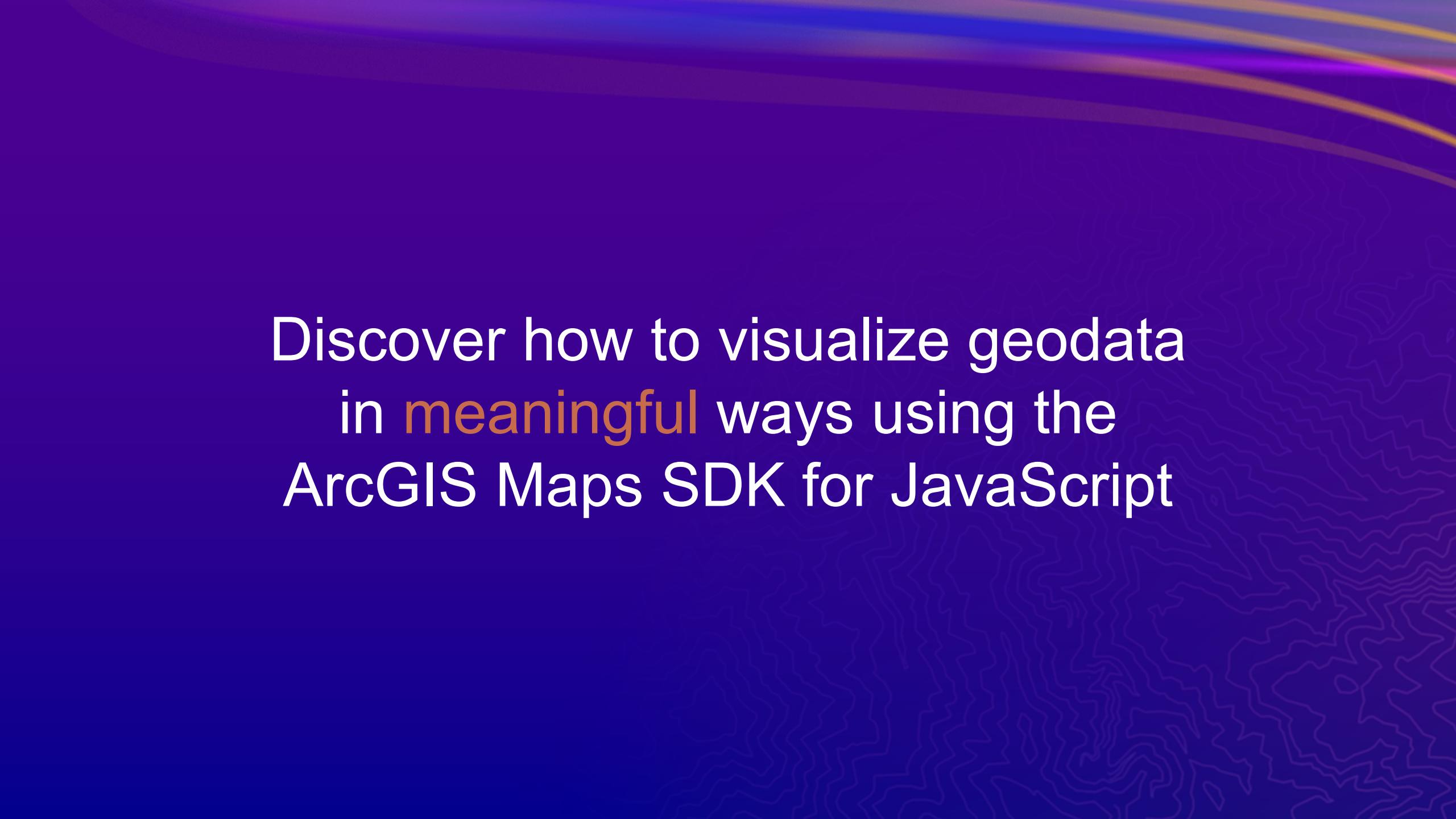


# ArcGIS Maps SDK for JavaScript: Data Visualization

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Discover how to visualize geodata  
in meaningful ways using the  
ArcGIS Maps SDK for JavaScript

The background features a dark purple gradient with a subtle wavy texture. At the top, there are horizontal bands of color: a thin blue band, a thicker yellow band, and a wider orange band. The main text is centered against this textured backdrop.

One visualization cannot tell  
the whole story

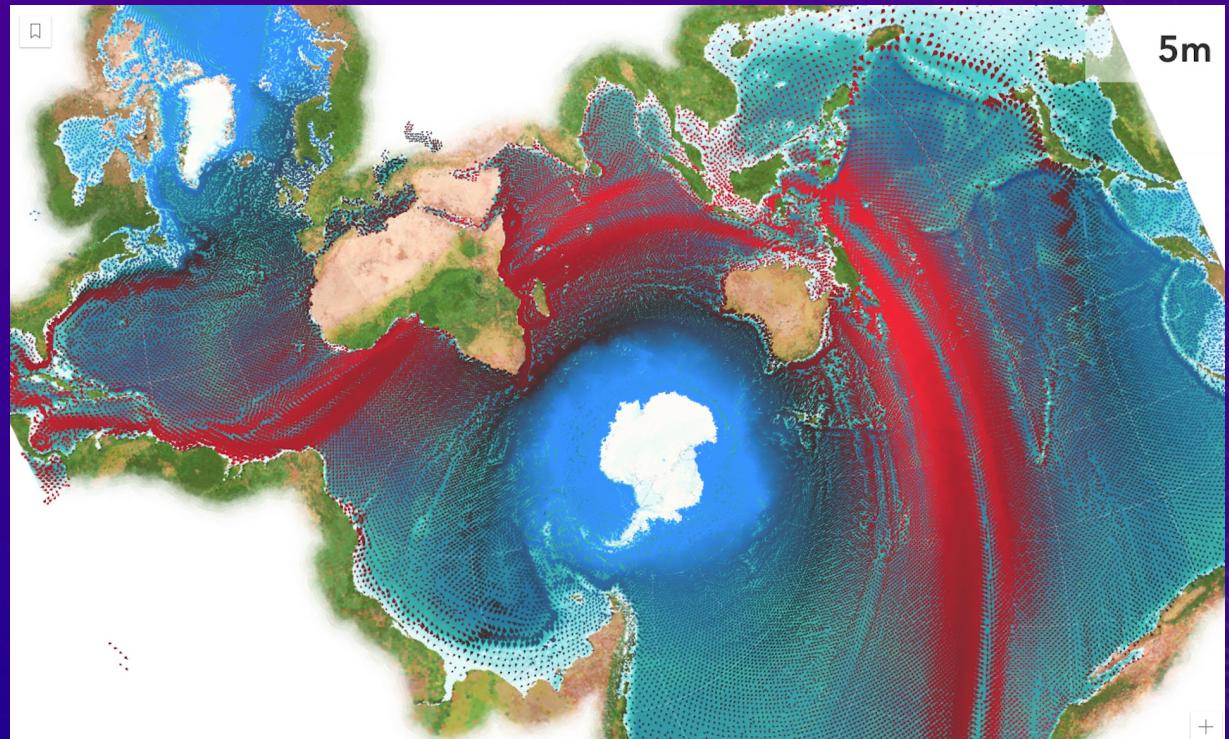
# API Overview

Renderers and symbols



# What can we visualize?

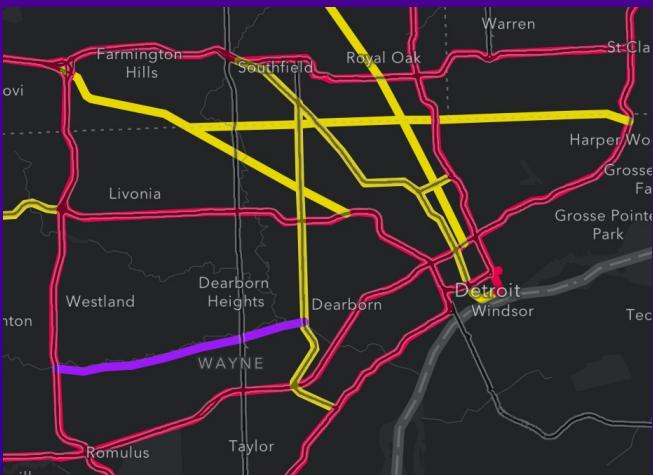
- Where?
- What?
- How much?
- When?
- Multivariate



# Symbols

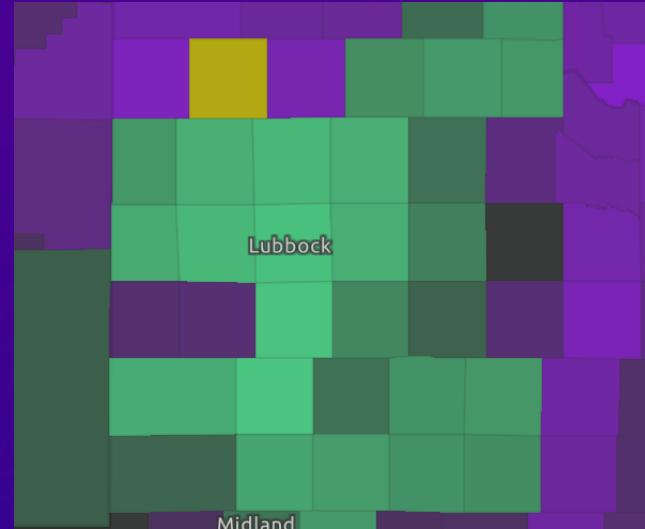
Geographic symbols

# Symbol primitives



SimpleLineSymbol

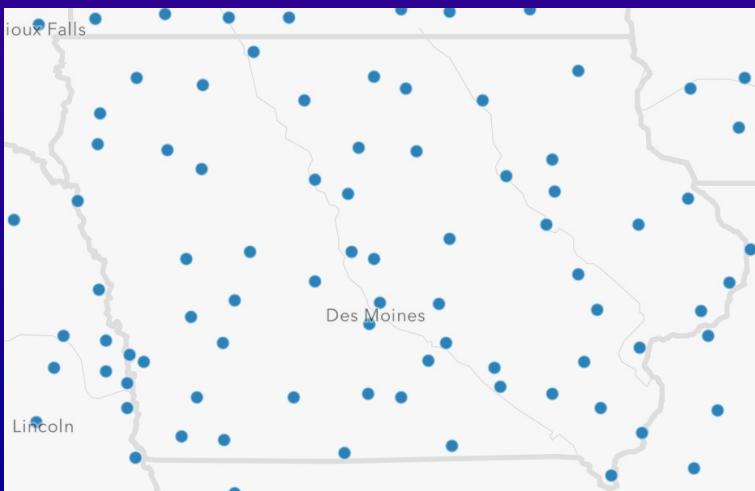
```
const sls = {  
  type: "simple-line",  
  width: 1,  
  color: [255, 255, 255, 1],  
  style: "solid",  
  cap: "round",  
  join: "round"  
}
```



SimpleFillSymbol

```
const sfs = {  
  type: "simple-fill",  
  color: [0, 0, 0, 0.25],  
  style: "solid",  
  outline: {  
    width: 1,  
    color: [255, 255, 255, 1]  
  }  
}
```

SimpleMarkerSymbol



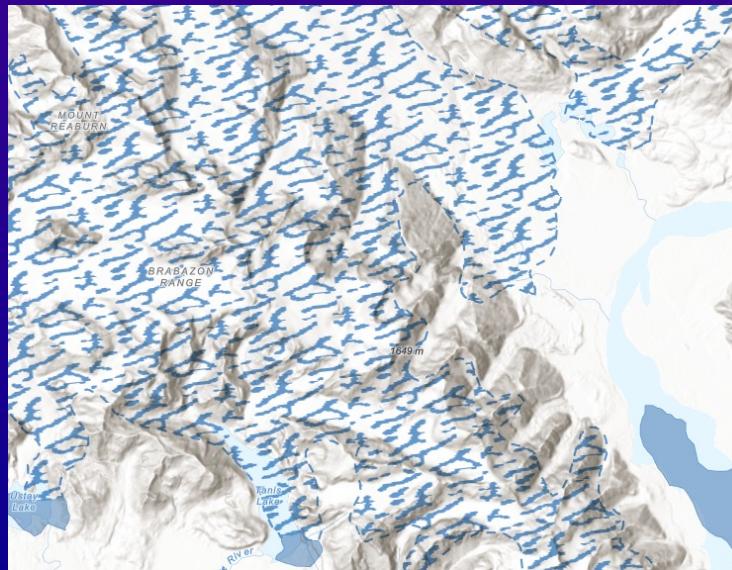
```
const sms = {  
  type: "simple-marker",  
  color: [255, 255, 255, 0.25],  
  size: 12,  
  style: "circle",  
  outline: {  
    width: 1,  
    color: [255, 255, 255, 1]  
  }  
}
```

# Picture symbols



PictureMarkerSymbol

```
const pms = {  
  type: "picture-marker",  
  url: "image-url",  
  height: 12,  
  width: 12  
}
```



PictureFillSymbol

```
const pfs = {  
  type: "picture-fill",  
  url: "swamp.png",  
  width: 12,  
  height: 12,  
  xoffset: 0,  
  yoffset: 0  
}
```

# CIMSymbol

High quality, scalable



Scaled vector symbol



Scaled image

Symbol layers



Symbol



1

layer1



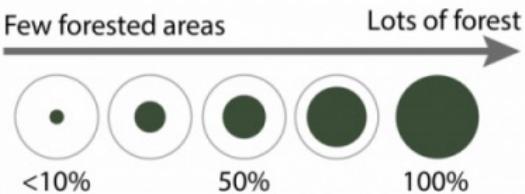
layer2



layer3

## Primitive Overrides

Dynamically update attributes of an individual symbol layer using Arcade



# How is it used in the ArcGIS Maps SDK for JavaScript?

```
// require(["esri/symbols/CIMSymbol"], function(CIMSymbol)
const cimSymbol = new CIMSymbol({
  data: {
    type: "CIMSymbolReference",
    symbol: {
      type: "CIMLineSymbol", // CIMPolygonSymbol or CIMPolygonSymbol
      symbolLayers: [{ ... }]
    },
    primitiveOverrides: [{ ... }]
  }
});
```

