

## Tutorial: Mapping Literary Space with QGIS

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### Introduction

This tutorial is designed especially for teachers, students, and readers of literature. It invites them to use QGIS in a way that speaks to their own needs. QGIS is open-source software, which means that it's free to users and developed, maintained, and fixed by volunteers. Please be patient as you learn to use this program, even if you don't always get the responses you want quickly. As with any learning experience, don't hesitate to **ask questions** and explore possible answers. And remember that as you've saved your underlying data, projects can be rebuilt. We've all been there. **I recommend saving in multiple locations, as well as keeping an extra copy on your desktop for quick use.**

### PHASE 1: Preparing your Spreadsheet

#### Step 1: Read and take notes

- Read through the text. Come up with some research questions that you would like the map to answer. These will help you decide on the types of data you will need to collect to answer those questions.
- Decide on the categories that you want to include in your spreadsheet (see Fig. 1 for an example dataset on *Souls Belated* by Edith Wharton).

#### Essential categories to include in your spreadsheet:

- Character name
- Passage (e.g. a brief quote from the passage)
- Page number(s) of passage
- Physical location (e.g. address, city, etc. Be specific as you can!)
- Latitude
- Longitude

#### Highly recommended categories:

- Location type (e.g. city, park, hotel)
- Chronology (e.g. day 1)
- Chapter of passage

#### Suggested categories:

- Date

- Time (or time of day)
- Season
- Identifiable information (e.g. gender, nationality, age, class, physical ability)
- How many with? (i.e. number of people character is with)
- Who with? (i.e. names of people character is with)
- Comments on the text
- Notes on the process
- Source

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Character	Passage	Page number	Physical Location	Latitude	Longitude	Location Type	Chronology	Chapter	Date	Time	Gender	Class	Nationality	Howmanywith?	Whowith?	CommentonText	Notesonprocess	Sources	
2				Essential																
3																				
4																				
5																				
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Figure Coming up with categories in spreadsheet

## Step 2: Prepare your Spreadsheet

- Choose a character from the text and read through the story closely. Take a note of every location they are listed as being in and fill out the categories in your spreadsheet. Be sure to mark the page number of any location referenced.
- Search for the latitude and longitude of each location in [Google Maps](#) or [LatLong](#). Input this into your spreadsheet.\* If you don't know the exact location, make an educated guess based on your readings and your exploration of the map.

\*When putting coordinate columns into your spreadsheet, order must be first latitude then longitude, not the other way around. Latitude represents N/S and is a positive number; longitude represents E/W and is a negative number.

Take a looK at the sample dataset below for *Souls Belated* with some of the data filled in (Fig. 2).

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Character	Passage	Page #	Physical Location	Latitude	Longitude	Location Type	Chronology	Gender	Class	Nationality	How many with?	Whom with?	Comment on Text	Notes on process
Lydia	inner railway carriage had been run when the train left Bologna; but at the first station beyond Milan their only remaining companion a courtly person who	1	w of Bologna north from	44.505884	11.341819	train	Day 1	F	Upper	American	3	Gannett and unnamed		How to indicate in transit?
Lydia	inner railway carriage had been run when the train left Bologna; but at the first station beyond Milan their only remaining companion a courtly person who	1	Milan	45.485891	9.202094	train	Day 1	F	Upper	American	3	Gannett and unnamed		
Gannett	inner railway carriage had been run when the train left Bologna; but at the first station beyond Milan their only remaining companion a courtly person who	1	w of Bologna north from	44.505884	11.341819	train	Day 1	M	Upper	American	3	Lydia and unnamed		
Gannett	inner railway carriage had been run when the train left Bologna; but at the first station beyond Milan their only remaining companion a courtly person who	1	Milan	45.485891	9.202094	train	Day 1	M	Upper	American	3	Lydia and unnamed		
Unnamed Italian	inner railway carriage had been run when the train left Bologna; but at the first station beyond Milan their only remaining companion a courtly person who	1	north from Milan	45.485891	9.202094	train	Day 1	M	Middle	?	3	Lydia and Gannett	The Italian is courtly; but not identifiable by class	
Lydia	Existence in the commodious Tillotson mansion in Fifth Avenue with Mrs. Tillotson senior commanding the approaches from the second-story front windows had been reduced to a series of purely automatic acts.	2	Fifth Avenue Mansion	40.766161	-73.97244	mansion	Flashback to Lydia's marriage	F	Upper	American	3	Lydia, Tillotson, Mrs. Tillotson		Educated guess on the longitude, as Wharton's wealthy characters often live in the East 60s
Lydia & Gannett	Lydia and Their wanderings during the year had indeed been like the flight of the outlaws: through Sicily, Dalmatia, Transylvania and Southern Italy they had persisted in their race avoidance of their kind Gannett	3	Sicily	37.534169	14.103991	train, hotel	Flashback to Lydia's flight with Gannett	M, F	Upper	American	2	Lydia and Gannett		Educated guesses on the latitude and longitude for all of these
Lydia & Gannett	Lydia and Their wanderings during the year had indeed been like the flight of the outlaws: through Sicily, Dalmatia, Transylvania and Southern Italy they had persisted in their race avoidance of their kind Gannett	3	Dalmatia	43.514908	16.41063	train, hotel	Flashback to Lydia's flight with Gannett	M, F	Upper	American	2	Lydia and Gannett		Educated guesses on the latitude and longitude for all of these
Lydia & Gannett	Lydia and Their wanderings during the year had indeed been like the flight of the outlaws: through Sicily, Dalmatia, Transylvania and Southern Italy they had persisted in their race avoidance of their kind Gannett	3	Transylvania	46.766667	23.583333	train, hotel	Flashback to Lydia's flight with Gannett	M, F	Upper	American	2	Lydia and Gannett		Educated guesses on the latitude and longitude for all of these

