

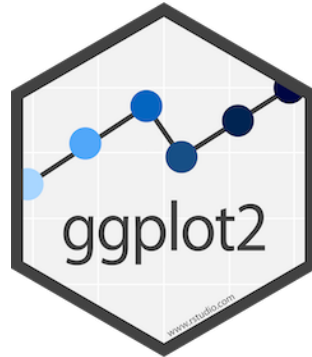
Introduction to Data Visualization

Visualizing Geospatial Data Part II

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Geospatial Visualization-Tools

- ggplot (functions in addition to `geom_polygon()`)



- [ArcGIS](#)



- [Leaflet](#)



ggplot features

- Underlying principle and syntax under ggplot2 to create maps and non-spatial figures are very similar.
- The only major difference between them is the choice of `geom_*()` types:
 - *`geom_polygon()` similar to paths, the start and end points are connected and the inside is coloured by fill*
 - *`geom_sf()` for `sf` (vector) objects*
 - *`geom_raster()` for raster data*
 - *`geom_stars()` for stars (both vector and raster) object*

ggplot features

- `geom_sf()` allows for visualizing sf objects.
- `geom_sf()` automatically detects the geometry type of spatial objects stored in sf & draw maps accordingly

– *The following codes create maps of Kansas wells (points), Kansas counties (polygons), and railroads in Kansas (lines):*

```
g_wells <- ggplot(data = gw_KS_sf) + geom_sf()  
g_county <- ggplot(data = KS_county) + geom_sf()  
g_rail <- ggplot(data = KS_railroads) + geom_sf()
```

ArcGIS (Online)

- Cloud-based software to create and share interactive web maps.
- You can:
 - *Make maps –of course 😊*
 - *Share maps and apps*
 - *Collaborate*
 - *Analyze data*
 - *Work with your data*

ArcGIS-Quick Start

- Type “umich” on the [login page](#) and select UM.

Sign in with



ArcGIS login

Your ArcGIS organization's URL

umich .maps.arcgis.com

☐ Remember this URL

Continue



No account? [Create an account](#)

[Privacy](#)

