

# Mapping Social Vulnerability and Flood Damages

Public Housing Units in Lumberton, North Carolina after Hurricane Matthew, 2016

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# Abstract

Scholars believe that residents of public housing are one of the most socially vulnerable people that face significant damages in disasters.

Hurricane Matthew made landfall in North Carolina on October 8, 2016, as a Category 1 storm.

Lumberton were devastated by heavy rainfall and the river flooding that began after Hurricane Matthew.

Lumberton is a diverse socio-demographic city with one-third of households who live at or below the poverty level.

Lumberton has a particular combination of minorities with a high percentage of African American and Native American.

This city has 729 public housing units.

The flood destroyed 37% of public housing units in Lumberton.

# Data and Maps

## Data:

- 2015-ACS estimation data
- U.S. Department of Housing and Urban Development (HUD) data
- Housing Authority of City of Lumberton (HACL) data
- A part of survey data of my thesis

## Maps:

- Social vulnerability at the block-group level in Lumberton, NC,
- Location of public housing developments in the city,
- Damage assessment of public housing units' samples
- Abandoned public housing developments

# This Project & My Thesis

## My thesis Goals:

Find the specific vulnerabilities of the public housing residents in Lumberton, North Carolina

- I use social vulnerability weighted Index defined by Van Zandt and Colleagues in 2012 to show the distribution of vulnerability in the city.

How these vulnerabilities affect the impact of flood damages in the public housing developments.

- Show the location of public housing developments and the damages to these units based on damage assessment of the sampled units to show the severity of damages.

My thesis is a part of a larger longitudinal and interdisciplinary recovery-based field study in Lumberton conducted by **the Center of Excellence (CoE)** on Risk-Based Community Resilience Planning with collaborators from the **National Institute of Standards and Technology (NIST)**.



# Web Mapping Technology

Excel

QGIS

GeoJSON

HTML, CSS, JavaScript, and JQuery

Leaflet maps

HighCharts

Array

# Key Challenges

Preparing my damage assessment data that I have to reduce the sampled units for this project. I have 596 samples and I need 88 of them for this project.

Making Coropleth maps

Find a way to present all the information on a single map.

Working on the format of the webpage to present maps and charts and the texts

# Introduction Part

Using containers to have two images and text together in a line!

```
File Edit Find View Navigate Debug Help
Working Files
index.html
ex8
ex8.html
map.geojson
planningSchools.csv
planningSchools.json

132 <div id="pics"></div>
133
134 <p><strong>Case Study:</strong></p>
135 <body data-hm-ch-ph-ph-loaded="true">
136 <!-- images added to show maps-->
137 <div class="fix1">
138 <div class="img-container">
139 
140 </div>
141 <div class="img-container">
142 
143 </div>
144 <p><br> Robeson County is located on coastal region of southeastern North Carolina.<br> Lumberton is the County seat of Rebeson County.<br> This city spans 15.8 square Miles.<br><br> Lumberton has 21,707 population:<br> • 39% Non-Hispanic White<br> • 36.7% Non-Hispanic African-American <br> • 12.7% Native American<br> • 6.7% Hispanic<br> • 4.8% Other</p>
145 </div>
146 <br>
147 <div class="text">
148 <p><strong>Background:</strong>
149 <br>• Hurricane Matthew made landfall in North Carolina on October 8, 2016, as a Category 1 storm.<br>• Several communities including Lumberton were devastated by heavy rainfall and the river flooding that began after Hurricane Matthew.
150 <br>• Lumberton is a diverse socio-demographic city with one-third of households who live at or below the poverty level.<br>• Lumberton is considered as a "minority-majority community" with a high percentage of African American and Native American.<br>
151 </p></div>
152 <br>
153 <div id="SlideShow">
154 <h3>
155 </h3>
156 <script>
157 //images of Matthew!--- damages
158 var i =0;
159 var images = [];
160 var time = 2000;
161
162 images [0] = "https://si.wsj.net/public/resources/images/BN-QG077_ROBESO_GR_20161013104450.jpg";
163 images [1] = "https://i.ytimg.com/vi/Lk82fTyhjBI/maxresdefault.jpg";
164 images [2] = "https://www.robesonian.com/wp-content/uploads/2017/03/web1_housing3-2.jpg";
165 images [3] = "https://www.trbimg.com/img-58129b9d/turbine/ct-north-carolina-death-toll-hurricane-matthew-20161027";
166 images [4] = "https://cf-images.us-east-1.prod.boltdns.net/v1/static/5615998031001/9dead926-073d-4cc0-b66b-5aadb50d6ec0/818547c7-c651-4d50-ac5a-4026d812b787/1280x720/match/image.jpg";
167
168 //function: show slides of images
169 function changeImg() {
170
```

