



ESRI DEVELOPER SUMMIT 2023

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

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.g  
view.whenLayerView(layer)  
.then((layerView) => console.log  
// If there were problems with  
.catch(console.error);
```

```
const view = new  
  container: "vie  
  map: map,  
  environment: {  
    lighting: {  
      directShadowsEnabled
```

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 [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

Add a group ×

Group name

Choose default user role

 Field operator This role allows users in the field to create new Reports, and view and edit existing Reports and Attachments	<input checked="" type="radio"/>	 Office coordinator This role allows teammates on-base to view, duplicate, and create meaningful insights from Reports	<input type="radio"/>
---	----------------------------------	--	-----------------------

 You can edit this choice later on, in Settings.

Back Cancel Save

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.g  
view.whenLayerView(layer)  
.then((layerView) => console.log  
// If there were problems with  
.catch(console.error);
```

```
const view = new  
  container: "vie  
  map: map,  
  environment: {  
    lighting: {  
      directShadowsEnabled:  
    }  
  }
```

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...

Show animations

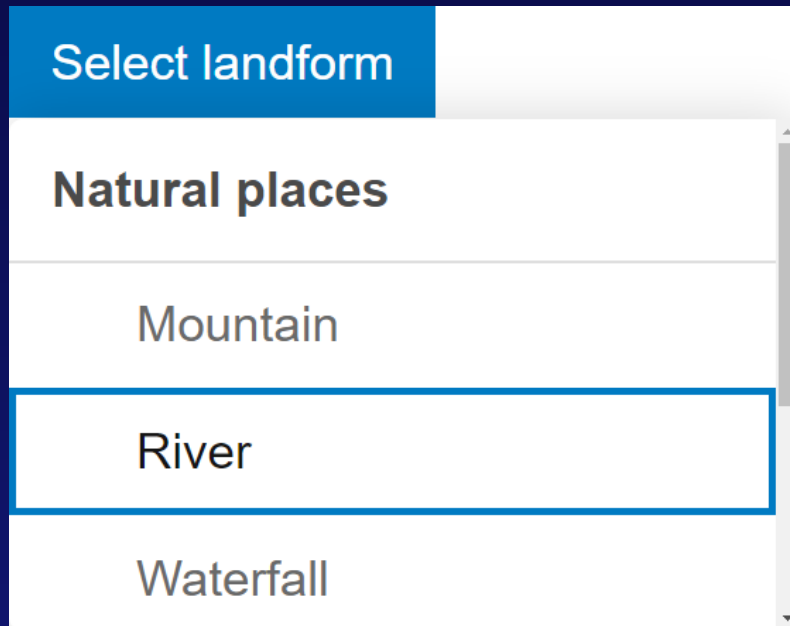


Adjusting polygons...

Animations not shown

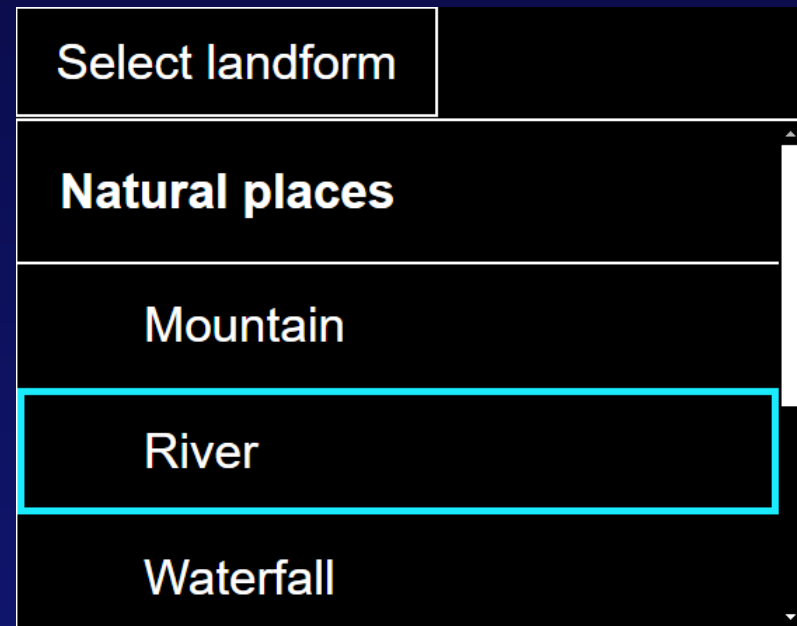
High contrast support

Calcite Dropdown sample



A screenshot of a dropdown menu titled "Select landform". The menu is open, showing a list of options: "Natural places", "Mountain", "River", and "Waterfall". The "River" option is highlighted with a blue border. The background of the menu is white, and the text is black.

High contrast disabled



A screenshot of a dropdown menu titled "Select landform". The menu is open, showing a list of options: "Natural places", "Mountain", "River", and "Waterfall". The "River" option is highlighted with a red border. The background of the menu is black, and the text is white.

