# Mapbox – Mapping Impervious Surface % in 3D

Within this mini-lab, we will explore rendering impervious surface data in Mapbox using 3D and color rendering techniques. We will then compare the platform Mapbox to other online mapping platforms.

## Pre-lab reading:

https://www.vpr.org/post/epa-gives-preliminary-thumbs-gov-scotts-clean-water-funding-plan

http://www.lcbp.org/wp-content/uploads/2013/11/76_MappingImperviousSurfaces.pdf (skim for information relevant to questions that will appear later in the lab)

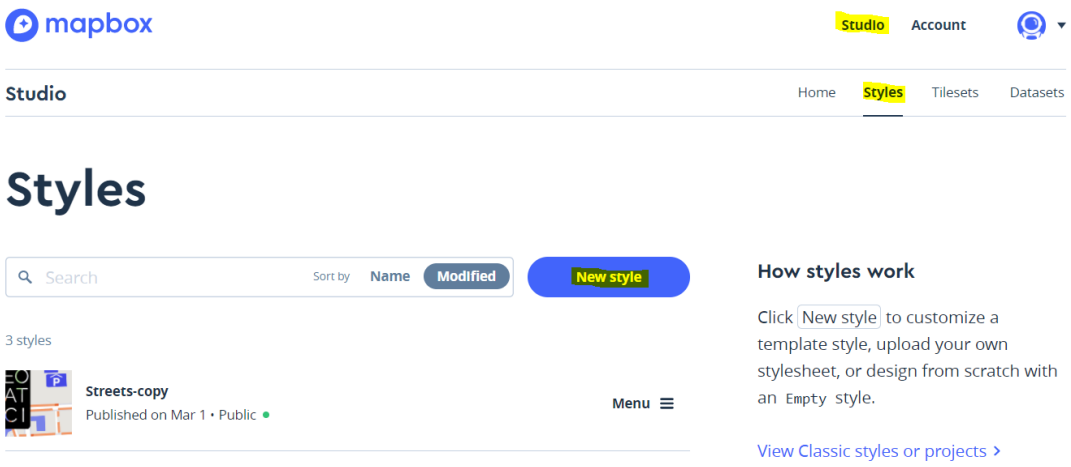
Definition of a parcel: https://en.wikipedia.org/wiki/Land_lot

