



Forest Service  
U.S. DEPARTMENT OF AGRICULTURE

# ArcGIS Online Arcade

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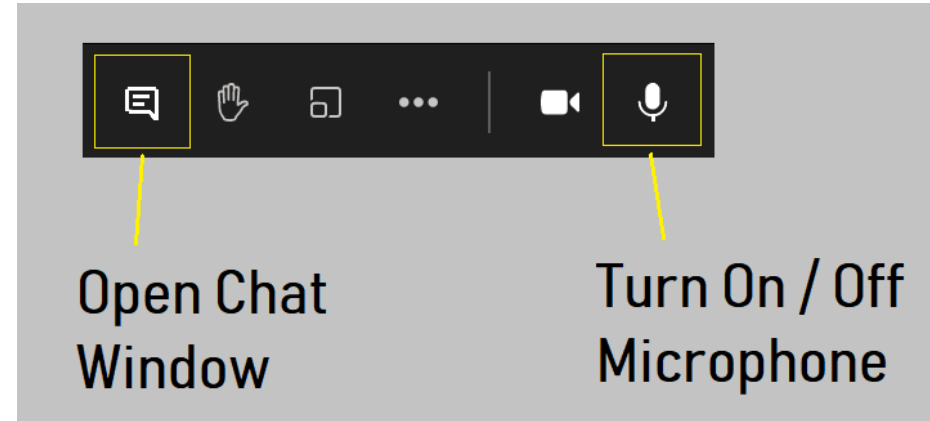


Geospatial Technology  
and Applications Center

# Housekeeping

## Teams

- Quick orientation on interface
- How to turn on Captioning
- Question or comment?
  - Un-mute
  - “Raise” your hand
  - Send a chat

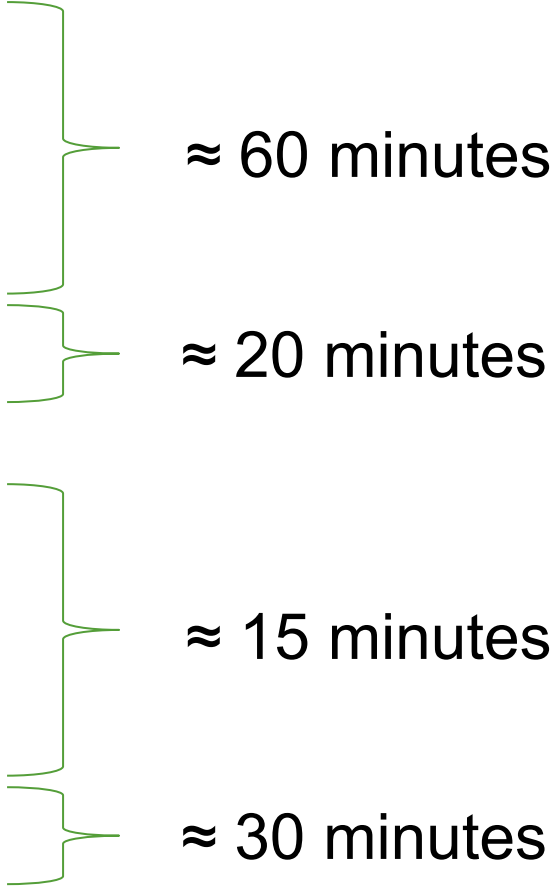


# Course Format & Learning Styles

- Many different learning styles: visual, auditory, kinesthetic, etc.
- Webinar format seeks to address a variety of learning styles
  - PPTs, live demonstrations, step-by-step exercises
  - Content may be repetitive for some people
  - Feel free skip formats that don't serve your learning style



# Course Overview

- Lesson
  - Demo 1 – Arcade Playground and Labeling
  - Exercise 1
  - Noon (MT): Demo 2 – Pop-ups and Visualizations
  - Exercise 2
- 
- | Activity   | Duration     |
|--|--------------|
| Lesson   | ≈ 60 minutes |
| Demo 1 – Arcade Playground and Labeling          |              |
| Exercise 1                                       | ≈ 20 minutes |
| • Noon (MT): Demo 2 – Pop-ups and Visualizations | ≈ 15 minutes |
| Exercise 2                                       |              |
|  | ≈ 30 minutes |

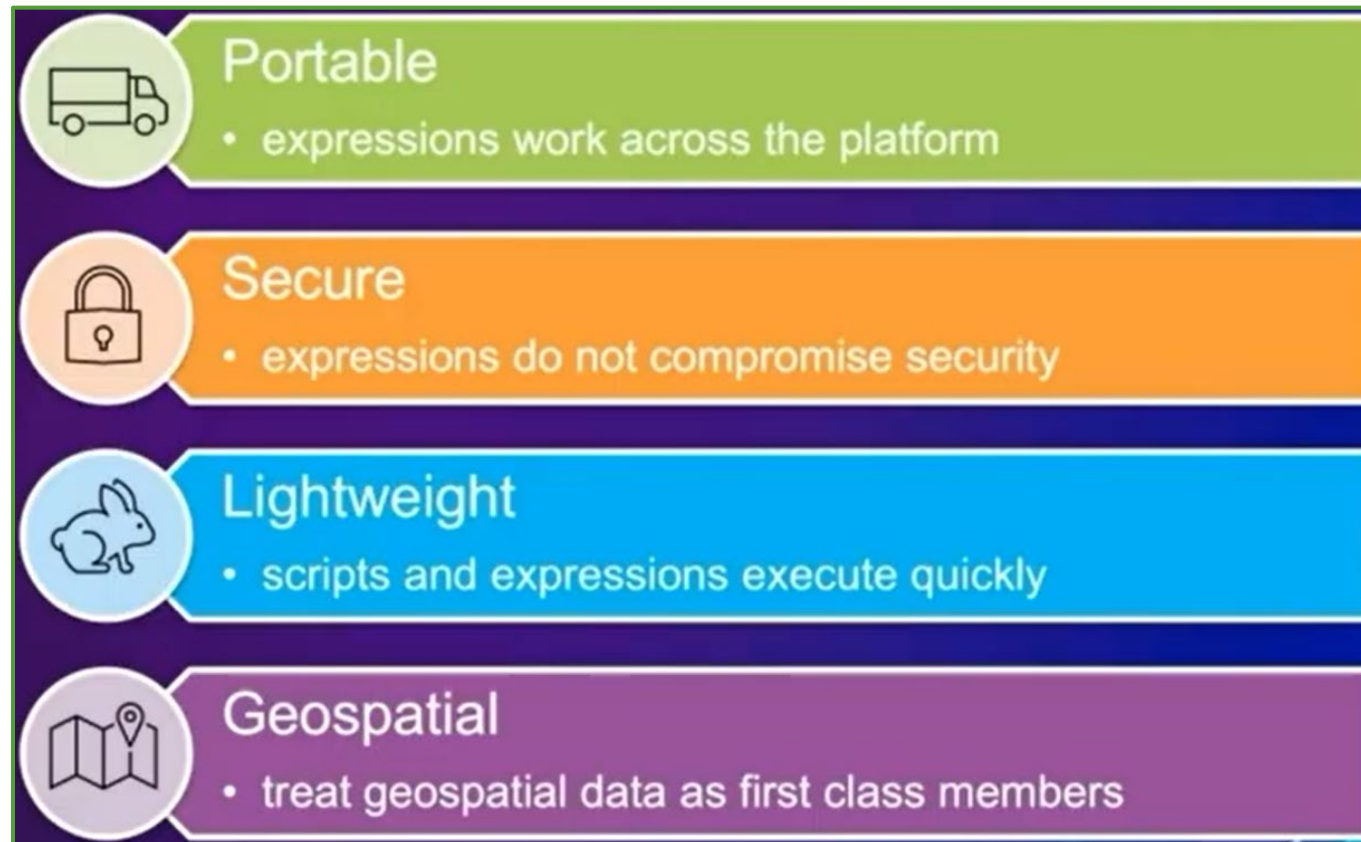


# Lesson Overview

- What is ArcGIS Arcade?
- Why use it?
- Profiles in AGOL
- Expressions, and workflow
- Arcade language basics
- Advanced functionality
- Tips
- Future improvements

# What is Arcade?

- “...a portable, lightweight, and secure expression language used to create custom content in ArcGIS applications”



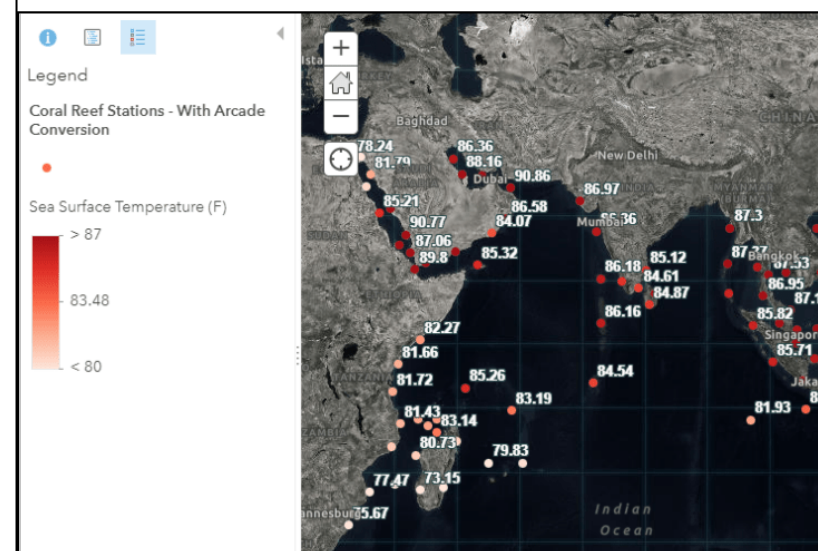
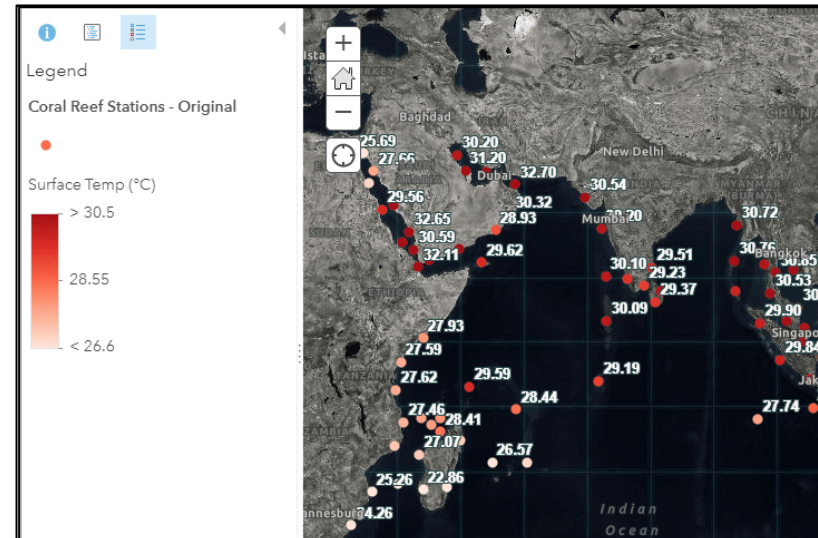
# Arcade is *not*....

