



## Introduction to QGIS

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29 July 2015

**Data**politan****

Data Solutions for the Modern Metropolis

## Goals

- Review the fundamentals of analyzing and visualizing spatial data
- Introduce basic spatial operations in QGIS
- Provide a real-world scenario for using QGIS
- Demonstrate how to connect to a spatial database (PostgreSQL/PostGIS)

## Key Takeaways from the Course

- You will understand how to load and visualize data in QGIS
- You will understand how to perform basic spatial analysis tasks in QGIS
- You will understand how to work with data stored in a PostgreSQL/PostGIS database

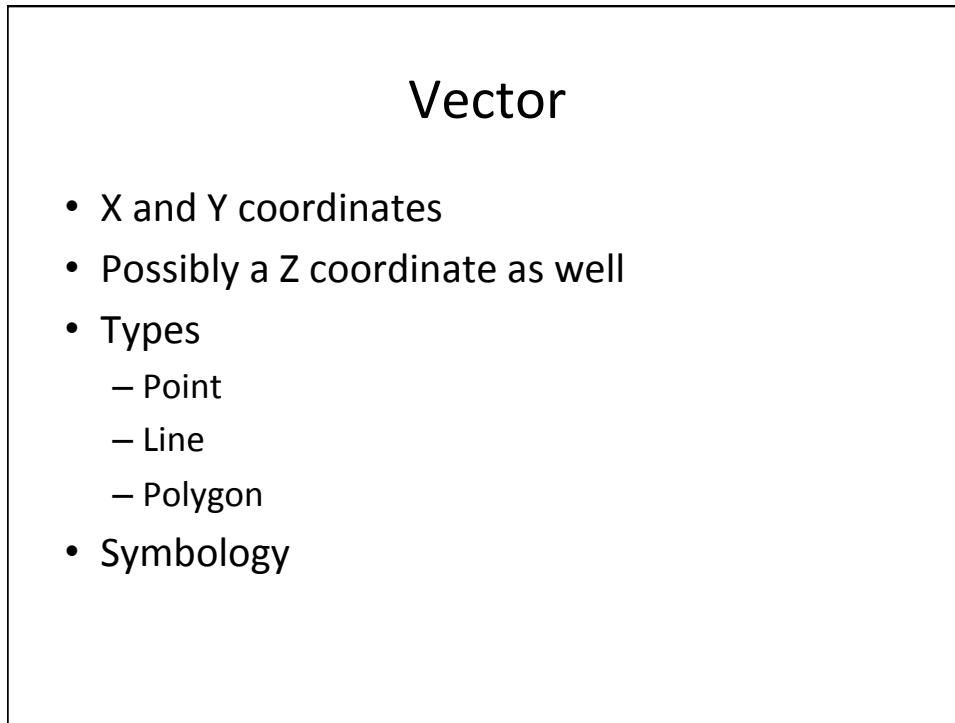
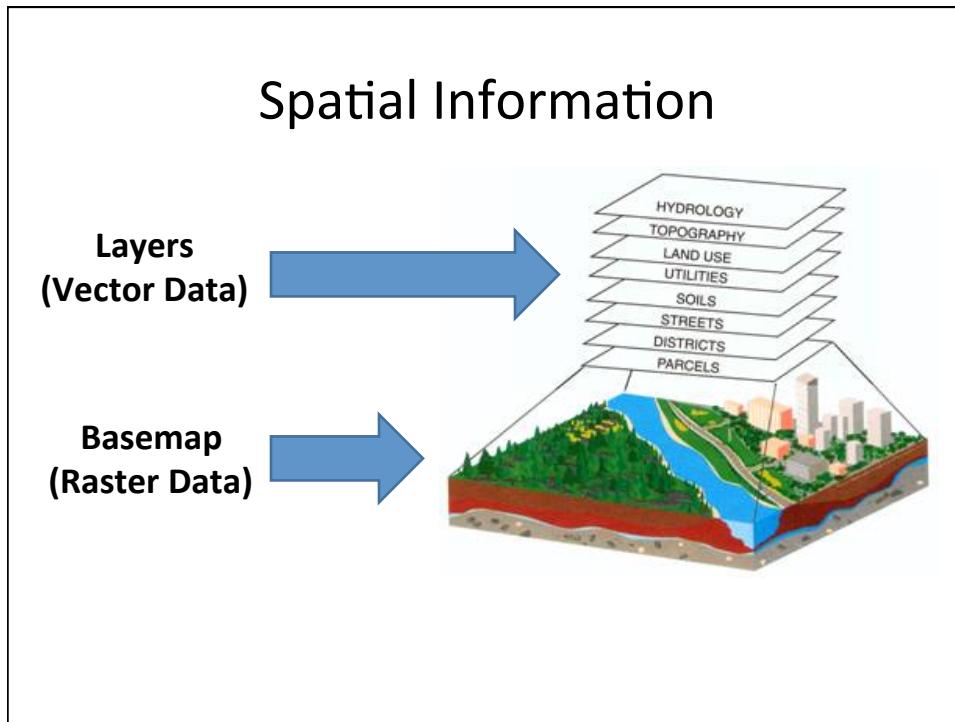
## Assumptions

- You have some familiarity with geospatial information systems (GIS)
- You understand the basics of cartography and spatial analysis
- You have some familiarity with databases

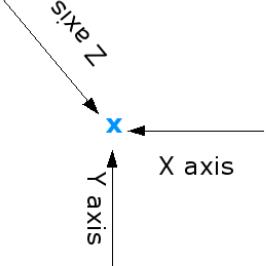
## Goals for this Morning

- Review basic geospatial principles and GIS tools
- Discuss spatial data formats
- Demonstrate how to load raster and vector data into QGIS
- Demonstrate how to style spatial data
- Demonstrate how to create a heat map from point data

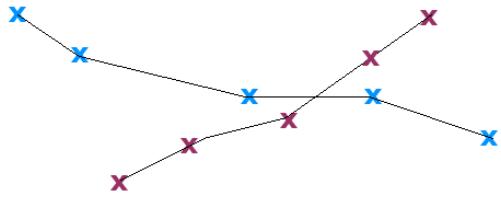
## FIRST, A QUICK REVIEW



### Vector Point Feature

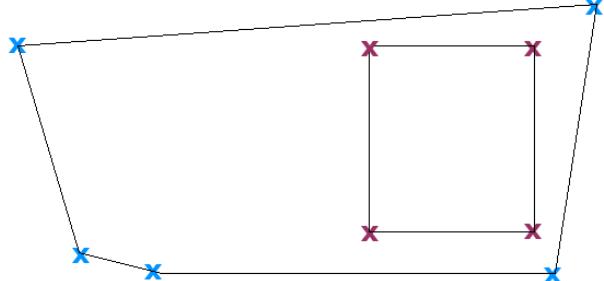
<b>Point Geometry (indicates the x,y and z position of the feature)</b>

<b>Point attributes (describe the feature)</b>
Id, Name, Description 1, Tree, Outside our classroom 2, Light post, At the school entrance

### Vector Polyline Feature

<b>Polyline Geometry (a series of connected vertices that do not form an enclosed shape)</b>

<b>Polyline attributes (describe the feature)</b>
Id, Name, Description 1, Footpath 1, From class to the playground 2, Footpath 2, From the school gate to the hall

### Vector Polygon Feature

**Polygon Geometry (a series of connected vertices that do form an enclosed shape)**

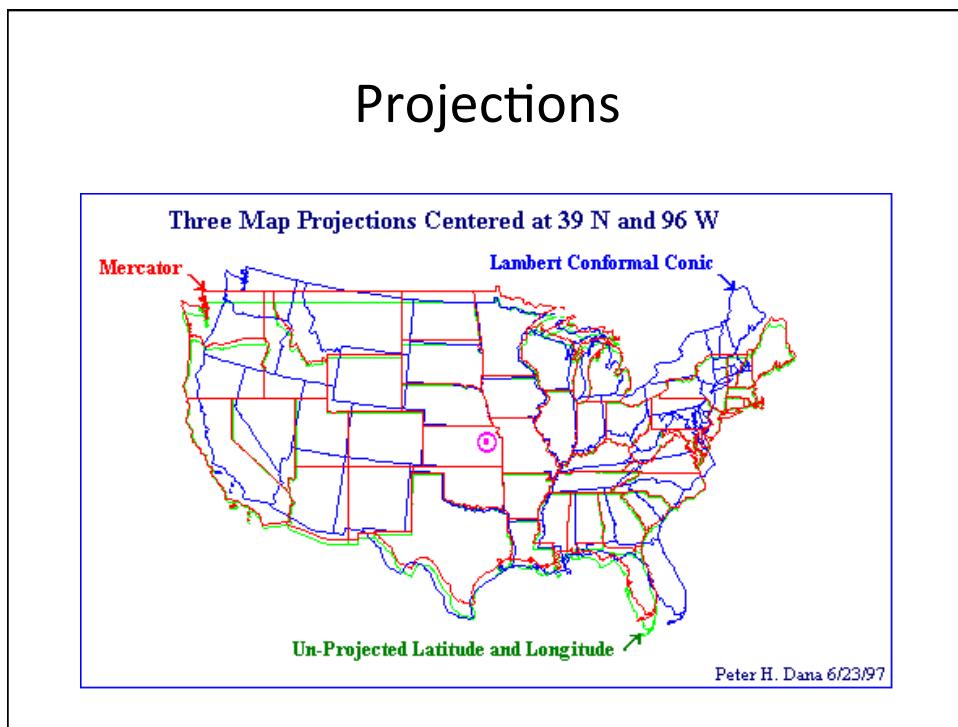
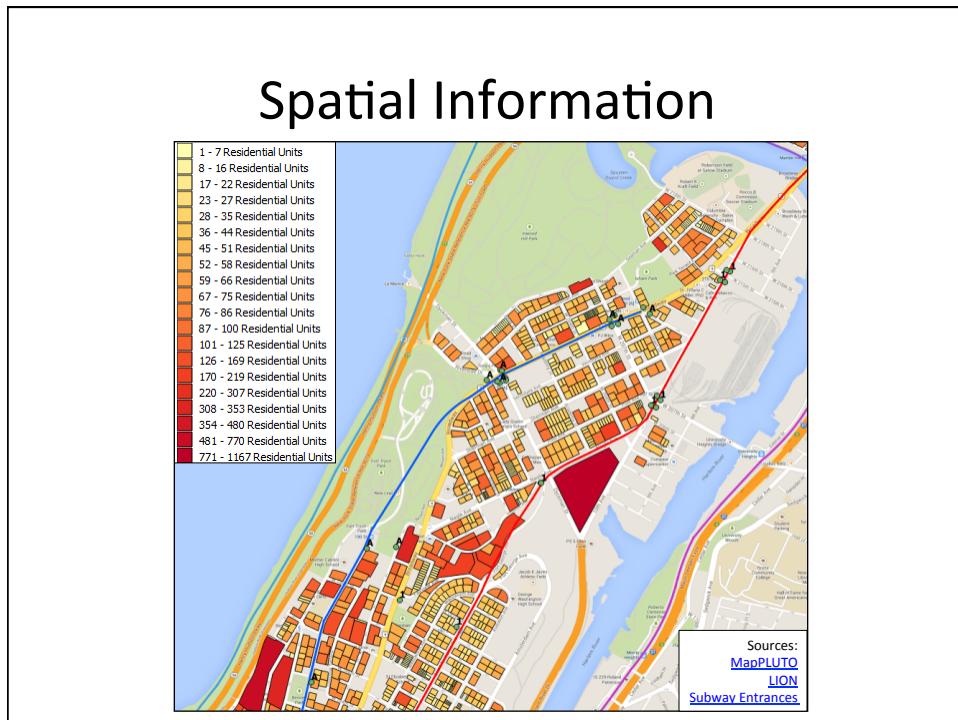


**Polygon attributes (describe the feature)**

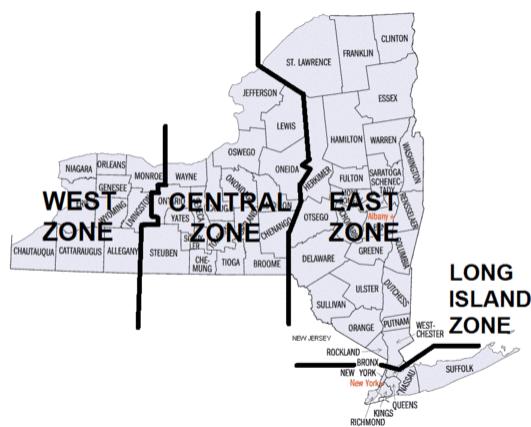
<i>Id, Name, Description</i>
1, School Boundary, Fenceline for the school 2, Sports Field, We play soccer here

## Raster

- Grid of values
- Examples
  - Basemaps
  - Satellite imagery



## Projections



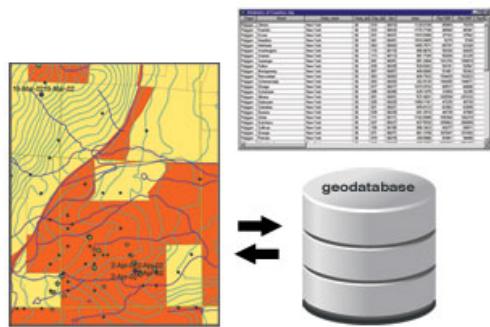
## Geocoding

253 Broadway  
New York, NY 10023           40.713408,-74.0069874  
(982229, 199126)

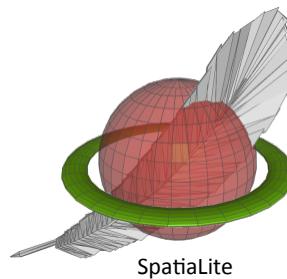
## Geospatial Information Systems (GIS)



## GIS and Geodatabases



# Spatial Databases



## Data Formats - CSV

```

1 IncidentID,Dispatcher,Officer,Post,DateEntered,IncidentDate,IncidentTime,AddressNum,OnStreet,CrossStreet1,CrossS
2 treet2,Corner,Condition,SubCondition,SubSubCondition,OtherCondition,Disposition,Remarks,latitude,longitude
3 14-016213,dblackwell,"MELNIK, LYUDMILA",VEH-1-AM,2014-07-06T01:21:58Z,2014-07-06T00:00:00Z,1899-12-
31T01:21:58Z,75.0,WALL ST,,,I/F/O,HOMELESS OUTSTRETCHED,NO ENCAMPMENT,,PUBLIC SAFETY/DEPARTED,2 HOMELESS I/S/O
4 75 WALL ST PK S/O MELNIK O/S GOT THE INDIVIDUALS TO DEPART AREA CLEAR,40.7052824817,-74.0077436661
5 14-017148,jgambao,"MARCUS, JERRY",113-PM,2014-07-16T04:31:45Z,2014-07-16T00:00:00Z,1899-12-31T02:47:45Z,40.
0,EXCHANGE PL,,I/F/O,HOMELESS OUTSTRETCHED,NO ENCAMPMENT,,PUBLIC SAFETY,I/F/O 40 EXCHANGE PL 2 HOMELESS
OUTSTRETCHED,40.7059382815,-74.0102822106
6 14-016596,jrivera,"LEGENT, JACQUES",109-AM,2014-07-10T07:05:34Z,2014-07-10T00:00:00Z,1899-12-
31T07:05:34Z,BROADWAY,RECTOR ST ,N/W/C,HOMELESS OUTSTRETCHED,NO ENCAMPMENT,,BRC,"N/W/C BWAY & RECTOR ST 1
HOMELESS OUTSTRETCHED IN SLEEPING BAG NTFD BRC SPOKE W/FRANCIS. BRC O/S, NO CLIENT FOUND.",40.7074504859,-74.
0119459841
7 14-016213,dblackwell,"MELNIK, LYUDMILA",VEH-1-AM,2014-07-06T01:27:10Z,2014-07-06T00:00:00Z,1899-12-
31T01:27:10Z,1.0,BROADWAY,GREENWICH ST.,I/F/O,HOMELESS OUTSTRETCHED,NO ENCAMPMENT,,PUBLIC SAFETY,1 HOMELESS ON
THE GREENWICH ST SIDE OF 1 BWAY,40.7047850763,-74.0149986329
8 14-016679,jgambao,"BONNAIRE, RODRIGUE",104-AM,2014-07-11T04:44:37Z,2014-07-11T00:00:00Z,1899-12-31T03:31:37Z,8.
0,STATE ST,,,I/F/O,HOMELESS OUTSTRETCHED,NO ENCAMPMENT,,PUBLIC SAFETY,I/F/O 8 STATE ST HOMELESS OUTSTRETCHED,40
.7023917277,-74.0133732039
9 14-017584,golombardo,"MELNIK, LYUDMILA",VEH-1-AM,2014-07-21T01:44:20Z,2014-07-21T00:00:00Z,1899-12-
31T01:44:20Z,WHITEHALL ST,PEARL ST,,S/W/C,HOMELESS OUTSTRETCHED,NO ENCAMPMENT,,PUBLIC SAFETY,"S/W/C WHITHELL
ST & PEARL ST, 1 HOMELESS OUTSTRETCHED I/S/O SLEEPING BAG, HOMELESS REFUSED TO DEPART & SERVICES",40.703099202,
-74.0129982575
10 14-016599,jrivera,"LEGENT, JACQUES",109-AM,2014-07-10T07:12:03Z,2014-07-10T00:00:00Z,1899-12-
31T07:12:03Z,FRONT ST,JOHN ST,,N/E/C,HOMELESS OUTSTRETCHED,NO ENCAMPMENT,,BRC,"N/E/C FRONT ST & JOHN ST 2
HOMELESS OUTSTRETCHED ON BENCHES NTFD BRC SPOKE W/FRANCIS. BRC O/S, NO CLIENT FOUND.",40.7064080052,-74.
0045589936