More parcel data goodness: http://geodata.vermont.gov/pages/parcels

## Lab instructions:

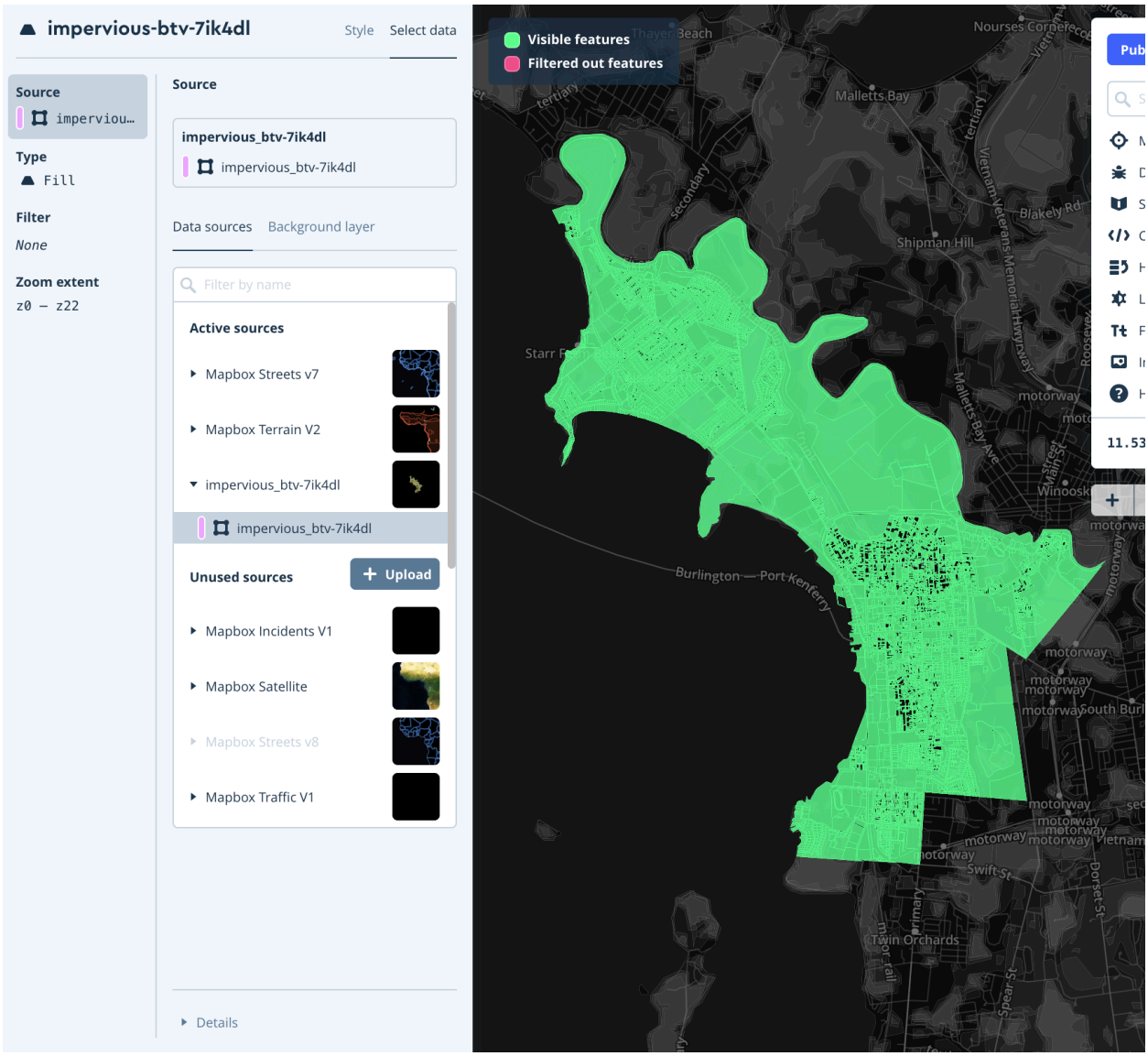
1. Download the lab materials by clicking on the green "Clone or download" button here (note: do not just click on each file): https://github.com/VCGIjbower/webmapping-materials
2. Examine the files. Unzip "impervious_btv.zip".
    1. *What kind of file format does it contain?*
3. Pull it into QGIS. I created this data from two source datasets: Burlington parcel data from 2015, and the impervious surface data mentioned in your second reading (vector form, with each area of impervious surface represented by a single polygon). This data is useful because it represents the percentage (in decimal form) of each parcel, or land lot, that is covered by impervious surface. This, in turn, could be the starting basis for implementing a clean-water impervious surface tax per parcel, as mentioned in the first article.
4. The data has three primary columns: SUM_Shape, Imperv_Per, and Area. Imperv_Per represents percent impervious surface area per parcel.
    1. *How do you think Imperv_Per was calculated?*
    2. *How do you think this layer was created (be specific in mentioning tools)?*
    3. *What year was the source impervious surface data created?*
    4. *At what resolution is it accurate?*

5. Symbolize the data with a graduated color ramp using Imperv_Per as your field.
6. Now that you know a little about this data, we're going to upload it to the web to visualize impervious surface percentage by parcel in 3D.
7. Create a Mapbox account: https://www.mapbox.com/signup/
8. Click on "Studio".
9. Pick a template style to start from (one of the free ones)!

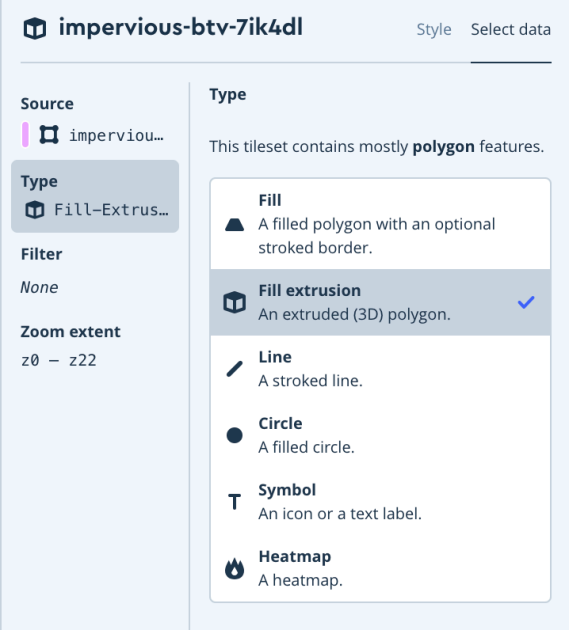



Once you're in, notice the layers that comprise the template map. You can change the symbology of any of these layers or add/remove as you wish.

