Performing Spatial Queries

QGIS Tutorials and Tips

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Performing Spatial Queries

Spatial queries are core to many types of GIS analysis. In QGIS, this functionality is available via the *Spatial Query* plugin.

Overview of the task

We will be working with 2 datasets – a lines layer representing rivers and a point layer representing cities. The task is to run a spatial query to find all cities that are within 10 kms of a river.

Other skills you will learn

- Opening .zip files directly in QGIS.
- Choosing an appropriate projection and re-projecting vector data.
- Creating buffers.
- Selecting features using SQL-like expressions.
- · Coverting a shpefile to a KML file.
- Validating your results using Google Earth.

Get the data

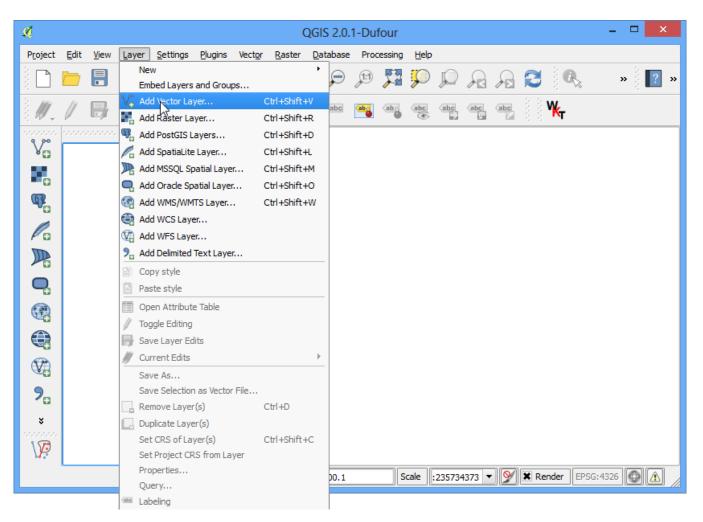
We will use **ne_10m_rivers_lake_centerlines** and **10m_populated_places_simple** datasets from Natural Earth.

Download Rivers and Lake Centerlines

Download Populated Places.

Procedure

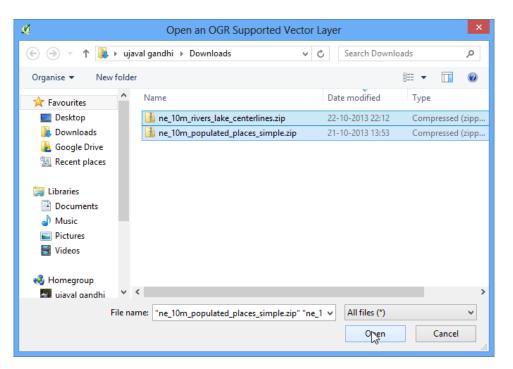
1. Once you have downloaded the data, open QGIS. Go to Layer > Add Vector Layer.



2. Click Browse and navigate to the folder where you downloaded the zip files.

1	Add vector layer	2	? ×
Source type]
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Source			
Dataset			Browse
L	Open	Cancel	Help

3. Hold the *Shift* key and click on both the zip files to select them. Click Open.



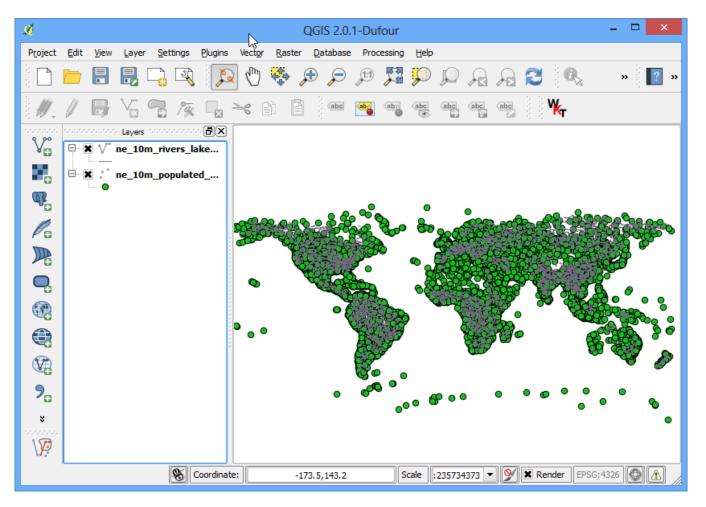
4. You will be asked to choose a layer from the zip archive. Select ne_10m_rivers_lake_centerlines.shp and click OK.