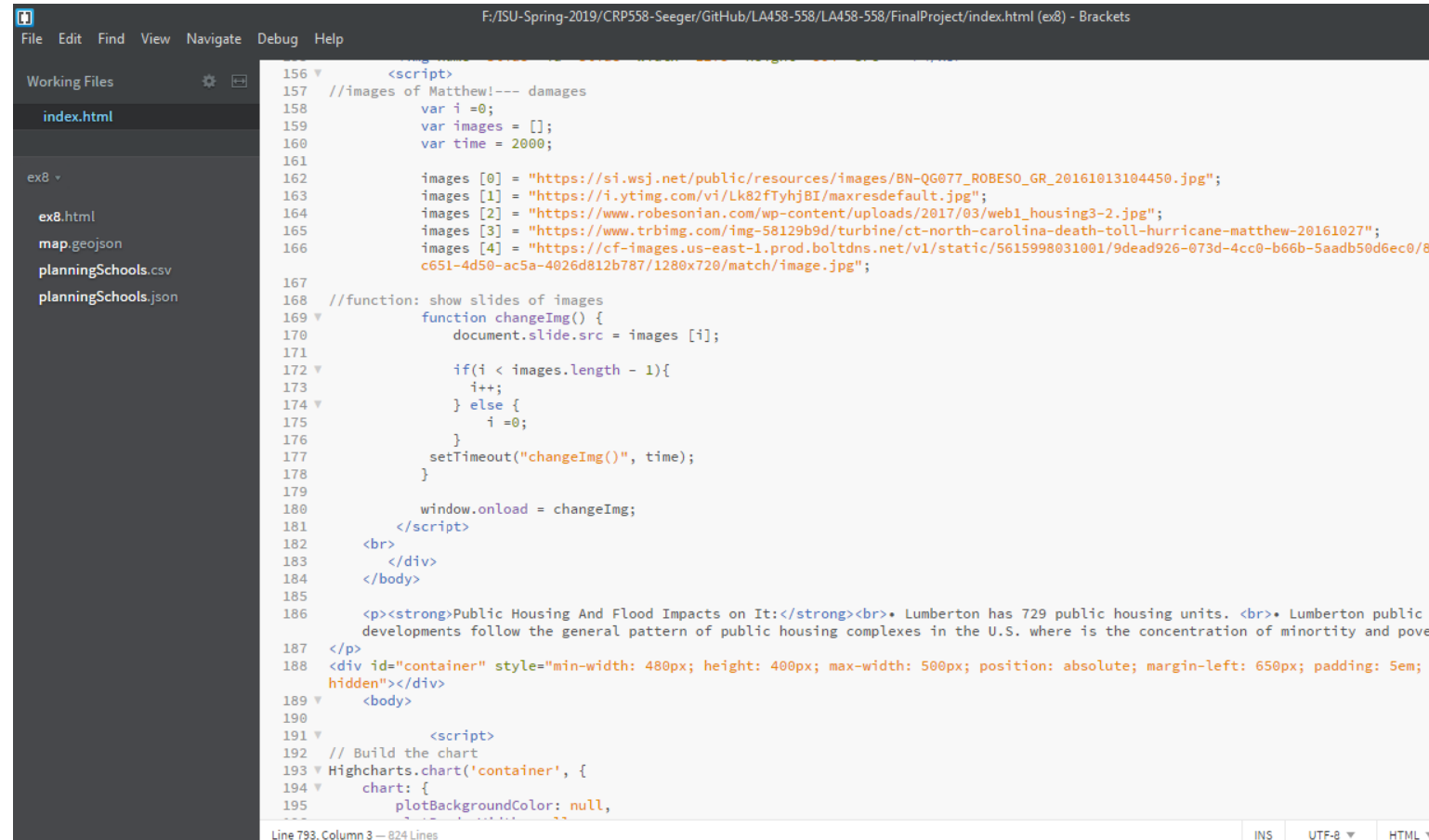
Line 815, Column 296 — Selected 256 columns — 824 Lines

INS UTF-8 HTML Spaces: 4



# Images Slide Show

Having image slide  
show to show some  
pictures of the  
floods  
using Array



```
F:\ISU-Spring-2019\CRP558-Seeger\GitHub\LA458-558\LA458-558\FinalProject\index.html (ex8) - Brackets
File Edit Find View Navigate Debug Help

Working Files
index.html
ex8
ex8.html
map.geojson
planningSchools.csv
planningSchools.json

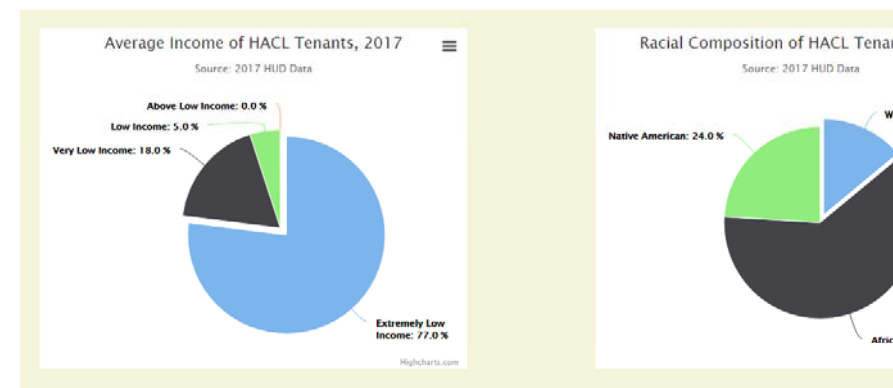
156 <script>
157 //images of Matthew!--- damages
158     var i =0;
159     var images = [];
160     var time = 2000;
161
162     images [0] = "https://si.wsj.net/public/resources/images/BN-QG077_ROBES0_GR_20161013104450.jpg";
163     images [1] = "https://i.ytimg.com/vi/Lk82fTyhJBI/maxresdefault.jpg";
164     images [2] = "https://www.robsonian.com/wp-content/uploads/2017/03/web1_housing3-2.jpg";
165     images [3] = "https://www.trbimg.com/img-58129b9d/turbine/ct-north-carolina-death-toll-hurricane-matthew-20161027";
166     images [4] = "https://cf-images.us-east-1.prod.boltdns.net/v1/static/5615998031001/9dead926-073d-4cc0-b66b-5aadb50d6ec0/8c651-4d50-ac5a-4026d812b787/1280x720/match/image.jpg";
167
168     //function: show slides of images
169     function changeImg() {
170         document.slide.src = images [i];
171
172         if(i < images.length - 1){
173             i++;
174         } else {
175             i =0;
176         }
177         setTimeout("changeImg()", time);
178     }
179
180     window.onload = changeImg;
181 </script>
182 <br>
183 </div>
184 </body>
185
186 <p><strong>Public Housing And Flood Impacts on It:</strong><br>• Lumberton has 729 public housing units. <br>• Lumberton public
developments follow the general pattern of public housing complexes in the U.S. where is the concentration of minority and pove
187 </p>
188 <div id="container" style="min-width: 480px; height: 400px; max-width: 500px; position: absolute; margin-left: 650px; padding: 5em;
hidden"></div>
189 <body>
190
191 <script>
192 // Build the chart
193 Highcharts.chart('container', {
194     chart: {
195         plotBackgroundColor: null,
```