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)

3d blues **bright** 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

1 2 3 4 5 6 7 8 9 10 11 12 13 20

3. Colorblind friendly

4. Filter by hexadecimal (optional)

5. Search criteria (more strict)

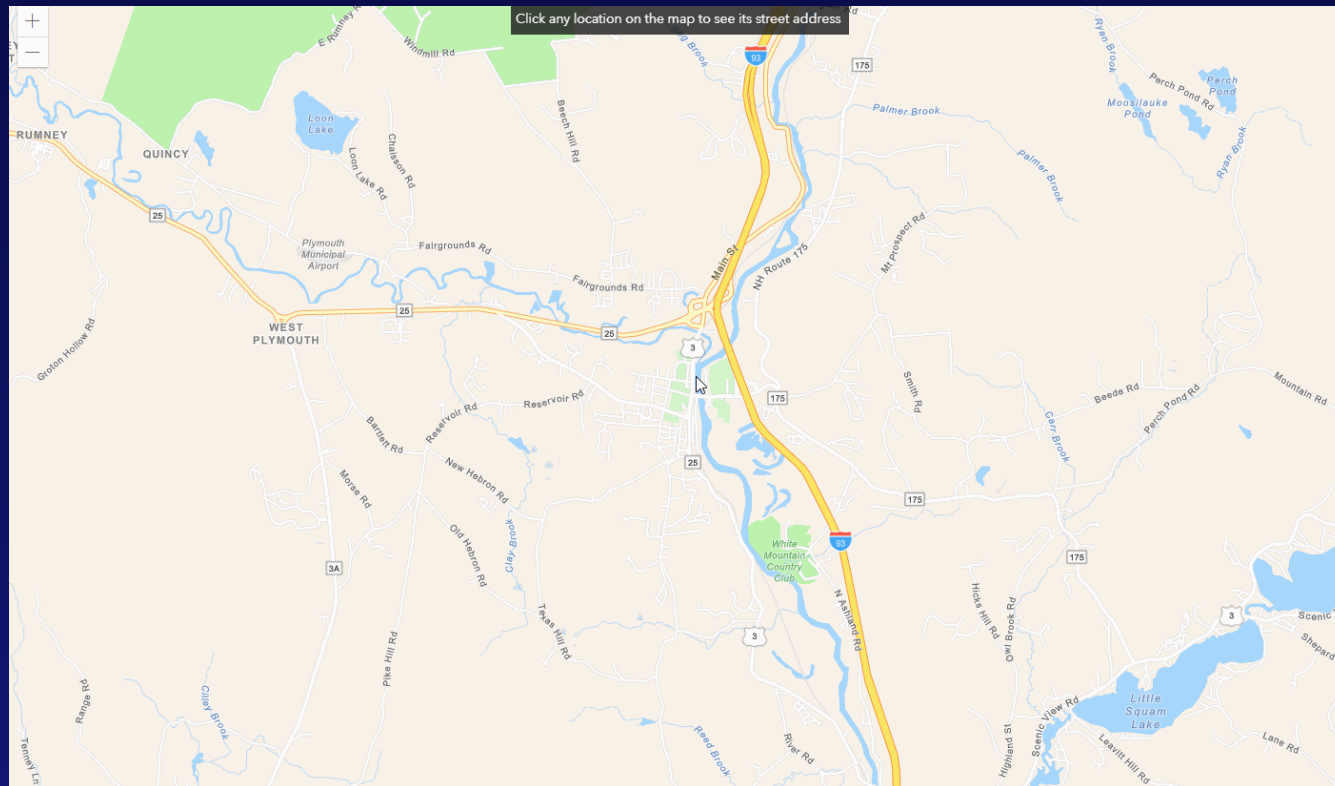
227 color ramps

Blue 11 #404d54 #48799d #4d96ce #74bbbed #bce6f9 <input type="button" value="Copy hex values"/>	Blue 11 #404d54 #48799d #4d96ce #74bbbed #bce6f9 <input type="button" value="Copy hex values"/>	Blue 12 #45537a #4e6dbd #5686ff #96b8fe #e6f5fa <input type="button" value="Copy hex values"/>	Blue 12 #45537a #4e6dbd #5686ff #96b8fe #e6f5fa <input type="button" value="Copy hex values"/>	Blue 16 #005353 #007b7b #00a4a4 #00cccc #00ffff <input type="button" value="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

