



Building Accessible Web Apps with ArcGIS Maps SDK for JavaScript and Calcite Design System

ESRI DEVELOPER SUMMIT 2023

Kelly Hutchins

Kitty Hurley

Agenda

Building accessible web apps

1. Introduction to accessibility
2. Web Content Accessibility Guidelines (WCAG)
3. Accessibility with JS Maps SDK and Calcite
4. Build accessibility into mapping apps
5. Tools and resources



Accessibility and WCAG

Kitty Hurley

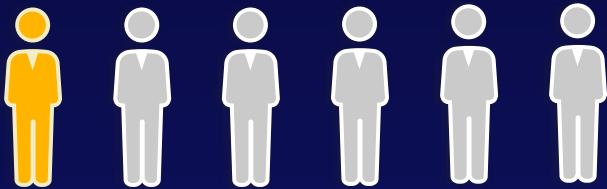
```
const layer = view.map.allLayers.get(0);
view.whenLayerView(layer)
  .then(layerView => console.log(
    // if there were problems with
    .catch(console.error);
```

```
const view = new View({
  container: "view",
  map: map,
  environment: {
    lighting: {
      directShadowsEnabled: true
    }
  }
});
```

An introduction

Who are we designing for?

- **12.7%** of Americans have a disability¹
- **47.1%** of Americans **over 75 years** of age have a disability¹
- **1.3 billion people worldwide** experience a **significant** disability²



1 in 6 people

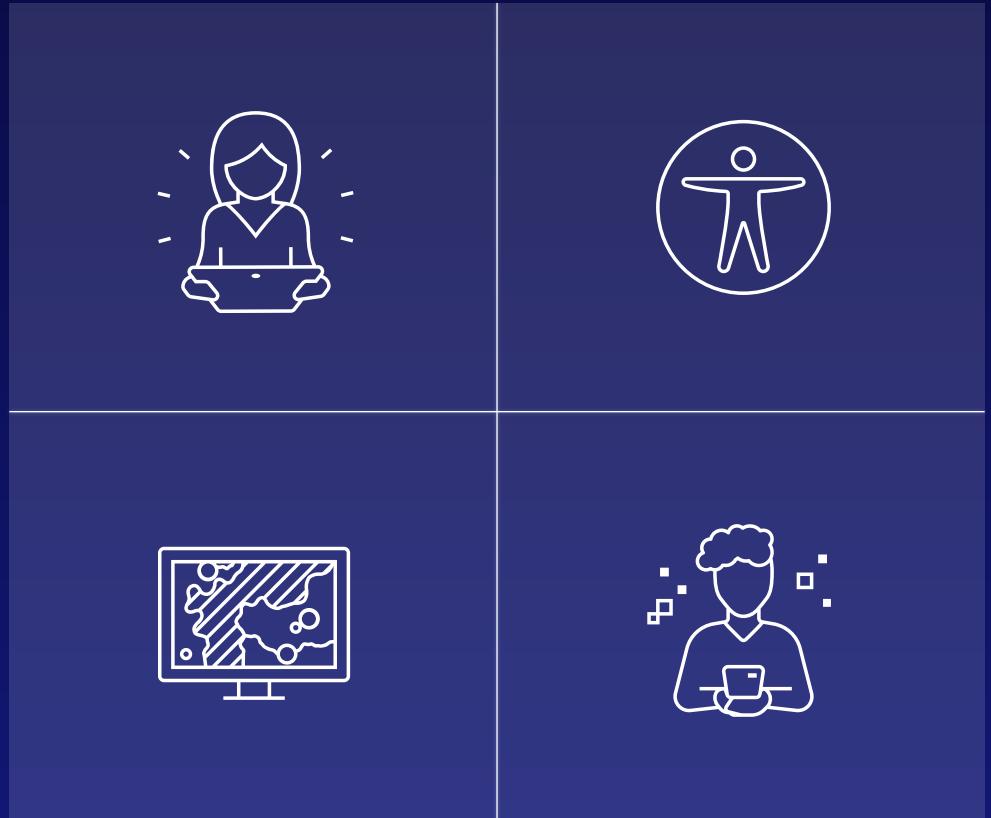
¹ [2021 American Community Survey](#)

² [World Health Organization](#)

Why accessibility?

Benefits to the web

- Reach a **broader** audience
- **Reduce** risk of legal complications
- Develop an **innovative** mindset
- Improve **reputation**
- **Reduce** load times



Web standards

Web Content Accessibility Guidelines (WCAG) 2.1

- Success Criterion
 - 1. Perceivable
 - 2. Operable
 - 3. Understandable
 - 4. Robust
- Levels
 - A: Basic ★
 - AA: Desirable (*Many organizations*) ★★
 - AAA: Comprehensive ★★★

WCAG examples

Different levels and their meaning

Level	Success Criterion	Description
A	1.4.1: Use of Color	Color is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.
AA	1.4.3: Contrast (Minimum)	The visual presentation of text and images of text has a contrast ratio of at least 4.5 to 1.
AAA	1.4.6: Contrast (Enhanced)	The visual presentation of text and images of text has a contrast ratio of at least 7 to 1.

1.4.1: Use of Color

Level A

Color is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.

Desired subdomain

big-map-fan

.city-of-acme.gov

! Apologies, this subdomain has already been registered.

1.4.3: Contrast (Minimum)

Level AA

The visual presentation of text and images of text has a contrast ratio of at least 4.5 to 1.

Desired subdomain

big-map-fan

.city-of-acme.gov

! Apologies, this subdomain has already been registered.

1.4.6: Contrast (Enhanced)

Level AAA

The visual presentation of text and images of text has a contrast ratio of at least 7 to 1.

