



AMERICAN MUSEUM OF NATURAL HISTORY  
CENTER FOR BIODIVERSITY AND CONSERVATION

# Using QGIS

Peter Galante

Biodiversity Informatics Specialist

Center for Biodiversity and Conservation

American Museum of Natural History

# Outline

- QGIS overview
- GIS Data files
- Basic operations
- QGIS interface
- Follow along

# QGIS

QGIS is a powerful software built by many developers as a free, open-source tool to perform GIS tasks.

Open-source indicates that it's programming, content, and design are open to use and modification by anybody\*

\* Some terms apply: Some licenses do not allow commercial use.

# GIS

While other open-source GIS software exist (e.g. DIVA-GIS), QGIS is the most popular and best supported.

Another software that is important to know about is ArcGIS, developed by ESRI. All of the principles and techniques learned for QGIS are able to translate over to ArcGIS. Fortunately, there is no cost for QGIS. Some of the higher-end tools are less elegant in QGIS, but there is a lot of overlap.

# Outline

- QGIS overview
- GIS Data files
- Basic operations
- QGIS interface
- Follow along

## Vector Data Files

The most common type of vector data (polygon, point, line) you will come across are “shapefiles”. These data are usually broken up into many ancillary files that are **necessary** to plot the data.

These file types were developed by ESRI, the developer of arguable the most popular GIS software: ArcGIS.

.shp file is the geometry file that described the shapes

.shx file is the “index” file used for plotting

.dbf file contains the database that is paired with each shape. This is where the shape’s attribute table is found

*Other files:*

.prj contains information relating to the projection of the shape

When managing your GIS data, you **MUST** keep all shapefiles ancillary files together in the same directory.

The easiest way to do this without using a databasing software (e.g., ArcCatalog, DB Manager) is to save shapefiles into their own directory.

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help

Layers

- ne\_10m\_admin\_1\_states\_pro...
- Concave hull
- alldaynight
- Neilmask
- 0
- 7
- allday
- alltwilight
- allnight
- NeilAlphaHull0.3
- landcover\_2010\_nyc\_3ft\_reP...
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7

Processing Toolbox

Search...

- Recently used
- Cartography
- Database
- File tools
- Graphics
- Interpolation
- Layer tools
- Network analysis
- Raster analysis
- Raster terrain analysis
- Raster tools
- Vector analysis
- Vector creation
- Vector general
- Vector geometry
- Vector overlay
- Vector selection
- Vector table
- GDAL
- GRASS

