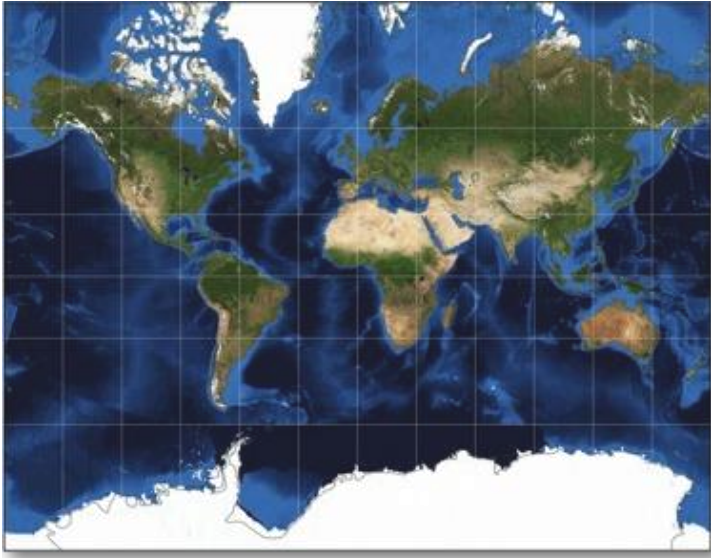
Global Positioning Systems (GPS) commonly use EPSG:4326 by default, but this can be modified, so that your GPS returns data in a different CRS. For this reason, it is essential that you document the CRS of your GPS when recording occurrence data. If the datum is unknown, your GIS may assign the wrong datum and position data points in the wrong place.

Projected Coordinate Reference Systems (CRS)

To represent the near-spherical surface of the Earth on a flat surface, such as a map or a screen, a map projection is needed. Map projections mathematically stretch and transform the curved surface to make it lie flat for easier representation.

Map projections are also used to reproject spatial data layers from a 3-dimensional geographic coordinate system to a 2-dimensional flat (or "planimetric") surface when calculating the area of a site, a species' range or an ecosystem's extent.

Many different projections have been developed, optimised for different purposes. For example, the Mercator projection prioritises accuracy of direction and is widely used in navigation. In contrast, the Mollweide and World Cylindrical Equal-Area projections prioritise accuracy of area and can be used to compare the size of species' ranges or sites around the globe.



Mercator projection – directions are accurate, but area is greatly distorted. Source: [USFWS](#)



Mollweide projection – areas are accurate, but direction is distorted. Source: [USFWS](#)

For the purposes of KBA assessment, the ability to measure area accurately and consistently anywhere on the globe is a high priority. The KBA Guidelines therefore specify that area should be calculated in the World Cylindrical Equal-Area projection (specifically “+proj=cea +lat_ts=0 +lon_0=0 +x_0=0 +y_0=0 +datum=WGS84 +units=m

+no_defs"). This projected coordinate reference system can be referenced by the code "ESRI: 54034" in QGIS and "World_Cylindrical_Equal_Area" in ArcGIS.

As we'll see in the Polar Bear experiment below, it's important to specify the projected CRS when calculating area if we want accurate and consistent results. If we don't tell the GIS exactly how we want to convert our 3-dimensional geographic data to a 2-dimensional planimetric surface for the purposes of calculating area, the GIS may use a default method and give results that are inconsistent with other GIS, or it may simply produce an error message.

Topic summary

Well done — you've completed the topic on the importance of projection.

In the next topic, we'll install QGIS and set up a new QGIS project .

Topic 3: Installing QGIS and setting up a new QGIS project

This topic is provided for new users of QGIS. We'll provide guidance on how to install QGIS on your computer and set up a new QGIS project.

Install QGIS on your computer

QGIS is a freely available GIS software package that can be run on a desktop computer (MacOS, Windows, or Linux).

QGIS can be downloaded [here](#). For new users, we recommend you use the “most stable” all-in-one installer for your operating system.

You can find more detailed guidance on how to install and use QGIS [here](#).

When your installation is complete, navigate to the application and open QGIS.

You'll see a notice at the bottom of your QGIS page whenever a new version is available.

Set general options

Set the default Coordinate Reference System (CRS) for use in new projects:

Click on Settings > Options

Under CRS for Projects, check the option for Use a default CRS and make sure the box says EPSG:4326 – WGS 84.


Click on OK

Options — CRS


▼ CRS for Projects

When a new project is created

☐ Use CRS from first layer added

☒ Use a default CRS EPSG:4326 - WGS 84 

▼ CRS for Layers

Default CRS for layers EPSG:4326 - WGS 84 

When a new layer is created, or when a layer is loaded that has no CRS

☒ Leave as an unknown CRS (take no action)

☐ Prompt for CRS

☐ Use project CRS

☐ Use default layer CRS

☐ Planimetric measurements


If you like, you can also change your general settings to work in kilometers rather than meters.

Click on Settings > Options > Map Tools

For Preferred distance units, select Kilometers

For Preferred area units, select Square Kilometers

▼ Measure Tool

Rubberband color 

Decimal places 3

Keep base unit ☒

Preferred distance units Kilometers

Preferred area units Square Kilometers

Preferred angle units Degrees

Set up a new QGIS project

To set up a new QGIS project, go to the menu bar at the top of your QGIS page.

Select Project > new


You'll see a new blank project.

If you check the lower-right of your QGIS project page, the CRS should be "EPSG:4326".

Save the project

We recommend that you save your QGIS project regularly, so that you don't need to repeat steps every time you work on a similar project.

We also recommend that you keep all your spatial data in a single spatial data folder with subfolders added as needed.

Click on the  button to save the project with an appropriate name in your QGIS folder.

Open a project

To open an existing project

Select Project > Open or Project > Open Recent

Topic summary

Well done — you've completed the topic on setting up a new QGIS project.

We recommend you Save your project now.

In the next topic, we'll add some base maps to your QGIS project.

Topic 4: Adding base maps to your QGIS project

When delineating terrestrial, freshwater or coastal marine KBAs in a GIS, we strongly recommend that you use high-resolution satellite imagery as your background layer as this can help identify areas where the boundary needs to be refined.

In this topic, we'll show you how to add base maps to your QGIS project, together with other useful layers, such as national borders, boundaries of existing KBAs and projected areas. We'll also show you how to implement some related tasks such as merging several spatial layers into a single layer and selecting features (e.g., KBAs) by attributes (e.g., name).

Load ESRI high-resolution satellite imagery into QGIS

Here, we'll walk you through the process of adding high-resolution satellite imagery from the ESRI Living Atlas website. This is the base map we'll use throughout this tutorial. Later, we'll show you where to find additional base maps that might be useful for delineating KBAs.

From the main [ESRI Living Atlas](#) webpage, click on Browse and Base maps.

Click on World Imagery.

In the bottom right of the World Imagery page, you'll see a link for the URL of this map server layer. Copy this.

In the QGIS menu bar, select Layer > Data Source Manager > ArcGIS Map Server.

Then choose to create a New connection and complete the details for the ArcGIS Map Server Layer. In this case enter a Name (e.g., "Living Atlas – World Imagery") and paste in the URL that you copied from the ESRI Living Atlas webpage

Click OK to save the new connection

Note. You'll only have to do this once. This layer will now be available to you in QGIS whenever you want to use it as a base map.

Add ESRI high-resolution satellite imagery as a base map to your project

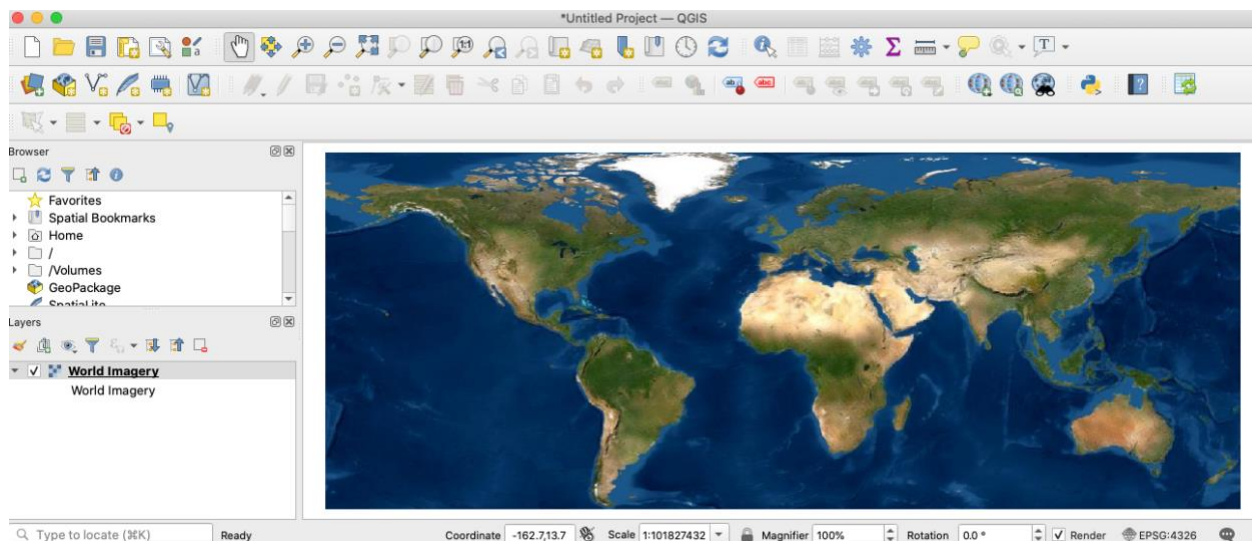
Next, you'll want to add the satellite imagery as a base map to your project.