Desired subdomain

big-map-fan

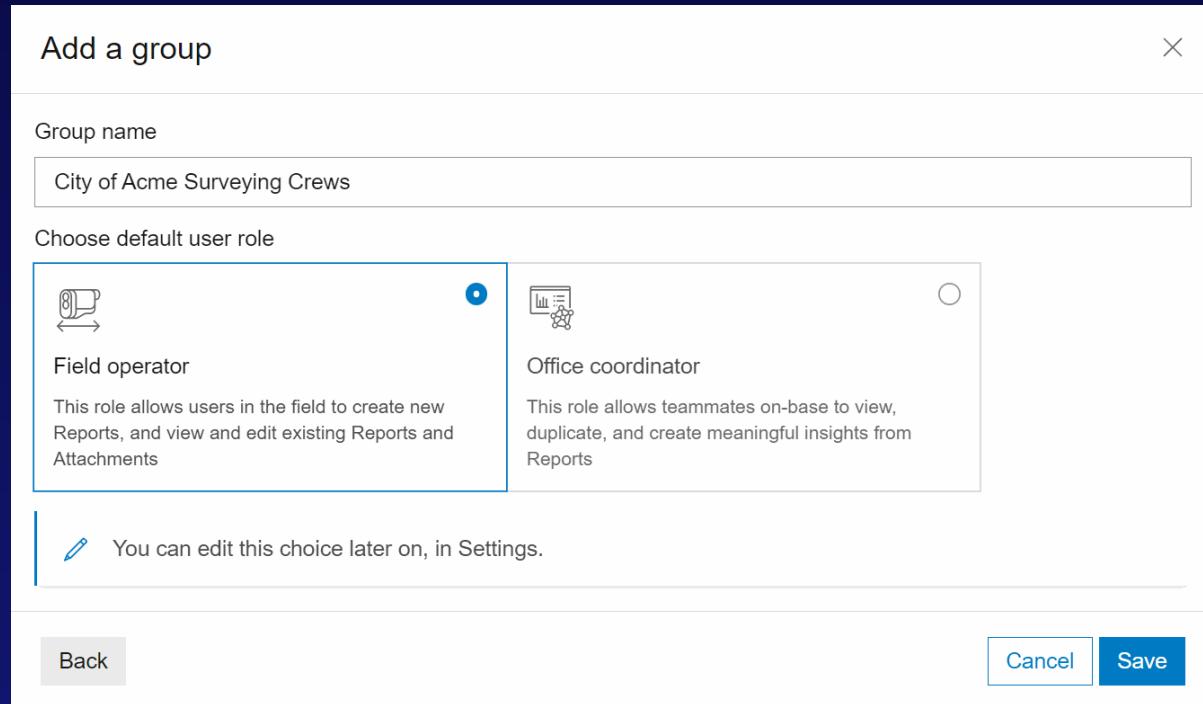
.city-of-acme.gov

! Apologies, this subdomain has already been registered.

Custom color for enhanced color contrast support demonstration

WCAG 2.2

Upcoming Success Criterion changes



2.4.7: Focus Visible

- Change from Level AA to **Level A**
- Any keyboard operable user interface has a mode of operation where the keyboard focus indicator is visible.



Accessibility with JS Maps SDK and Calcite

Kitty Hurley

```
const layer = view.map.allLayers.get(0);
view.whenLayerView(layer)
  .then(layerView => console.log(
    // if there were problems with
    .catch(console.error);
```

```
const view = new View({
  container: "view",
  map: map,
  environment: {
    lighting: {
      directShadowsEnabled: true
    }
  }
});
```

Calcite accessibility

Accessibility features with Calcite

- Reduced motion support
- High contrast
- Improved keyboard navigation
- Conducted a third-party audit across components

Reduced motion support

Calcite Loader sample



Adjusting polygons...



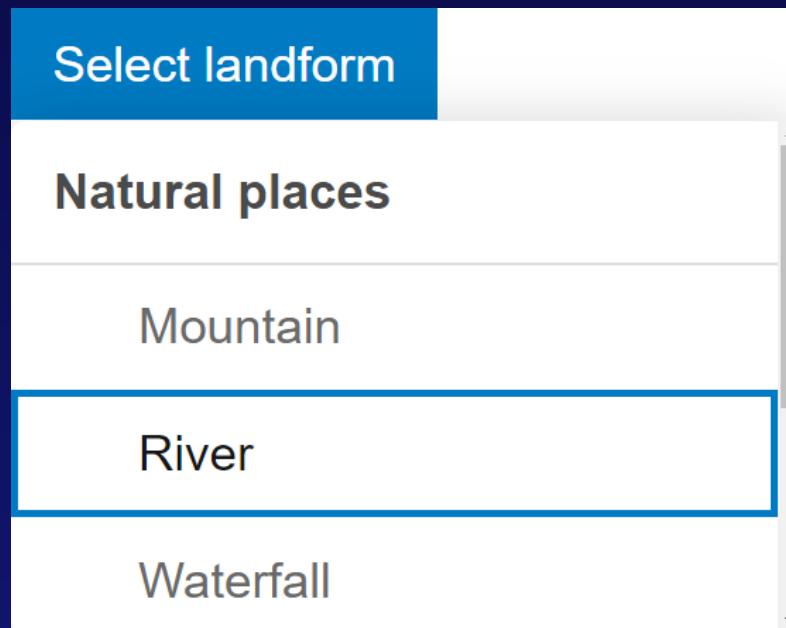
Adjusting polygons...

Show animations

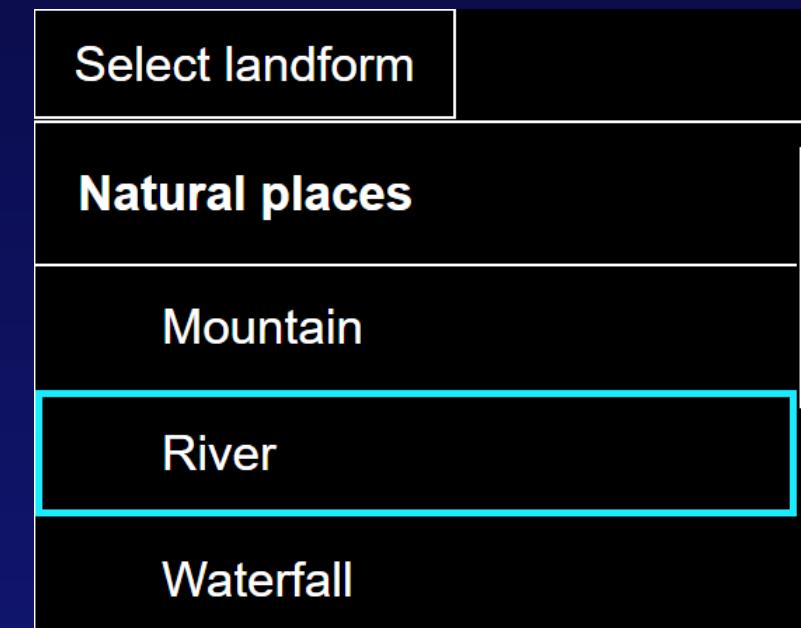
Animations not shown

High contrast support

Calcite Dropdown sample



High contrast disabled



High contrast enabled

JS Maps SDK accessibility

Accessibility features with JS Maps SDK

- **Colorblind friendly color ramps**
- **Popup focus** (4.23+)
- **Color contrast support in CSS themes** (4.25+)
- **Widget support** (4.25+)
 - BasemapGallery
 - Bookmarks
 - Directions
 - Editor
 - FeatureForm
 - Print

