ibi™ WebFOCUS®

Creating Multilayer Maps

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Contents

Creating Multilayer Maps

Multilayer maps allow you to show geographic information for multiple geolocation fields and data sources on a single map for easier comparison. You can add as many layers as you want to a multilayer map, utilizing multiple geographic roles, data sources, and map types. Multilayer mapping also allows you to use resources such as basemaps, reference layers, demographic layers, and navigation features from Esri ArcGIS Online, providing robust functionality and mapping enhancements out of the box. The multilayer mapping run-time interface allows you to navigate, make selections in, and adjust your view of the map, making it easier to explore and gain insights from your content.

Note: ibi™ WebFOCUS® Mapping uses features from ESRI ArcGIS online. The current API version is 4.24.

Creating Multilayer Map Procedures

A multi-layer map is created as a compound FOCEXEC procedure with one or more embedded layers. Each layer is a stand-alone map chart procedure that can be created using ibi™ WebFOCUS® Designer or using WebFOCUS® language syntax. These layers can be added directly to the multilayer map procedure, or can be referenced using -INCLUDE. You can create a multi-layer map from new, embedded layers and referenced external maps using the WebFOCUS text editor.

You can also build a map entirely from referenced, existing map procedures using the run-time map builder, which you can evoke from the text editor. The run-time map builder provides an easy-to-use interface that allows you to select and reorder the layers in your map, as well as set other run-time display options. However, it does not provide tools to create new, ad hoc map layers.

Creating Multi-Layer Maps With ibi WebFOCUS Language

When building a multi-layer map in the text editor using WebFOCUS syntax, the multi-layer map FOCEXEC should use the following format:

```
EMBED BEGIN PCHOLD FORMAT JSCHART

EMBED COMPONENT
map_layer_0

[EMBED COMPONENT
map_layer_1
.
.
.

EMBED COMPONENT
map_layer_n]

EMBED MAIN
GRAPH FILE SYSCOLUM
["heading"]
SUM FST.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH {BUBBLEMAP|CHOROPLETH}
ON GRAPH SET AUTOFIT ON
[ON GRAPH SET EMBEDHEADING ON]
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
TYPE=DATA, COLUMN=N1, BUCKET=NULL, $
[*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "basemap"
                    }
                ]
        }
    }
}
]
```

```
END
EMBED END
```

The compound procedure uses an HTML5, or JSCHART, output format, as indicated by the first line, EMBED BEGIN PCHOLD FORMAT JSCHART.

The compound procedure requires the EMBED BEGIN and EMBED MAIN sections to run properly. The EMBED MAIN section includes general properties for the entire multilayer map procedure. You can add properties to set a heading, turn on AUTOFIT so that the map fills the window in which it is run, and turn on EMBEDHEADING so that the heading, if you add one, is placed within the frame of the multilayer map.

You can also specify a basemap, in the *GRAPH_JS_FINAL block of the EMBED MAIN section, to use for the multilayer map. If you do not specify a basemap here, each layer also has its own basemap. The basemap of the last layer in the procedure will be used as the basemap for the multilayer map.

Although it is not displayed in the multilayer map at run time, some data is required in the EMBED MAIN section to run the procedure. As a result, point to an available data source using a GRAPH FILE command. One option is to use SYSCOLUM as the Master file. SYSCOLUM is a system synonym that contains information about tables associated with synonyms in your environment. This synonym is always available in WebFOCUS. You can use TBNAME, one of the fields in the SYSCOLUM synonym, as the field, and set a record limit of 1 to save on resource usage.

The StyleSheet for the multilayer map procedure specifies that a multilayer map should be generated using the CHART-LOOK property, and allows the procedure to run by referencing the data generated by the referenced field.

Once the structure of the multilayer map procedure is created with the EMBED BEGIN and EMBED MAIN commands, you can add multiple map layers using an EMBED COMPONENT commands. After typing EMBED COMPONENT, embed or reference a stand-alone map chart procedure. These can be added directly to the multilayer map procedure or referenced using -INCLUDE followed by an IBFS path pointing to the location of the map in your WebFOCUS repository. For more information on creating map layers, see Creating a Map Layer.

You can embed as many map layers as you want. When the multilayer map is run, the last embedded layer is displayed on top, followed by the previous embedded layer, and so on until the first embedded layer, which is displayed beneath all other layers, directly above the basemap. The last embedded map layer sets the basemap for the entire multilayer map, unless you specify a basemap in the EMBED MAIN section of the multilayer map procedure.

The following syntax creates a multilayer map with one choropleth layer, one bubblemap layer, one external map chart referenced using -INCLUDE, and one reference layer. The reference layer is generated as part of the choropleth layer.

```
EMBED BEGIN PCHOLD FORMAT JSCHART



EMBED COMPONENT
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.QUANTITY_SOLD
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Choropleth by Country', ORIENTATION=LANDSCAPE,
ARREPORTSIZE=DIMENSION,
       ARFILTER_TARGET='*', CHART-LOOK=com.geo.layer, ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N2, BUCKET=color, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiAddLayer": "USA_Tapestry_Segmentation_2012"
                },
                {
                    "ibiDataLayer": {
                        "map-metadata": {
                            "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_
GEOGRAPHY_CUSTOMER.COUNTRY_NAME"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "gray"
```

```
                    }
                ]
        }
    }
},
"agnosticSettings": {
    "chartTypeFullName": "Choropleth"
}

*END
ENDSTYLE
END
```

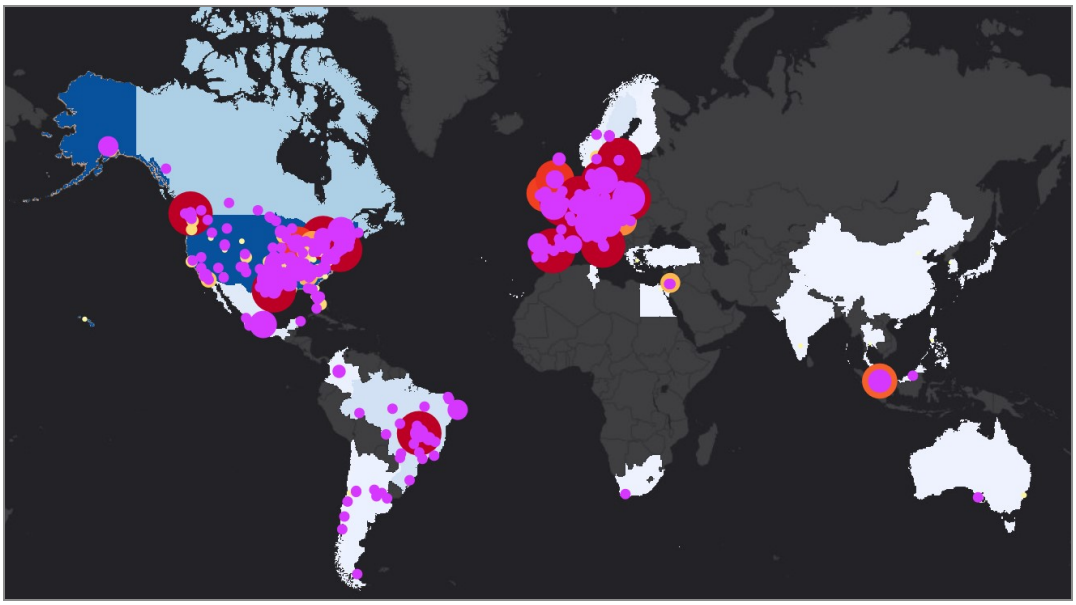
```
EMBED COMPONENT
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.REVENUE_US
WF_RETAIL_LITE.WF_RETAIL_SALES.QUANTITY_SOLD
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.CITY_NAME
WHERE WF_RETAIL_LITE.WF_RETAIL_STORE_SALES.STORE_TYPE EQ 'Store Front';
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET GRWIDTH 1
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Stores Bubble Map', ORIENTATION=LANDSCAPE,
ARREPORTSIZE=DIMENSION,
       ARFILTER_TARGET='*', CHART-LOOK=com.ibi.geo.layer,
ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N2, BUCKET=color, $
TYPE=DATA, COLUMN=N3, BUCKET=size, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
                            "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_
GEOGRAPHY_STORE.CITY_NAME"
```

```
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
},
"colorScale": {
    "colors": ["#ffffb2", "#fecc5c", "#fd8d3c", "#f03b20", "#bd0026"]
},
"agnosticSettings": {
    "chartTypeFullName": "Bubblemap"
}

*END
ENDSTYLE
END
```

```
EMBED COMPONENT
-INCLUDE IBFS:/WFC/Repository/My_Workspace/~user1/referenced_map.fex



EMBED MAIN
GRAPH FILE SYSCOLUM
"Multilayer Map Example"
SUM FST.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
TYPE=DATA, COLUMN=N1, BUCKET=NULL, $
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
```

```
            "customBaseMaps":                [
                    {
                        "ibiBaseLayer": "dark-gray"
                    }
                ]
        }
    }
}
END
EMBED END
```

The result of the request is shown in the following image.



The EMBED MAIN section specifies to use the dark gray basemap for the entire multilayer map. If no basemap was specified here, then the basemap from the last layer, which was added using a -INCLUDE, would be used. When you run the procedure, you can navigate the map and show and hide each layer using the options on the map toolbar.

Creating Multi-Layer Maps With the Run-Time Map Builder

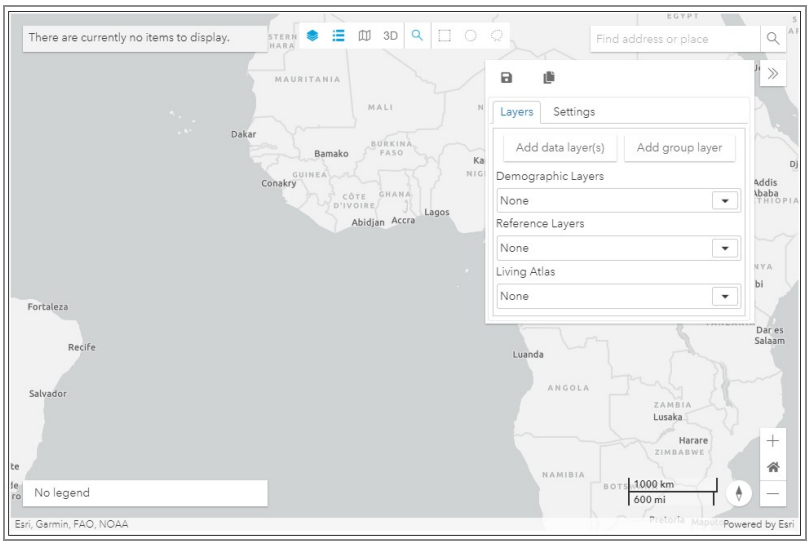
You can use the run-time map builder to add existing layers to an empty map, which you can then save as a new multi-layer map procedure. You can add user-created data layers and configured demographic layers and reference layers, then reorder them and set

applicable display properties, as well as change the position of the different interface components and set a header for the map. The view that you have of the map when you save it, including the current basemap, zoom level, and center point, are used as the default when the new multi-layer map is opened.

You can evoke the run-time map builder by running a standard FOCEXEC procedure from the WebFOCUS text editor. On the WebFOCUS Home Page, in the Workspaces view, select **Other** on the Action bar, and then click **Text Editor**. In the text editor, paste the following syntax, and run the procedure:

```
EMBED BEGIN PCHOLD FORMAT JSCHART
EMBED MAIN
GRAPH FILE SYSCOLUM
SUM CNT.TBNAME
IF READLIMIT EQ 1
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TITLETEXT=Multi-layer map development tool, CHART-LOOK=com.ibi.geo.map,
$
TYPE=DATA, COLUMN=N1, BUCKET=NULL, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "devTools": {
                        "create": true
                },
                "layers": {
                    "visible" : true
                }
    }
}

END

EMBED END
```

The run-time map builder opens with a blank map, as shown in the following image.

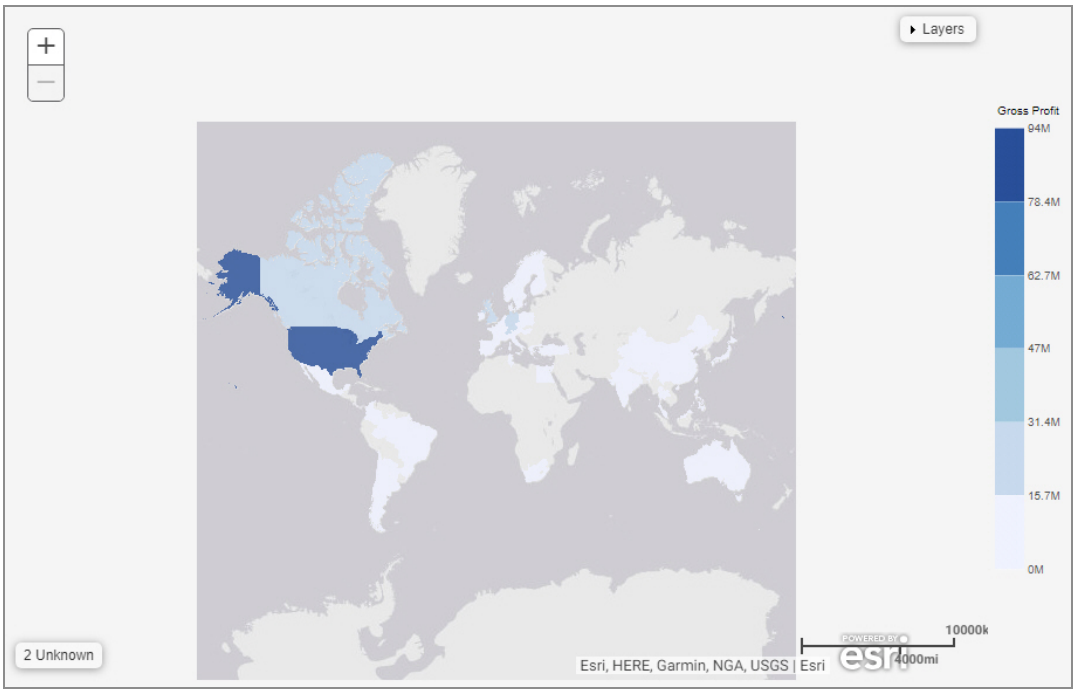


Creating a Map Layer

When you create a multilayer map, each layer is a standalone HTML5 map chart. You can create choropleth maps and bubble maps in WebFOCUS® Designer and then add them to the multilayer map. Alternatively, you can use WebFOCUS language syntax to create choropleth, bubble, and line map layers, either as individual files or directly within the multilayer map procedure.

Creating Choropleth Maps in ibi WebFOCUS Designer

Choropleth maps can be used to create geographically based heat maps. They are useful for visualizing location-based data, trends, and distributions across a geographic area, as shown in the following image.



Note: Choropleth maps require at least one measure and one Georole, which contains geographic location information. You can add a field to the Color bucket to color the map.

The Clear buckets content display option is available for a choropleth map. It removes the fields from all buckets.

You can add fields to the following buckets for a choropleth map:

- **Color.** Use a measure field to apply a color scale to the areas on the choropleth map. You can also use a dimension to color the areas on the map. Each area can show one color, so it is advisable to use overarching categories that apply to distinct sets of points. For example, you could use a country field in the Color bucket to categorize the states shown on the map.
- **Location.** Enables you to specify a Geolocation field for use in a map. Each value from the field is plotted on the map if it is recognized. A choropleth can plot geographic areas, such as cities, states, or countries.