```

## Data Formats - JSON

```
{
  - intersection: {
    boroughCode1In: "1",
    crossStreetNamesFlagIn: "B",
    firstBoroughName: "MANHATTAN",
    firstStreetCode: "13349001010",
    firstStreetNameNormalized: "WATER STREET",
    geosupportFunctionCode: "2",
    geosupportReturnCode: "11",
    message: "'VIETNAM VETERANS MEMORIAL PLAZA' NOT RECOGNIZED. THERE ARE NO SIMILAR NAMES",
    secondStreetNameNormalized: "VIETNAM VETERANS MEMORIAL PLAZA",
    streetName1In: "WATER ST",
    streetName2In: "VIETNAM VETERANS MEMORIAL PLAZA",
    workAreaFormatIndicatorIn: "C"
  }
}
```

## Data Format - GeoJSON

```
1  {
2    "type": "FeatureCollection",
3    "crs": { "type": "name", "properties": { "name": "urn:ogc:def:crs:OGC:1.3:CRS84" } },
4    "features": [
5      { "type": "Feature", "properties": { "stop_id": 101, "stop_code": null, "stop_name": "242ND STREET-BWAY (Van Cortland Park)", "stop_desc": null, "stop_lat": 40.889248, "stop_lon": -73.898583, "zone_id": null, "stop_url": null, "location_t": 0, "parent_sta": null }, "geometry": { "type": "Point", "coordinates": [ -73.898583, 40.889248 ] } },
6      { "type": "Feature", "properties": { "stop_id": 103, "stop_code": null, "stop_name": "238TH STREET-BWAY", "stop_desc": null, "stop_lat": 40.884653, "stop_lon": -73.900878, "zone_id": null, "stop_url": null, "location_t": 0, "parent_sta": null }, "geometry": { "type": "Point", "coordinates": [ -73.900878, 40.884653 ] } },
7      { "type": "Feature", "properties": { "stop_id": 104, "stop_code": null, "stop_name": "231ST STREET-BWAY", "stop_desc": null, "stop_lat": 40.878856, "stop_lon": -73.904834, "zone_id": null, "stop_url": null, "location_t": 0, "parent_sta": null }, "geometry": { "type": "Point", "coordinates": [ -73.904834, 40.878856 ] } },
8      { "type": "Feature", "properties": { "stop_id": 106, "stop_code": null, "stop_name": "225TH STREET-BWAY (Marble Hill)", "stop_desc": null, "stop_lat": 40.874561, "stop_lon": -73.909831, "zone_id": null, "stop_url": null, "location_t": 0, "parent_sta": null }, "geometry": { "type": "Point", "coordinates": [ -73.909831, 40.874561 ] } },
9      { "type": "Feature", "properties": { "stop_id": 107, "stop_code": null, "stop_name": "215TH STREET-10 AV", "stop_desc": null, "stop_lat": 40.869444, "stop_lon": -73.915279, "zone_id": null, "stop_url": null, "location_t": 0, "parent_sta": null }, "geometry": { "type": "Point", "coordinates": [ -73.915279, 40.869444 ] } }
10     ]
}
```

Eric Brelsford – GeoJSON and Github tutorial

[http://youtu.be/TQs7fy09d\\_M](http://youtu.be/TQs7fy09d_M)

## Data Formats - XML

```

Wifi Hotspot Locations.kml *
1  <?xml version="1.0" encoding="UTF-8"?><kml xmlns="http://www.opengis.net/kml/2.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.opengis.net/kml/2.2 http://schemas.opengis.net/kml/2.2.0/ogckml22.xsd">
2    <Document xmlns:atom="http://purl.org/atom/ns#>
3      <name>geo_ehc4-fktp:geo_ehc4-fktp-1</name>
4      <LookAt>
5        <longitude>-73.94379544500774</longitude>
6        <latitude>40.7282938568271</latitude>
7        <altitude>67588.03741316183</altitude>
8        <range>54559.03513915667</range>
9        <tilt>0.0</tilt>
10       <heading>0.0</heading>
11       <altitudeMode>clampToGround</altitudeMode>
12     </LookAt>
13     <Placemark id="geo_ehc4-fktp-1.1">
14       <name><![CDATA[geo_ehc4-fktp-1.1]]></name>
15       <description><![CDATA[<h4><![geo_ehc4-fktp-1]></h4>
16
17 <ul class="textattributes">
18
19   <li><strong><span class="atr-name">ID</span></strong> <span class="atr-value">882.0</span></li>
20   <li><strong><span class="atr-name">NAME</span></strong> <span class="atr-value">TechSpace</span></li>
21   <li><strong><span class="atr-name">ADDRESS</span></strong> <span class="atr-value">41 East 11th Street</span></li>
22   <li><strong><span class="atr-name">CITY</span></strong> <span class="atr-value">New York</span></li>
23   <li><strong><span class="atr-name">URL</span></strong> <span class="atr-value">http://www.techspace.com/</span></li>
24   <li><strong><span class="atr-name">PHONE</span></strong> <span class="atr-value">212-331-1100</span></li>
25   <li><strong><span class="atr-name">TYPE</span></strong> <span class="atr-value">Free</span></li>
26   <li><strong><span class="atr-name">ZIP</span></strong> <span class="atr-value">10003</span></li>
27   <li><strong><span class="atr-name">_SocrataID</span></strong> <span class="atr-value">sgm9-bu33</span></li>
28 </ul>
29 ]]></description>

```

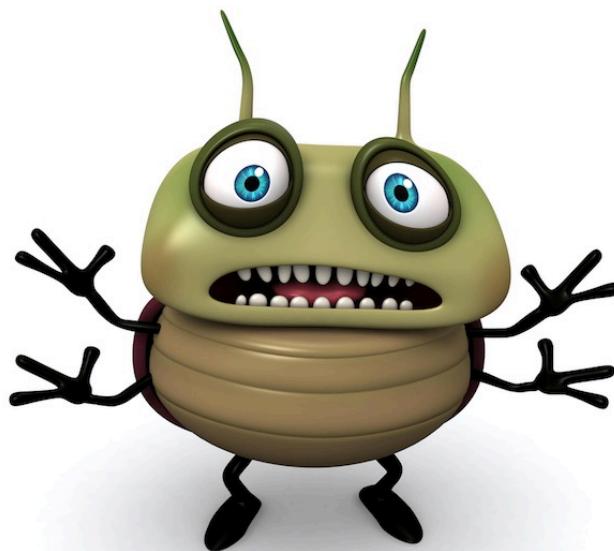
## QGIS – The Good

- Open-source software that's freely available
- Works with lots of different data types, including ESRI shapefiles, KML, GeoJSON, and text files
- Works with various spatial databases
- Strong community developing features and plug-ins

## QGIS – The Bad and The Ugly

- Not an enterprise software like ESRI ArcGIS
- The visual style is a little clunky
- Features tend to change between versions (moving around, menu option changes, etc)
- Major versions tend to have major feature changes
- Plug-ins tend not to work with newer versions
- And it crashes (and will do so several times today)

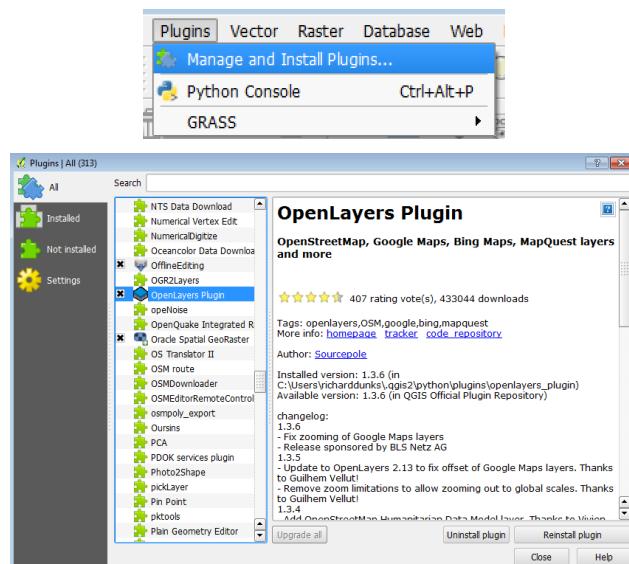
And of course...



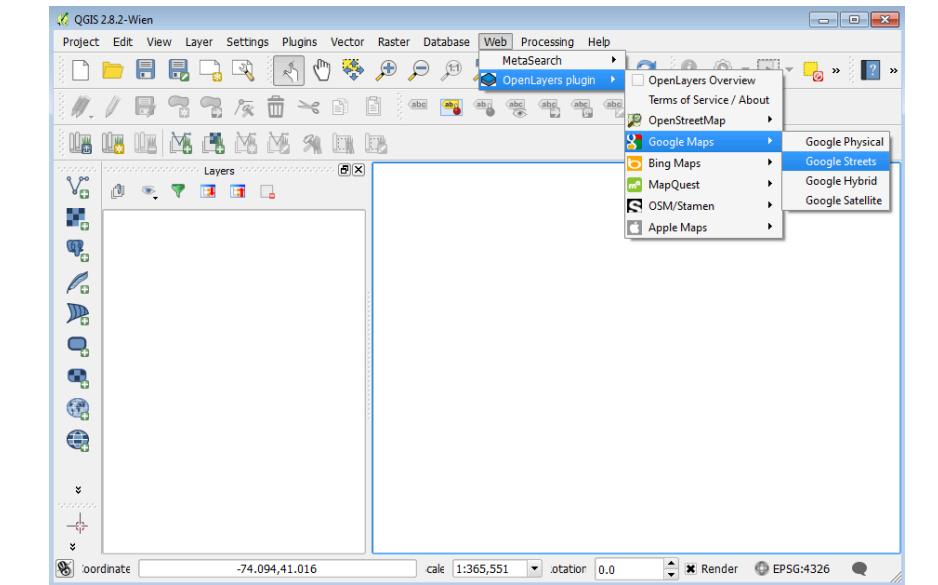
## Bugs

- Projects with different CRS layers tend to get misaligned when zooming
  - Zoom in and then back out
- Google basemaps tend not to appear on load
  - Have to zoom in to get them to appear
- Other odd behavior that they're hopefully working on
  - <https://hub.qgis.org/wiki/17/Bugreports>