To create maps

Your content

Home

Gallery

Map

Scene

Notebook

Groups

Content

University of Michigan

University of Michigan

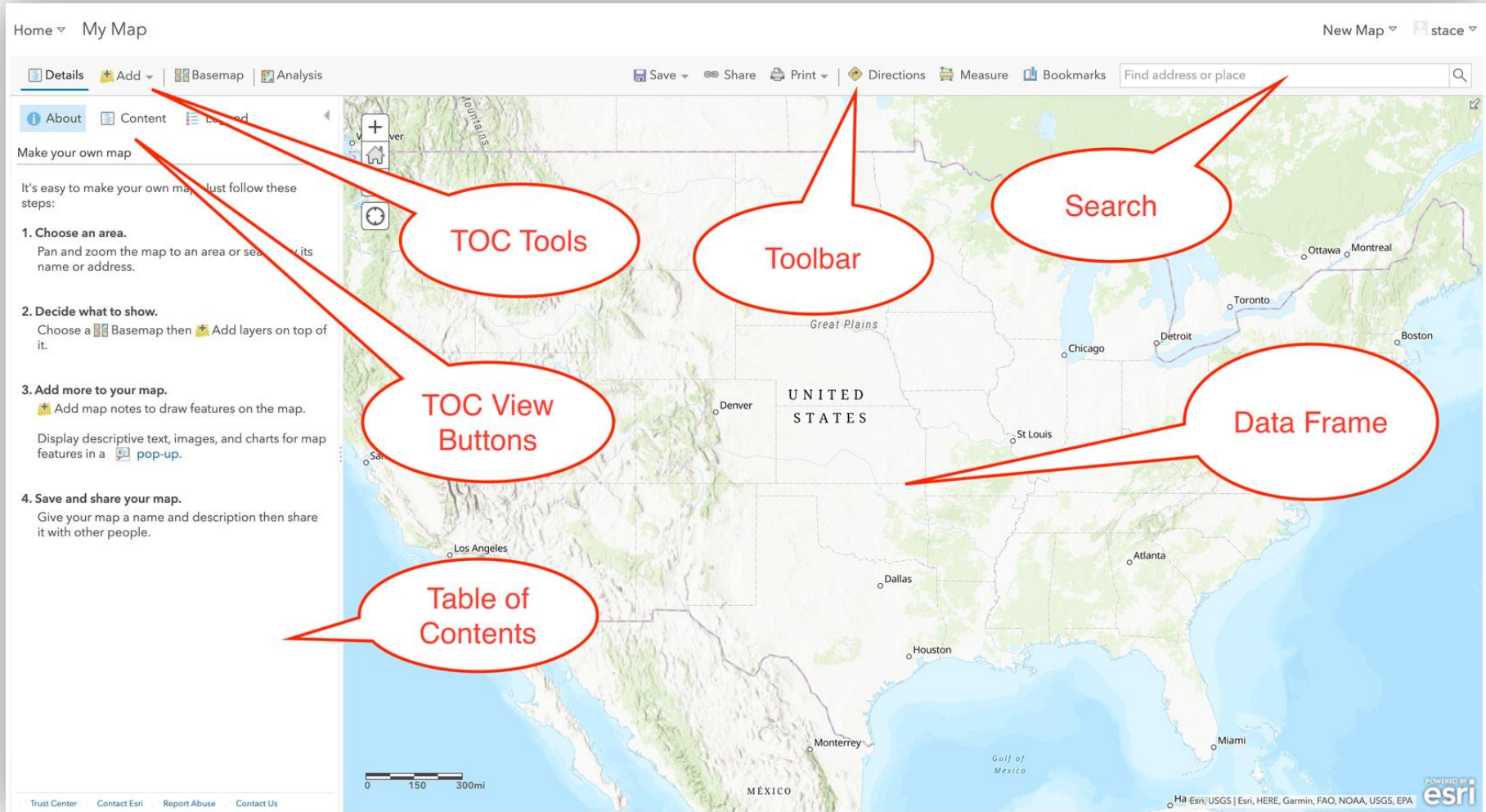


Subscription ID
1416867292

System health

✓ All systems operational

ArcGIS-Quick Start



The screenshot shows the ArcGIS Story Maps Quick Start interface. The main map area displays a map of the United States with various cities labeled. The interface includes a top navigation bar with options like 'Home', 'My Map', 'New Map', and 'stace'. Below this is a toolbar with icons for 'Details', 'Add', 'Basemap', 'Analysis', 'Save', 'Share', 'Print', 'Directions', 'Measure', and 'Bookmarks'. A search bar is located on the right side of the toolbar. On the left side, there is a 'Table of Contents' panel with a 'Make your own map' section. This section contains four steps: 1. Choose an area, 2. Decide what to show, 3. Add more to your map, and 4. Save and share your map. Red callouts point to specific components: 'TOC Tools' points to the 'Add' button in the toolbar; 'Toolbar' points to the main toolbar; 'Search' points to the search bar; 'TOC View Buttons' points to the 'Table of Contents' panel; 'Table of Contents' points to the 'Table of Contents' panel; and 'Data Frame' points to the main map area.

Home ▾ My Map

New Map ▾ stace ▾

Details Add ▾ Basemap Analysis Save ▾ Share Print ▾ Directions Measure Bookmarks Find address or place

About Content Layers

Make your own map

It's easy to make your own map. Just follow these steps:

- 1. Choose an area.**
Pan and zoom the map to an area or search for its name or address.
- 2. Decide what to show.**
Choose a Basemap then Add layers on top of it.
- 3. Add more to your map.**
Add map notes to draw features on the map.
Display descriptive text, images, and charts for map features in a pop-up.
- 4. Save and share your map.**
Give your map a name and description then share it with other people.