> **Note:** Geolocation fields must be configured in the data source to use a corresponding geographic role. Values from the field are matched to values from the geographic role to plot them in the correct location. For example, if your field contains country names, use the Country Name geographic role.

- **Tooltip.** The data placed in this bucket displays in the tooltip at run time. Can be used to make additional information available without changing the appearance of the chart.
- **MultiPage.** Enables the creation of multiple graphs based on the field that you place in this bucket.

Create a Choropleth Map in ibi WebFOCUS Designer

Procedure

1. Open WebFOCUS Designer. On the default WebFOCUS Home Page, click **Visualize Data**.

   WebFOCUS Designer opens in a new browser tab.
2. In WebFOCUS Designer, click the **Add data** button to select a data source.
3. Select a workspace and a data source available from that workspace.

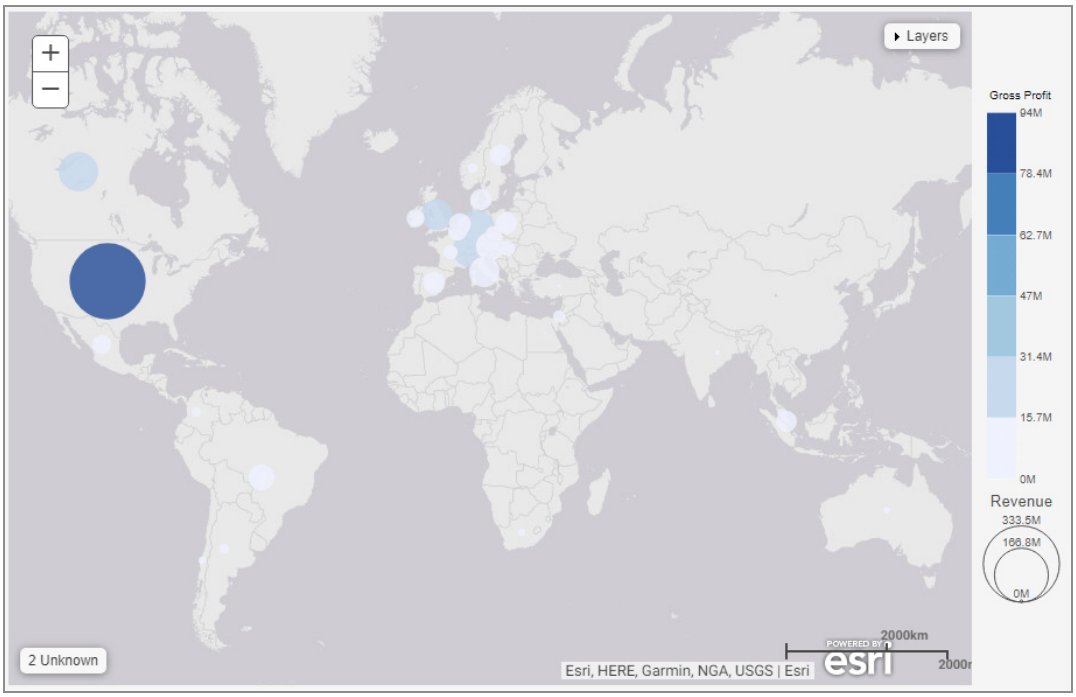
   Once you select a data source, WebFOCUS Designer loads with options to create a single content item.
4. On the Content picker, change the chart to a choropleth map.
5. Add a measure to the Color bucket and one field with an assigned geographic role to the Location bucket.

   The choropleth map refreshes with your selections.
6. You can perform the following tasks with your choropleth map:
   a. Change the field in the Location bucket to analyze other trends.
   b. Zoom in or out to see different views of the data.

7. Save your choropleth map.

Creating Bubble Maps in ibi WebFOCUS Designer

Proportional symbol maps, or bubble maps, use symbols of different sizes to represent data associated with different areas or locations within the map, as shown in the following image.



Note: Proportional symbol maps require at least one measure and one Georole, which contains geographic location information. You can add a field to the Color bucket to color the map.

The Clear buckets content display option is available for a proportional symbol map. It removes the fields from all buckets.

You can add fields to the following buckets for a proportional symbol map:

- **Size.** Use a measure field to determine the size of bubbles on the proportional

symbol map.

- **Color.** Use a measure field to apply a color scale to the bubbles on the proportional symbol map. You can also use a dimension to color the points on the map. Each point can show one color, so it is advisable to use overarching categories that apply to distinct sets of points. For example, you could use a country field in the Color bucket to categorize points representing states.
- **Location.** Enables you to specify a Geolocation field for use in a map. Each value from the field is plotted on the map if it is recognized. A proportional symbol map can plot geographic areas, such as cities, states, or countries, as well as individual point locations such as street addresses and geographic coordinates.

  > **Note:** Geolocation fields must be configured in the data source to use a corresponding geographic role. Values from the field are matched to values from the geographic role to plot them in the correct location. For example, if your field contains country names, use the Country Name geographic role.

- **Tooltip.** The data placed in this bucket displays in the tooltip at run time. Can be used to make additional information available without changing the appearance of the chart.
- **MultiPage.** Enables the creation of multiple graphs based on the field that you place in this bucket.

Create a Bubble Map in ibi WebFOCUS Designer

Procedure

1. Open WebFOCUS Designer. On the default WebFOCUS Home Page, click **Visualize Data**.

   WebFOCUS Designer opens in a new browser tab.

2. In WebFOCUS Designer, click the **Add data** button to select a data source.
3. Select a workspace and a data source available from that workspace.

   Once you select a data source, WebFOCUS Designer loads with options to create a single content item.

4. On the Content picker, change the chart to a bubble map.
5. Add measures to the Color and Size buckets and one field with an assigned geographic role to the Location bucket.

   The proportional symbol map refreshes with your selections.

   > **Note:** In this case, we have also added Product, Subcategory to add color to the map.

6. You can perform the following tasks with your proportional symbol map:
   a. Change the field in the Location bucket to analyze other trends.
   b. Zoom in or out to see different views of the data.
7. Save your proportional symbol map.

Creating a Choropleth Map Using ibi WebFOCUS Language

A choropleth map uses a geolocation field that can generate polygons to plot geographic areas on a map. These areas can be colored using a color scale generated by a measure field or using series colors based on a dimension field.

The structure of a choropleth map request is outlined in the following syntax reference.

```
GRAPH FILE master_file
SUM measure_field
BY geolocation_field
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.esri.map, $
TYPE=DATA, COLUMN=measure_field, BUCKET=color, $
*GRAPH_SCRIPT
*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
```

```
                        "map-metadata": {
            "map_by_field": "geolocation_field"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":
                 [
                    {
                        "ibiBaseLayer": "basemap"
                    }
                ]
        }
    }
},
"agnosticSettings": {
    "chartTypeFullName": "Choropleth"
}
*END
ENDSTYLE
END
```

Where:

master_file

Is the Master File used as the data source for your map.

measure_field

Is a measured field that you can analyze using a color scale.

geolocation_field

Is a field containing geographic locations that can be plotted as polygons on a map. This field should have the appropriate geographic role assigned to it. For example, if the values of the geolocation field are country names, then it should use the COUNTRY geographic role.

`ON GRAPH SET LOOKGRAPH CHOROPLETH`

Defines the chart type as a choropleth map.

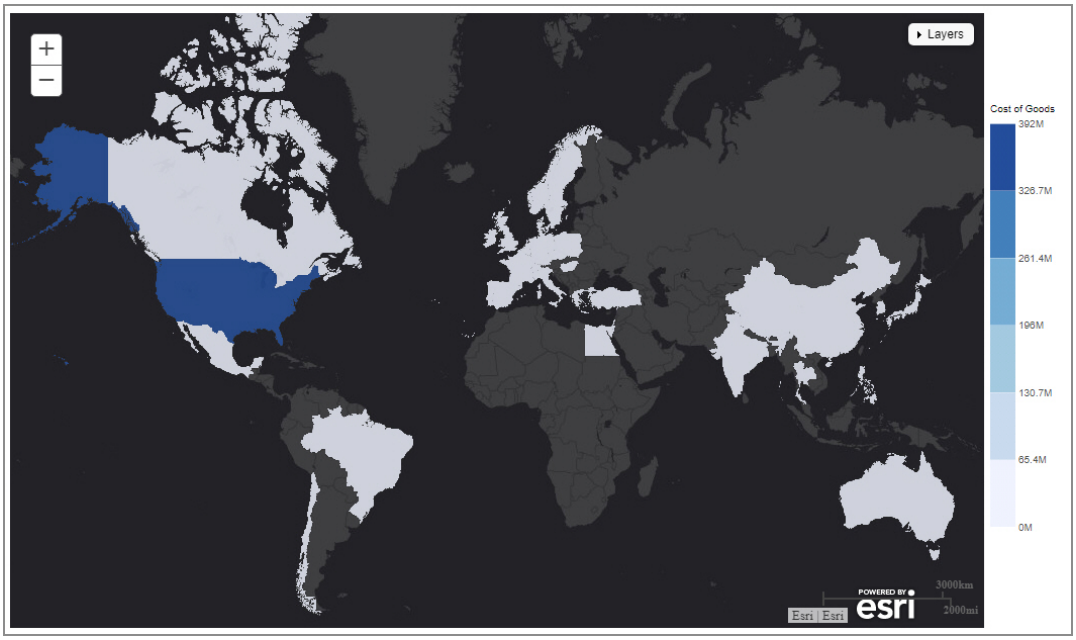
basemap

Is a basemap listed in the geo_services.xml file. For more information on available basemaps, see Creating Multilayer Map Procedures.

The following is an example of a basic choropleth map showing the cost of goods sold by country. It uses the Dark Gray Canvas basemap.

```
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.COGS_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Choropleth Map', CHART-LOOK=com.esri.map,
ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=COGS_US, BUCKET=color, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
                            "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_
GEOGRAPHY_STORE.COUNTRY_NAME"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "dark-gray"
                    }
                ]
        }
    }
},
"agnosticSettings": {
    "chartTypeFullName": "Choropleth"
}

*END
ENDSTYLE
END
```

The output is shown in the following image.



Creating a Bubble Map Using ibi WebFOCUS Language

Proportional symbol maps, or bubble maps, use symbols of different sizes to represent data associated with different areas or locations within the map.

The structure of a bubble map request is outlined in the following syntax reference.

```
GRAPH FILE master_file
SUM measure_field_1
BY measure_field_2
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.esri.map, $
TYPE=DATA, COLUMN=measure_field_1, BUCKET=color, $
TYPE=DATA, COLUMN=measure_field_2, BUCKET=size, $
*GRAPH_SCRIPT
*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":            [
                {
```

```
                    "ibiDataLayer": {
                        "map-metadata": {
            "map_by_field": "geolocation_field"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":
                 [
                    {
                        "ibiBaseLayer": "basemap"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

Where:

master_file

Is the Master File used as the data source for your map.

measure_field_1, measure_field_2

Are measure fields that you can analyze using a color scale or by point size.

geolocation_field

Is a field containing geographic locations that can be plotted as polygons on a map. This field should have the appropriate geographic role assigned to it. For example, if the values of the geolocation field are country names, then it should use the COUNTRY geographic role.

`ON GRAPH SET LOOKGRAPH BUBBLEMAP`

Defines the chart type as a bubble map.

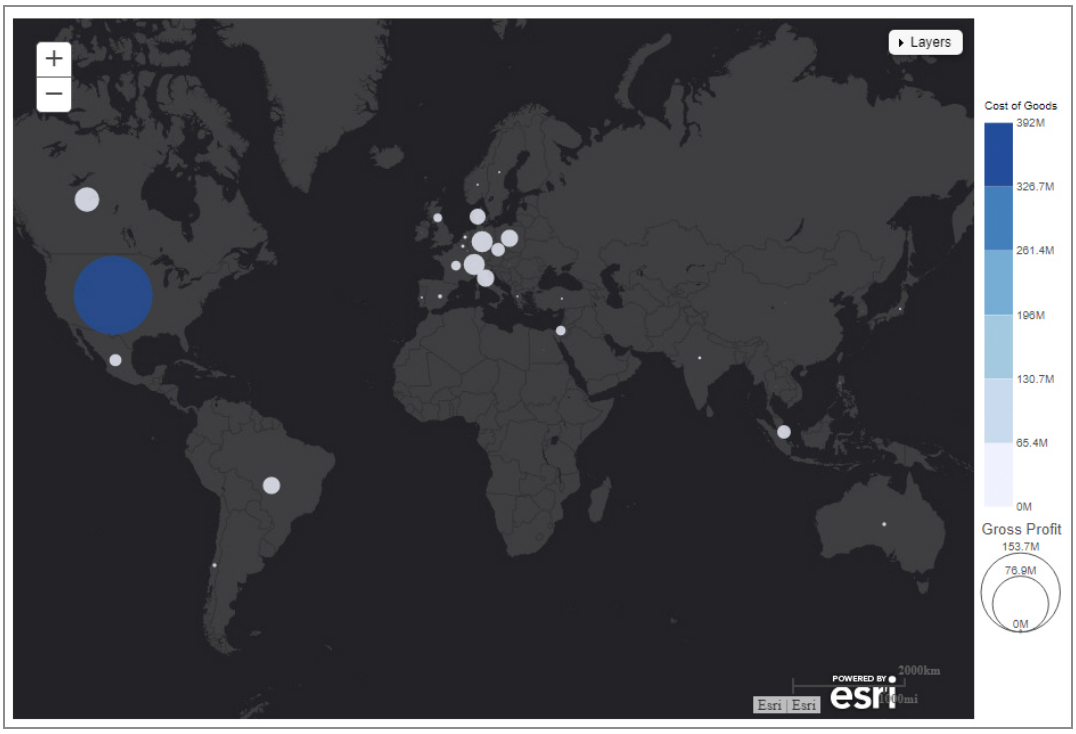
basemap

Is a basemap listed in the geo_services.xml file.

The following is an example of a basic bubble map showing the cost of goods sold and gross profit by country. It uses the Dark Gray canvas basemap.

```
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.COGS_US
WF_RETAIL_LITE.WF_RETAIL_SALES.GROSS_PROFIT_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Bubble Map', CHART-LOOK=com.esri.map, $
TYPE=DATA, COLUMN=COGS_US, BUCKET=color, $
TYPE=DATA, COLUMN=GROSS_PROFIT_US, BUCKET=size, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
                            "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_
GEOGRAPHY_STORE.COUNTRY_NAME"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "dark-gray"
                    }
                ]
        }
    }
}


*END
ENDSTYLE
END
```

The output is shown in the following image.



Creating a Line Map Using ibi WebFOCUS Language

You can create a line map to plot lines between two sets of points. These lines can be either straight lines, or a navigable route between points. To plot a line, you must use a field with the geographic role of GEOMETRY_LINE. Each line value includes an array of geometry points that determines the path of the line when it is plotted.

The structure of a line map request is outlined in the following syntax reference.

```
GRAPH FILE master_file
PRINT line_field
[tooltip_field]
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH LINEMAP
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.esri.map, $
TYPE=DATA, COLUMN=tooltip_field, BUCKET=tooltip, $
*GRAPH_SCRIPT
*GRAPH_JS_FINAL
```

```
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-geometry": {
            "map_by_field": "line_field"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":
                 [
                    {
                        "ibiBaseLayer": "basemap"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

Where:

master_file

Is the Master File used as the data source for your map.

line_field

Is a geometry line field. It should include an array of geometry points and have a geographic role of GEOMETRY_LINE

tooltip_field

An optional field that you can use to provide contextual information in the tooltip for each line. For example, if your map layer displays lines representing the flight paths of commercial airliners, you can use the tooltip to display the flight number to identify each one.