- for writing standalone programs
  - Use it to write expressions
- a replacement for geoprocessing or automation
  - It can save you some steps, though!



# Why Use Arcade?

- Easy to get started
- On the fly calculations
  - Map will stay up to date even if your data changes
- Expressions can be used in downstream applications
- Examples:
  - Combine and format fields
  - Add new fields
  - Change data type and units
  - Perform calculations like Excel
  - Rotate symbols
  - And much more!



Sea Surface Temperature (F)

Expression

Test

```
1 $feature.sst * 1.8 + 32
2
3
4
```





# Arcade Profiles

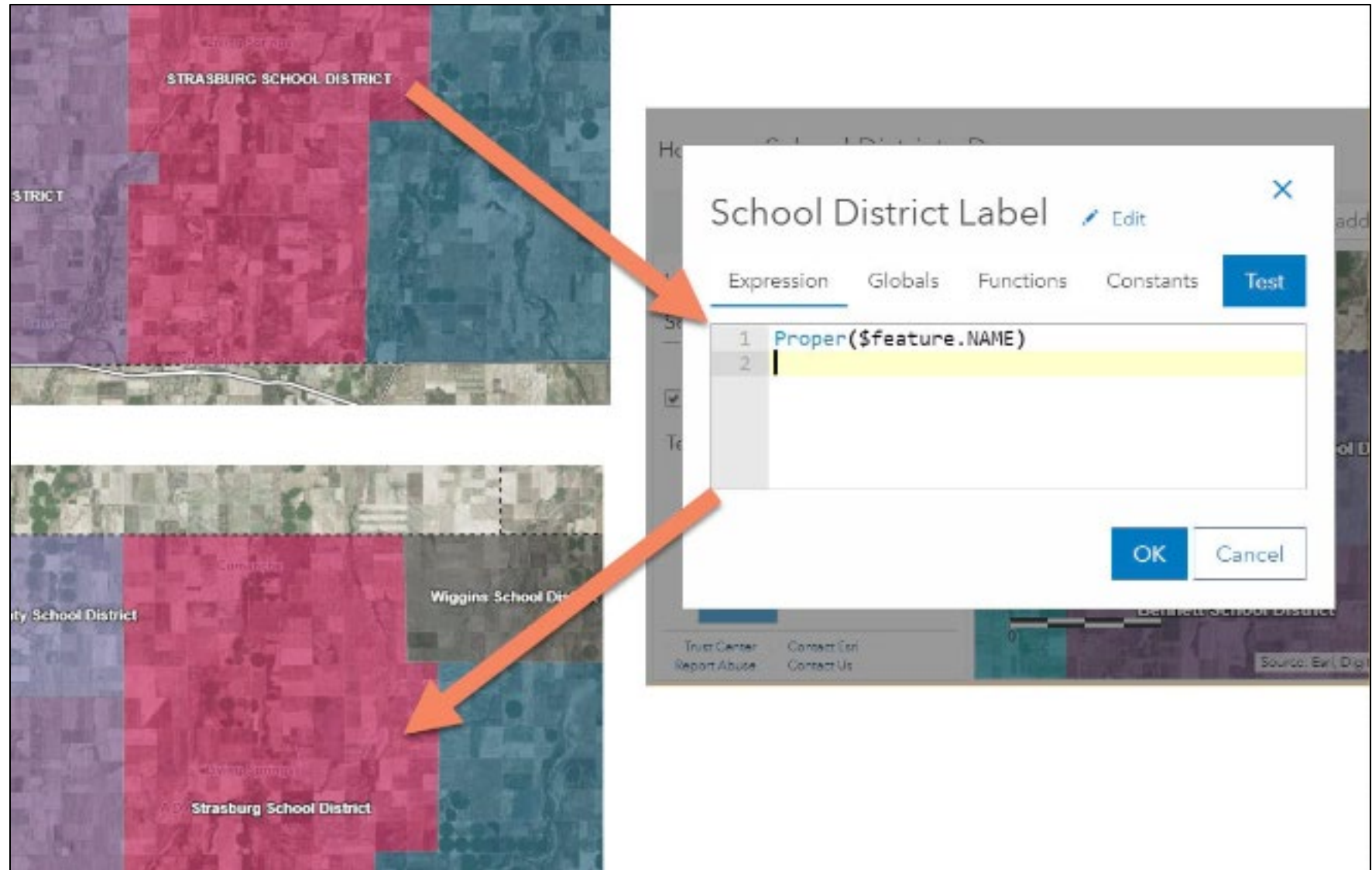


See the ArcGIS Arcade Guide: [Profiles](#)



- Formatting labels in AGOL

# Labeling Profile



The image shows a map of school districts with labels like "STRASBURG SCHOOL DISTRICT" and "Wiggins School District". An orange arrow points from the map to a configuration window titled "School District Label". The window has tabs for "Expression", "Globals", "Functions", and "Constants". The "Expression" tab is active, showing a list of expressions with "1 Proper(\$feature.NAME)" selected. At the bottom of the window are "OK" and "Cancel" buttons. Another orange arrow points from the bottom of the configuration window back to the map.

School District Label

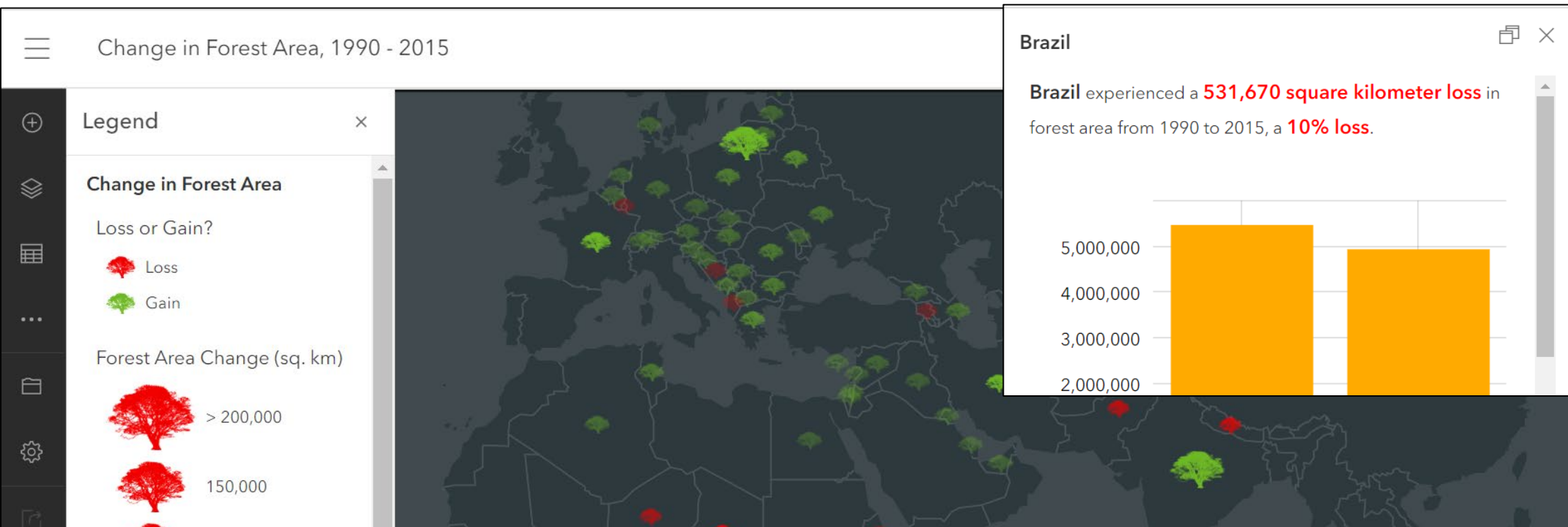
Expression Globals Functions Constants Test

1 Proper(\$feature.NAME)

2

OK Cancel

# Pop-up Profile



Gain

Edit

Expression

Test

```
1 var difference = text(Abs($feature.F2015-$feature.F1990), "square kilometer change");
2 var change = $feature.F2015-$feature.F1990;
3
4 When (change > 0, difference + " square kilometer gain", null)
```

Loss

Edit

Expression

Test

```
1 var difference = text(Abs($feature.F2015-$feature.F1990), "square kilometer change");
2 var change = $feature.F2015-$feature.F1990;
3
4 When (change < 0, difference + " square kilometer loss", null)
```