# Charts

Using Highchart's pie chart code  
Using containers to have the  
charts in a line

```
240 </script>
241
242 <div id="container2" style="min-width: 500px; height: 400px; max-width: 500px; position: relative; margin-right: 0px;
243 margin-left: 0px; padding: 5px;"></div>
244 <
245 <script>
246 // Build the chart//
247 Highcharts.chart('container2', {
248   chart: {
249     plotBackgroundColor: null,
250     plotBorderWidth: null,
251     plotShadow: false,
252     type: 'pie'
253   },
254   title: {
255     text: 'Average Income of HACL Tenants, 2017'
256   },
257   subtitle: {
258     text: 'Source: 2017 HUD Data'
259   },
260   tooltip: {
261     pointFormat: '{series.name}: <b>{point.percentage:.1f}%</b>'
262   },
263   plotOptions: {
264     pie: {
265       allowPointSelect: true,
266       cursor: 'pointer',
267       dataLabels: {
268         enabled: true,
269         format: '{<b>{point.name}</b>: {point.percentage:.1f}% ',
270         style: {
271           color: (Highcharts.theme && Highcharts.theme.contrastTextColor) || 'black'
272         }
273       }
274     }
275   },
276   series: [{
277     name: 'Income',
278     colorByPoint: true,
279     data: [{
280       name: 'Extremely Low Income',
281       y: 77,
282       sliced: true,
```

```
192 // Build the chart
193 Highcharts.chart('container', {
194   chart: {
195     plotBackgroundColor: null,
196     plotBorderWidth: null,
197     plotShadow: false,
198     type: 'pie'
199   },
200   title: {
201     text: 'Racial Composition of HACL Tenants, 2017'
202   },
203   subtitle: {
204     text: 'Source: 2017 HUD Data'
205   },
206   tooltip: {
207     pointFormat: '{series.name}: <b>{point.percentage:.1f}%</b>'
208   },
209   plotOptions: {
210     pie: {
211       allowPointSelect: true,
212       cursor: 'pointer',
213       dataLabels: {
214         enabled: true,
215         format: '{<b>{point.name}</b>: {point.percentage:.1f}% ',
216         style: {
217           color: (Highcharts.theme && Highcharts.theme.contrastTextColor) || 'black'
218         }
219       }
220     }
221   },
222   series: [{
223     name: 'Race',
224     colorByPoint: true,
225     data: [{
226       name: 'White',
227       y: 14,
228       sliced: true,
229       selected: true
230     }, {
231       name: 'African-American',
232       y: 62
233     }, {
234       name: 'Native American',
235       y: 24
236     }
237   ]
238 }
```



# Tables

Using html codes to make  
tables

Using containers to have the  
tables in a line

```
368 </div>
369 </div>
370 <div class="centered" style="width:80%">
371 <div style="float:right; height:500px; width:55%">
372 <h4 class="centered"><strong>Base Social Vulnerability Indicators</strong></h4>
373 <table style="width:115%">
374 <tr>
375 <td>Single parent households with children/ Total Households</td>
376 </tr>
377 <tr>
378 <td>Population 5 or below; Population 65 or above/Total Population</td>
379 </tr>
380 <tr>
381 <td>Population 65 or above and below poverty/ Pop. 65 or above</td>
382 </tr>
383 <tr>
384 <td>Workers using public transportation/ Civilian pop. 16+ and employed</td>
385 </tr>
386 <tr>
387 <td>Occupied housing units without a vehicle/ Occupied housing unit</td>
388 </tr>
389 <tr>
390 <td>Persons in renter occupied housing units/ Total occupied housing units</td>
391 </tr>
392 <tr>
393 <td>Non-white population/Total population</td>
394 </tr>
395 <tr>
396 <td>Population in group quarters/Total population</td>
397 </tr>
398 <tr>
399 <td>Housing units built 20 years ago; Mobile Homes; Vacant Housing units/Total housing Units</td>
400 </tr>
401 </table>
402 </div>
403 </div>
404 </div>
405 </div>
406 </div>
407 </div>
408 </div>
409 </div>
410 </div>
```

```
303 group.<br>
304 choropleth map made based on the social vulnerability weighted index scores. <br> Based on the weighted social vulnerability index
305 scores, the housing tenure, race and poverty are the main vulnerabilities of the residents of public housing units
306 </p><br>
307 <div id="tables">
308 <div class="centered" style="width:75%">
309 <div style="float:left; height:500px; width:40%">
310 <h4 class="centered"><strong>Public Housing Developments in Lumberton</strong></h4>
311 <table style="width:100%">
312 <tr>
313 <th>Developments</th>
314 <th>Numbers of Units</th>
315 </tr>
316 <tr>
317 <td>The Meadows</td>
318 <td>40</td>
319 </tr>
320 <tr>
321 <td>The Meadows Ext</td>
322 <td>24</td>
323 </tr>
324 <tr>
325 <td>Davis Heights</td>
326 <td>60</td>
327 </tr>
328 <tr>
329 <td>Eastwood Terrace</td>
330 <td>50</td>
331 </tr>
332 <tr>
333 <td>Rozier Homes</td>
334 <td>30</td>
335 </tr>
336 <tr>
337 <td>Hilton Heights</td>
338 <td>42</td>
339 </tr>
340 <tr>
341 <td>Mohr Plaza</td>
342 <td>100</td>
343 </tr>
344 <tr>
345 <td>Turner Terrace</td>
346 <td>100</td>
347 </tr>
```