`ON GRAPH SET LOOKGRAPH LINEMAP`

Defines the chart type as a line map.

basemap

Is a basemap listed in the geo_services.xml file.

You may not have a geometry line field available for you to use in a line map. If this is the case, you can define the lines on the map by using the WebFOCUS functions. You can use the GIS_LINE function to create a straight line between two points, or use the GIS_DRIVE_ROUTE function to create a navigable route from one point to another.

To use these functions, you will also need geometry point fields to represent the start and end points of the lines. In this example, we create a map connecting customer address locations with the locations of the stores where they made their purchases. In this case, we only have the address of each customer, while we have the longitude and latitude of each store.

Let us start by generating a geometry point for each customer address using the GIS_GEOCODE_ADDR_CITY function. The GIS_GEOCODE_ADDR_CITY function can be defined as follows:

```
GIS_GEOCODE_ADDR_CITY( street_addr, city , state [, country])
```

Where:

street_addr

Fixed length alphanumeric

Is the street address to be geocoded.

city

Fixed length alphanumeric

Is the city name associated with the street address.

state

Fixed length alphanumeric

Is the state name associated with the street address.

country

fixed length alphanumeric

Is a country name, which is optional if the country is the United States.

Using our customer address fields, we will populate the function to create a DEFINE field called CUSTOMER_LOCATION as follows:

```
CUSTOMER_LOCATION/A200 =
GIS_GEOCODE_ADDR_CITY(WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_
CUSTOMER.ADDRESS_LINE_1,
WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME,
WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.STATE_PROV_NAME,
WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME);
```

We are supplying values for the optional country name parameter since we have customers outside the United States.

Next, we will generate geometry points for each store location. We have longitude and latitude values for each store, so we will use the GIS_POINT function. The GIS_POINT function can be defined as follows:

```
GIS_POINT(wkid, longitude, latitude)
```

Where:

wkid

Fixed length alphanumeric

Is a spatial reference code (WKID). WKID is an abbreviation for Well-Known ID, which identifies a projected or geographic coordinate system.

longitude

D20.8

Is the longitude for the point.

latitude

D20.8

Is the latitude for the point.

Using our store latitude and longitude fields, we will populate the function to create a DEFINE field called STORE_LOCATION, as follows:

```
STORE_LOCATION/A200 = GIS_POINT('4326',
WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.ADDRESS_LONGITUDE,
WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.ADDRESS_LATITUDE);
```

WKID 4326 reflects the decimal degree format of the longitude and latitude values we are using.

Now that the start and end points are defined, we can use functions to create the lines to draw on our map. To create a simple, direct line that goes from the customer location to the store location as the crow flies, use the GIS_LINE function. The GIS_LINE function can be defined as follows:

```
GIS_LINE(geometry1, geometry2)
```

Where:

geometry1

Alphanumeric or text

Is the start point of the line.

geometry2

Alphanumeric or text

Is the end point of the line.

Using the two previously created define fields as our start and end points, we can create a DEFINE field called LINE to generate the line as follows:

```
LINE/TX250 (GEOGRAPHIC_ROLE=GEOMETRY_LINE) =
GIS_LINE(CUSTOMER_LOCATION, STORE_LOCATION);
```

Notice that we specified that the field should use a geographic role of GEOMETRY_LINE. You must specify the geographic role, otherwise the line will not be drawn properly. The DEFINE fields created above serve as the start and end points for each line.

To create a line that represents the driving route from the address of the customer to that of the store, you can instead use the GIS_DRIVE_ROUTE function.

```
ROUTE/TX250 (GEOGRAPHIC_ROLE=GEOMETRY_LINE) =
GIS_DRIVE_ROUTE(CUSTOMER_LOCATION, STORE_LOCATION);
```

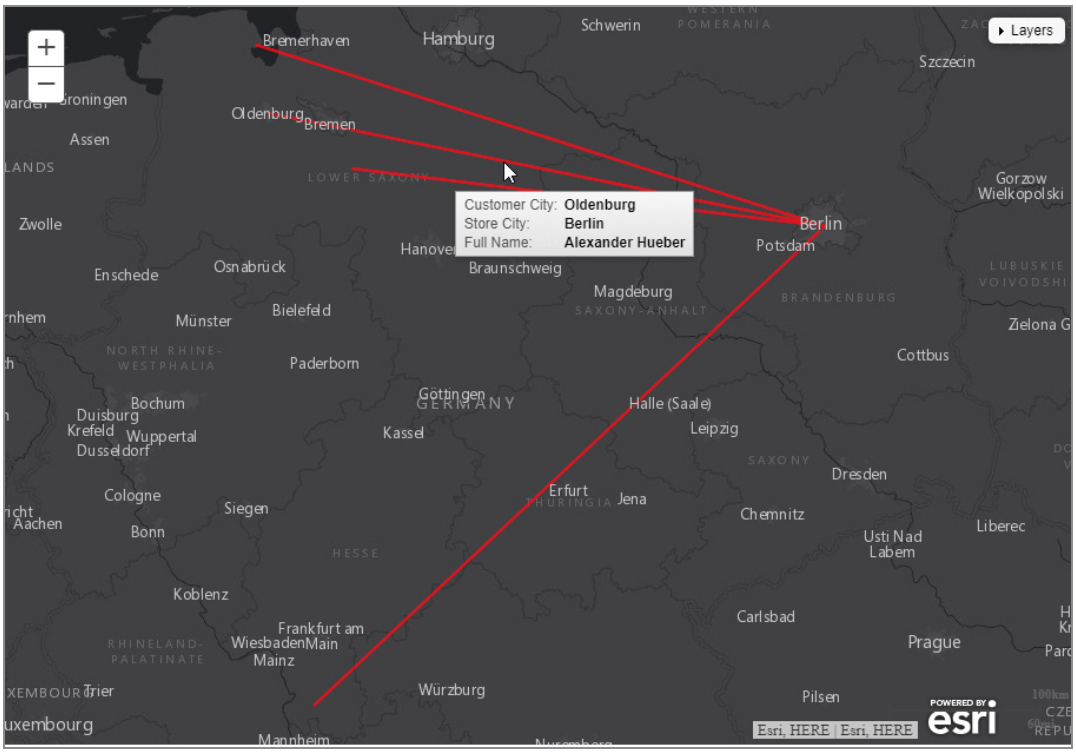
Once again, we have specified the geographic role and used the previously created DEFINE fields as the start and end points.

The DEFINE field representing the line can then be used as the map_by_field value in the request. The following is an example of a procedure that plots straight lines between each customer and the stores where they shopped, using the GIS_LINE function. This map uses the dark gray basemap and shows customer city, store city, and customer name information in the tooltip. It is filtered to show data for only one customer.

```
DEFINE FILE WF_RETAIL_LITE
CUSTOMER_LOCATION/A200 = GIS_GEOCODE_ADDR_CITY(
    WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.ADDRESS_LINE_1,
    WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME,
    WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.STATE_PROV_NAME,
    WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME);
STORE_LOCATION/A200 = GIS_POINT('4326', WF_RETAIL_LITE.WF_RETAIL_
GEOGRAPHY_STORE.ADDRESS_LONGITUDE,
     WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.ADDRESS_LATITUDE);
LINE/TX250 (GEOGRAPHIC_ROLE=GEOMETRY_LINE) = GIS_LINE(CUSTOMER_LOCATION,
STORE_LOCATION);
END

GRAPH FILE WF_RETAIL_LITE
PRINT LINE
WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME
WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.CITY_NAME
WF_RETAIL_LITE.WF_RETAIL_CUSTOMER.FULLNAME
WHERE WF_RETAIL_LITE.WF_RETAIL_CUSTOMER.FULLNAME EQ 'Alexander Hueber';
WHERE WF_RETAIL_LITE.WF_RETAIL_STORE_SALES.STORE_NAME NE 'Web';
ON TABLE PCHOLD FORMAT JSCHART
ON TABLE SET LOOKGRAPH LINEMAP
ON TABLE SET EMBEDHEADING ON
ON TABLE SET AUTOFIT ON
ON TABLE SET STYLE *
TYPE=REPORT, TITLETEXT='Map', PAGESIZE=E, CHART-LOOK=com.esri.map, $
TYPE=DATA, COLUMN=N2, BUCKET=tooltip, $
TYPE=DATA, COLUMN=N3, BUCKET=tooltip, $
TYPE=DATA, COLUMN=N4, BUCKET=tooltip, $
*GRAPH_JS_FINAL
"extensions" : { "com.esri.map": {
"overlayLayers":
[{
"ibiDataLayer":
    {"map-geometry" :
        {"map_by_field" : "LINE"}
            }
        }
    ],
"baseMapInfo": {
    "customBaseMaps" : [
        {"ibiBaseLayer" : "dark-gray"}
            ]
        }
    }
}
*END
```

```
ENDSTYLE
END
```

The resulting map is shown in the following image.



On the map, you can see that the customer used four different addresses, but always went to the same store location in Berlin. From the layer list you can turn the line layer into a route.

The following request uses the same data, but instead generates a map showing the driving route from each customer address to each store.

```
DEFINE FILE WF_RETAIL_LITE
CUSTOMER_LOCATION/A200 = GIS_GEOCODE_ADDR_CITY(
    WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.ADDRESS_LINE_1,
    WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME,
    WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.STATE_PROV_NAME,
    WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME);
STORE_LOCATION/A200 = GIS_POINT('4326', WF_RETAIL_LITE.WF_RETAIL_
GEOGRAPHY_STORE.ADDRESS_LONGITUDE,
     WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.ADDRESS_LATITUDE);
ROUTE/TX250 (GEOGRAPHIC_ROLE=GEOMETRY_LINE) = GIS_DRIVE_ROUTE(CUSTOMER_
LOCATION, STORE_LOCATION);
```

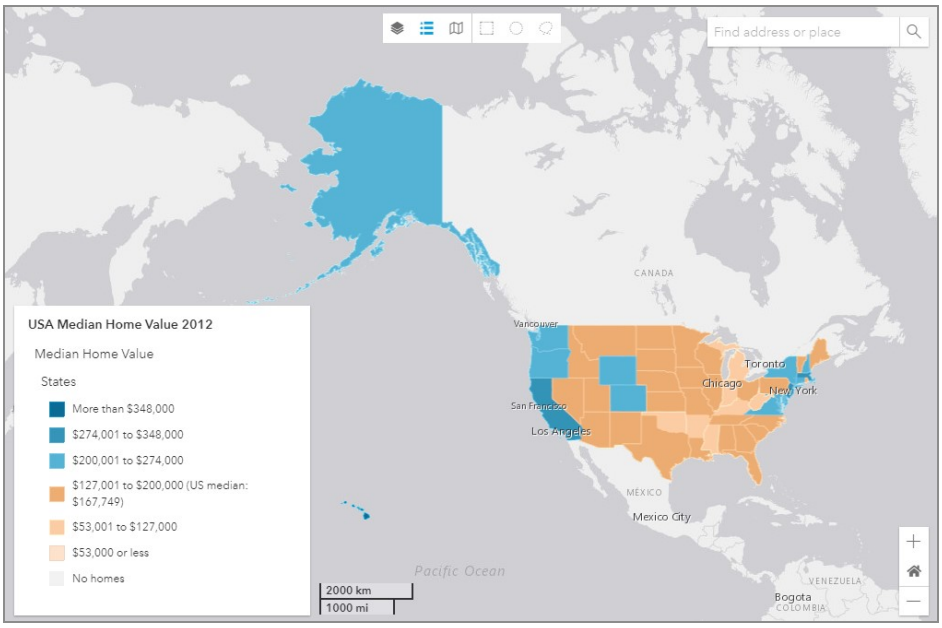
```
END

GRAPH FILE WF_RETAIL_LITE
PRINT ROUTE
WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME
WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.CITY_NAME
WF_RETAIL_LITE.WF_RETAIL_CUSTOMER.FULLNAME
WHERE WF_RETAIL_LITE.WF_RETAIL_CUSTOMER.FULLNAME EQ 'Alexander Hueber';
WHERE WF_RETAIL_LITE.WF_RETAIL_STORE_SALES.STORE_NAME NE 'Web';
ON TABLE PCHOLD FORMAT JSCHART
ON TABLE SET LOOKGRAPH LINEMAP
ON TABLE SET EMBEDHEADING ON
ON TABLE SET AUTOFIT ON
ON TABLE SET STYLE *
TYPE=REPORT, TITLETEXT='Map', PAGESIZE=E, CHART-LOOK=com.esri.map, $
TYPE=DATA, COLUMN=N2, BUCKET=tooltip, $
TYPE=DATA, COLUMN=N3, BUCKET=tooltip, $
TYPE=DATA, COLUMN=N4, BUCKET=tooltip, $
*GRAPH_JS_FINAL
"extensions" : { "com.esri.map": {
"overlayLayers":
[{
"ibiDataLayer":
    {"map-geometry" :
        {"map_by_field" : "ROUTE"}
            }
        }
    ],
"baseMapInfo": {
    "customBaseMaps" : [
        {"ibiBaseLayer" : "dark-gray"}
            ]
        }
    }
}
*END
ENDSTYLE
END
```

The resulting map is shown in the following image.

Visualizing Demographic Layers and Reference Layers

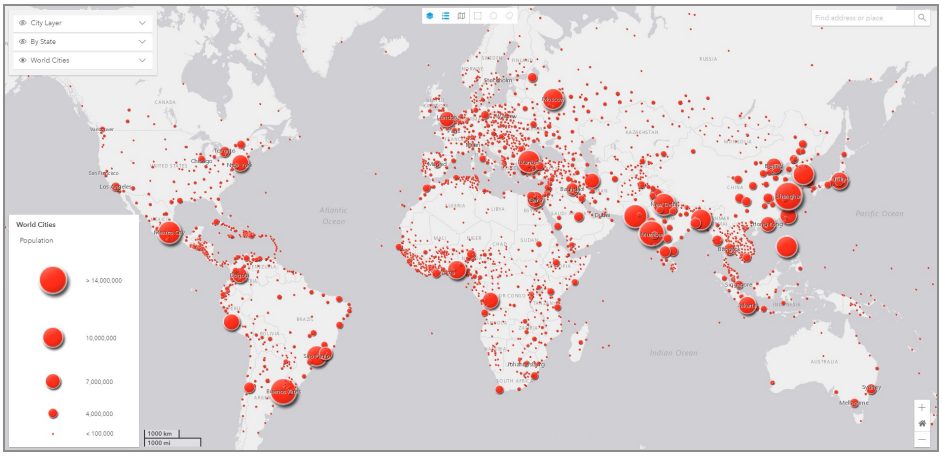
You can provide context and additional information to your maps by adding two types of context layers. These layer types, saved on ArcGIS Online, can be referenced and displayed in a multilayer map alongside data layers that you create using WebFOCUS tools, complementing and contextualizing the geographic information in your own data.

Demographic layers provide different metrics and information about geographic areas, and typically take the form of a choropleth. A set of demographic layers with information about the United States is included with WebFOCUS by default. The following image shows a map with a demographic layer representing the median home value of each state.