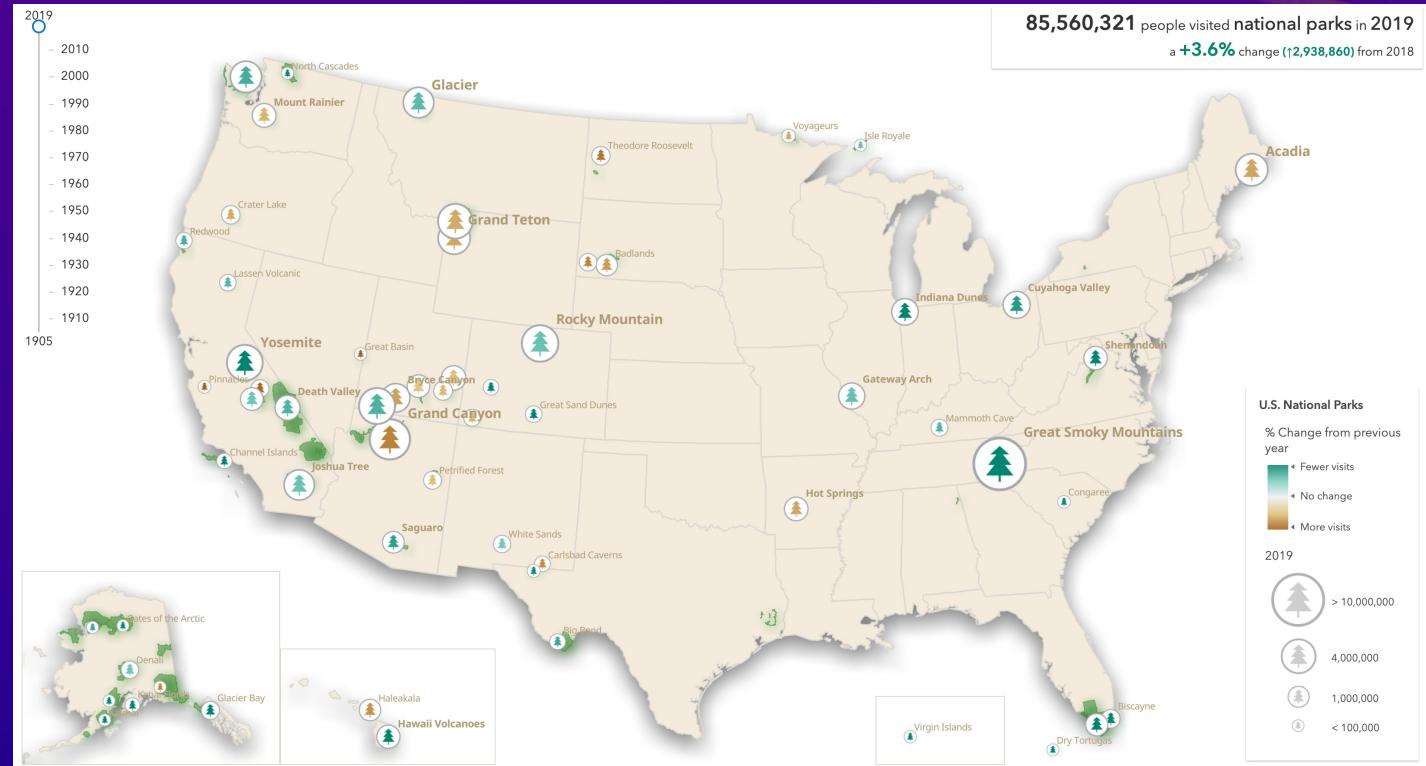
follows the [cim-spec](#)

# WebStyleSymbol

# 2d styles

# Cartographic Information Model (CIM)

- Vectors
  - Scalable
  - Multi-layer
  - Overrides



```
const webStyleSymbol = new WebStyleSymbol({  
    name: "park",  
    styleName: "Esri2DPointSymbolsStyle"  
});
```