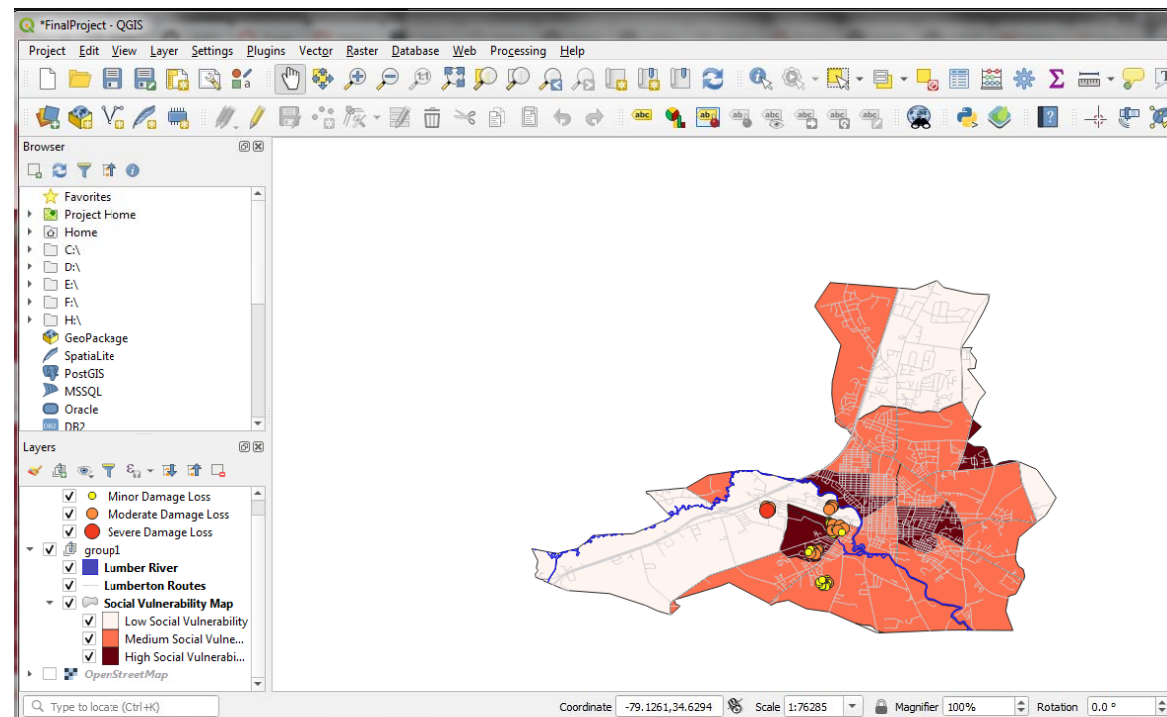
Public Housing Developments in Lumberton		Base Social Vulnerability Indicators
Developments	Numbers of Units	Single parent households with children/ Total Households
The Meadows	40	Population 5 or below; Population 65 or above/Total Population
The Meadows Ext	24	Population 65 or above and below poverty/ Pop. 65 or above
Davis Heights	60	Workers using public transportation/ Civilian pop. 16+ and employed
Eastwood Terrace	50	Occupied housing units without a vehicle/ Occupied housing unit
Rozier Homes	30	Persons in renter occupied housing units/ Total occupied housing units
Hilton Heights	42	Non-white population/Total population
Mohr Plaza	100	Population in group quarters/Total population
Turner Terrace	100	Housing units built 20 years ago; Mobile Homes; Vacant Housing units/Total housing Units
Lumbee Homes	93	Persons in poverty/Total population
Myers Park	30	Occupied housing units without a telephone/Total occupied housing units
Tudor Court	60	Population above 25 with less than high school/Total pop above 25
Weaver Court	100	Population 16+ in labor force and unemployed/Pop in Labor force 16+
Total	729	Population above 5 that speak English not well or not at all/Pop >5