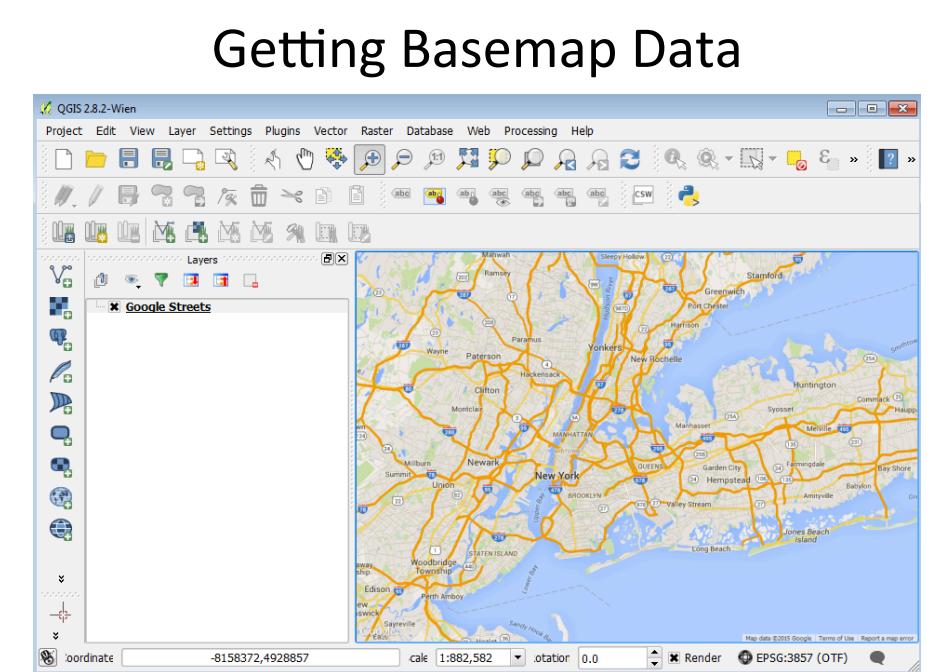
## Getting Basemap Data



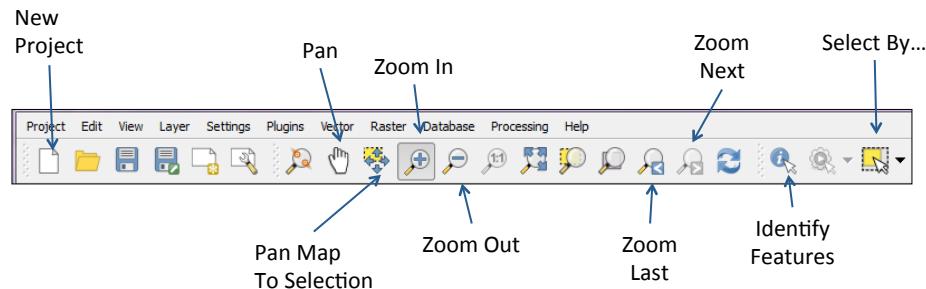
## Getting Basemap Data



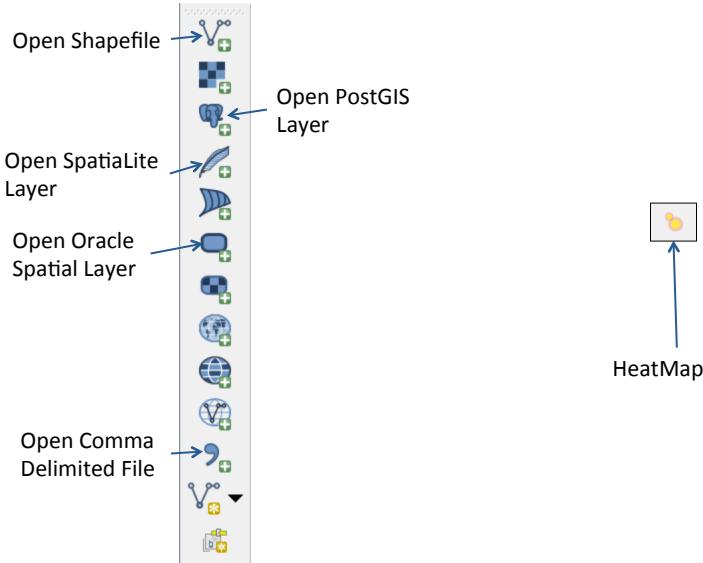
## Getting Basemap Data



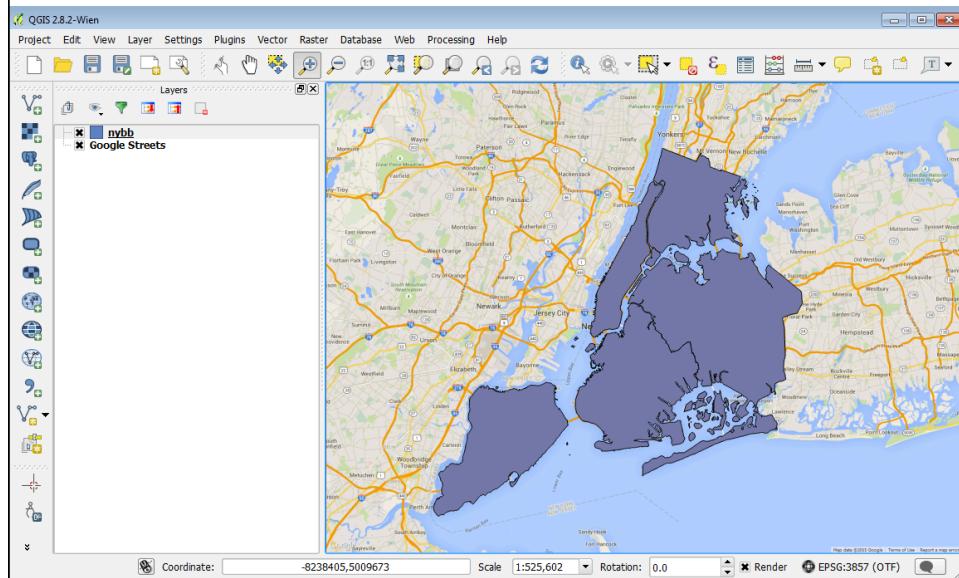
## Menu Bar Overview



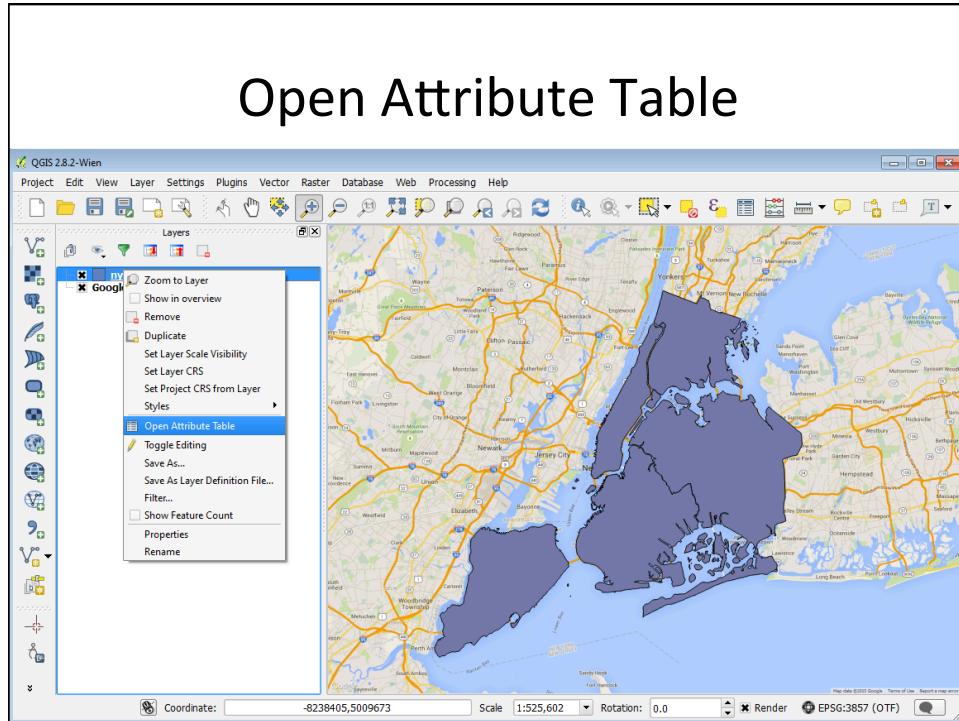
## Side Bar Overview



## Add Shapefile to QGIS



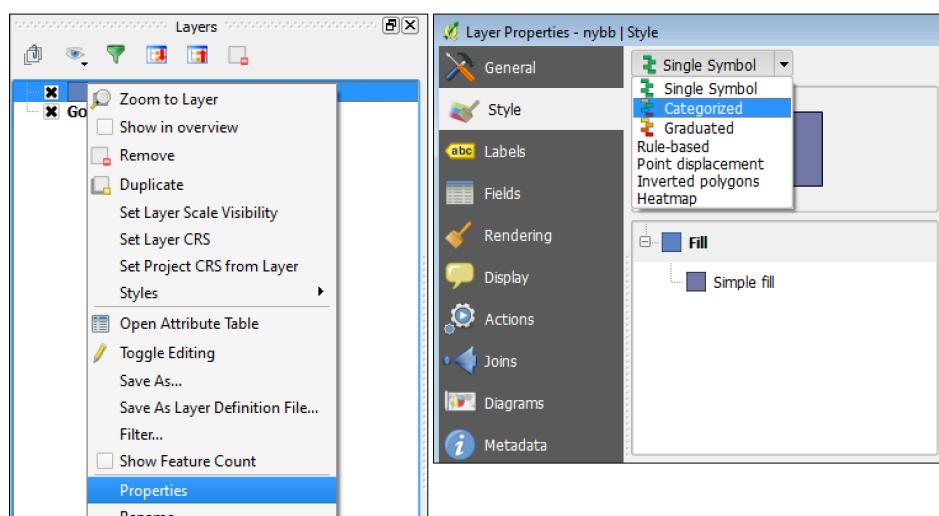
## Open Attribute Table



## Layer Attribute Table

	BoroCode	BoroName	Shape_Leng	Shape_Area
3	1	Manhattan	358532.95641...	636442167.46...
4	2	Bronx	464517.89055...	1186804144.7...
2	3	Brooklyn	726568.94634...	1959432236.8...
1	4	Queens	861038.47929...	3049947236.7...
0	5	Staten Island	330385.03697...	1623853249.9...

## Let's add some style



## Style Features by Category

Two screenshots of a GIS styling interface are shown. The top screenshot shows the 'Symbol' dropdown set to 'BoroName' with a color ramp selected. The bottom screenshot shows a detailed legend for the five boroughs of New York City, each represented by a unique symbol and color.

**Top Screenshot:**

Column: BoroCode  
Symbol: BoroName (highlighted)  
Shape\_Leng  
Symbol Shape\_Area

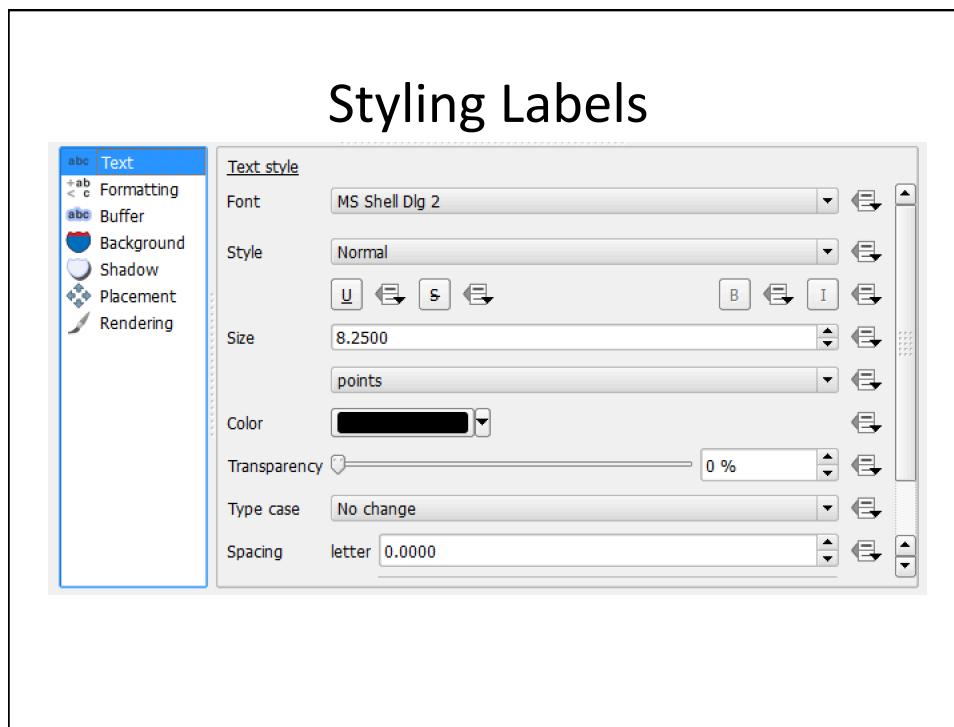
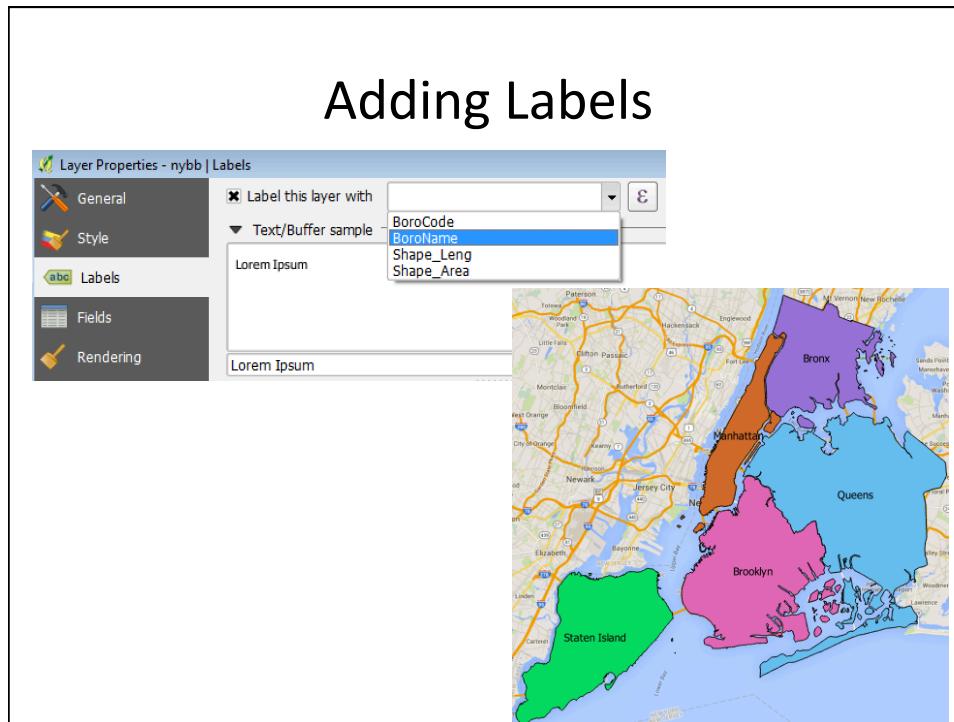
**Bottom Screenshot:**

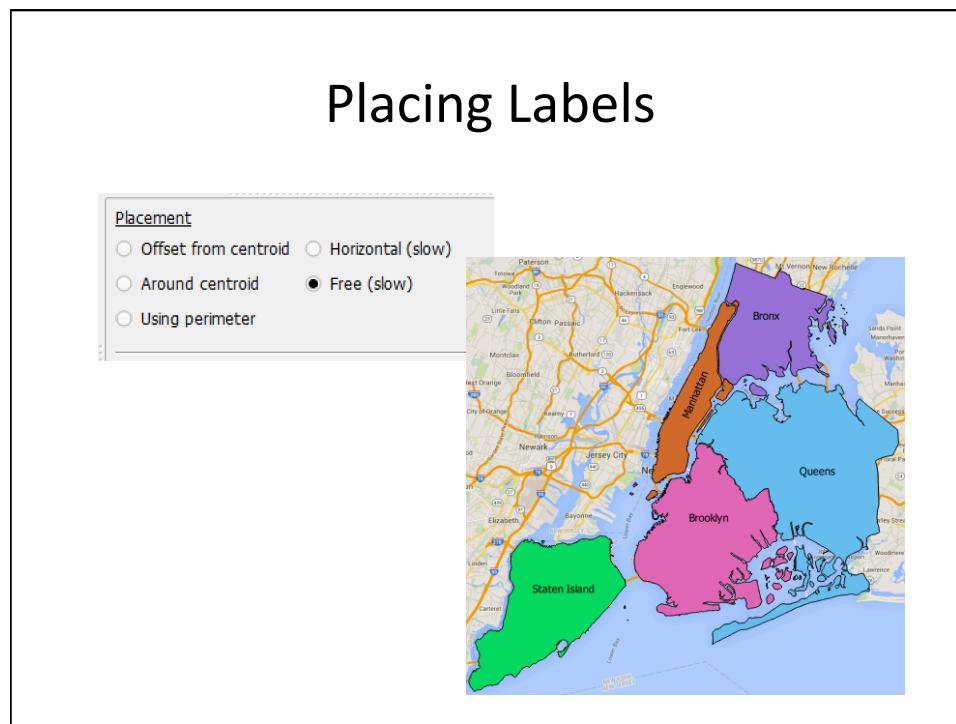
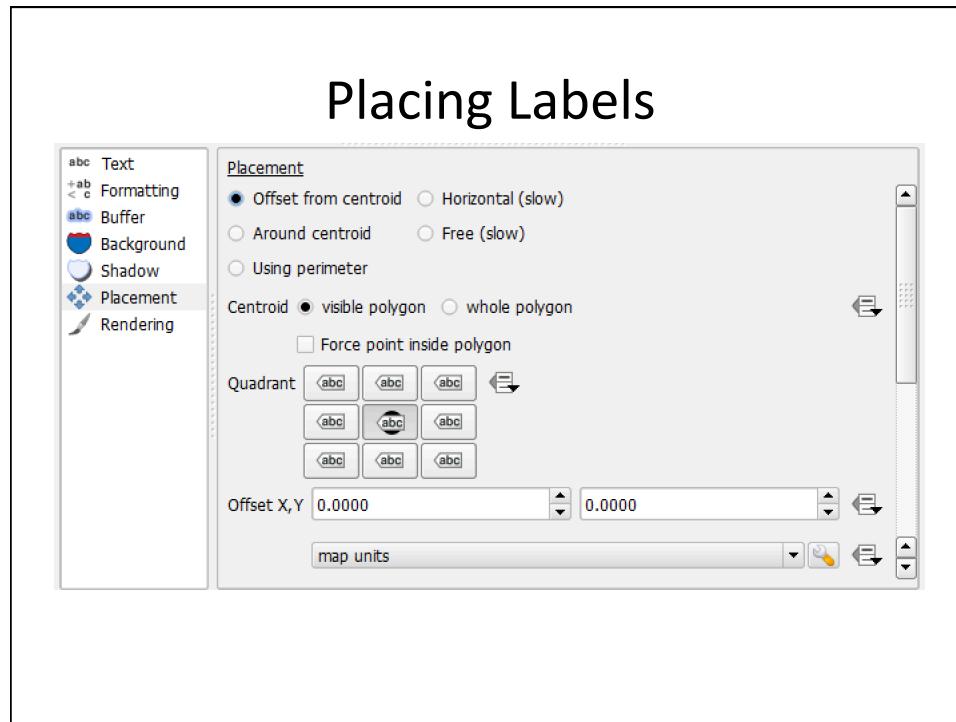
Column: BoroName  
Symbol: Change... Color ramp Random colors