Figure Sample Dataset for Souls Belated

## Step 3: Clean up your spreadsheet:

- Common errors to look for include typos, spelling errors, and errors in characters' names. As you expand your project, I recommend creating an **error list**—including frequent typos, ambiguities around characters' names or places, etc. That will help you figure out which areas need particular attention.
- Use Excel Find and Replace to check for spelling errors, particularly of characters' names. Errors in spelling and spacing will create additional characters, which you don't want.
- It's possible that you will lose accent marks or dashes, especially if you have been working with e-texts from Project Gutenberg, which occasionally contain OCR errors. You can search for whatever error message the file translates such things into through Excel Find and Replace.
- You may also lose punctuation when you convert your Excel spreadsheet to a CSV file.
- [OpenRefine](#) also offers a way of cleaning large amounts of data. You will need to download it to your computer. This is a good way to search for spelling errors and other kinds of typos, especially if you have a **lot** of data.

**Remember, no data set is perfect...but the more you correct now, the less you will have to fix later on.** Consult Fig. 3 for a complete dataset for the *Age of Innocence* by Edith Wharton.



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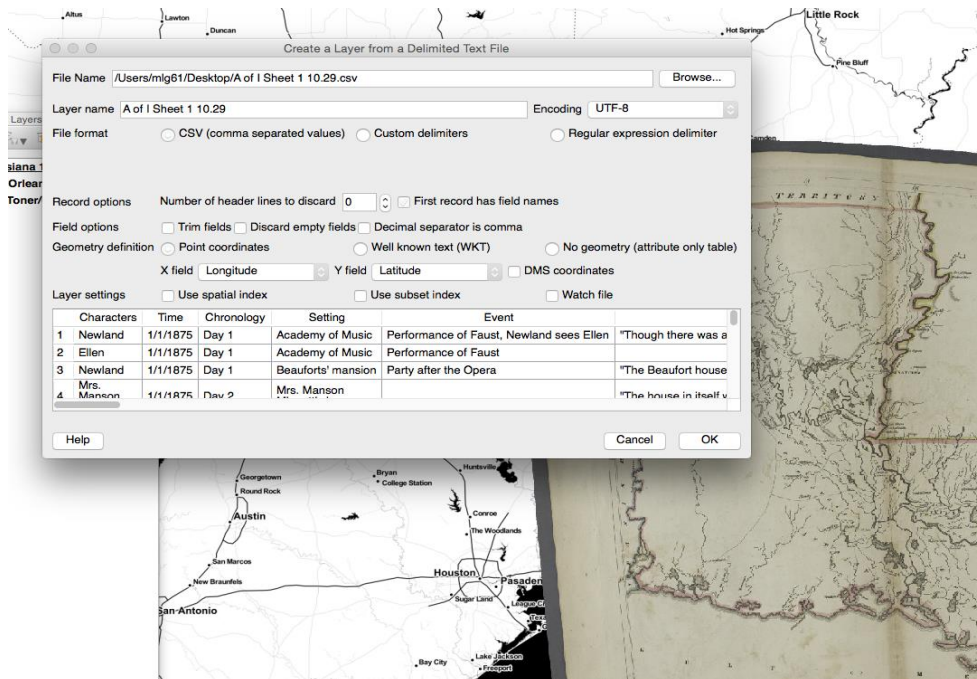
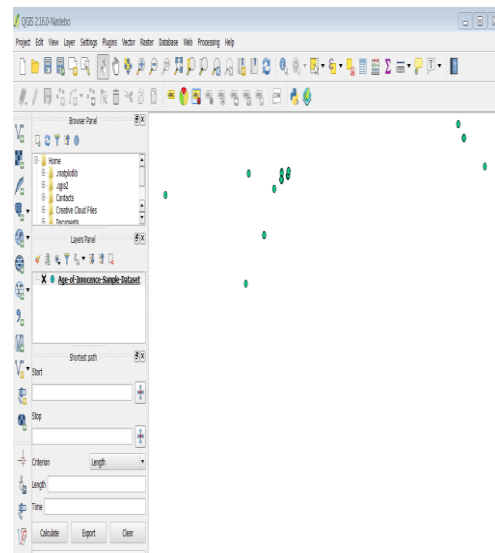


Figure . Importing .csv file as delimited text layer

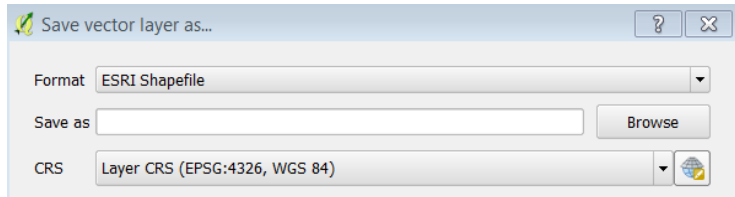
- Then, the coordinate reference system selector will come up. Click OK again. You'll now see a reference to your csv sheet on the Panel.
- Right click and zoom to layer, and your map should be populated.