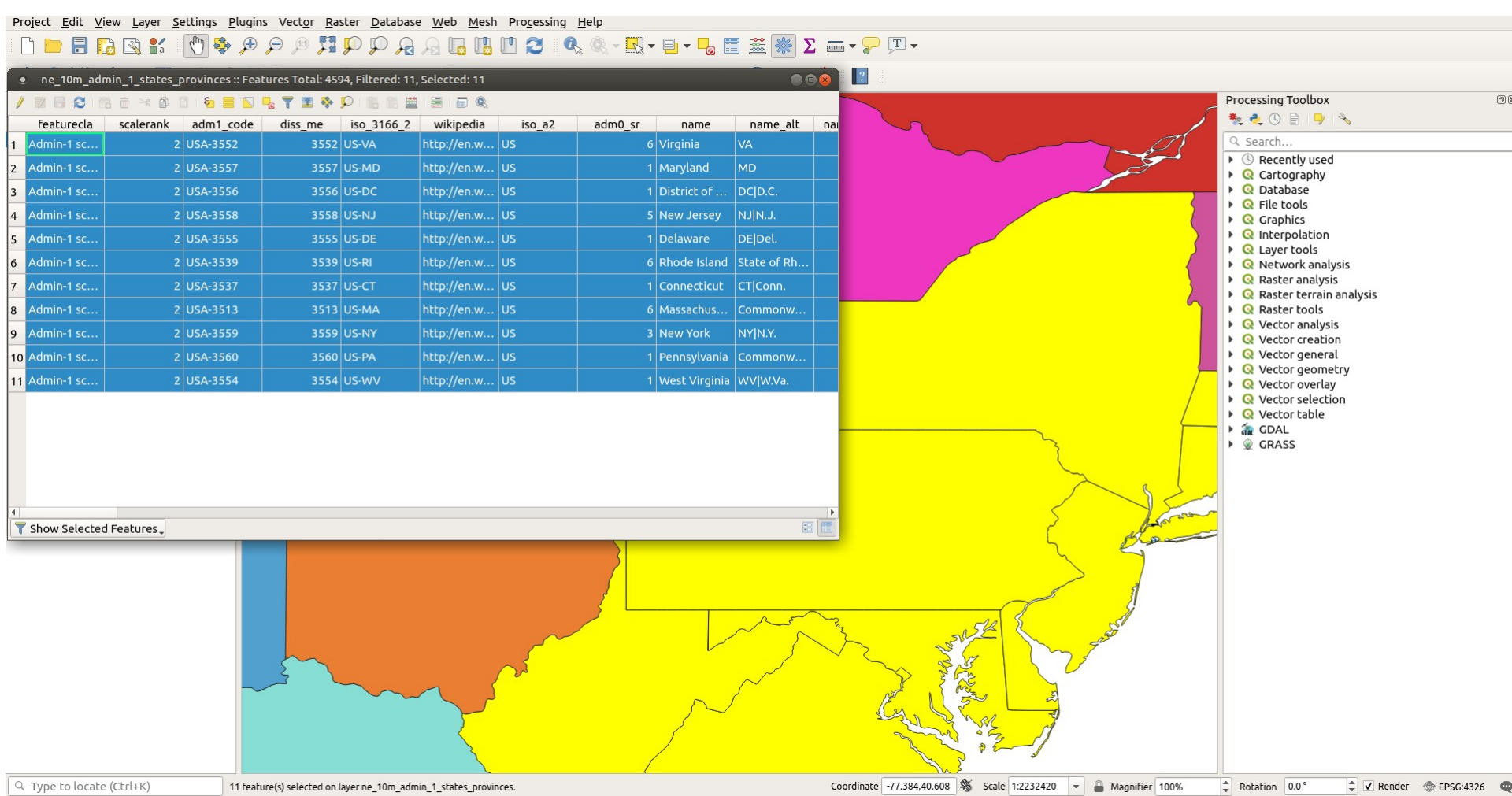
ne\_10m\_admin\_1\_states\_provinces :: Features Total: 4594, Filtered: 4594, Selected: 0

featurecla	scalerank	adm1_code	diss_me	iso_3166_2	wikipedia	iso_a2	adm0_sr	name	name_alt
Admin-1 sc...	3	ESP-5809	5809	ES-B		ES	1	Barcelona	
Admin-1 sc...	3	FRA-5271	5271	FR-11		FR	1	Aude	Languedoc...
Admin-1 sc...	3	ESP-5814	5814	ES-CS		ES	1	Castellón	
Admin-1 sc...	3	ESP-5846	5846	ES-T		ES	1	Tarragona	
Admin-1 sc...	3	ESP-5803	5803	ES-A		ES	1	Alicante	
Admin-1 sc...	3	ESP-5849	5849	ES-V		ES	1	Valencia	
Admin-1 sc...	3	ESP-5804	5804	ES-AL		ES	1	Almería	
Admin-1 sc...	3	ESP-5836	5836	ES-MU		ES	5	Murcia	
Admin-1 sc...	3	ESP-5834	5834	ES-MA		ES	1	Málaga	
Admin-1 sc...	3	ESP-5821	5821	ES-GR		ES	1	Granada	
Admin-1 sc...	7	PRT-5498	5498	PT-15	http://en.w...	PT	5	Setúbal	
Admin-1 sc...	3	ESP-5844	5844	ES-SE		ES	1	Sevilla	
Admin-1 sc...	7	PRT-748	748	PT-14		PT	1	Santarém	
Admin-1 sc...	7	PRT-746	746	PT-11		PT	5	Lisboa	Lisbon Lisb...
Admin-1 sc...	7	PRT-752	752	PT-06		PT	1	Coimbra	
Admin-1 sc...	7	PRT-740	740	PT-10		PT	1	Leiria	