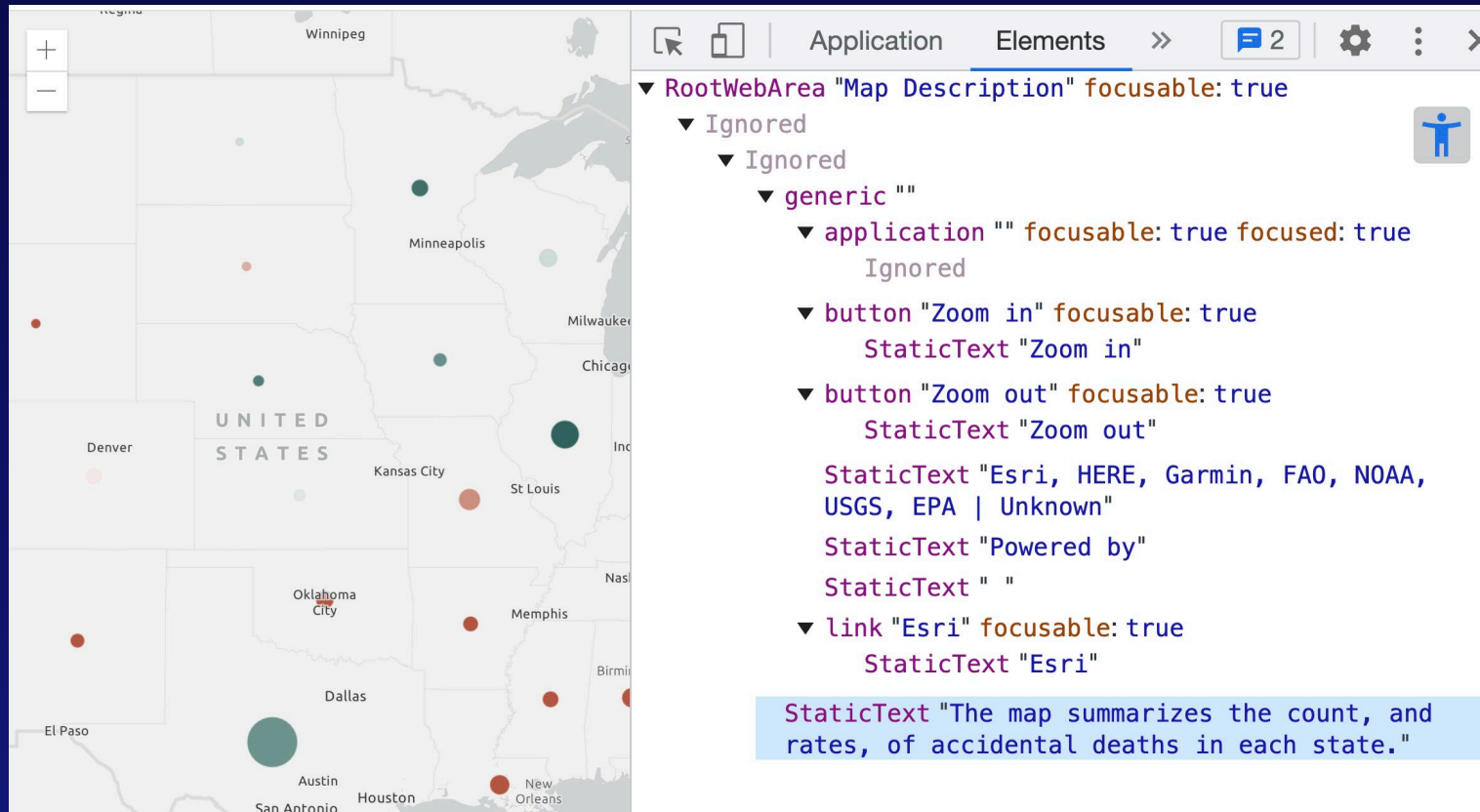
Kelly Hutchins

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

```
const view = new
container: "vie
map: map,
environment: {
  lighting: {
    directShadowsEnabled
```

Describe map contents

Add context to map focus



The image shows a web application interface with a map of the United States on the left and a browser's developer tools on the right. The map displays several colored dots (green, red, orange) representing data points across various states. The developer tools show the DOM tree for the map area, with the following structure:

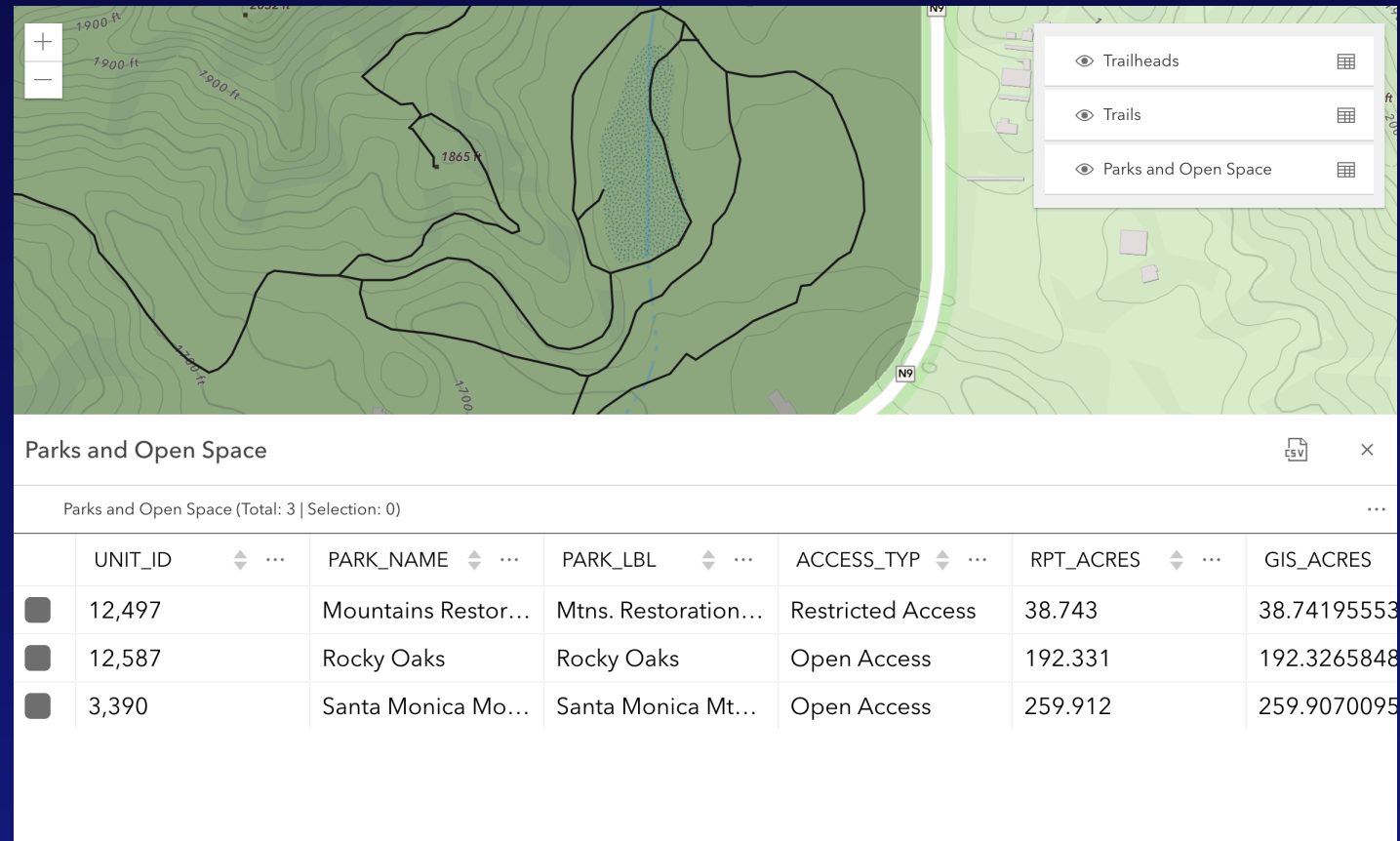
```
RootWebArea "Map Description" focusable: true
├── Ignored
│   └── Ignored
│       └── generic ""
│           ├── application "" focusable: true focused: true
│           │   └── Ignored
│           ├── button "Zoom in" focusable: true
│           │   └── StaticText "Zoom in"
│           ├── button "Zoom out" focusable: true
│           │   └── StaticText "Zoom out"
│           ├── StaticText "Esri, HERE, Garmin, FAO, NOAA, USGS, EPA | Unknown"
│           ├── StaticText "Powered by"
│           ├── StaticText " "
│           └── link "Esri" focusable: true
│               └── StaticText "Esri"
└── StaticText "The map summarizes the count, and rates, of accidental deaths in each state."
```