# Renderers

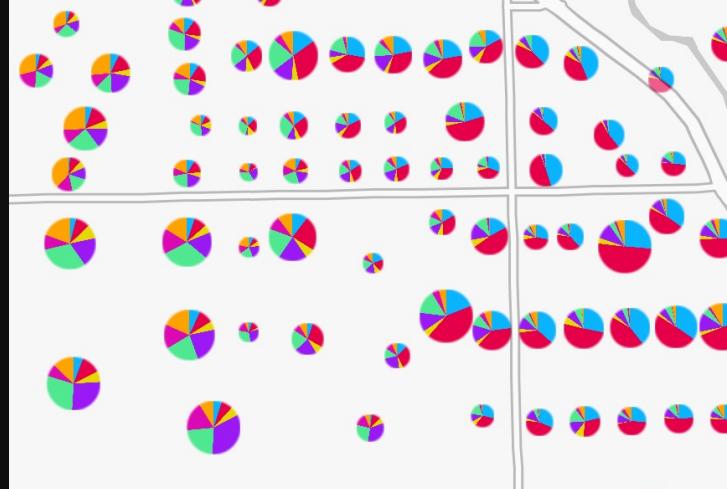


# Renderers

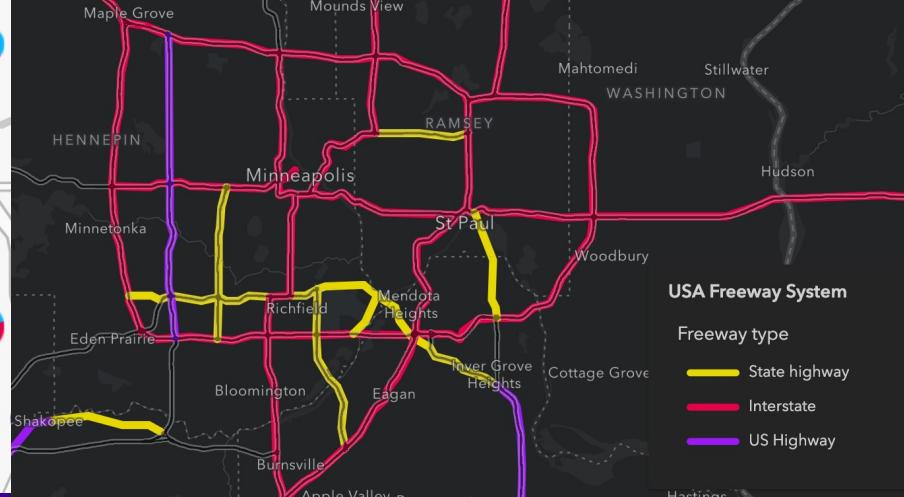
SimpleRenderer



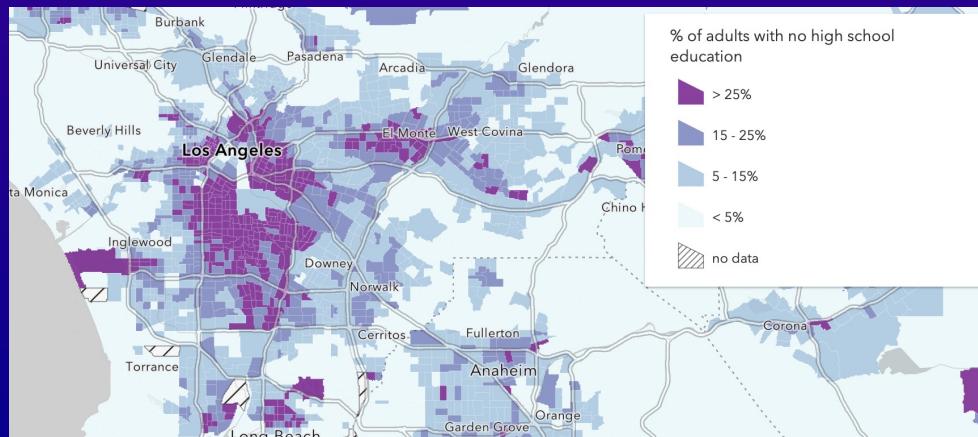
PieChartRenderer



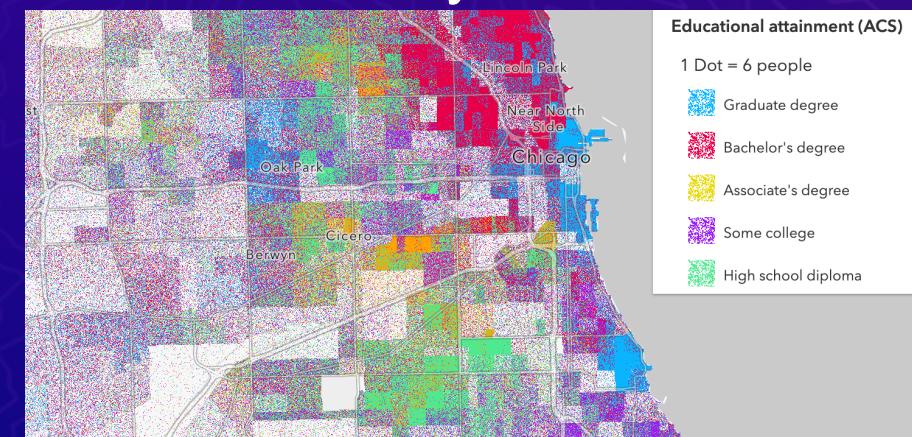
UniqueValueRenderer



ClassBreaksRenderer



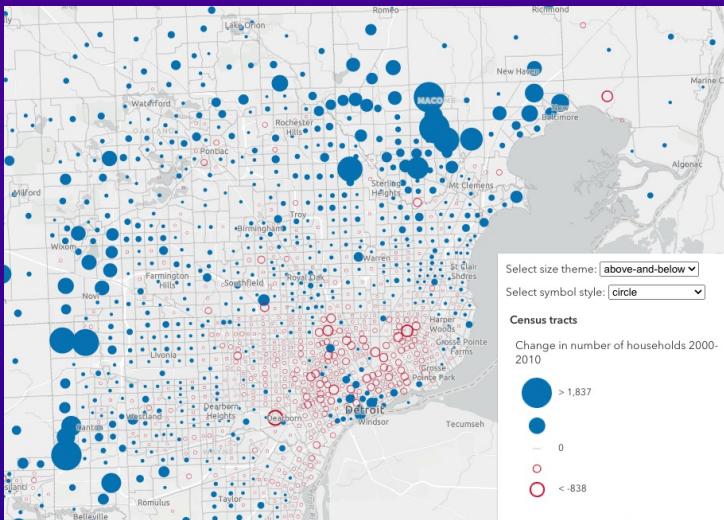
DotDensityRenderer



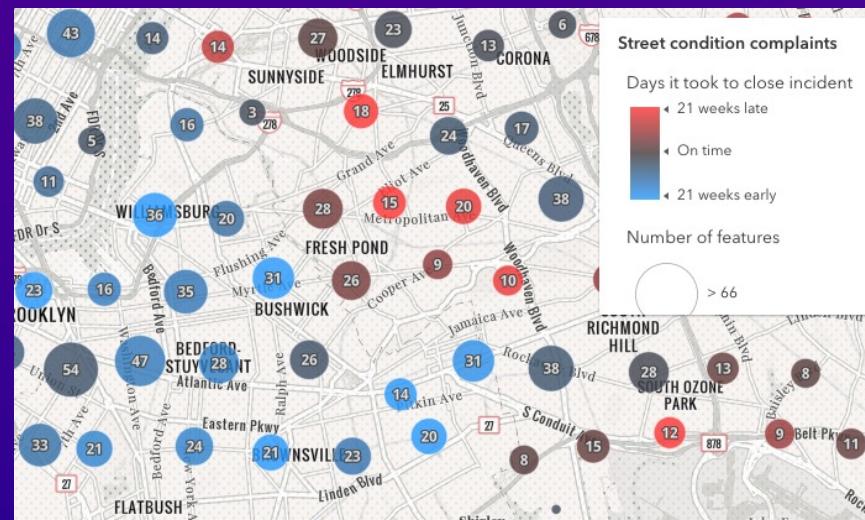
# Renderers

## Derivative styles created from standard renderer types

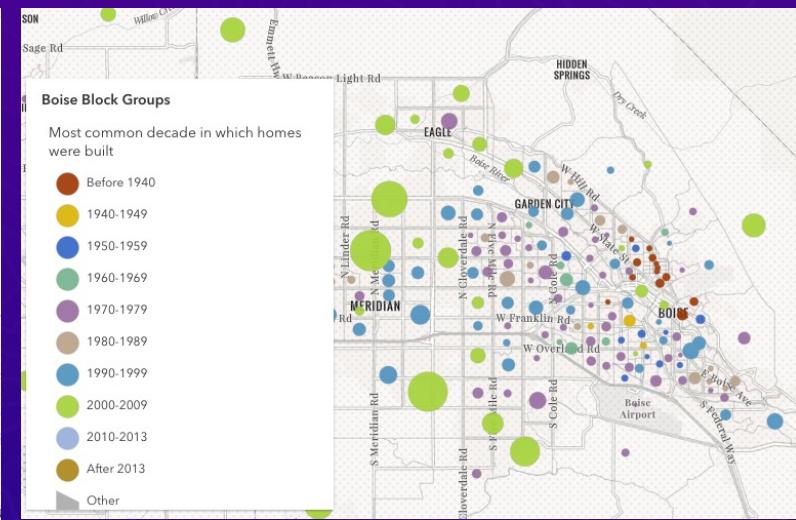
# Above and below



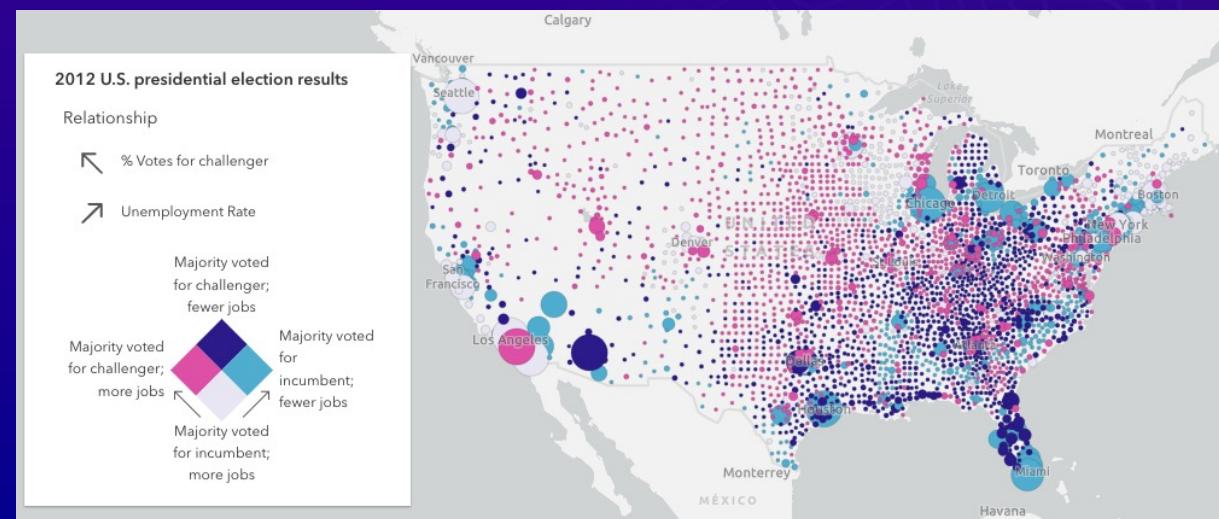
Age



# Predominance



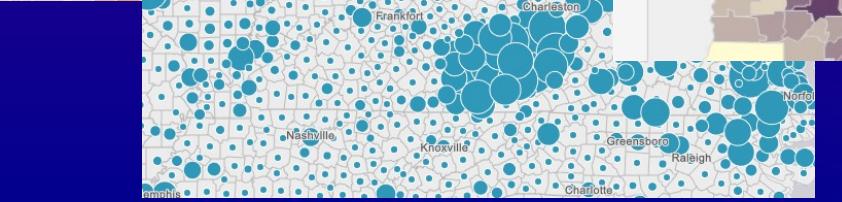
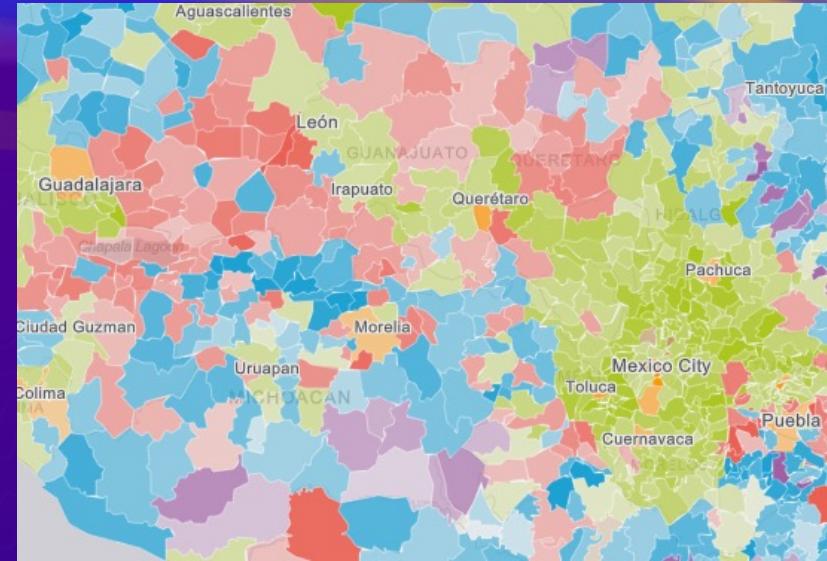
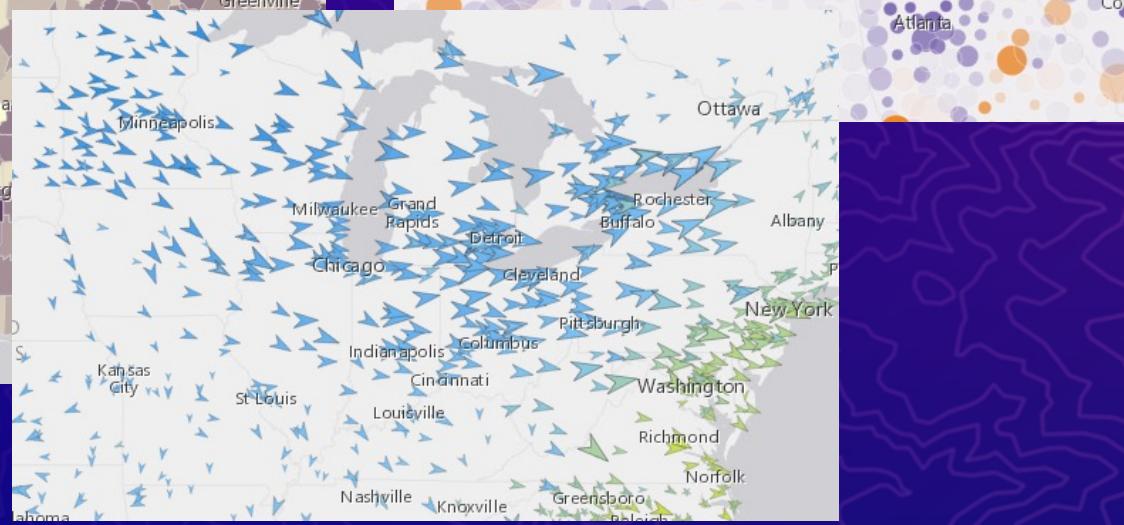
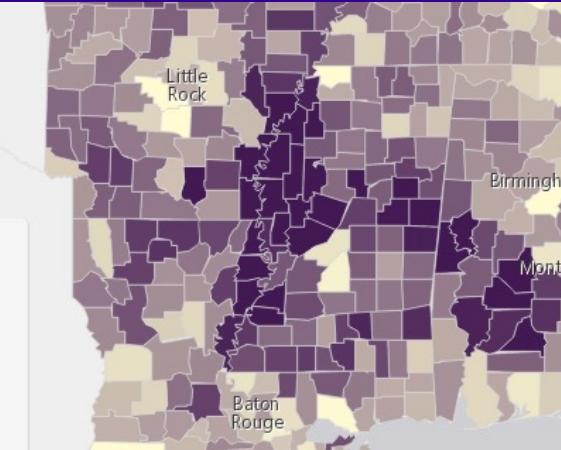
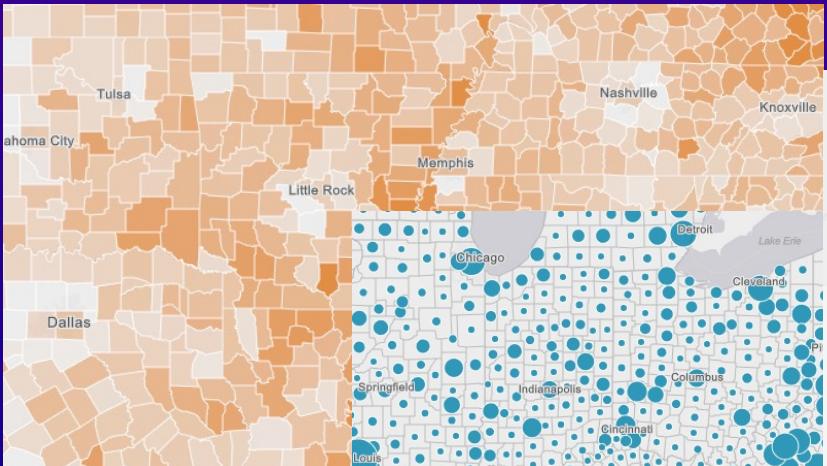
## Relationship



# Visual variables

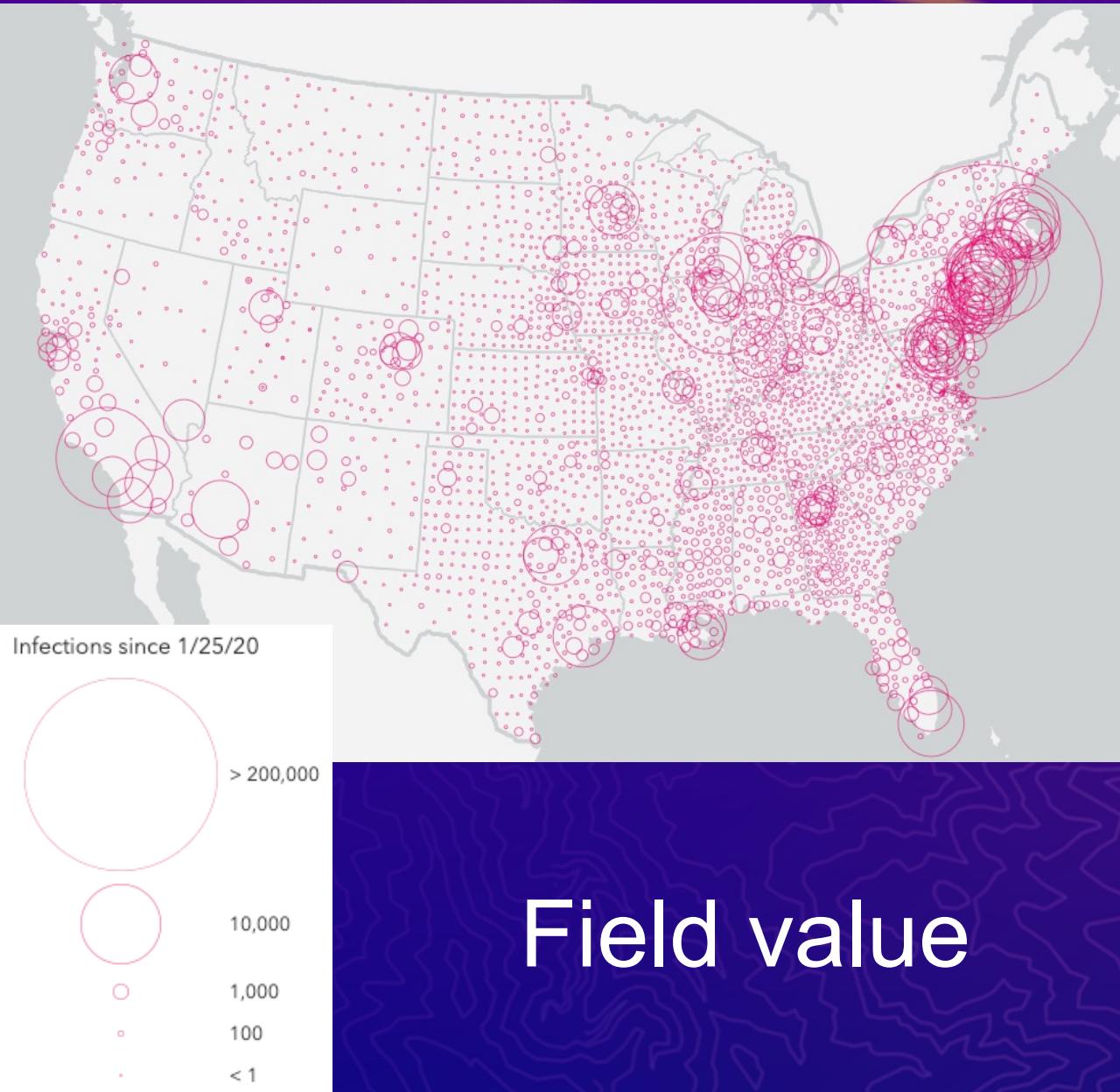
- Color
- Size
- Opacity
- Rotation

- A property of the renderer
- Overrides symbol properties with data
- For numeric data-driven continuous visualizations



# Data-driven visualization

```
layer.renderer = new SimpleRenderer({  
    symbol: new SimpleMarkerSymbol({  
        style: "none",  
        outline: new SimpleLineSymbol({  
            color: new Color("rgba(227, 0, 106)"),  
            width: 0.5  
        })  
    }),  
    visualVariables: [  
        new SizeVariable({  
            field: "INFECTIONS_6_1_2020",  
            stops: [  
                { value: 1, size: "2px" },  
                { value: 100, size: "4px" },  
                { value: 1000, size: "10px" },  
                { value: 10000, size: "50px" },  
                { value: 200000, size: "200px" }  
            ]  
        })  
    ]  
});
```



# Data-driven visualization

Symbol

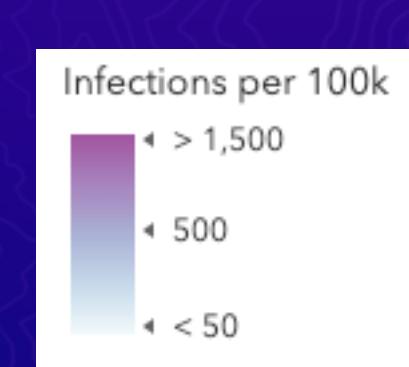
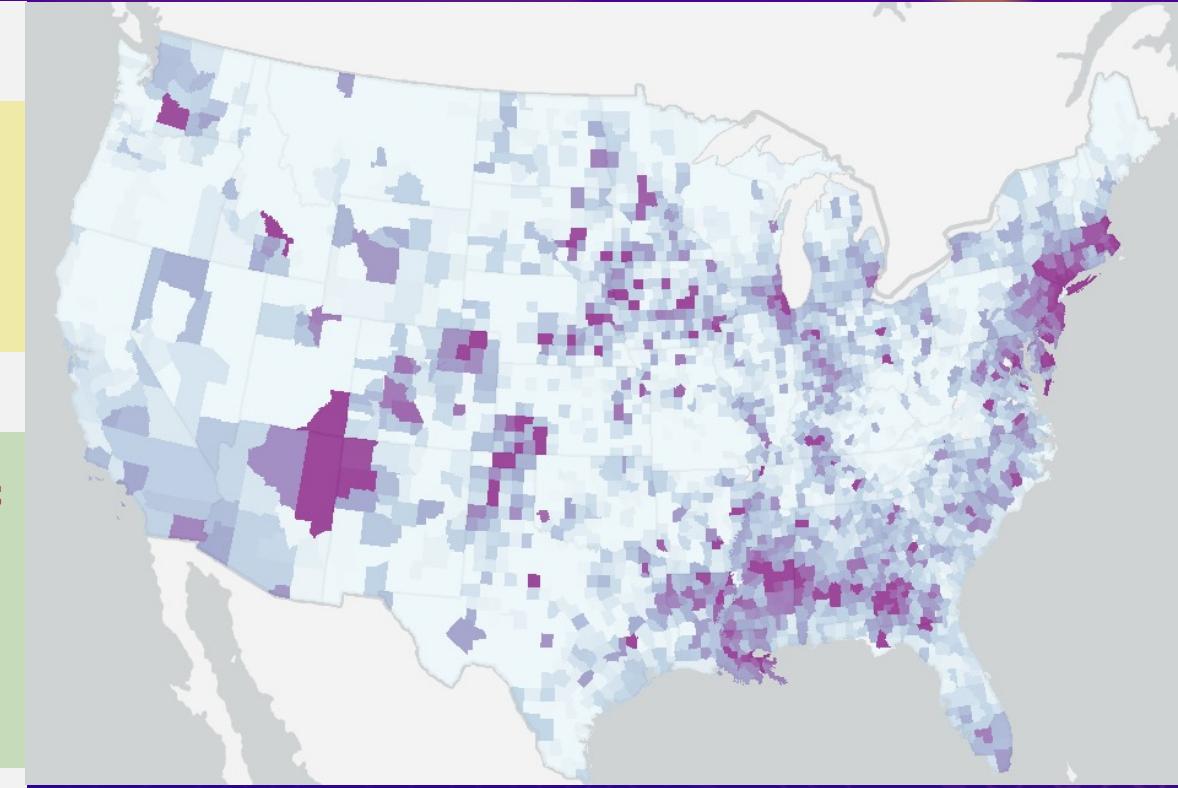
```
layer.renderer = new SimpleRenderer({
  symbol: new SimpleFillSymbol({
    outline: new SimpleLineSymbol({
      color: "rgba(128,128,128,0.4)",
      width: 0
    })
  }),
  visualVariables: [
    new ColorVariable({
      valueExpression: `

        var currentDayValue = $feature["DAYSTRING_05_31_2020"];
        var currentDaySplit = Split(currentDayValue, "|");
        var infections = Number(currentDaySplit[0]);
        var deaths = Number(currentDaySplit[1]);
        var population = $feature.Population_1;
        return (infections / population ) * 100000;

      `,
      valueExpressionTitle: `Infections per 100k`,
      stops: [
        { value: 50, color: "#edf8fb" },
        { value: 200, color: "#b3cde3" },
        { value: 500, color: "#8c96c6" },
        { value: 1000, color: "#8856a7" },
        { value: 1500, color: "#810f7c" }
      ]
    })
  ]
});
```