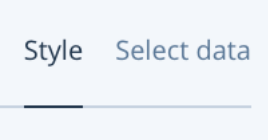
10. Click on "+ Add layer" in the upper left.
11. Then, click on "+ Upload" next to "Unused sources". This will open a dialogue that allows you to upload a new tileset. Read about map tiles here to understand what they are: https://en.wikipedia.org/wiki/Tiled_web_map.
    1. *What are the advantages of using maps composed of many tiles instead of a single map image?*
12. Upload the original zipped file that you inspected in QGIS called **impervious_btv.zip**. You may have to wait a little for it to show up, but it should eventually appear under "Unused sources" with a new, confusing name like below. Click on the arrow next to it to select the layer within it. It should then show up as an "active source".



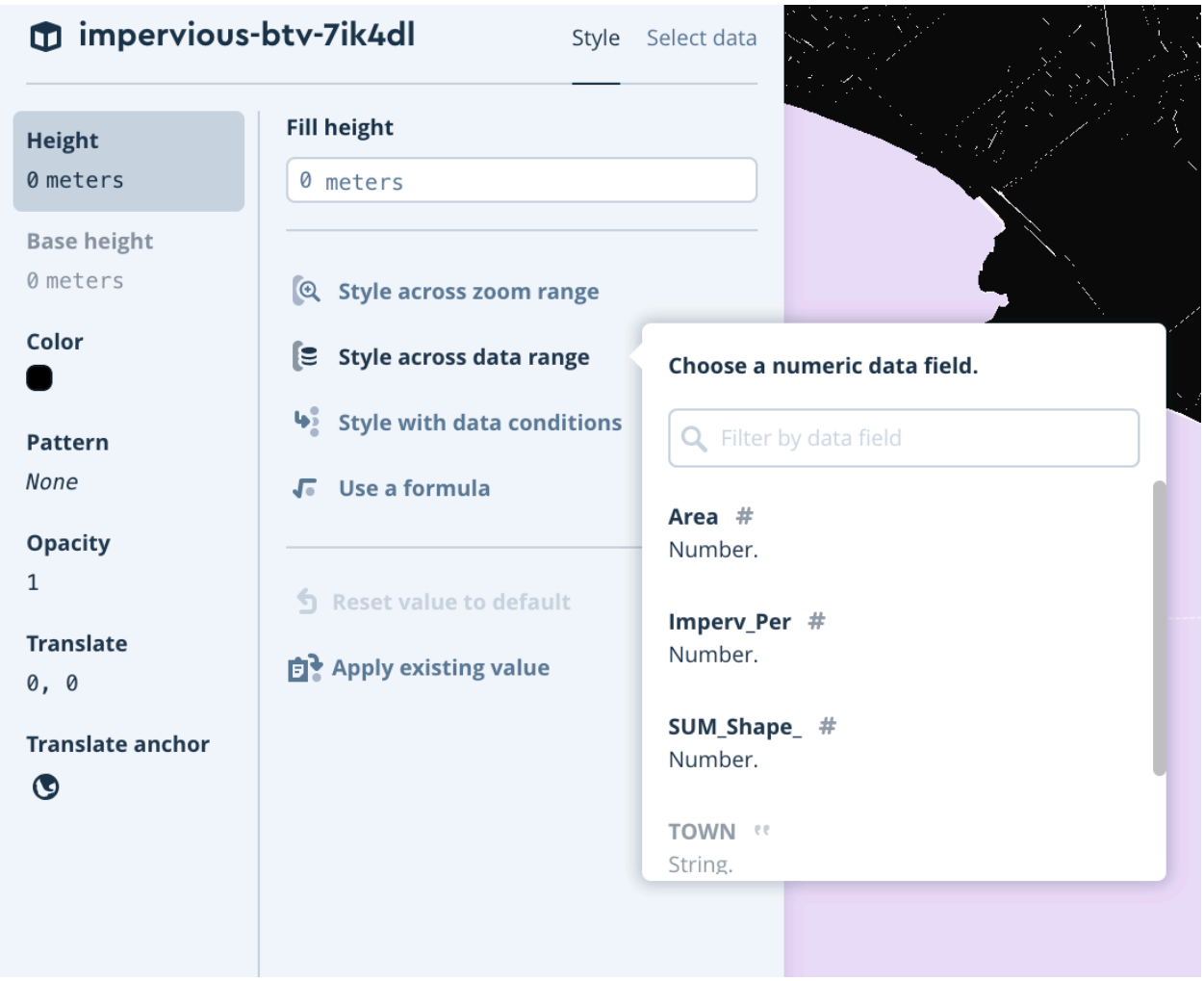

13. Congratulations, you made your first tileset! Now we need to turn it into a layer (symbolize it and make it 3D). Under "type," select "Fill Extrusion," since we want to use the height attribute to symbolize the percentage of impervious surface in each parcel as well as our colors (we could use different variables, but this is just to make the percent impervious surface area pop). Notice some of the other attributes possible – they may look confusing but are very helpful to developers (setting the zoom level affects when the layer shows up, and you can filter based on geometry type, etc.).




