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):*

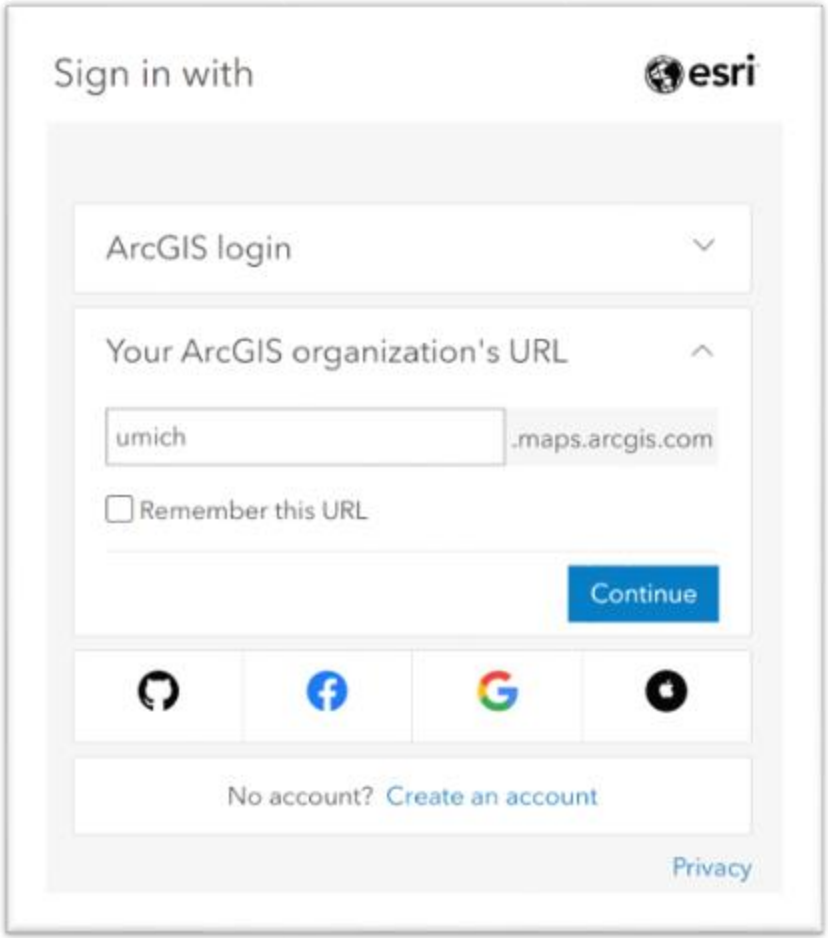
```
g_wells <- ggplot(data = gw_KS_sf) + geom_sf()
g_county <- ggplot(data = KS_county) + geom_sf()
g_rail <- ggplot(data = KS_railroads) + geom_sf()
```