Data

Color  
driven  
by data



Arcade  
expression

# Symbol Size by Scale

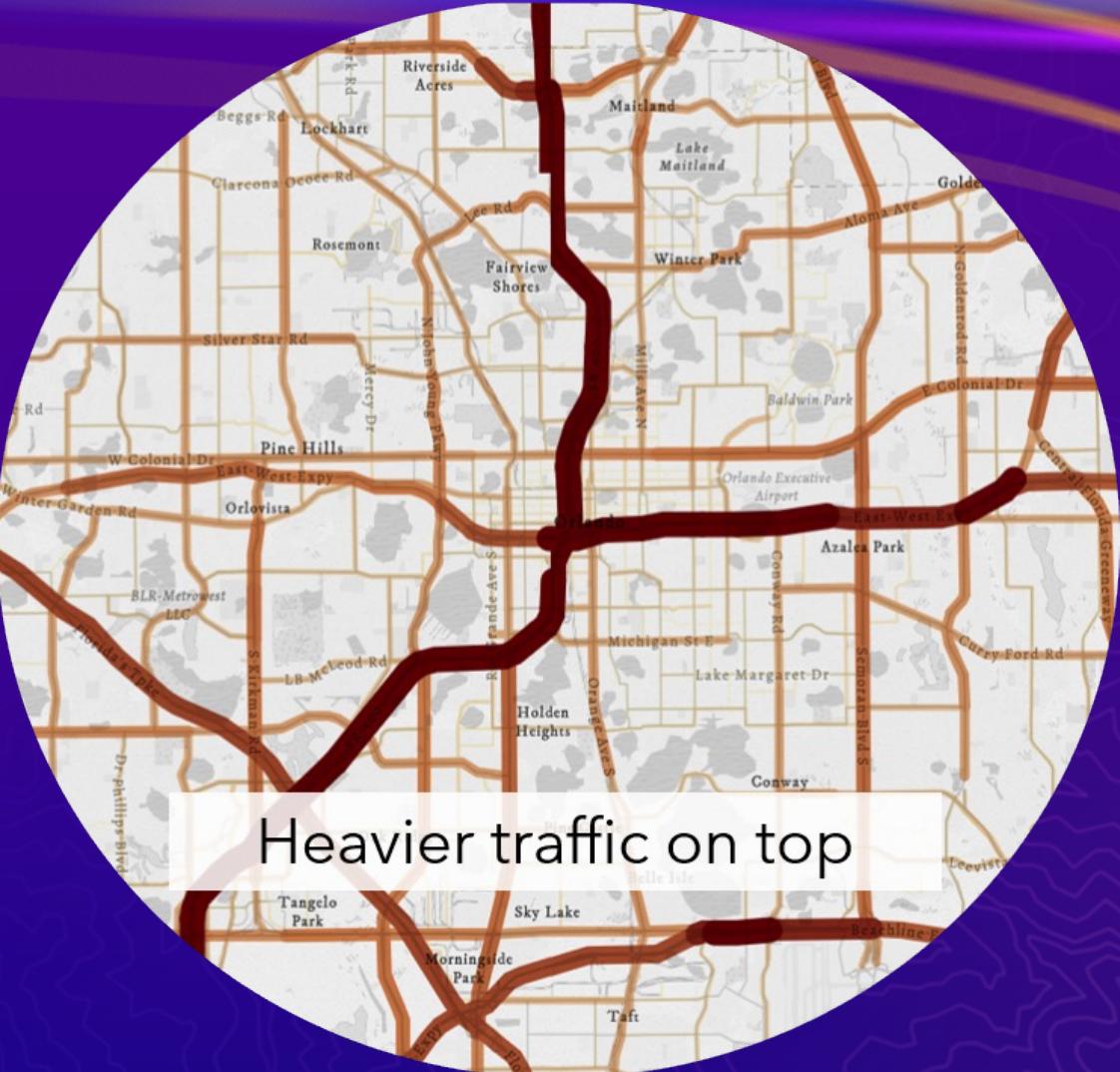
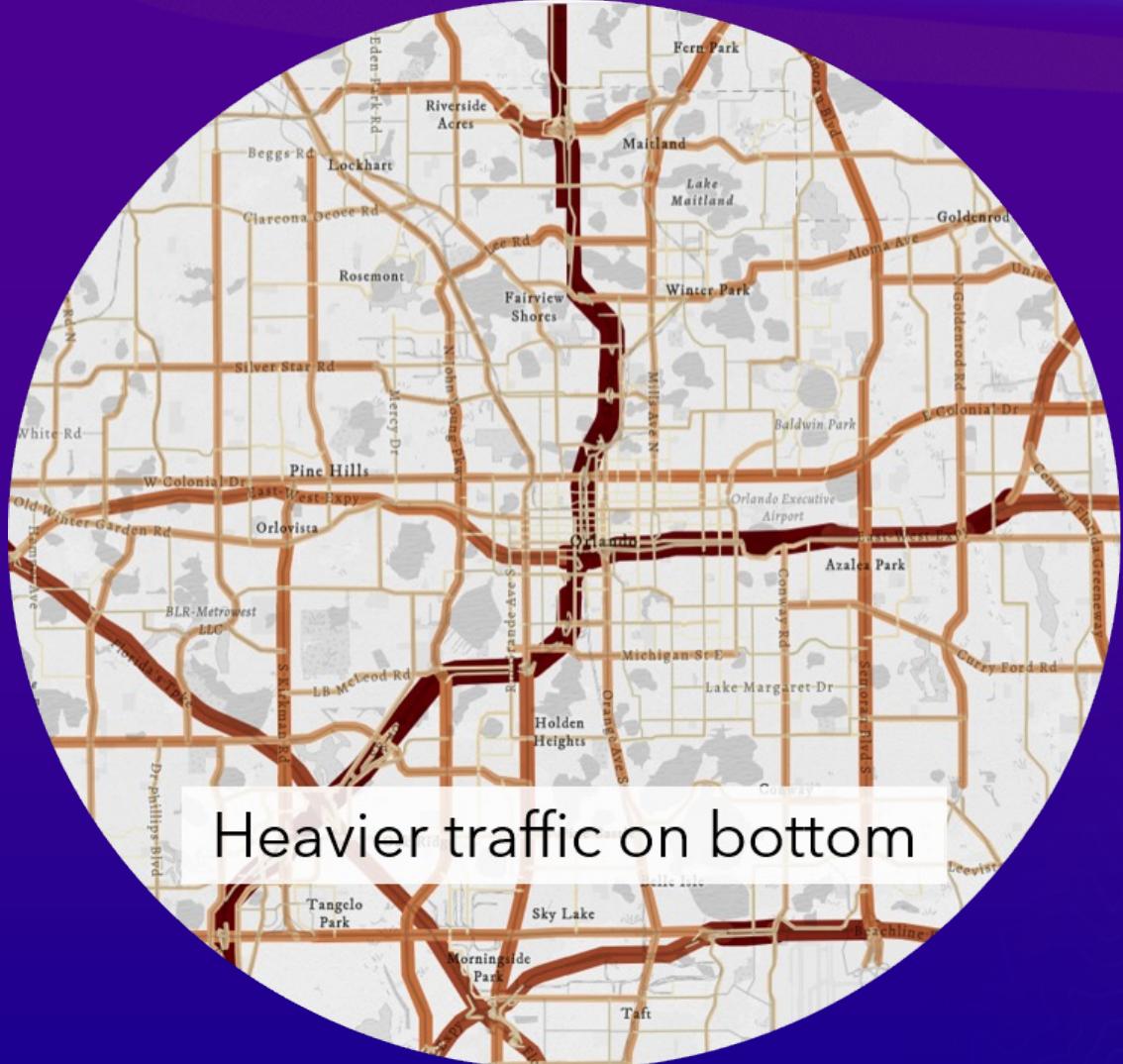


[ArcGIS blog: How and why to size symbols by scale in web maps](#)

# Aggregation and Density

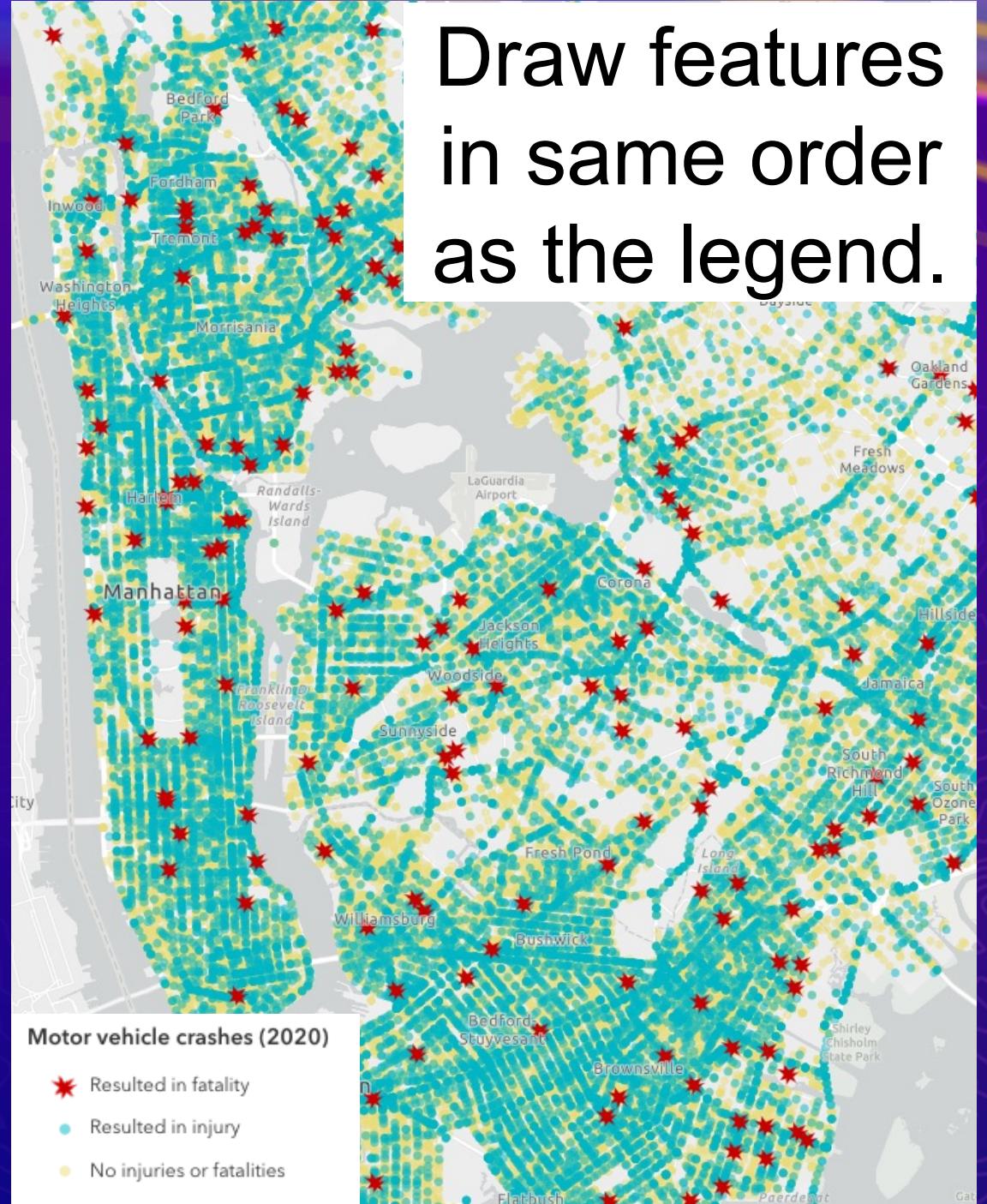


# Drawing order control

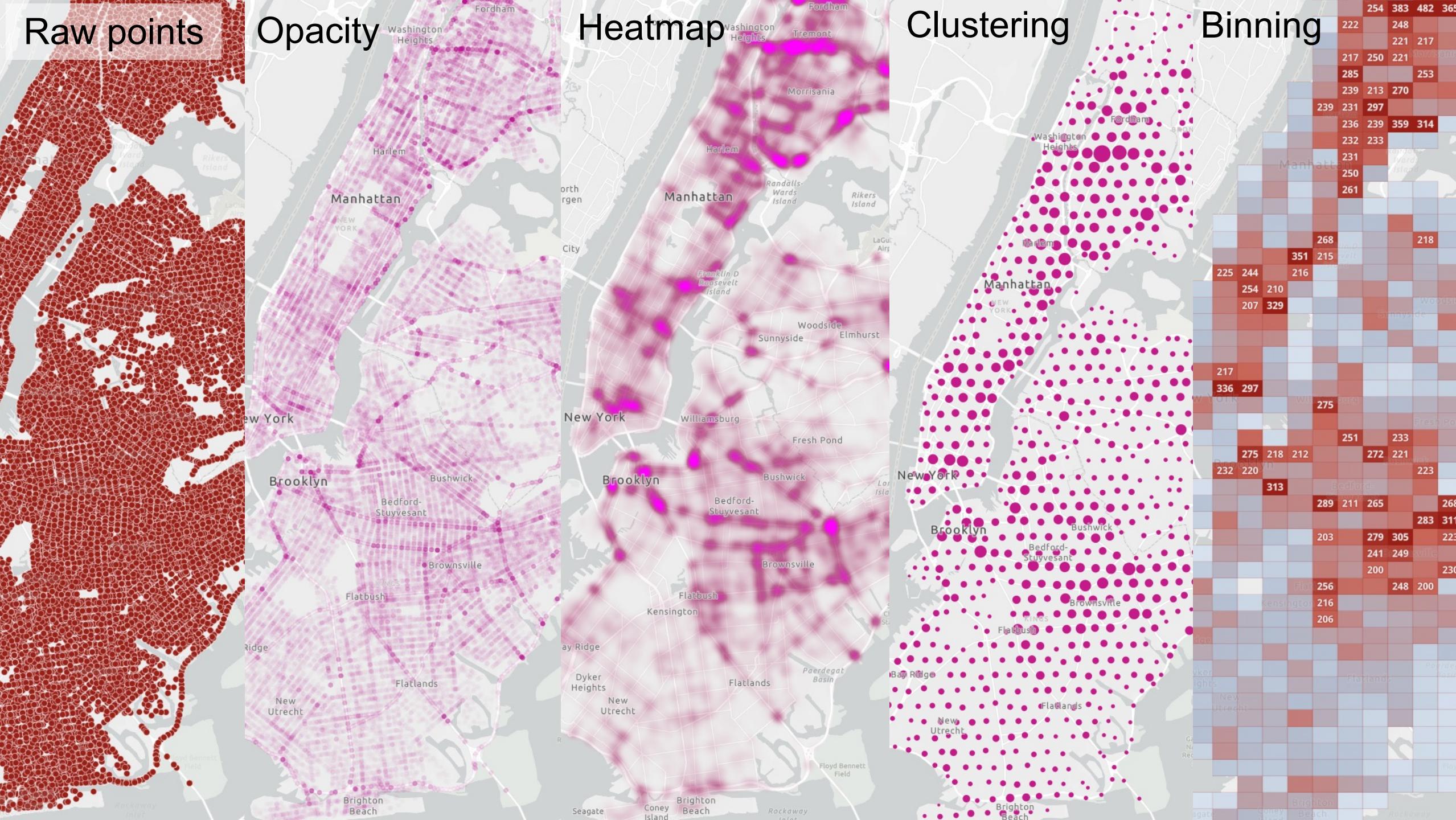


Feature layers, CSV, GeoJSON,  
OGC Feature Layers

```
renderer: {
  type: "unique-value",
  labelingInfo: {
    title: "Crash location"
  },
  orderByClassesEnabled: true,
  valueExpression: `When()
  `,
  uniqueValueInfos: [
    {
      value: "Fatality",
      label: "Resulted in fatality",
      symbol: 
    },
    {
      value: "Injury",
      label: "Resulted in injury",
      symbol: 
    },
    {
      value: "None",
      label: "No injuries or fatalities",
      symbol: 
    }
  ]
}
```