As you zoom into some demographic layers, such as the one included with WebFOCUS, the information becomes more granular. For example, in the USA Median Home Value 2012 layer shown in the previous image, as you zoom into the map you can see data at a state, county, city, and neighborhood level.

Reference layers are borders and markers that, along with information shown on the basemap, can help delineate different geographic areas and clarify the location of markers and polygons in a multilayer map. Reference layers provided with WebFOCUS show national and regional borders and major cities in the United States and around the globe. The following image shows a map with a reference layer that displays markers for major cities around the world.



Demographic and reference layers from Esri ArcGIS online can be added to your WebFOCUS environment from the WebFOCUS Server Console. From the **Tools** menu, select **Workspace**

to open the Workspace view of the Server Console. Click **Settings**, point to **Geo Services**, and then click **Edit Configuration** to open the GEO configuration editor. Select **ContextLayer** from the Object menu, and then click **Add** to add a new context layer. Provide values for each field based on the properties of the layer in Esri ArcGIS.

Context layers can be added to a multilayer map as stand-alone layers, included in a request with a data layer, or added to a data layer with other context layers. Adding a context layer as a stand-alone layer, however, provides more control over the order in which it appears in your request, as you can place the context layer first to have it display as the bottom layer in the map, or add it as the last layer in the request to have it display on top of the other layers.

The structure of a map layer with a context layer is outlined in the following syntax reference:

```
GRAPH FILE SYSCOLUM
SUM CNT.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH EXTENSION
ON GRAPH SET STYLE *
TYPE=DATA, COLUMN=N1, BUCKET=NULL, $
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $
*GRAPH_SCRIPT
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiAddLayer": "context_layer"
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "basemap"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

where:

```
GRAPH FILE SYSCOLUM

SUM CNT.TBNAME

IF RECORDLIMIT EQ 1
```

Provides data required to run the procedure. Although no data is actually used to generate a context layer, data values are required to run the FOCEXEC procedure. The Master File, field, and record limit used here can be used in all WebFOCUS environments, and supplies a single value to limit resource usage.

context_layer

Is the name of the context layer, defined in the GEO configuration editor or the geo_services.xml configuration file in your WebFOCUS Server installation. If you add a custom context layer, use the name that you provided. You can also use the following pre-configured reference layers:

- **World_Cities.** Shows markers at the locations of major cities around the world.
- **World_Countries.** Shows the borders of countries around the world.
- **USA_Maj_Cities.** Shows markers at the locations of major cities in the United States.
- **USA_Counties_Gen.** Shows the borders of counties in the United States.
- **World_Continents.** Shows the borders of each continent on Earth.
- **USA_ZIP.** Shows the borders of ZIP codes in the United States.
- **USA_ZIP3.** Shows the borders of areas that share the first three digits of their ZIP codes.
- **World_Adm_Divs.** Shows the borders of states, provinces, and other top-level, sub-national administrative divisions in countries around the world.
- **USA_ZIP5.** Shows the borders of 5-digit ZIP codes in the United States.
- **USA_States_Gen.** Shows the borders of states in the United States.

The following pre-configured demographic layers can be used if you configured the adapter for Esri ArcGIS with your ArcGIS account credentials to create a named connection:

- **USA_Tapestry_Segmentation.** Displays a choropleth map of the United States with lifestyle categories based on demographic and socioeconomic data.

- **USA_Population_Density.** Displays a choropleth map of the United States based on population density.
- **USA_Population_Growth.** Displays a choropleth map of the United States based on projected change in population.
- **USA_Per_Capita_Income.** Displays a choropleth map of the United States based on per-capita income.
- **USA_Restaurant_Spending.** Displays a choropleth map of the United States based on restaurant spending.
- **USA_Health_Care_Spending.** Displays a choropleth map of the United States based on healthcare spending.
- **USA_Unemployment_Rate.** Displays a choropleth map of the United States based on the unemployment rate.
- **USA_Median_Age.** Displays a choropleth map of the United States based on the median age.
- **USA_Median_Home_Value.** Displays a choropleth map of the United States based on the median home value.
- **USA_Median_Household_Income.** Displays a choropleth map of the United States based on the median household income.

basemap

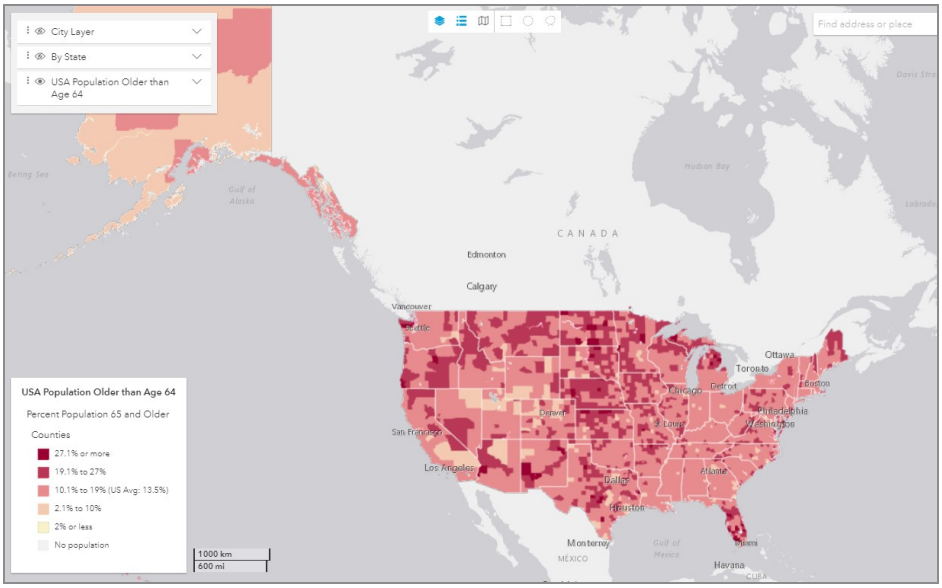
Is a basemap listed in the geo_services.xml file. For more information on available basemaps, see Creating Multilayer Map Procedures.

The following syntax example can be added as a layer in a multilayer map to display the USA Population Older than Age 64 demographic layer.

```
GRAPH FILE SYSCOLUM
SUM CNT.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH EXTENSION
ON GRAPH SET STYLE *
type=data, column=n1, bucket=null, $
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
```

```
        "overlayLayers":            [
                {
                    "ibiAddLayer": "USA_Population_Older_than_Age_64"
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

When run as part of a multilayer map, the demographic layer appears as shown in the following image.

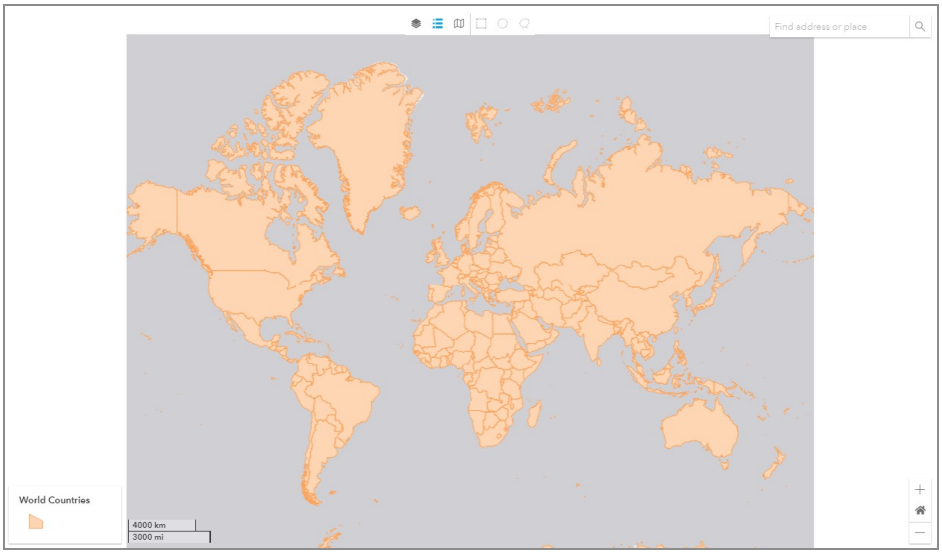


The following syntax can be added as a layer in a multilayer map to display the World Countries reference layer.

```
GRAPH FILE SYSCOLUM
SUM CNT.TBNAME
IF RECORDLIMIT EQ 1
```

```
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH EXTENSION
ON GRAPH SET STYLE *
type=data, column=n1, bucket=null, $
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiAddLayer": "World_Countries"
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

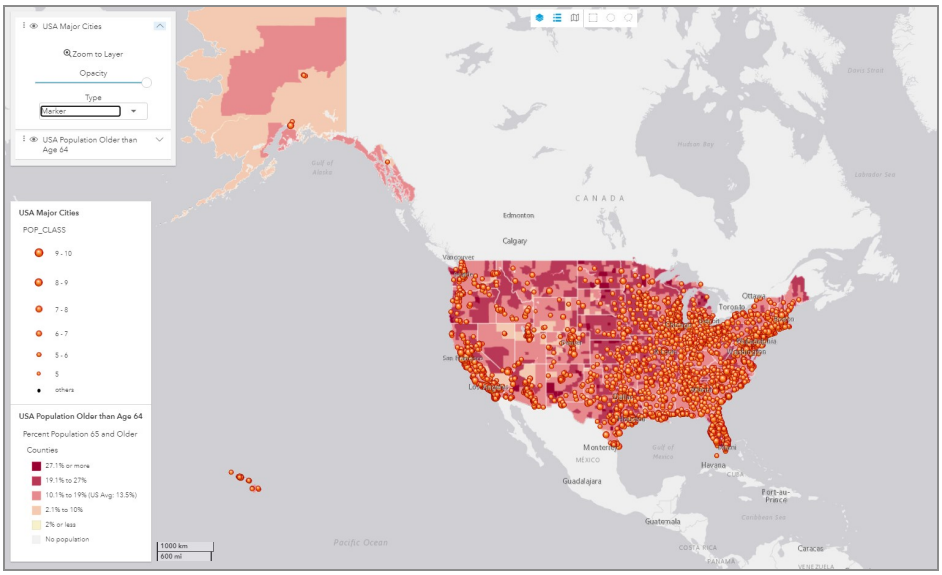
When you run a multilayer map with this layer, it appears as shown in the following image.



You can add multiple context layers to a single map layer. The following syntax example generates both the USA Major Cities reference layer and the USA Population Older than Age 64 demographic layer. Layers are placed in reverse order. The layer listed first displays on the bottom, and the layer listed last displays on top.

```
GRAPH FILE SYSCOLUM
SUM CNT.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH EXTENSION
ON GRAPH SET STYLE *
type=data, column=n1, bucket=null, $
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiAddLayer": "USA_Population_Older_than_Age_64"
                                    },
                {
                    "ibiAddLayer": "USA_Maj_Cities"
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

When you run a multilayer map with this layer, the demographic layer and reference layer both appear, as shown in the following image.

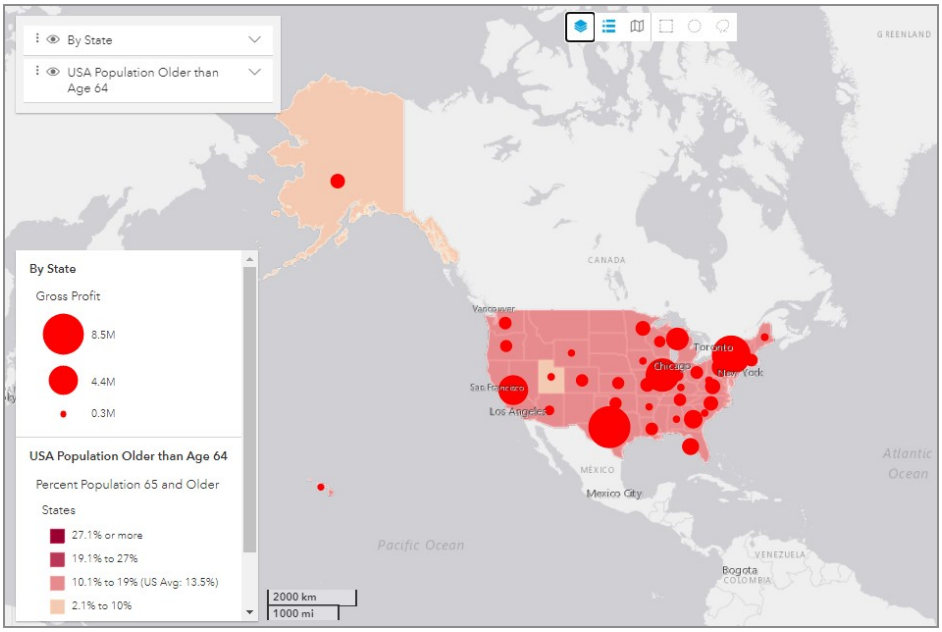


You can also include a context layer as part of a data layer. The following syntax adds the USA Population Older than Age 64 demographic layer underneath to a data layer showing gross profit by store state.

```
EMBED COMPONENT

GRAPH FILE wfretail82/wf_retail_lite
SUM GROSS_PROFIT_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.STATE_PROV_NAME
WHERE WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME EQ 'United
States'
WHERE WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.STATE_PROV_NAME NE
'Idaho'
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET STYLE *
type=report, titletext='By State', $

-* INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $
type=data, column=n2, bucket=size, $

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiAddLayer": "USA_Population_Older_than_Age_64"
                                    },
                {
```

```
                    "ibiDataLayer": {
                        "map-metadata": {
        "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.STATE_
PROV_NAME"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
}
END
```

When run as part of a multilayer map, the data layer and demographic layer appear as shown in the following image.



Customizing Multi-Layer Maps

When creating a multi-layer map, some properties affect the base layer or the entire map. These include the ability to set the basemap, default zoom level, selection area units, and more. These properties are generally defined in the EMBED MAIN section of the multi-layer map request.

Specifying a Basemap for a Multi-Layer Map

Since a multi-layer map displays multiple map layers in a single map, only one basemap is used. By default, the basemap of the last embedded layer is used. However, you can override this by specifying a basemap in the EMBED MAIN section of the procedure. Add a syntax specifying the basemap in the *GRAPH_JS_FINAL block, in the following format:

```
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps":                  [
                    {
                        "ibiBaseLayer": "basemap"
                    }
                ]
        }
    }
}
```

Where:

basemap

Is a basemap listed in the geo_services.xml file. The default location of this file is:

```
drive:\ibi\srvnn\home\catalog\geo_services.xml
```

The following basemaps are available by default:

- **gray-vector.** Gray vector.
- **satellite.** World imagery.
- **Terrain.** Terrain with labels.