Colorblind friendly color ramps

Accessibility features with JS Maps SDK

1. Color scheme (tags)

bright

3d blues browns categorical centered-on dark diverging esri-brand extremes

grays greens heatmap light lines oranges pinks point-cloud purples reds

sequential subdued yellows

2. Number of Colors

5

3. Colorblind friendly

4. Filter by hexadecimal (optional)

#b5c2d9, b5c2d9 or #fffcfd, #b1cdc2, #629eb0, #38627a, #0d2644

5. Search criteria (more strict)

Search

227 color ramps

Blue 11

#404d54
#48799d
#4d96ce
#74bbcd
#bce6f9

Copy hex values

Blue 11

#404d54
#48799d
#4d96ce
#74bbcd
#bce6f9

Copy hex values

Blue 12

#45537a
#4e6dbd
#5686ff
#96b8fe
#e6f5fa

Copy hex values

Blue 12

#45537a
#4e6dbd
#5686ff
#96b8fe
#e6f5fa

Copy hex values

Blue 16

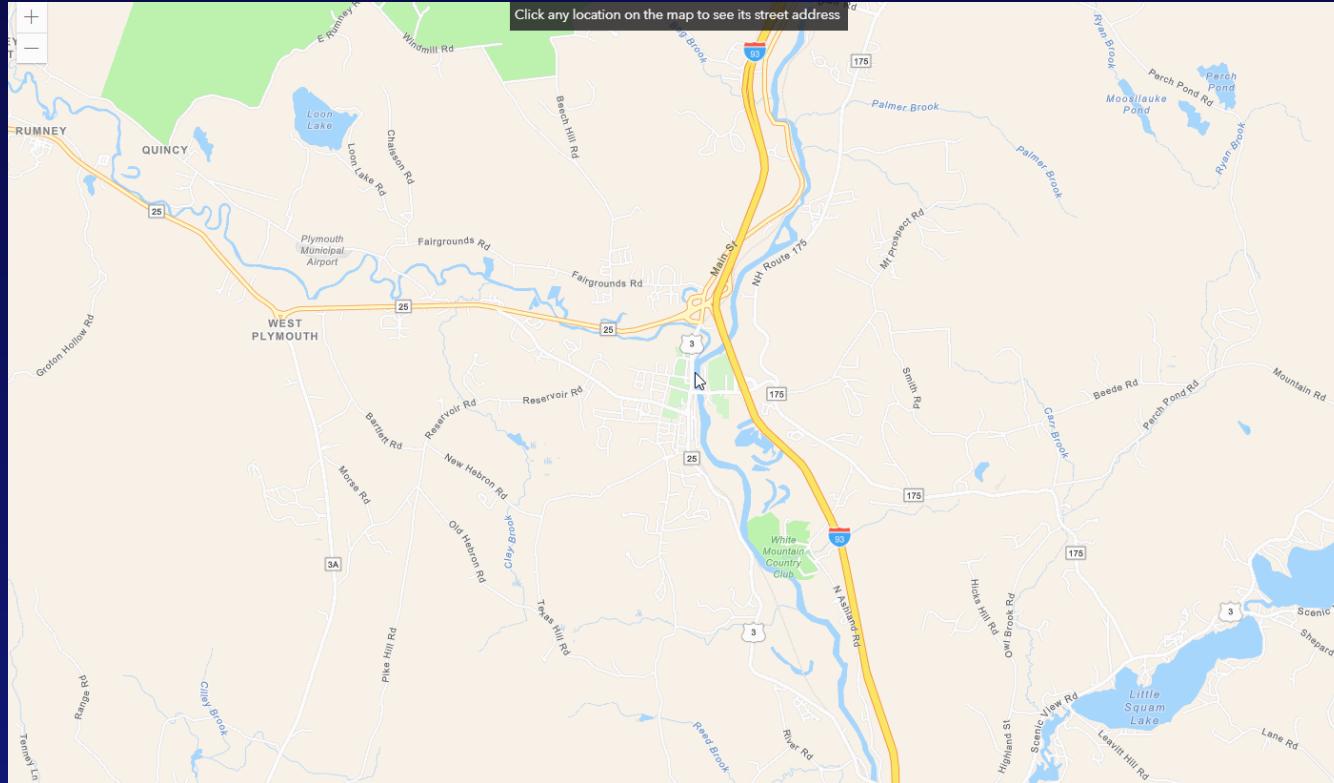