In the QGIS menu bar, select `Layer > Data Source Manager > ArcGIS Map Service` and select the base map that you just saved

Click `Connect` and select "World Imagery"

Click `Add` and the map server layer will be added to your QGIS project as the base map

Your QGIS project page should now look similar to the image below (right-click on "World Imagery" and select `Zoom to Layer` if the base map doesn't fill your page):



Check your project projection

Check again that the lower-right of your QGIS project page says "EPSG:4326". The World Imagery layer is in a projected CRS (a pseudo-Mercator projection), but is displayed in the specified geographic CRS based on your QGIS project settings.

You can explore different projections by selecting `Project > Properties > CRS`:

- if you copy-paste "EPSG: 3857" into the Filter box, highlight "WGS 84/ Pseudo-Mercator" in the box below, and then click `Apply` and `OK`, you'll see that the base map has been transformed and Greenland is now about the same size as Africa;
- if you copy-paste "ESRI: 54034" into the Filter box, highlight "World_Cylindrical_Equal_Area" in the box below, and then click `Apply` and `OK`,

you'll see that the base map has been transformed again and Africa is now much larger than Greenland.

In reality, Africa is approximately 30 million km², whereas Greenland is approximately 2 million km², so you can see that the World Cylindrical Equal-Area projection is more appropriate for estimating and comparing the size of species' ranges and sites around the globe.

Remember to switch back to EPSG:4326 when you've finished experimenting.

We recommend you `Save` your project now.

Add national borders

The Database for Global Administrative Areas (GADM) is a good source for spatial data on administrative boundaries. We'll use Mozambique for the purposes of demonstration throughout this tutorial.

From the [GADM country page](#), select your country in the drop down box, and then select `shapefile` to download the shapefile as a zipfile

Navigate to the downloaded zipfile in your downloads folder, unzip it, and copy all the files to your `spatial data` folder

To add the new country spatial data layer to your QGIS project:

In the QGIS menu bar, select `Layer > Add Layer > Add Vector Layer`, click on the ... at the right of the `Vector Datasets` box and then navigate to your `spatial data` folder

Select the "gadm .." file with "0.shp" at the end (e.g., `gadm36_MOZ_0.shp`) and click `Open`


Click `Add` then `Close`

On the left of your QGIS project page, you'll see a list of the spatial data layers, right-click on your new country layer and select `Zoom to Layer`

Note that the GADM files with higher numbers represent lower-level administrative boundaries. You can follow a similar process to add those to your QGIS project if they might be useful.

If you choose to use a different shapefile (e.g., the official shapefile for your country's national boundaries), follow the same process above but select the appropriate ".shp" file.

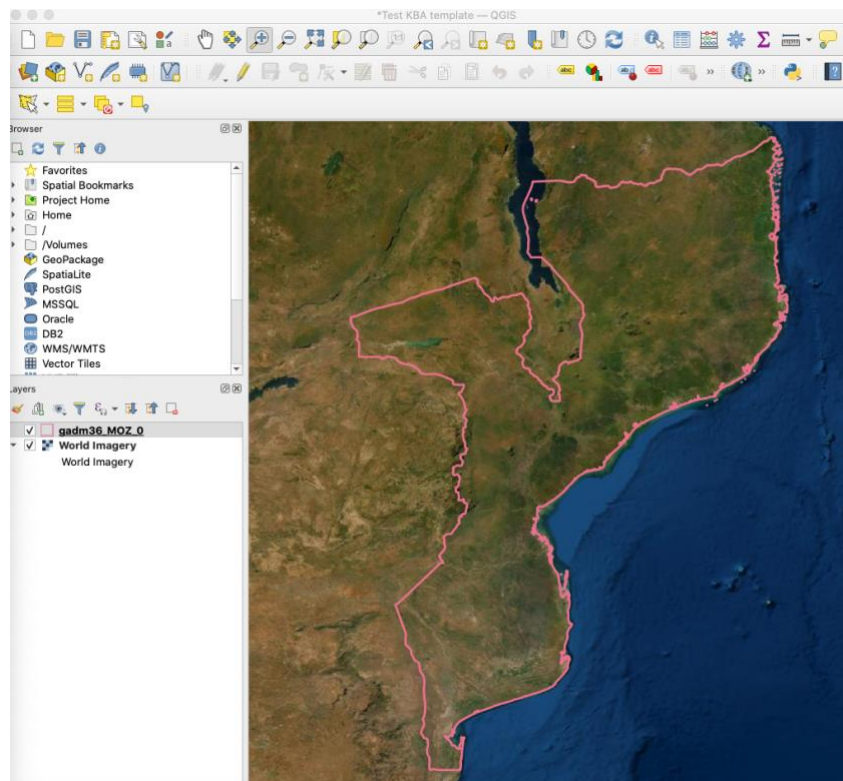
To switch from a filled polygon to an outline:

Click again on your `country` layer and then click on the  button above-left to open the Layer Styling Panel

Select one of the outline options (e.g., the pink square — you may need to scroll down) and then click Apply


Close the Layer Styling Panel by clicking on the x in the upper-right

Your QGIS project page may now look similar to this:



If you want to zoom in to check how well the country borders align with natural features:

Select the  button in the main toolbar and then select the area on the map where you want to focus

To move the area in view without changing the zoom level, select the  button in the main toolbar and then use your mouse to pan around the map

To switch between displaying and not displaying a spatial data layer, check or uncheck the box next to the layer in the `Layers` Panel on the left

For example, the image below shows how the northeastern border of Mozambique, as represented in the GADM shapefile, follows the River Rovuma and the coastline.



We recommend you `Save` your project now.

Import existing KBAs

Request KBA spatial data for your country from the [KBA website](#). When you receive them, save the files in your `spatial data` folder.

To add the global KBAs spatial data layer to your QGIS project:

In the QGIS menu bar, select `Layer > Add Layer > Add Vector Layer`, click on the `...` at the right of the `Vector Datasets` box and then navigate to your `spatial data` folder

Select the “KBAsGlobal ... POL.shp” and click `Open` then `Add`

Click on the ... again, then select “KBAsGlobal ...PNT.shp” (if it exists) then click Open then Add then Close

Note. You’ll only have a “KBAsGlobal ...PNT.shp” if some of the KBAs in your country are denoted by points rather than polygons.

If you want to identify a polygon:

Make sure the relevant spatial data layer is highlighted in the left Layer Panel



Click on the button in the main toolbar to Identify Features and then click on the polygon in question

A table will pop up showing the attribute data for the selected feature; click on the x to close



You can follow the instructions above to change the Layer Styling (hint: click on). If you choose a turquoise fill and 50% opacity, your QGIS project will now look similar to the image below:



We recommend you Save your project now.

Import existing protected areas

Run a Google search for protectedplanet.net and your country name. (We'll use Mozambique's protected areas in the examples below so you may want to download those to follow along.)

Download the relevant dataset by following the relevant on-site instructions, and selecting SHP

Navigate to the downloaded zipfile in your downloads folder, unzip everything, and copy all the files to your spatial data folder

This dataset is generally packaged as 3 separate polygon shapefiles.

In QGIS, follow the process above to add each of the 3 polygon shapefiles to your QGIS project (hint: start by selecting Layer > Add Layer > Add Vector Layer; click Open and Add for each layer, then Close when you're done)

Merge several spatial layers into a single layer

You can choose to merge these 3 shapefiles (or layers) into a single layer:

In the QGIS menu bar, select `Vector > Data management Tools > Merge Vector Layers`

Click on ... next to the `Input Layers` box and check the 3 folders containing your 3 shapefiles (e.g., named "WDPBA_WDOECM..."), then click OK

Under `Destination CRS`, select `EPSG:4326 – WGS 84`


Click on ... next to the `Merged` box, select `Save to File` and then save your new merged shapefile in your spatial data folder, then click OK

Finally click `Run` at the lower-right

Your new shapefile will be added to your QGIS project; you can right-click on the old "WDPBA_WDOECM..." files and select `Remove Layer` to remove from them from your QGIS project; the files will be removed from display, not deleted

You may also want to move the `KBA` layer above the `WDPA` layer in the `Layers Panel`, so that KBAs are superimposed on protected areas

Repeat this process for point data if necessary.


Follow the instructions above to change the `Layer Styling` (hint: click on ). If you choose a green fill and 50% opacity, your QGIS project will now look like the image below:




We recommend you Save your project now.

Select features by attribute

It is often useful to select one or more features from a set of features in a spatial layer. Here, we'll demonstrate one way to do this, but QGIS provides several different options.

In the `Layers Panel` at the left of your QGIS project, right-click on your merged protected area layer and select `Open Attribute Table` (or click on the  button in the toolbar)

Click on the  button at the top to `Select/filter features using form`

At the box labelled NAME, type “Chimanimani”



At the lower-right, click on the button; 2 features should now be selected, both named “Chimanimani”, corresponding to the Chimanimani National Park and its buffer zone

Close the Attribute Table and you’ll see the selected features highlighted in bright yellow — you can right-click on your merged protected area layer and select Zoom to Selection to zoom in.

Sometimes it’s useful to save selected features as a new shapefile:

Right-click again on your merged protected area layer and select Export > Save Selected Features As ...