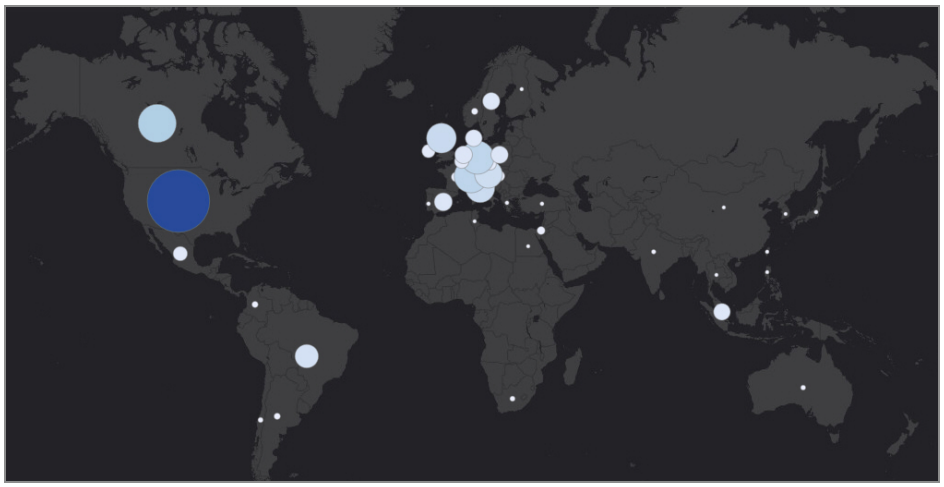
- **oceans.** Oceans Map.
- **osm.** Open Street Map.
- **hybrid.** World Imagery with Labels.
- **streets-night-vector.** Streets Night Vector.
- **streets-navigation-vector.** Streets Navigation Vector.
- **topo-vector.** Topographic Vector.
- **dark-gray-vector.** Dark Gray Vector.
- **streets-vector.** Streets Vector.
- **streets-relief-vector.** Streets Relief Vector.
- **None.** No basemap.

The following syntax example shows the EMBED MAIN section of a multi-layer map request, with the ibiBaseLayer property set to use the Dark Gray Canvas basemap.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
SUM FST.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [
                    {
                        "ibiBaseLayer": "dark-gray-vector"
                    }
                ]
        }
    }
```

```
}
END
```

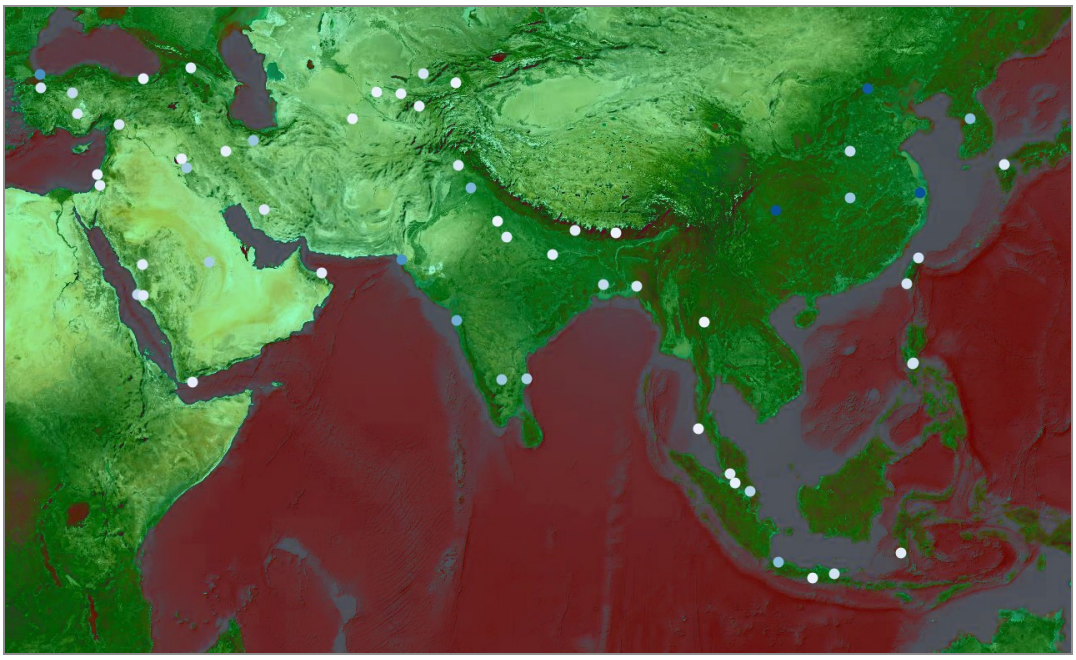
An example of a multi-layer maps using this EMBED MAIN section is shown in the following image.



When you run a multi-layer map, you also have the option of changing the basemap at any time by clicking the **Base maps** button on the run-time toolbar. Each basemap shows different levels of simplicity, symbolism, and detail, and focus on different types of geographic and urban features, so you can choose a basemap that highlights the type of information that you want to communicate with your content.

Applying Color Blending Effects to Base Layers

You can blend base layers together to customize the aesthetic of your map. You can combine a basemap or a background color with a tile layer, and modify how the layer and background are combined using color blending effects. You can even blend multiple layers together to create more varied effects. For example, the following image shows a map that uses the difference blending effect to combine a satellite tile layer with a maroon background, resulting in a unique background appearance.



To apply blending to a tile layer, add a new tile layer to your environment as described in Configuring Geographic Information. In the image shown above, the layer is the Satellite basemap from Esri, re-added to the ibi™ WebFOCUS® Reporting Server as a context layer. You can then use the layer in your map along with a specified basemap, or without a basemap. When you choose not to use a basemap, you can blend the selected layer with a background color of your choice.

You can specify the layer, blending effect, basemap, and background color in the EMBED MAIN section of a multi-layer map request, in the following format.

```
"extensions":{
       "com.ibi.geo.map": {
              "overlayLayers": [
              {
                     "ibiAddLayer": "layer_name",
                     "options": {
                            "opacity": opacity,
                            "index": index,
                            "blendMode": "effect"
                     }
              }
       ],
              "baseMapInfo": {
                     "customBaseMaps": [{
                            "ibiBaseLayer": "basemap_name"
                                   }
                            ]
```

