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Guide to creating a species range map on ArcGIS Online

Want to learn how to create a map in the style of this for your favorite species of wildlife? Follow this guide to learn how to gather data for your species and plot it on an online map.

1. Gathering data
   a. The first step to making your map is choosing a species in which you are interested. This could be any species, but the examples all map mammals. Once you have thought of a species, it would be best to look it up on a search engine to see its scientific name. This is a two-word name which identifies a given species. It may appear in italics in any given article about a species.
   b. Next, head to the Global Biodiversity Information Facility, or GBIF. This is a website which stores information about where exactly species have been found over time. GBIF will be the main source of data for your map. You should create an account so that you can download any data you need.
   c. On GBIF, you can start with a blank search and narrow it down with a set of filters to create your preferred query. Some important filters are the "Scientific name", "Location", and/or "Administrative areas" filters.
      i. "Scientific name": You will want this to correspond to your chosen species, so put in the scientific name you found earlier.
      ii. "Location": You might think about drawing in an extent on the map provided. This will limit the amount of data you end up downloading to just the area inside the shape.
      iii. "Administrative areas": You could also opt to put in a state of your choice (e.g., Vermont) and confine the data to just the land area of that state. This would help if you are only interested in Vermont data but do not want to draw in the entire state boundary with the "Location" filter.
   d. Once you have changed any other filters you would like to, you are now ready to download! Navigate to the right side of the page under the words "Search

Occurrences" and click the "Download" tab. Make sure to select the "Simple" option.

e. Next, wait for GBIF to email you with a link to your download. Once you unzip or extract what you downloaded, you now have what is called a CSV, or comma-separated values, file. This file stores information about places where your species has been seen or found over time.

2. Getting started with a map

a. The next big step is to add the data from GBIF onto an online map. You can use a website called ArcGIS Online for this.

b. You can create an ArcGIS Online Public Account (scroll down on this page) and avoid having to pay.

c. Once you are logged in, click on the "Map" heading on the top of the screen. This will bring you to a blank map of the world.

d. You should first save your map and give it a name.

e. Next, one of the first things you may want to change is the basemap. This refers to what the map looks like underneath any other data layers you might add to it. You can click on the basemap tab on the left toolbar and explore the options. For a more stylish basemap, you could consider choosing OpenStreetMap.

3. Adding species data to the map

a. Navigate to the left toolbar and click "Add", then "Add layer from file". Find where you downloaded the GBIF data and select the .csv file.

b. The first page which comes up is "Fields". You do not have to change anything here and can click "Next".

c. The second page is "Location Settings". It is important that you click on the dropdown menu and select "decimalLatitude" for latitude and "decimalLongtitude" for longitude. This ensures that the map will plot the data correctly.

d. The final page is for organization. Give the layer a title which describes what it is; for example, you could name it "GBIF_[your species name here]". If you would

like, you can organize it further by sorting it into a particular folder on ArcGIS Online or giving it tags and summary information. Click "Create and add to map" once done.

    e. The layer is now on your map! You should see some small circular points scattered on the map. Each point represents one instance where your chosen species is known to have been found at a specific date.

4. Stylizing the species data

    a. One crucial aspect of making a map is stylizing your layers, or customizing their shape, color, transparency, and more. While the points are already on the map, they may not pop out depending on what your basemap is. To start working with this, navigate to the "Styles" tab on the right-side toolbar.

    b. Click "Edit layer style".

    c. The "Choose attributes" section is a powerful tool for customization. This allows you to symbolize points differently based on some of their information instead of having them look the same across the board. For these maps, it is recommended that you try symbolizing based on the field of "year", which was included in the GBIF file you uploaded earlier. Scroll down to find this field in the list.

    d. All of a sudden, the points will all change sizes. That's okay! The website believes you want to make later points much bigger than earlier points, but you can probably tell that this is not a very readable map. To fix this, scroll down and select "Counts and amounts (color)." Now, the points will go back to normal but have different colors.

    e. To get the map to look like the example, you will want to click "Style options" and then scroll down and check "Classify data". You can now change a few things.

        i. First, you can increase or decrease the number of classes. You can think of a class as a group of years.

        ii. On the long, vertical bar, you can change the year at which each class starts and ends. For example, if you want a class that spans 1900-1925, you can click on the underlined numbers and type in a different year. Note

that the starting and ending year (e.g., 1910 and 2024) are the limits of the data, so there are no points outside of that timeframe.

    iii.   As for the colors, you can change them by going to "Symbol style" and then "Colors". A set of colors is called a <u>color ramp</u>. If possible, try to choose one that would work well for colorblind individuals. You can refer to the helpful reference website [ColorBrewer](#), which has a checkbox for colorblind safe palettes.

    iv.   You may also want to change the outline, size, or transparency, which are also in "Symbol style". Making layers somewhat transparent helps if you are overlaying a layer on top of another.

  f. You now should have a set of points with the symbology you prefer!

5. Introducing natural community data

  a. <u>Natural communities</u> are very specific types of natural habitat which are deemed important by the state. They are named in reference to the groups of plants which are found there or particular landscape features. You can add these to the map by navigating to the "Add" tab on the left toolbar > "Browse Layers" > "ArcGIS Online". Type in "VCD – Natural Communities" and add it to the map.

  b. You may not want to symbolize these data yet, but if you are satisfied without progressing further you can.

6. Spatial analysis

  a. You are able to use ArcGIS Online to analyze your data. The particular analysis you can attempt to replicate the example map is to find out which points overlap the any natural communities, which show up as small areas on the map. This would tell us that the species was spotted or found within the current area of the natural community, which informs our understanding of what types of habitats the species lives in.

  b. On the right toolbar, navigate to Analysis > "Find locations" heading > "Find by Attributes and Location".

  c. Next, "Build new query"

      i.   "Find features from [natural communities layer]"

      ii.   "Spatial expression"

      iii.   "Next"

d. "+ Spatial expression"

      i.   the first box should say "intersects"

      ii.   the second box should have your GBIF data layer

      iii.   "Add"

e. Name your new layer in the appropriate box and run the analysis.

f. You now have a layer which contains only the natural communities in which your chosen species has been found according to the GBIF data. You can symbolize this in much the same way as you did the points (see step 4). For the example map, the natural communities were symbolized with the field of priority, which conveys the importance of the particular example of the natural community to the state.

7. Touching up the map

a. The map could use a few final touches after you have symbolized your two layers.

b. By default, a pop-up appears when you click on a point or natural community. Control what goes in these text boxes with the "Pop-ups" and "Fields" tabs on the right toolbar when you have selected a layer.

      i.   Change the display name of a field with the "Fields" tab. Also, you can click on the "year" field for the GBIF data to remove the comma separator.

      ii.   Change which fields go into the pop-up on the "Pop-ups" tab. You can also change the title. In the example map, the year is always in the title because the title includes "{year}".

c. You can add state boundaries in the same way as you added the natural communities data. The "ArcGIS Online" option after "Browse Layers" contains some helpful layers from Esri, such as "United States State Boundaries" and "Provinces and Territories of Canada".

      i.   For these boundary layers, you will definitely want to disable pop-ups entirely on the "Pop-ups" tab on the right toolbar. You will also want to

select the "Properties" tab on the right toolbar and disable showing the layer in the map legend, as they are self-explanatory. Your GBIF and natural communities layers should stay in the legend, however.