si.	Select layers	to add ? ×
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0	ne 10m rivers lake centerlines.shp	Vector
i 1	ne_10m_rivers_lake_centerlines.VERSION.txt	Vector
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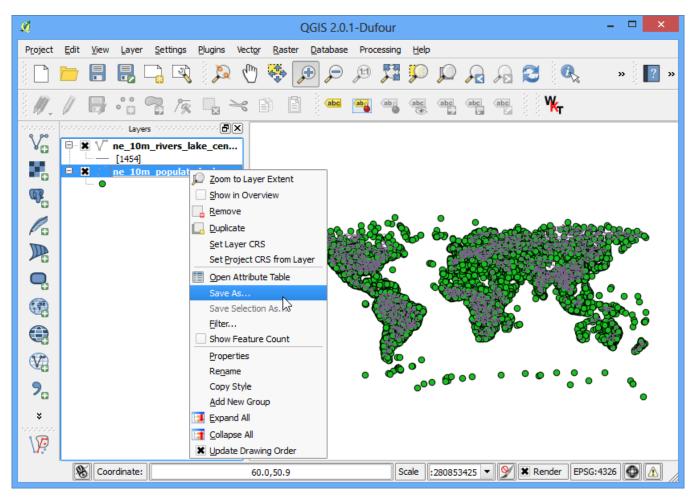
5. Since you have selected multiple files, repeat the process for the next file. Select 10m_populated_places_simple.shp and click OK.

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Layer ID	Layer name ne_10m_populated_places_simple.shp ne_10m_populated_places_simple.VERSION.txt	Type Vector Vector								
		OK Select All Cance								

6. You will see both the shapefiles now loaded in QGIS.



7. We will be created buffers around the point and line layers. The **Buffer** geoprocessing tool in QGIS uses **layer units** to calculate buffer distances. The layers we have are in **Geographic Coordinate Reference System (CRS)** with the unit of **degrees**. This is not appropriate as we want our analysis to use **metres** or **kilometres**. To achive this, we must re-project our layers to a **Projected Coordinate Reference System (CRS)**. Right-click on the **10m_populated_places_simple layer** and choose Save As.



8. In the Save vector layer as... dialog, click Browse next to Save as and select the output file location. Name the output file as *populated_places_reprojected.shp*. Next, click the Browse button next to CRS.

Ø.	Save vector layer as ? ×
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Save as	s/populated_places_reprojected.shp Browse
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uru -	WGS 84
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Data source	
Layer	
Skip attribute	
	OK Cancel Help

9. Now we must choose an appropriate CRS for our purpose. For creating buffers, a Azimuthal Equidistant projection would be best suited as radial distances around the center of the projection are accurate. In our case, since the dataset is global, we will choose a world projection. In the Coordinate Reference System Selector dialog, start searching for *world az.* and you will see the results show up. Select the *World_Azimuthal_Equidistant* and click OK.

Note

The **World_Azimuthal_Equidistant** projection spans 90 degrees from the origin. Here the origin being 0 degrees longitude, the only data contained within +/- 90 degrees longitude will be converted.

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Select the coordinate reference system for the vector file. The coordinate reference system.	data points will be transformed from the layer
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Recently used coordinate reference systems	
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Coordinate reference systems of the world	Hide deprecated CRSs
Coordinate Reference System	Authority ID
Projected Coordinate Systems	
□ Azimuthal Equidistant	
World_Azimuthal_Equidistant	EPSG:54032
Selected CRS: World_Azimuthal_Equidistant	
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	OK Cancel Help

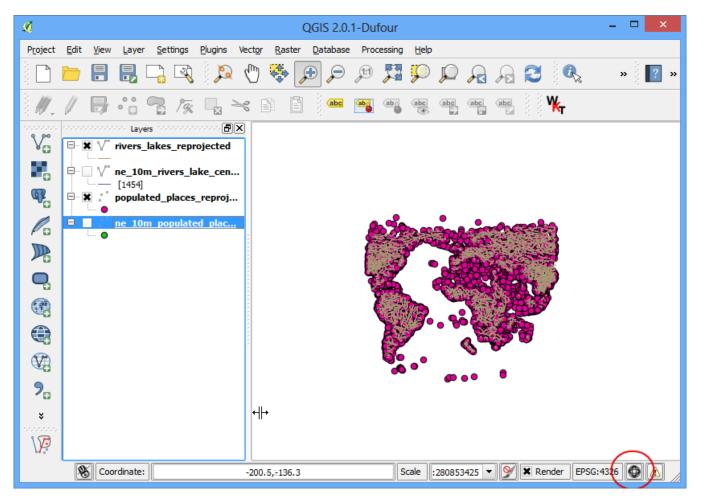
10. Back in Save vector layer as ... dialog, check the box next to Add saved file to map and click **OK**.