# Maps

Joined Excel table to the Block Groups' in QGIS to make Coropleth map

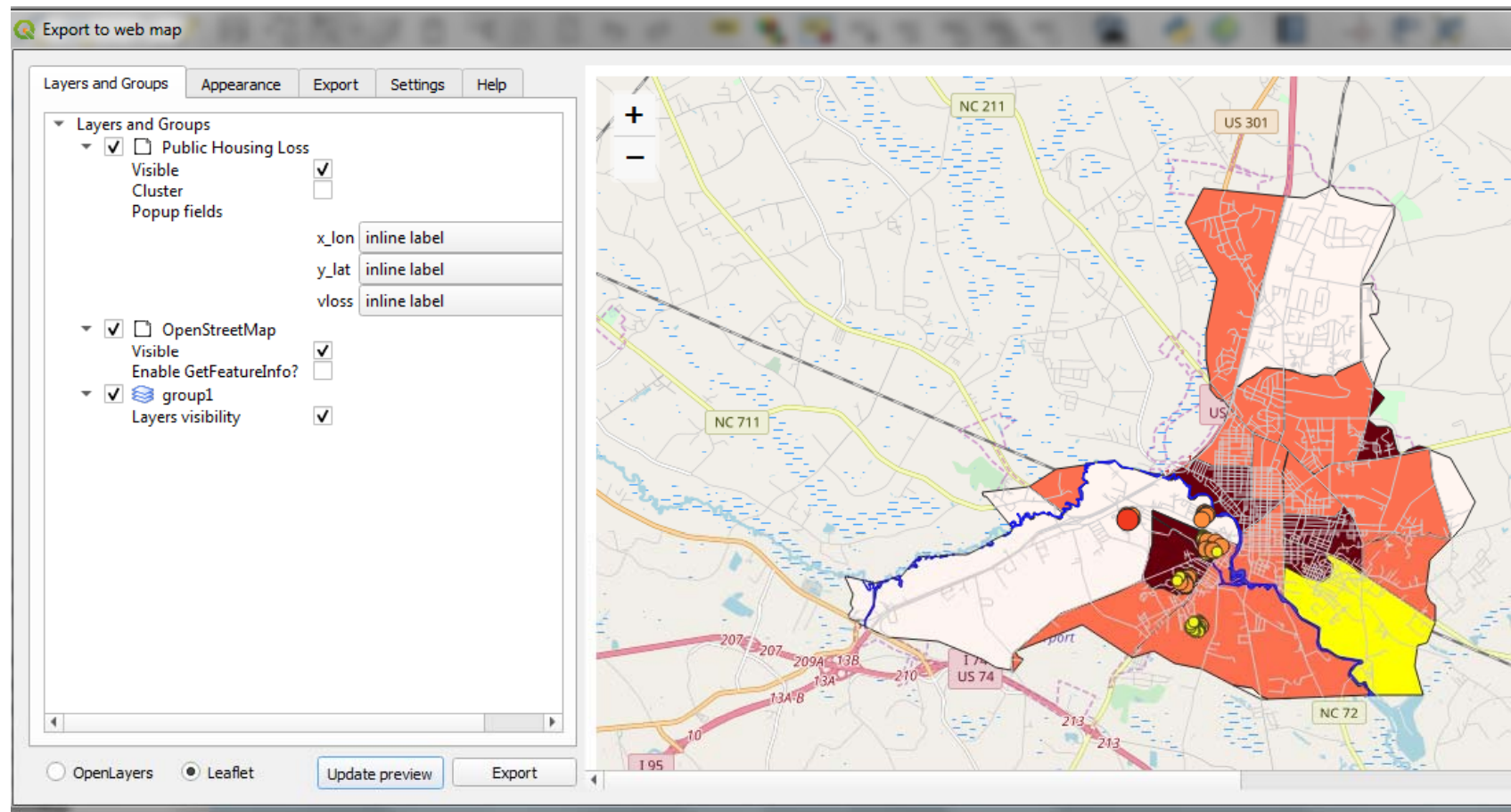
Export public housing point features and add them to the map

Add layers such as river, roads, and open street map



# Maps

Exporting the  
Leaflet map in  
HTML  
Exporting the code  
to the html file



```

438
439 <!-- adding maps of QGIS-->
440 <body>
441 <div id="map"></div>
442 <body>
443 <script src="js/qgis2web_expressions.js"></script>
444 <script src="js/leaflet.js"></script>
445 <script src="js/leaflet.rotatedMarker.js"></script>
446 <script src="js/leaflet.pattern.js"></script>
447 <script src="js/leaflet-hash.js"></script>
448 <script src="js/AutoLinker.min.js"></script>
449 <script src="js/rbush.min.js"></script>
450 <script src="js/labelgun.min.js"></script>
451 <script src="js/labels.js"></script>
452 <script src="data/SocialVulnerabilityMap_0.js"></script>
453 <script src="data/LumbertonRoutes_1.js"></script>
454 <script src="data/LumberRiver_2.js"></script>
455 <script src="data/PublicHousingLoss_4.js"></script>
456 <script>
457 var highlightLayer;
458 function highlightFeature(e) {
459     highlightLayer = e.target;
460
461     if (e.target.feature.geometry.type === 'LineString') {
462         highlightLayer.setStyle({
463             color: 'ffff00',
464         });
465     } else {
466         highlightLayer.setStyle({
467             fillColor: 'ffff00',
468             fillOpacity: 1
469         });
470     }
471     highlightLayer.openPopup();
472 }
473 var map = L.map('map', {
474     zoomControl:true, maxZoom:28, minZoom:1
475 });
476 var hash = new L.Hash(map);
477 map.attributionControl.setPrefix('<a href="https://github.com/tomchadwin/qgis2web" target="_blank">qgis2web</a> &middot; <a href="http://leafletjs.com" title="A JS library for interactive maps">Leaflet</a>');
478 var bounds_group = new L.featureGroup([]);
479 function setBounds() {
480     if (bounds_group.getLayers().length) {