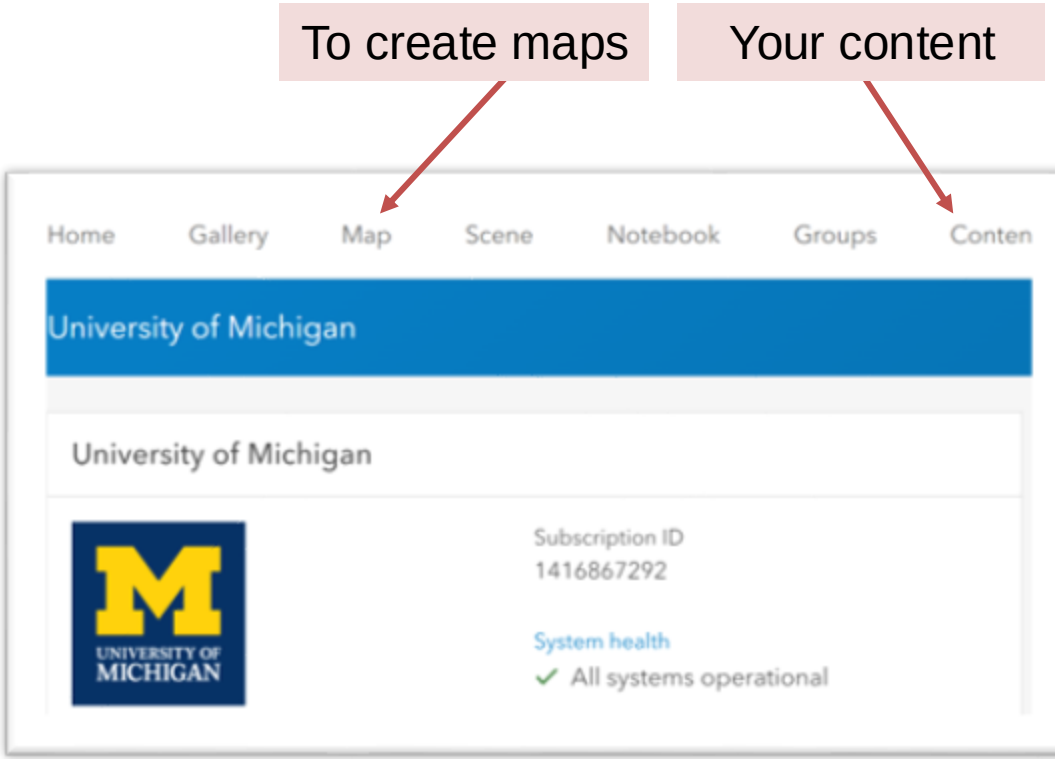
ArcGIS (Online)