### 3. Save your new layer

- Your sheet will then appear on your Layers panel on the left-hand side (Fig. 5).
- Right click on the delimited text layer and click on "save as"; then you will get the option to save as an ESI shapefile (Fig. 6).
- **Hit Browse first in order to place the layer in your chosen directory.** Give it a unique title different from the imported file.
- Change the CRS to "**Layer CRS (EPSG 4326/WGS 84)**".
- Make sure "Add saved file to map" is checked. Then click OK.



- Delete the original delimited text layer file from your Layers Panel by right-clicking on it and selecting Remove.



### 1. Add a basemap

Right now, your map might loOK like a bunch of dots floating in space. To add context with a basemap:

- Click on Plugins in the top toolbar and select “Manage and Install Plug-Ins”. You will see a list of plug-ins.
- Search for “OpenLayers Plugin” (make sure that OpenLayers is one word). This will give you access to base maps.
- Click on “OpenLayers Plugin” and select Install Plugin.
- Click on Web in the top toolbar.
- Select OpenLayers plugin
- Choose your basemap.

*\*\*OpenStreetMap or OSM/Toner are good base maps. Google Street Maps, you’ll see, is very busy visually.\*\**

Congrats, your core map is created! Now, you’ll begin to filter your data for each individual character. Save all your layers in the same place where you saved the first layer - this will make it much easier to bring layers into subsequent maps.

**HINT: Be consistent about where you save things. This will save you lots of time and energy.**

### Step 2: Create Layers for Individual Characters

1. Right-click on the main layer (the Shapefile you created) in your Layers Panel and then choose “Filter.”
2. Then double-click click “Characters”.
3. Click on the Equals (=) symbol.
4. Under values, select “All.”
5. Double-click on one of the characters.
6. Verify expression (For example, in Fig. 7, “Characters = ‘Ellen’).
7. Click OK.

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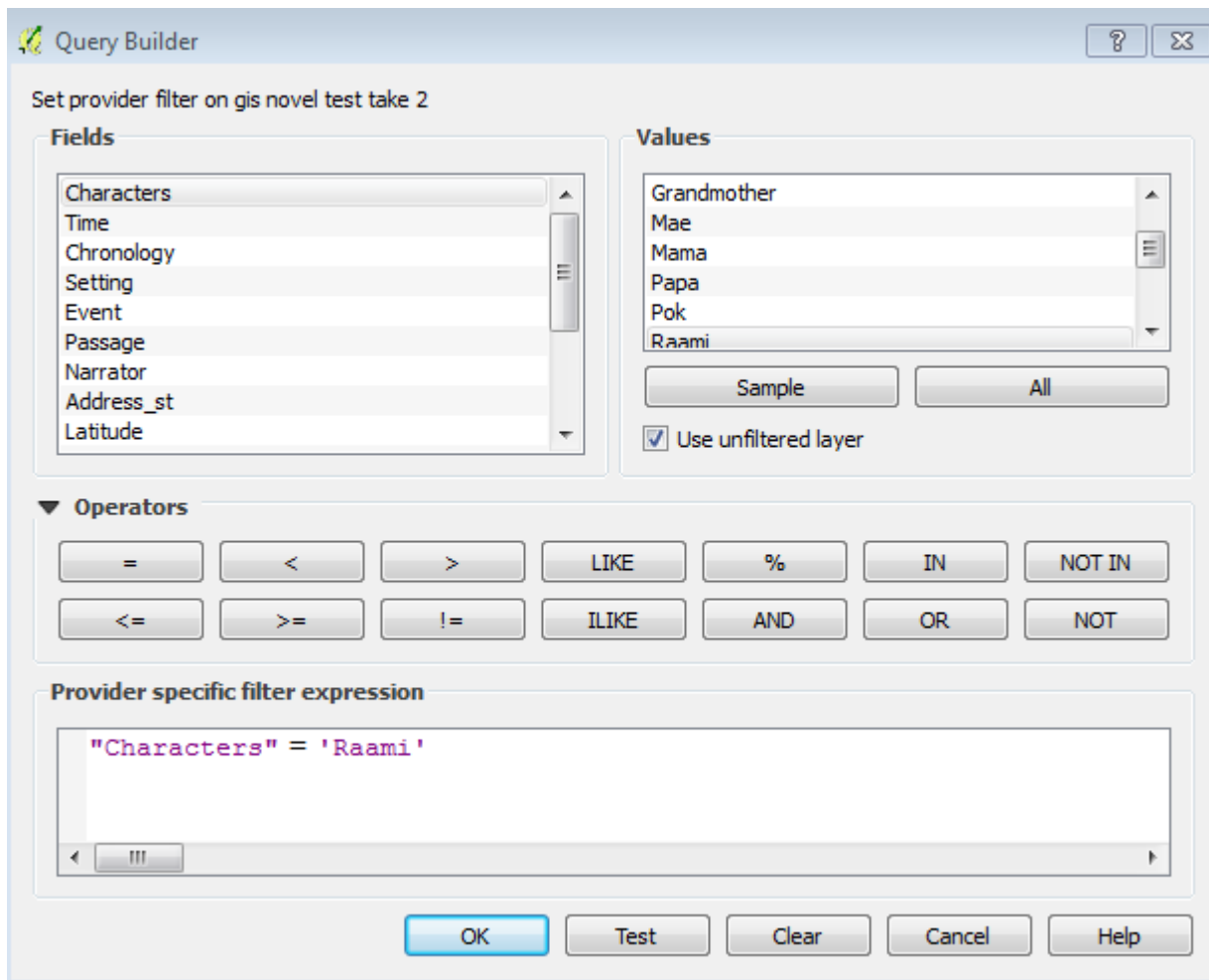