#005353
#007b7b
#00a4a4
#00cccc
#00ffff

Copy hex values

Accessible color ramps

Popup focus

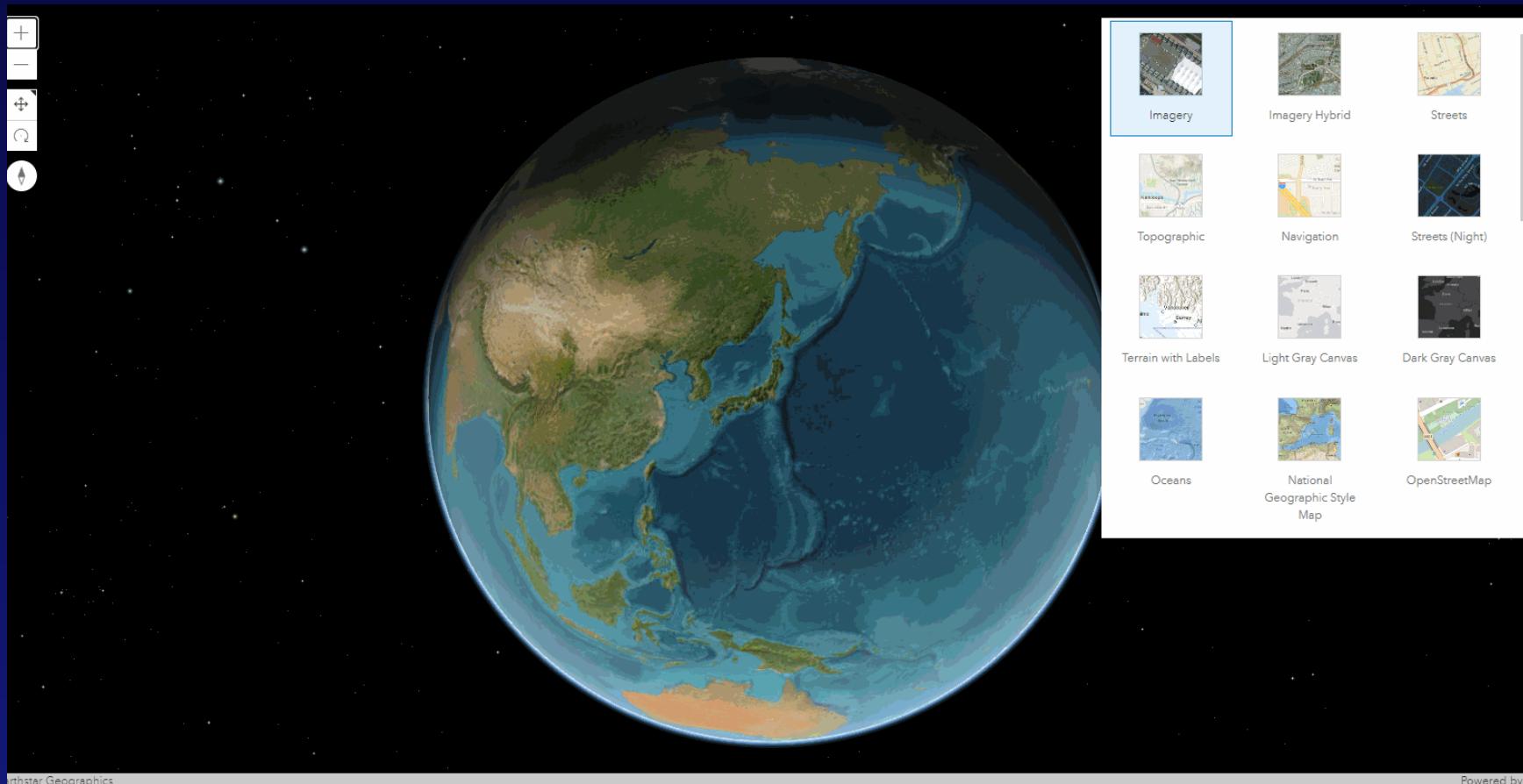
JS Maps SDK accessibility



The `shouldFocus` option for Popup's `open` method.

Color contrast and widget support

JS Maps SDK accessibility



The BasemapGallery's improved color contrast and role in 4.25+.



Build accessibility into mapping apps

Kelly Hutchins

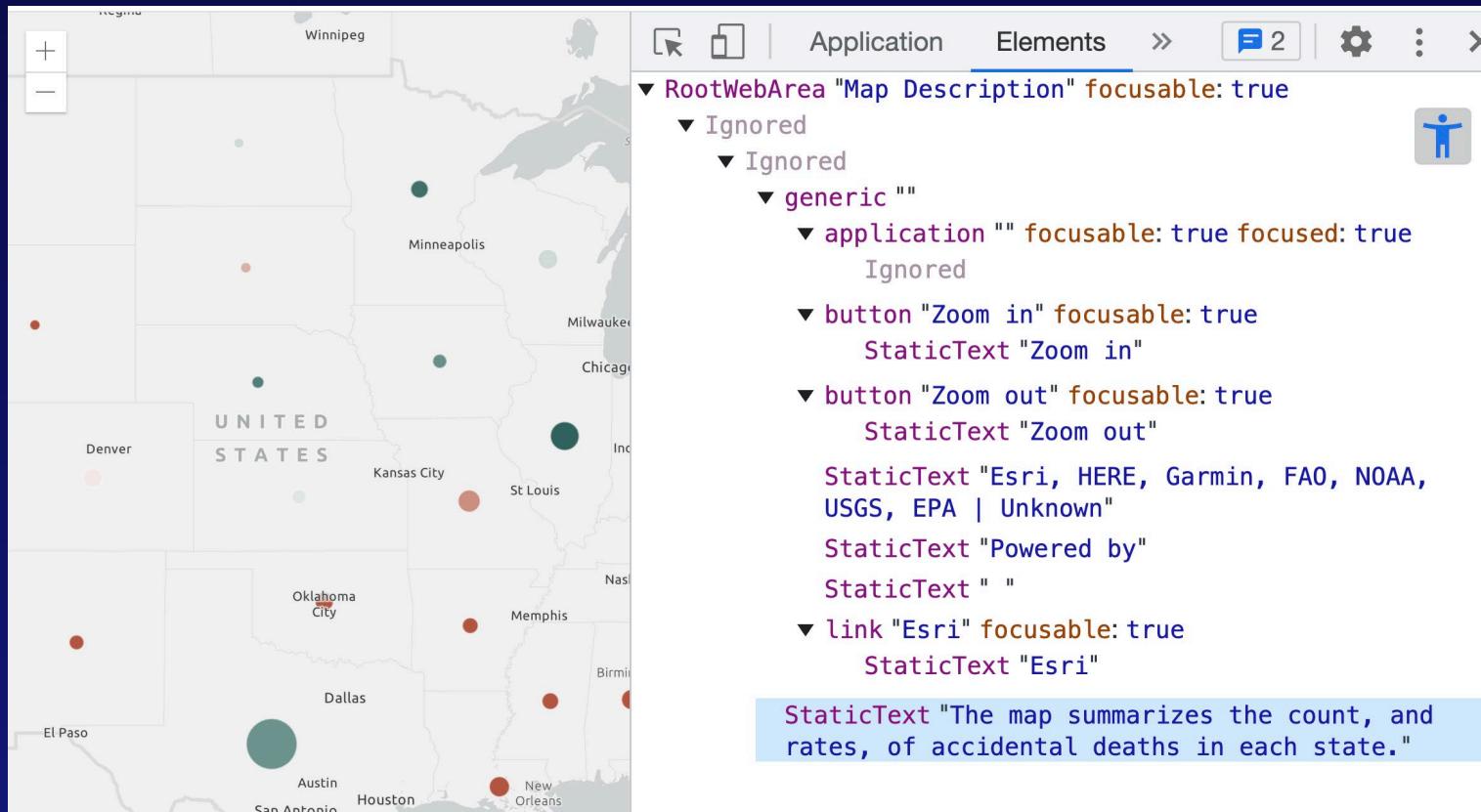
```
const layer = view.map.allLayers.get(0);  
view.whenLayerView(layer)  
.then(layerView => console.log(  
// if there were problems with  
.catch(console.error);
```

```
const view = new View({  
  container: "view",  
  map: map,  
  environment: {  
    lighting: {  
      directShadowsEnabled: true  
    }  
  }  
});
```