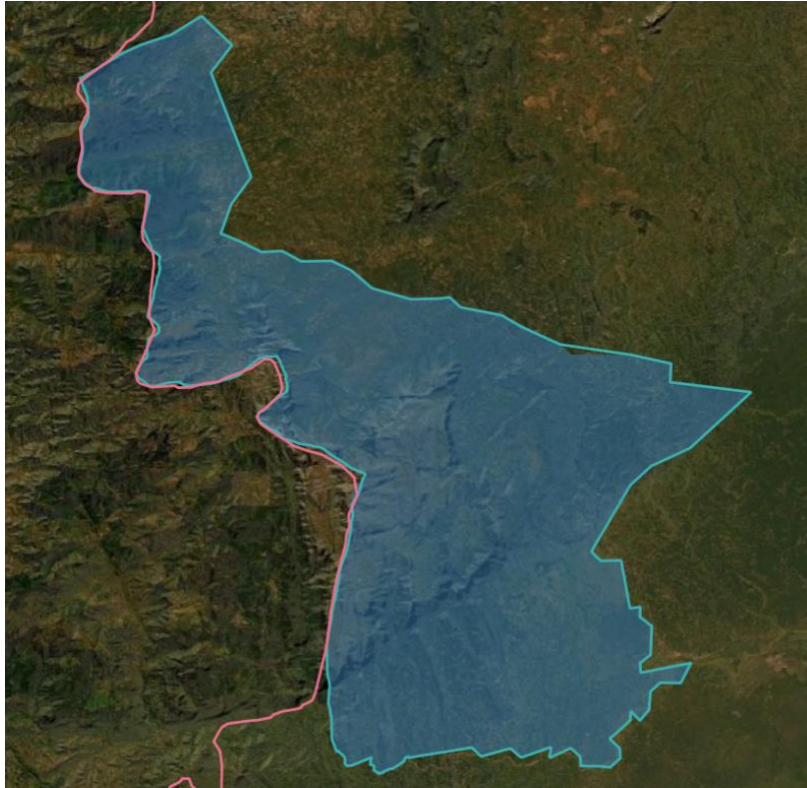
Click on the ... at the right of the File name box and then navigate to your spatial data folder; save the layer with a suitable name (e.g., “Chimanimani”); click save

We recommend that you keep the data layer in its original geographic CRS at this stage; the CRS box should say EPSG:4326 – WGS 84

Click ok

Your new shapefile will now be listed as a spatial layer in the Layers Panel

Follow the instructions above to change the Layer Styling. If you choose a blue fill and 50% opacity, your QGIS project will now look similar to the image below. (We have unchecked the merged WDPA layer in the Layers Panel and changed the Layer Styling of the KBA layer to a turquoise outline to show the recently confirmed Chimanimani KBA based on the Chimanimani National Park and its buffer zone.)



Topic summary

Well done — you’ve completed the topic on setting high-resolution satellite imagery as a base map for your project and on importing spatial data on existing KBAs and protected areas.

We recommend you [Save your project now](#).

In the next topic, we’ll add some occurrence data to your project.

Topic 5: Working with occurrence data

In this topic, we'll show you how to download occurrence data from the IUCN Red List and add it to your QGIS project as a spatial layer and how to import occurrence data from the Global Biodiversity Information Facility (GBIF). Even if you do not plan to use number of localities as an assessment parameter, recent and reliable occurrence data can be useful in providing confirmation of presence.

In addition, we'll show you how to count the number of points (e.g., occurrences) in a polygon, although we note that it is often better to estimate the number of localities in a proposed site visually.

Download occurrence data from the IUCN Red list and add to a project as a spatial layer

Many plant species that have been assessed for the IUCN Red List have occurrence data and no range map. For the purposes of demonstration, we'll look at the occurrence data for *Aloe plowesii* (VU), a geographically restricted species confined to the rocky grasslands of the central Chimanimani Range on the border of Zimbabwe and Mozambique.

Go to the [IUCN Red List](#) and search for "*Aloe plowesii*", click on the download button in the upper-right, and select Range data - Points (CSV) and complete the data request form. You may need to create an account first

Navigate to the downloaded zipfile in your downloads folder, unzip everything, and copy all the files to your spatial data folder — we recommend you save the data to a subfolder named "*Aloe_plowesii*" or similar.

In the QGIS menu bar, select Layer > Add Layer > Add Delimited Text Layer, click on the ... at the right of the File name box and then navigate to the relevant species subfolder in your spatial data folder

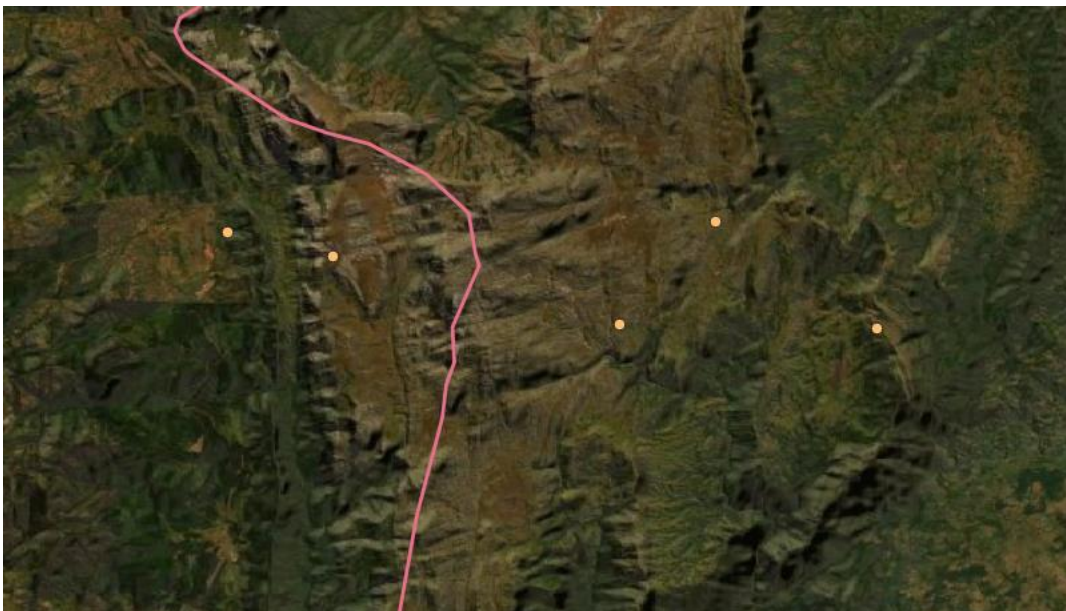
Select the "points_data.csv" file and click Open

Note that the section on Geometry Definition should have Point Coordinates checked, the X field should be "longitude", the Y field should be "latitude", and the Geometry CRS should say "EPSG:4326 – WGS 84"

Click Add then Close


In the `Layers Panel` on the left of your QGIS project page, you'll see a list of the spatial data layers, including a new layer called "points_data". This is not very descriptive, so you can rename the layer in your QGIS project by right-clicking on the layer and selecting `Rename Layer` (e.g., as "*Aloe plowesii*"); this is just cosmetic — it does not change the name of the underlying file)

You can change the `Layer Styling` just as you did for polygons. If you choose yellow and increase the size to "3", then `Zoom to Layer` your QGIS project will now look like the image below. (The pink line represents the border between Zimbabwe to the west and Mozambique to the east.)



If you check the IUCN Red List account for *Aloe plowesii*, you'll see that 2 threat-defined locations have been identified from a total of 8 collections. The Mozambique KBA Secretariat reviewed this information in consultation with relevant species experts and determined that each of these locations likely represents a discrete population for the purposes of KBA identification: one in Mozambique (represented by 3 georeferenced occurrences in the spatial data table) and one over the border in Zimbabwe (represented by 2 georeferenced occurrences in the spatial data table).

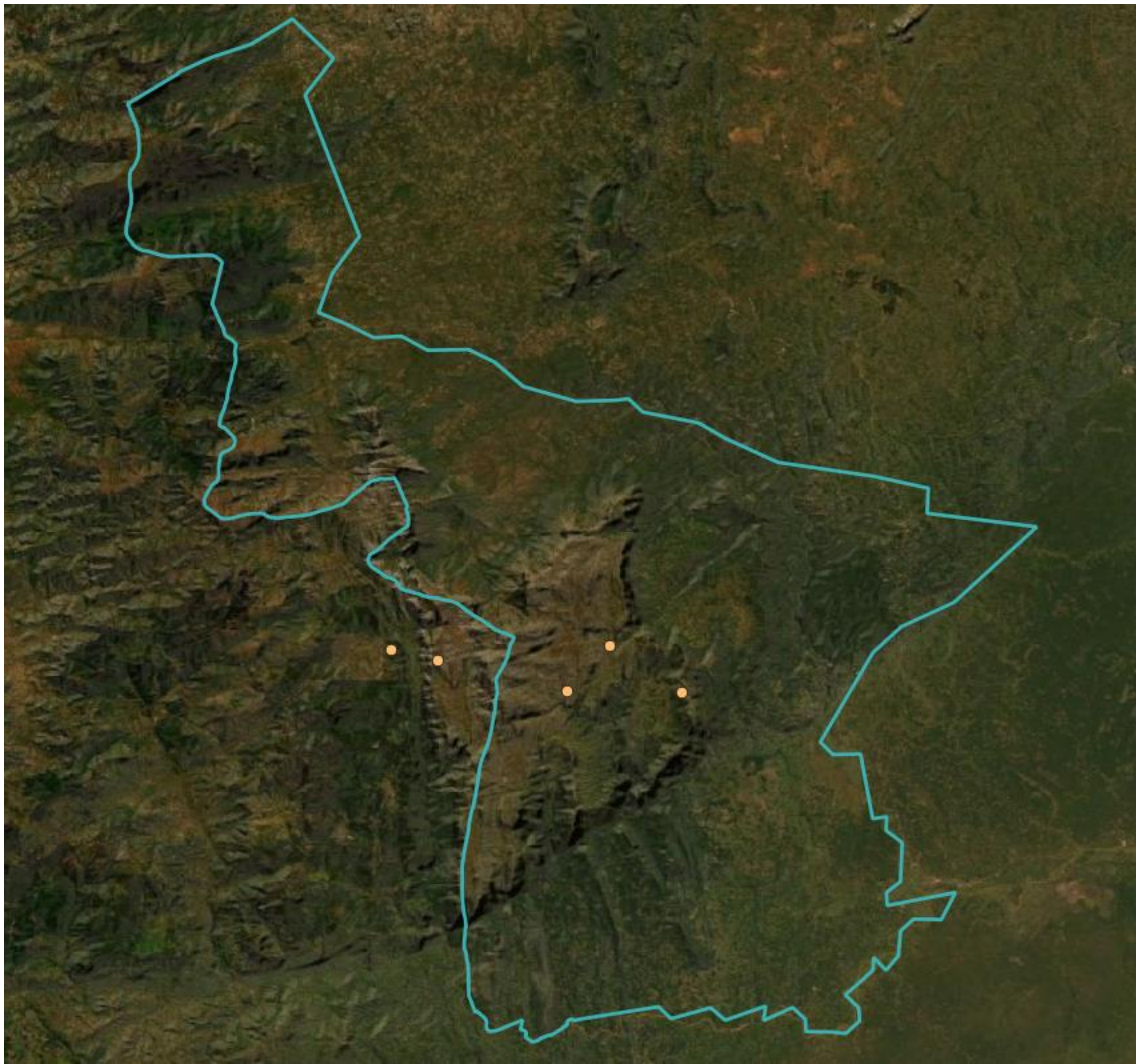


If you click on the  button in the main toolbar to `Identify Features` and then click on a point, you'll see information about that particular occurrence, including the collection date (i.e. `event_year`).