TOC Tools

Toolbar

Search

TOC View Buttons

Table of Contents

Data Frame

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MEXICO

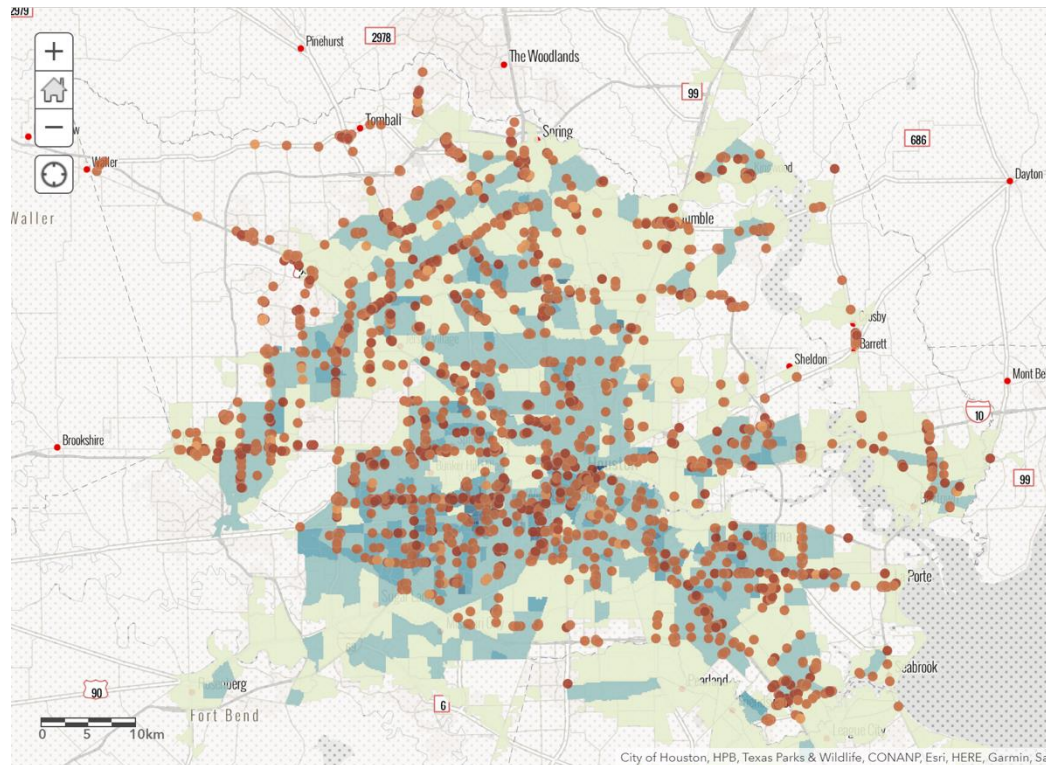
esri

ArcGIS-Quick Start

- Choose a basemap (imagery, streets, terrain ...)
 - *Let's choose Newspaper Map (click content to see your layers)*
- Add layer
 - *Search for layers → [My Content, My Favorite, ArcGIS online ...]*
 - *Houston Tracts w demographics from ArcGIS online*
 - *Change style and color map to reflect the population/sq mile*
 - *Add HarrisCountyBrandsSept18_Resturants_Ratings.csv as another layer*
 - *Change style and color to reflect ratings from 1 through 5.*