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

Provide data in alternate formats

Accompany the map with data

- Table
- CSV



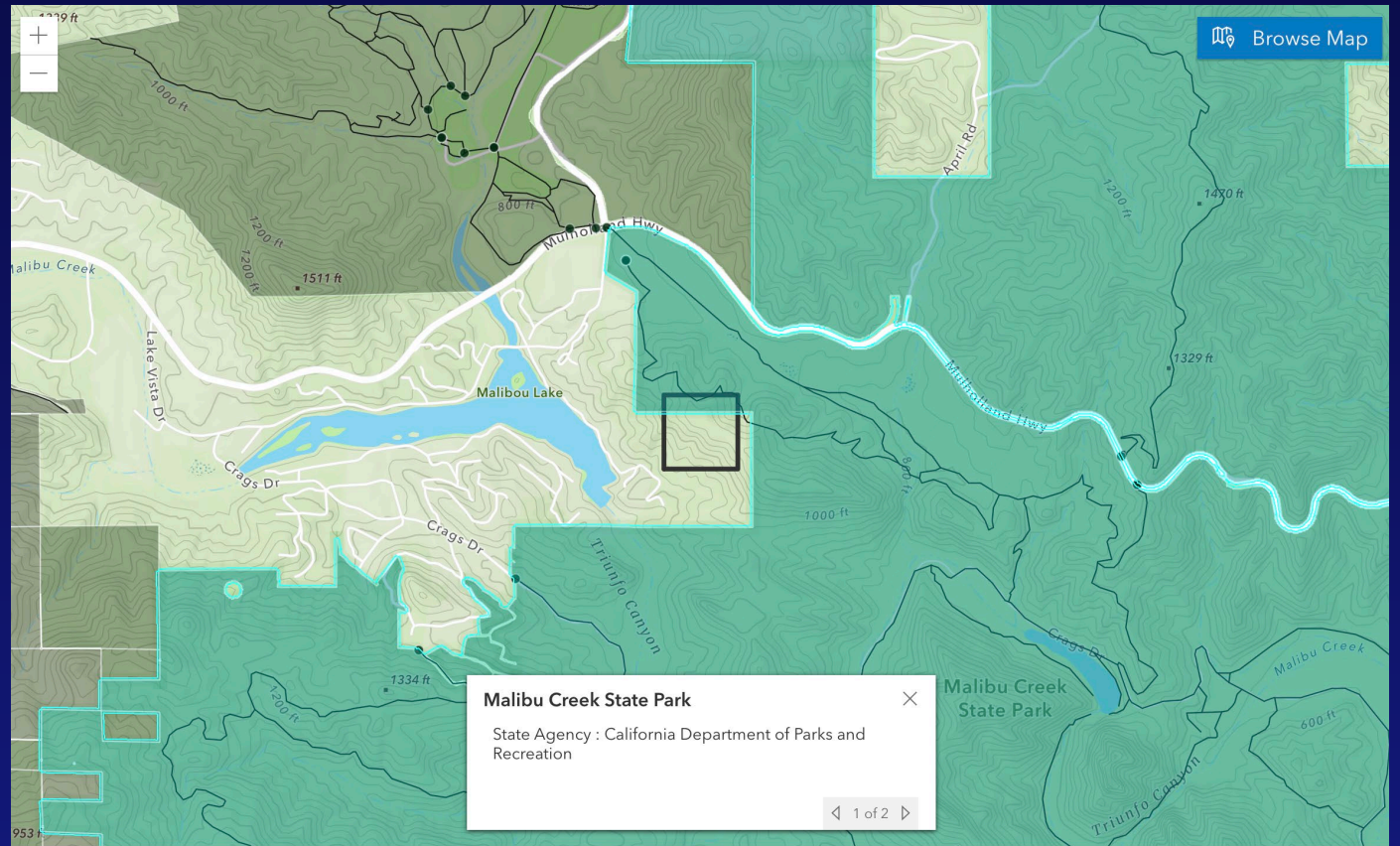
The screenshot displays a GIS interface. At the top, a topographic map shows contour lines and a highlighted area. A legend on the right lists 'Trailheads', 'Trails', and 'Parks and Open Space'. Below the map, a table titled 'Parks and Open Space' is shown, containing three rows of data. The table has columns for UNIT_ID, PARK_NAME, PARK_LBL, ACCESS_TYP, RPT_ACRES, and GIS_ACRES. A CSV icon is visible in the top right corner of the table area.

	UNIT_ID	PARK_NAME	PARK_LBL	ACCESS_TYP	RPT_ACRES	GIS_ACRES
■	12,497	Mountains Restor...	Mtns. Restoration...	Restricted Access	38.743	38.74195553
■	12,587	Rocky Oaks	Rocky Oaks	Open Access	192.331	192.3265848
■	3,390	Santa Monica Mo...	Santa Monica Mt...	Open Access	259.912	259.9070095