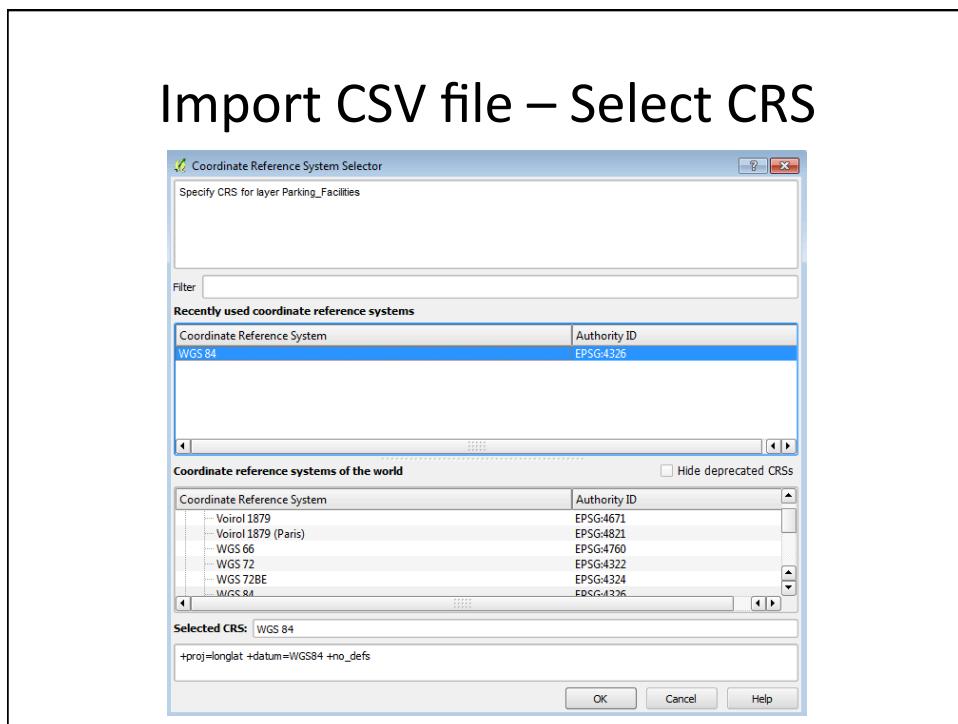
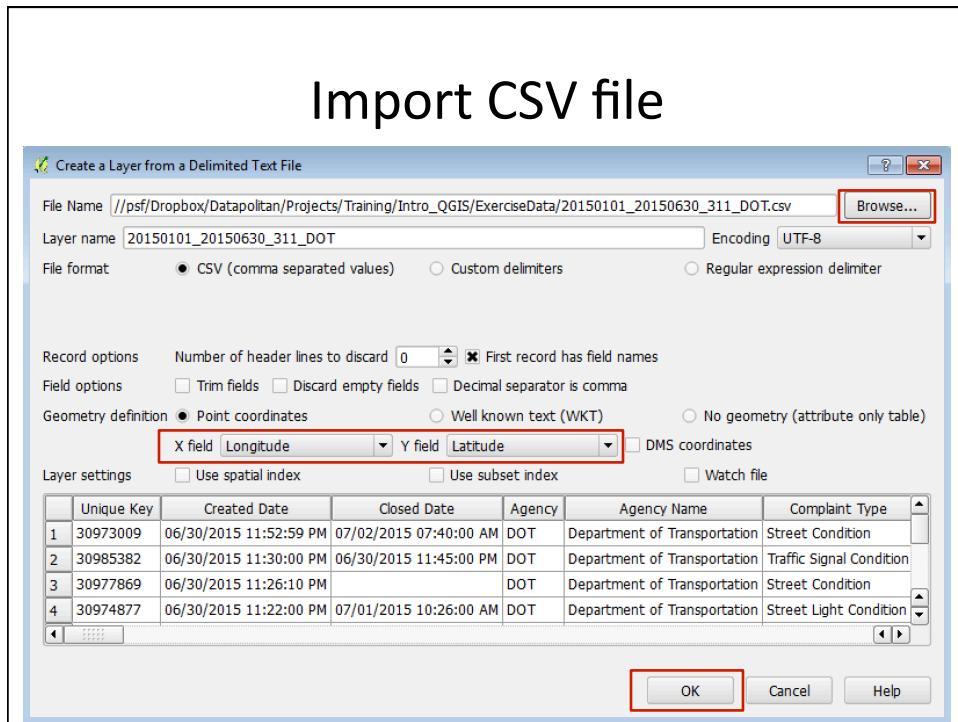
Symbol	Value	Legend
×	Bronx	Bronx
×	Brooklyn	Brooklyn
×	Manhattan	Manhattan
×	Queens	Queens
×	Staten I...	Staten Island

Buttons: Classify (highlighted), Add, Delete, Delete all, Advanced









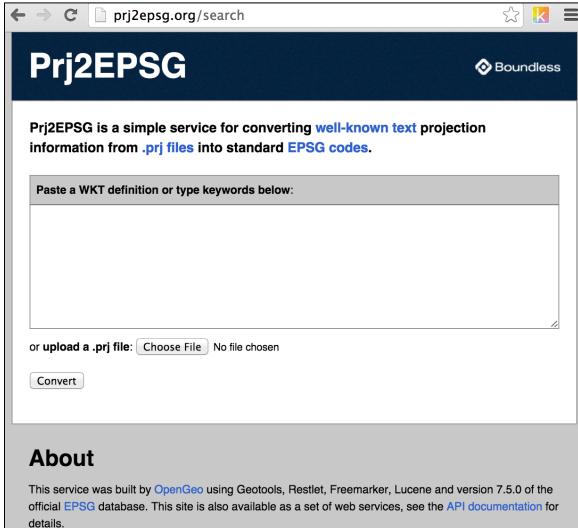
## Spatial Reference System Identifier (SRID)

- Unique value identifying spatial reference system
- Used in spatial databases to identify spatial reference systems
- Originally developed by the European Petroleum Survey Group (EPSG)

## Commonly Used SRIDs

- WGS 84 -> 4326
- NAD 83 -> 4269
- NAD83 New York State Plane Long Island Sound (ft) -> 2263

## Looking Up SRID from Shapefile



<http://prj2epsg.org/search>

## Results

Found a single exact match for the specified search terms:

- o [4326 - GCS\\_WGS\\_1984](#)

## EPSG:4326

- o **Name:** WGS 84
- o **Scope:** Horizontal component of 3D system. Used by the GPS satellite navigation system and for NATO military geodetic surveying.
- o **Remarks:** -
- o **Area of validity:** World.

**WKT representation:**

```
GEOGCS["WGS 84",
    DATUM["World Geodetic System 1984",
        SPHEROID["WGS 84", 6378137.0, 298.257223563, AUTHORITY["EPSG", "7030"]],
        AUTHORITY["EPSG", "6326"]],
    PRIMEM["Greenwich", 0.0, AUTHORITY["EPSG", "8901"]],
    UNIT["degree", 0.017453292519943295],
    AXIS["Geodetic longitude", EAST],
    AXIS["Geodetic latitude", NORTH],
    AUTHORITY["EPSG", "4326"]]
```

**EPSG:2263**

- **Name:** NAD83 / New York Long Island (ftUS)
- **Scope:** Large and medium scale topographic mapping and engineering survey.
- **Remarks:** State law defines system in US survey feet. Federal definition is metric - see code 32118. For applications with an accuracy of better than 3 feet, replaced by NAD83(HARN) / SPCS.
- **Area of validity:** United States (USA) - New York - counties of Bronx; Kings; Nassau; New York; Queens; Richmond; Suffolk.

**WKT representation:**

```
PROJCS["NAD83 / New York Long Island (ftUS)",  
    GEOGCS["NAD83",  
        DATUM["North American Datum 1983",  
            SPHEROID["GRS 1980", 6378137.0, 298.257222101, AUTHORITY["EPSG", "7019"]],  
            TOWGS84[1.0, 1.0, -1.0, 0.0, 0.0, 0.0, 0.0],  
            AUTHORITY["EPSG", "6269"]],  
        PRIMEM["Greenwich", 0.0, AUTHORITY["EPSG", "8901"]],  
        UNIT["degree", 0.017453292519943295],  
        AXIS["Geodetic longitude", EAST]]
```

## Import CSV file – Select CRS

Coordinate Reference System	Authority ID
WGS 84	EPSG:4326

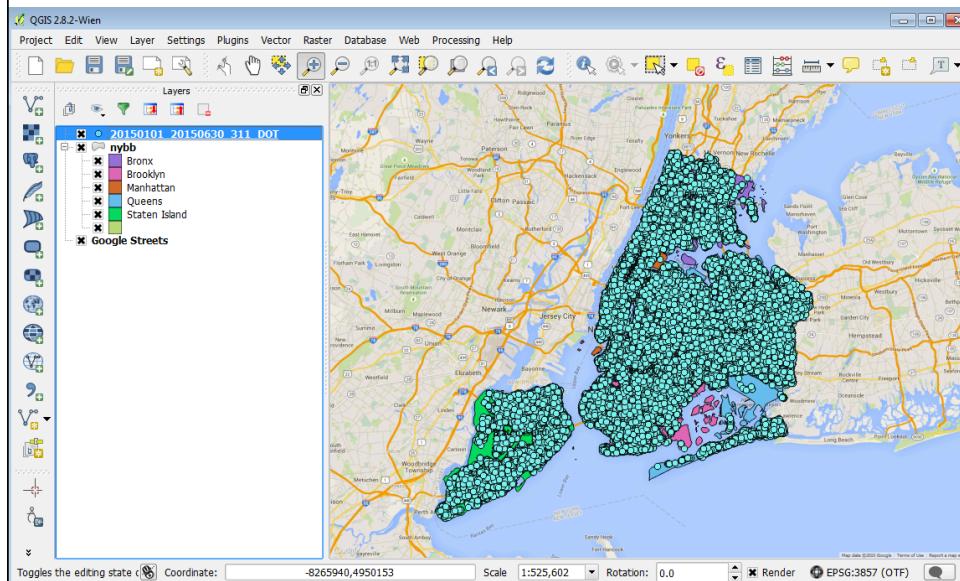
Coordinate reference systems of the world

Coordinate Reference System	Authority ID
Voroi 1879	EPSG:4671
Voroi 1879 (Paris)	EPSG:4821
WGS 66	EPSG:4760
WGS 72	EPSG:4322
WGS 72B	EPSG:4324
WGS 84	EPSG:4326

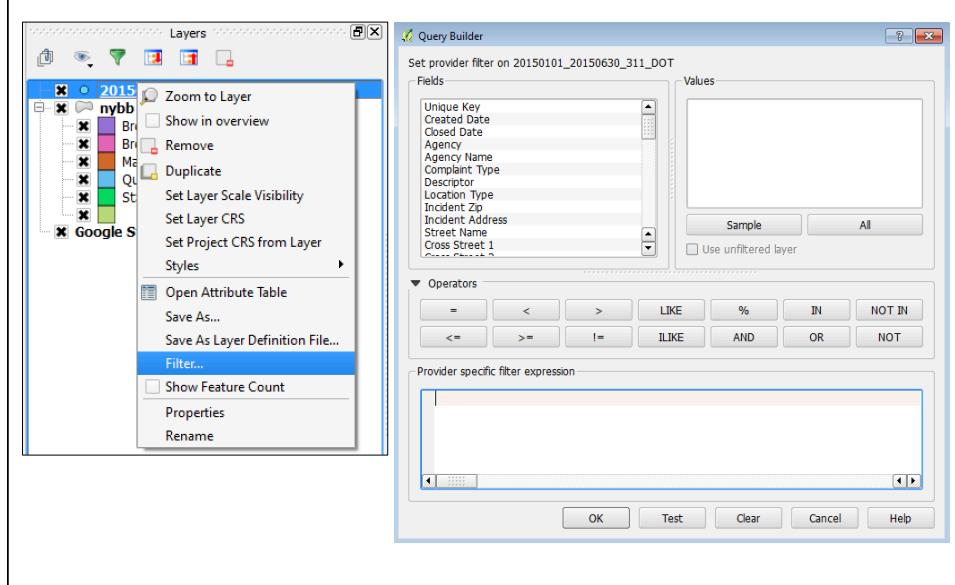
Selected CRS: WGS 84  
+proj=longlat +datum=WGS84 +no\_defs

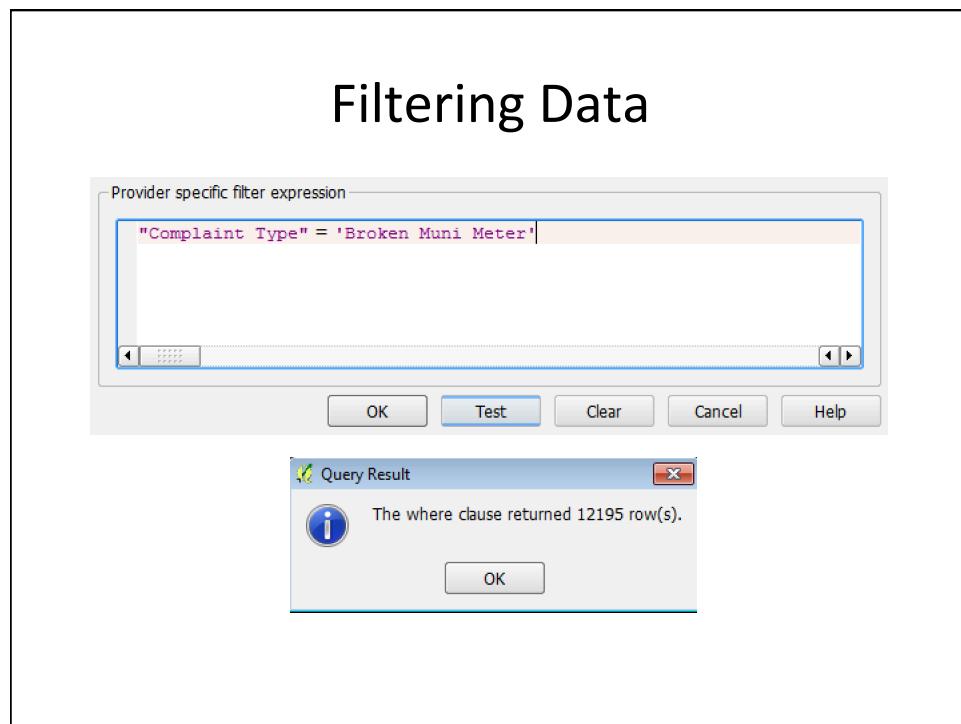
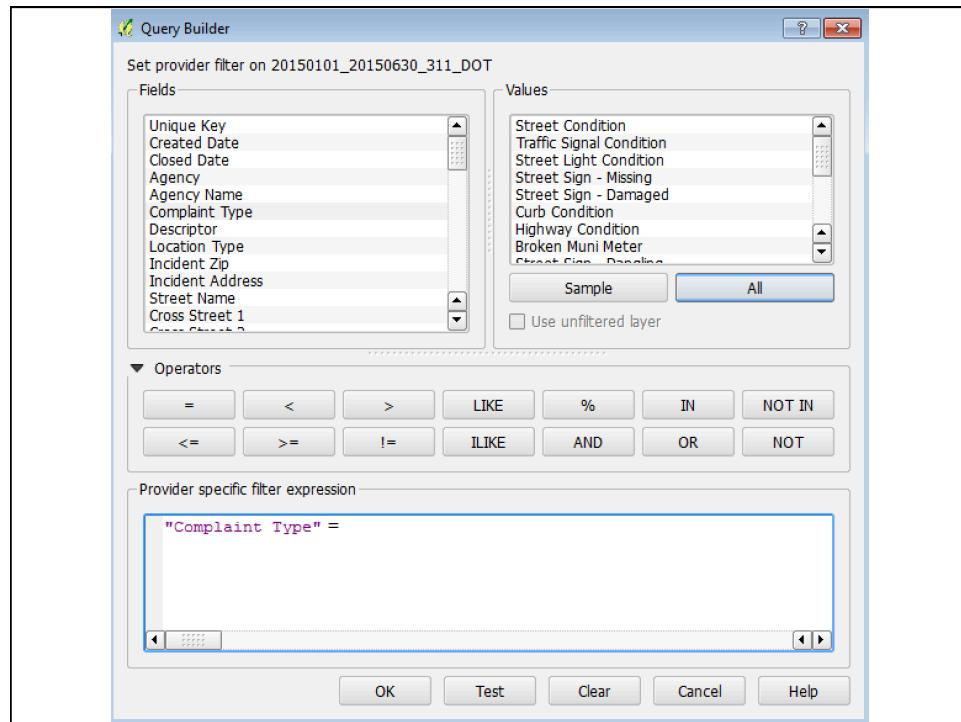
OK Cancel Help