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Format	ESRI Shapefile	-							
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OGR creation opt	ions								
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11. Repeat the re-projection process for the *ne_10m_rivers_lake_centerlines* layer and save the new layer as *rivers_lake_reprojected.shp*.

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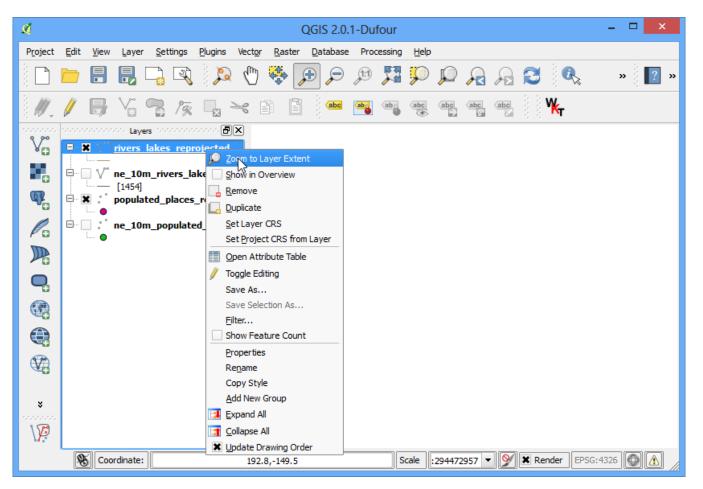
12. Now you will have 4 layers in your *Layers Panel*. Un-check the boxes next to the original layers to display only the re-projected layers. The re-projected layers are still being shown in the *Geographic CRS* because of a setting. Let's turn that off. Click on the Project Properties button. This setting can also be accessed from Project + Project Properties.



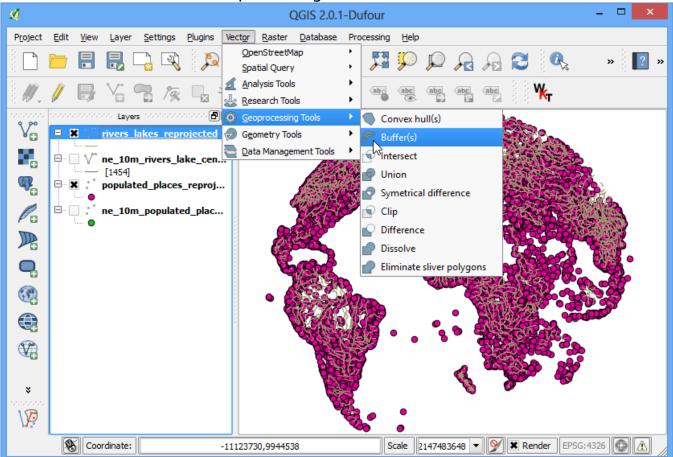
13. In the CRS tab of the Project Properties dialog, un-check the box next to Enable on-the-fly CRS transformation. Click OK.

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	WGS 84	EPSG:4326	
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	Selected CRS: WGS 84		
	+proj=longlat +datum=WGS84 +no_de	efs	
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14. Back in the main QGIS window, right-click on any one of the re-projected layers and select Zoom to Layer Extent.



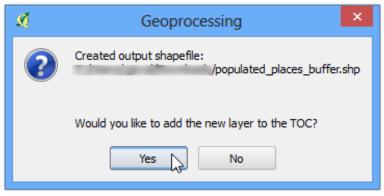
15. Now you will see the data in the layer's CRS. We will now create buffers for both the datasets. Click Vector • Geoprocessing Tools • Buffer.