Show All Features

Coordinate -79.705,45.549 Scale 1:2234256 Magnifier 100% Rotation 0.0° Render EPSG:4326

# Attribute Table



The table is paired with geographic data and can be queried



## Raster Data Files

Since rasters are essentially grids, many types of files can be plotted as rasters. The most popular are:

1. GeoTiff – .tif files with geography metadata associated (origin, x, y, information)  
These are by far the most popular in biology
2. Ascii – .asc files are text files with geography metadata in the header
3. netCDF – .cdf files are popular with some older datasets

There are many more, but you are most likely to come across these. Since rasters are essentially image files, even .jpg or .jpeg files can be used.

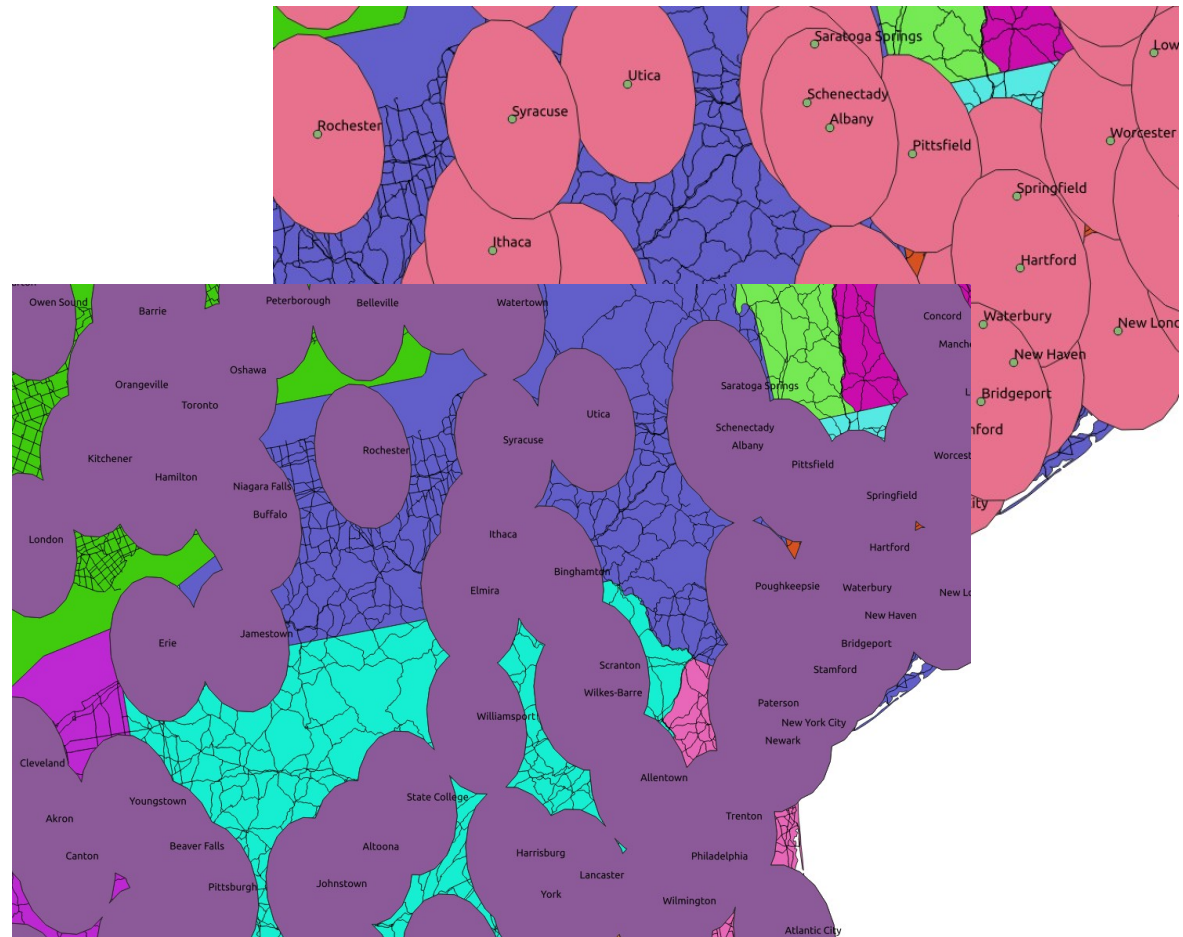
# Outline

- QGIS overview
- GIS Data files
- **Basic operations**
- QGIS interface
- Follow along