# Visualization Profile

- Pair and rotate symbols



First Symbol



Second Symbol



Composite Symbol

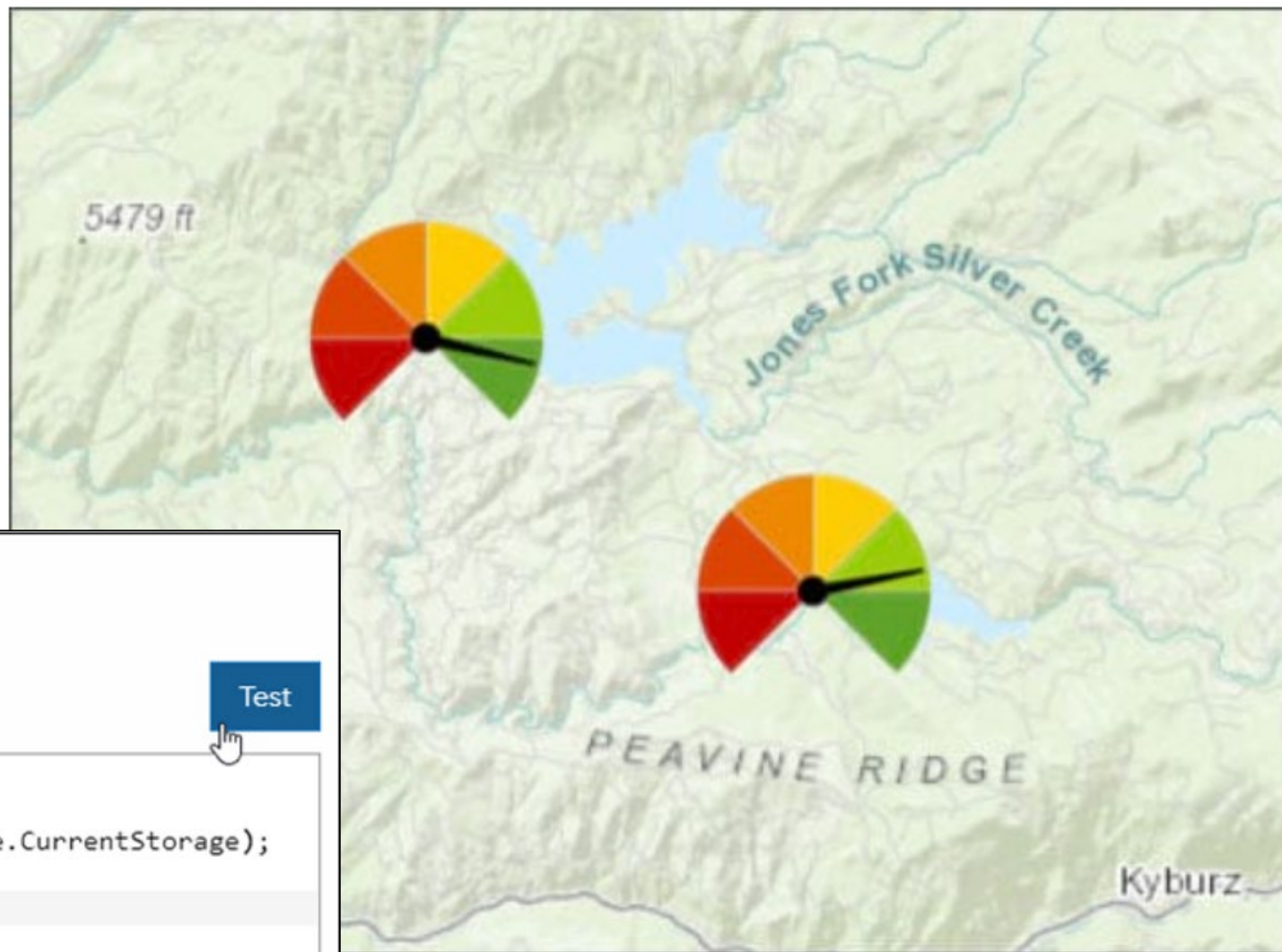
## Calculate Rotation

[Edit](#)

Expression

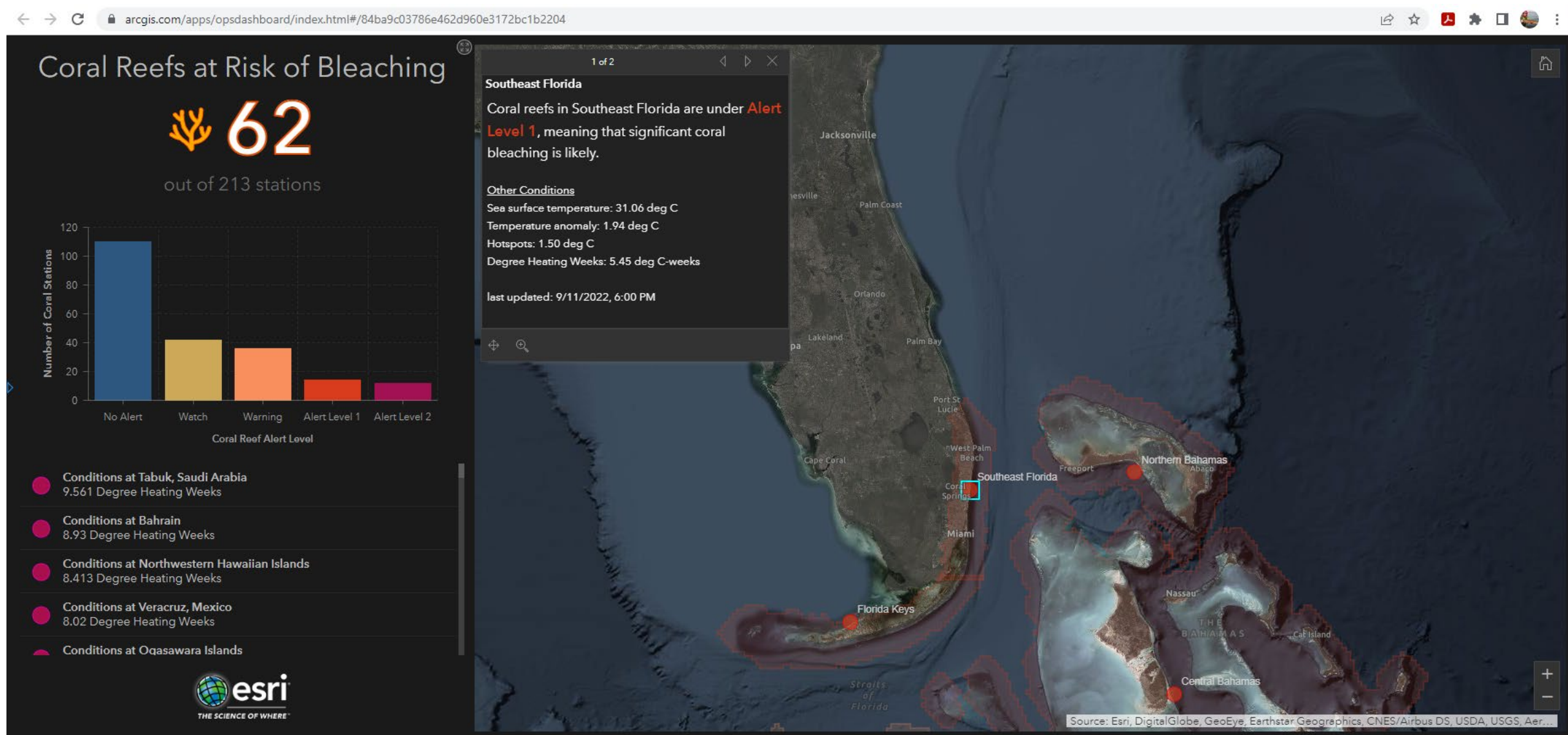
```
1 var percent_capacity = 0;  
2 var integer_capacity = 0;  
3 percent_capacity = ($feature.TotalCapacity / $feature.CurrentStorage);  
4 integer_capacity = (percent_capacity * 100);  
5 return integer_capacity;
```

