Preliminary Maps of Iowa Substance Use Recovery Infrastructure
CRP 558: Final Project
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Introduction:

The Preliminary Maps of Iowa Substance Use Recovery Infrastructure included substance use mortality data for the United States and the state of Iowa, with overlaying layers of COVID-19 data and a preliminary list of Iowa substance use recovery providers across the state. The map aimed to replicate features from the Your Life Iowa provider map in effort to develop a preliminary tool to analyze and search Iowa recovery services. This project was successful in building filtering tools to display this information, as well as developing a variety of interactive features aimed to enhance a viewer's ability to engage with the materials.

This project was unsuccessful in replicating the radio button and list features of the Your Life Iowa provider map and ran into challenges successfully geocoding each location of the Iowa substance use recovery provider list. This report will provide an overview of the data and tools used to build this project, as well as discuss the strengths and challenges of project development. This report will also provide example code and discuss future recommendations.

Data & Tool:

The overall project was established in collaboration with my graduate research assistant assignment to the Advancing Substance Use Recovery in Iowa project, a project led by an Iowa State team working with The Substance Abuse Bureau of the Iowa Department of Public Health and funded by the Substance Abuse and Mental Health Administration. One of the tasks of this team is to complete an environmental data scan of agencies that are currently providing substance use recovery services in the state of Iowa. The Advancing Substance Use Recovery in Iowa project was interested in mapping their preliminary data in effort to visualize their findings. As a result, I collaborated with the Principle Investigators of this project to include this visualization as part of my final web mapping project.

Table 1: Project Data and Tools

Data	Plugins and tools featured	Link to Data Source
Iowa substance use recovery providers	Brackets, GitHub, Leaflet, QGIS, MMQGIS, AwesomeMarker, MarkerCluster, Bootstrap, & JQuery	N/A
COVID-19 cases	Brackets, GitHub, Leaflet, Esri-Leaflet	https://services.arcgis.com/vPD5PVLI6sfkZ5E4/ArcGIS/rest/services/IA_COVID19_Cases/FeatureServer
Iowa & United States substance induced mortality rates 1999-2018 per 100,000	Brackets, GitHub, Leaflet, & QGIS	https://wonder.cdc.gov/
Iowa: County-level boundaries	Brackets, GitHub, Leaflet, & QGIS	https://geodata.iowa.gov/dataset/county-boundaries-iowa
United States: State-level boundaries	Brackets, GitHub, Leaflet, & QGIS	https://catalog.data.gov/dataset/tiger-line-shapefile-2017-nation-u-s-current-state-and-equivalent-national

The table above references the data and tools utilized to build the Preliminary Maps of Iowa Substance Use Recovery Infrastructure. This project was built with the code editor Brackets, the open source Javascript library Leaflet, and the software development platform Github. Substance induced mortality data from 1999-2018 was exported from the Center for Disease Control WONDER online database to highlight regional patterns of substance induced mortality across the United States and Iowa counties. This data was used to provide an overall introduction to the topic of substance use as well as act as a layer of analysis to visualize the locations of substance use recovery providers. This data was downloaded at both the country and county levels as XX files and then uploaded into QGIS, joined to state and county boundary shapefiles, and then exported as geoJSON layers.

The preliminary list of Iowa substance use recovery providers was created in an excel file, saved as a .csv file, uploaded to QGIS, and then geocoded with the MMQGIS plugin. After this file was geocoded it was then exported as a geoJSON file and integrated into the web map. Once in the web map AwesomeMarker, MarkerCluster, Bootstrap, and JQuery were used to enhance the markers of this point file, as well as to build buttons and filtering tools.

The Esri-Leaflet plugin was also used to upload the representational state transfer (REST) COVID-19 data as a feature layer due to this project's desire to showcase daily COVID-19 data changes. This project also experimented with ArcGIS online to geocode and create feature layers but decided not to include this tool in the final project.

Example Code:

In addition to the above plugins and tools, I used a variety of code to create choropleth maps, circle markers, and legends. Additionally, the class example from Rakibul Ahasan's final project inspired me to include a series of maps, containers, and buttons. I used this project as a resource, as well as referenced CRP 558 lecture materials, leafletjs.com, and w3schools.com to create my code.