Count the number of occurrences in a polygon

Please review the KBA Guidelines and consult with species experts before using number of localities as an assessment parameter. QGIS includes functionality to count the number of points in a polygon feature, but, given that one discrete population may be represented by multiple points, it is often better to estimate the number of localities in a proposed site visually. (Note that it's important to involve species experts in the process of identifying discrete populations from occurrence data as they will have knowledge of the species' dispersal range. Also, some known occurrences may not be included in the spatial data table.)

For example, if we wanted to estimate the number of localities of *Aloe plowesii* in the Chimanimani KBA, we would overlay the points on the polygon, right-click on the points layer and select `Zoom to Layer`. In the image below, you can see clearly that all the georeferenced occurrences in Mozambique (representing a single locality according to relevant experts) fall within the Chimanimani KBA (we have zoomed out so that you can see the whole KBA).



As a final step, we should check whether the occurrence data can be used to confirm recent presence of the species in the KBA. Here, we'll demonstrate one way to do this, but QGIS provides several different options.


In the main toolbar, click on the  button to select `Select Feature(s)` and then draw a box that encompasses all the points in the KBA

Now open the `Attribute Table` for the occurrence data layer (hint: click on



) and you'll see the 3 points in the KBA highlighted




If necessary, click on the  button at the lower-right to `Switch to table view` — you can then easily see the `event_year` for each of the selected points.


In this case, all 3 georeferenced occurrences from the Chimananimani KBA were collected in 2014 — this information can be used to confirm the recent presence of the species in the KBA.

Import occurrence data from the Global Biodiversity Information Facility (GBIF)

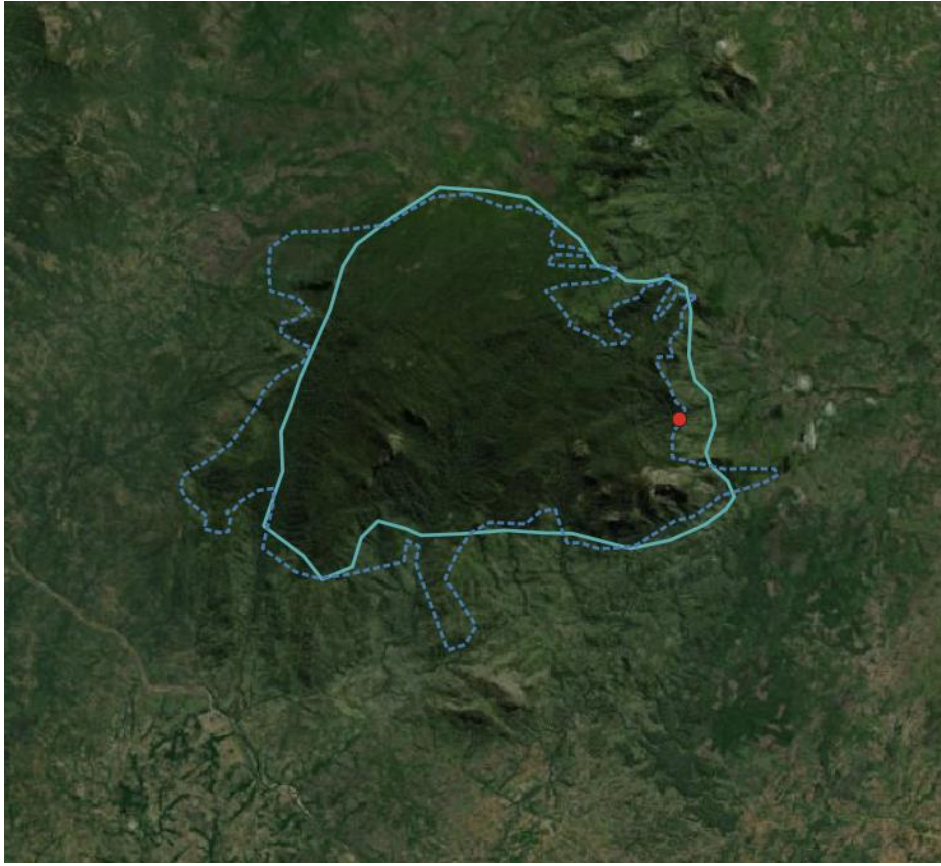
There is a plugin for retrieving occurrence data from the Global Biodiversity Information Facility (GBIF) and importing it directly into QGIS. GBIF data may contain errors, but datasets provided by museums and recognised experts are often useful, especially for species that do not yet have an IUCN Red List account.

In the QGIS menu bar, select `Plugins > Manage and install plugins`. In the left panel, click `All` and in the search box, type “GBIF occurrences”. Select `GBIF Occurrences` and click on `Install Plugin`. Once the plugin is installed, click on `Close`

Once the GBIF Plugin is installed, click on the  button to open the GBIF Occurrences window. Enter the name of the species you wish to search for (e.g., “*Nadzikambia baylissi*”, which occurs in Mozambique) and click on `Load occurrences`

The occurrence data for the species will show up in your `Layers Panel`. In this case, there is a single occurrence. If you open the `Attribute Table`, , you’ll see that 4 specimens were collected in 2009 by Bill Branch (Professor W. R. Branch of the Port Elizabeth Museum in South Africa).

This [article](#) provides some more information about the discovery of the Mount Mabu Chameleon (*N. baylissi*). The species is restricted to the forested slopes of Mount Mabu, as indicated by the species’ range map in the IUCN Red List account. It is a trigger species for the [Mount Mabu KBA](#). In the image below, you can see how the species’ range (blue dotted outline) encompasses the forested area, extending slightly beyond the boundaries of the KBA (turquoise outline). The GBIF occurrence data collected in 2009 (red point) can be used to confirm the species’ recent presence in the KBA.



Topic summary

Well done — you’ve completed the topic on working with occurrence data.

We recommend you [Save your project now](#).

In the next topic, we’ll add some range maps to your project.

Topic 6: Working with range polygons

In this topic, we'll switch from point data to polygon data. We'll show you how to download a range polygon from the IUCN Red List and add it to your QGIS project as a spatial layer. We'll also introduce the coding system used to distinguish different types of range polygon. It is essential that you check these codes to confirm that you are using the appropriate polygons when estimating range. For example, you should only use range polygons coded as "Extant" or "Probably Extant".

In a future version, we'll also show you how to download ecosystem distribution maps from the Red List of Ecosystems, once a suitable mechanism has been established.

Download a range polygon from the IUCN Red List and add it to a project as a spatial layer

For many species, range maps can be downloaded from the IUCN Red List account. IUCN range shapefiles often comprise multiple features (i.e. individual polygons or groups of polygons), each coded in terms of Presence, Origin and Season.

For non-migratory species, the [KBA Guidelines](#) specify that KBA Proposers should use polygons coded as follows:

- Presence = 1 (Extant) and 2 (Probably Extant);
- Origin = 1 (Native) and 2 (Reintroduced) and 6 (Assisted Colonisation); and
- any Season code (see below for migratory species).

For migratory species that have distinct breeding and non-breeding ranges identified in IUCN Red List range maps, breeding and non-breeding ranges will typically be assessed separately:

- KBA Proposers should use the area of the range coded as follows for the breeding range:
 - Presence = 1 (Extant) and 2 (Probably Extant);
 - Origin = 1 (Native) and 2 (Reintroduced) and 6 (Assisted Colonisation); and
 - Seasonality = 1 (Resident) and 2 (Breeding Season) and 5 (Seasonal Occurrence Uncertain).
- KBA Proposers should use the area of the range coded as follows for the non-breeding range:
 - Presence = 1 (Extant) and 2 (Probably Extant);

- Origin = 1 (Native) and 2 (Reintroduced) and 6 (Assisted Colonisation); and
- Seasonality = 1 (Resident) and 3 (Non-breeding Season) and 5 (Seasonal Occurrence Uncertain).

Let's consider a specific example, the Whooping Crane (*Grus americana*, EN):

Go to the [IUCN Red List](#) and search for “Whooping Crane”, click on the download button at the upper-right, and select Range data - Polygons (SHP)

Navigate to the downloaded zipfile in your downloads folder, unzip it, and copy all the files to your spatial data folder — we recommend you save the data to a subfolder named “Grus_americana” or similar.