Test



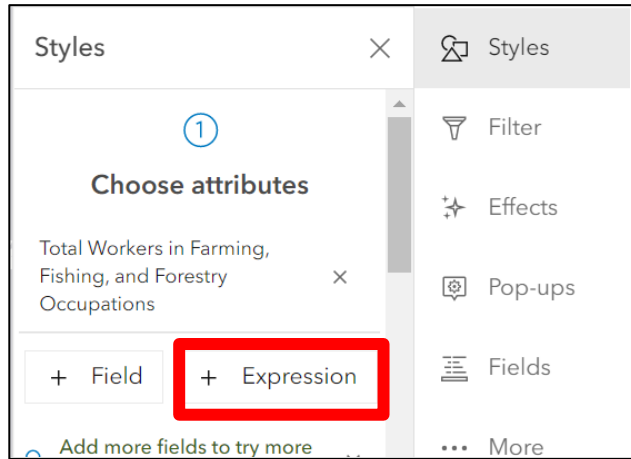


# Dashboard Profile

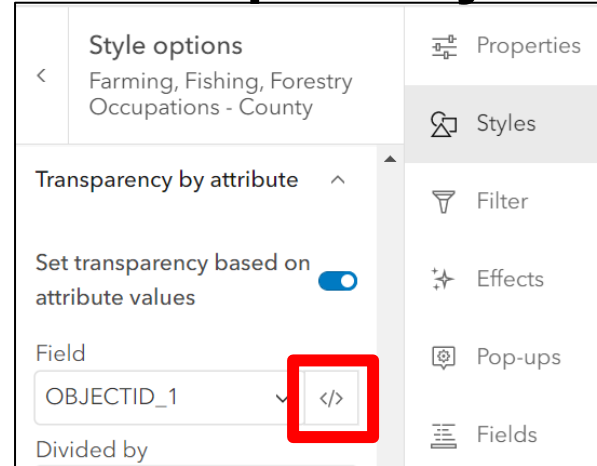


# Opening the Arcade Editor

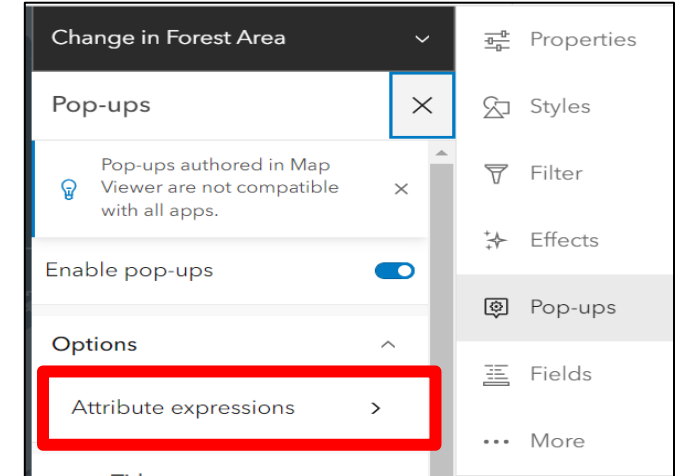
## Symbology



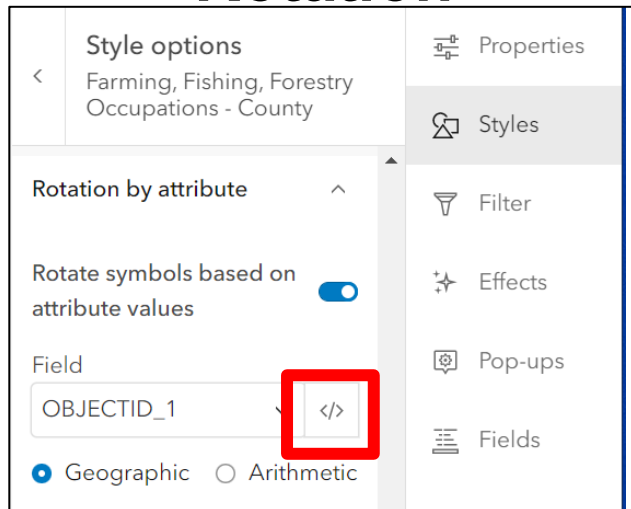
## Transparency



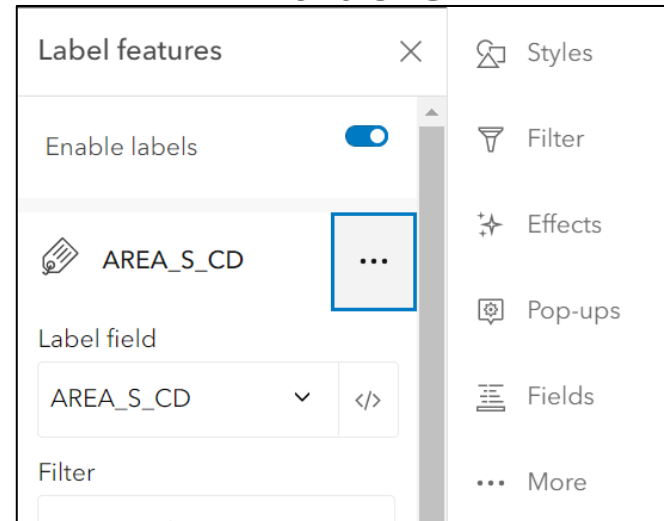
## Pop-ups



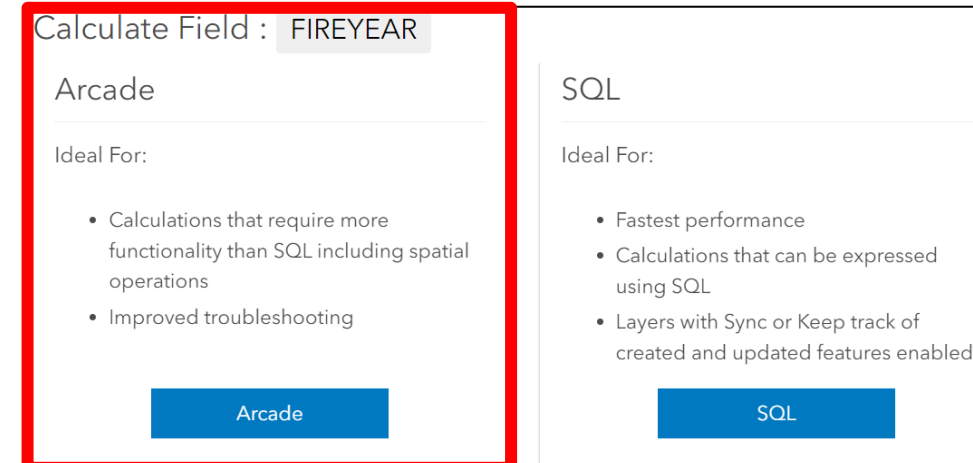
## Rotation



## Labels

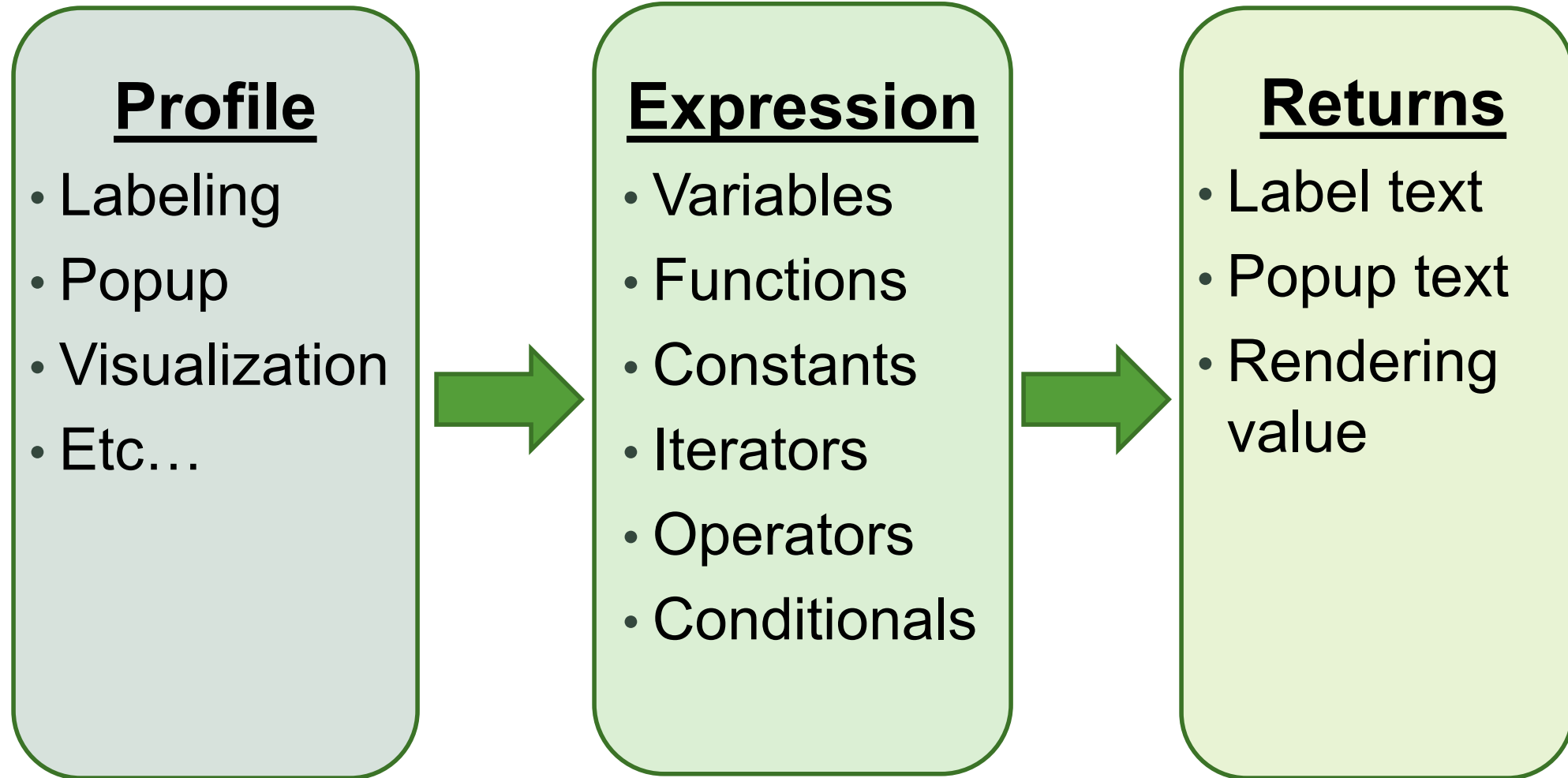


## Calculate Field Values





# Arcade Workflow



# Variables

Local variable X  
declared and assigned  
to integer value

```
var x = 10;
```

```
return x; // returns 10
```

Variable X re-assigned  
to new string value

```
x = "hello";
```

```
return x; // returns "hello"
```