- 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*

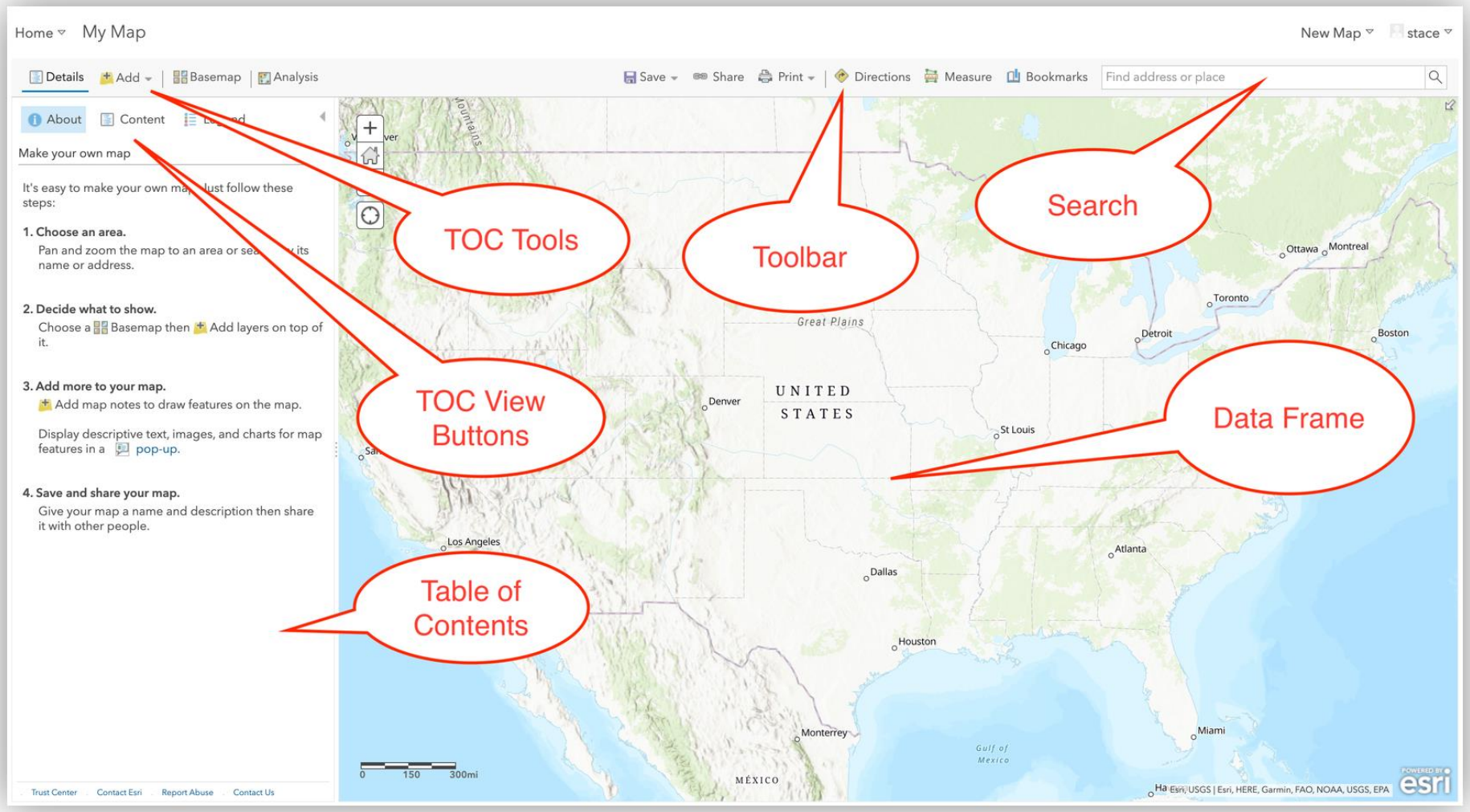
ArcGIS-Quick Start

- Type “umich” on the login page and select UM.