Figure Adding character layers

8. Now your original layer is filtered. Right click the Layer and select Save As. Browse to the original location of your layer/shapefile and give it a new name (e.g. the character's name). Then click OK.  
**(Don't worry; your underlying data is still there in its original, complete form.)**
9. Now you should have three layers. Right click on your main layer again and select "Filter".
10. Select "Clear" at the bottom of the dialog to remove your current filter. At that point, you can start the process to filter for another character.
11. Repeat until you have separate layers for all characters and character groupings.

*HINT: If layers aren't displaying, right-click on each layer, and hit "Layer CRS." Make your layer CRS is set to **WGS 84/EPSSG 4326** (See Fig. 8). Then click OK.*

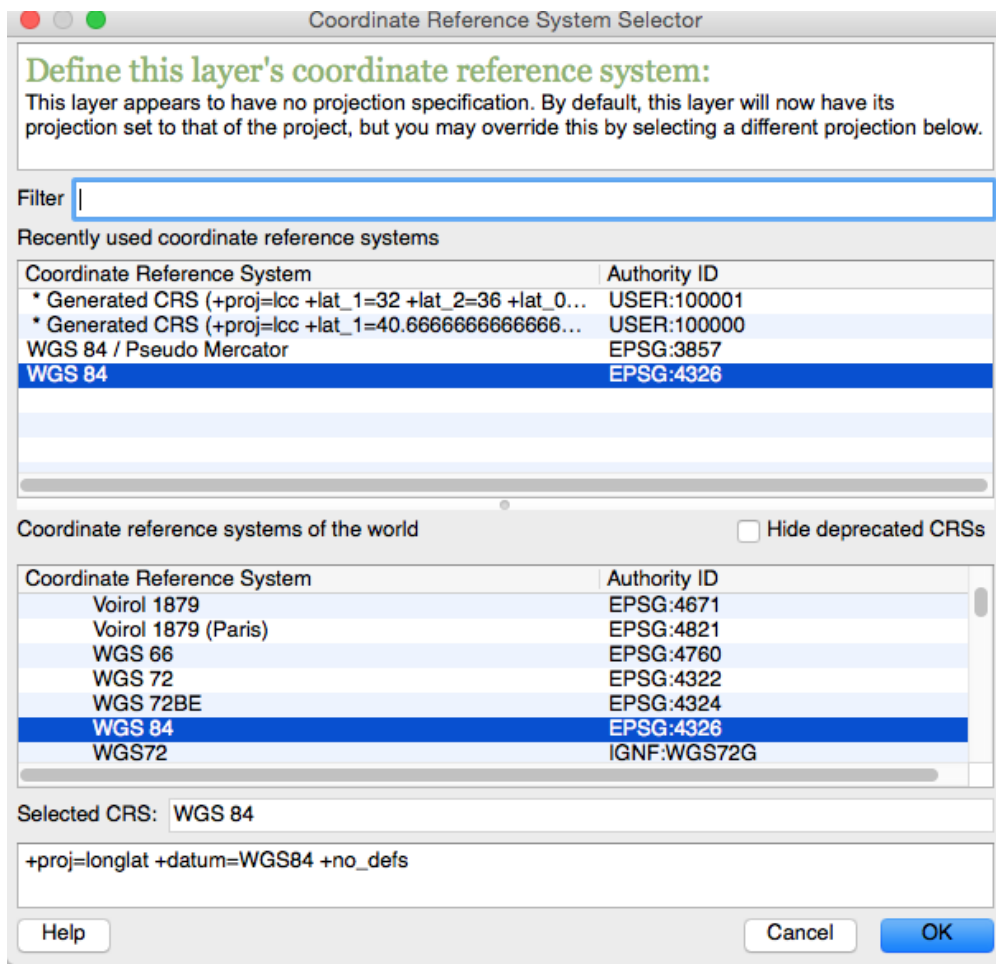


Figure . Coordinate Reference System Selector.