Describe map contents

Add context to map focus

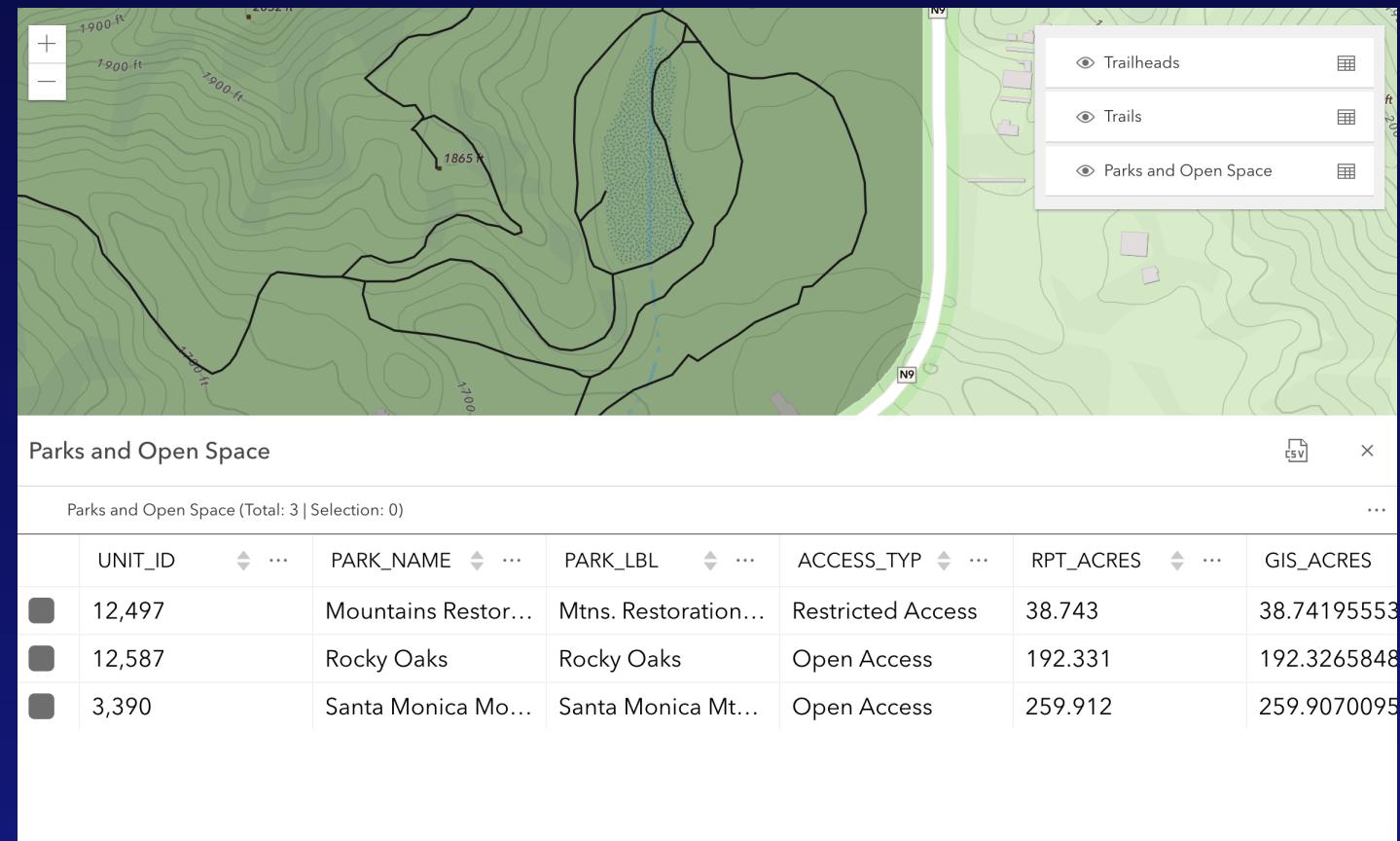


Associate descriptive information with the map using `aria-describedby`.