The below code is provided as an example of how I built the last map on my project. I refer to this map as *map 4* in my code. This example does not include the lines necessary to use the plugins or showcase my full geoJSON files. This information can be found in my CRP 558 repository in github. To review my full code, please follow the link to my final project folder.

The code below is found in the style section of my index file to tell the browser how to build my map 4 container, map, and the buttons featured in this section.

```
#map4container {position: absolute; background-color: #D3D3D3; color: black; text-align: center;
margin-right: 0px; margin-left:0px; width:600px; height:400px; padding 0;}
#map4 {position: relative; height: 400px; margin-left:600px; border-left:2px; padding 0;
overflow: hidden;}

.button {
   background-color: #4CAF50;
   border: none;
   color: white;
   padding: 5px 10px;
   text-align: center;
   text-decoration: none;
   display: inline-block;
   font-size: 14px;
   width: 200px;
   height: 60px;
   margin: 4px 2px;
   cursor: pointer;
   }
```

This information is then referenced within the body section of my index file to tell the browser the location, text, and script id's necessary to build this map and the associated buttons.

```
<div id='map4container'>
<h2>Interested in locating a specific recovery provider?</h2>
<p>Click on the buttons below to explore options of Iowa Substance Use Recovery Providers:</p>
<div class="btn-group">
  <button type="button" id="women" class="button">Female Only</button>
  <button type="button" id="men" class="button">Male Only </button>
  <br><button type="button" id="family" class="button">Families</button>
  <button type="button" id="veteran" class="button">Veterans</button>
  <br><button type="button" id="housing" class="button">Housing </button>
  <button type="button" id="Religion" class="button">Religious and Faith Based</button>
  <br><button type="twelve" id="twelve" class="button">12-Step Programs</button>
  <button type="button" id="Out" class="button">Outpatient Services</button>
  </div>
  </div>
<div id="map4"></div>
```

The below information is housed within the script section of my index file to tell the browser how the above features behave and identifies the data associated. This code tells the browser what base layers to include in map 4 as well as the latitude, longitude, and zoom level showcased in map 4.

```
//map 4
var OSM4 = L.tileLayer('https://{s}.tile.osm.org/{z}/{x}/{y}.png', {
    attribution: '&copy; <a href="https://osm.org/copyright">OpenStreetMap</a> contributors',
    maxZoom: 18
    });

var map4 = L.map('map4', {
    center: [42,-93],
    zoom: 7,
    layers: [OSM4]
            });
```

The below code is also found within my script section. The variable 'phoneMarker' showcases how I implemented the awesome marker plug in to build the phone markers. The variable 'all' references the geoJSON variable SIRP (used to define the single layer of Iowa recovery providers in this map). The variable 'all' references the 'phoneMarker' function and includes a function to build the popups for this layer.

```
//awesome marker for phone icon
var phoneMarker = L.AwesomeMarkers.icon({
    icon: 'phone',
    prefix: 'fa',
    markerColor: 'blue'
    });

//map 4 data
var all = L.geoJSON(SIRP, {
    pointToLayer: function(feature, latlng) {
    return L.marker(latlng, {
    icon: phoneMarker})
    },
    onEachFeature: function (feature, layer) {
        popupOptions = {maxWidth: 200};
        if (feature.properties.URL == "NA"){
        layer.bindPopup("<b>Site name: </b>" + feature.properties.Name +
                    "<br><b>Phone Number: </b>" + feature.properties.Phone +
                    "<br><b>Link:</b> No URL available",popupOptions);}
        else{layer.bindPopup("<b>Site name: </b>" + feature.properties.Name +
                    "<br><b>Phone Number: </b>" + feature.properties.Phone +
                    "<br><b>Link: </b>" + '<a
                    href="'+feature.properties.URL+'">'+feature.properties.URL+'</a>'
        ,popupOptions);    }
        }}
        )
        .addTo(map4);
```

