1. Open QGIS
   1. Add Plugins
      1. Need to add MMQGIS and OpenLayers Plugin
2. Download Tiger Line file from Census.gov
   1. Open a web browser and head to [www.census.gov/geo/maps-data/](http://www.census.gov/geo/maps-data/)
      1. Click on TIGER Products, on the next page select ‘Cartographic Boundary Shapefiles’
      2. In the State Based Files section, Select ‘Census Tract’
      3. Click on the tab labeled ‘2014’ since our data is from 2014 and we want the geographies to match (I can make it 2015 if you want, but the Vacancy Index shapefile is 2014 Tracts)
      4. Select Michigan from the drop-down and click ‘Go’. A download should begin.
      5. Unzip the file and save to network drive folder
3. Add the shapefile to QGIS
   1. Note that at the bottom right, CRS indicator will now say OTF in parentheses
   2. Open Properties 🡪 Examine CRS 🡪
      1. Change CRS
         1. Right Click file 🡪 Save As… 🡪Change to WGS84(4326)🡪 Name file: MI\_Tracts
   3. Save Project before continuing
4. Change OTF settings for QGIS
   * 1. Go to Settings 🡪 Options 🡪 Don’t Enable On the Fly Projection
5. Clip File with Detroit Boundary
   1. Add Detroit Boundary Shapefile
   2. Vector 🡪Geoprocessing🡪Clip
      1. Input Layer: MI\_Tracts
      2. Clip Layer: Detroit Boundary
      3. Save as Temp file
   3. Remove Detroit Boundary file
   4. Save Project before continuing
6. Census Data Table (Per Capita household income) -
   1. Open table, discuss source (Simply Map vs. Fact Finder) and per capita income.
   2. Join table to Shapefile
      1. Open properties of shapefile, click join, click ‘+’ symbol
      2. Join Layer=HouseholdPCI\_2014; Join Field=Tract\_fips; Target field=TractCE
      3. Choose ‘Household\_PCI’ as fields to join
      4. Check Box for “Custom field name prefix’ and delete the text in the box
      5. Click OK and then click OK again to close the shapefile properties.
7. Save As… to make the join permanent
   1. Name File: Detroit\_PCI
   2. Save Project
8. Change Style
   1. Right-click and open the properties of Detroit\_PCI shapefile
   2. Select ‘Style’ and from the drop-down menu at the top, select ‘graduated’
      1. Column = Household PCI
      2. Make sure method = color
      3. Mode = Natural Breaks (Jenks) and 4 classes, click ‘Classify’
      4. Click ‘apply’ and OK to close the window and view the range of incomes across the city.
9. Add ‘Vacancy\_Index\_November\_2014’ shapefile
   1. Not the difference in the shapefiles, same info but the water has been removed from these polygons.
10. Selection to isolate neighborhoods by 2 criteria
    1. Open attribute table for Detroit\_PCI🡪 Select by Expression (top of window (ε))
       1. Select Fields and Values from the middle window
          1. Dbl click on Household, you will see it appear in the left window
       2. Select Operators in the middle window
          1. Double click on <=
       3. Enter 24000 in the Left window to finish the expression and Click the Select Button
       4. Close attribute table
    2. Right Click layer 🡪 Save As…
       1. Browse to folder, name new file PCI\_24K
       2. Click ‘Save Only Selected Features’
       3. Click OK
       4. Remove Detroit\_PCI
11. Repeat selection for Vacancy shapefile
    * 1. Select Fields and Values from the middle window
         1. Dbl click on Pct\_VeryLi, you will see it appear in the left window
      2. Select Operators in the middle window
         1. Double click on >=
      3. Enter 25 in the Left window to finish the expression and Click the Select Button
      4. Close attribute table
    1. Right Click layer 🡪 Save As…
       1. Browse to folder, name new file ‘HighVacancy’
       2. Click ‘Save Only Selected Features’
       3. Click OK
       4. Remove original Vacancy Index file
    2. Save Project.
12. Run Intersection tool
    1. Vector🡪Geoprocessing🡪Intersection
       1. Input Layer: High\_Vacancy
       2. Other Layer: PCI\_24K
       3. Save to File: Intersection
13. With the areas narrowed down, Geocode Grocery Stores!
    1. MMQGIS 🡪Geocode🡪Geocode CSV with Google Maps/OSM
       1. Click Browse
          1. Add ‘Grocery\_StoreList.csv’
          2. Verify that drop down menus are correct for address, city, state
          3. Browse to save new shapefile AND Not Found.csv to workspace
          4. Patience may be required while Geocode processes!
14. Grocery Heat Map (No site within half a mile of other grocery stores)
    1. Go to Raster 🡪HeatMap 🡪HeatMap
       1. Input point layer = Grocery\_StoreList
       2. Output Raster = Click ‘Browse’ and save file to network folder
          1. Name file: Grocery\_Heatmap
       3. Leave other settings at Default (Radius should be 1000/ roughly .5 miles)
       4. Click ‘OK’ to run the tool and the Heat map should load
       5. Open Properties 🡪 Render Type (Singleband Pseudocolor) 🡪 Select YeloRD 🡪 Hit Classify button and click OK
15. Transform Heatmap to Vector
    1. Raster 🡪 Conversion 🡪 Polygonize
       1. Name new Vector file ‘Grocery\_Buffer and save to Network folder
       2. Click OK to run.
       3. View Vector output, discuss similarity to Buffers
16. Run Difference tool for Final results!
    1. Click Vector 🡪 Geoprocessing 🡪Difference
       1. Input Layer: Intersection
       2. Difference Layer: Grocery\_Buffer
       3. Save to File: Final\_Sites
    2. Open Properties, Click Style
       * 1. Change Fill to Transparent, thicken border width (1 or higher)
    3. Web 🡪 OpenLayersPlugin 🡪 Google Maps 🡪 Google Sattelite
       * 1. Have students observe spaces chosen for our community garden/coop