Provide data in alternate formats

Accompany the map with data

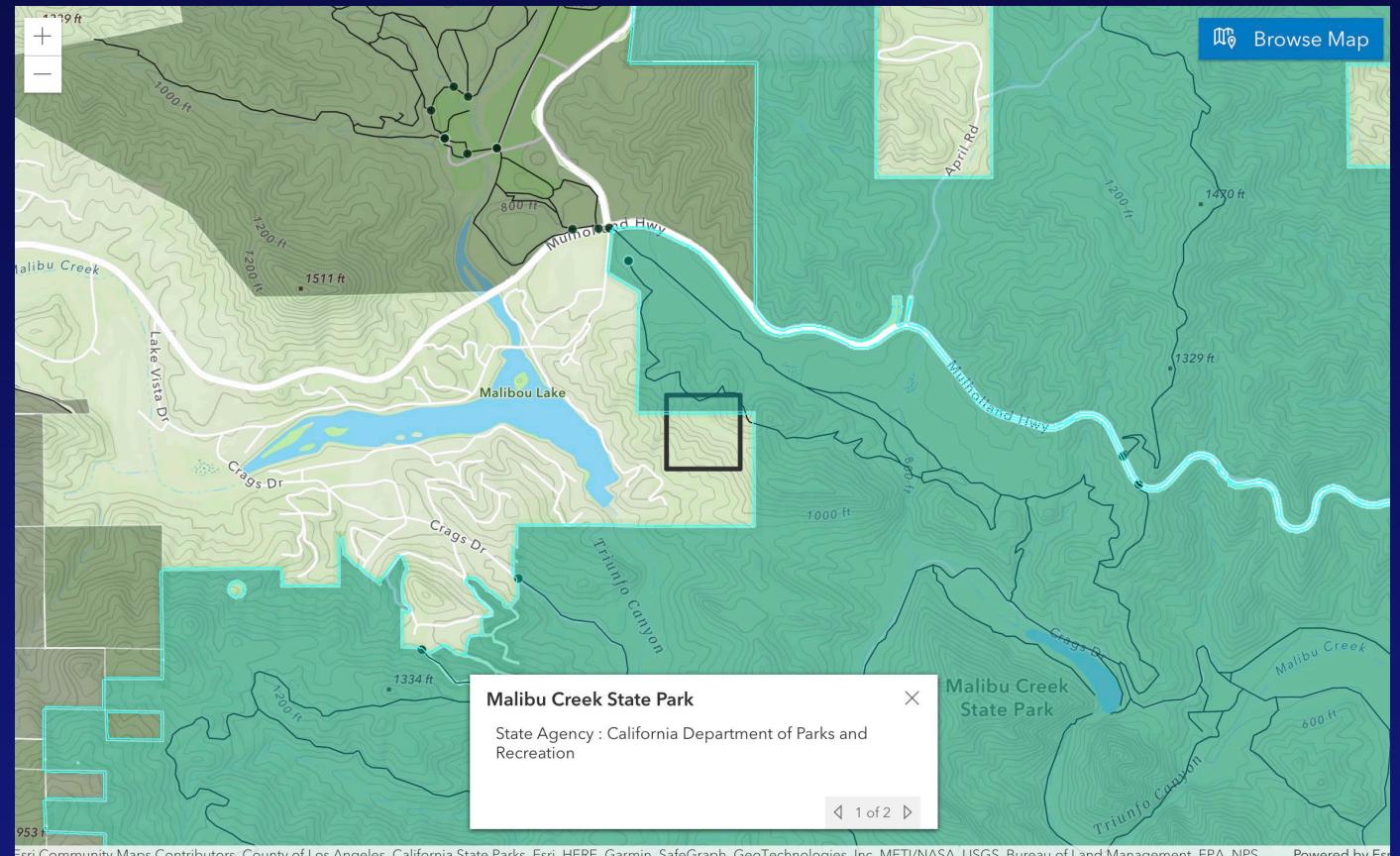
- Table
- CSV



Navigate map data

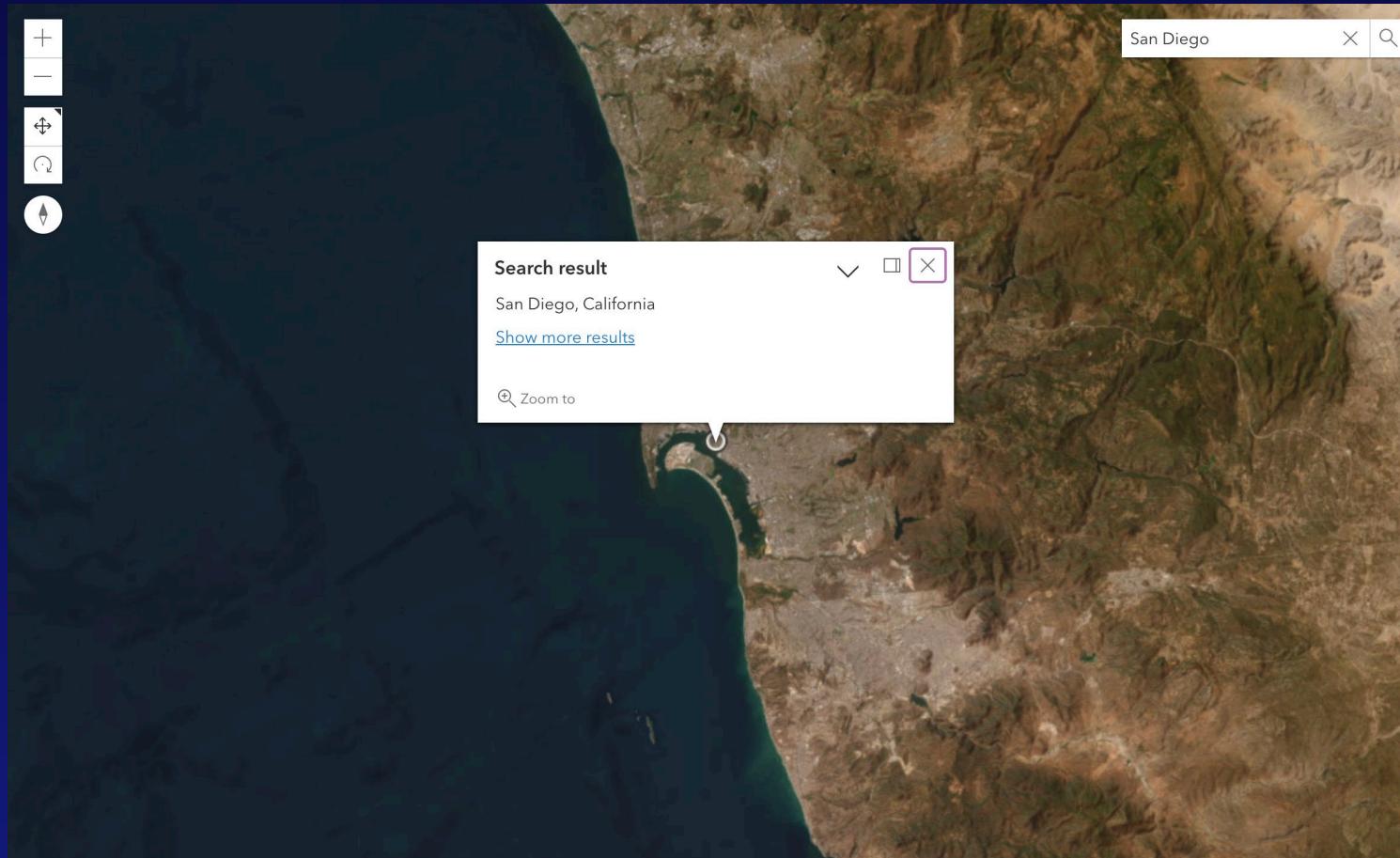
Support keyboard navigation

- Use `map.focus` and the `navigating` event
- Announce updates with `aria-live`



Search focus

Introduce meaningful keyboard focus



Handle focus between the search dialog and result popup.