## Import CSV file

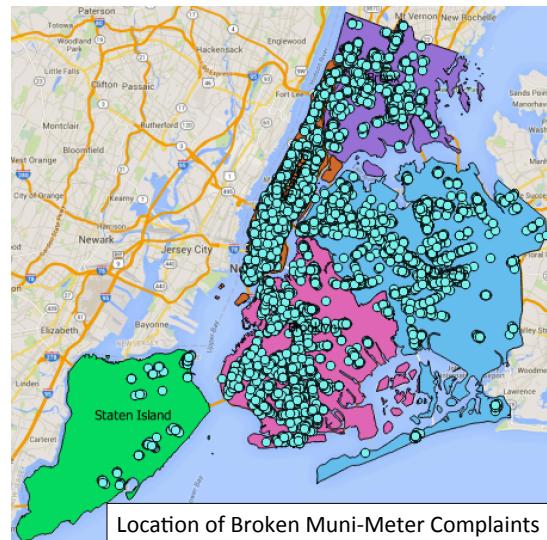


## Filtering Data

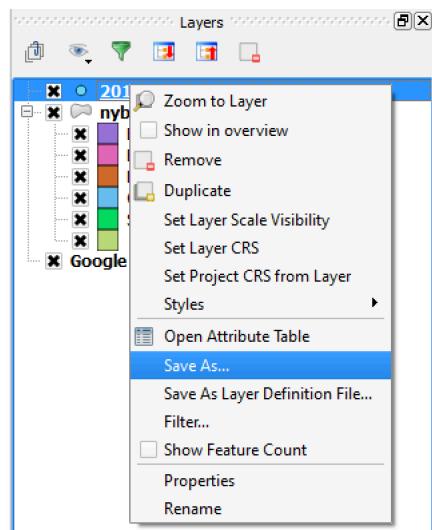


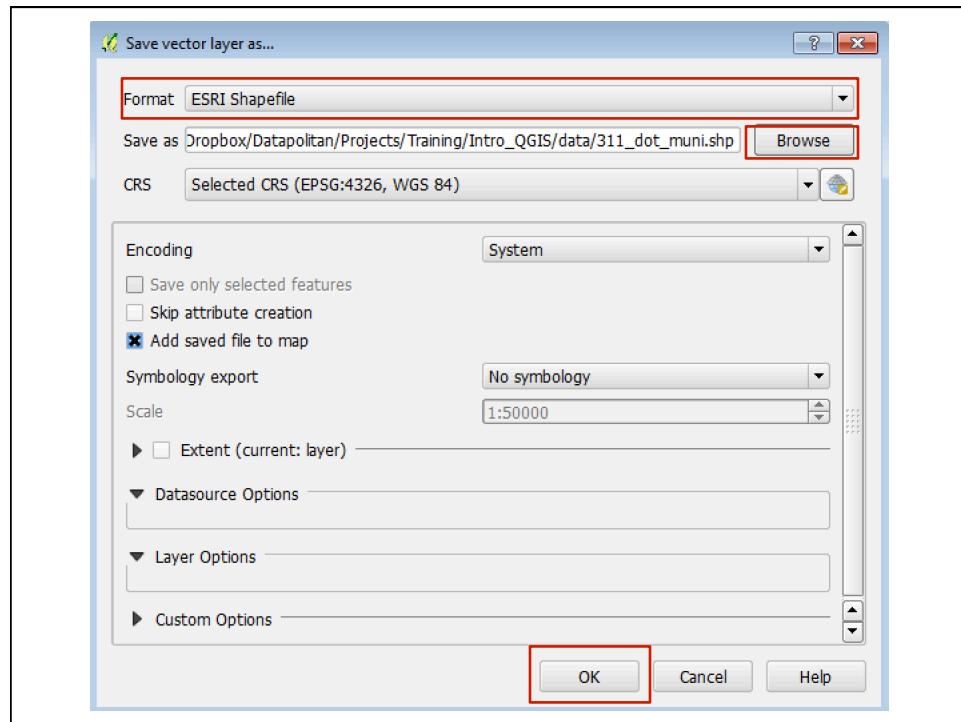


## Filtering Data



## Save CSV as a Shapefile





## Connect to the Remote Database

**Host:** utility.c1erymiua9dx.us-east-1.rds.amazonaws.com

**Post:** 5432

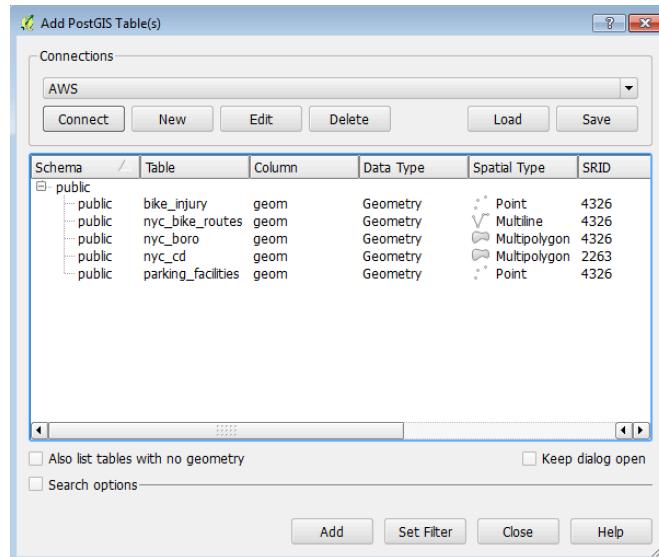
**Username:** student

**Password:** qgis

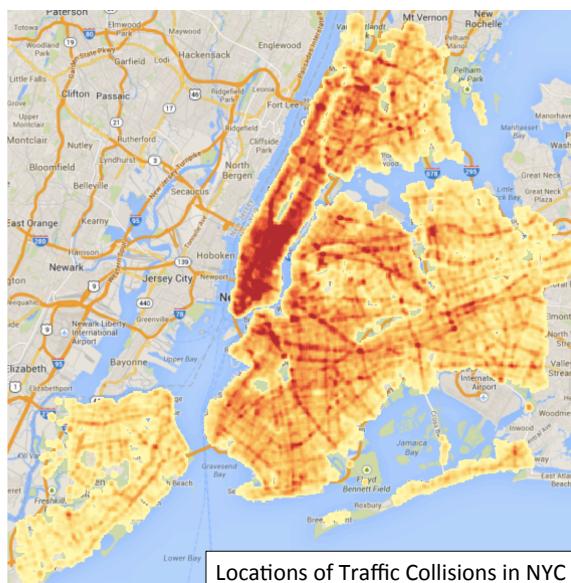
**Test connection** dialog box: Connection to utility was successful

**Create a New PostGIS connection** dialog box (Name: AWS, Host: utility.c1erymiua9dx.us-east-1.rds.amazonaws.com, Port: 5432, Database: utility, Username: student, Password: qgis). The 'OK' button at the bottom right is highlighted with a red box.

## Connect to the Remote Database



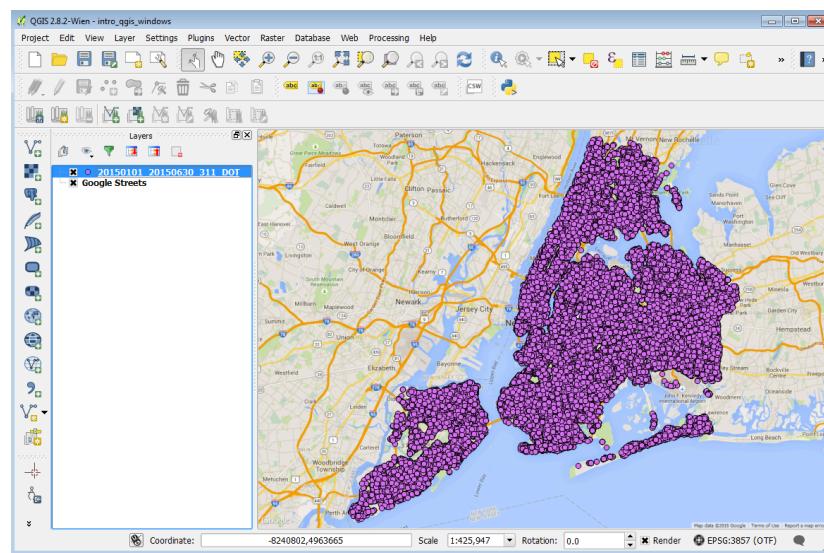
## What is a heat map?



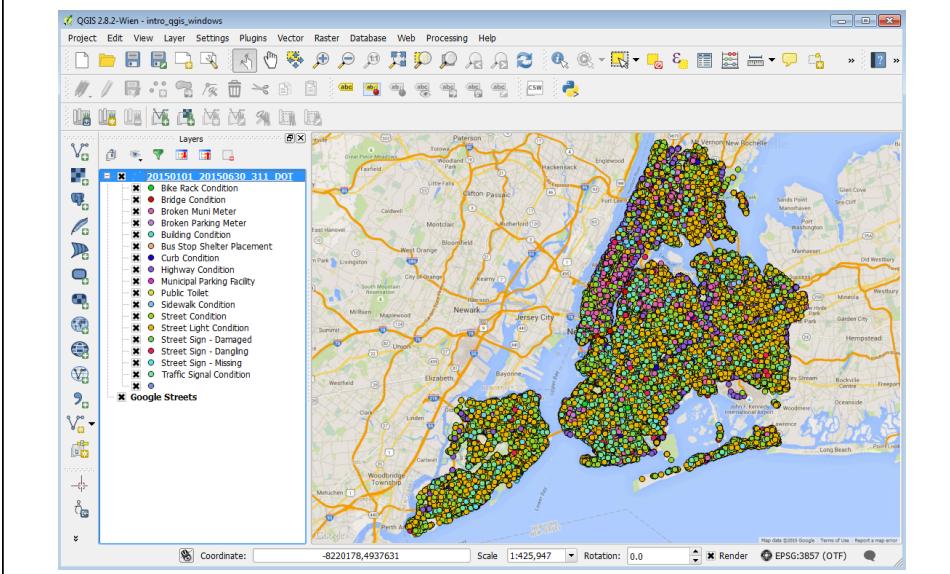
## Why do we use heat maps?

- One of the best ways to visualize dense point data
- Useful for doing cluster analysis or hotspot analysis

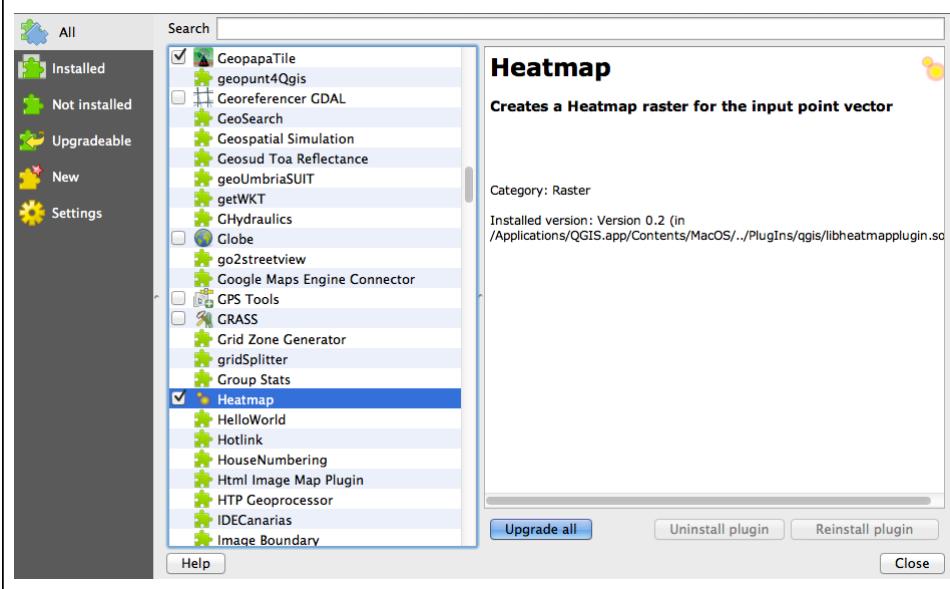
## 311 DOT Complaints

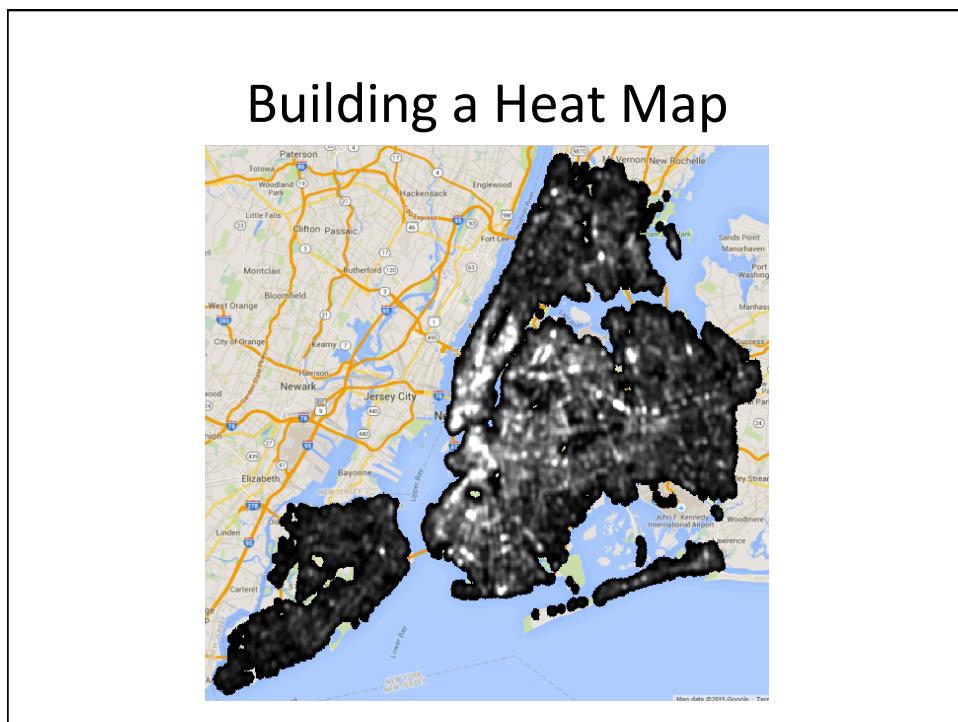
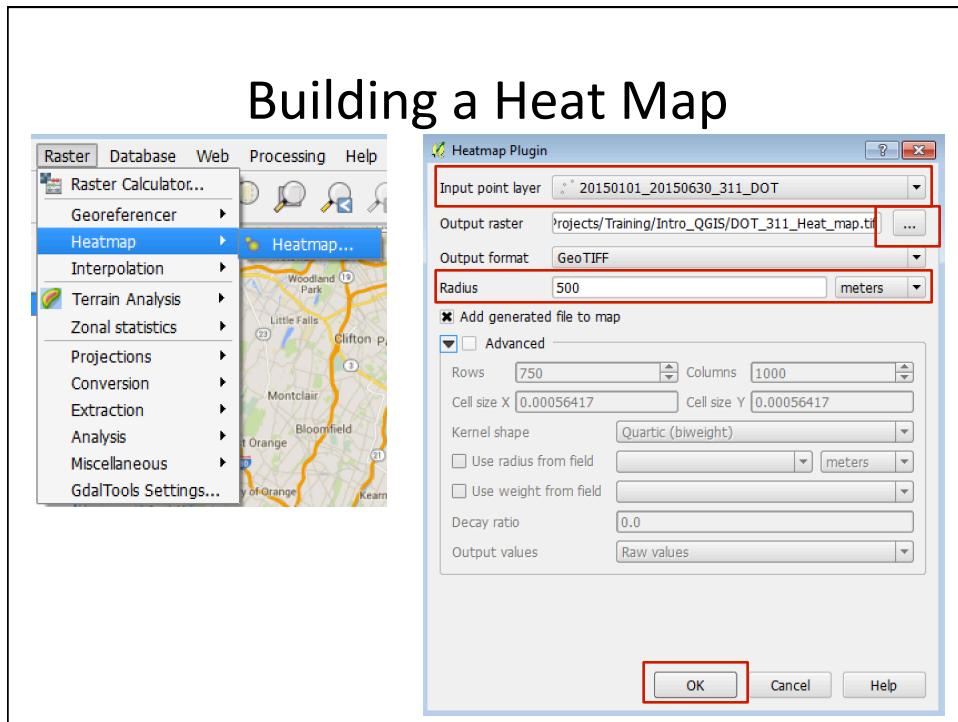