ArcGIS-Quick Start



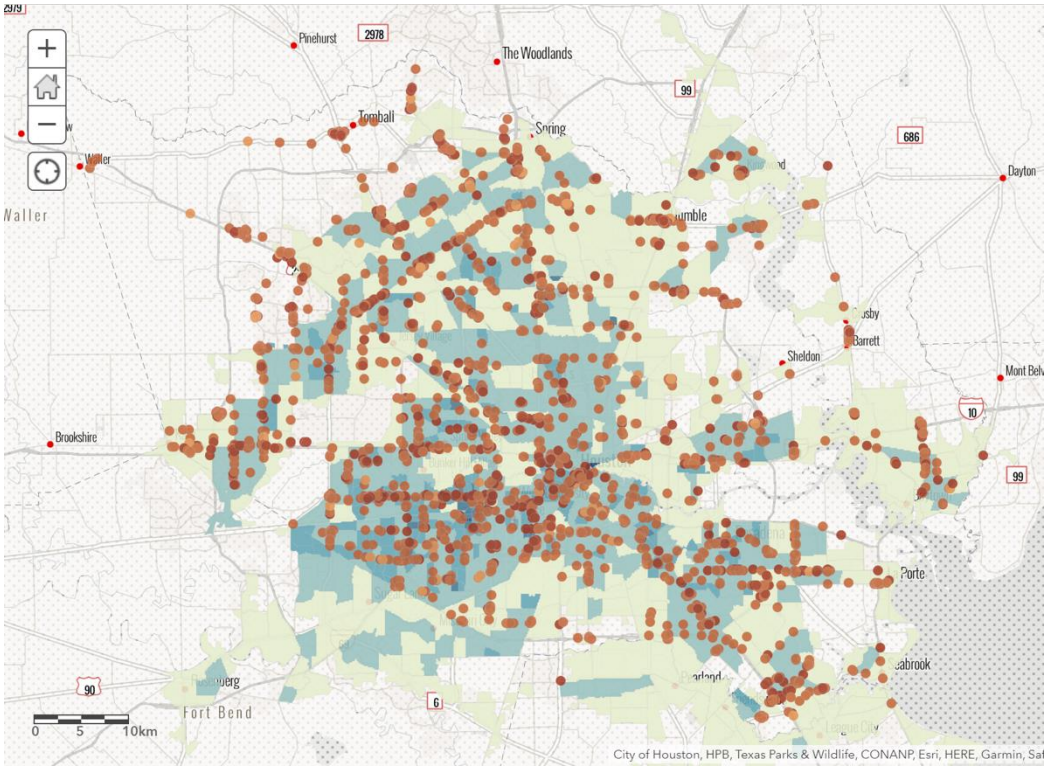
Credit: https://storymaps.arcgis.com/

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.*

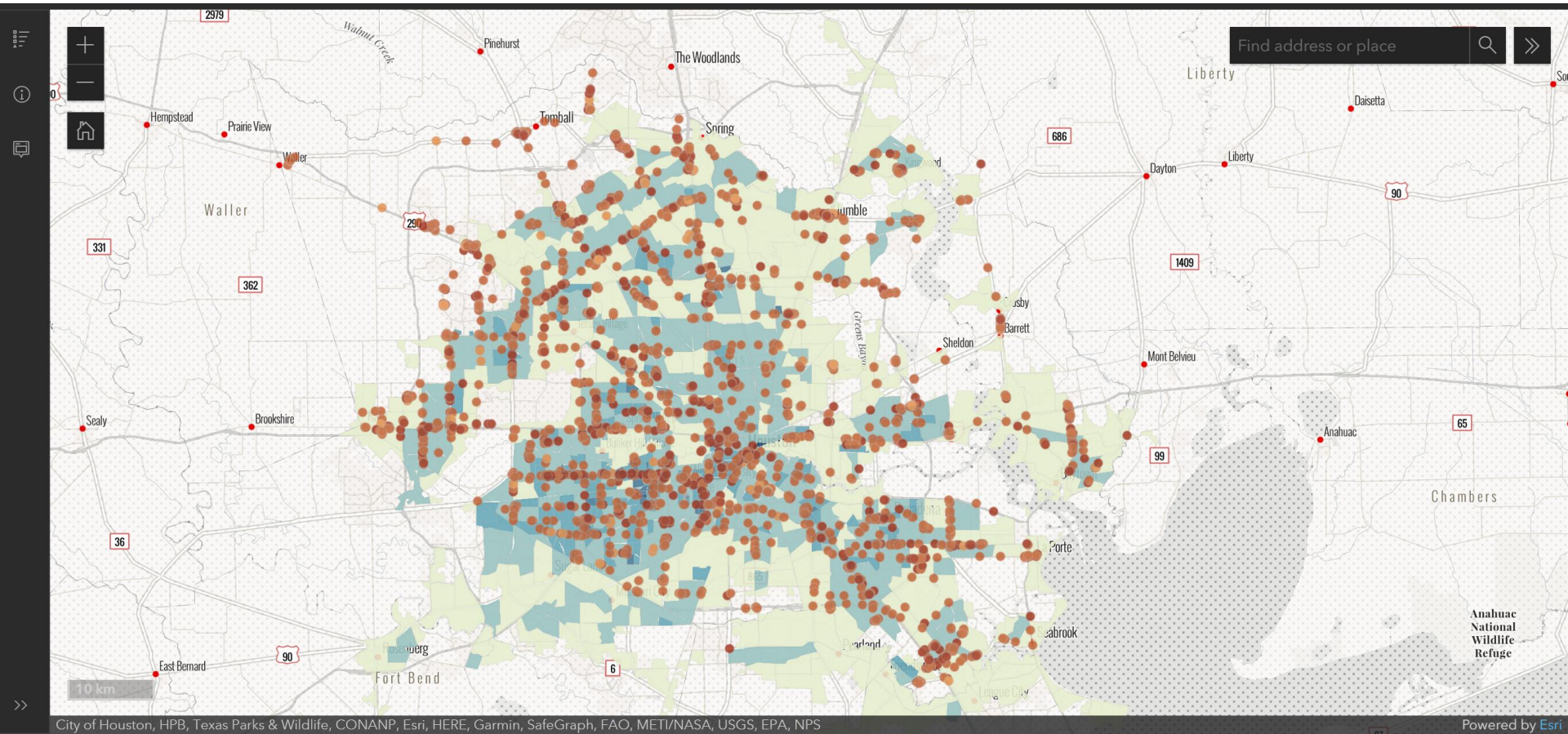
ArcGIS-Quick Start

- 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-
XQoYMqMTK8LvdxXYG3nZ448hOEQiglfqkJs1NOQV44cWnUrBc8PkAOcXy20w0vlaXaVUearIOBhiXZ5V3ynx
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.eyJ1IjoibWFwYm94IiwiYSI6ImNpejY4NXVycTA2emYycXBndHRqcmZ3N3gifQ.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.