Disable animation

Accommodate larger audiences

- Widget: GoToOverride
- goToOptions
- Disable animation when prefers-reduced-motion is active

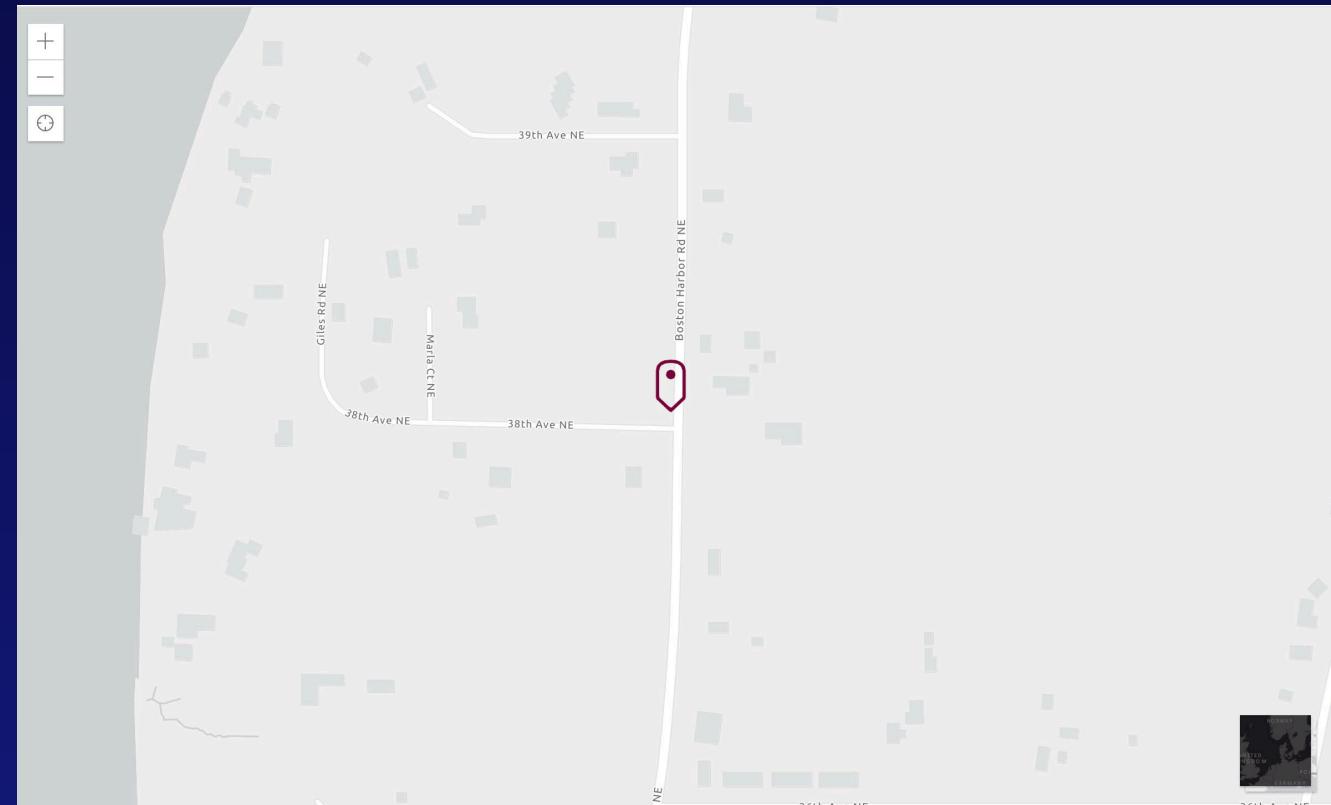
```
view.popup.goToOverride = goToOverride;

function goToOverride(view, goToParams) {
  const mediaQuery = window.matchMedia("(prefers-reduced-motion: reduce)");
  if (mediaQuery.matches) {
    goToParams.options = {
      ...goToParams.options,
      ...{
        animate: false,
      },
    };
  }
  return view.goTo(goToParams.target, goToParams.options);
}
```

Basemap color

Dynamically modify colors for sufficient color contrast

- `colorUtils`
 - `getBackgroundColor`
 - `getBackgroundColorTheme`
- Update graphics to support sufficient color contrast





Further exploration

Kelly Hutchins
Kitty Hurley

```
const layer = view.map.allLayers.get(0);
view.whenLayerView(layer)
  .then(layerView => console.log(`Layer loaded`))
  // if there were problems with the layer
  .catch(console.error);
```

```
const view = new View({
  container: "view",
  map: map,
  environment: {
    lighting: {
      directShadowsEnabled: true
    }
  }
});
```

Furthering accessibility

Developer guidance and accessibility

- Designing for individuals
- Content
- Forms and labels
- Checklist

On the autistic spectrum



Do use simple sentences and bullets.



Avoid creating a wall of text.