## 311 DOT Complaints

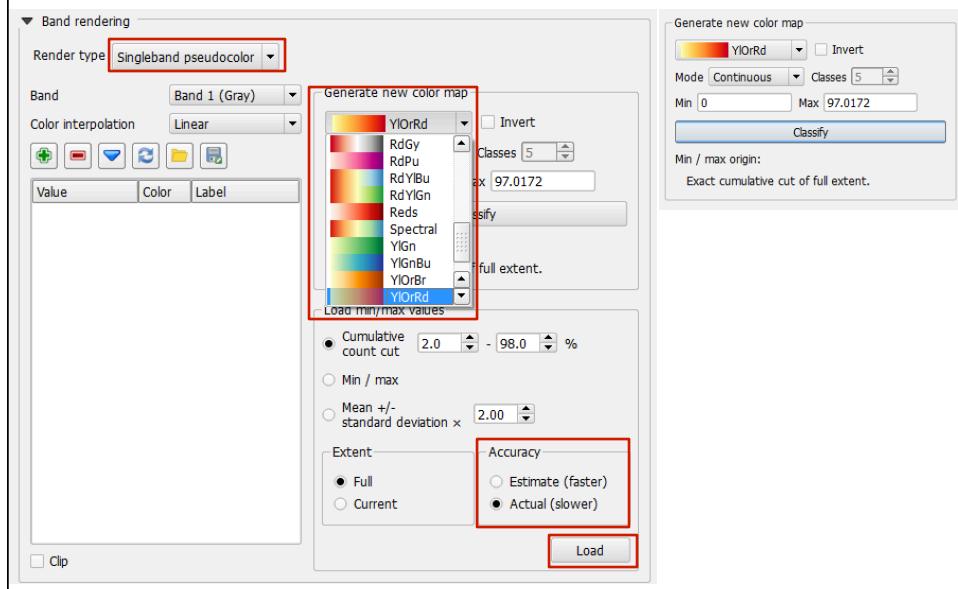


## Enabling the Heatmap Plug-in

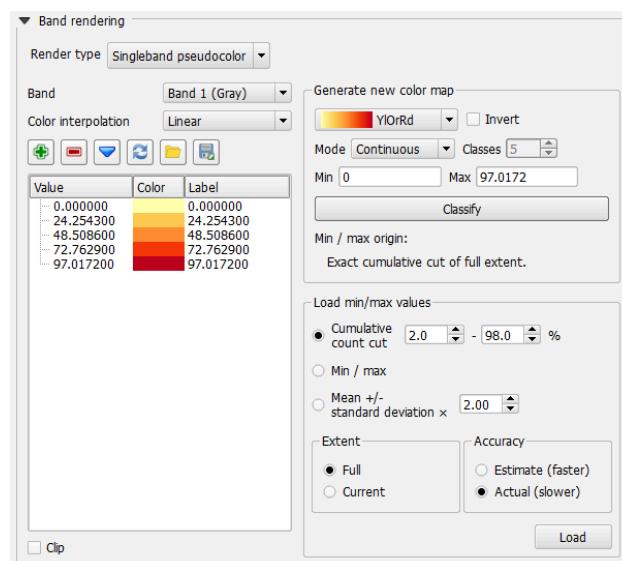




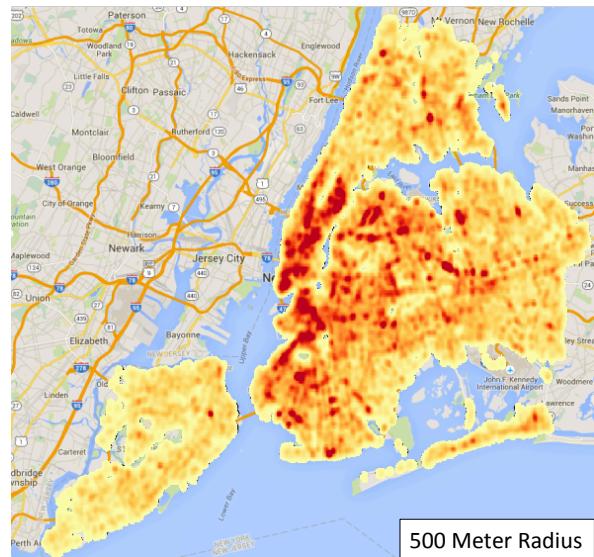
## Building a Heat Map



## Building a Heat Map



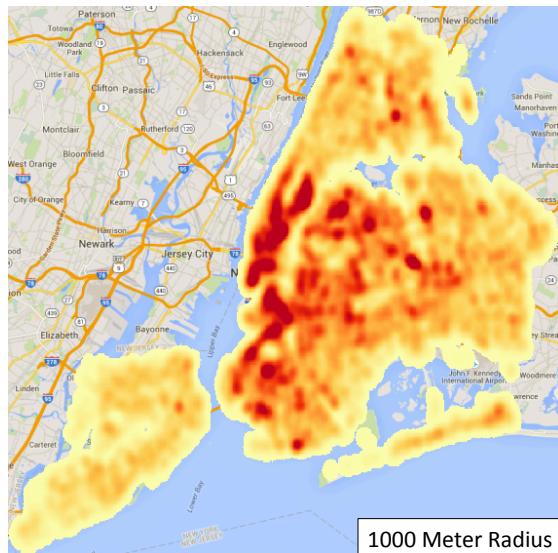
## Heat Map of 311 DOT Complaints 1 January – 30 June 2015



## Heat Map of 311 DOT Complaints 1 January – 30 June 2015

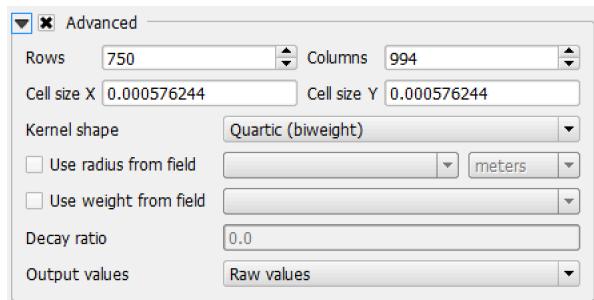


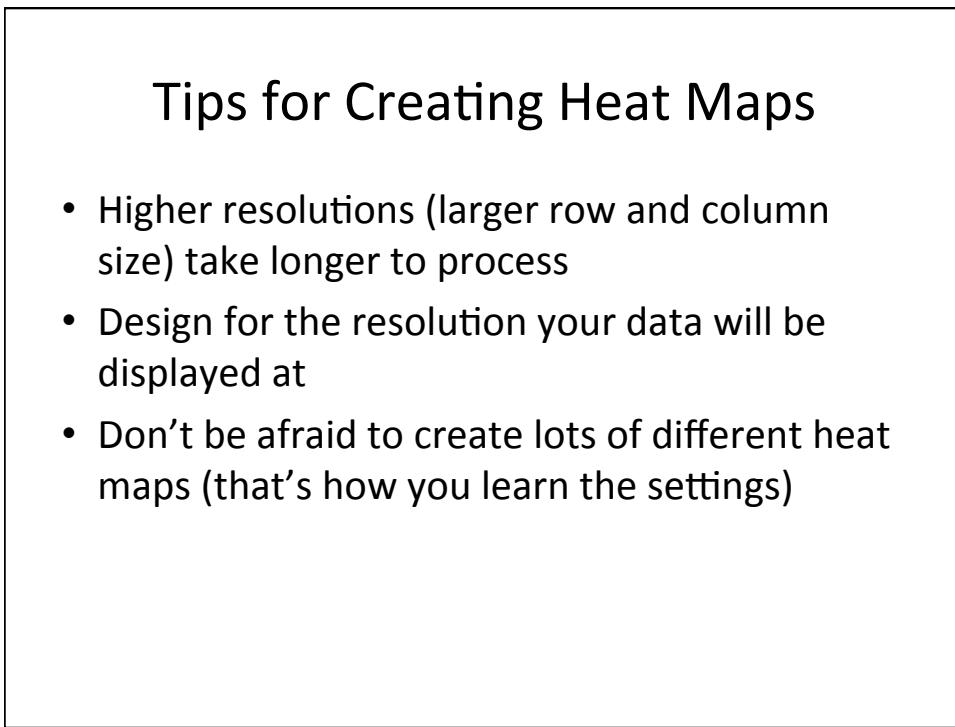
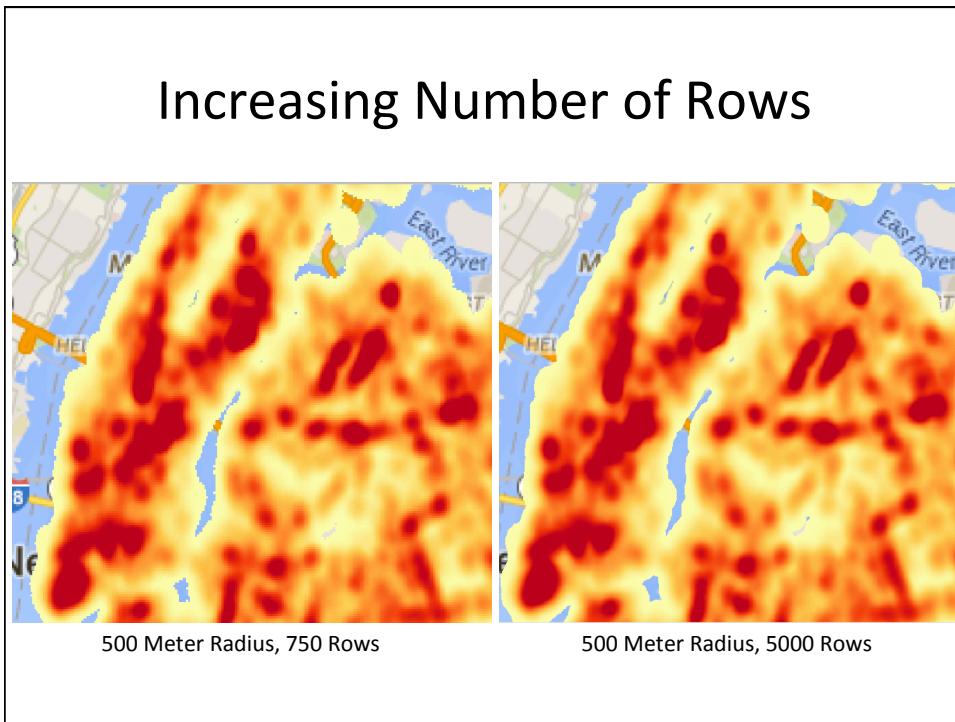
## Heat Map of 311 DOT Complaints 1 January – 30 June 2015



### Tips for Creating a Heat Map

- Adjust the radius to get the results you want
- Increase the rows and columns in the advanced features to get greater resolution (less pixelation)





## What We've Covered So Far

- How to display base maps
- How to add shapefile layers
- How to style features
- How to add a CSV file
- How to create a heat map

## Goals for the Afternoon

- Demonstrate doing spatial analysis in QGIS including joining data, creating buffers, and selecting by location
- Introduce SQL and how to perform spatial queries
- Practice creating maps in QGIS