# Variable Data Types

## Data types

**Array**      `var label = [NAME, TEMP, WIND, RH];`

**Boolean**    `var RAINING = true;`

**Date**        `var today = Date(2021, 7, 12);`

**Dictionary** `var WIND = Dictionary("Speed", 10,  
                          "DIRECTION", "southwest");`

**Number**     `var TEMP = 65;`

**Text**        `var NAME = "Mt. Rainier"`

## ArcGIS specific data types

Attachment

Feature

FeatureSet

FeatureSetCollection

Geometry

Portal

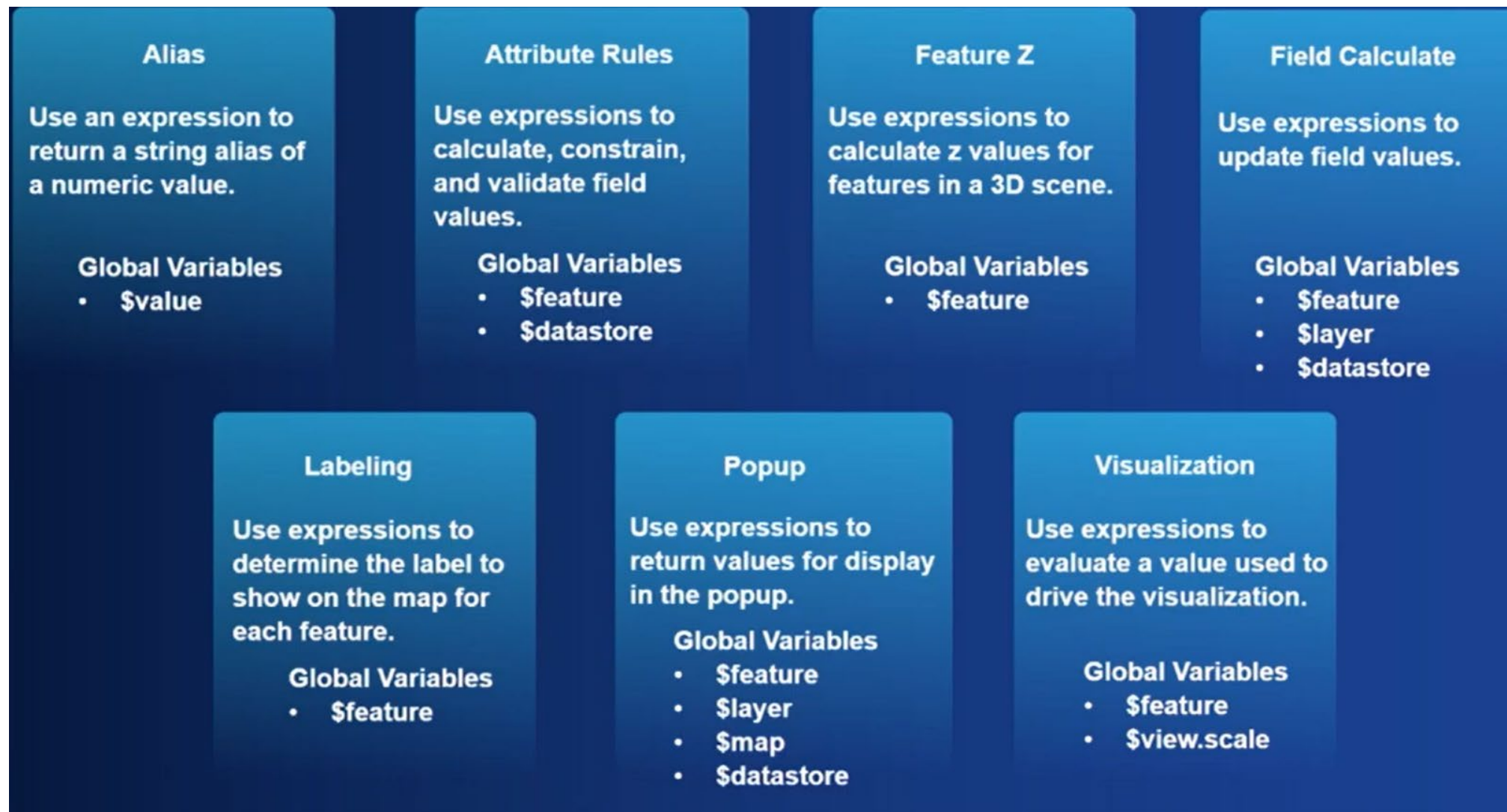
# Global Variables

The screenshot shows a software interface with a top navigation bar containing 'Expression', 'Test', 'Globals', 'Functions', and 'Constants'. The 'Globals' tab is highlighted with a red border. Below the tabs, a dropdown menu is set to 'Popup'. A list of fields is displayed on the right, each with a label and a corresponding global variable name. A blue callout box with the text 'Fields of your data appear here' points to this list.

Field Label	Global Variable
Field: Base Elevation	<code>\$feature.BASEELEV</code>
Field: Building Height	<code>\$feature.BLDGHEIGHT</code>
Field: Building Identifier	<code>\$feature.BUILDINGID</code>
Field: Eave Height	<code>\$feature.EAVEHEIGHT</code>
Field: Facility Site Code	<code>\$feature.FEATURECODE</code>



# Global Variables and Profiles





# Local and Global Variables

```
var DEG = $feature.WIND_DIRECT
```

Declares  
variable

Name of  
variable

Global with  
reference to  
field within a  
feature

# Functions

Expression

Test

Globals **Functions** Constants

Filter by Name

Abs

Acos

All

Angle

1 Angle(pointA, pointB)

View the complete function reference at  
<https://developers.arcgis.com/arcade/function-reference/>

[Return to function list](#)

Angle ( pointA , pointB ) returns { Number }

Returns the arithmetic angle of a line between two points in degrees (0 - 360). The angle is measured in a counter-clockwise direction relative to east. For example, an angle of 90 degrees points due north. Only the x-y plane is considered for the measurement. Any z-coordinates are ignored. Point features can be used instead of any or both Point geometries. *If the points are identical, then an angle of 0 degrees is returned.* See [bearing](#).

Name	Type	Description
pointA	Point / Feature	The first Point or Feature used to calculate the angle.
pointB	Point / Feature	The second Point or Feature used to calculate the angle.

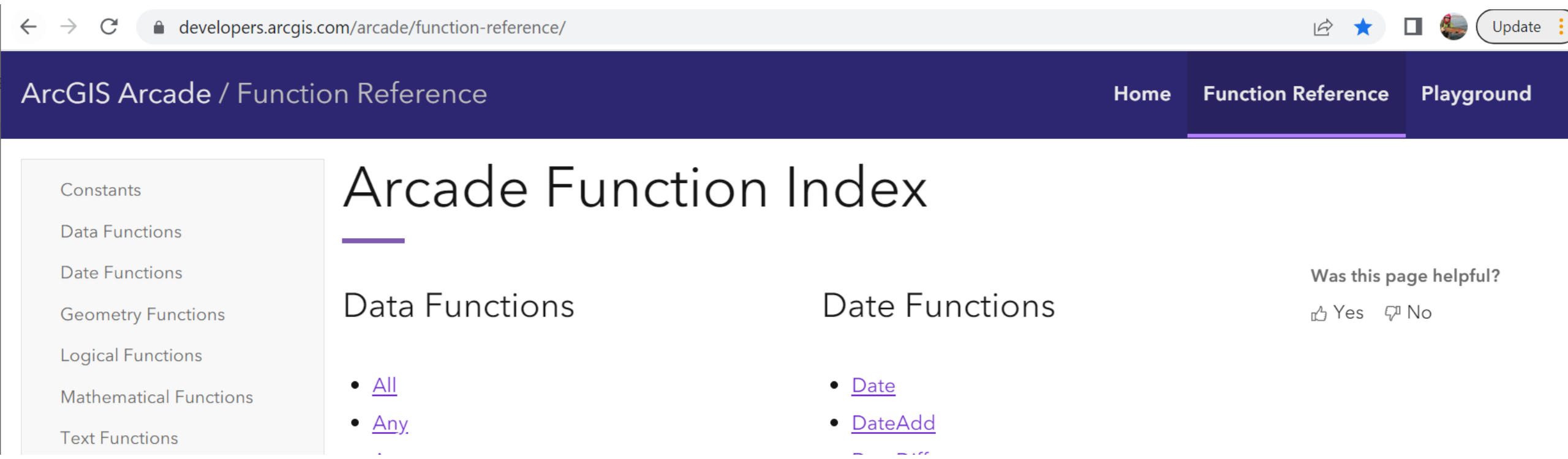


# Functions

View the complete function reference at

<https://developers.arcgis.com/arcade/function-reference/>

- Not all functions designed for all profiles



The screenshot shows the ArcGIS Arcade Function Reference page. The browser address bar displays the URL <https://developers.arcgis.com/arcade/function-reference/>. The page has a dark blue header with the title "ArcGIS Arcade / Function Reference" and navigation links for "Home", "Function Reference" (which is active), and "Playground". On the left, a sidebar lists function categories: Constants, Data Functions, Date Functions, Geometry Functions, Logical Functions, Mathematical Functions, and Text Functions. The main content area is titled "Arcade Function Index" and is divided into two columns: "Data Functions" and "Date Functions". The "Data Functions" column lists links for "All" and "Any". The "Date Functions" column lists links for "Date" and "DateAdd". In the bottom right corner, there is a feedback section titled "Was this page helpful?" with "Yes" and "No" buttons.

← → ↺ 🔒 developers.arcgis.com/arcade/function-reference/ 🔗 ★ 📱 🌐 Update

ArcGIS Arcade / Function Reference Home Function Reference Playground

## Arcade Function Index

Constants

Data Functions

Date Functions

Geometry Functions

Logical Functions

Mathematical Functions

Text Functions

### Data Functions

- [All](#)
- [Any](#)

### Date Functions

- [Date](#)
- [DateAdd](#)

Was this page helpful?

👍 Yes 👎 No



# Function Example

**Filter**(\$feature, "class = 'sensitive'")

Function

Current  
feature

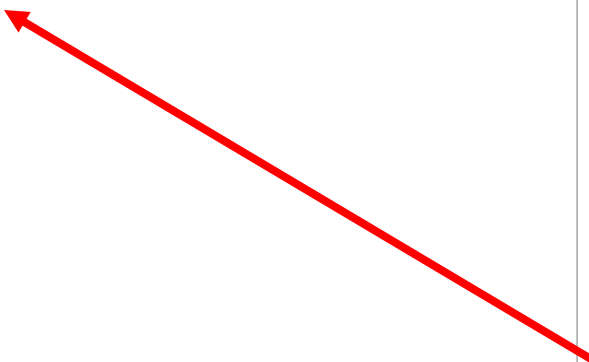
Function  
parameter

# Constants

Expression Test Globals Functions Constants

1 \$feature.FIRENAME + TextFormatting.NewLine + \$feature.FIREYEAR

Infinity  
PI  
TextFormatting.BackwardSlash  
TextFormatting.DoubleQuote  
TextFormatting.ForwardSlash  
TextFormatting.NewLine  
TextFormatting.SingleQuote



Result →





# Conditional Statements

```
1 if(x > 2){  
2     return "High"  
3 }  
4 else{  
5     return "Low"  
6 }  
7
```

```
1 IIf(x > 2, "High", "Low")  
2
```

```
1 When(x > 2 && x < 10, "Medium",  
2     x <= 2, "Low",  
3     "High")
```

# Iterators

Iterator

Iteration  
condition

```
for(var i=1; i<100; i++) {  
    if (i==3) continue;  
  
    if (i==5) break;  
    n+=i;  
}
```



# Operators

<div><div>← → ↺</div><div>🔒 developers.arcgis.com/arcade/guide/logic/</div></div>				
ArcGIS Arcade			Home	Function
<div>Getting Started</div> <div>Release Notes</div> <div>• Structure and logic</div> <div>Type System</div> <div>Profiles</div> <div>Version Matrix</div> <div>FAQ</div>	/=	Divide assign	Divides a number variable by a number and assigns the result to the variable.	<code>x /= 2</code>
	++	Increment by one	Increments a number variable by one.	<code>x++</code> or <code>++x</code>
	--	Decrement by one	Decrements a number variable by one.	<code>x--</code> or <code>--x</code>
		Logical or	Returns <code>true</code> if one of two conditions is true.	<code>x    y</code>
	&&	Logical and	Returns <code>true</code> if both given conditions are true.	<code>x &amp;&amp; y</code>
	!	Logical not	Returns <code>true</code> if the statement is false.	<code>!x</code>
	==	Equal to	Evaluates if the two given variables are equal to each other.	<code>x == y</code>
	!=	Not equal to	Evaluates if the two given variables are not equal to each other.	<code>x != y</code>

Mathematical --- + - \* /

Increment --- i++ j--

Comparison --- == != > <

Logical --- && ||



# Arcade basics

- Semi-colons at end of statements
- Return statements only required for custom functions
- Case insensitive

```
1  //This is a single line comment
2
3  /*
4   This is a multi-
5   line comment
6  */
7
8  var x = 10;
9  var y = 100;
10 return x*y;
```