In the QGIS menu bar, select Layer > Add Layer > Add Vector Layer, click on the ... at the right of the Vector Datasets box and then navigate to the relevant species subfolder in your spatial data folder

Select the “data_0.shp” file and click Open


Click Add then Close

The new layer is called “data_0”, which is not very descriptive, so you can rename the layer in your project by right-clicking on the layer and selecting Rename Layer (e.g., as “whooping_crane”); this is just cosmetic — it does not change the name of the underlying file)

Right-click on the Whooping Crane layer again and select Open Attribute

Table (or highlight the layer in the Layers Panel and click on the  button in the toolbar)

The panel on the left indicates that there are four separate “features” (i.e. polygons or groups of polygons); highlight each one in turn and check how they differ in terms of Presence, Origin and Season — each polygon is coded Presence = 1 (i.e. the species is considered Extant throughout the mapped range); and Origin = 1 (i.e. the species is considered Native throughout the mapped range), but Season is coded 1, 2, 3, or 4.


If you like, you can click on the  button to Dock Attribute Table, which will allow you to select different polygons in the Attribute Table and see their spatial extent in your QGIS Project simultaneously


Let's imagine we want to assess possible KBAs for the Whooping Crane in its breeding range only. Following the KBA Guidelines, we want to select Seasonal = 1 (Resident) and 2 (Breeding Season) only:

With a single species and just 4 polygons, the simplest method is to highlight the relevant polygons (i.e. those coded Seasonal=1, or Seasonal=2), using the shift key to highlight multiple rows — you'll see the 2 small polygons in the northwest and southeast of the range highlighted in bright yellow on your map

If you want to save this as a new shapefile, right-click on the Whooping Crane layer, select Save Selected Features As . . . , then save the selected features in your spatial data folder under a new name (e.g., "Grus_americana_breeding")

You can repeat this process to select the non-breeding range.

Click on the  button to Deselect all features from the current active layer

Select polygons coded Seasonal=1, or Seasonal=3. If you want to select multiple polygons that are non-adjacent in the table, click the  button at the lower-right to Switch to form view then check the relevant boxes.

The non-breeding range comprises 2 small polygons in the south of the range. The migration corridor or passage range (Seasonal = 4) is not included in either the breeding or non-breeding range.

Remember that, for species that have been extirpated from part of their range or introduced for non-conservation purposes outside their native range, you only want to include polygons coded Presence = 1 or 2 and Origin = 1, 2 or 6.

In the image below, the passage range is shown in pale yellow, the breeding range in purple, and the non-breeding range in red hatch.



We'll not return to the Whooping Crane for a while, so you can tidy up your Layers Panel by right-clicking and selecting `Remove Layer`.

Download an ecosystem distribution map from the Red List of Ecosystems

[This section will be completed once a mechanism for downloading ecosystem distribution maps from the Red List of Ecosystems has been established.]

Topic summary

Well done — you've completed the topic on working with range polygons.

We recommend you `Save` your project now.

In the next topic, we'll look at GIS tools for delineating KBAs.

Topic 7: GIS tools for delineating KBAs

This topic focuses on GIS tools and techniques for adjusting the boundaries of existing KBAs or delineating new KBAs. Please see the KBA Standard and KBA Guidelines for guidance on the principles that should be followed in KBA delineation.

We'll start by showing you where to find additional base maps that might be useful for KBA delineation. We'll then show you how to digitise a new polygon or refine an existing polygon. We'll also use this opportunity to show you how to dissolve multiple features (e.g., polygons) into a single feature (e.g., set of polygons with shared attributes). This can be useful if, for example, you digitise several spatially separate polygons representing the range of a species (with the same values for presence, origin and season).

Additional base maps for delineating KBAs

When working on KBA delineation, you may want to refer to additional base maps. You can access a wide variety of base maps through the `QuickMapService` plugin.

First, load or update the plugin as follows:

In the QGIS menu bar, select `Plugins > Manage and Install Plugins`

`Check Installed` to see whether `QuickMapServices` is already installed and upgrade if a new version is available

If `QuickMapServices` is not already installed, check `Not installed` and follow the instructions

Next, search for additional base maps and add them to your project:

In the QGIS menu bar, select `Web > QuickMapService > Search QMS`

Try searching for “google satellite hybrid” or “google terrain hybrid” and adding those to your project

To identify additional layers that are available for your country, zoom to your country and then click `Filter by extent`

Basemaps for marine applications

If you are working on marine KBAs, you will probably want to refer to a basemap that shows ocean bathymetry. After installing the `QuickMapService` plugin, as above:

In the QGIS menu bar, select Web > QuickMapService > Search QMS

Search for “ocean” and add the ESRI ocean basemap to your project

When delineating marine KBAs, it may be useful to reference bathymetric contours (i.e. contours indicating the depth of the sea floor). Bathymetry data can be downloaded from the General Bathymetric Chart of the Oceans (GEBCO) in various forms. Here we will demonstrate how to download bathymetric data for a specific area and display the data as bathymetric contours.

On the GEBCO page for [gridded bathymetry data](#), click on “download data for user-defined areas” and then “application”

Select your region of interest on the map; in the panel on the left, select the latest version, and then check the box under GeoTIFF and Grid, then click on “Add to basket” and then “View basket”.

Once your data have downloaded, navigate to the downloaded zipfile in your downloads folder, unzip it, and copy all the files to your spatial data folder

In the QGIS menu bar, select Layer > Add Layer > Add Raster Layer, click on the ... at the right of the Raster Datasets box and then navigate to your spatial data folder

Select the “gebco ..” file with “.tif” at the end and click Open

Click Add then Close

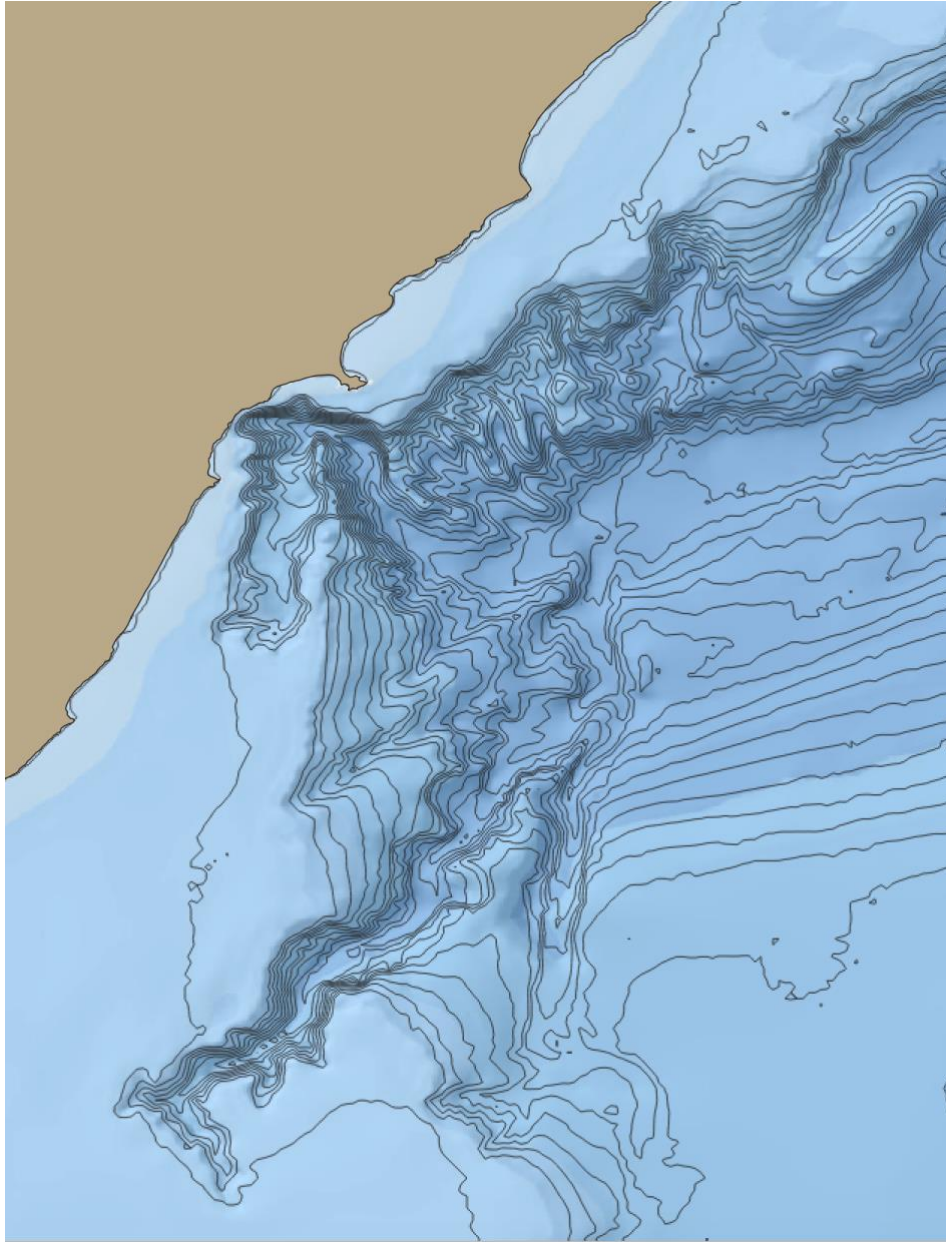
In the Layers Panel, highlight your new bathymetry layer and open the

Layer Styling Panel,



In the dropdown box at the top, select Contours

The image below shows the ESRI ocean layer with GEBCO contours overlaid, revealing the complex bathymetry around New Zealand’s Kaikoura Canyon.



Note that the GEBCO datasets have traditionally focused on deeper waters (e.g., depths greater than 200 m), but work is ongoing to incorporate datasets for shallower waters (see [here](#) for details). In the meantime, you may need to reach out to your national hydrographic service to access bathymetric data for shallower waters in your region.

Digitise a polygon and create a new spatial layer

You may wish to delineate an entirely new site which requires a new polygon to be digitised. To do so, first make sure that the appropriate Layers Panel, Digitising Toolbar, Manage Layers Toolbar and Map Navigation Toolbar are displayed.