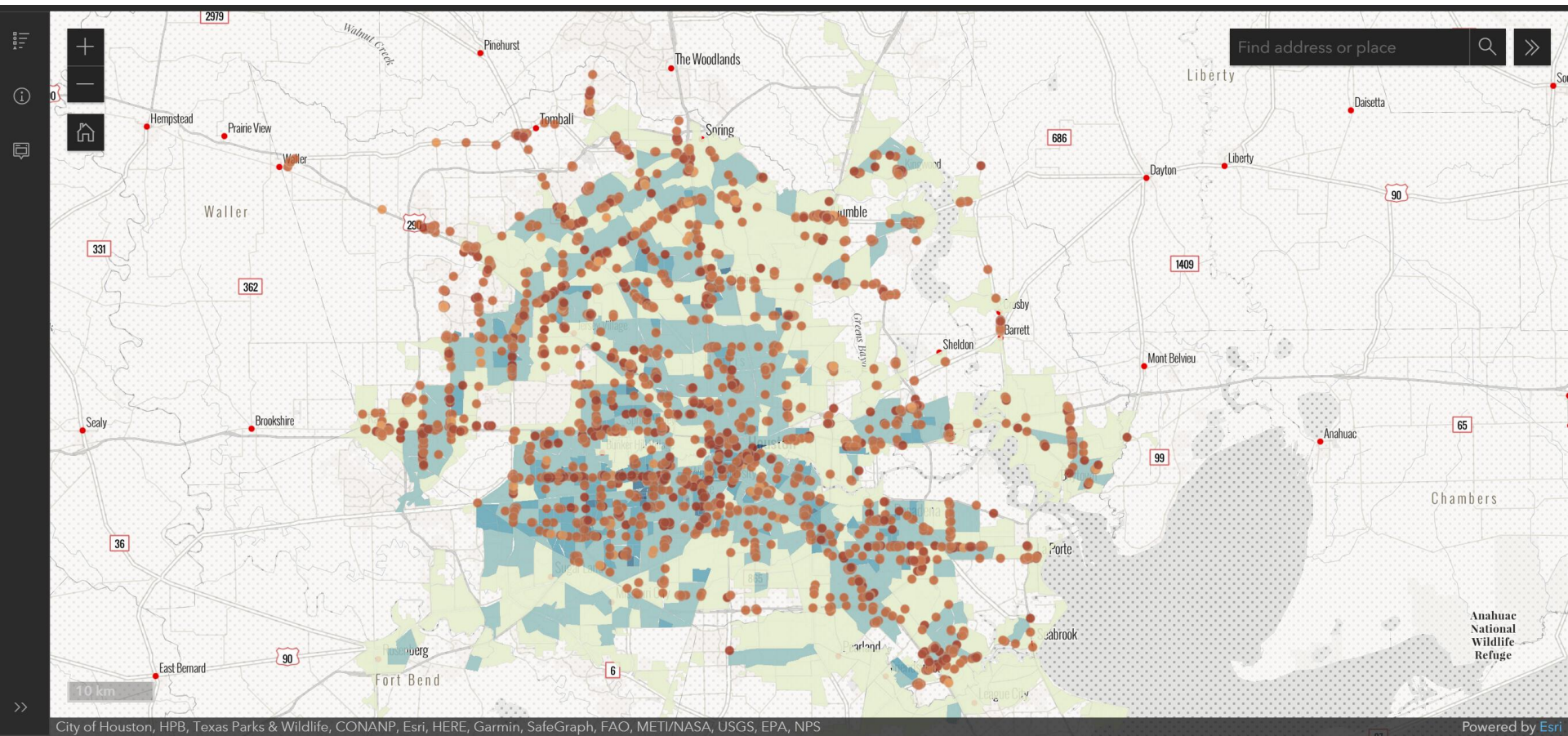
ArcGIS-Quick Start

- You can save and share your map.
- You can even create a web app.