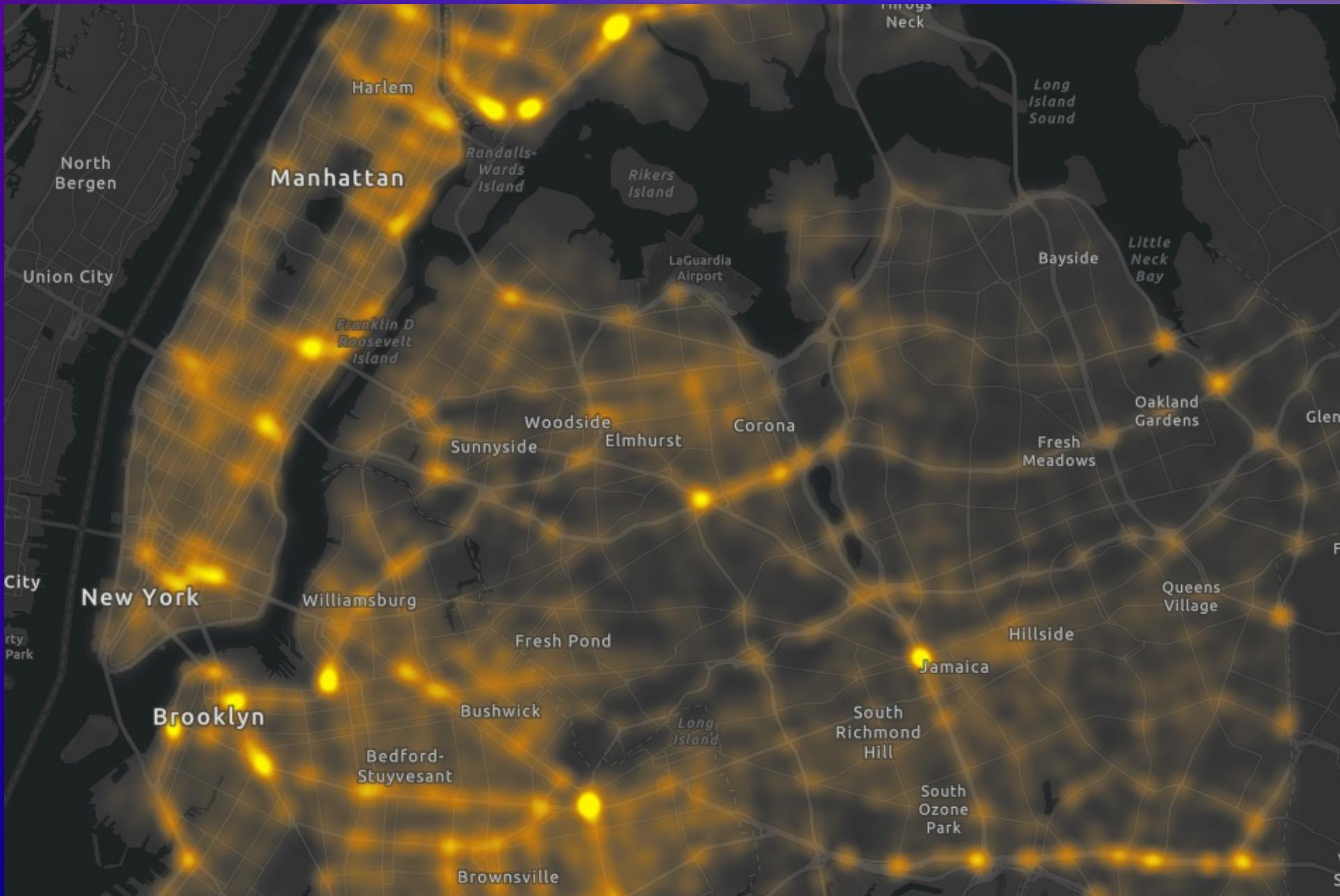


Draw features in same order as the legend.



# Heat map

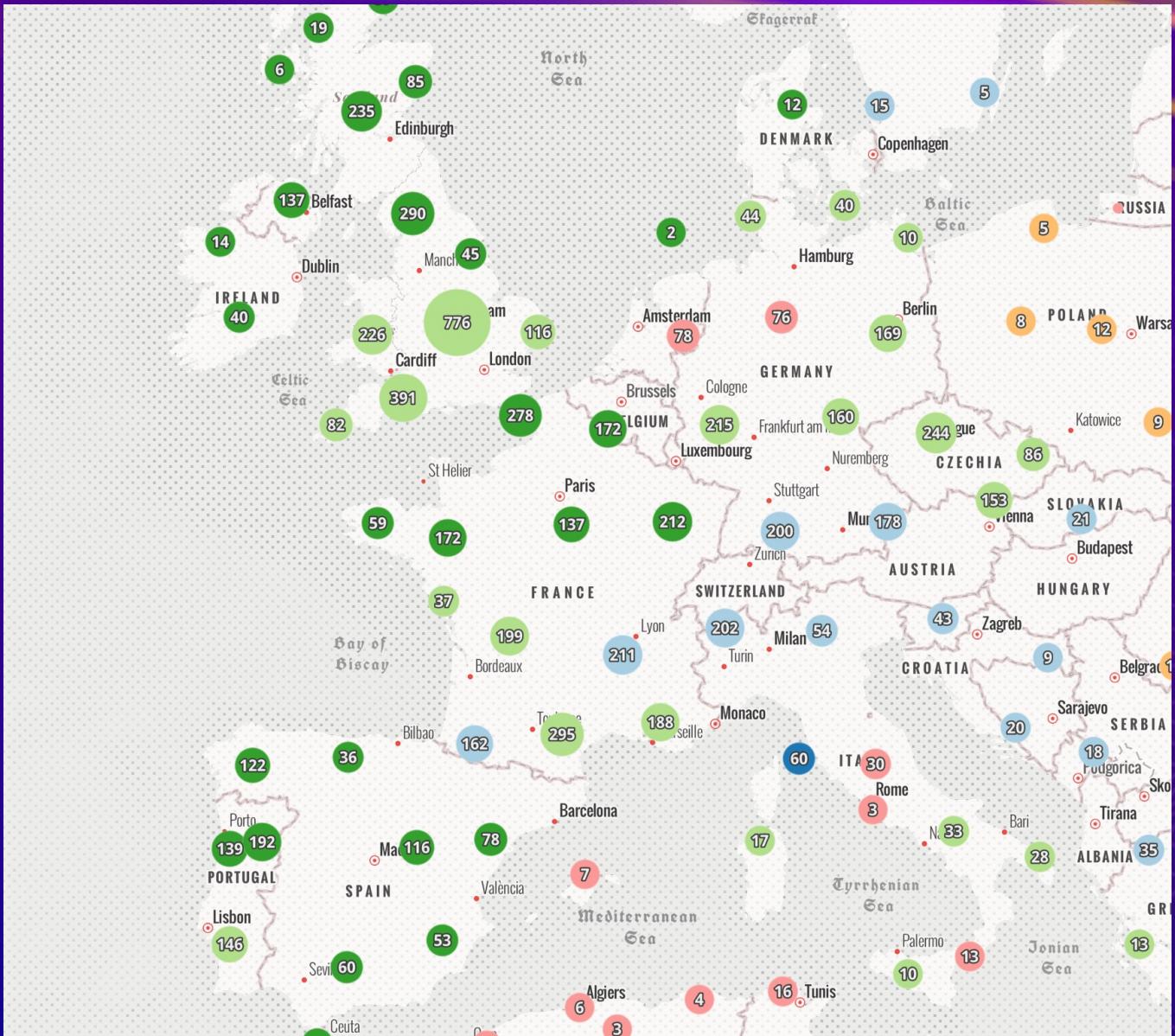
- Density as a continuous surface.
- Can be dynamic or static.
- Weighted heat maps.
- Supports popups and labels.



# Clustering

- Client-side aggregation dynamically updates at all scales
- Aggregates in screen space
- Summarizes the features within the cluster using the layer's renderer
- Aggregate fields
- Feature access with Arcade in the popup

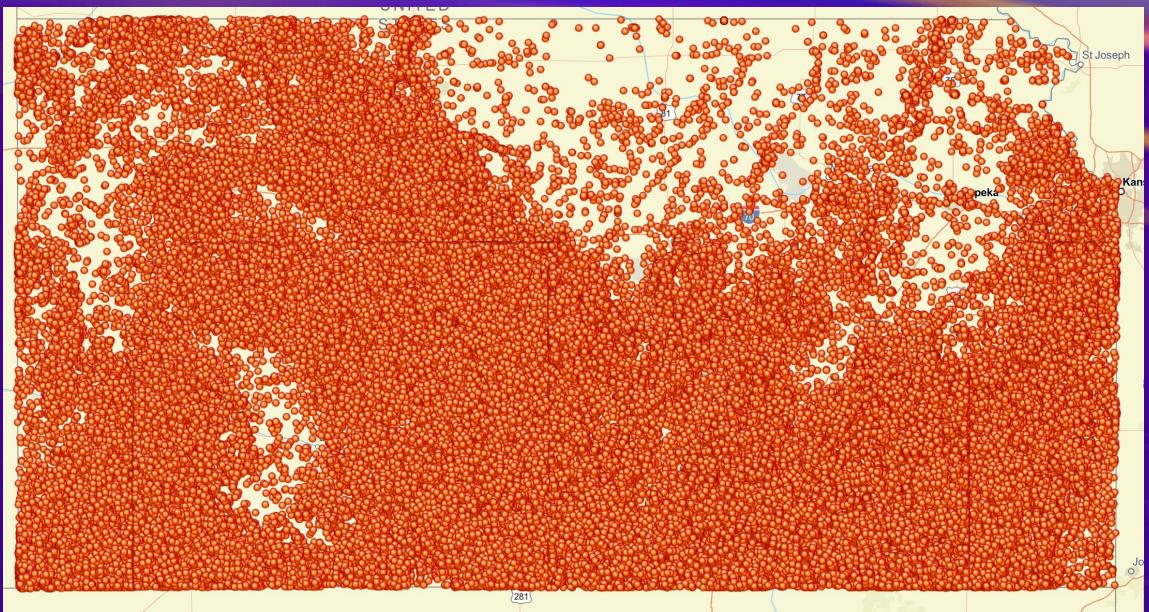
```
layer.featureReduction = {  
  type: "cluster"  
};
```



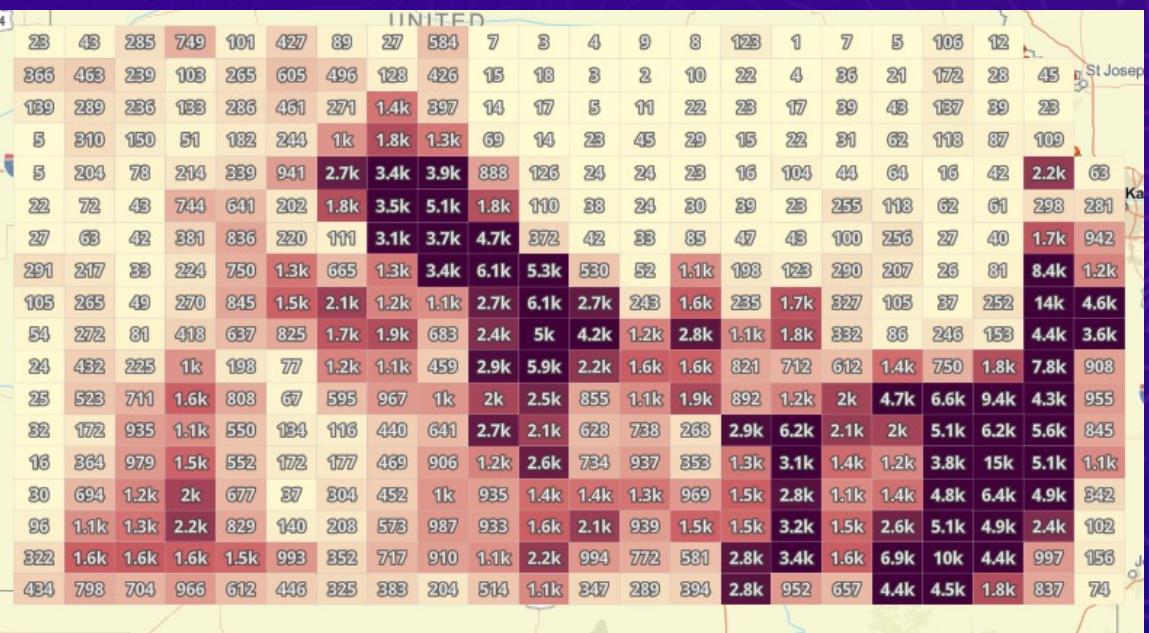
# Binning

- Client-side aggregation at fixed bin level
- Aggregates in geographic space
- Can style with any renderer
- Aggregate fields
- Feature access with Arcade in the popup

Before



After



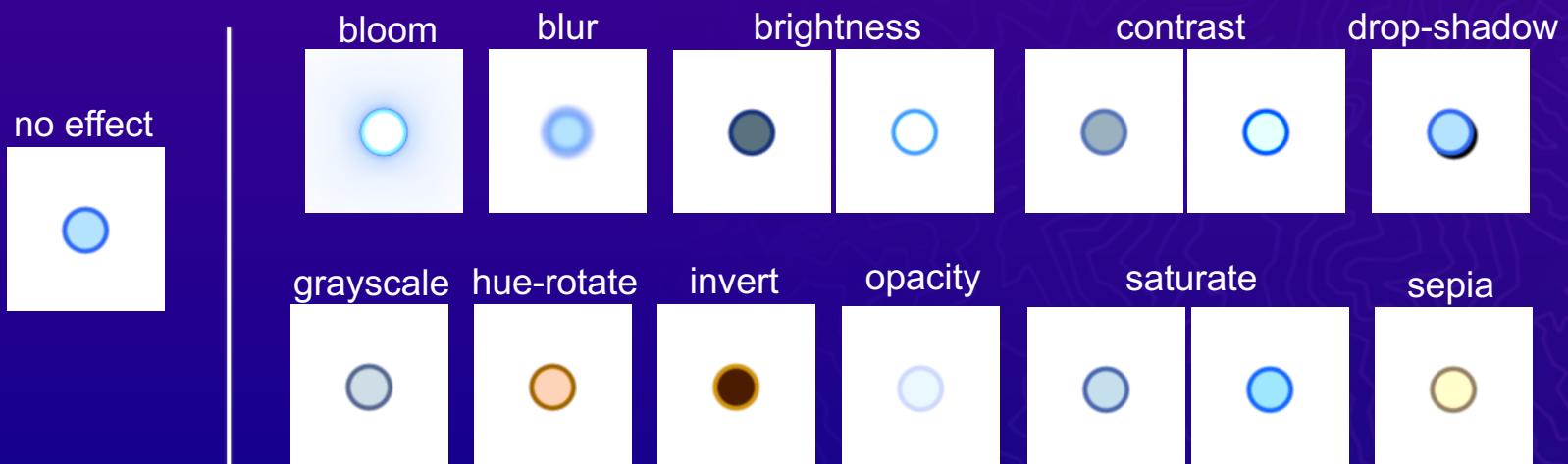
```
const layer = new FeatureLayer({  
  featureReduction: {  
    type: "binning",  
    fixedBinLevel: 6,  
    labelingInfo: [  
      // labels configured here  
    ],  
    popupTemplate: {  
      content: "{aggregateCount} car crashes occurred in this area."  
    },  
    renderer: {  
      type: "simple",  
      // other renderer properties  
    }  
  }  
});
```