```

Line 114, Column 89 — Selected 2 lines — 824 Lines

INS

UTF-8 ▼

HTML ▼



Space

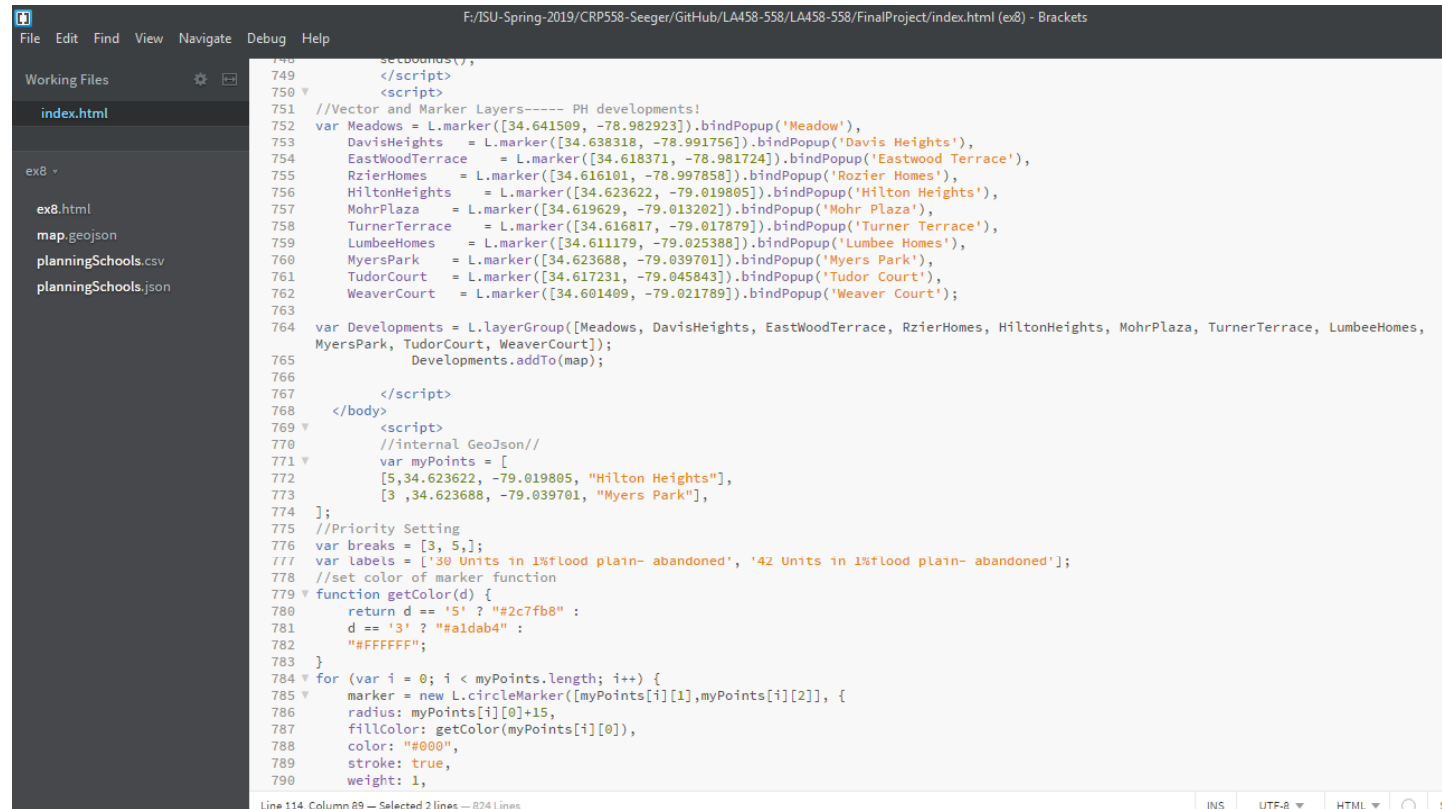


```
F:\ISU-Spring-2019\CRP558-Seeger\GitHub\LA458-558\LA458-558\FinalProject\index.html (ed) - Brackets
View Navigate Debug Help
index.html
475
476 var hash = new L.Hash(map);
477 map.attributionControl.setEfi('a href="https://github.com/tomchadwin/qgis2web" target="blank">qgis2web</a> &ndotdot; <a
478 href="http://leafletjs.com" title="A JS library for interactive maps">Leaflet</a>');
479 var bounds_group = new L.FeatureGroup([]);
480 function setBounds() {
481   if (bounds_group.getLayers().length) {
482     map.fitBounds(bounds_group.getBounds());
483   }
484 }
485 function pop_SocialVulnerabilityMap_0(feature, layer) {
486   layer.on({
487     mouseout: function(e) {
488       for (i in e.target._eventParents) {
489         e.target._eventParents[i].resetStyle(e.target);
490       }
491       if (typeof layer.closePopup == 'function') {
492         layer.closePopup();
493       } else {
494         layer.eachLayer(function(feature) {
495           feature.closePopup();
496         });
497       }
498       mouseover: highlightFeature,
499     });
500   });
501 }
502 function style_SocialVulnerabilityMap_0(feature) {
503   if (feature.properties['SV_Index_W'] >= 111.030000 && feature.properties['SV_Index_W'] <= 389.400000 ) {
504     return {
505       pane: 'pane_SocialVulnerabilityMap_0',
506       opacity: 1,
507       color: 'rgba(35,35,35,1.0)',
508       dashArray: '',
509       lineCap: 'butt',
510       lineJoin: 'miter',
511       weight: 1.0,
512       fill: true,
513       fillOpacity: 1,
514       fillColor: 'rgba(255,245,240,1.0)',
515     };
516   }
517   if (feature.properties['SV_Index_W'] >= 389.400000 && feature.properties['SV_Index_W'] <= 3342.000000 ) {
518     return {
519       pane: 'pane_SocialVulnerabilityMap_0',
520       opacity: 1,
521       color: 'rgba(35,35,35,1.0)',
522       dashArray: '',
523       lineCap: 'butt',
524       lineJoin: 'miter',
525       weight: 1.0,
526       fill: true,
527       fillOpacity: 1,
528       fillColor: 'rgba(252,112,80,1.0)',
529     };
530   }
531   if (feature.properties['SV_Index_W'] >= 3342.000000 && feature.properties['SV_Index_W'] <= 6969.470000 ) {
532     return {
533       pane: 'pane_SocialVulnerabilityMap_0',
534       opacity: 1,
535       color: 'rgba(35,35,35,1.0)',
536       dashArray: '',
537       lineCap: 'butt',
538       lineJoin: 'miter',
539       weight: 1.0,
540       fill: true,
541       fillOpacity: 1,
542       fillColor: 'rgba(103,0,13,1.0)',
543     };
544   }
545 }
546 map.createPane('pane_SocialVulnerabilityMap_0');
547 map.getPane('pane_SocialVulnerabilityMap_0').style.zIndex = 400;
548 map.getPane('pane_SocialVulnerabilityMap_0').style['mix-blend-mode'] = 'normal';
549 var layer_SocialVulnerabilityMap_0 = new L.geoJson(json_SocialVulnerabilityMap_0, {
550   attributions: '',
551   pane: 'pane_SocialVulnerabilityMap_0',
552   onEachFeature: pop_SocialVulnerabilityMap_0,
553   style: style_SocialVulnerabilityMap_0,
554 });
555 bounds_group.addLayer(layer_SocialVulnerabilityMap_0);
556 map.addLayer(layer_SocialVulnerabilityMap_0);
557 function pop_LumbertonRoutes_1(feature, layer) {
558   layer.on({
559     mouseout: function(e) {
560       for (i in e.target._eventParents) {
561         e.target._eventParents[i].resetStyle(e.target);
562       }
563       if (typeof layer.closePopup == 'function') {
564         layer.closePopup();
565       } else {
566         layer.eachLayer(function(feature) {
567           feature.closePopup();
568         });
569       }
570       mouseover: highlightFeature,
571     });
572   });
573 }
574 function style_LumbertonRoutes_1_0() {
575   return {