```
                        },
                "background": "color"
        }
}
```

Where:

layer_name

Is the name of a tile layer added to your environment as a context layer. This layer is blended with the basemap using the selected blendMode effect.

opacity

Is the opacity of the tile layer, as a decimal value between 0 and 1. An opacity value of 1 makes the layer fully opaque, and an opacity value of 0 makes it completely transparent. Reducing the opacity reduces the intensity of the blending effect.

index

A numeric value that determines the layers position in relation to other layers, if multiple context layers have been added to the map. Layers with higher index values appear on top of those with lower index values.

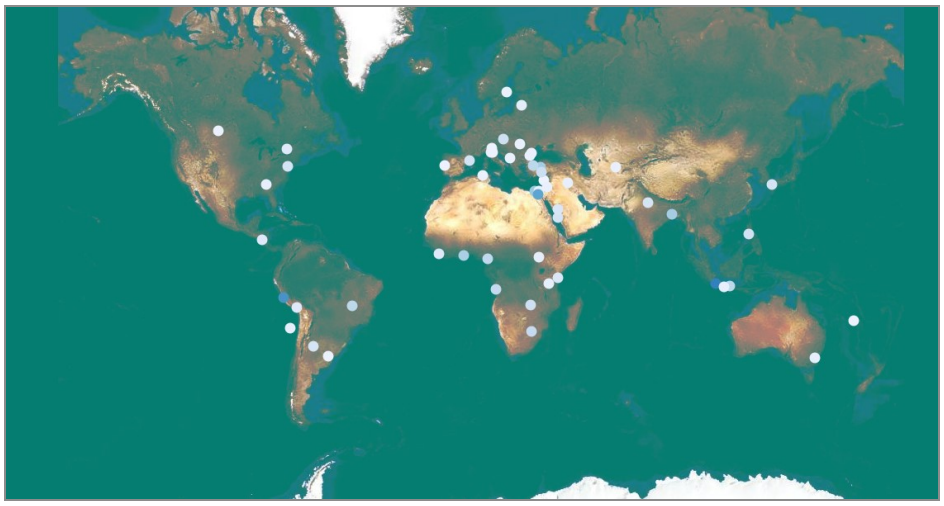
`effect`

Is the blending effect that should be applied to the layer. Each of these effects combines the layers, basemap, and background color in the map in different ways. Detailed descriptions of these blending effects are available at https://developers.arcgis.com/javascript/latest/api-reference/esri-layers-WebTileLayer.html#blendMode. The following blending effects are available. Each effect in the list is accompanied by an image that shows the result when the blending effect is applied to a satellite tile layer on a plain, teal-colored background. A bubble layer has also been added.

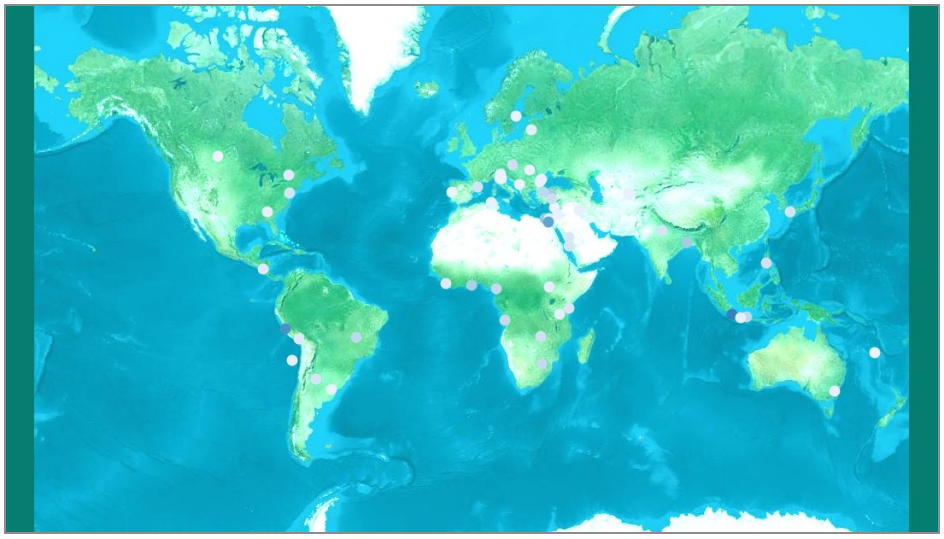
- **normal.** No blending is applied, as shown in the following image.

- **average.** The layer and background are blended together in equal proportion, as shown in the following image.

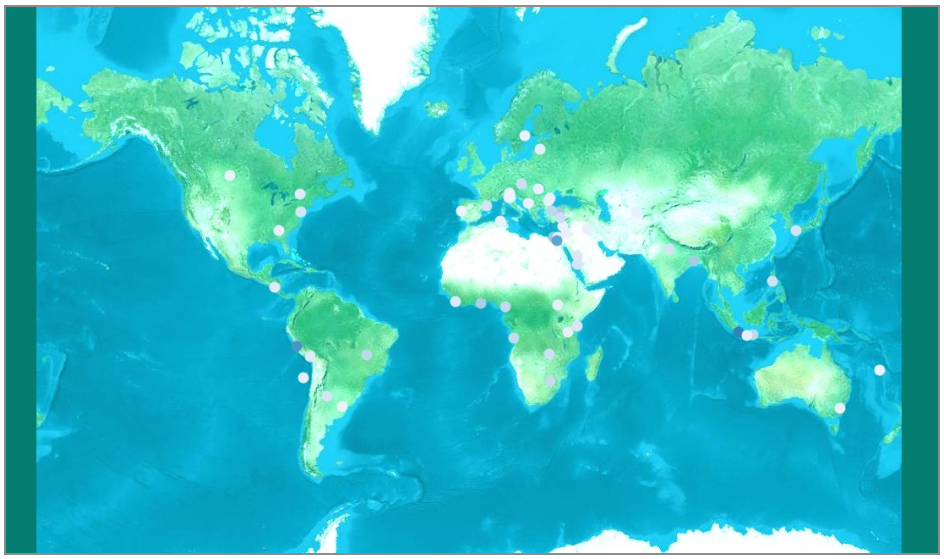
- **lighten.** Keeps the lightest color of the overlapping layers, as shown in the following image.



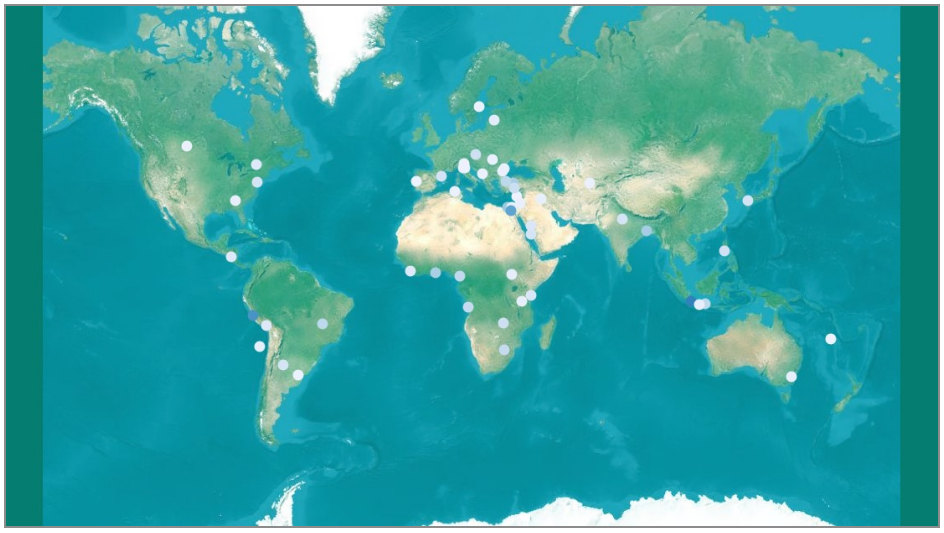
- **lighter.** Colors in overlapping layers are added together, taking opacity into account, as shown in the following image.



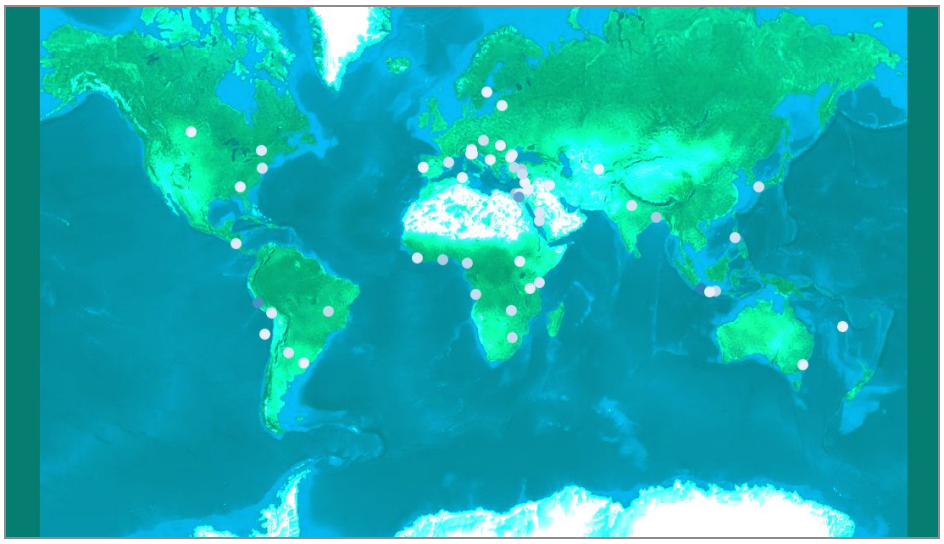
- **plus.** Colors in overlapping layers are added, ignoring opacity settings, as shown in the following image.



- **screen.** Inverts, multiplies, then reverts the colors in overlapping layers, as shown in the following image.



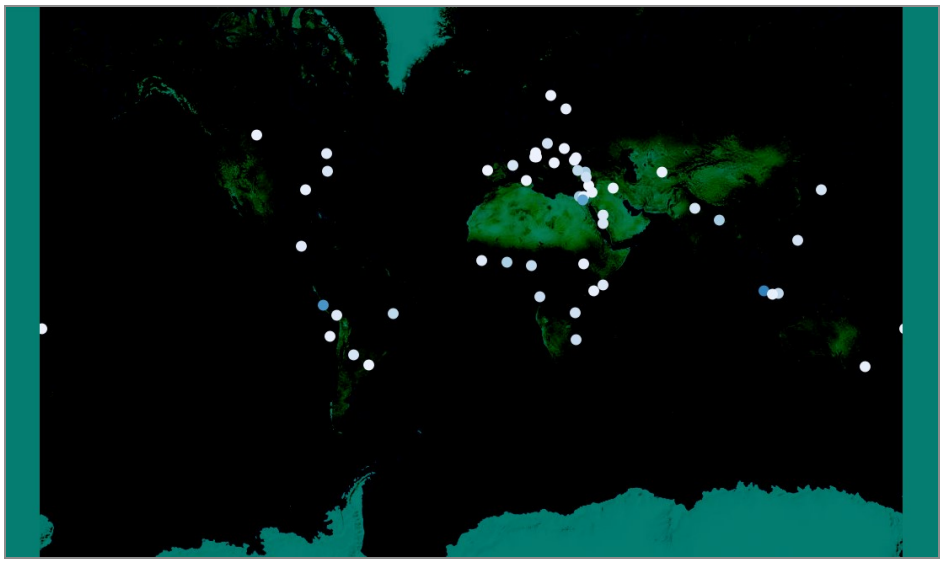
- **Color-dodge.** Divides the color of the bottom layer by the invert of the top layer, as shown in the following image.



- **darken.** Keeps the darkest color of the overlapping layers, as shown in the following image.

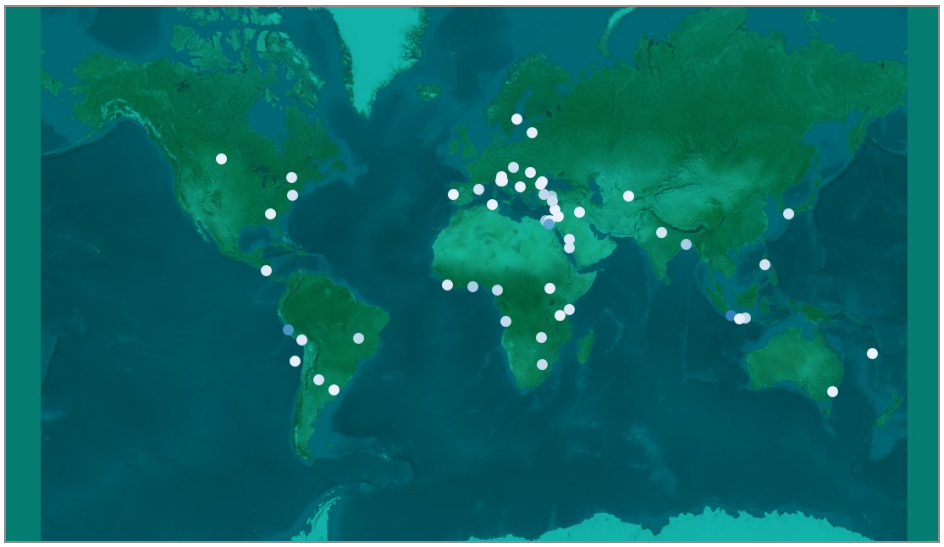
- **multiply.** Multiplies the colors of each layer together, as shown in the following image.

- **color-burn.** Divides the invert of the bottom layer by the top layer, then inverts the resulting colors, as shown in the following image.



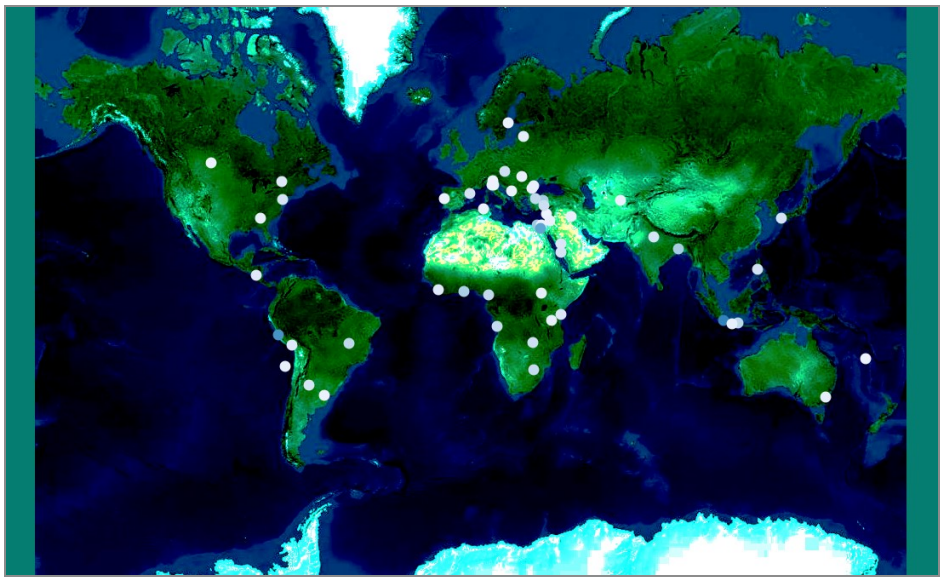
- **overlay.** Is a combination of the multiply and screen effects that lightens light areas of the background, and darkens dark areas of the background, as shown in the following image.

- **soft-light.** Compares the layers, then applies a half-strength screen to areas where the top layer is lighter than the background, and a half-strength multiply to areas where the top layer is darker, as shown in the following image.



- **Hard-light.** Is a combination of the multiply and screen affects that lightens light areas of the top layer and lightens light areas of the top layer, as shown in the following image.

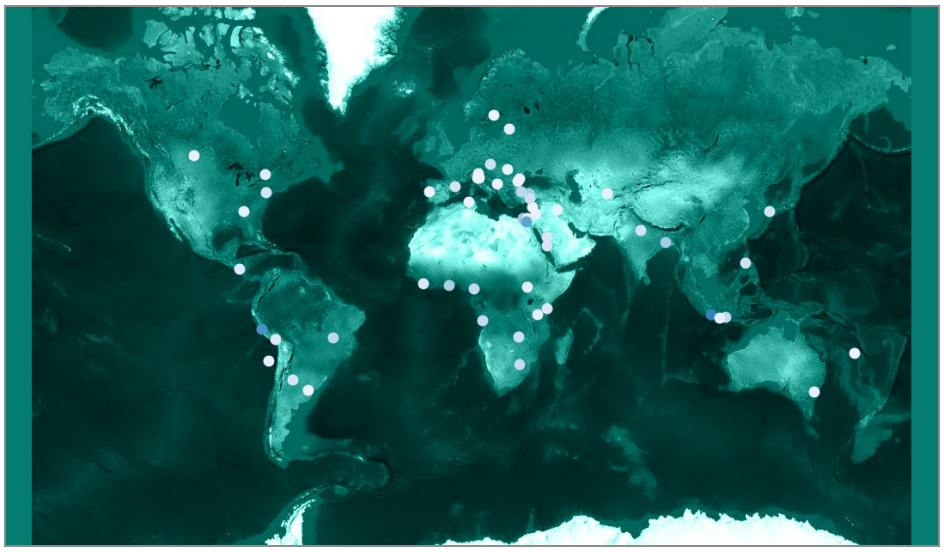
- **vivid-light.** Is a combination of color-dodge and color-burn. Applies color dodge to areas where the top layer is lighter, and applies color burn to areas where the top layer is darker, as shown in the following image.



- **hue.** Takes the hue of the top layer and applies the saturation and brightness of the background layer, as shown in the following image.

- **saturation.** Takes the saturation of the top layer and applies the hue and brightness of the background layer, as shown in the following image.

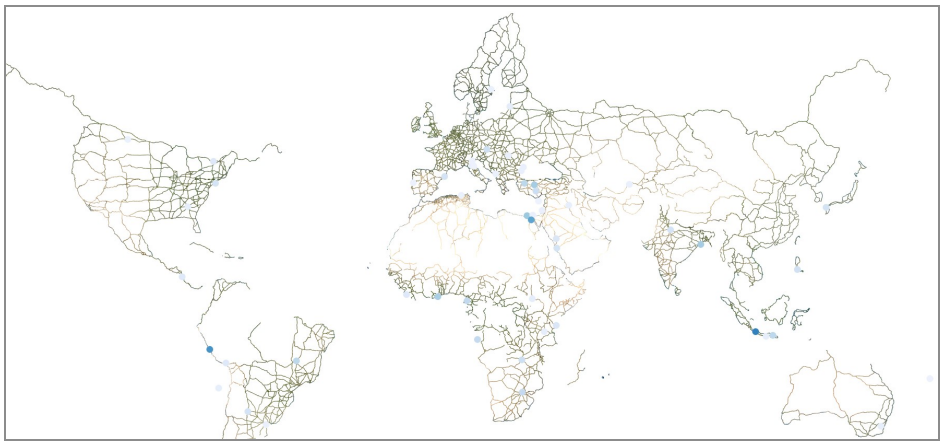
- **luminosity.** Takes the brightness of the top layer and applies the hue and saturation of the background layer, as shown in the following image.



- **color.** Takes and hue and saturation of the top layer and applies the luminosity of the background layer, as shown in the following image.

- **destination-over.** The background layer is drawn over the top layer. This is best used with a background layer with transparent areas.
- **destination-atop.** The background layer is drawn over the top layer only where the two overlap. This is best used with a background layer with transparent areas.

- **destination-in.** The background layer is drawn where it overlaps with the top layer, leaving everything else transparent. This is best used with a foreground layer that has transparent areas, to show the background in the non-transparent areas. The following image shows a map where the foreground layer has outlines for major roadways, and the satellite layer is used as the background. The lines covered by the foreground layer show the background image as a result of the destination-in effect.

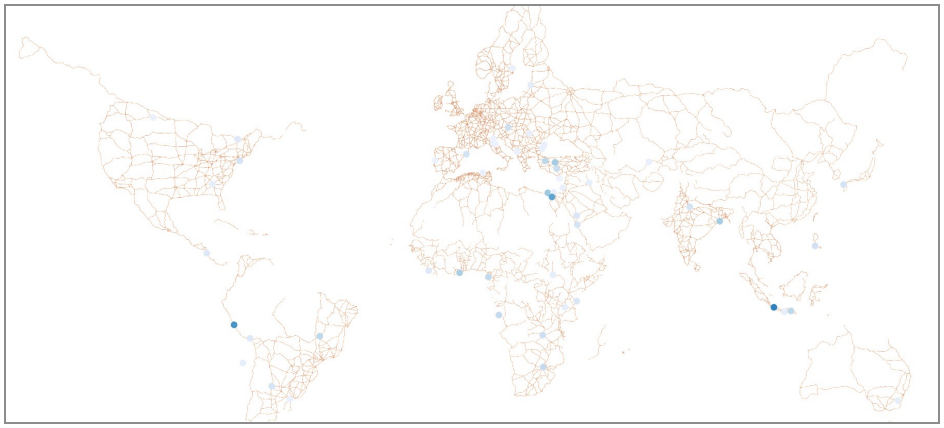


- **destination-out.** The background layer is drawn where it does not overlap with the top layer. Areas where the two layers overlap are left transparent. This is best used with a foreground layer with transparent areas. The following image shows a map where the foreground layer has outlines for major roadways, and the satellite layer is used as the background. The lines covered by the foreground layer are transparent, and the background satellite layer displays as a result of the destination-out effect.

- **source-atop.** The foreground layer is drawn over the background layer. This is

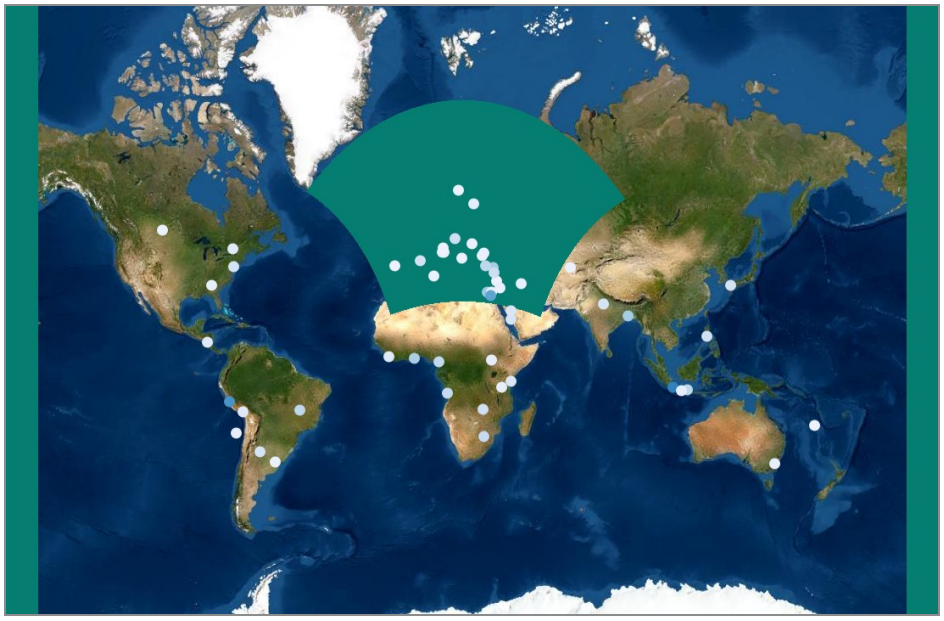
best used with a foreground layer that has some transparent areas, allowing the background layer to show through. The following image shows a map where major roadways are represented as lines, and the satellite layer in the background is visible underneath.

- **source-in.** The foreground layer is drawn over the background layer, and the transparent areas of the foreground layer are made transparent, completely hiding the background. This allows you to show only a foreground layer with transparent areas, and hide it to see only the background layer. The following image shows a map where major roadways are represented as lines. The satellite background layer is not visible underneath it as a result of the source-in effect.

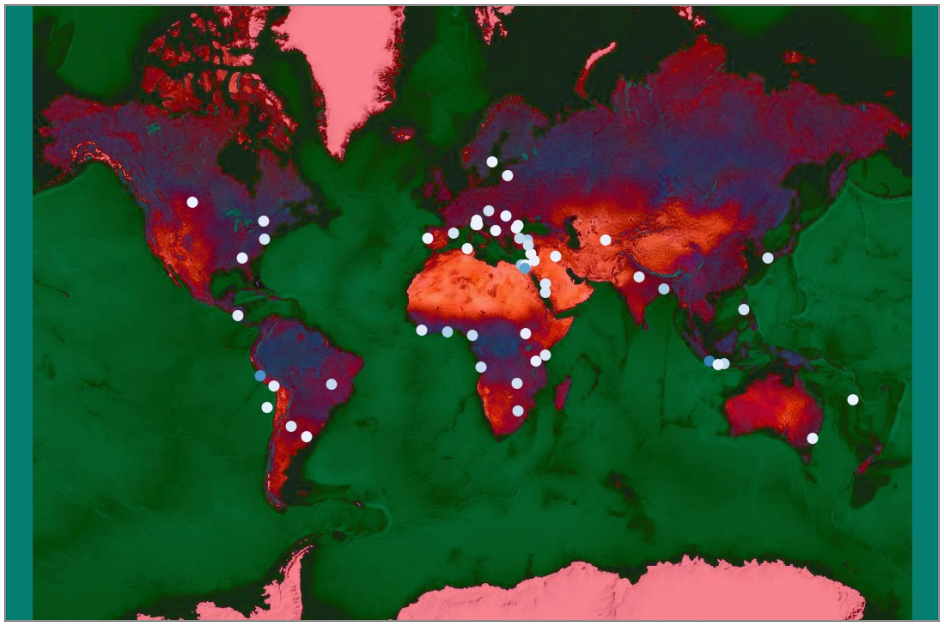


- **source-out.** The foreground layer is only drawn where it does not overlap with the background layer. Transparent areas of the background are still considered to overlap. Areas that do overlap become transparent, and no layer displays.
- **xor.** Top and background layers are both made transparent where they overlap.

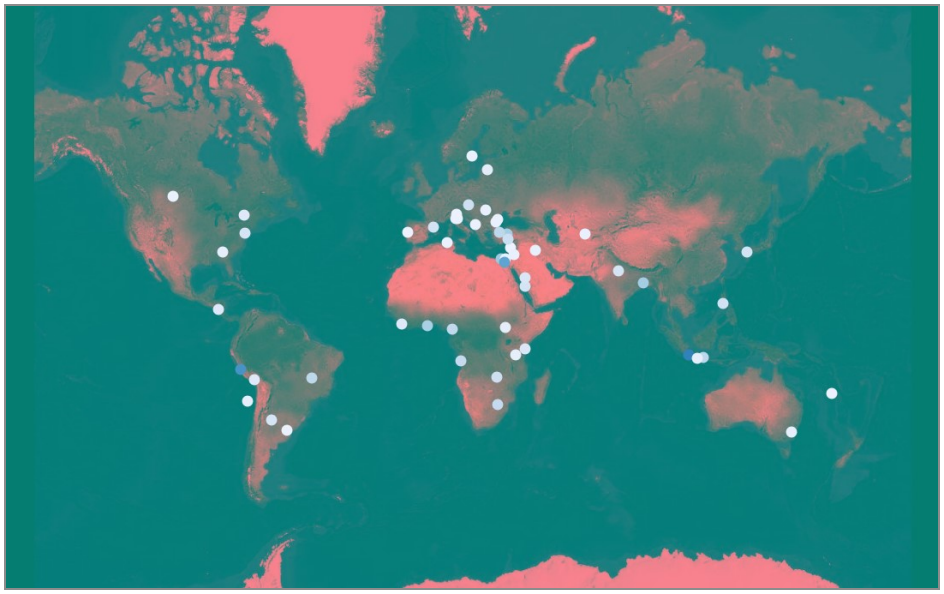
The following image shows a map where the top layer is a map of Europe, and the bottom layer is the satellite layer. The area where the map of Europe and satellite layer overlap becomes transparent, revealing the teal background.



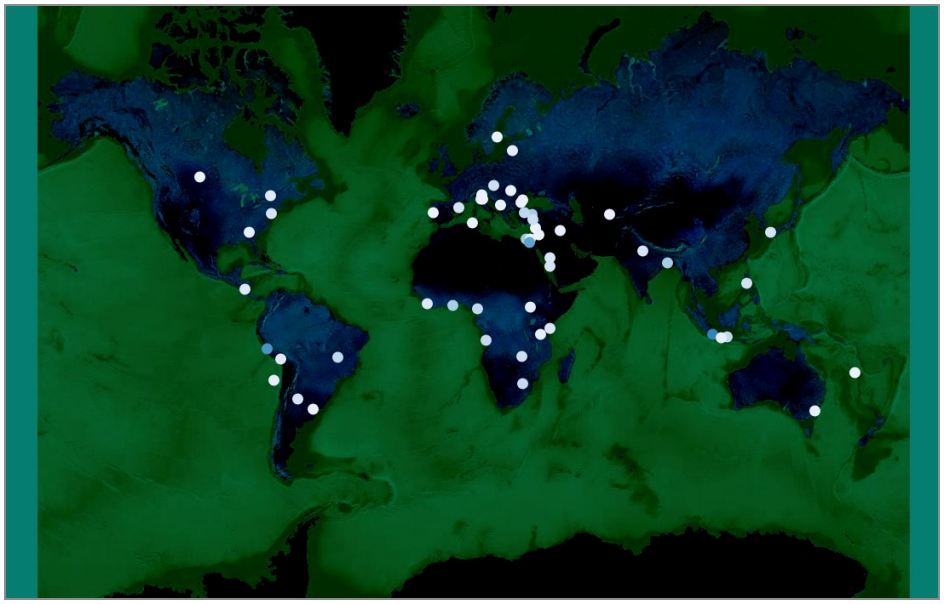
- **difference.** Subtracts the darker color in an area with overlapping layers from the lighter color, as shown in the following image.



- **exclusion.** Similar to difference, subtracts the darker color in an area with overlapping layers from the lighter color, lightening lighter colors and making darker colors transparent, as shown in the following image.

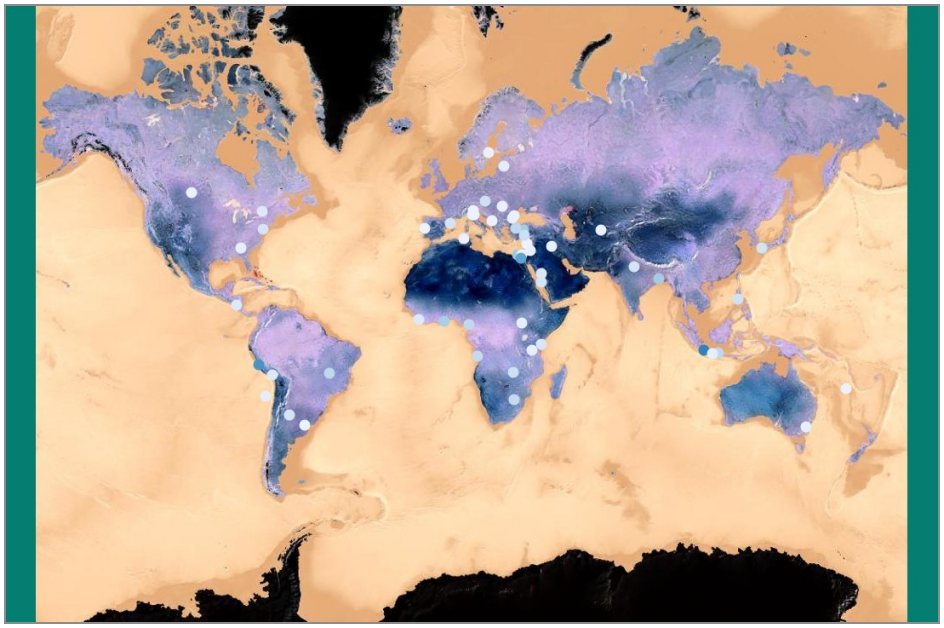


- **minus.** Subtracts the color of the top layer from the background color. When the value is negative, black displays, as shown in the following image.



- **invert.** Inverts the background layer where layers overlap. In the following image,

two satellite layers have been added, one over the other. The top layer has the invert effect applied, so that the second satellite layer can be shown with inverted colors.



- **reflect.** Light areas are made brighter and black pixels become transparent, heightening the reflection of light off shiny objects. The following image shows the reflected effect applied to the satellite layer on a teal background, with the map zoomed in on the city of Vienna to demonstrate how the effect looks with buildings and different types of terrain.

basemap_name

Is the name of a basemap available in your environment. For more information, see Customizing Multi-Layer Maps.

color

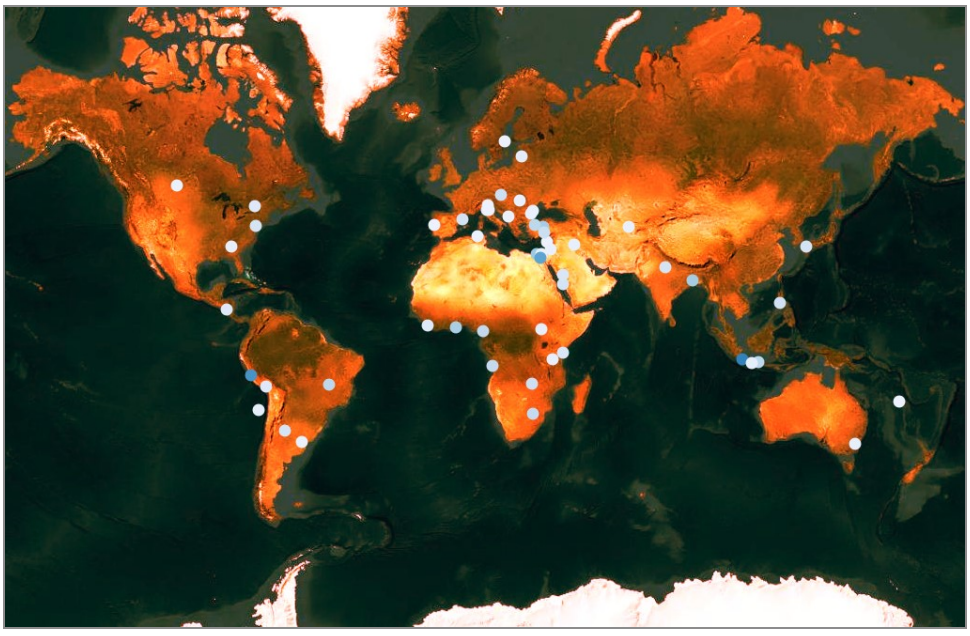
Is a color string to set a background color for the map. This can be a color name in single quotation marks, an RGB string in parentheses in the format rgb(**r**, **g**, **b**), a hexadecimal code preceded by a pound sign (#), or another accepted format. If you do not set a background color, a white background is used by default.

The following syntax example contains the EMBED MAIN section of a multi-layer map, where a satellite tile layer with the hard-light effect applied is layered over an orange background with no basemap.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
SUM CNT.TBNAME
IF READLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
CHART-LOOK=com.ibi.geo.map, $
TYPE=DATA, COLUMN=N1, BUCKET=NULL, $
*GRAPH_JS
*GRAPH_JS_FINAL
"extensions":{
       "com.ibi.geo.map":{
```

```
    "overlayLayers":[
       {
       "ibiAddLayer":"satellite_lyr",
              "options":{
                     "opacity": 1, "index":1,
                     "blendMode":"hard-light"
                     }
              }
       ],
       "baseMapInfo": {
        "customBaseMaps": [
            {
            "ibiBaseLayer": "None"
                }
            ]
        },
    "background":"#ff6726"
       }
}

*END
ENDSTYLE
END
EMBED END
```