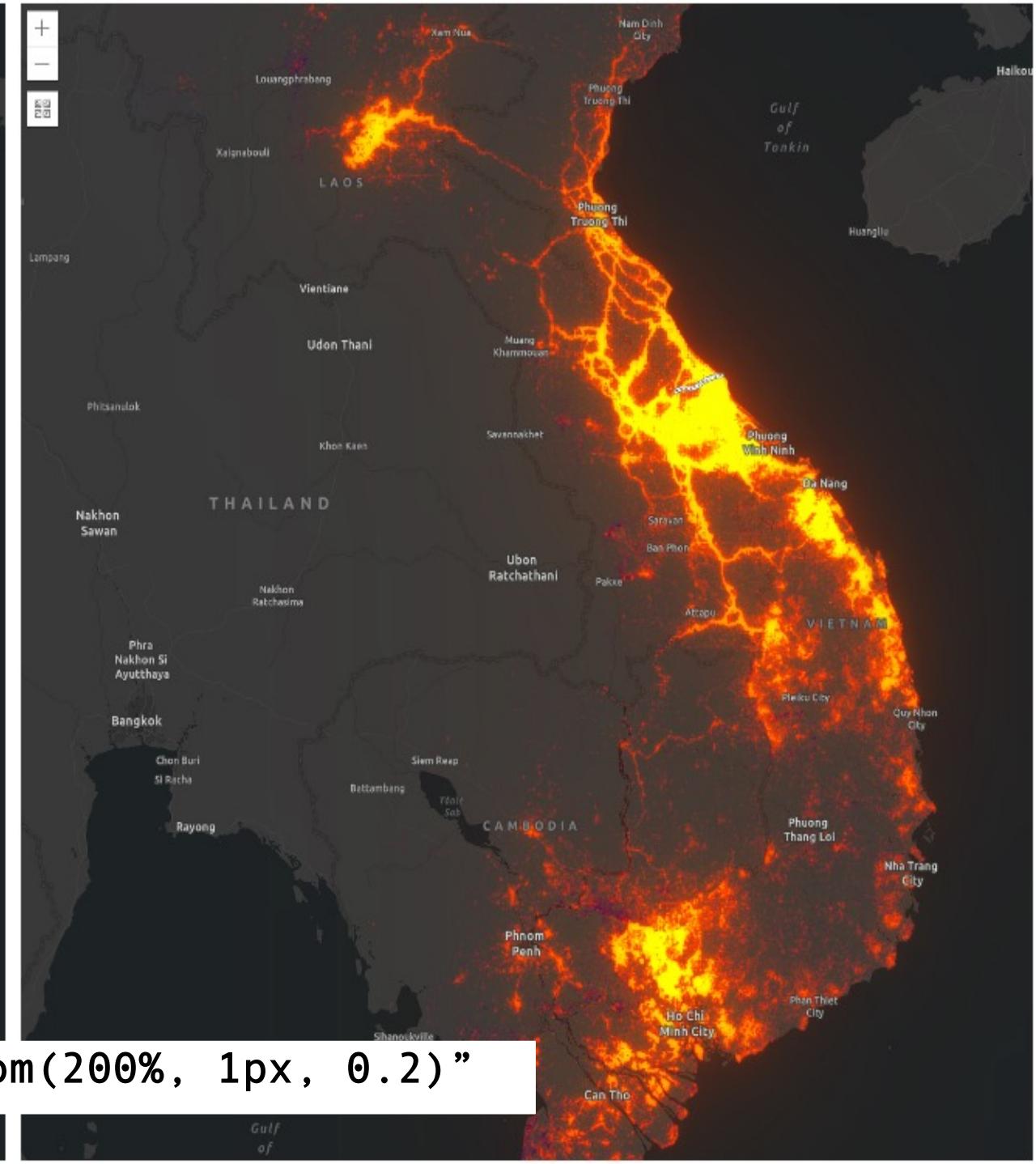
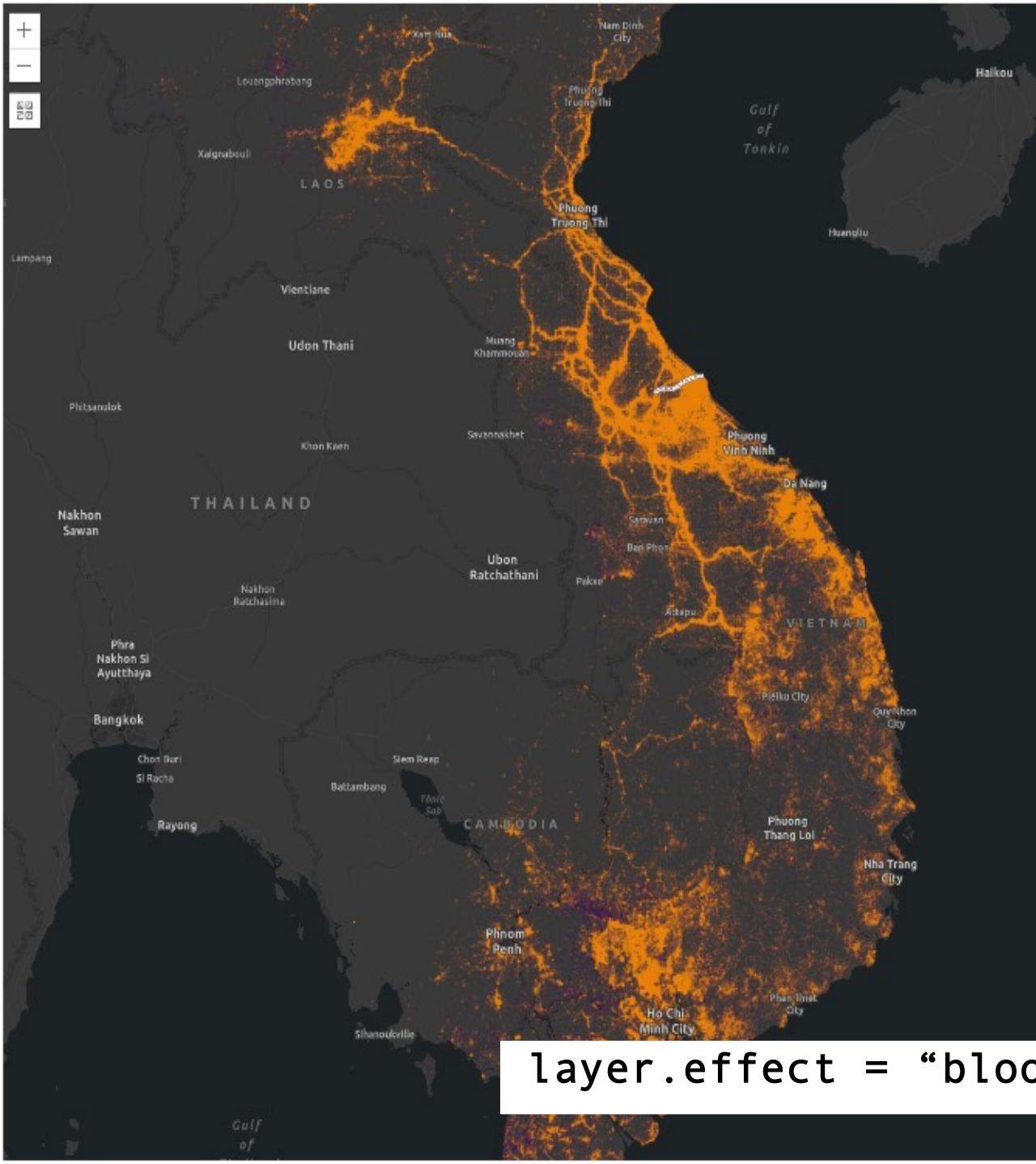
# Blending and effects



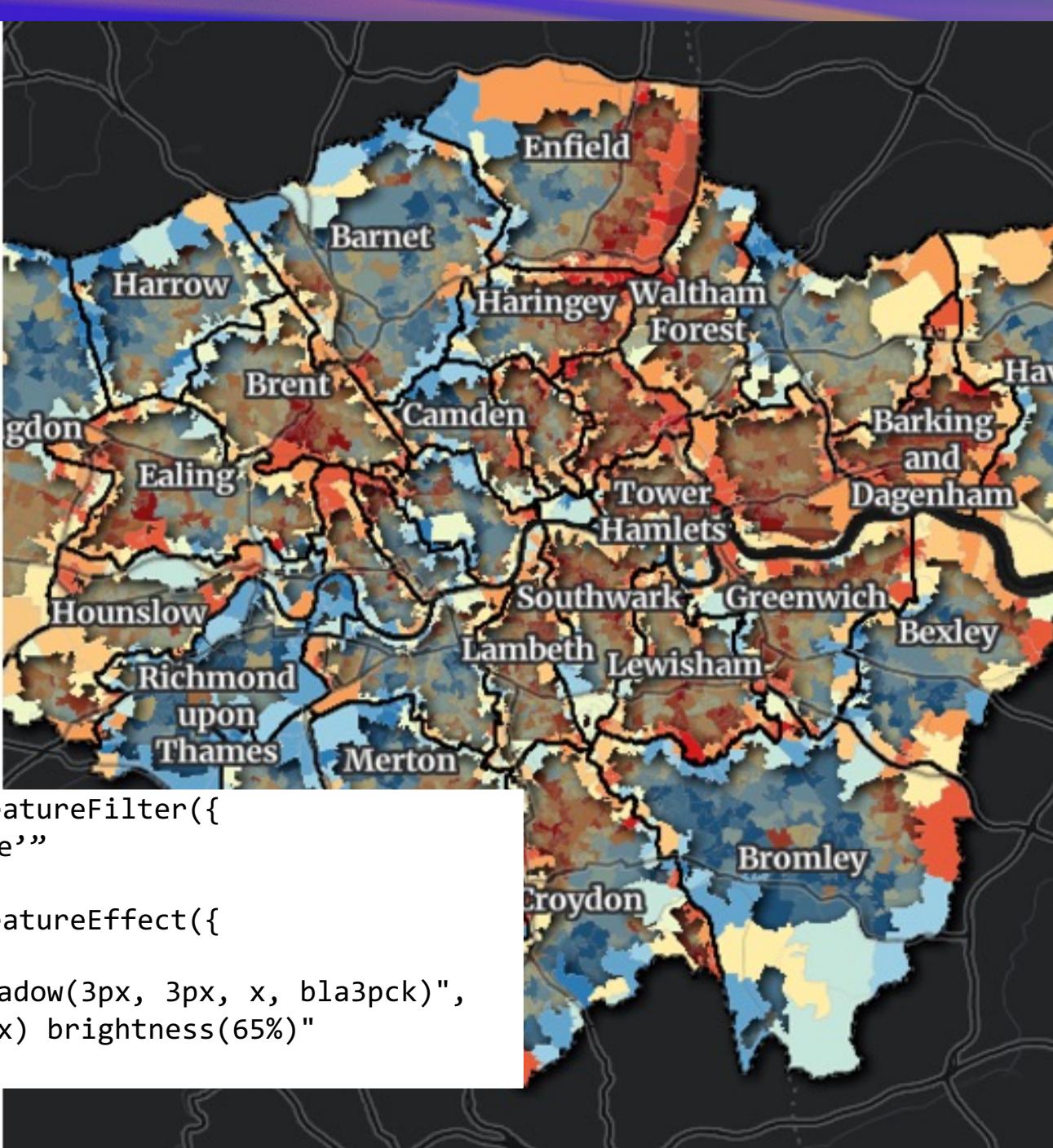
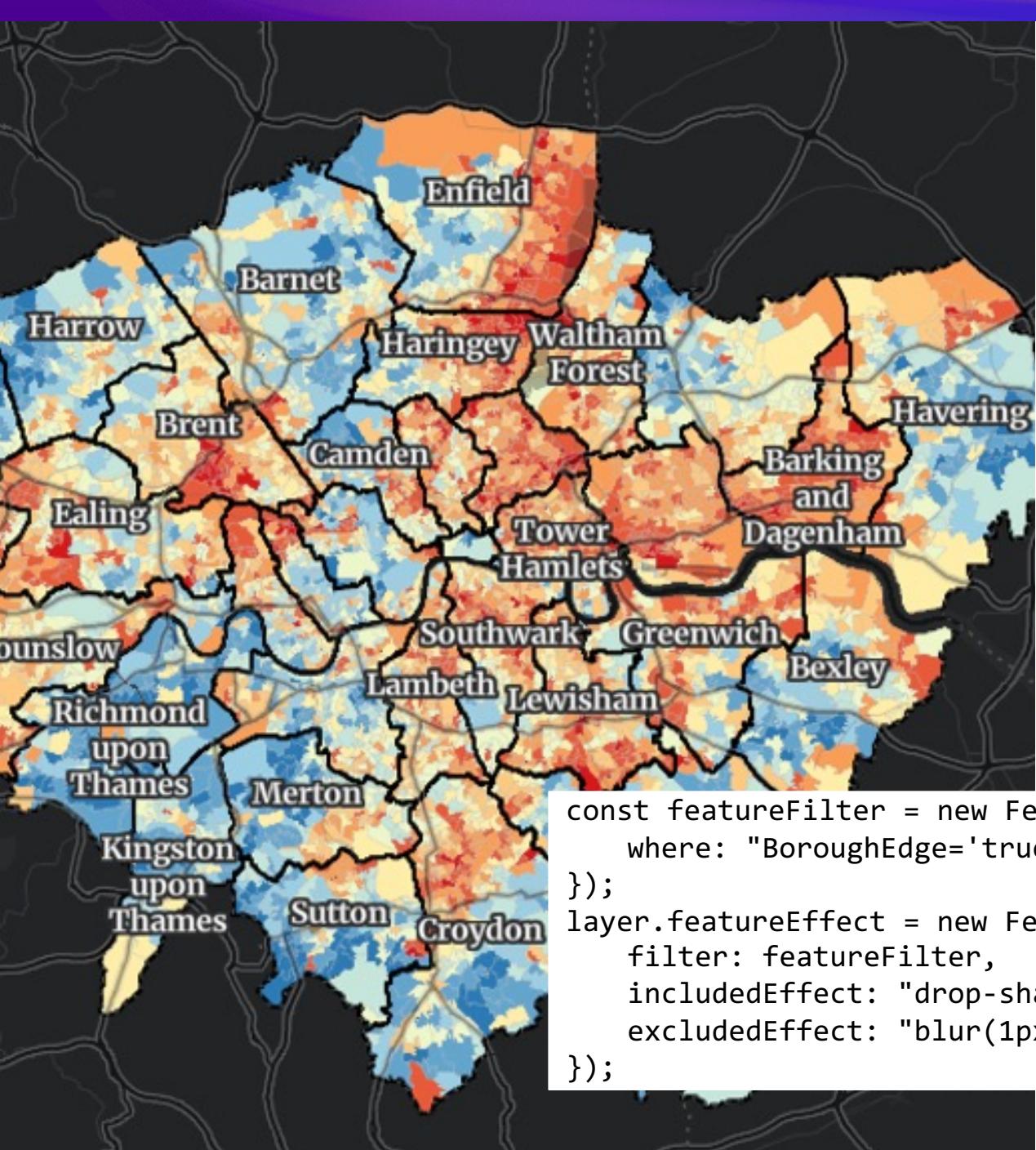
# Layer & feature effects