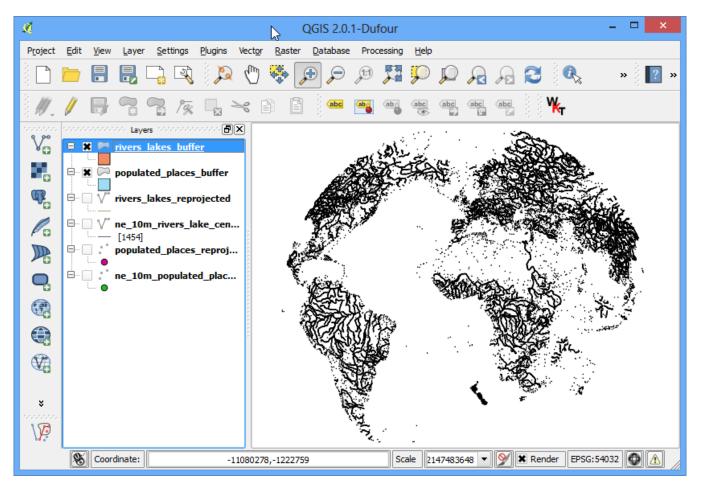
16. In the Buffer tool, select *populated_places_reprojected* layer as Input. Enter the buffer distance as *10000*. Note that we want a buffer of 10kms and since the CRS units are metres, we need to enter 10,000. Enter the output file name as *populated_places_buffer.shp*. Click OK.

🕺 📐 Buffer(s) ? 🗙
Input vector layer
populated_places_reprojected
Use only selected features
Segments to approximate 5
Buffer distance 10000
O Buffer distance field
scalerank
Dissolve buffer results
Output shapefile
sers/ujaval/Downloads/populated_places_buffer.shp Browse
O% OK Close

17. Once the buffer processing is over, click the Yes to add the newly created layer to the TOC.



18. Repeat the same buffer process for the *rivers_lake_reprojected* layer and create an output file named *rivers_lake_buffer.shp*.



19. The *rivers_lake_buffer* contains features that are both rivers as well as lakes. Our analysis calls for using only river features, so we will run a query to select only river features. Right-click on the *rivers_lake_buffer* layer and select Open Attribute Table.

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20. You will see that the	featurecla attribute	contains the	information	we can	use to
select the river feature	s. Click on Select fe	atures using a	n expression	button.	

ø	Attrik	oute table - rive	ers_lakes_buffer	:: Features tota	l: 1454, filtered:	1454, selected:	0 - 🗆 🗙					
	dissolve $ abla$	scalerank	featurecla	name	name_alt	rivernum	note 🔺					
0	0River	1.00000000	River	rrawaddy Delta	NULL	0	NULL					
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2	1001River	9.00000000	River	Tonle Sap	NULL	1001	NULL					
3	1002Lake Cente	9.00000000	Lake Centerline	NULL	NULL	1002	NULL					
4	1002River	9.00000000	River	NULL	NULL	1002	NULL					
5	1003Lake Cente	9.00000000	Lake Centerline	Vorma	NULL	1003	NULL					
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18	1010River	9.00000000	River	6. Fork Kuskok	NULL	1010	NULL					
19	1011River	9.00000000	River	South Nahanni	NULL	1011	NULL					
20	1012River	9.00000000	River	Keele	NULL	1012	NULL 🔺					
21	1013River	9.00000000	River	Miramichi	NULL	1013	NULL					
SI SI	how All Features											

21. Enter the expression "*featurecla*" = "*River*"`*and click :guilabel:*`*Select* and then click "guilabel: *Close* to back to the main QGIS window.

🗴 Sele	ect By Expression ? ×
Function List	Selected Function Help
Search ⊕ String ⊕ Color ⊕ Geometry ⊕ Record ⊕ TimeManager ⊟ Fields and Values ↓ Gissolve ↓ scalerank ↓ featurecla ↓ name_alt ↓ rivernum	Field Double click to add field name to expression string. Right-Click on field name to open context menu Field Values 'Lake Centerline' 'River'
Operators = + - / * ^	Load all unique values Load 10 sample values
Expression	
"featureda" = 'River'	
Output preview: 1	E Select Close

22. Now we are ready to perform the spatial query. You need to enable the **Spatial Query plugin** to use this functionality. See Using Plugins for more details. Once enabled, go to Vector , Spatial Query , Spatial Query.