Navigate map data

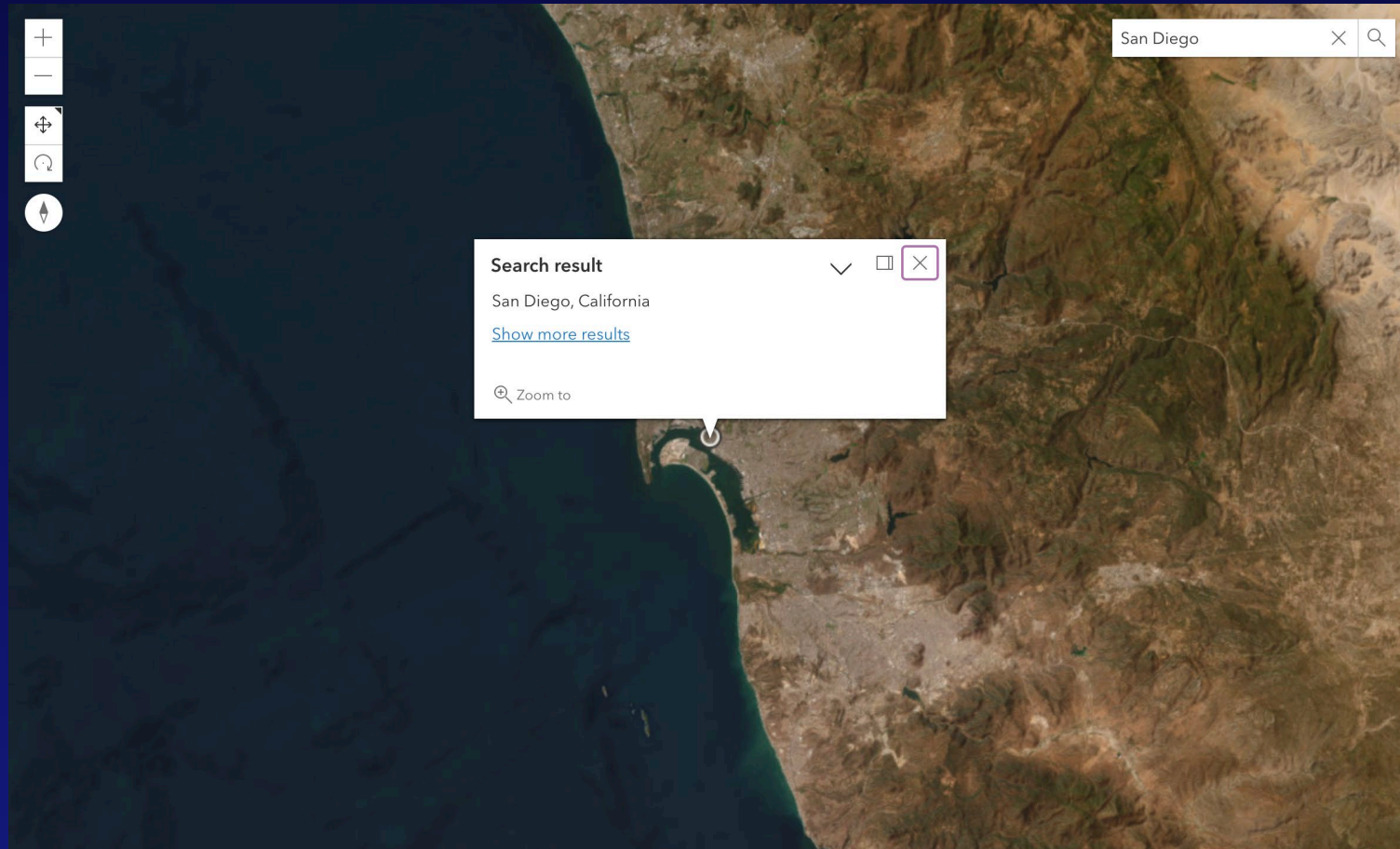
Support keyboard navigation

- 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

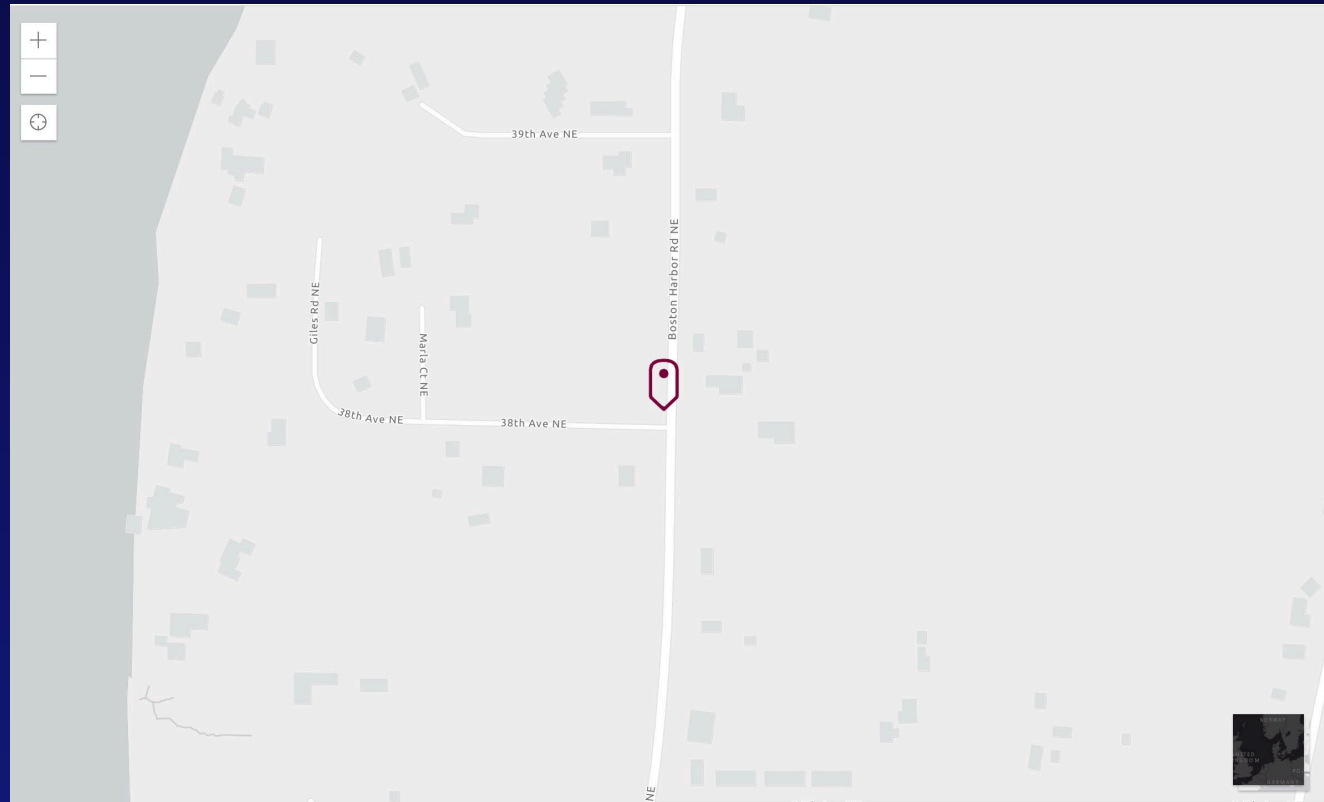
```
view.popup.goToOverride = goToOverride;

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(
  view.whenLayerView(layer)
  .then((layerView) => console.log(
    // If there were problems with
    .catch(console.error));
```

```
const view = new
  container: "vie
  map: map,
  environment: {
    lighting: {
      direct ShadowsEnabled
```