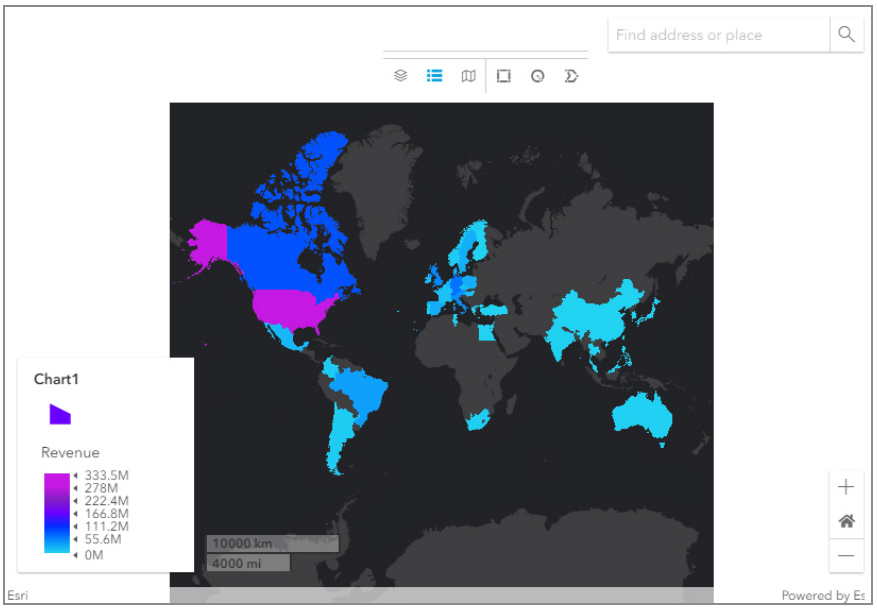
When run, the hard-light effect is applied to blend the satellite layer with the orange background, as shown in the following image.



Setting the Theme of the Run-Time Interface

When you run a multi-layer map, you are provided with components to help you interpret the map and change your view of the map. These include a legend, run-time toolbar, layer list, and more. For more information, see Interacting With Multilayer Maps at Run Time.

By default, these interface components are white with dark gray icons, as shown in the following image.



However, you can apply a different, available theme by setting a value for the theme property, under extensions:com.ibi.geo.map in the EMBED MAIN section of the procedure. You can also apply the selected theme to the tooltips that appear when you point to areas of the map by using the inheritEsriTheme property. These can be set in the following format.

```
"uiTheme": "theme"
```

Where:

theme

Contains a set of properties associated with different areas of the run-time interface:

- widgets

    - color
    - font-size
    - font-family
    - font-weight
    - background-color
- active
    - color
- hover
    - color
    - background-color
- legend
    - color
    - font-size
    - font-family
    - font-weight
    - background-color

In the following syntax example, showing the EMBED MAIN section of a multi-layer map, the theme has been set to **dark-blue** to match the dark gray basemap and the colors in the color scale of the choropleth map layer. For more information on setting a color scale, see Customizing Map Layers. The theme has been set to apply to the tooltips as well. Notice that, to match the theme and basemap, the chart background has also been set to a dark gray color using the fill property.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
COUNT *
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
```

```
*GRAPH_JS_FINAL
"fill": {
    "color": "rgb(34, 35, 39)"
},
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [
                    {
                "ibiBaseLayer": "dark-gray"
                    }
                ]
            },
        "theme": "dark-blue",
         "inheritEsriTheme": true
    }
}
END
EMBED END
```

The inheritEsriTheme property in the EMBED MAIN section of the multi-layer map procedure can be used to pass styling properties used in the map toolbar and widgets to the tooltip. When the inheritEsriTheme property is set to true, the default tooltip styling in multi-layer maps matches the runtime interface theme of the map to provide consistent styling throughout all areas of the map interface. You can still apply styling from the WebFOCUS theme StyleSheet instead, by setting the "inheritEsriTheme" property to false. By default, the value of inheritEsriTheme is set to true.

The following is an example of uiTheme properties and values that can be used.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
COUNT *
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL
"fill": {
    "color": "rgb(34, 35, 39)"
},
"extensions": {
```

```
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [
                    {
                "ibiBaseLayer": "dark-gray"
                    }
                ]
            },
         "uiTheme": {
            "widgets" : {    "color":  "#ffffdd",
     "font-size": "14pt",
     "font-family": "Tw Cen MT",
     "font-weight" : "bold",
     "background-color" : "#193d7f"             },

"active" : {
     "color": "#faa404" },
"hover" : {
     "color": "#fc3d1c",
     "background-color" : "#2295a9"
},
"legend" : {
"color":  "#ffffdd",
     "font-size": "14pt",
     "font-family": "Tw Cen MT",
     "font-weight" : "bold",
     "background-color" : "#193d7f"
    }
}
END
EMBED END
```

When the multi-layer map is run, the theme is applied to the interface components, and the tooltip inherits the theme background color and font as shown in the following image.

Setting a Fixed Initial Scope for a Map

By default, when a multi-layer map loads, the initial view of the map is set to a zoom level and location that allows all values from all layers to display. However, you can specify your own initial zoom level and center coordinates to determine the scope of the map on loading.