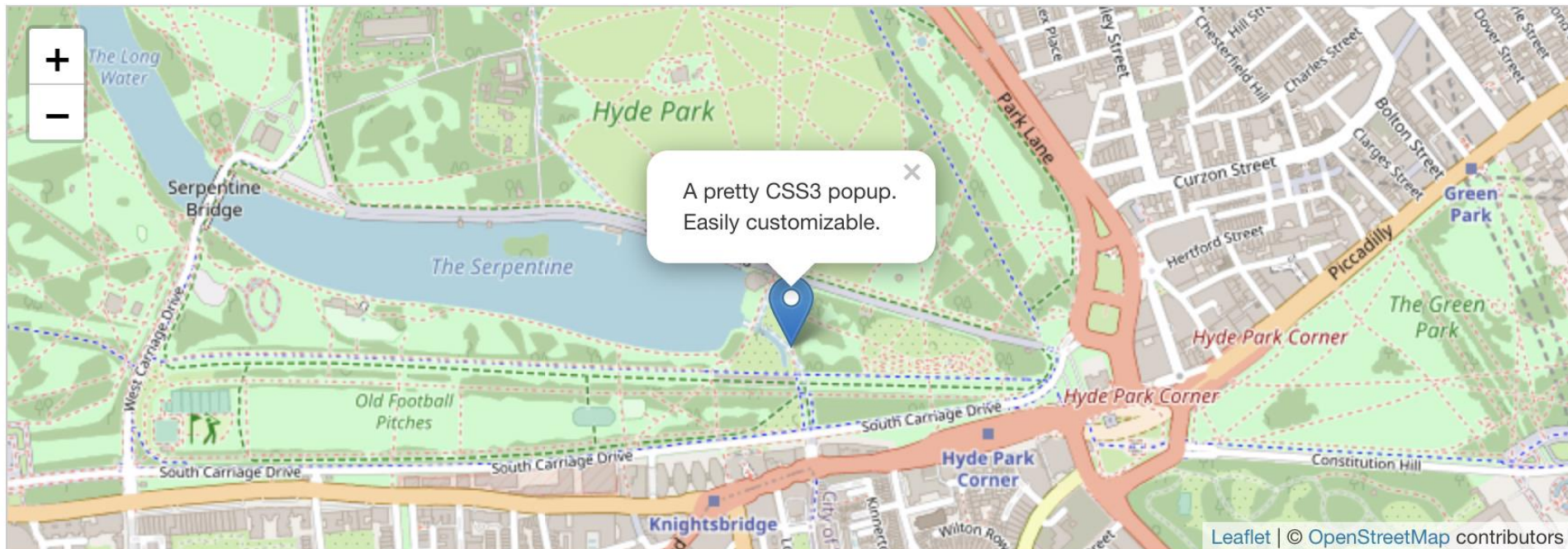
ArcGIS-Quick Start

- And here's a snapshot from [the web page](#) I created



Leaflet

- Leaflet is the leading open-source JavaScript library for mobile-friendly interactive maps.
- It has all the mapping features most developers ever need.



Leaflet-Quick Start-1

Include Leaflet CSS file in the head section of your document

```
<link rel="stylesheet"
href="https://unpkg.com/leaflet@1.7.1/dist/leaflet.css" integrity="sha512-
xodZBNTC5n17Xt2atTPuE1HxjVMSvLVW9ocqUKLsCC5CXdbqCmblAshOMAS6/keqq/sMZMZ19sc
R4PsZChSR7A==" crossorigin="" />
```

Include Leaflet JavaScript file **after** Leaflet's CSS

```
<script src="https://unpkg.com/leaflet@1.7.1/dist/leaflet.js" integrity="sha512-
XQoYMqMTK8LvdxXYG3nZ448h0EQiglfqkJs1NOQV44cWnUrBc8PkAOcXy20w0vlaXaVUearIOBhiXZ5V3ynx
wA==" crossorigin=""></script>
```

Put a div element with a certain id where you want your map to be

```
<div id="map"></div>
```

Make sure the map container has a defined height in CSS

```
#map { height: 180px; }
```

Leaflet-Quick Start-2

Initialize the map with a chosen geographical coordinates and a zoom level

```
var map = L.map('map').setView([43.0125, -83.6875], 10);
```

Add a tile layer

```
L.tileLayer('https://api.mapbox.com/styles/v1/{id}/tiles/{z}/{x}/{y}?access_token={accessToken}', { attribution: 'Map data &copy; <a href="https://www.openstreetmap.org/copyright">OpenStreetMap</a> contributors, Imagery © <a href="https://www.mapbox.com/">Mapbox</a>', maxZoom: 18, id: 'mapbox/streets-v11', tileSize: 512, zoomOffset: -1, accessToken: 'your.mapbox.access.token' }).addTo(map);
```

You can use the following access token

```
pk.eyJ1IjoibWFWYm94IiwiaSI6ImNpejY4NXVycTA2emYycXBndHRqcmZ3N3gifQ.rJcFIG214AriISLbB6B5aw
```

Leaflet-Choropleth Example-1

Get a [GeoJson content](#)

```
<script type="text/javascript"
src="https://leafletjs.com/SlavaUkraini/examples/choropleth/us-
states.js"></script>
```

Getting color depending on population density value

```
function getColor(d) {
  return d > 1000 ? '#800026' :
    d > 500  ? '#BD0026' :
    d > 200  ? '#E31A1C' :
    d > 100  ? '#FC4E2A' :
    d > 50   ? '#FD8D3C' :
    d > 20   ? '#FEB24C' :
    d > 10   ? '#FED976' : '#FFEDA0';
}
```

Leaflet-Choropleth Example-I1

Setting style and filling with colors

```
function style(feature) {  
  return {  
    weight: 2,  
    opacity: 1,  
    color: 'white',  
    dashArray: '3',  
    fillOpacity: 0.7,  
    fillColor: getColor(feature.properties.density)  
  };  
}
```

Now adding the GeoJson data to the map with the desired style

```
var geojson = L.geoJson(statesData, {  
  style: style,  
}).addTo(map);
```

In-class Assignment

- Please go to ArcGIS online
- Add National Geographic Style Map as a base map.
- Add **wind_shiloh.csv** from the DATA folder as another layer.
- Choose year_range attribute to present the wind turbines.
- Publish it as a web app and submit your URL as a response to this assignment.