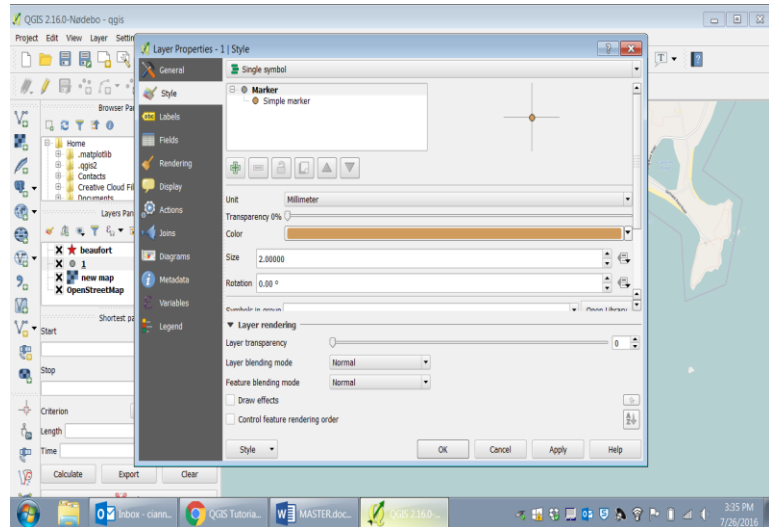
Now that you have separate layers for each character, you can create distinct visual properties for them.



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### Step 3: Add Symbology

- Right-click on your new layer and select Properties.
- Click on Styles (Fig. 9).
- You can create a single symbol for the layer by scrolling down and choosing the symbol you would like to use to represent that character. You can also change the color and the size of the symbol. Make your symbol large so you can see it (ex: a circle, sized 6.0 px).
- Click OK.
- Repeat this process for each character layer. Be sure to make each of their symbols unique so you can tell them apart on the map.



### PHASE 3: GEOREFERENCING

First, congratulate yourself on making it this far and producing an attractive, interesting map from which teachers, students, and readers of literature can learn. Now, you can add latitude and longitude coordinates to historic maps, turning .jpegs into maps that can be overlaid on contemporary ones. These **georeferenced** maps will allow you to position your characters with respect to the settings of their times. To do this, you will georeference the maps (adding latitude and longitude coordinates) and turn them into **.tiffs**—high-resolution raster images you can overlay onto your map.

**Step 1. Download a high-resolution map.** Good comprehensive sources are the [David Rumsey Map Collection](#) (Fig. 11) and [NYPL Map Warper](#). Search for the map you wish to use. Then click on Export and choose to save it at the highest resolution possible. Note: the file will be downloaded as a .zip file; extract the file and re-save the image with a logical name. Crop out any extraneous borders so that only the map is showing.

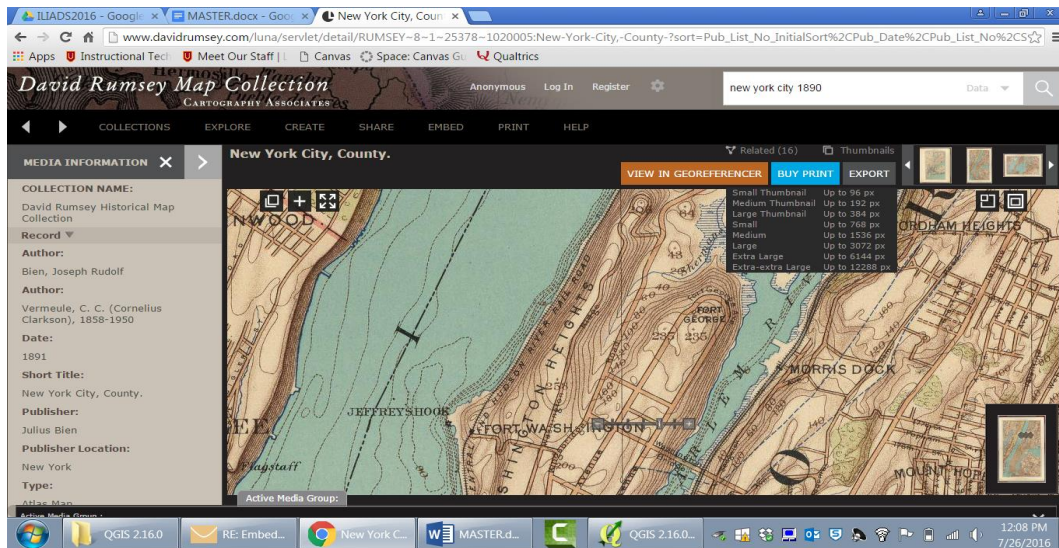
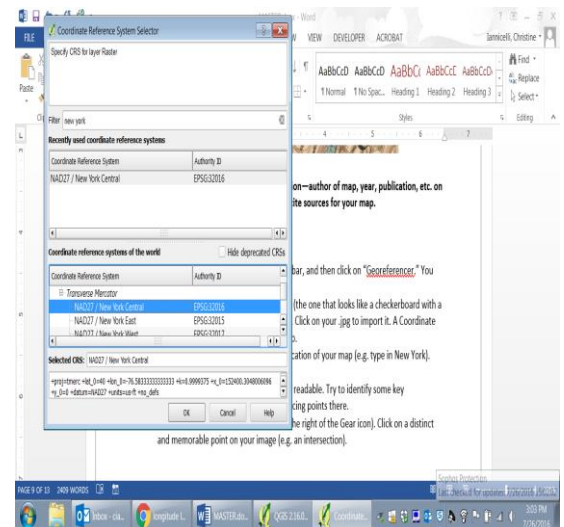