- Apply CSS filter-like functions to all features, or based on a filter
- Can be scale dependent
- **Supported effects:**

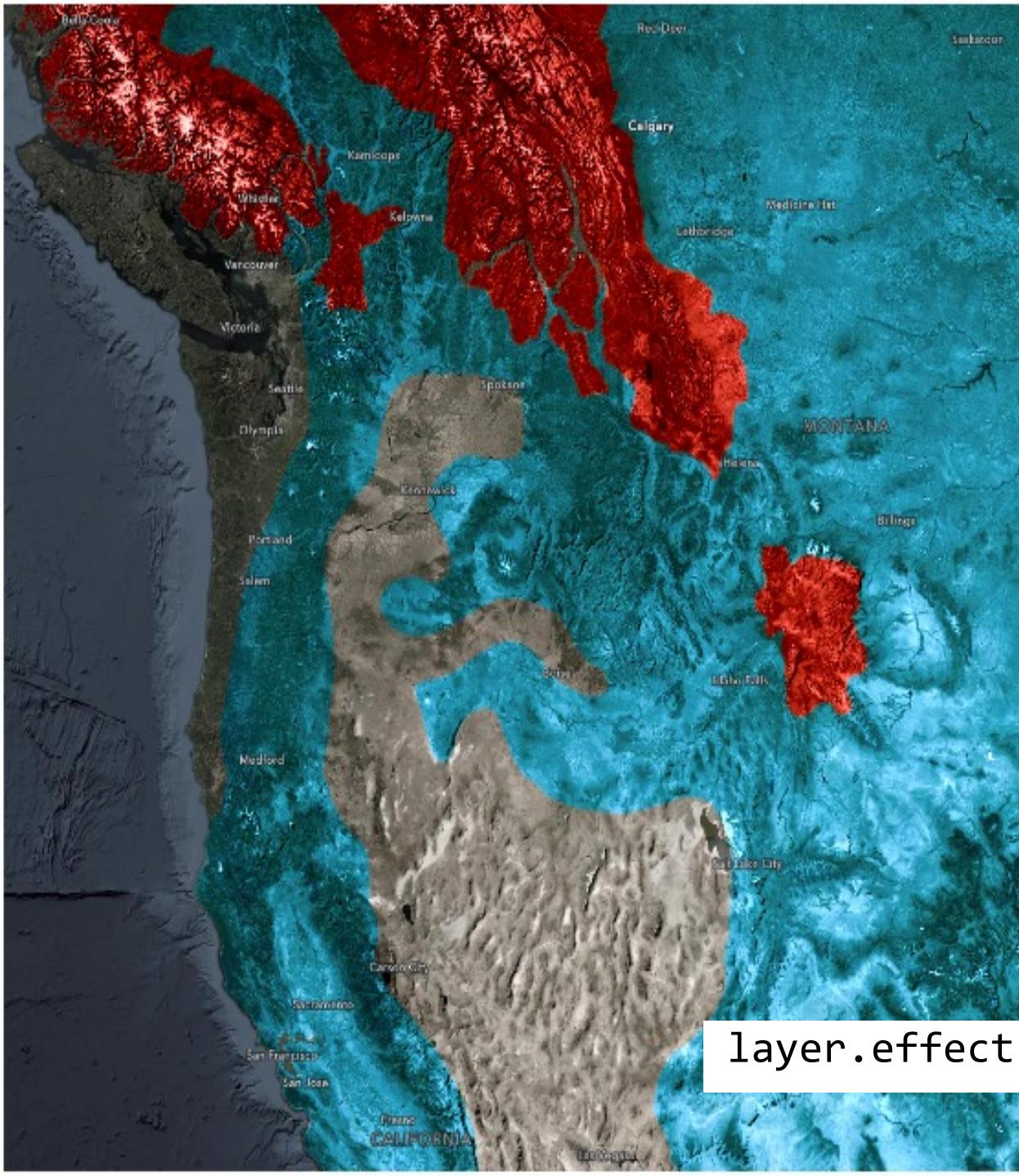




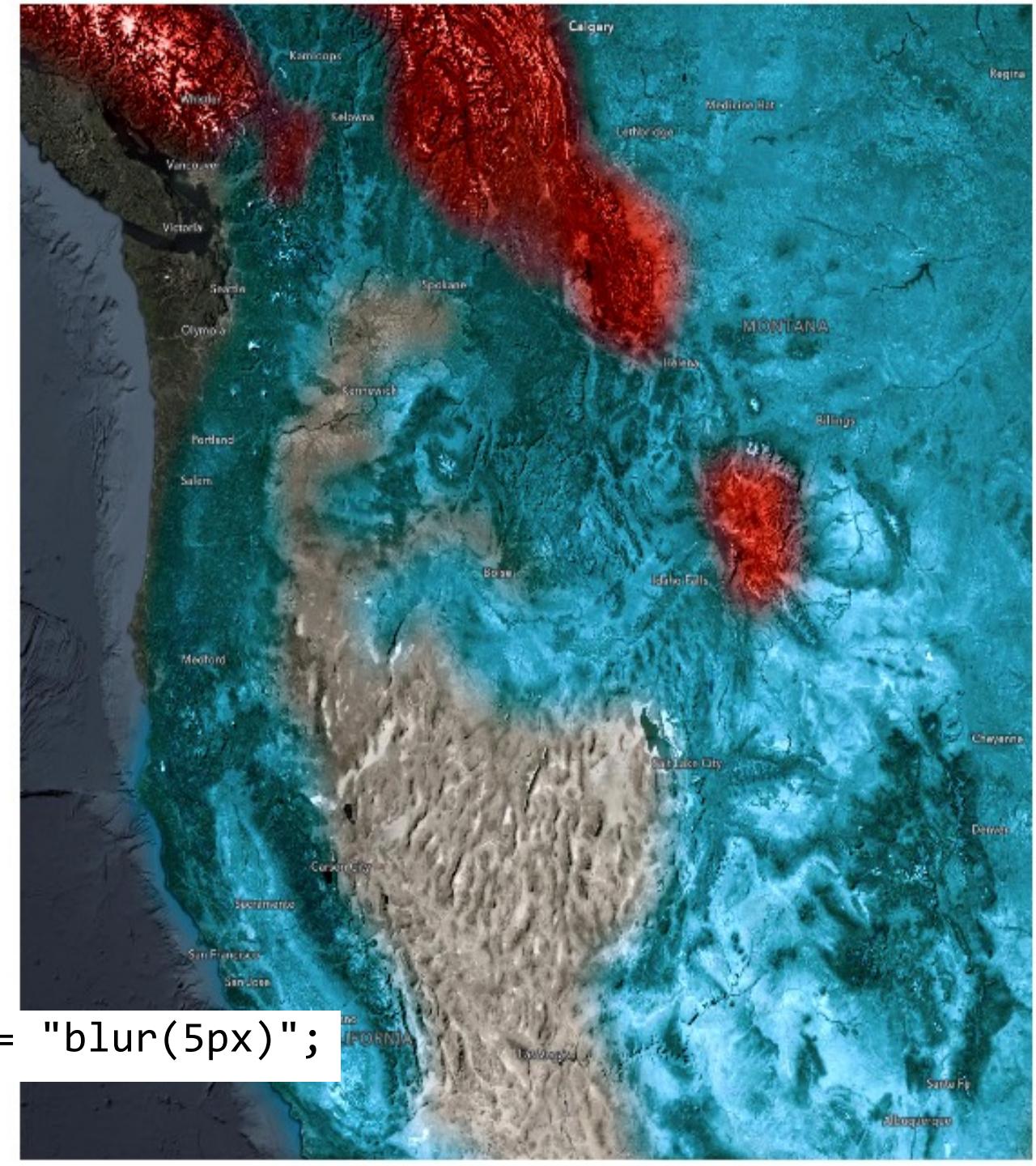
`layer.effect = "bloom(200%, 1px, 0.2)"`



```
const featureFilter = new FeatureFilter({
  where: "BoroughEdge='true'"
});
layer.featureEffect = new FeatureEffect({
  filter: featureFilter,
  includedEffect: "drop-shadow(3px, 3px, 1px, black)",
  excludedEffect: "blur(1px) brightness(65%)"
});
```