14. Okay, now we can set the height attribute in our data. Click on the “Style” tab (we’ve been in Data so far).

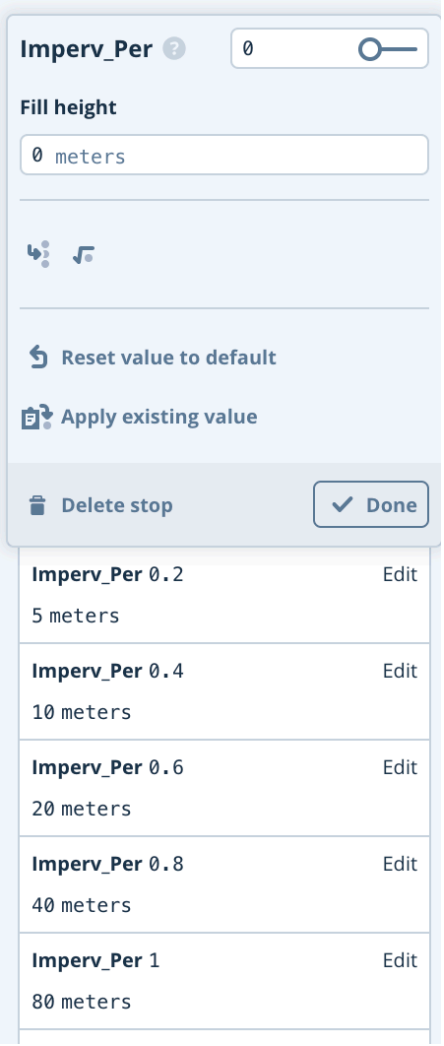



15. Select “Style across data range” so that we can use a data field, rather than an actual height field, to pop out our polygons.




16. Now select the attribute (field) that you want to use to extrude (pop out) the polygons. Set your levels using the ones I've predefined. Since the attribute reflects the percent impervious surface, our breaks correspond to percentiles: 0.2 = 20% and so forth. I've graded the heights to make the higher percentiles stick out exponentially more, but you can play around and set what works for you. "Add stop" to set each value (percent, in decimals) and the extruded height (in meters).

You'll notice your data is still completely black, so take me at my word when I say the height attribute has now been set. It'll pop more once we add color.