(Panels and Toolbars can be added or removed by right-clicking the grey panel above the base map.)

In the Manage Layers Toolbar, click the New Shapefile Layer button,



Your File name should be something useful (e.g., the proposed name for the new KBA). Click the ... next to the File name field, navigate to the appropriate folder, and click Save


Change Geometry type to Polygon

By default, the CRS is set at EPSG:4326 – WGS 84. Once the new polygon layer has been created, it can be projected into World Cylindrical Equal-Area projection later, if necessary.

Polygon attributes can be added within the New Field section and the Type specified as Text Data, Whole Number, Decimal Number, or Date. For each new field, type the Name, then select the appropriate Type, click Add to Fields List. After all fields have been added, click OK. (Please see the shapefile templates provided on the KBA website (on the [Tools page](#)) for standard Field Names and Types for KBA shapefiles.)

Your new shapefile will now show up as a spatial layer in your Layers Panel.

To draw the polygon:

First make sure the new Layer is highlighted, then click the Toggle Editing button, , followed by the Add Polygon Feature button, .

On your base map, select as many points as necessary to delineate an accurate and precise boundary. When satisfied with your boundary, right-click.

In the pop-up window, fill in the Attributes for the new polygon. You can leave the id field as NULL or assign a name or number. Then click OK.

In most scenarios, you will only create one polygon. However, if you are proposing a site that consists of more than one polygon:

Assign a unique id to your initial polygon and click OK.

Then, draw a new polygon boundary, right-click, assign a unique id to the new polygon, then click OK. Repeat this process until all desired polygons have been delineated.

Finally, click Save Layer Edits button, , to save your new polygon layer.

You can practice by delineating polygons around lakes or islands, as shown in the image below.





For large polygons, it will often make sense to delineate an initial polygon roughly at a relatively broad spatial resolution (e.g., 1:50000) and then refine it at a finer resolution (e.g., 1:15000). You can check the Scale at the bottom of your QGIS project window. See below for how to refine an existing polygon.

Adjust or refine an existing polygon on-screen and create a new spatial layer


When adjusting an existing polygon, we strongly recommend that you first save a copy of the existing polygon and edit that.

Right-click on the target layer and select `Export > Save Features As...` to save the layer under a new name. The new layer will show up in your Layers Panel

Highlight the new layer, click the Toggle Editing button, , then select the Vertex Tool (Current Layer), . Hover the cursor over the polygon to reveal the points used to delineate the existing polygon; click on a point then move the cursor to shift the point

Note that you can add and remove points as part of this process. To create a smoother boundary, create a new point by clicking on the line midway between two existing points and then move the new point

To remove a point, highlight the point and then press delete on your keyboard

Repeat this process to redelinate the polygon, then click the Save Layer Edits button, , to save your new polygon.

For example, we edited the polygon in the image above to include some of the sand bars. The image below shows both the original and edited polygons.



Dissolve multiple features into a single feature

In some cases, it may be useful to combine multiple polygons represented as different features into a single one. For example, it may be useful to dissolve different polygons representing a species' breeding or non-breeding range into a single feature.

On the QGIS menu bar, select `Vector > Geoprocessing Tools > Dissolve ...`

A new window will open that will ask you to select which layer you wish to dissolve (i.e. the `Input Layer`), and which `Dissolve field(s)` to use. If the `Dissolve field(s)` box is left blank, all polygons in the layer will be merged into a single feature. Alternatively, if one or more fields are selected, by clicking on the `...` to the right of the `Dissolve field(s)` box, selecting one or more fields and then clicking `ok`, polygons with the same value for selected fields will be dissolved into a single feature.

For example, we created a new layer representing the distribution of mature males and females of a fictitious sea lion species in the breeding and non-breeding season (left panel in image below; numbers refer to polygon ids). The layer comprises 3 polygons represented as separate features — the `Attribute Table` is shown below.

	id	Species	Male	Female	Breeding	Count
1	1	sea lion	1	1	1	1500
2	2	sea lion	1	1	0	1000
3	3	sea lion	1	0	0	500

Applying the `Dissolve` tool with `Dissolve field(s)` left blank, dissolves the 3 polygons into a single feature. But, applying the `Dissolve` tool with “`Breeding`” selected as a `Dissolve field`, dissolves the 2 polygons coded `Breeding = 0` into a single feature (shown in green in the right panel below), leaving the remaining polygon (coded `Breeding = 1`) as a separate feature.



Note that, when dissolving polygons, the attributes of one input polygon will be used to populate the attributes for the dissolved polygon. Please check the `Attribute Table` carefully to make sure that it accurately represents the attributes of dissolved polygons and edit as appropriate. (For example, in this case, the count for one of the two non-breeding polygons is retained, so we must edit the attribute data (see below) to show the sum of the counts of the dissolved polygons instead.)

Topic summary

Well done — you’ve completed the topic on GIS tools for delineating new KBAs.

We recommend you `Save` your project now.

In the next topic, we’ll look at how to calculate area and values of area-based parameters.

Topic 8: Calculating area and area-based assessment parameters

In many cases, accurate estimation of area-based parameters (e.g, species' range or ecosystem extent) is essential for assessing whether a site qualifies as a KBA. Area calculations for the same polygon may vary depending on the projection used — it is important that you specify the projection correctly to ensure that area calculations used in KBA assessments are consistent.

In this topic, we will take some time to demonstrate this point, by using various methods to calculate the area of the global range polygon for the Polar Bear. We provide two methods for calculating area correctly for the purposes of KBA assessment in QGIS — you may use whichever you prefer as the answer will be the same.

We'll also show you how to intersect a range polygon with a site polygon and calculate the area of the range that falls within the site. We'll first demonstrate this using a non-migratory species as an example, and then look at how to do this for a migratory species with multiple range polygons coded by season.

A Polar Bear experiment to demonstrate the importance of projection

As explained above, it's important that any layers used for area calculations are based on the standard equal-area projection used in KBA analysis: the World Cylindrical Equal-Area projection (i.e. ESRI: 54034).

QGIS is a user-friendly GIS package that provides several methods for estimating the area of a polygon. It's important that you use the correct method for KBA identification. If you don't, the results may not match calculations from other GIS packages — the scale of the error will depend on the size of the area and its geographic location. Given that KBA assessment often relies on accurate estimation of the proportion of a species' range or an ecosystem's extent at a site, it's essential that area calculations are accurate and consistent. We'll demonstrate this issue with an experiment using the range map for the Polar Bear.

Polar bear range map

For the purposes of this exercise, we'll use the IUCN Red List range map for the Polar Bear (*Ursus maritimus*, VU):

Go the [IUCN Red List](#) and search for “Polar Bear”, download the range data and add the Polar Bear range shapefile to your QGIS project as you did for the Whooping Crane. We recommend you save the Polar Bear data to a subfolder named “Ursus_maritimus” or similar

The new layer is called “data_0”, so you might want to rename it as you did for the Whooping Crane

Rough-and-ready area estimation: \$area

First we’ll estimate the area of the Polar Bear range using a rough-and-ready method for area estimation using unprojected spatial data. In this method, QGIS can estimate the area of an unprojected polygon (e.g., a polygon in EPSG:4326) by referring to the underlying ellipsoid (e.g., WGS 84). This method can produce good results, especially for small areas near the Equator, but it’s not reliable.

Check the CRS by right-clicking on the Polar Bear layer, selecting Properties and then Source; you’ll see that the Assigned CRS is EPSG:4326 – WGS 84. This means that the spatial layer is the standard geographic coordinate system based on the WGS 84 ellipsoid and has not been projected. Close the Layer Properties box.



Now open the Attribute Table, for the Polar Bear layer



Click on the button at the top to open the Field Calculator

In the center box, select Geometry and then double-click on “\$area”

The area estimate will show in the lower-left by Preview: 22,634,789 (plus a few decimal places); the estimate will be in square kilometers if you set that as your Preferred area units earlier.

Note down the area estimate somewhere handy for comparison and click Cancel; close the Attribute Table

Reprojecting the spatial data layer

Next we’ll reproject the Polar Bear range data in standard World Cylindrical Equal-Area projection and repeat the experiment.

Highlight the Polar Bear range layer in the Layers Panel on the left

In the QGIS menu bar, select Vector > Data Management Tools > Reproject Layer

In the Target CRS box, select Project CRS: ESRI; 54034 – World_Cylindrical_Equal_Area, and then click Run

The new temporary layer will show up in the Layers Panel on the left, labelled Reprojected

Now use the same rough-and-ready method as before to estimate the range area. The area estimate will be almost the same as the previous estimate because both estimates are based on the same underlying ellipsoid (i.e. WGS 84).

Based on the experiment so far, it looks like it doesn't really matter whether or not you reproject the data layer as the rough-and-ready estimates are almost the same, even for this large range area. The problem is that they are not accurate and a different GIS would calculate area differently.

Correct area calculation based on the specified projection: area(\$geometry)

Now let's calculate area correctly, based on the specified projection:

Open the Attribute Table for the reprojected Polar Bear layer again and then open the Field Calculator

In the left box under Expression, copy-paste "area(\$geometry)/1000^2"; the 1000^2 converts from m² to km² for comparison with our previous estimates

The area calculation will show in the lower-left by Preview: 22,637,383 (plus a few decimal places)

Note down the area calculation somewhere handy for comparison, click Cancel, and close the Attribute Table

If you compare the new calculation with the rough-and-ready estimate, you'll find a difference of some 2,500 km²!

The correct method calculates the area based on the projection we specified. Essentially we use the projected CRS (in this case the World Cylindrical Equal-Area projection) to

tell QGIS exactly how we want to convert our 3-dimensional geographic data to a 2-dimensional planimetric surface for the purposes of calculating area.

Another user should get the same result for the same shapefile in the same projection in any other GIS.