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

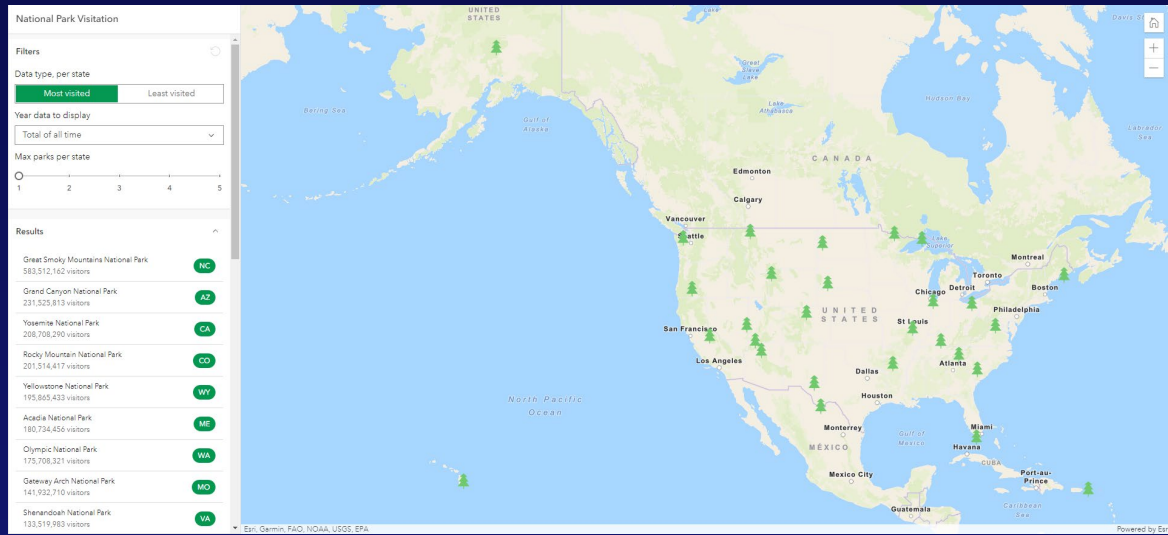
Testing tools

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

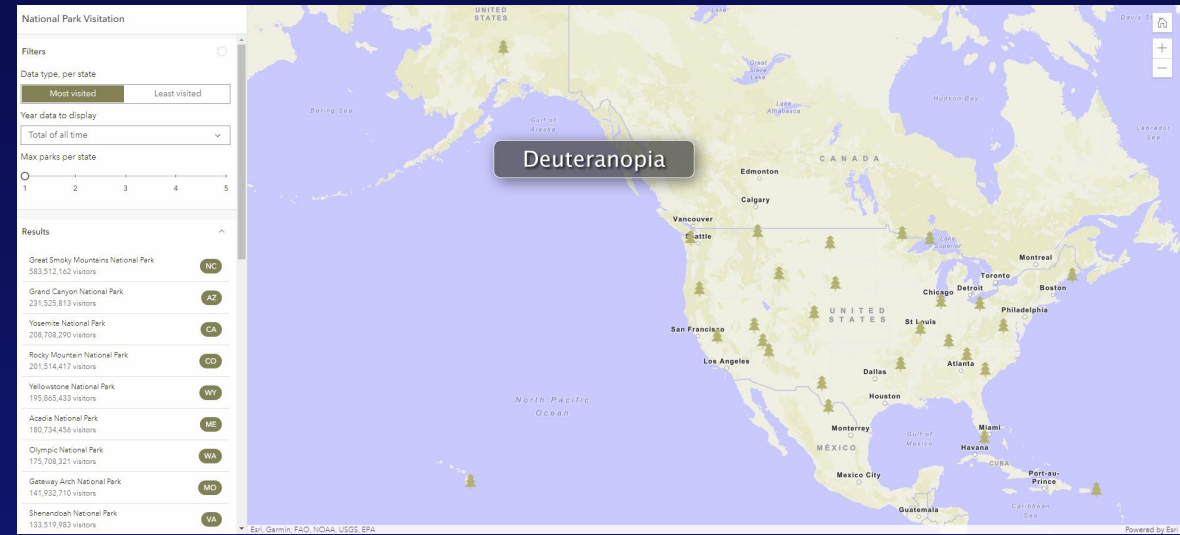


Color Oracle

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

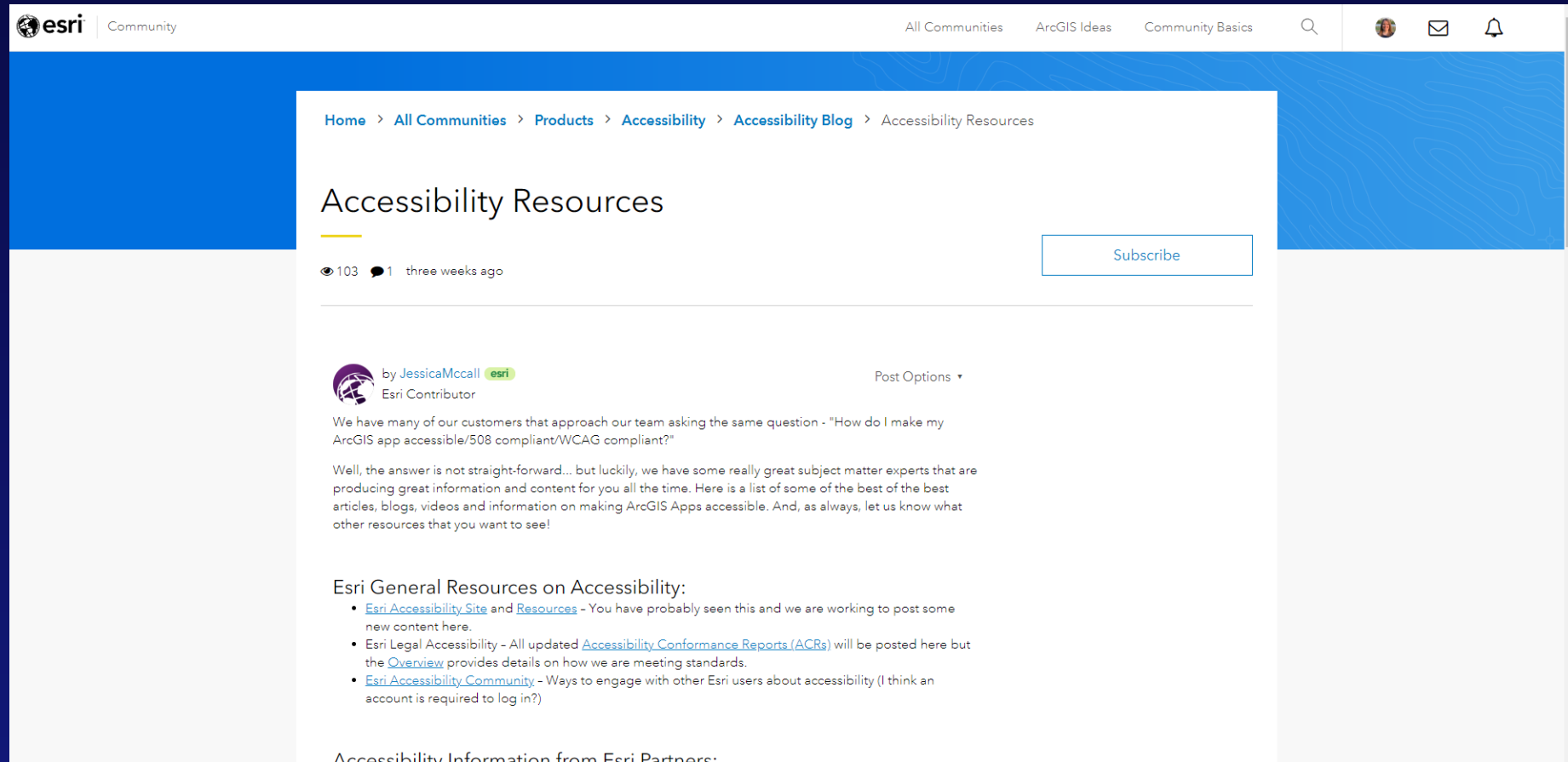
Accessibility resources

- 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 web browser displaying an Esri Community blog post. The page has a blue header with the Esri logo and navigation links. The main content area is white with a blue sidebar on the left. The post title is 'Accessibility Resources' and it includes a 'Subscribe' button. The author is identified as Jessica McCall, an Esri Contributor. The post text discusses resources for making ArcGIS apps accessible and lists several links for further information.

esri | Community

All Communities ArcGIS Ideas Community Basics

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

Accessibility Resources

103 1 three weeks ago [Subscribe](#)

by Jessica McCall esri Esri Contributor [Post Options](#)

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](#)

```
const layer = view.map.allLayers[0];
view.whenLayerView(layer)
.then(layerView => console.log('Layer view ready'))
.catch(console.error);
```

`</SCRIPT>`



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```
const view = new SceneView({
  container: "viewDiv",
  map: map,
  environment: {
    lighting: {
      direction: 0,
    }
  }
});
```

**LIVE
BY
THE
CODE**