Figure Export a Map from an Online Source

**Reminder: Make a note of the citation information—author of map, year, publication, etc. on the left. You will need this information to cite sources for your map.**

## Step 2: Import your map into Georeferencer

- Open QGIS, click on Raster in the top toolbar, and then click on “Georeferencer.” You will be taken to another window.
- Click on the button all the way on the left (the one that looks like a checkerboard with a plus sign on it); your directories will open. Click on your .jpg to import it. A Coordinate Reference System Selector box will pop up (Fig. 12).
- Use the Filter search engine to find the location of your map (e.g. type in New York). Under the “Coordinate reference systems of the world”, you will see a list of systems you can choose from. Choose the location closest to your map’s location and then click OK.



## Step 3: Add points to your map

- Zoom in to make sure that the map is still readable. Try to identify some key intersections on the map—you will be placing points there.
- Select the Add Point symbol (the icon to the right of the Gear icon – See Fig. 13). Click on a distinct and memorable point on your image (e.g. an intersection).

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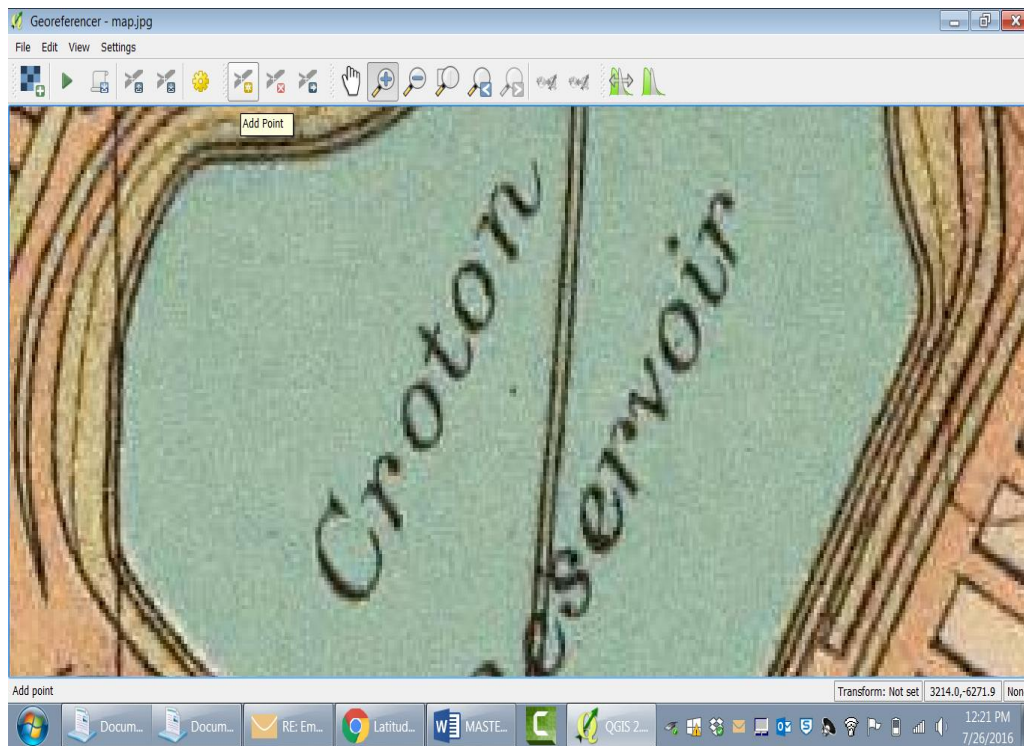


Figure Adding a Point

- Click there and the box below titled “Enter Map Coordinates” should pop up (Fig. 14).
- Minimize QGIS and open up Google Maps or [LatLong](#). Find the same spot and copy down the latitude (positive number) and longitude (negative number).
- Return to the “Enter map coordinates” box in QGIS and input the points (**Note: X/East is the longitude; Y/North is the latitude number**). Then click OK.

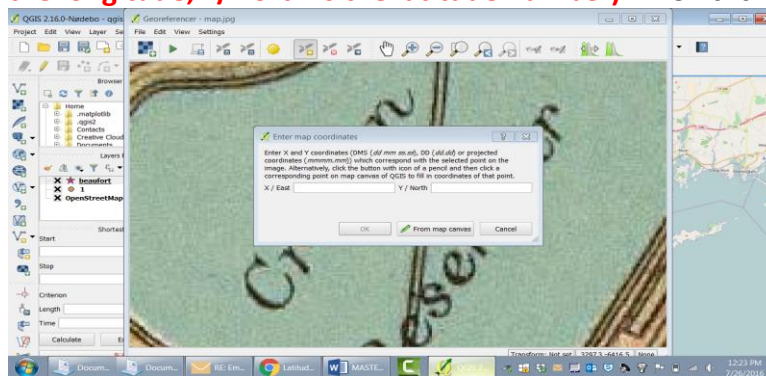


Figure . Georeferencing-- Entering Map Coordinates.

**Option #2:** If you do not want to use Google Maps or Latlong, you can click on the “From map canvas” button when you are in the “Enter map coordinates” box. This will take you back to your QGIS project. Zoom in on your main map and find the location. Click on it and QGIS will automatically copy the coordinates for you in the “Enter map coordinates” box.