## Spatial Relationships

### Intersects



Point &amp; Multipoint



Multipoint &amp; Multipoint



Point &amp; Linestring



Multipoint &amp; Linestring



Linestring &amp; Linestring



Linestring &amp; Polygon



Multipoint &amp; Polygon



Linestring &amp; Multipolygon

### Disjoint



Point &amp; Multipoint



Multipoint &amp; Multipoint



Point &amp; Linestring



Multipoint &amp; Linestring



Linestring &amp; Linestring



Linestring &amp; Polygon

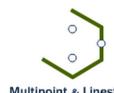


Multipoint &amp; Polygon



Polygon &amp; Polygon

### Cross



Multipoint &amp; Linestring



Linestring &amp; Linestring



Multipoint &amp; Polygon



Linestring &amp; Multipolygon

### Overlap



Multipoint &amp; Multipoint



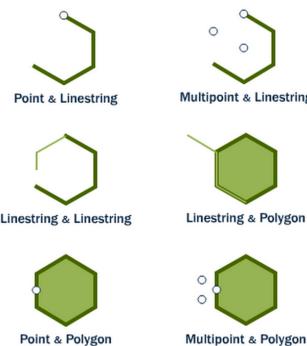
Linestring &amp; Linestring



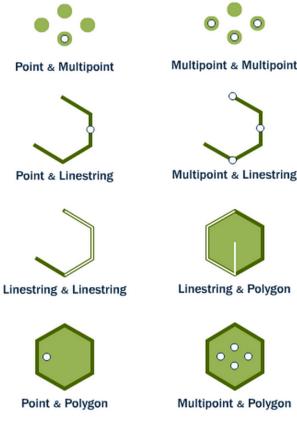
Polygon &amp; Polygon

## Spatial Relationships

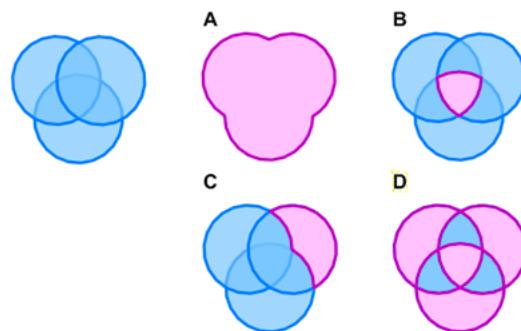
### Touch



### Within/Contains

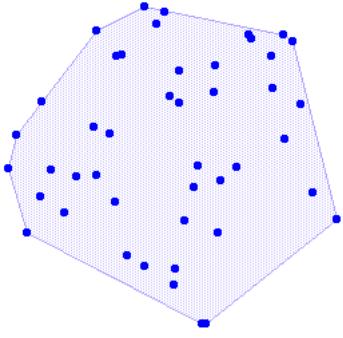


## Spatial Relationships

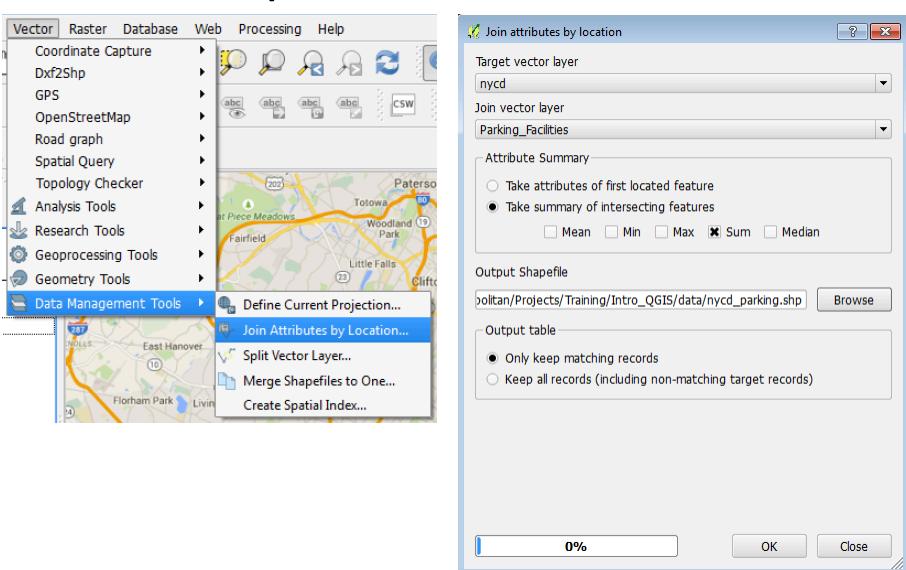


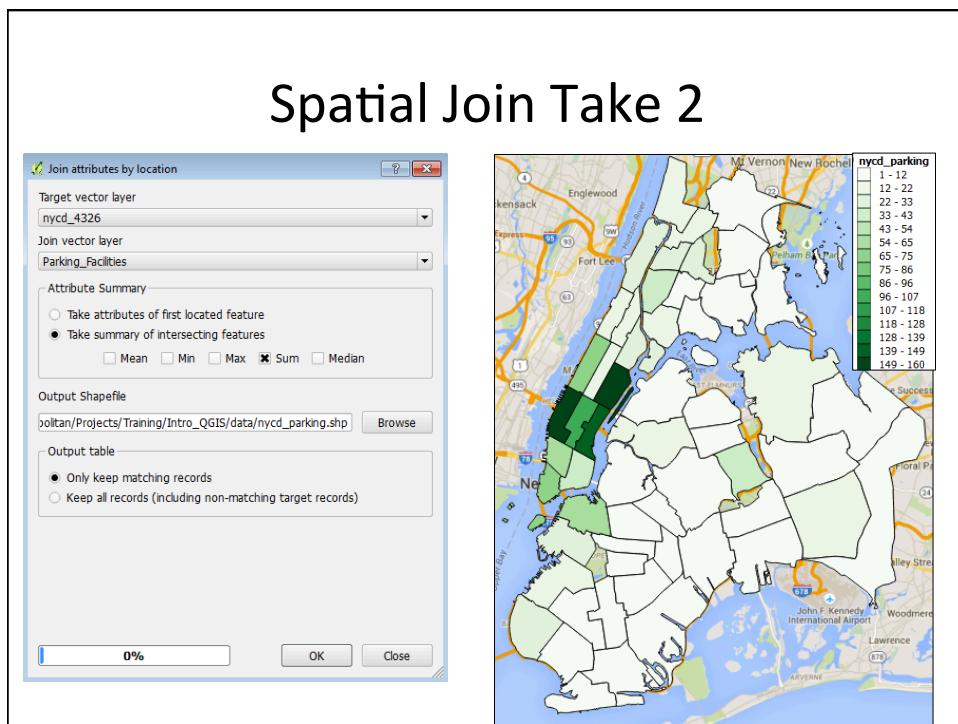
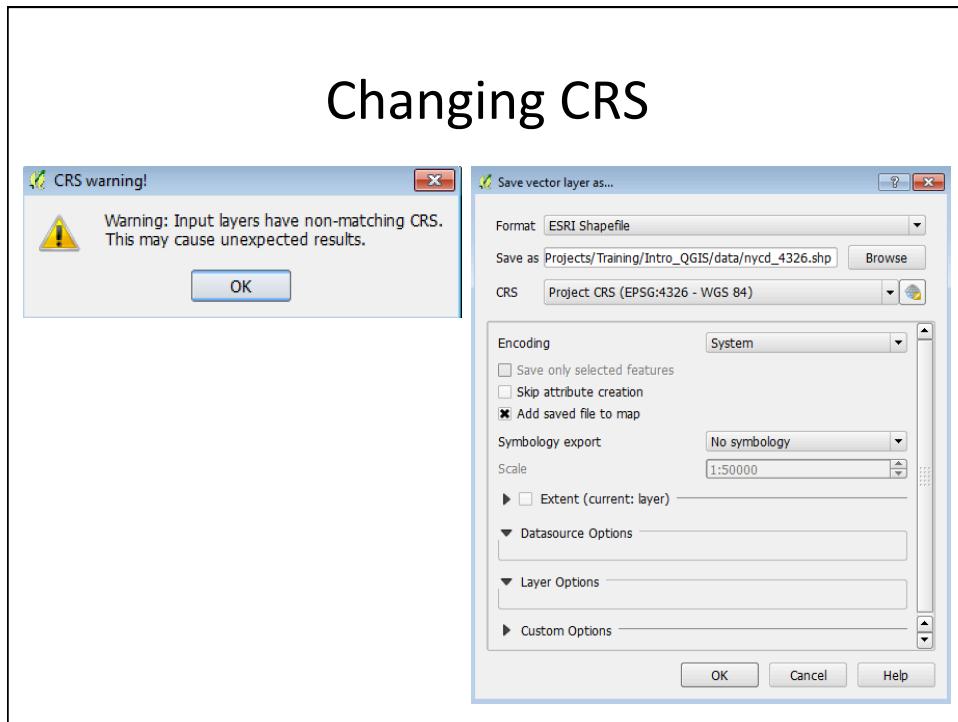
# Spatial Join

- Point to Polygon
  - Relate points inside a polygon to that polygon (ex. count the number of points)
- Polygon to Point
  - Points can take on value of enclosing polygon



## Spatial Join in QGIS





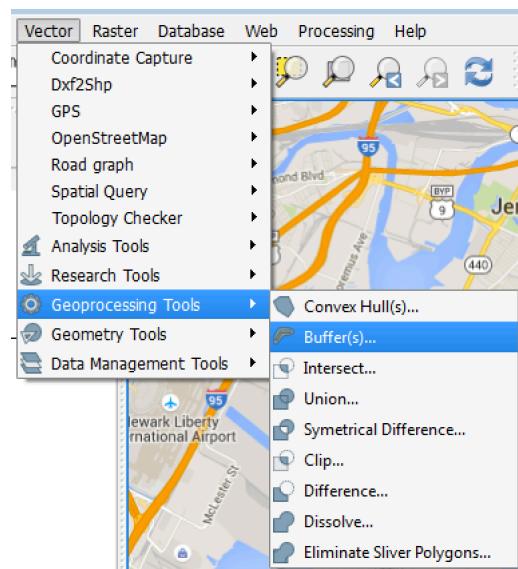
## MORE INFORMATION ON JOINS

[http://maps.cga.harvard.edu/qgis/wkshop/join\\_spatial.php](http://maps.cga.harvard.edu/qgis/wkshop/join_spatial.php)

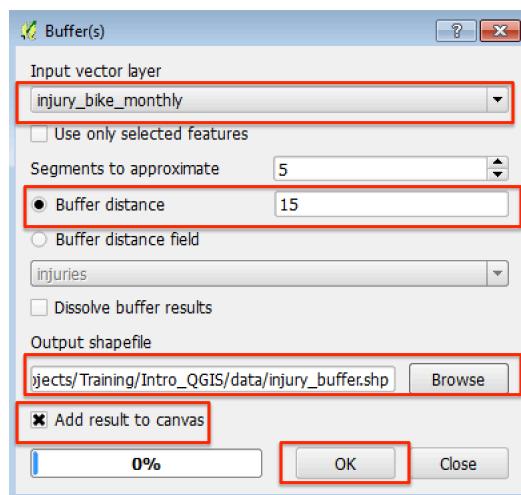
## IF YOU'RE INTERESTED IN CREATING A PROPER MAP

[http://www.qgistutorials.com/en/docs/making\\_a\\_map.html](http://www.qgistutorials.com/en/docs/making_a_map.html)

## Buffering



## Creating Buffers



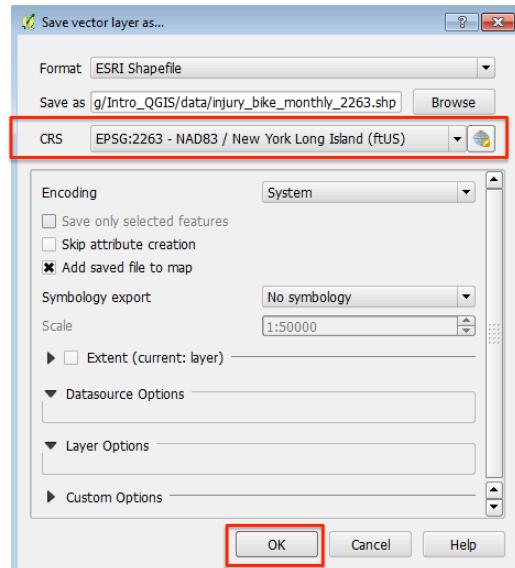
Oops



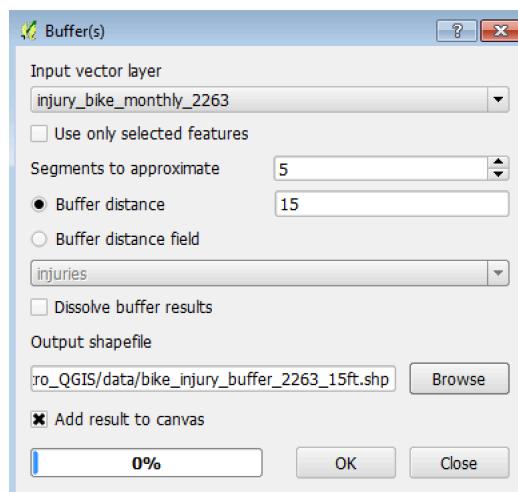
## SRID Map Units

- Each SRID has a base unit of distance
  - WGS84 -> decimal degrees (how far is 5 decimal degrees?)
- Have to convert projection to measure distance in SRID that matches desired units of measure
- Let's use 2263 (New York State Plane Long Island Sound, ft)

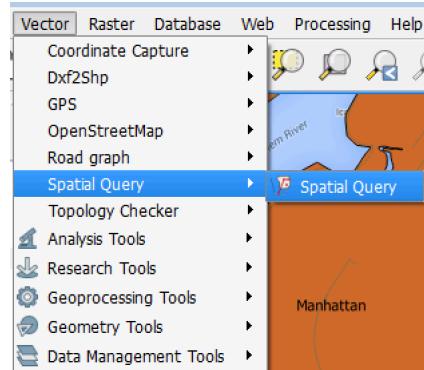
## Reproject Data



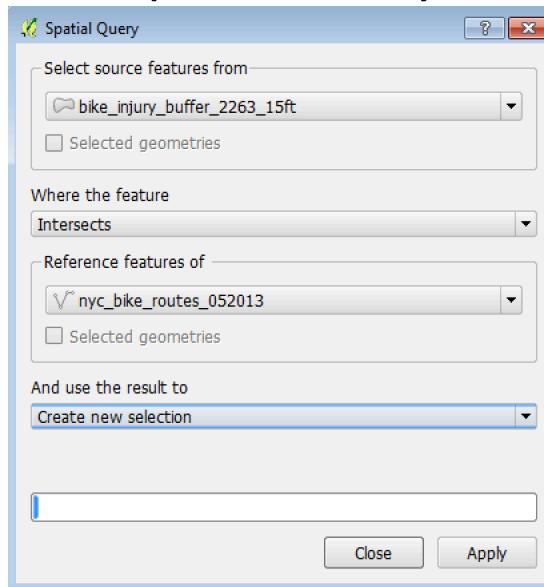
## Buffering Take 2

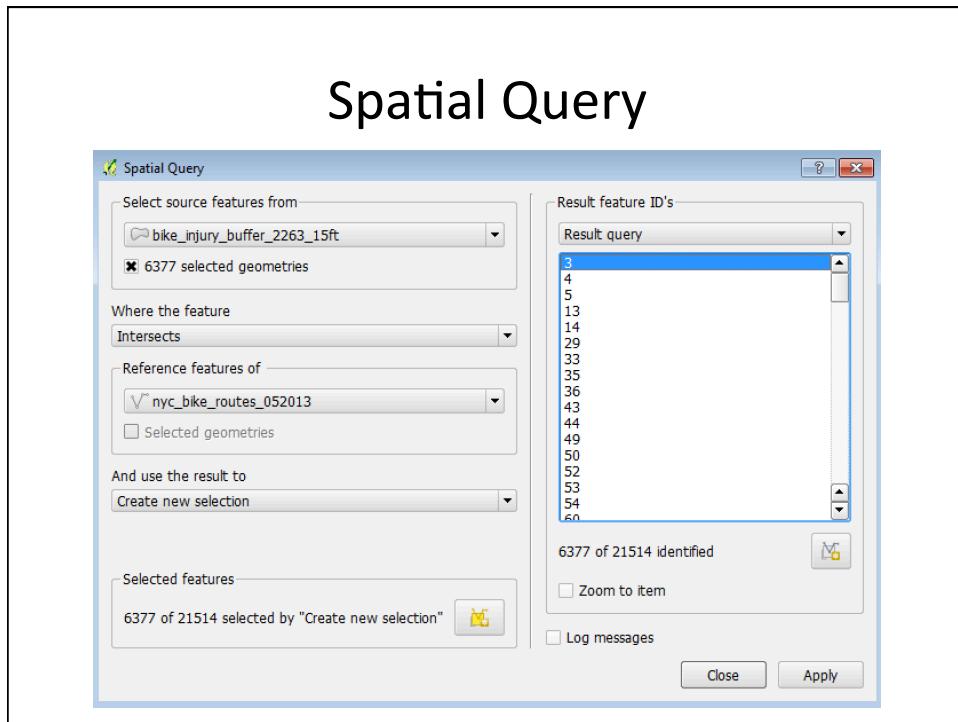


## Finding Accidents Near Bike Paths

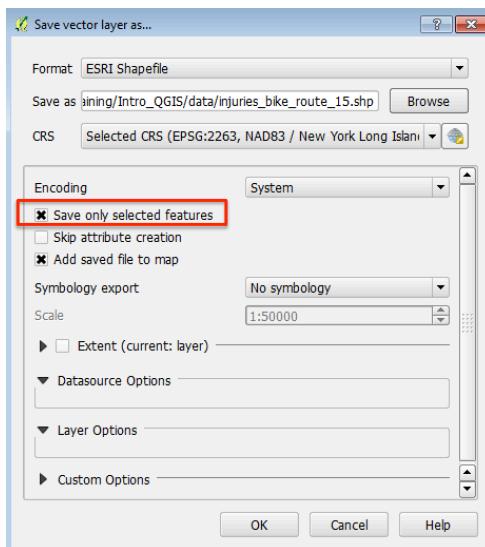


### Spatial Query

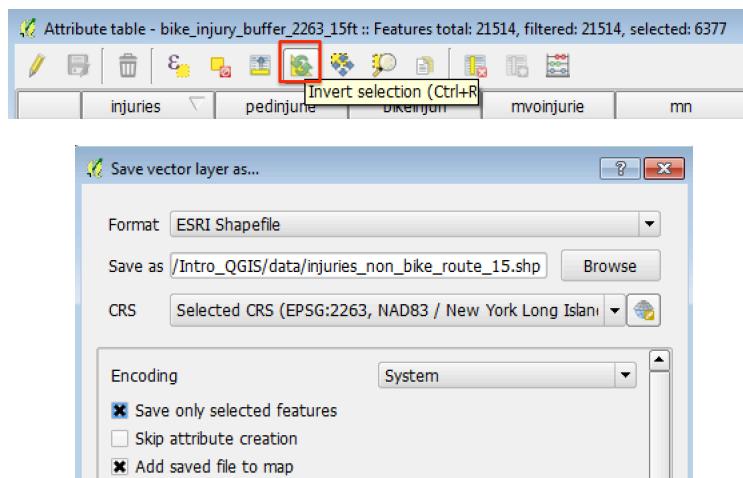




## Save Selection of Injuries Near Bike Paths



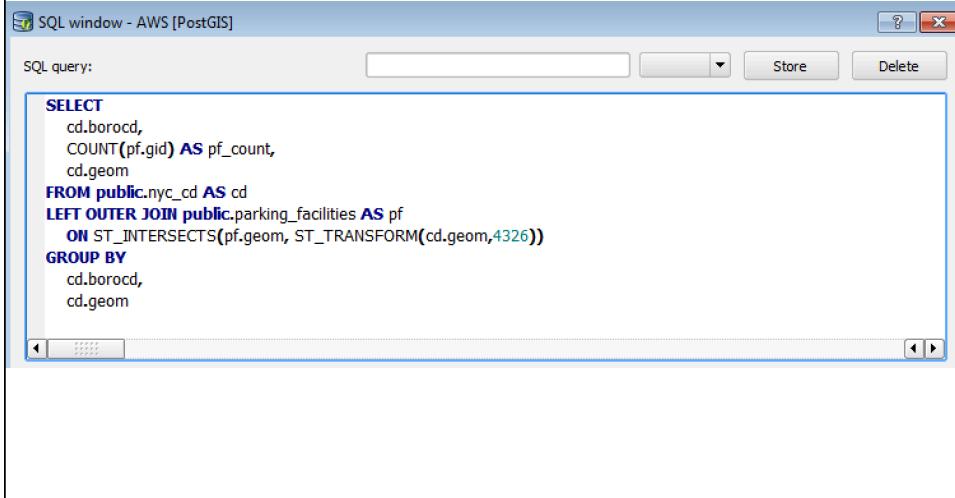
## Finding Incidents Not on Bike Paths (Invert Selection)