# Labeling Expression

output value

function

variable

operator

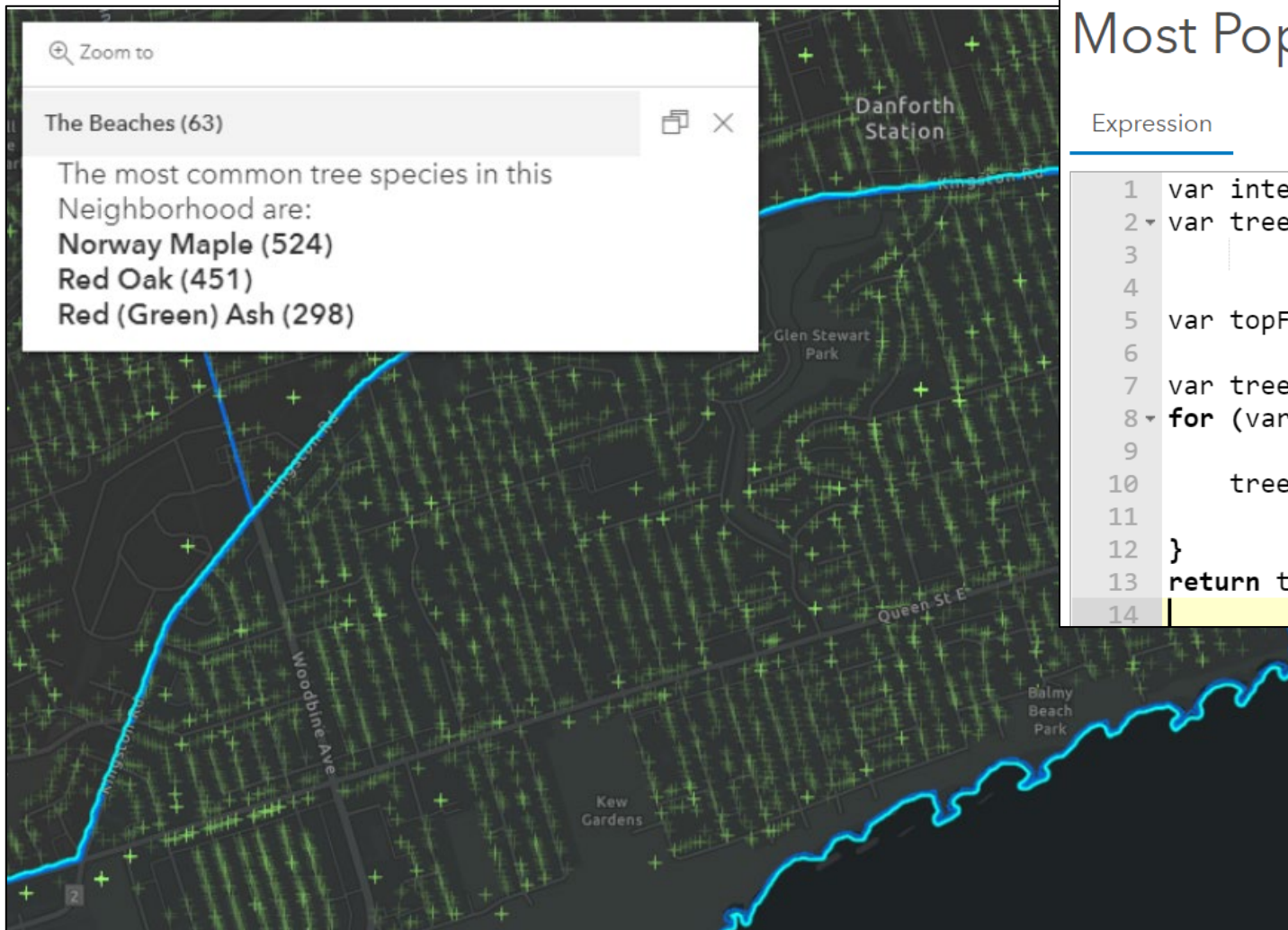
constant

literal

```
1 var label = Trim($feature.Station_Name +  
2  
3 Textformatting.Newline + Round($feature.TEMP,0) +  
4  
5 'F' + Textformatting.Newline + $feature.R_Humidity +  
6  
7 '%RH'
```



# GroupBy function



## Most Popular Trees [Edit](#)

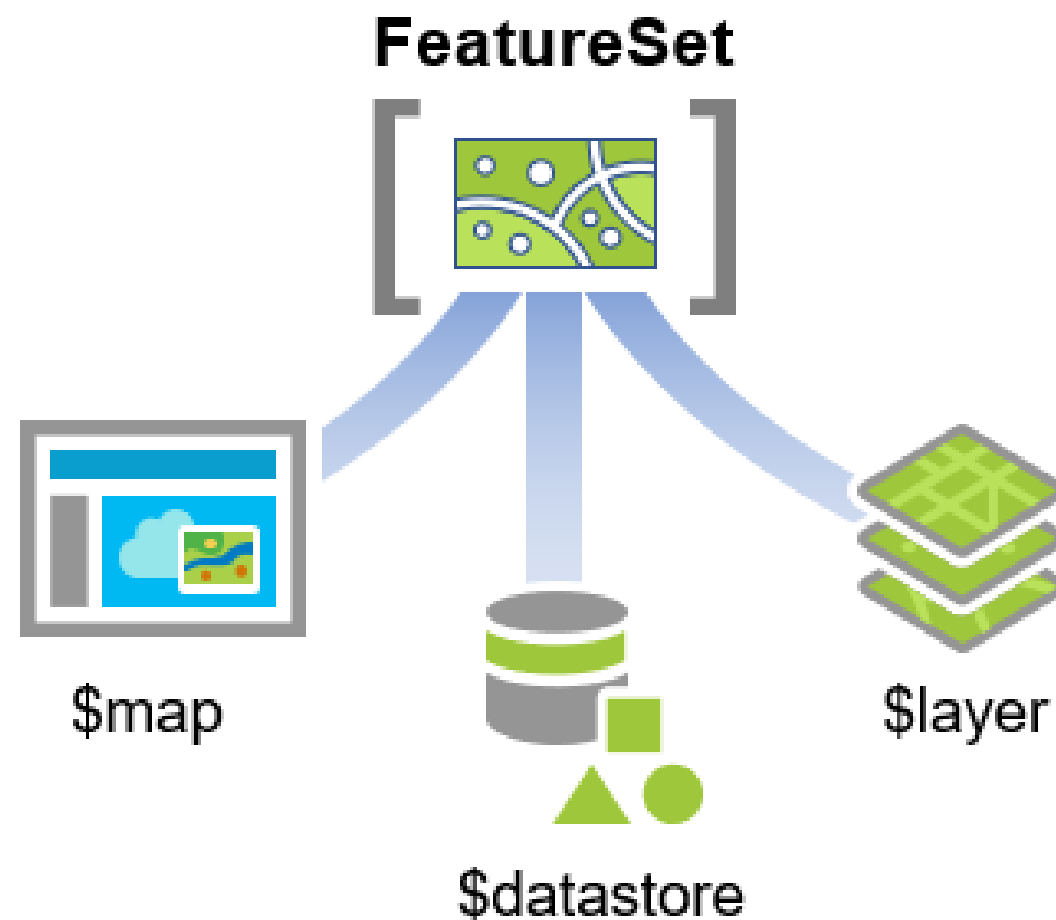
Expression

Test

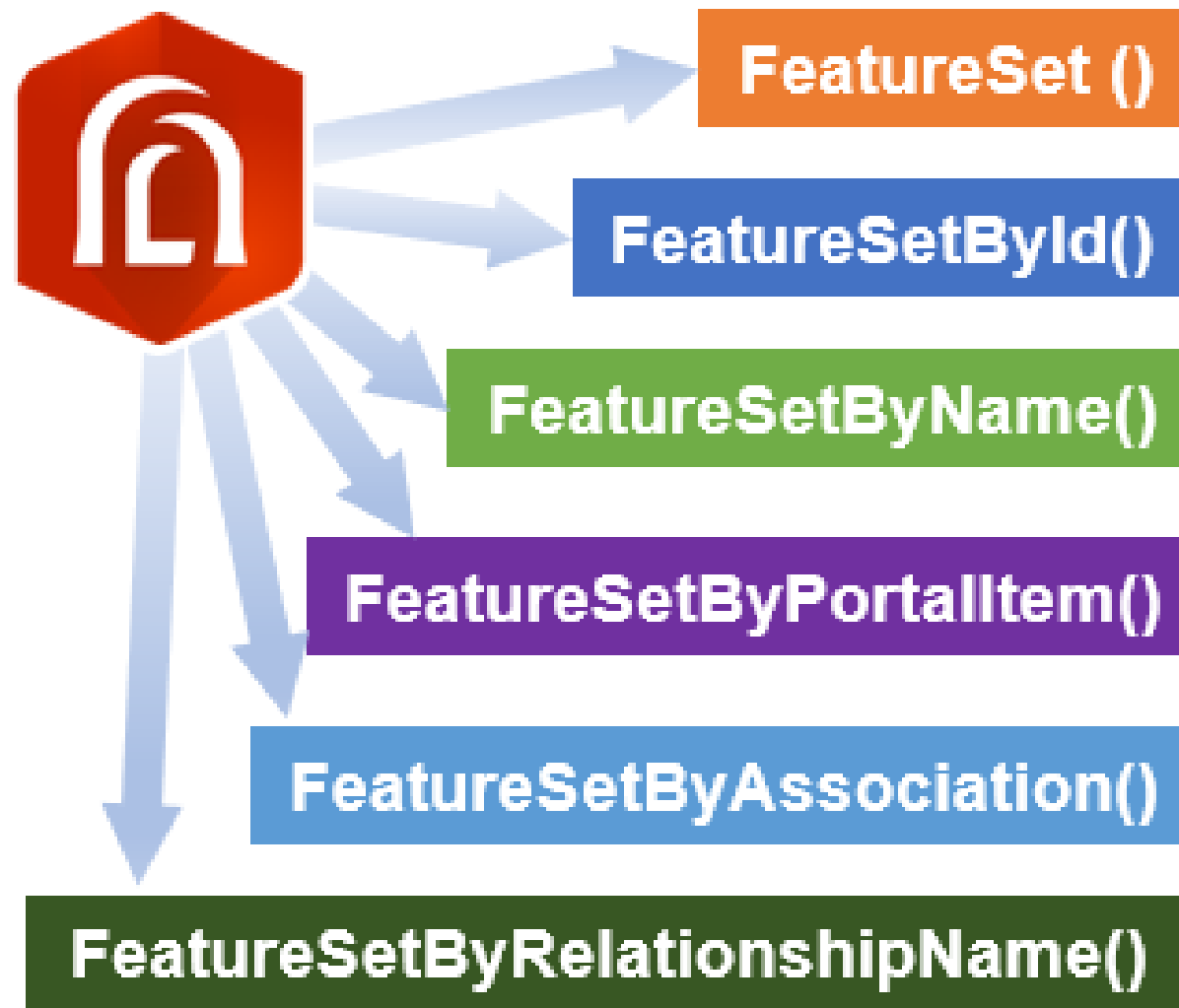
```
1 var intersectArea = Intersects(FeatureSetByName($map, "Urban Fo
2 var treeList = groupBy(intersectArea, "COMMON_NAM",
3 | | | {name:"count", expression:"COMMON_NAM", stati
4
5 var topFeatures = Top(OrderBy(treeList, "count DSC"),3)
6
7 var treeList = ''
8 for (var topFeature in topFeatures) {
9
10     treeList += Proper(topFeature.COMMON_NAM) + " (" + topFeat
11
12 }
13 return treeList
14
```