- Repeat until you have four points on the map and try to span the map. Use the panning tool to move back and forth. **And be patient! This is easier than making your shapefiles but still takes time and concentration.**

#### Step 4: Georeference your map

- When you've added four points, click on the Gear symbol. Change transformation type to "Thin Plate Spline."
- Change Target SRS to "Project SRS (EPSG:4326, WGS:84)".
- Click on ... next to Output Raster and give your map a title. Save it in the same place as all your other layers.
- Check the box next to "Load in QGIS". Then click on OK.
- Click on the "Play" button (the green arrow) and QGIS will georeference your map. You will get a message saying that the map has been successfully georeferenced. If you successfully georeferenced the map, it will be overlaid onto the base map as in Fig. 15.

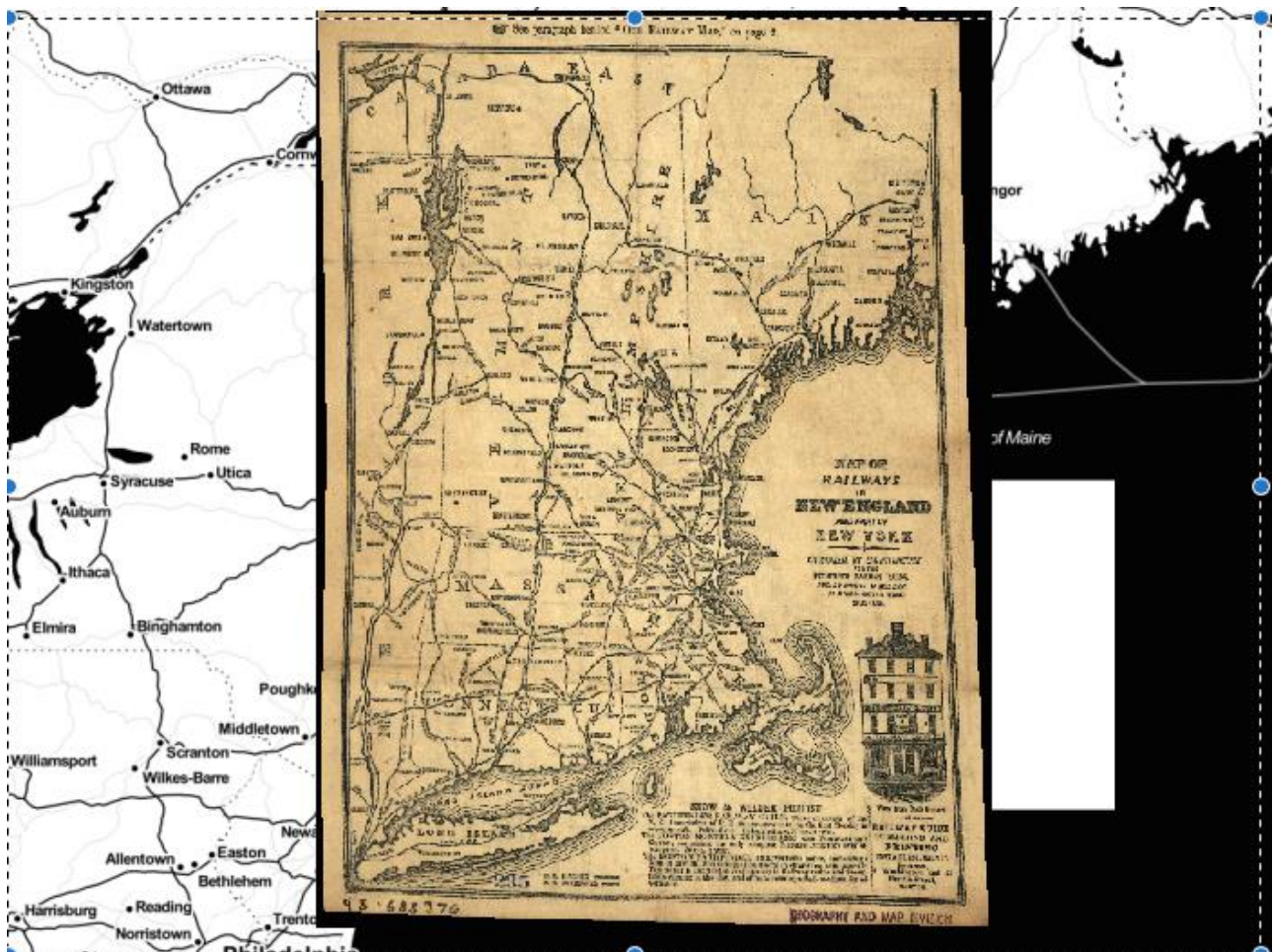


Figure . Georeferenced Map of New England-NY Railway Lines.