576     pane: 'pane_LumbertonRoutes_1',
577     opacity: 1,
578     color: 'rgba(208,206,208,1.0)',
579     dashArray: '',
580     lineCap: 'square',
581     lineJoin: 'bevel',
582     weight: 1.0,
583     fillOpacity: 0,
584   };
585 }
586 map.createPane('pane_LumbertonRoutes_1');
587 map.getPane('pane_LumbertonRoutes_1').style.zIndex = 401;
588 map.getPane('pane_LumbertonRoutes_1').style['mix-blend-mode'] = 'normal';
589 var layer_LumbertonRoutes_1 = new L.geoJson(json_LumbertonRoutes_1, {
590   attributions: '',
591   pane: 'pane_LumbertonRoutes_1',
592   onEachFeature: pop_LumbertonRoutes_1,
593   style: style_LumbertonRoutes_1_0,
594 });
595 bounds_group.addLayer(layer_LumbertonRoutes_1);
596 map.addLayer(layer_LumbertonRoutes_1);
597 function pop_LumbertonRoutes_1(feature, layer) {
598   layer.on({
599     mouseout: function(e) {
600       for (i in e.target._eventParents) {
601         e.target._eventParents[i].resetStyle(e.target);
602       }
603       if (typeof layer.closePopup == 'function') {
604         layer.closePopup();
605       } else {
606         layer.eachLayer(function(feature) {
607           feature.closePopup();
608         });
609       }
610       mouseover: highlightFeature,
611     });
612   });
613   var popupContent = '<table>
614     <tr>
615       <th scope="row">x_lon</th>
616       <td> + (feature.properties['x_lon'] !== null ? Autolinker.Link(String(feature.properties['x_lon'])) : '') + '</td>
617     </tr>
618     <tr>
619       <th scope="row">y_lat</th>
620       <td> + (feature.properties['y_lat'] !== null ? Autolinker.Link(String(feature.properties['y_lat'])) : '') + '</td>
621     </tr>
622     <tr>
623       <th scope="row">v_loss</th>
624       <td> + (feature.properties['v_loss'] !== null ? Autolinker.Link(String(feature.properties['v_loss'])) : '') + '</td>
625     </tr>
626   </table>';
627   layer.bindPopup(popupContent, {maxHeight: 400});
628 }
629 function style_PublicHousingLoss_4_0(feature) {
630   switch(String(feature.properties['v_loss'])) {
631     case '0.0049999999':
632       return {
633         pane: 'pane_PublicHousingLoss_4',
634         radius: 4.0,
635         opacity: 1,
636         color: 'rgba(35,35,35,1.0)',
637         dashArray: '',
638         lineCap: 'butt',
639         lineJoin: 'miter',
640         weight: 1,
641       };
642     case '0.0049999999':
643       return {
644         pane: 'pane_PublicHousingLoss_4',
645         radius: 4.0,
646         opacity: 1,
647         color: 'rgba(35,35,35,1.0)',
648         dashArray: '',
649         lineCap: 'butt',
650         lineJoin: 'miter',
651         weight: 1,
652       };
653     case '0.0049999999':
654       return {
655         pane: 'pane_PublicHousingLoss_4',
656         radius: 4.0,
657         opacity: 1,
658         color: 'rgba(35,35,35,1.0)',
659         dashArray: '',
660         lineCap: 'butt',
661         lineJoin: 'miter',
662         weight: 1,
663       };
664     case '0.0049999999':
665       return {
666         pane: 'pane_PublicHousingLoss_4',
667         radius: 4.0,
668         opacity: 1,
669         color: 'rgba(35,35,35,1.0)',
670         dashArray: '',
671         lineCap: 'butt',
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1393         radius: 4.0,
1394         opacity: 1,
1395         color: 'rgba(35,35,35,1.0)',
1396         dashArray: '',
1397         lineCap: 'butt',
1398         lineJoin: 'miter',
1399         weight: 1,
1400       };
1401     case '0.0049999999':
1402       return {
1403         pane: 'pane_PublicHousingLoss_4',
1404         radius: 4.0,
1405         opacity: 1,
1406         color: 'rgba(35,35,35,1.0)',
1407         dashArray: '',
1408         lineCap: 'butt',
1409         lineJoin: 'miter',
1410         weight: 1,
1411       };
1412     case '0.0
```