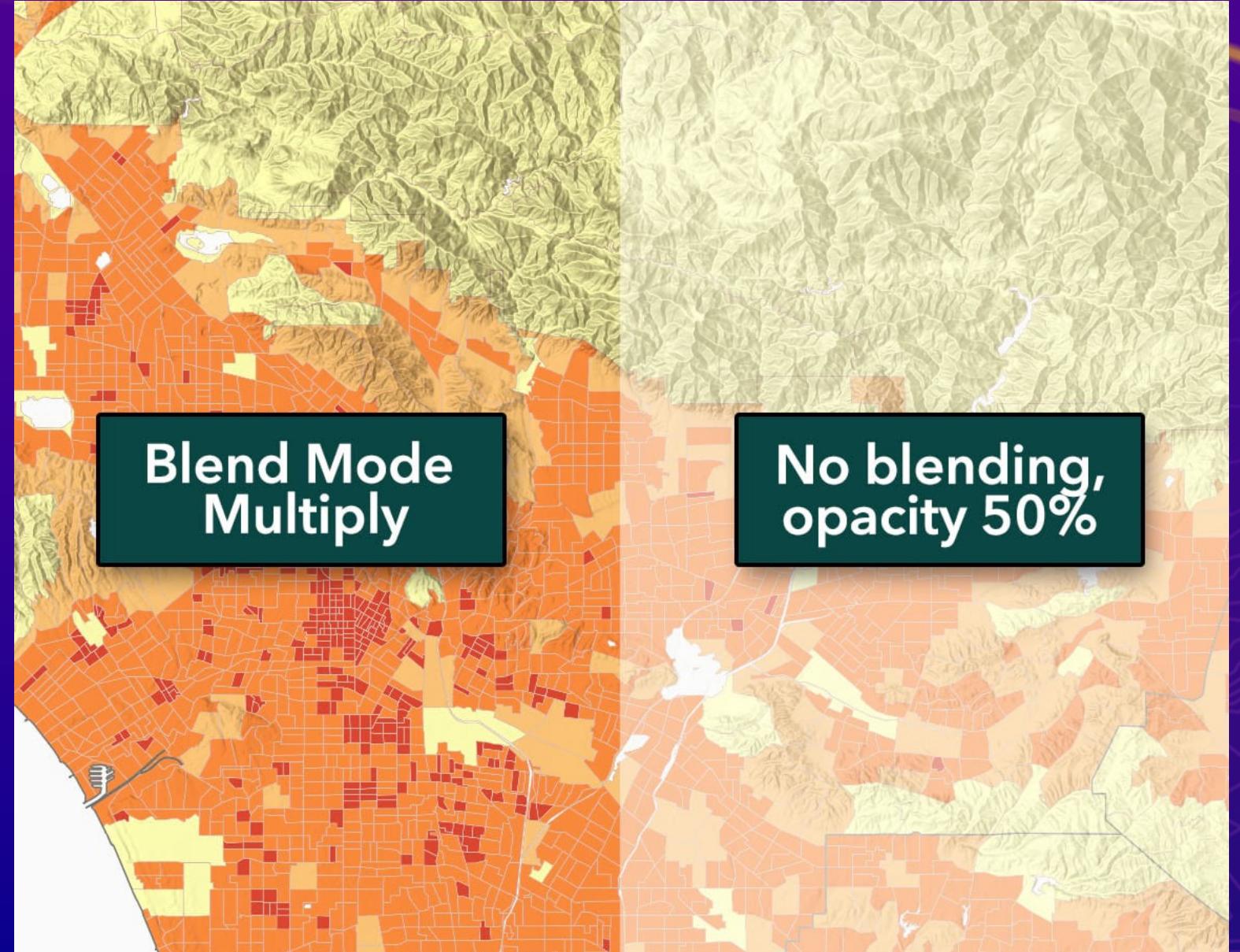


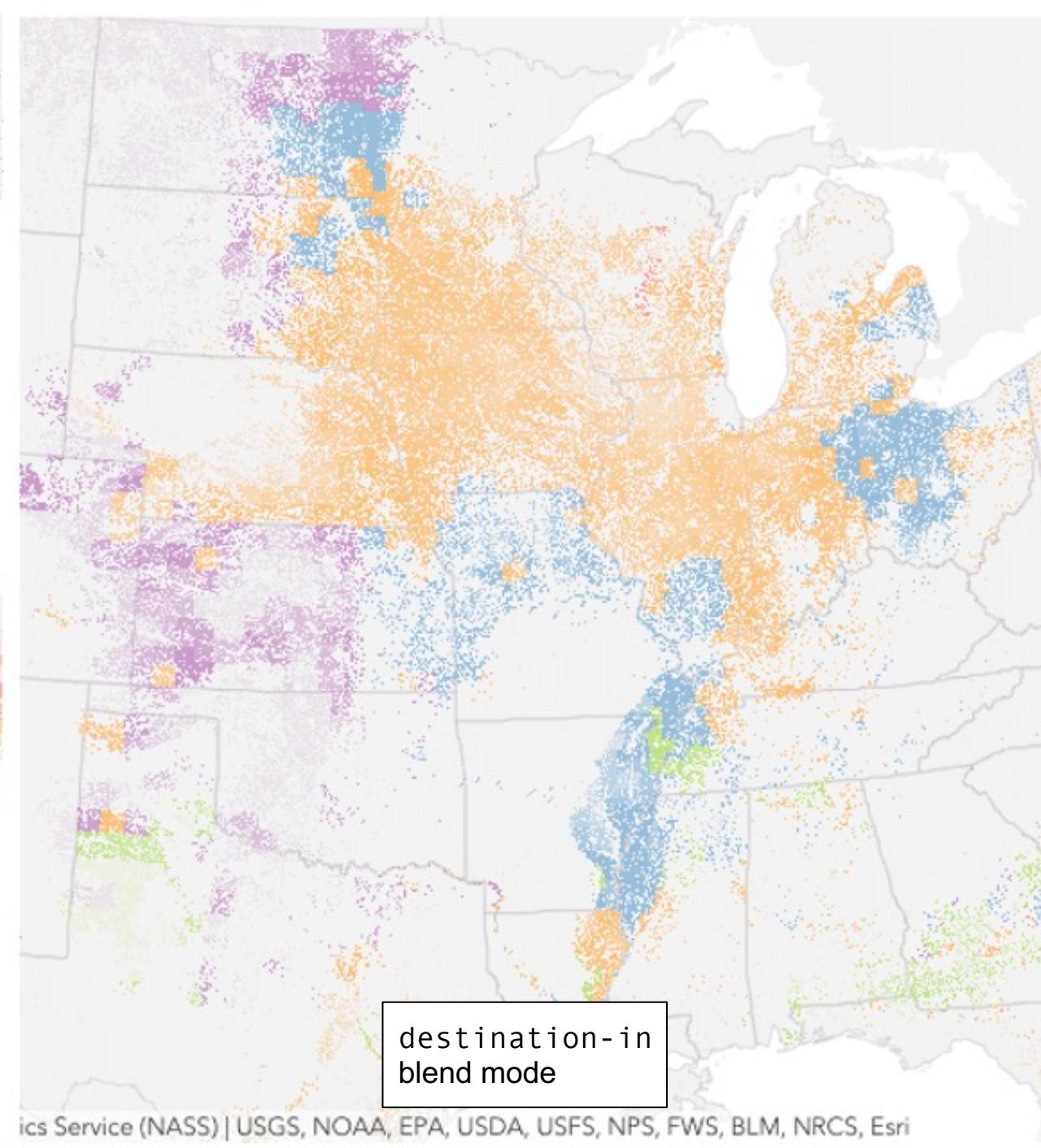
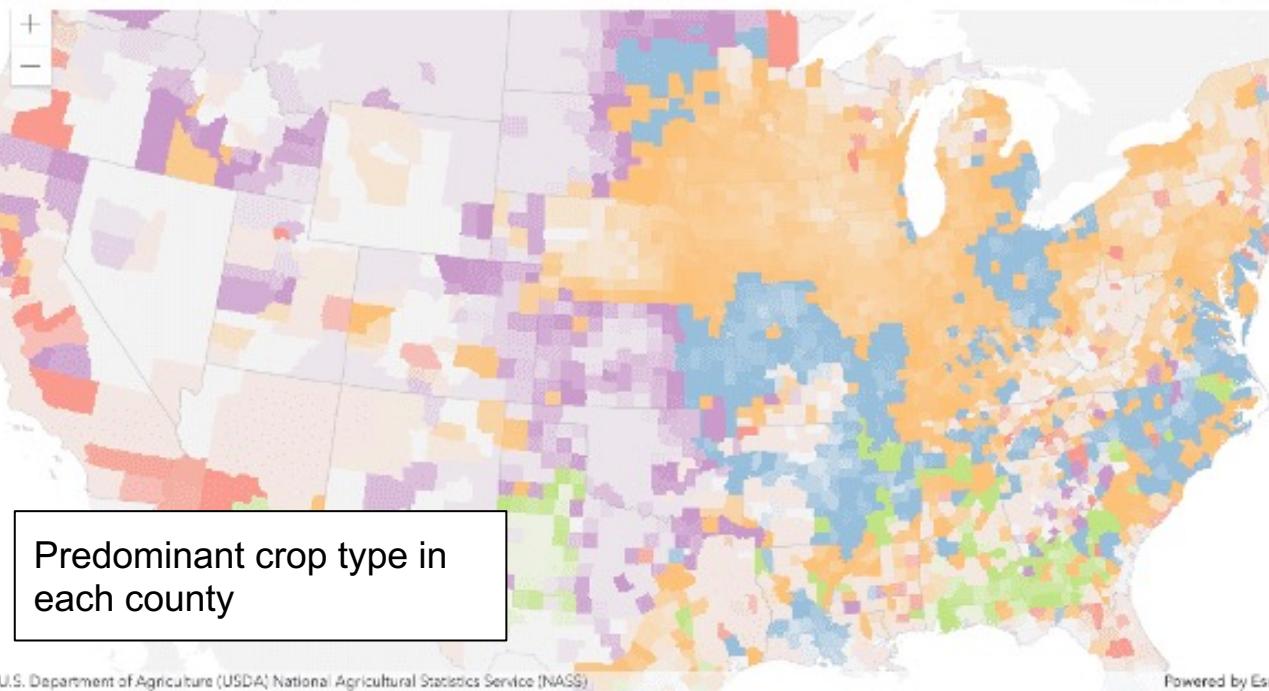
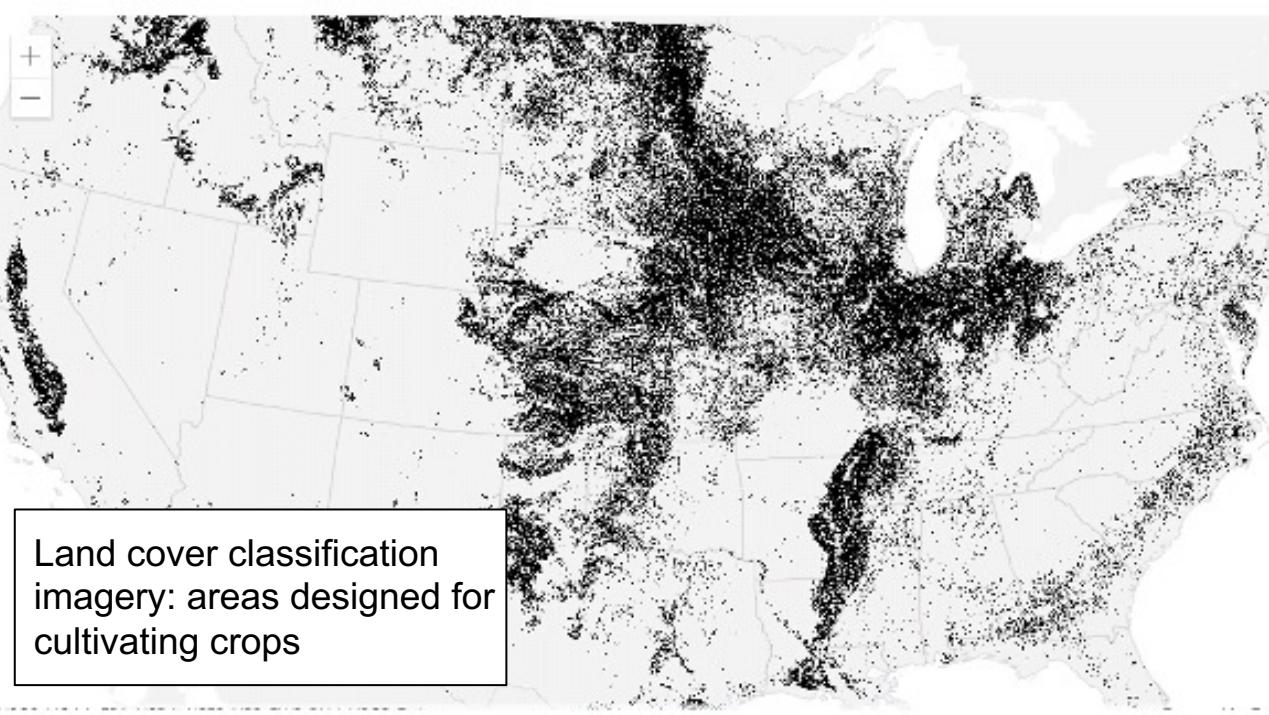
layer.effect = "blur(5px)";

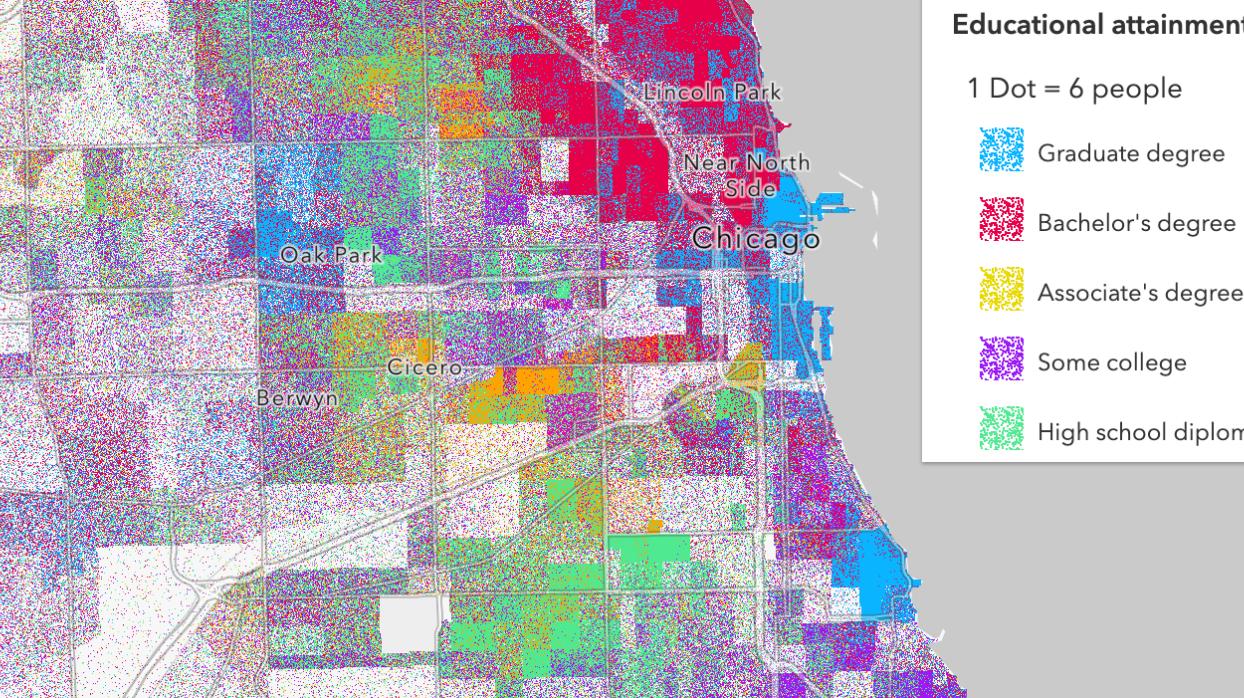


# Blend modes

- Helps to combine/blend the visualization of two or more layers
- Blend mode themes:
  - Lighten
  - Darken
  - Contrast
  - Component
  - Compositing
  - Invert







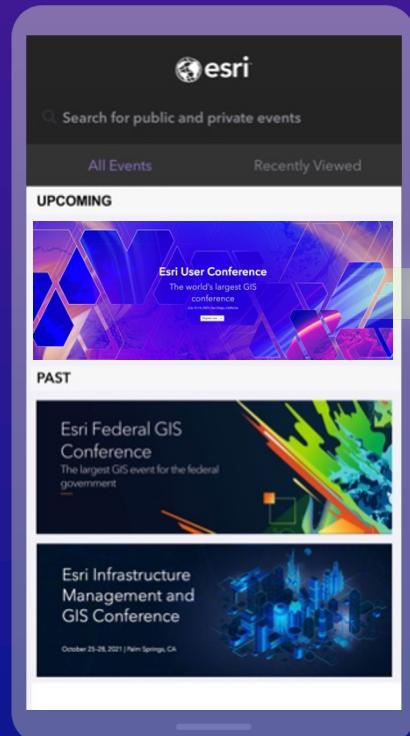
# Demos

# Resources

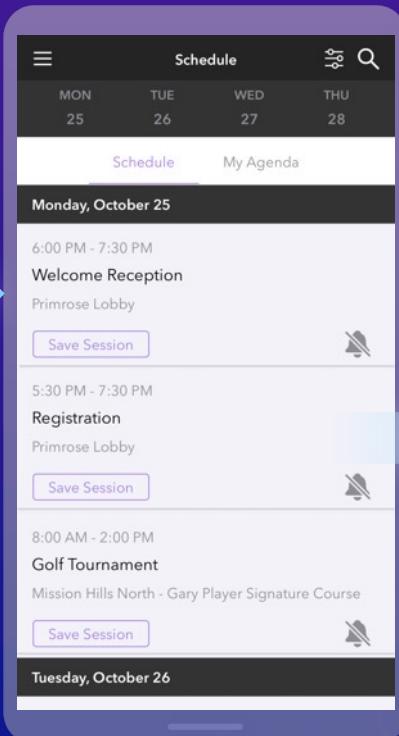
- [Get started with visualization](#)
- [ArcGIS Blog](#)
- [Visualization Samples](#)
- [Documentation](#)
  - [Renderer](#)
  - [Symbol](#)

# Please Share Your Feedback in the App

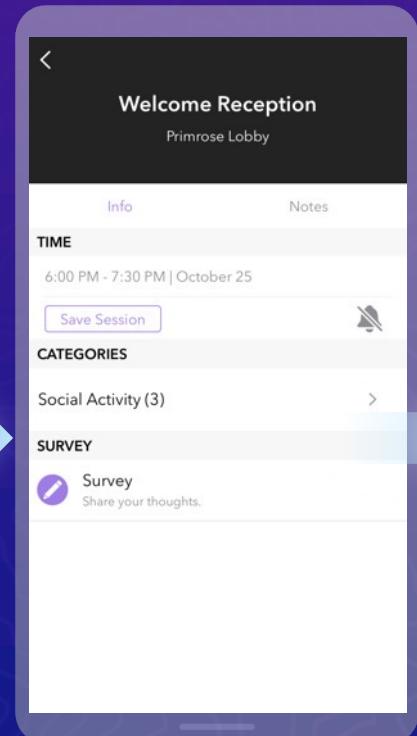
Download the Esri Events app and find your event



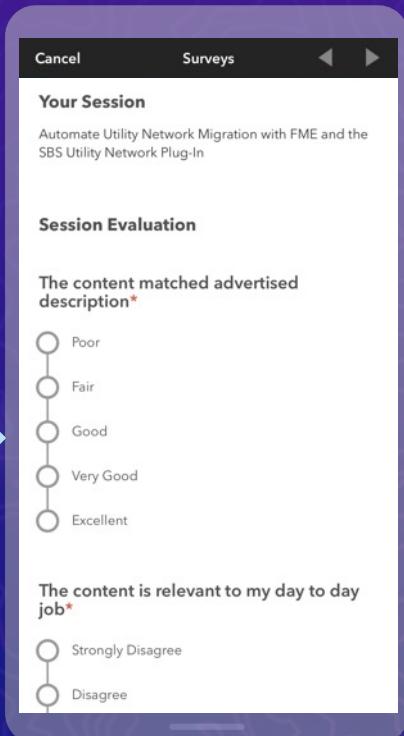
Select the session you attended



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Log in to access the survey





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