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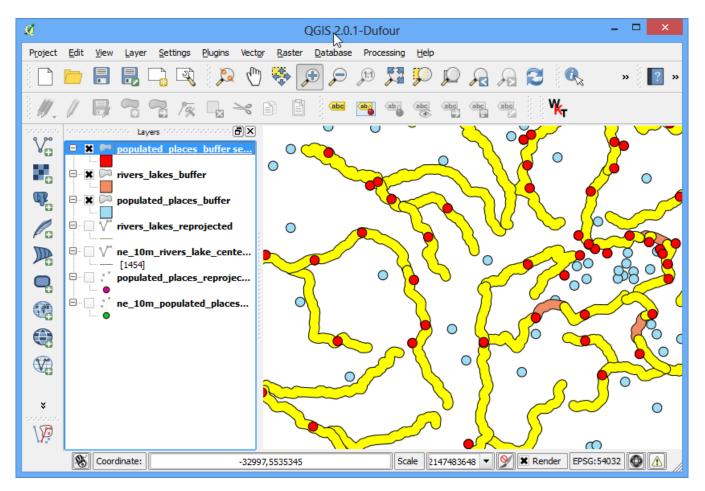
23. For our query, we want to select features from the buffered places that intersect with the buffered river lines. Make sure the checkbox next to **selected geometries** is checked. This is to ensure the query uses only river features that we selected previously. Click Apply.

🔏 💦 Spatial Query 📍 🗙				
Select source features from				
populated_places_buffer				
Selected geometries				
Where the feature				
Intersects 🔹				
Reference features of				
□ rivers_lakes_buffer				
1201 selected geometries				
And use the result to				
Create new selection				
Close Apply				

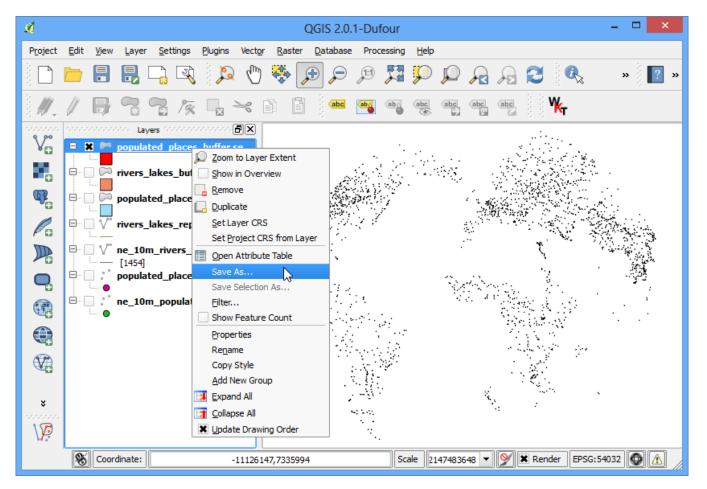
24. Once the query is complete, you will see a new section named Selected features. Click on the Create layer with selected button. A new layer will be added to the *Layers Panel*. Click Close.

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Select source features from > populated_places_buffer > 2381 selected geometries	Result feature ID's Result query 21 22		•
Where the feature Intersects Reference features of rivers_lakes_buffer I201 selected geometries And use the result to Create new selection	24 26 27 30 31 33 34 38 40 49 52 53 59 70 72		
Selected features 2381 of 7322 selected by "Create new selection"	2381 of 7322 identified Zoom to item Log messages eate layer with selected Close	Apr	¥.

25. Zoom-in to any area and compare the results. You will notice that only the features that intersect with river buffers.



26. I usually like to verify my results to ensure the analysis is not flawed. One way to verify the results is to export this layer as a KML file and load it up in Google Earth. You can check if the areas you found really are within 10kms of a river. Right-click the layer and Save As....



27. In the Save vector layer as..., choose **WGS84** as the CRS. This because KML format needs the coordinates to be in this CRS. Name your KML as *cities_near_river.kml*.

Ø	Save vector layer as ?	×	
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Save as	aval/Downloads/cities_near_river.kml Brows	e	
Encoding	UTF-8	-	
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CRS	WGS 84 Browse	e)	
Symbology export	No symbology	-	
Scale	1:50000	* *	
OGR creation opt	tions		
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Skip attribute creation Add saved file to map			
	OK Cancel Help		

28. Open Google Earth and verify that the cities represented by these buffers are indeed close to rivers.