## SQL

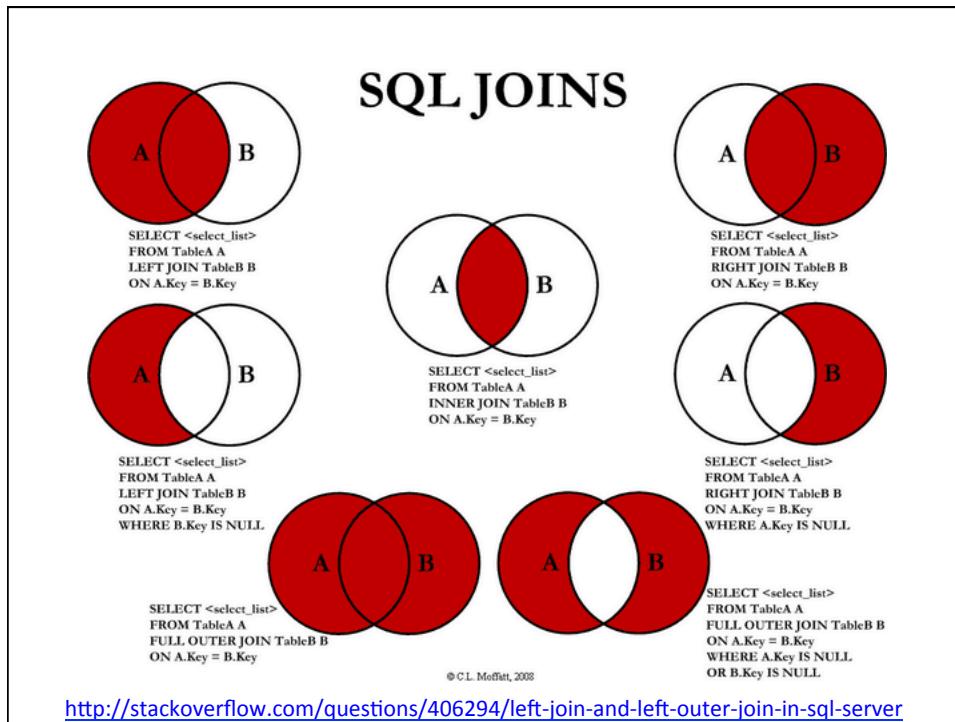
```
SELECT
    column1,
    column2,
    column3
FROM
    table
WHERE
    condition = True;
```

### Counting Parking Facilities by Community District in SQL



The screenshot shows a Windows application window titled "SQL window - AWS [PostGIS]". The window has a toolbar with "Store" and "Delete" buttons. The main area contains a SQL query:

```
SELECT
    cd.borocd,
    COUNT(pf.gid) AS pf_count,
    cd.geom
FROM public.nyc_cd AS cd
LEFT OUTER JOIN public.parking_facilities AS pf
    ON ST_INTERSECTS(pf.geom, ST_TRANSFORM(cd.geom,4326))
GROUP BY
    cd.borocd,
    cd.geom
```



## Doing the Buffer Exercise in SQL

SQL window - AWS [PostGIS]

SQL query:

```
SELECT
  b.*
FROM public.bike_injury AS b
INNER JOIN public.nyc_bike_routes AS routes
  ON ST_DWITHIN(routes.geom::geography,b.geom::geography,5)
```

SQL query:

```
SELECT b.*
FROM public.bike_injury AS b
INNER JOIN public.nyc_bike_routes AS r
  ON ST_DWITHIN(ST_TRANSFORM(r.geom,2263),ST_TRANSFORM(b.geom,2263),15)
```

# ST\_BUFFER

[Prev](#)      ***ST\_Buffer***      [8.10. Geometry Processing](#)      [Next](#)

---

**Name**

ST\_Buffer — (T) For geometry. Returns a geometry that represents all points whose distance from this Geometry is less than or equal to distance. Calculations are in the Spatial Reference System of this Geometry. For geography: Uses a planar transform wrapper. Introduced in 1.5 support for different end cap and mitre settings to control shape. buffer\_style options: quad\_segs=#,endcap=round|flat|square,join=round|mitre|bevel,mitre\_limit=#. #

**Synopsis**

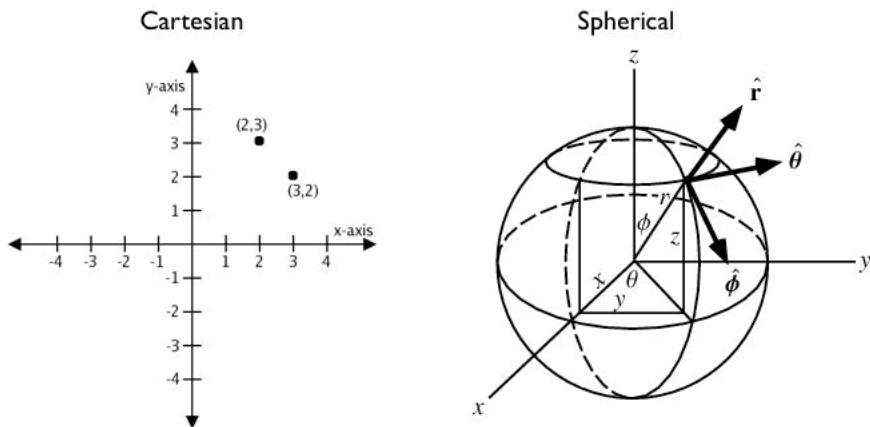
```
geometry ST_Buffer(geometry g1, float radius_of_buffer);
geometry ST_Buffer(geometry g1, float radius_of_buffer, integer num_seg_quarter_circle);
geometry ST_Buffer(geometry g1, float radius_of_buffer, text buffer_style_parameters);
geography ST_Buffer(geography g1, float radius_of_buffer_in_meters);
```

**Description** ST\_Buffer

Returns a geometry/geography that represents all points whose distance from this Geometry/geography is less than or equal to distance.

Geometry: Calculations are in the Spatial Reference System of the geometry. Introduced in 1.5 support for different end cap and mitre settings to control shape.

## Geometry vs Geography



## Geometry vs Geography



## Geometry vs Geography



# ST\_DWithin

*ST\_DWithin*  
**8.8. Spatial Relationships and Measurements**

---

[Prev](#) [Next](#)

**Name**

ST\_DWithin — Returns true if the geometries are within the specified distance of one another. For geometry units are in those of spatial reference and For geography units are in meters and measurement is defaulted to use\_spheroid=true (measure around spheroid), for faster check, use\_spheroid=false to measure along sphere.

**Synopsis**

```
boolean ST_DWithin(geometry g1, geometry g2, double precision distance_of_srid);
boolean ST_DWithin(geography gg1, geography gg2, double precision distance_meters);
boolean ST_DWithin(geography gg1, geography gg2, double precision distance_meters, boolean use_spheroid);
```

**Description**

Returns true if the geometries are within the specified distance of one another.

For Geometries: The distance is specified in units defined by the spatial reference system of the geometries. For this function to make sense, the source geometries must both be of the same coordinate projection, having the same SRID.

For geography units are in meters and measurement is defaulted to use\_spheroid=true (measure around WGS 84 spheroid), for faster check, use\_spheroid=false to measure along sphere.

## Exercise

- Working on your own or in groups, create for your assigned borough:
  - A heat map of bicycle injuries occurring on or near bike paths
  - A heat map of bicycle injuries occurring away from bike paths
- Prepare to present your (rough) spatial analysis to the class

## Reminders

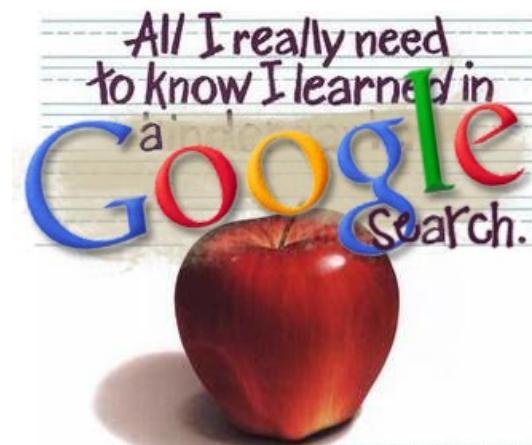
- Know your layer SRS
- Know the measurement units for your SRS
- When in doubt, zoom in and then zoom out
- If you're working with a CSV file and run into an error, export as a shapefile and try it again
- Save your project often
- Choose good file names

## Conclusion

- Maps are a great way to visualize and explore spatial data
- Some data is only intelligible when mapped
- QGIS is a cheap (as in free) way to get started
- There are many resources online for how to use QGIS and other GIS applications
- Share what you know with others -> Data wants to be mapped

## References

- Manuals
  - [https://www.qgis.org/en/docs/user\\_manual/index.html](https://www.qgis.org/en/docs/user_manual/index.html)
  - <http://gis.stackexchange.com/>
- Blogs of Interest
  - <http://spatialityblog.com/>
  - <http://anitagraser.com/>
  - <http://nathanw.net/>
  - <http://blog.datapolitan.com/>



All I really need to know about how to live and what to do and how to be I learned in kindergarten. Wisdom was not at the top of the graduate-school mountain, but there in the sandpile at Sunday School. These are the things I learned ■ Share everything. Play fair. Don't hit people. Put things back where you found them.

## Contact Information

### Instructor

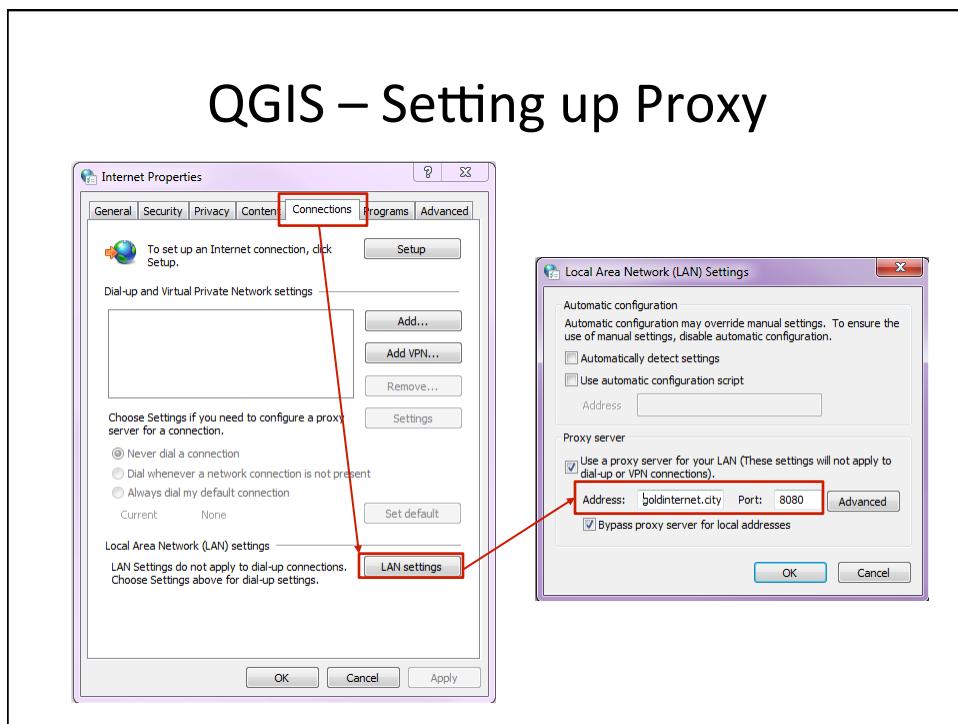
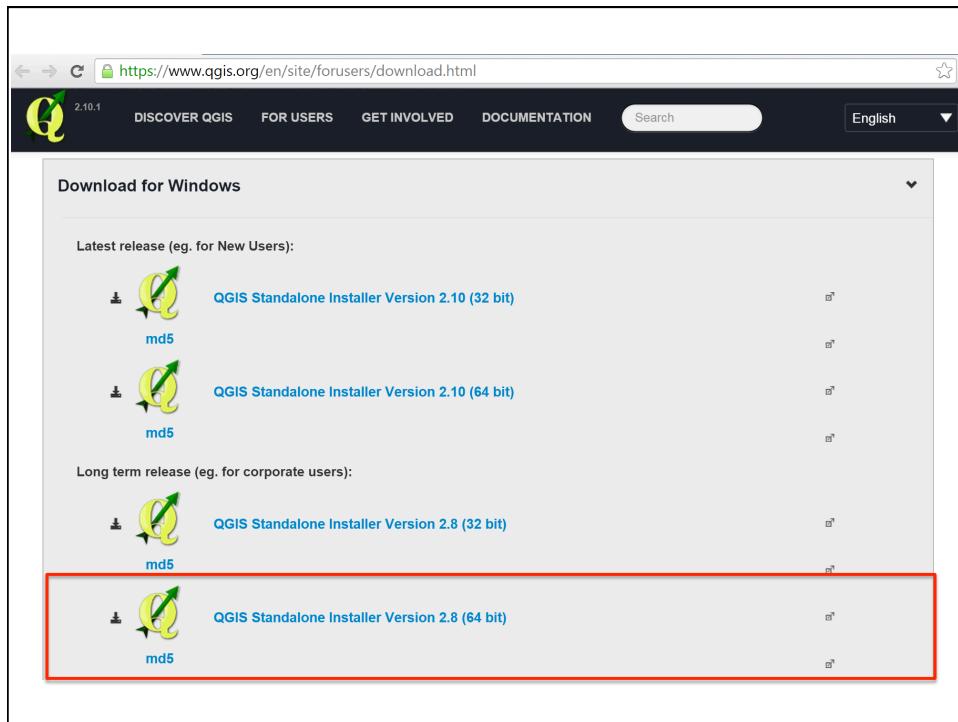
- Name: Richard Dunks
- Email: [richard@datapolitan.com](mailto:richard@datapolitan.com)
- Website: <http://www.datapolitan.com>
- Blog: <http://blog.datapolitan.com>
- Twitter: @rdunks1/@datapolitan

**THANK YOU!**

## **BACKUP SLIDES**

## **INSTALL QGIS**

<https://www.qgis.org/en/site/forusers/download.html>



## QGIS – Setting up Proxy