Correct area calculation using on-the-fly projection: `area(transform($geometry, ..., ...))`

If the correct method summarised above seems rather cumbersome, QGIS has provided an alternative method for estimating area in a specified projection without creating a new projected shapefile:

Right-click on the original spatial layer in the geographic CRS (i.e. EPSG:4326) and open the `Attribute Table` and then the `Field Calculator`

Copy-paste “`area(transform($geometry, 'EPSG:4326','ESRI:54034'))/(1000^2)`” into the `Expression` box

The new area calculation will be identical to the previous correct area calculation. The `transform()` function implements an on-the-fly projection (from EPSG:4326 to ESRI: 54034 as specified).

You can use either correct method to calculate area in QGIS for all KBA assessments, as they give the same results. We recommend the method based on on-the-fly projection as you don't need to save a copy of each shapefile in a different projection. For your convenience we repeat the code here:

`area(transform($geometry, 'EPSG:4326','ESRI:54034'))/(1000^2)`

We'll not return to the Polar Bear, so you can tidy up your `Layers Panel` by removing all Polar Bear layers.

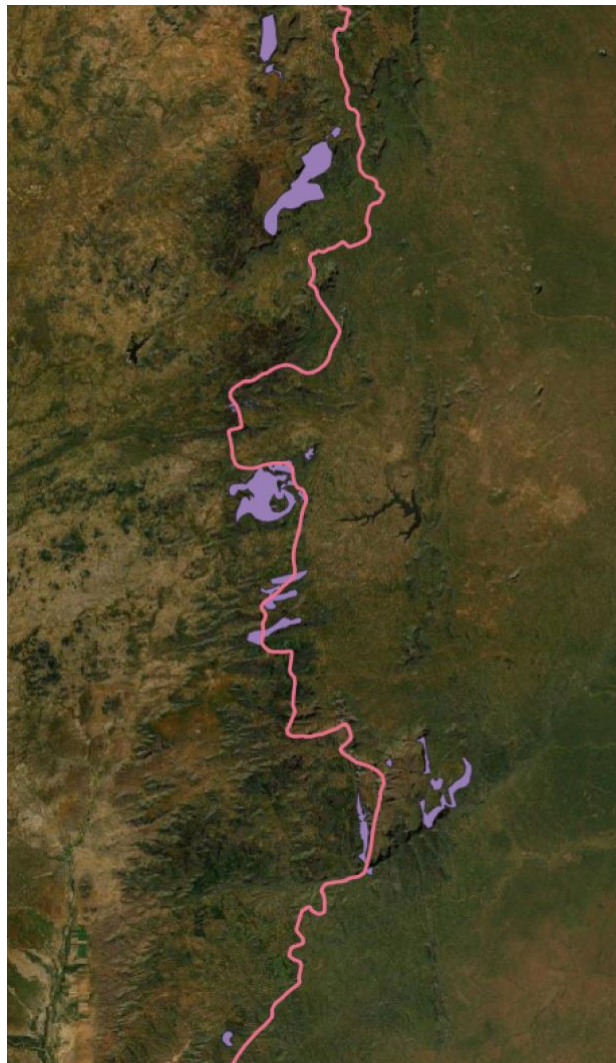
We recommend you `Save` your project now.

Estimating the size of WDPa sites

The WDPa polygon shapefiles include a field named `GIS_AREA`, calculated in the Mollweide projection. This value will be very similar to the value calculated using the World Cylindrical Equal-Area projection using the correct method summarised above. Nevertheless, it is important to recalculate the area using the World Cylindrical Equal-Area projection to ensure consistency across all sites.

Estimating global range area or ecosystem extent

For the next exercise, we'll use the IUCN Red List range map for Marshall's Pygmy Chameleon (*Rhampholeon marshalli*, VU). Follow the same steps as for the Whooping Crane and Polar Bear to download the range data from the [IUCN Red List](#) and import it to your QGIS project. As before, the shapefile is called "data_0", so you might want to rename it to something more specific. If you change the Layer Styling to purple, it will look similar to the image below:



Use the correct method for area calculation using on-the-fly projection, as described above for the Polar Bear.

Right-click on the chameleon spatial layer and open the Attribute Table. We only have one feature in this case, but it's always good practice to check that the Presence, Origin and Season codes match your current task

Open the Field Calculator, then copy-paste `"area(transform($geometry, 'EPSG:4326','ESRI:54034'))/(1000^2)"` into the Expression box

This time we'll save the area calculation to a new field by typing `"GLOB_AREA"` in the Output field name box, selecting Decimal number (real) in the Output field type box, and setting Precision = 3, then selecting ok

The global range area calculation will now show up in the final column: 529.890 km²

Close the Attribute Table, then right-click and Save Layer Edits

In this case, the total range area is slightly less than the estimated Area of Occupancy (AOO) given in the IUCN Red List account, possibly because AOO is calculated using 2 x 2 km grid cells.

Intersecting site and range or extent polygons to calculate the area within a site

Intersect a species' range with a KBA

If only part of a species' global range falls within a site, the first step to calculating the area of the range within the site is to create a new spatial layer based on the intersection of the species' global range polygon(s) with the site polygon. We'll save this layer as a shapefile so that it can be submitted as part of a KBA Proposal:

In the QGIS menu bar, select Vector > Geoprocessing Tools > Intersection

Set your chameleon layer as your Input layer and your site layer as your Overlay layer; you can use the Chimanimani layer you created earlier or the KBA layer for Mozambique if you have it

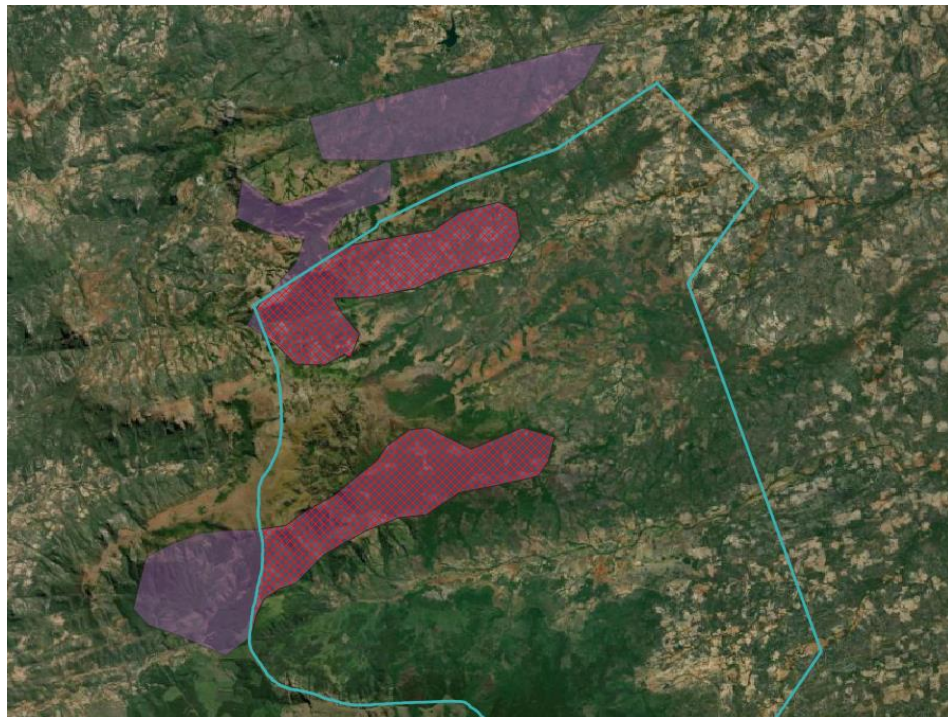
Leave Input fields to keep blank, so that all fields from the species range data are retained

Click on the ... next to Overlay fields to keep, and select the SitRecID and NatName if you are using an existing KBA, or WDPA_PID, NAME and

DESIG_ENG if you're using a WDPA data layer (e.g., the Chimanimani layer you created earlier) plus any other fields you think would be useful and click `ok`

Click the ... next to `Intersection`, select `Save to File ...` navigate to your chameleon subfolder and type in a name for your intersection shapefile, click `Save`, then `Run`

Your new shapefile will now show up in your `Layers Panel` — `Zoom to Layer` and you'll see it comprises the segments of the range polygons that intersect the Chimanimani KBA as shown in the image below (zoomed in to the north of the KBA, with the global range polygons in purple and the range within the site in red hatch).



Calculate the area of the intersection

Next open the `Attribute Table` for the new intersection layer

Calculate the area as before, but this time use the `Output field name` "SITE_AREA"




In the toolbar, click the button to `Save Layer Edits`

If you used the KBA layer, you'll see the range area in the KBA is 105.934 km² (i.e. 19.99% of the species' global range).

If you used the Chimanimani layer you created earlier, you'll see the range area in the National Park is 55.214 km² and the range area in the Buffer Zone is 50.841 km².

Sum the area of multiple features

While we could easily sum the range area within the National Park and the Buffer Zone on a calculator, QGIS also provides a convenient tool to do this.


In the main toolbar, click the  button for Statistics; select the relevant species layer, then select the relevant Field name immediately below (e.g., SITE_AREA), and you will see the sum of the area of all features in the row labelled Sum. In this case, we have 2 features (Count) and the total area is 106.055 km² (Sum). This is slightly greater than for the KBA as there are minor differences in the boundaries.

Estimating the range size of migratory species

In the case of Marshall's Pygmy Chameleon, we have a single feature, comprising multiple spatially distinct polygons, coded Presence = 1 (i.e. Extant); Origin = 1 (i.e. Native); and Seasonality = 1 (i.e. Resident). How would we adapt the process for estimating global or site-level range areas for migratory species with multiple features coded by season?

For migratory species that have distinct breeding and non-breeding ranges identified in IUCN Red List range maps (i.e. separate polygons coded by season), the KBA Guidelines say that breeding and non-breeding ranges will typically be assessed separately.