# Arcade FeatureSet

- Access information from multiple features
  - From same layer or any layer within your map (\$map) or service (\$datastore)
  - Spatially or attribute-driven
  - Work with data that is related informally or formally



# FeatureSet Functions







# Example of FeatureSetByName function syntax

```
var features = FeatureSetByName($map,'Hiking trails', ['Trail name', 'Difficulty', 'Length'], True);  
Return features;
```

Function parameter	Example
featureSetCollection	\$map
title	'Hiking trails'
fields	['Trail name', 'Difficulty', 'Length']
includeGeometry	True

For more information about the function, please review the syntax in the [ArcGIS Arcade Playground](#)

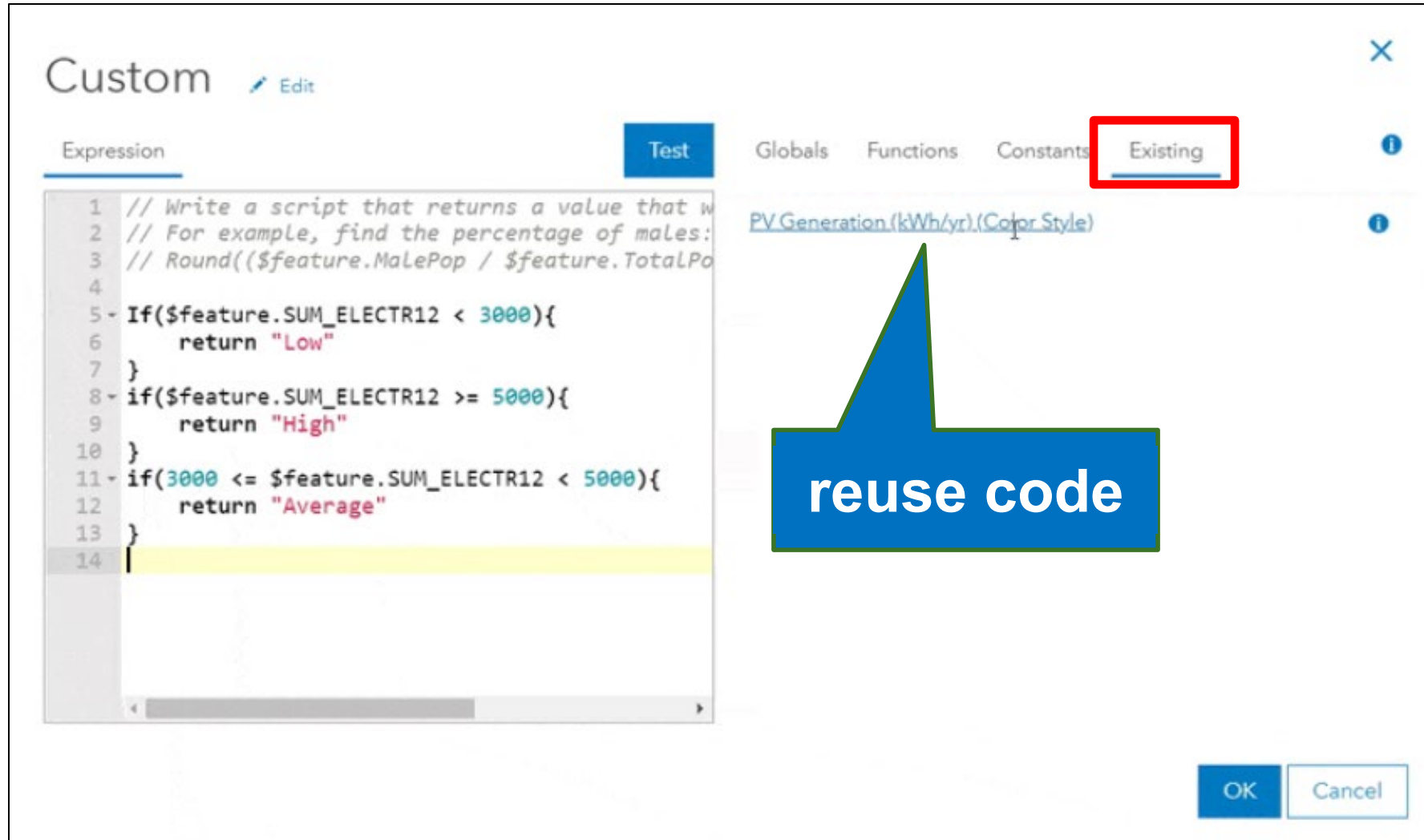


# User Defined Functions

```
function adder(x, y) {  
    var result = x+y;  
    return result*10;  
}
```

```
adder(10,2);
```

# Existing tab



# Other useful functionality

- Access image attachments and joined tables
- Complex calculations such as an index created from multiple fields
- Render based on geographic relationships

## Attachment


Defines information about attachments returned from feature service queries. These are fetched using the [Attachments\(\)](#) function.


Property	Type	Description
id	<a href="#">number</a>	The ID of the attachment.
name	<a href="#">string</a>	The file name of the attachment including the file extension.
contentType	<a href="#">string</a>	The content type of the attachment. The following are supported types: <code>bmp, ecw, emf, eps, ps, gif, img, jp2, jpc, j2k, jpf, jpg, jpeg, jpe, png, psd, raw, sid, tif, tiff, wmf, wps, avi, mpg, mpe, mpeg, mov, wmv, aif, mid, rmi, mp2, mp3, mp4, pma, mpv2, qt, ra, ram, wav, wma, doc, docx, dot, xls, xlsx, xlt, pdf, ppt, pptx, txt, zip, 7z, gz, gtar, tar, tgz, vrml, gml, json, xml, mdb, geodatabase</code> .
size	<a href="#">number</a>	The size of the attachment in bytes.

# ArcGIS Arcade Playground

← → ↻ 🔒 developers.arcgis.com/arcade/playground/



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ArcGIS Arcade / Playground

Home

Function Reference

**Playground**

Expression

**Test**

Globals

Functions

Constants



```
1 var x = 10;|
```

```
2
```

```
3
```

Default Profile



# Arcade Troubleshooting Tools

- Test button

The screenshot displays the Arcade Troubleshooting Tools interface. On the left, the 'Expression' tab is active, showing the formula `Count($layer) + $feature.BASEELEV`. A red arrow points from the 'Test' button to the 'Results' table. The 'Results' table has two columns: 'Result' and 'Value'. The first row shows the result of the expression as 68433. On the right, the 'Globals' tab is active, showing a dropdown menu with 'Popup' selected. Below this, a list of fields is displayed: '\$feature', 'Field: Base Elevation', '\$feature.BASEELEV', 'Field: Building Height', '\$feature.BLDGHEIGHT', 'Field: Building Identifier', '\$feature.BUILDINGID', 'Field: Eave Height', and '\$feature.EAVEHEIGHT'. A red box highlights the '\$feature.BASEELEV' field, and a red arrow points from it to the 'Value' column in the 'Results' table.