# GIS operations

## Spatial analyses.

- Buffers
- Dissolves
- Differences
- Centroids
- Masks



# Outline

- QGIS overview
- GIS Data files
- Basic operations
- **QGIS interface**
- Follow along

\*Untitled Project - QGIS

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help

Print layout Adding data Table of Contents Processing Toolbar Processing Toolbox

Hover over buttons to see function

Status of Processing Operation

Coordinate and scale information

Layers

- Buffered
- Dissolved
- ne\_10m\_populated\_places
- Buffered
- ne\_10m\_roads\_north\_america
- ne\_10m\_admin\_1\_states\_pro...
- LC80160302016111LGN00\_B1
- 0
- 27390
- LC80160302016111LGN00\_B2
- 0
- 28971
- LC80160302016111LGN00\_B3
- 0
- 31471
- LC80160302016111LGN00\_B4
- 0
- 34775
- LC80160302016111LGN00\_B5
- 0
- 41580
- LC80160302016111LGN00\_B6
- 0
- 56513
- LC80160302016111LGN00\_B8
- 0
- 57871
- AllBandtest
- AllBands
- SA

Processing Toolbox

Search...

- Recently used
- Cartography
- Database
- File tools
- Graphics
- Interpolation
- Layer tools
- Network analysis
- Raster analysis
- Raster terrain analysis
- Raster tools
- Vector analysis

Identify Results

Feature	Value

Mode: Current layer Auto open form

View: Tree Help

1 legend entries removed.

Coordinate 1377052,549414 Scale 1:2388212 Magnifier 100% Rotation 0.0° Render EPSG:102008

# Follow Along

# Follow Along

- Mapping nearby **Bigfoot!** sightings.





# Follow Along

- Mapping nearby **Bigfoot!** sightings.





# Follow Along

- **Bigfoot analysis: Data**

1. Find vector data online

1. Navigate to [naturalearthdata.com](http://naturalearthdata.com) and download large scale states and provinces

2. Download bigfoot occurrence from the course [website](#)

These data come from the [Bigfoot Research Organization](#) and were accessed from the R package ‘plotKML’; Hengl et al., 2015

# Follow Along

Add the data to QGIS:

**Vector data:**

Easily dragged into the map pane

**Point data:**

Must be added through the “Add delimited text layer” button

# Follow Along

Data can be subset in a number of ways:

1. Open up the attribute table for the states/provinces layer and explore it.

Sort the column header “admin” by clicking on it and scroll to “United States of America” and highlight all of these rows. (there should be 51 – why?)

Right click on the layer and `export>Save selected features as...`

2. Using “Select features by area or single click” tool, highlight the northeastern states and save as a new layer

# Follow Along

Data can be subset in a number of ways:

2. Using “Select features by area or single click” tool, highlight the northeastern states and save as a new layer
3. Using “Select by location” tool, find all Bigfoot sightings within the northeastern states. Save these as a new layer.

# Follow Along

Change custom colors for points and states.

Add labels for states

## Creating a finished map

First, take a look at some examples of bad maps:

<https://blog.stratasean.com/bad-maps-bad-maps>

<https://sites.psu.edu/swabmaps/2014/03/28/good-and-bad-maps/>

# Follow Along

Using the “Print Composer” tool, create a map

All maps should include:

1. Map Contents – what are you showing
2. Legend – how does the viewer interpret
3. Title
4. Scale bar – usually in km, but depends on context
5. North Arrow – for orientation
6. Data source

## GIS Projects

The majority of your grade for this course will be based on a comprehensive final project. Ideally, your project will represent some aspect of your graduate research. It should be of sufficient quality to be used in a publication, whether as just a map (or series of maps), supporting documentation, or values generated as part of an analysis.

If you do not have a project, or an interesting spatial aspect of a project, we can chat and come up with one.