# Public Housing Developments Location

Using vector and markers

Using array



```
File Edit Find View Navigate Debug Help
Working Files
index.html
ex8.html
map.geojson
planningSchools.csv
planningSchools.json

748 setBounds(),
749 </script>
750 </script>
751 //Vector and Marker Layers----- PH developments!
752 var Meadows = L.marker([34.641509, -78.982923]).bindPopup('Meadow'),
753 DavisHeights = L.marker([34.638318, -78.991756]).bindPopup('Davis Heights'),
754 EastWoodTerrace = L.marker([34.618371, -78.981724]).bindPopup('Eastwood Terrace'),
755 RzierHomes = L.marker([34.616101, -78.997858]).bindPopup('Rzier Homes'),
756 HiltonHeights = L.marker([34.623622, -79.019805]).bindPopup('Hilton Heights'),
757 MohrPlaza = L.marker([34.619629, -79.013202]).bindPopup('Mohr Plaza'),
758 TurnerTerrace = L.marker([34.616817, -79.017879]).bindPopup('Turner Terrace'),
759 LumbeeHomes = L.marker([34.611179, -79.025388]).bindPopup('Lumbee Homes'),
760 MyersPark = L.marker([34.623688, -79.039701]).bindPopup('Myers Park'),
761 TudorCourt = L.marker([34.617231, -79.045843]).bindPopup('Tudor Court'),
762 WeaverCourt = L.marker([34.601409, -79.021789]).bindPopup('Weaver Court');
763
764 var Developments = L.layerGroup([Meadows, DavisHeights, EastWoodTerrace, RzierHomes, HiltonHeights, MohrPlaza, TurnerTerrace, LumbeeHomes,
765 MyersPark, TudorCourt, WeaverCourt]);
766 Developments.addTo(map);
767
768 </script>
769 </body>
770 <script>
771 //internal GeoJson//
772 var myPoints = [
773 [5,34.623622, -79.019805, "Hilton Heights",
774 [3,34.623688, -79.039701, "Myers Park"],
775 ];
776 //Priority Setting
777 var breaks = [3, 5];
778 var labels = ['30 Units in 1% flood plain- abandoned', '42 Units in 1% flood plain- abandoned'];
779 //set color of marker function
780 function getColor(d) {
781 return d == '5' ? "#2c7fb8" :
782 d == '3' ? "#a1dab4" :
783 "#ffffff";
784 }
785 for (var i = 0; i < myPoints.length; i++) {
786 marker = new L.circleMarker([myPoints[i][1],myPoints[i][2]], {
787 radius: myPoints[i][0]*15,
788 fillColor: getColor(myPoints[i][0]),
789 color: "#000",
790 stroke: true,
791 weight: 1,
```



# Abandoned Public Housing Developments

g Internal  
son  
g legend



```
767 </script>
768 </body>
769 <script>
770 //internal GeoJson//
771 var myPoints = [
772   [5,34.623622, -79.019805, "Hilton Heights"],
773   [3 ,34.623688, -79.039701, "Myers Park"],
774 ];
775 //Setting
776 var breaks = [3, 5,];
777 var labels = ['30 Units in 1%flood plain- abandoned', '42 Units in 1%flood plain- abandoned'];
778 //set color of marker function
779 function getColor(d) {
780   return d == '5' ? "#2c7fb8" :
781     d == '3' ? "#a1dab4" :
782     "#ffffff";
783 }
784 for (var i = 0; i < myPoints.length; i++) {
785   marker = new L.circleMarker([myPoints[i][1],myPoints[i][2]], {
786     radius: myPoints[i][0]+15,
787     fillColor: getColor(myPoints[i][0]),
788     color: "#000",
789     stroke: true,
790     weight: 1,
791     opacity: 1,
792     fillOpacity: 0.8
793   });
794   .bindPopup(myPoints[i][2]) //note there is no comma here
795   .addTo(map);
796 }
797
798 var legend = L.control({position: 'bottomleft'});
799 legend.onAdd = function (map) {
800   var div = L.DomUtil.create('div', 'info legend');
801   // loop through items and generate legend items each
802   div.innerHTML += "<b> Abandoned Developments </b> <br>"
803
804   for (var i = 0; i < breaks.length; i++){
805     div.innerHTML +=
806       '<i style="background:' + getColor(breaks[i]) + ' "></i> ' + labels[i] + (breaks ? ' ' + '<br>' : '');
807   }
808   return div;
809 };
810 legend.addTo(map);
```

# Conclusion

```
Debug Help
F:/ISU-Spring-2019/CRP558-Seeger/GitHub/LA458-558/LA458-558/FinalProject/index.html (e8) - Brackets
102 padding: 4px;
103 }
104
105 tr:nth-child(even) {
106   background-color: #dddddd;
107 }
108
109 </style>
110 <title></title>
111 </head>
112 <body>
113   <header>
114     <h1><strong>Mapping Social Vulnerability and Flood Damages</strong></h1>
115     <h2>Public Housing Units in Lumberton, North Carolina after Hurricane Matthew, 2016</h2>
116   </header>
117   <div id="menu">
118     <ul>
119       <li><a class="active" href="#SlideShow">Pictures of Hurricane Matthew and Public Housings </a></li>
120       <li><a href="#container"> Race and Poverty Chart </a></li>
121       <li><a href="#tables"> Public Housing table and Social Vulnerability indicators </a></li>
122       <li><a href="#map"> Social Vulnerability and Damage Loss Map </a></li>
123     </ul>
124   </div>
125 </body>
126 <br>
127 <p><strong>Introduction:</strong>
128 <br>• Social Vulnerability consists of certain socioeconomic characteristics of individuals or group that limit the capacity to anticipate, cope
129 <br>with, resist and recover from the impacts of hazards.
130 <br>• Residents of public housing are among the most socially vulnerable groups with limited access to recovery resources and limited voice in
131 <br>recovery planning. They often have very limited access to temporary or permanent shelters of their choice due to factors such as lower income
132 <br>and limited access to information and decisions.<br>• My case study of the impacts of Hurricane Matthew on public housing in Lumberton, NC
```

- Using QGIS, web mapping and html coding I attempted to present my project.
- I used some links at the top of my web page to make it easier for a visitor to navigate through the page.

## Mapping Social Vulnerability and Flood Damages

### Public Housing Units in Lumberton, North Carolina after Hurricane Matthew, 2016

[Pictures of Hurricane Matthew and Public Housings](#) [Race and Poverty Chart](#) [Public Housing table and Social Vulnerability indicators](#) [Social Vulnerability and Damage Loss Map](#)

# Thank You!