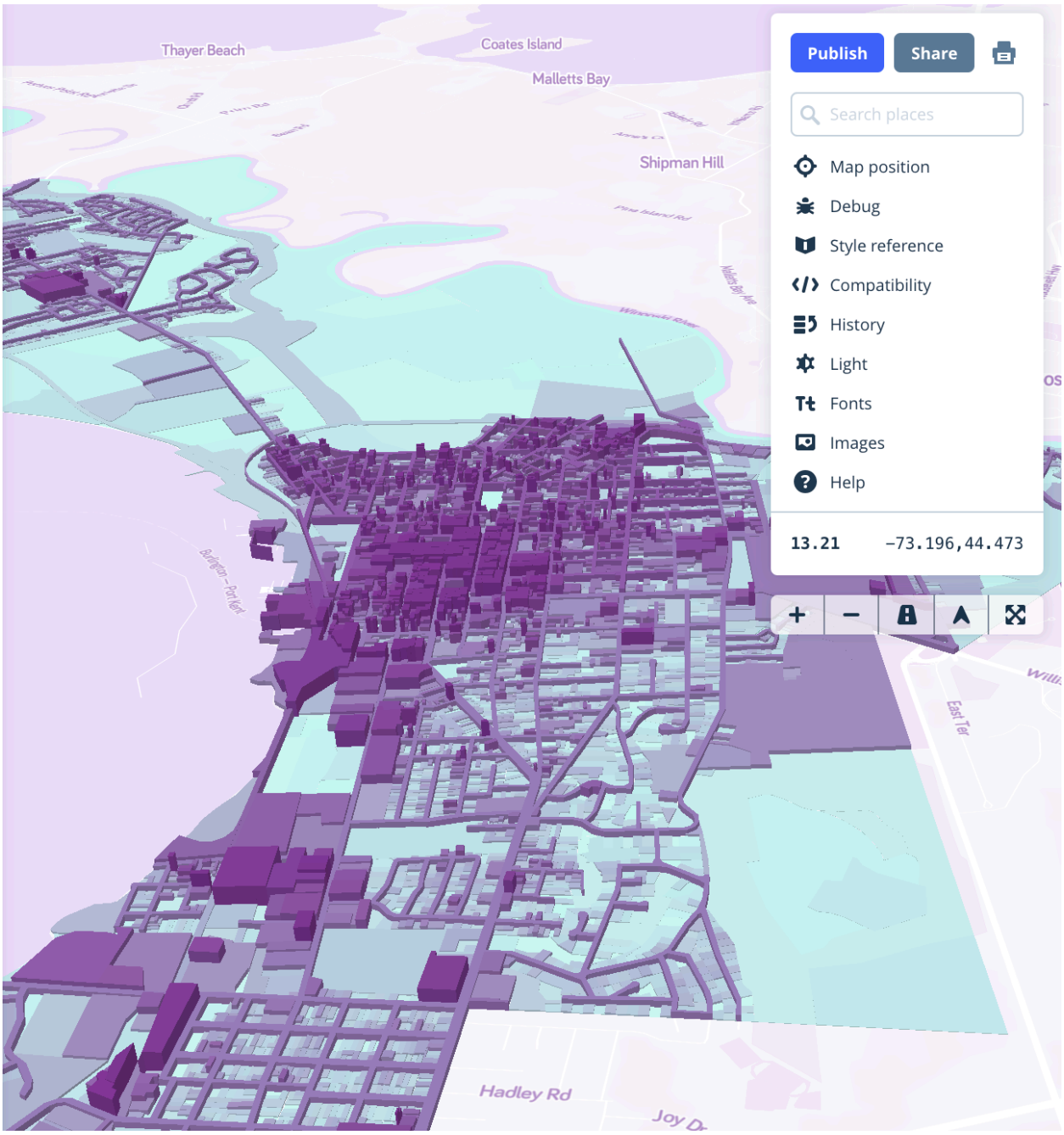

17. On to color! We're also going to set this as "value by data", since we want our colors to represent the percent impervious surface as well.

18. Set the field and then the breaks (same breaks as above, or you can let MapBox do it automatically for you). As for the color, here we have an opportunity to get creative!

Because I could spend hours obsessing over colors (and end up with not very good colors, to boot), I prefer to use a color assistant. Some resources are below.

http://colorbrewer2.org/ (best for accessibility)
https://www.canva.com/color-palette/ (upload a selfie and generate a color palette)

19. Now that you've set your colors, we've got a map! You can now publish or share your style—you can even embed it into a web map. First, let's move around to look at our data.




Move around:

- Click + drag to pan
- Right click + drag to change the tilt (perspective)
- Scrolly wheel zooms like usual
- Mini-controls under the coordinates and zoom level also perform these functions

Finally, make your map public. Click on the "Use" tab to embed it into a website (which you could host on Github, for example), or use with "Third party", which is what we're going to do. First, click on "WMTS" and copy the URL provided. Now go back to QGIS and "Add WMS/WMTS layer". Click "New" and input the URL, then click "Connect" and add your layer. Presto, it should show up! Notice that 3D isn't enabled. There's a better way to view our map.

Click on "Web." Notice the code. Don't worry about the code, though. This represents a webpage that you can paste into an empty text document, which will then create a website locally for you to look at your map. So, create a new text document using Notepad++. Copy the html from Mapbox (the blue clipboard button) and stick it in this text document. Save (make sure it saves with the extension .html, and if you're using a mac, make sure it saves as a plain text document) and close, and then open it using a web browser (right click and "open with" if you need). Your map should appear! It's probably zoomed into the wrong area—you can edit the coordinates within your .html file. Or just zoom to where you need to go. Notice that you can pan and zoom just as if you were in Mapbox.

Now, go back to Mapbox. Click on ArcGIS Online and copy the link provided. Leave this tab open so you can use the instructions when we go to ArcGIS Online in the next mini-lab.

# Follow-up questions:

*Visually, what type of parcels stand out as having the highest per-parcel impervious surface percentage?*

*What type of parcel probably has the most total impervious surface? Why isn't the road parcel 100% impervious (think about how the data was created)?*

# To submit:

Please submit all answers to italic questions and a screenshot of your Mapbox map (showing the 3D, from an angle).