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## PHASE 4: DISSEMINATION

There are several ways to share the analysis you've created with your map:

- 1) Share your dataset in a public or institutional repository (e.g. GitHub, Digital Commons, etc.).
- 2) Take multiple screenshots of your map, emphasizing various elements of your analysis. Use those images in a presentation to describe your findings, post them online with descriptive information, etc.
- 3) Install a CartoDB plugin in QGIS, then select "Add Connection" on the toolbar. Click on the Web tab and select CartoDB Plugin > "Upload layers to CartoDB". This will bring your map layers into CartoDB, where you can edit and display them.
- 4) Convert your map into an html file by following the directions below:
  - Install the "qgis2web" plugin.
  - Make sure that your layers are in the order you want them to display. Once you convert your map into html, you cannot change it.
  - To start the conversion process, click on "Web," then "Qgis2web." Then wait. (Note: At this point you will be practicing the art of patience for some time.) Soon, you will get a pop-up box that loOKs like Fig. 16.

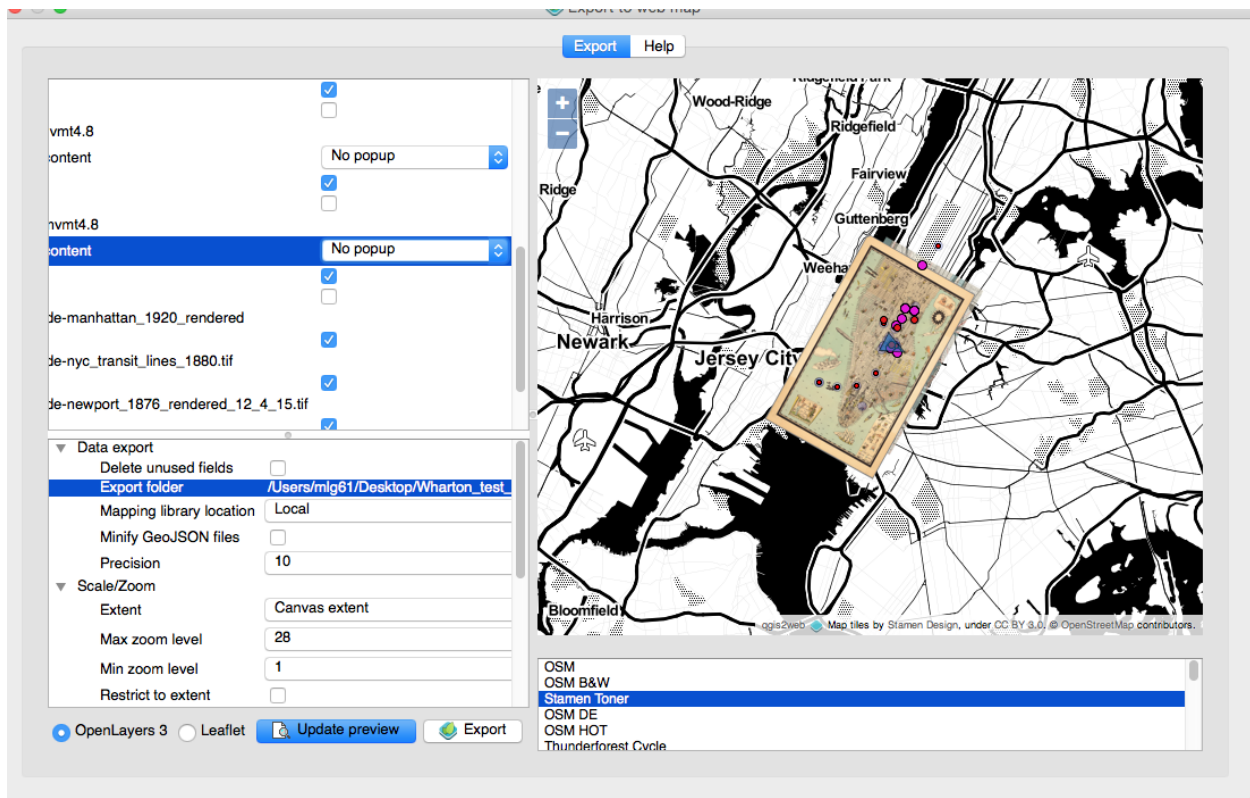


Figure . QGIS Conversion to .html; Update Preview and Export.

- Keep the numbers as is but make sure to change the folder title to a meaningful name that you can find. If you don't change anything else, it will import your map and it will be navigable. You can zoom in and out and navigate back and forth.
  - To customize, click on "Address search" and "Layers List" – this way you can turn layers on and off in the .html map, and use the address search to navigate.
  - Once you're done customizing, click "Update Preview." Then prepare to wait.
  - You will then get an image in the window on the right of the map; then click "Export." Then wait again. Eventually, the spinning symbol will go away and the arrow will return. This means your map is done!
  - Finally, go to the directory where you've directed the map. You'll see a file titled "index.html." Open it up and your map should be there! My recommendation: give that file a meaningful name immediately.
- 5) Work with your IT department to embed the map on a website. Contact us for more information on the process.

However you decide to disseminate your work, it's important that you acknowledge any data or image sources you used.

#### Useful Resources

- <http://www.qgistutorials.com/en/>. This is a great way to get started; author Ujaval Gandhi is a Tech Lead/Manager for the aerial imagery team at Google and a QGIS instructor/developer.
- <http://gis.stackexchange.com/> -- Q and A site for GIS users.
- There are many QGIS videos available on Youtube and other tutorials available on line.