Testing tips

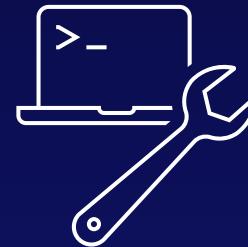
Accessibility test strategies

- No mouse challenge
- Assistive technologies
- Human testing

Accessibility tools

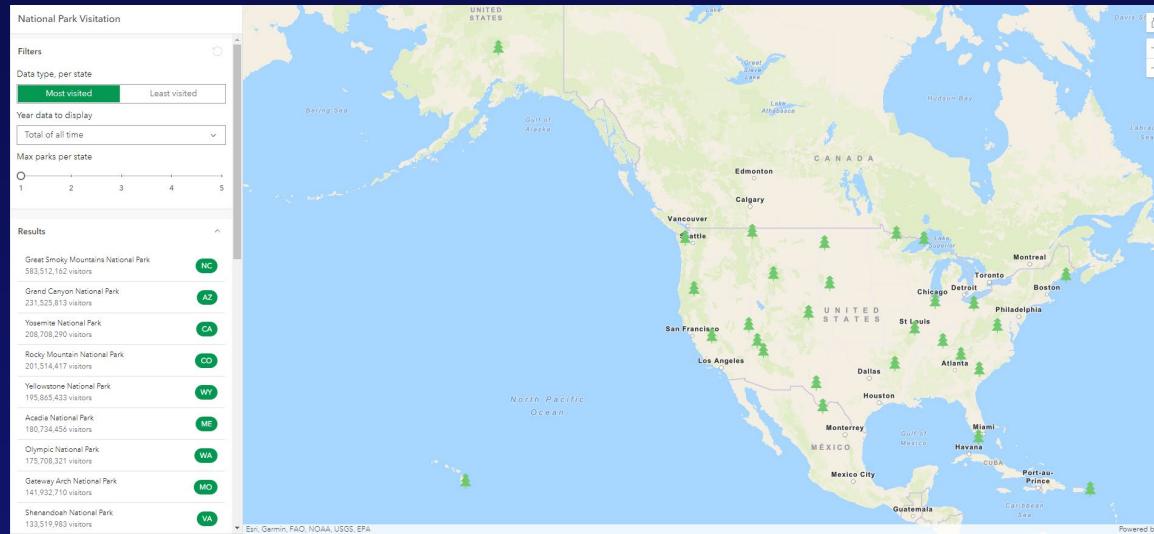
Testing tools

- Humans
- Assistive technologies
- Color Oracle
- WebAIM Color Contrast Checker
- WAVE
- aXe
- Browser developer tools (e.g., Lighthouse)

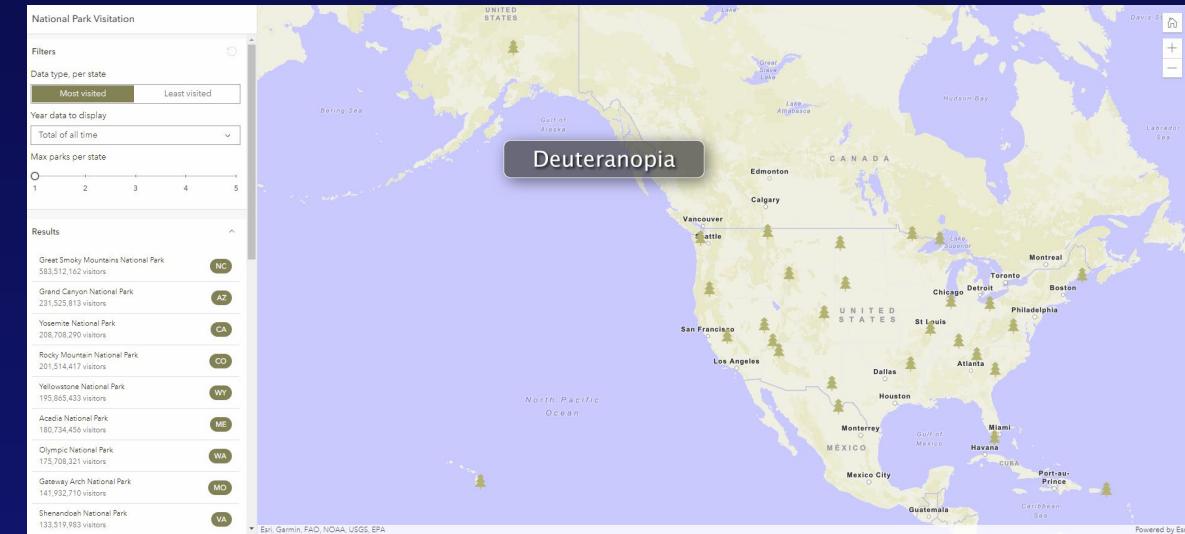


Color Oracle

Color blindness simulator for Windows, Mac and Linux



No filter



Deuteranopia filter

Code resources

Code snippets and samples

- GitHub demos and code
 - <https://kellyhutchins.github.io/DevSummit2023-A11y>
- Codepen collections
 - <https://codepen.io/collection/WvMEJM>
 - <https://codepen.io/collection/BNzmVw>



Further reading

Accessibility resources

- Calcite and accessibility
 - <https://developers.arcgis.com/calcite-design-system/foundations/accessibility>
- Subscribe to our Accessibility Community
 - <https://community.esri.com/t5/accessibility/ct-p/accessibility>



Accessibility blog

Accessibility resources

The screenshot shows a blog post titled "Accessibility Resources" by JessicaMccall, an Esri Contributor. The post discusses how to make ArcGIS apps accessible and provides links to general resources and partner information.

Breadcrumbs: Home > All Communities > Products > Accessibility > Accessibility Blog > Accessibility Resources

Post Details: 103 views, 1 comment, posted three weeks ago. A "Subscribe" button is available.

Author: JessicaMccall (Esri Contributor)

Post Options: Post Options ▾

Text Content:

We have many of our customers that approach our team asking the same question - "How do I make my ArcGIS app accessible/508 compliant/WCAG compliant?"

Well, the answer is not straight-forward... but luckily, we have some really great subject matter experts that are producing great information and content for you all the time. Here is a list of some of the best of the best articles, blogs, videos and information on making ArcGIS Apps accessible. And, as always, let us know what other resources that you want to see!

Esri General Resources on Accessibility:

- [Esri Accessibility Site and Resources](#) - You have probably seen this and we are working to post some new content here.
- Esri Legal Accessibility - All updated [Accessibility Conformance Reports \(ACRs\)](#) will be posted here but the [Overview](#) provides details on how we are meeting standards.
- [Esri Accessibility Community](#) - Ways to engage with other Esri users about accessibility (I think an account is required to log in?)

Accessibility Information from Esri Partners:

Accessibility blog post on resources



esri®

THE
SCIENCE
OF
WHERE®

Copyright © 2023 Esri. All rights reserved.

```
const layer = view.map.atLayer(0);
view.whenLayerView(layer)
  .then((layerView) => console.log("Layer loaded"))
  // If there were problems
  .catch((error) => console.error(error));
```

ESRI API

```
const view = new SceneView({
  container: "viewDiv",
  map: map,
  environment: {
    lighting: {
      directShading: true
    }
  }
});
```

LIVE
BY
THE
CODE