Let's return to the Whooping Crane example. If you previously removed the crane layer, add it back to your QGIS project now. Then apply the same procedure as for the chameleon to calculate the area of each of the four features, but this time set the Output field name to "FEAT_AREA".

If you like, click on the  button to Dock Attribute Table — you'll now see the Attribute Table below your map. You'll notice that several of the features are overlapping. Consequently, if we simply summed the area for all four features, we would overestimate the combined spatial footprint.

To calculate the global area of the breeding range:

First check the Presence and Origin codes for all features, then select the relevant features that are coded Seasonal = 1 (i.e. Resident) or Seasonal = 2 (i.e. Breeding Season)

Check that the selected polygons do not overlap (this can often be done visually, but see below for a more technical approach)


In the main toolbar, click the  button for Statistics; select the relevant species layer, then select the relevant Field name immediately below (e.g., FEAT_AREA)

You'll see the sum of the area of all features. In this case, the Count shows that we have 4 features, but we can check the Selected features only box to focus on the 2 features that comprise the breeding range: the sum of the area of selected features is 6,122.73 km².

To calculate the global area of the non-breeding range:

Click on the  button to Deselect all features from the layer


Select polygons coded Seasonal=1 (i.e. Resident) and Seasonal=3 (i.e. Non-breeding) and check that the selected polygons do not overlap

Use the Statistics tool, , to calculate the sum of the area of the selected features: 10,919.7 km².


Handling overlapping features when estimating range size

The Topology Checker plugin can be useful for checking whether range polygons overlap without relying on visual inspection.

In the QGIS menu bar, select Plugins > Manage and Install Plugins. Search for "Topology Checker" and make sure it's checked.

In the QGIS menu bar, select Vector > Topology Checker. Click on the  button to configure. Under Current Rules, select the relevant species layer. In

the next box, select the rule “must not overlap”. Click `Add Rule`, then click `OK`.

Then click the  button in `Topology Checker` to `Validate All`. Any overlaps will show up as “errors” in the box below. Note, however, that these may include marginal overlaps between adjacent polygons.

If there are overlaps between features that should be included in the same range size estimation (e.g., polygons coded as `Seasonal = 1` (i.e. Resident) and `Seasonal = 2` (i.e. Breeding Season)), the best approach is to `Dissolve` the relevant features into a single feature before calculating the area:

In the QGIS menu bar, select `Vector > Geoprocessing Tools > Dissolve` Select the relevant species layer, checking `selected features` if appropriate.

You can leave the box under `Dissolved as` “[Create temporary layer]” or click on the ... to `Save to File...`

Open the `Attribute Table` for the new `Dissolved` layer. Then calculate the area using the correct area calculation method with on-the-fly projection (i.e. by opening the `field calculator` and pasting “`area(transform($geometry, 'EPSG:4326', 'ESRI:54034'))/(1000^2)`” into the `Expression` box).

If you try this for the crane layer, the result will be 1544372.885, which is approximately the same as the sum of all 4 features (i.e. 1.54437e+06) as overlaps are marginal.

Topic summary

Well done — you’ve completed the topic on calculating area and values of area-based parameters.

We recommend you `Save` your project now.



In the next topic, we’ll look at ways to edit attribute data.


Topic 9: Working with attribute data

Shapefile templates will be provided on the KBA website (in the [Tools section](#)). You may need to add, rename or remove attribute Fields and/or modify Field data types to match the appropriate template. In this topic, we'll show you how to do this.

Adding and removing attribute fields



To add an attribute Field to an existing spatial layer:

Open the Attribute Table, , and click on the Toggle Editing button, .

Click on the New field button, , to add an attribute field and complete the information required in the Add Field window

Click on the Save edits button, , to save your changes

To remove an attribute Field from an existing spatial layer:

Open the Attribute Table, , and click on the Toggle Editing button, .

Click on the Delete field button, , and select the field(s) you want to remove from the Delete Fields window

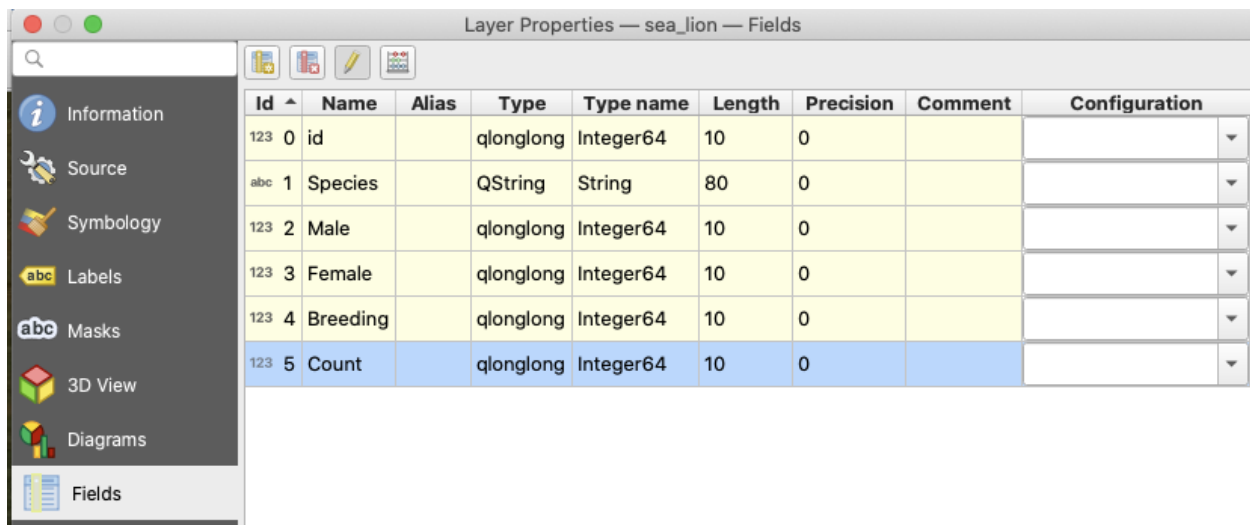
Click on the Save edits button, , to save your changes

Editing the properties of an existing attribute field

To change the name or edit other properties of an attribute Field:

Right-click on the target layer in the Layers Panel and select Properties, then click on Fields on the left of the Layer Properties window

For example, the Fields for the fictitious sea lion species we created earlier look like this:




To change the name of an attribute Field:

Click on the Toggle Editing button, , and type in the new name for the attribute

Click on the Toggle Editing button, , again and save your changes and then close the Layer Properties window

To change data type, open the Refactor fields tool:

Click on the Processing Toolbox button, , in the menu bar and type “refactor” in the search box to find the Refactor fields tool

Double-click on Refactor fields to open a pop-up window, select the target layer in the Input layer box, and then use the drop-down options in the Fields mapping window to change field types (see example below). (When changing from a Whole number to a Decimal number, you will also need to increase the Precision to the number of decimal places required.)

Parameters Log

Input layer

sea_lion [EPSG:4326]

☐ Selected features only

Fields mapping

	Source Expression	Name	Type	Length
0	123 id	id	Whole number (integer - 64bit)	10
1	abc ecies	Species	Text (string)	80
2	123 Male	Male	Whole number (integer - 64bit)	10
3	123 female	Female	Whole number (integer - 64bit)	10
4	123 breeding	Breeding	Whole number (integer - 64bit)	10
5	123 mate	Estimate	Whole number (integer - 64bit)	10

Leave the Refactored box blank to create a temporary layer or click on the ... to Save to File...



Select Run, then Close

For example, we revised the attribute field properties for our fictitious sea lion, renaming the “Count” field to “Estimate” and changed the field type from Whole number to Decimal number with Precision = 3 (see below):

	id	Species	Male	Female	Breeding	Estimate
1	1	sea lion	1	1	1	1500.000
2	3	sea lion	1	0	0	500.000
3	2	sea lion	1	1	0	1000.000

Edit attribute data

To edit attribute data in an existing Field:

Open the Attribute Table, , and click on the Toggle Editing button, .

Edit the data as required

Click on the `Save edits` button, , to save your changes

Topic summary

Well done — you've completed the topic on working with attribute data.

We recommend you `Save` your project now.

In the next topic, we'll show you how to prepare KBA shapefiles for submission.

Topic 10: Preparing KBA shapefiles for submission

In this final topic, we'll show you how to export a spatial layer from QGIS as a ESRI shapefile so that it can be submitted as part of a KBA Proposal.

Specifications for KBA shapefiles

KBA boundaries and spatial data on the distribution of trigger biodiversity elements within a KBA must be provided as ESRI shapefiles.

Shapefiles must be provided in a standard projection and datum (i.e. Lat/Lon on WGS 84 in decimal degrees; EPSG 4326), following a set format with specific attributes.

Shapefile templates will be provided on the KBA website (in the [Tools section](#)).

Please see the [KBA Proposal Process guidance document](#) (Annex B) for the complete KBA mapping standards.

Export a spatial layer as an ESRI shapefile

In the Layers Panel, right-click on the target layer, select Export, then Save Features As ...

Make sure the Format box shows "ESRI shapefile"

Make sure the CRS box says EPSG:4326 – WGS 84

Click on the ... to the right of the File name box and navigate to your spatial data folder

Follow the file name and other requirements in the [KBA Proposal Process guidance document](#) (Annex B)

Then click ok

Contributors

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Updates and Feedback

This tutorial will be updated periodically.

We would welcome user feedback and additional material, including step-by-step instructions for additional tasks relevant to KBA identification and delineation.

Please email Andrew Snyder (asnyder@rewild.org) if you have comments or suggestions or would like to contribute to this tutorial.

Summary of changes

Version 1.1 (September 2021)

Topics 3-10: introductory sections added.

Version 1.0 (August 2021)