Expression

1 `Count($layer) + $feature.BASEELEV`

Test

Globals Functions Constants

Popup

← Back

\$feature

Field: Base Elevation  
\$feature.BASEELEV

Field: Building Height  
\$feature.BLDGHEIGHT

Field: Building Identifier  
\$feature.BUILDINGID

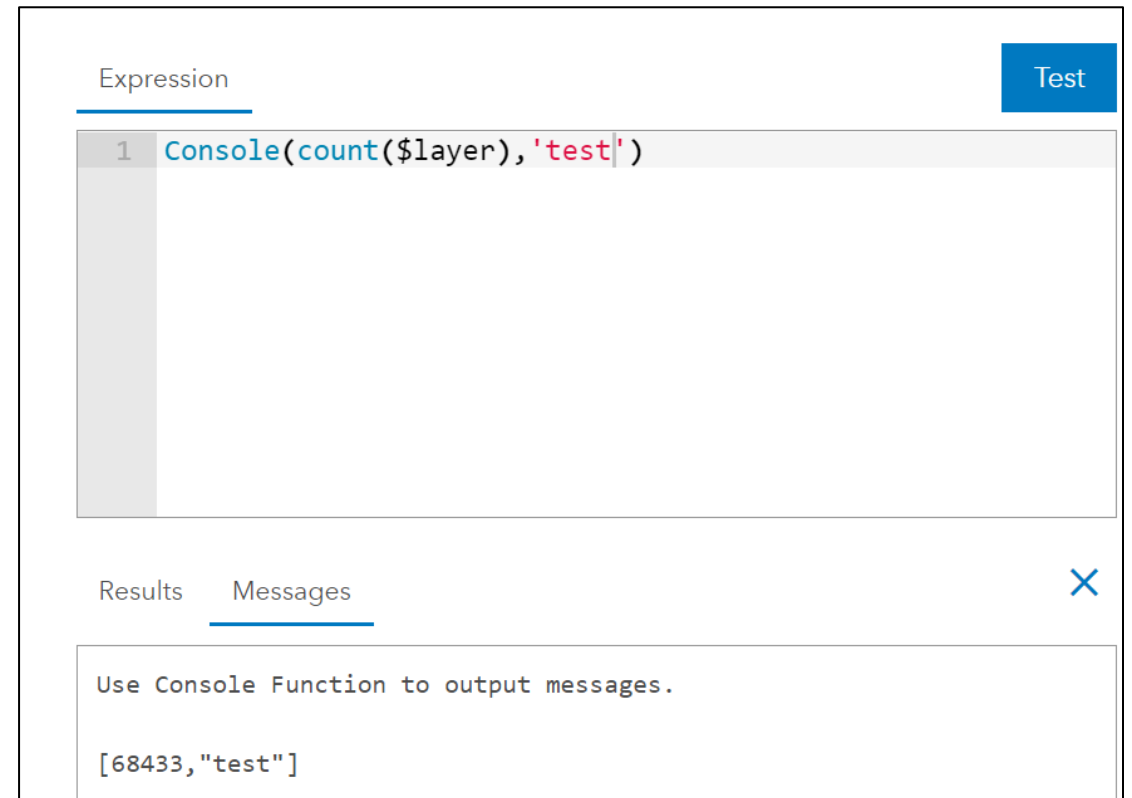
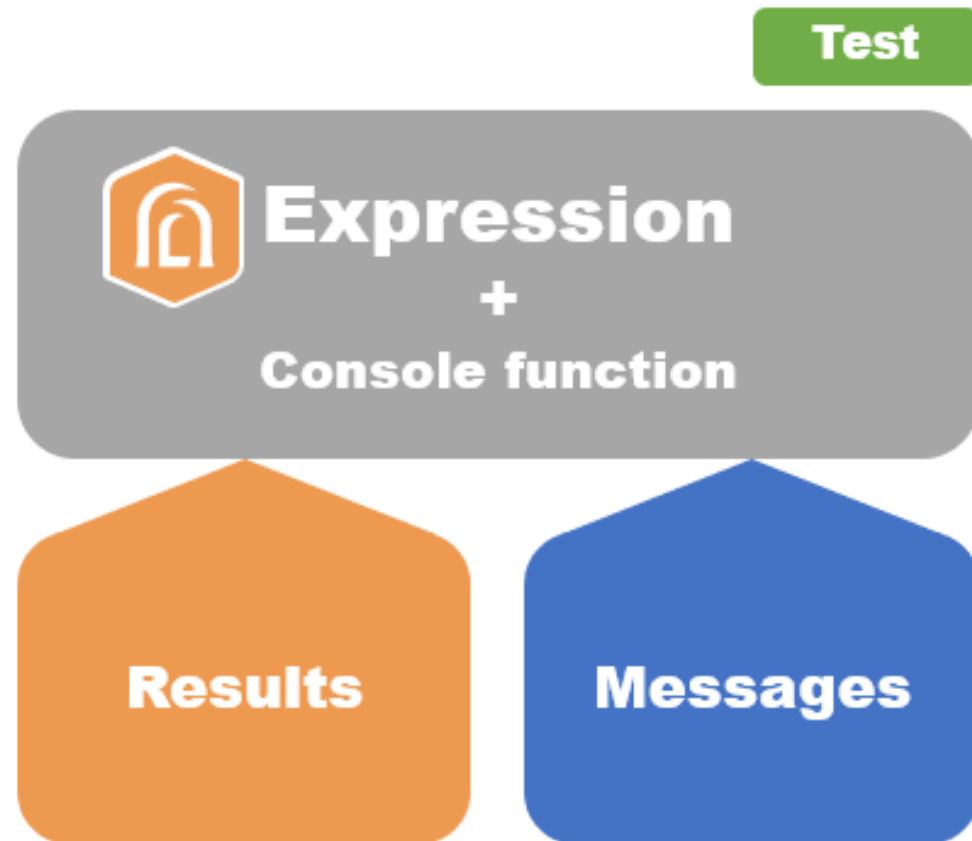
Field: Eave Height  
\$feature.EAVEHEIGHT

Results Messages

Result	Value
Result	68433

# Arcade Troubleshooting Tools

- Console function





# Version Matrix

- Make sure you are using the right Arcade version
- <https://developers.arcgis.com/arcade/guide/version-matrix/>

Arcade	<a href="#">ArcGIS Pro</a>	<a href="#">ArcGIS Enterprise server</a>	<a href="#">ArcGIS Enterprise portal</a>	<a href="#">ArcGIS API for JavaScript</a>	<a href="#">ArcGIS Runtime</a>
<a href="#">1.18</a>	3.0	n/a	n/a	n/a	100.14
<a href="#">1.17</a>	n/a	11.0	11.0	4.23   3.40	n/a
<a href="#">1.16</a>	n/a	n/a	n/a	4.22   3.39	100.13
<a href="#">1.15</a>	2.9	10.9.1	n/a	4.21   3.38	n/a
<a href="#">1.14</a>	n/a	n/a	n/a	n/a   n/a	100.12





# Setting yourself up for success

- Plan things out ahead of time. Think about the logic your expression will use.
- For long expressions, factor out logic into functions.
- If your expression is slow, keep the following in mind:
  - FeatureSets can be expensive queries so only request what you need.
  - Use attribute queries instead of spatial queries when possible.
  - Combine multiple expressions into one when possible.



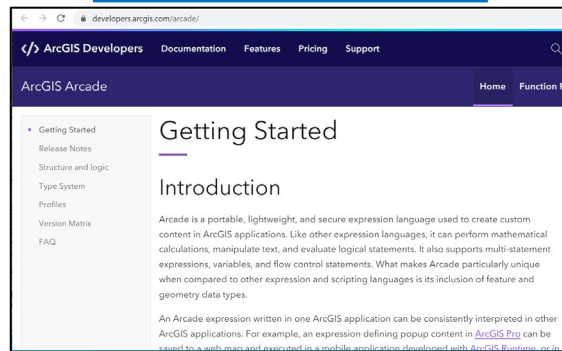
# What's next

- New editor
- More flexibility for formatting expression results for different locales
- Access to EXIF data for attachments
- Length3D() function
- More flexibility in pop-ups
- Better URL/URI encoding options
- Easier use of feature sets when the data has relationships
- More functions

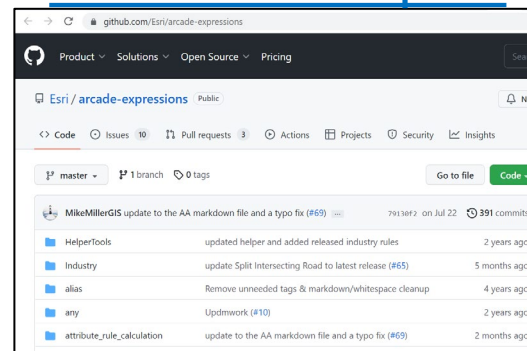
# Resources for Arcade

<http://esriurl.com/ArcadeResources>

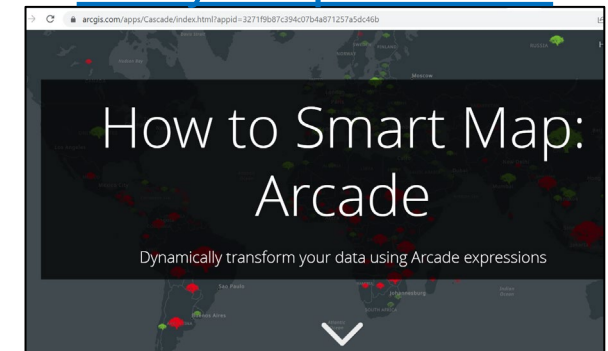
## Documentation



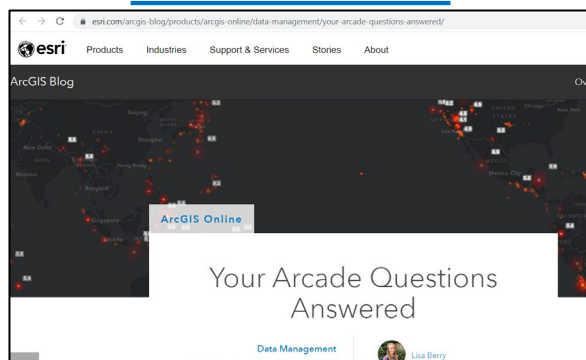
## GitHub Examples



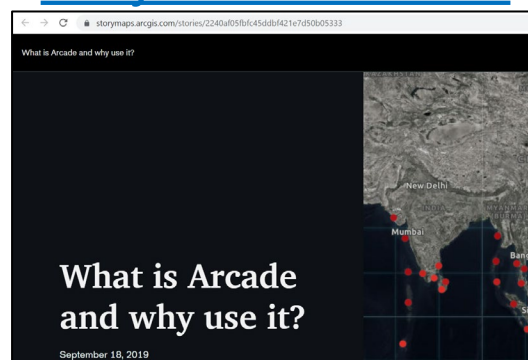
## Story Map Tutorial



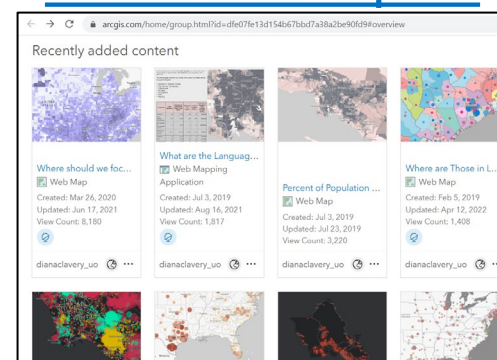
## Arcade FAQ



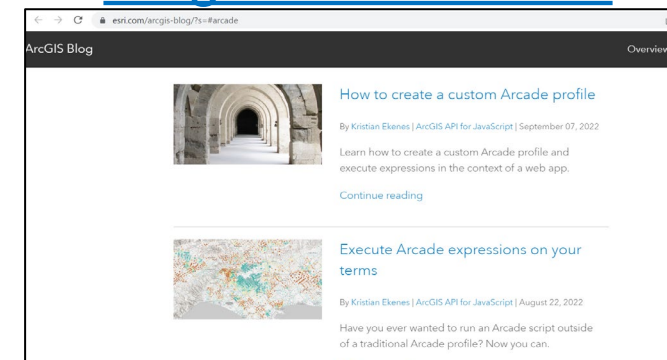
## Why Use Arcade?



## AGOL Examples



## Blogs about Arcade



# Demo of Exercise 1

Demo of Exercise 2 begins at 11:45 am (MT)