The below code also appears in the script section of my index file and creates a popup function referenced by a series of variables that were created to build the buttons in this map. The first several lines of this section reference a function I created to define the popup information for the variables that follow. The variable 'housing' is an example of a variable that follows this function and was created to build the buttons on this map. This variable references the SIRP variable in my geoJSON file and filters the information in this file to only show the points in this layer that are referenced by the Service Type: Recovery Housing. This variable then references the popup function to include the below information when the button is clicked.

```
//map 4 pop up function
function popupProvider(feature, layer) {
    popupOptions = {maxWidth: 200};
        if (feature.properties.URL == "NA"){
        layer.bindPopup("<b>Site name: </b>" + feature.properties.Name +
                    "<br><b>Phone Number: </b>" + feature.properties.Phone +
                    "<br><b>Link:</b> No URL available",popupOptions);}
        else{layer.bindPopup("<b>Site name: </b>" + feature.properties.Name +
                    "<br><b>Phone Number: </b>" + feature.properties.Phone +
                    "<br><b>Link: </b>" + '<a
                    href="'+feature.properties.URL+'">'+feature.properties.URL+'</a>'
        ,popupOptions);    }
        }

//map 4 data for buttons
var housing = L.geoJSON(SIRP, {
    onEachFeature: popupProvider,
    filter: function(feature, layer) {
        if (feature.properties.ServiceTyp == 'RecoveryHousing') {
        return true;
        }
        },
    pointToLayer: function(feature, latlng) {
        return L.marker(latlng, {icon: phoneMarker});
        },
        })
```

Finally, the last several lines of this example show the function that is referenced by the housing button. This section of code tells the button what to display and what to remove from the map when the button is activitated. In this example, the housing button removes all layers except for the housing variable.

```
//map 4 filtering
$("#housing").click(function() {
    map4.addLayer(housing);
    map4.removeLayer(all);
    map4.removeLayer(women);
    map4.removeLayer(family);
    map4.removeLayer(veteran);
    map4.removeLayer(men);
    map4.removeLayer(twelve);
    map4.removeLayer(Out);
    map4.removeLayer(Religion);
    });
```

Strengths:

The strengths of this project include the overall interactivity of the map and the inclusion of a variety of tools to build this web map. The interactivity features not only include the use of unique markers, clustering markers, buttons, and filters, but also includes popups with useful information related to the dataset, as well as features that highlight the polygon features of the map. In addition, this project includes REST services that allow the data to be updated automatically with COVID data. This not only provides a unique level of analysis but also creates the opportunity to monitor changes overtime without having to manually update the map.

Challenges:

Working with a preliminary dataset introduced challenges to this project as the dataset required geocoding and adjustments in effort to prepare for mapping and filtering. I was unsuccessful in geocoding several points of the dataset due to limitations with MMQGIS's ability to locate several providers. To problem solve this I utilized ArcGIS online to geocode and this allowed for all points to be successfully mapped. However, I did not continue to use ArcGIS online as this tool required the layer to be publicly published on this tool and I did not feel comfortable publishing a preliminary dataset to this source. As a result, the current map is missing 7 providers originally collected in this round of data analysis. Additionally, because this was a preliminary dataset built by the Advancing Substance Use Recovery in Iowa team, additional time was taken to collaborate and explore privacy procedures regarding the dataset. This collaboration resulted in permission to use the preliminary dataset and make it available as needed to create the project.

Next Steps:

Data collection and mapping will continue by the Advancing Substance Recovery in Iowa project team to locate additional substance use recovery providers in Iowa and visualize their locations in the state. Web mapping will also continue and aim to replicate the tool by Your Life Iowa in effort to provide users with an ability to search and locate substance use recovery providers across Iowa. Additional steps may include adding additional columns to the provider dataset in effort to provide more filtering options, as the current filtering categories were added manually for use of this project.

Conclusion

In conclusion, the Preliminary Maps of Iowa Substance Use Recovery Infrastructure final project successfully mapped preliminary data of Iowa substance use recovery providers. The project also successfully added substance induced mortality data, COVID-19 data, and provided interactive tools that allow users to spatially explore this preliminary dataset. While this project was unsuccessful in recreating the radio button and list features of the [Your Life Iowa provider map](#) and was unable to geocode 7 providers, this project was able to implement a variety of learnings from the CRP 558 course that will aide in the projects future development.

References

Please review my final project website and code for additional references utilized in this project.