When you run the map, clicking the **Reset Extent** button returns the view of the map to the starting extent. Click **Zoom to Layer** on the Layers menu to change the extent to view all points in a selected layer.

For information on setting the initial view of a 3D multi-layer map, see Creating 3D Maps.

To set the initial scope of a map, use the extensions:com.ibi.geo.map:baseLayer center and zoom properties in the following format:

```
"baseLayer": {
       "center": [longitude, latitude],
       "zoom": level
              }
```

Where:

longitude, latitude

Are the longitude and latitude, respectively, for the center point of the map. Use negative values for coordinates west of the prime meridian and south of the equator.

level

Is a numeric zoom level. The higher the zoom level, the closer to the center point the map displays, resulting in a smaller initial extent. A zoom level of 1 shows the entire Earth. The maximum zoom level is typically somewhere between 15 and 25, depending on the basemap.

The following example generates a single bubble map layer that shows sales for different cities in the province of Quebec. Although there were sales in the northern and eastern areas of the province, the bulk of sales are expected to be in the southern area of the province. Therefore, the map has been centered near Trois-Rivieres, roughly halfway between Montreal and Quebec City, using the baseLayer:center property. Additionally, a moderate zoom level, close enough to avoid having too many overlapping bubbles, has been set using the baseLayer:zoom property.

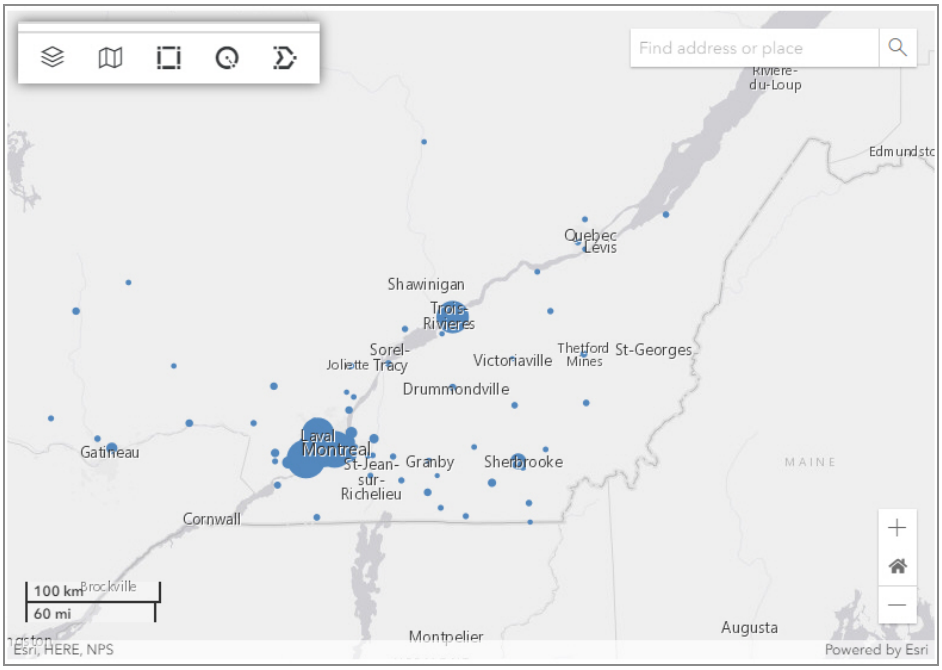
```
EMBED BEGIN PCHOLD FORMAT JSCHART

EMBED COMPONENT
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.QUANTITY_SOLD
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME
WHERE WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.STATE_PROV_NAME EQ
'Quebec';
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Chart1', ORIENTATION=LANDSCAPE,
ARREPORTSIZE=DIMENSION, ARFILTER_TARGET='*', CHART-LOOK=com.esri.map,
ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N2, BUCKET=size, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
```

```
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
                            "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_
GEOGRAPHY_CUSTOMER.CITY_NAME"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

```
EMBED MAIN
GRAPH FILE SYSCOLUM
SUM FST.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
TYPE=DATA, COLUMN=N1, BUCKET=NULL, $
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
```

```
        },
        "baseLayer": {
        "center": [-72.33,46.21], "zoom": 7
        }
    }
}
END
EMBED END
```

The following image shows the initial view of the map when it is run.



Externally Setting Layer Display Properties

While you can set properties such as visibility and opacity within a map layer, you can also set them externally to the layer, allowing you to display the same layer with different properties when it is used in different multi-layer maps, whether the map layer is written directly into the multi-layer map, or it is referenced by -INCLUDE syntax. For information on setting the default opacity of a layer, see Customizing Map Layers, and for information on setting the default visibility of a layer, see Customizing Map Layers.

In addition to opacity and visibility, these external layer display properties also allow you to set a new title for the layer, which displays in the layer list at run time, set the order in which the layers display, and set a layer to which the multi-layer map should zoom to on

load, as an alternative to zooming to display all layers, or setting a fixed center point and zoom level, as described in Customizing Multi-Layer Maps.

You can set properties to refresh layers independently, or to automatically refresh a layer based on a set timer. You can also manually invoke auto-refresh from the layer menu at run-time.

To apply these properties external to the single-layer map procedure, set an AS name for the component containing the layer, either written into the multi-layer map procedure or referenced using -INCLUDE, and then, in the EMBED MAIN section of the multi-layer map procedure, reference the layer as a component, using the AS name in its own *GRAPH_JS section. You can set these properties for as many layers as you want, using the syntax represented below:

```
EMBED BEGIN PCHOLD FORMAT JSCHART
EMBED COMPONENT AS ASNAME1layer 1

EMBED COMPONENT AS ASNAME2layer 2

...

EMBED MAIN
GRAPH FILE SYSCOLUM
HEADING CENTER
""
SUM CNT.TBNAME
IF READLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
CHART-LOOK=com.ibi.geo.map, $
TYPE=DATA, COLUMN=N1, BUCKET=NULL, $
```

```
*GRAPH_JS
*COMPONENT ASNAME1
"component":{
       "title": "title1",
       "opacity": opacity1,
       "visible": visibility1,
       "index": index1,
       "zoomToOnLoad": zoomTo,
       "path": "ibfs path",
       "refreshInt": n,
```

```
        "refreshStart": true/false
                }

*GRAPH_JS
*COMPONENT ASNAME2
"component":{
        "title": "title2",
        "opacity": opacity2,
        "visible": visibility2,
        "index": index2
                }

...

*GRAPH_JS_FINAL
"extensions": {
        "com.ibi.geo.map": {
                properties
        }
}
END
EMBED END
```

Where:

ASNAME1, ASNAME2

Are AS names that can be used to refer to each map layer in the EMBED MAIN section of the procedure, allowing you to assign display properties to them.

layer 1, layer 2

Are map layers to display in the multi-layer map. These can be written directly into the multi-layer map procedure, or referenced externally using -INCLUDE syntax.

title1, title2

Are optional titles for each layer that display in the layer list at run time. If no title value is provided, then the value of the TITLETEXT StyleSheet property in the layer is used as the title in the layer list, as described in Customizing Map Layers. If there is no value for either the title property or the TITLETEXT StyleSheet property, then generic text is used.

opacity1, opacity2

Are optional decimal values within a range of 0 to 1 that represents the opacity level of each layer. An opacity value of 0 is fully transparent, while a value of 1 is fully opaque.

1, full opacity, is the default value.

visibility1, visibility2

Are optional boolean values that specify whether or not a layer should display when the multi-layer map loads. Use a value of **true** to show the layer, or **false** to hide it initially.

True is the default. When running a multi-layer map, click the **Layer View** icon  to hide a visible layer or display a hidden layer.

index1, index2

Are optional numeric values to indicate the sort order of the layers on the map. A lower index value indicates that the layer should display below the others, while a higher index value indicates that the layer should display above layers with a lower index value. If the index property is not set, then layer sorting is based on the order in which the layers are listed, unless the layersOrder property is set in the multi-layer map to automatically order the layers based on their type, as described in Customizing Multi-Layer Maps.

zoomTo

Is an optional boolean value that, when set to **true**, sets the multi-layer map to zoom to a specific layer in the map instead of a fixed location or all points, when the map initially loads. This gives you the advantage of being able to focus on a specific layer while still allowing the focus to adapt to changes in the data for the specified layer. Set the zoomToOnLoad property to **true** for only one layer in the map.

ibfs path

If the layer is an external layer referenced using -INCLUDE, use that path. If the layer was created within the map, use the IBFS path of the multi-layer map itself. However, in this case, the entire multi-layer map is refreshed, instead of an individual layer.

n

n is the number of seconds between refreshes on the map refresh timer.

true/false

Set to **true** to have the map refresh timer start automatically when the map loads. Set to **false** to require the map refresh timer to be started manually.

properties

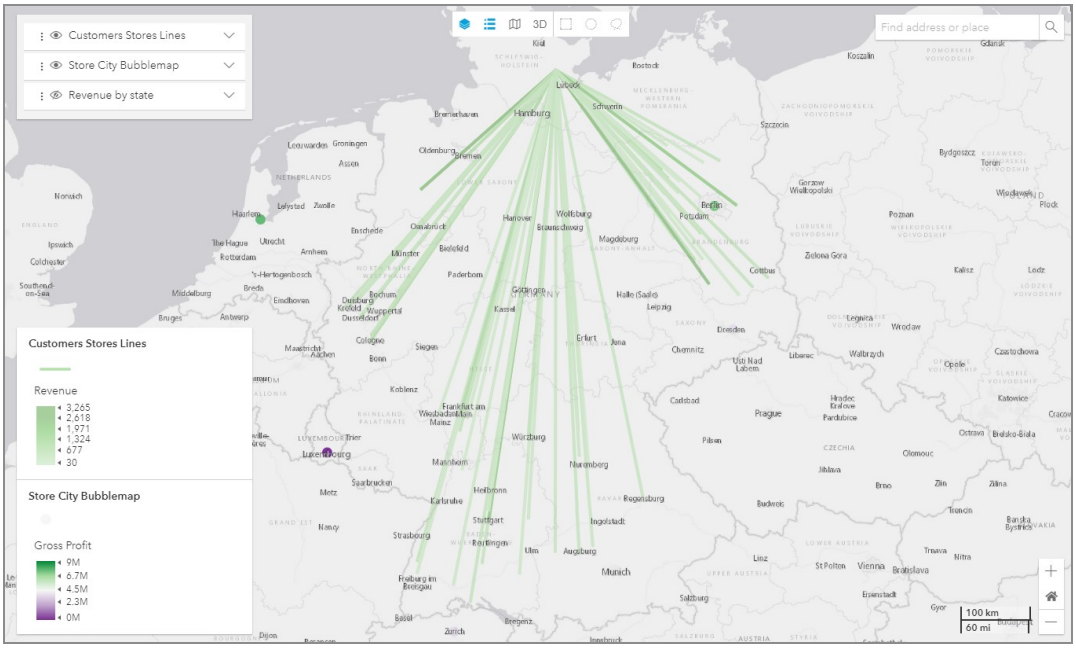
Are properties that you can add to the EMBED MAIN section of a multi-layer map procedure that affects the entire map. For more information, see the other topics in Customizing Multi-Layer Maps.

For example, the following multi-layer map procedure contains three layers: a choropleth layer, a line map layer, and a bubble map layer. All three of these layers are referenced using -INCLUDE. In the EMBED MAIN section of the procedure, the map is set to zoom to the line map layer, which is set to 50% opacity and is also set to display above the other layers. The bubble map layer is set to display directly below the line map layer, since its index value is the next highest. Finally, the choropleth layer is hidden by default, and, when activated, displays below the other layers due to its low index value.

```
EMBED BEGIN PCHOLD FORMAT JSCHART
EMBED COMPONENT AS CHOROPLETHLAYER
-INCLUDE IBFS:/WFC/Repository/maps/demo/choroplethlayer.fex
EMBED COMPONENT AS LINELAYER
-INCLUDE IBFS:/WFC/Repository/maps/demo/linelayer.fex
EMBED COMPONENT AS BUBBLELAYER
-INCLUDE IBFS:/WFC/Repository/maps/demo/bubblelayer.fex

EMBED MAIN
GRAPH FILE SYSCOLUM
HEADING CENTER
""
SUM CNT.TBNAME
IF READLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
CHART-LOOK=com.ibi.geo.map, $
TYPE=DATA, COLUMN=N1, BUCKET=NULL, $
*GRAPH_JS
*COMPONENT CHOROPLETHLAYER
"component": {
       "title":"Revenue by state", "opacity":1, "visible": false, "index":1
               }*GRAPH_JS
*COMPONENT LINELAYER
"component": {
       "title":"Customers Stores Lines", "opacity": 0.5, "visible": true,
               "index": 3, "zoomToOnLoad":true
       }*GRAPH_JS
*COMPONENT BUBBLELAYER
"component": {
```

```
        "title":"Store City Bubblemap", "index": 2
                }

*GRAPH_JS_FINAL
"extensions": {
        "com.ibi.geo.map": {
                "baseMapInfo": {
                        "customBaseMaps": [{
                                "ibiBaseLayer":"gray"
                                        }
                                ]
                        }
                }
        }

END
EMBED END
```

When run, the map displays as shown in the following image.



Configuring the Map Scale Bar

The scale bar can be used to judge the size of the area displayed in the map, as well as to approximate the distance between two points. You can change the location, units, and

style of the scale bar by specifying properties in the EMBED MAIN section of a multi-layer map procedure.

To configure the scale bar, use the following properties under extensions:com.ibi.geo.map:scalebar.

```
"scalebar": {
       "visible" : boolean,
       "scalebarUnit": "units",
       "attachTo": "position",
       "index": number
       "scalebarStyle": "style"
              }
```

Where:

Boolean

A boolean value. Use **true** to display the scale bar and **false** to hide it. **True** is the default.

units

Changes the units displayed on the scale bar. Use **non-metric** to show imperial units such as feet and miles, **metric** to show metric units such as meters and kilometers, or **dual** to show both. When using the **dual** option, the scale bar style is always displayed as a line. **Dual** is the default.

position

Is a string specifying the position of the scale bar on the map. This can be one of the following values:

- **bottom-leading.** Dynamically positions the scale bar at the bottom of the map, on the leading side. When the text on the page reads left-to-right, this is the left side. When the text reads right-to-left, this is the right side.
- **bottom-trailing.** Dynamically positions the scale bar at the bottom of the map, on the trailing side. When the text on the page reads left-to-right, this is the right side. When the text reads right-to-left, this is the left side.
- **bottom-left.** Positions the scale bar in the lower left corner of the map. This is the default.
- **bottom-right.** Positions the scale bar in the lower right corner of the map.

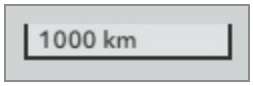
- **top-leading.** Dynamically positions the scale bar at the top of the map, on the leading side. When the text on the page reads left-to-right, this is the left side. When the text reads right-to-left, this is the right side.
- **top-trailing.** Dynamically positions the scale bar at the top of the map, on the trailing side. When the text on the page reads left-to-right, this is the right side. When the text reads right-to-left, this is the left side.
- **top-left.** Positions the scale bar in the upper left corner of the map.
- **top-right.** Positions the scale bar in the upper right corner of the map.

number

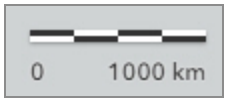
A whole number. When there are multiple multi-layer map interface elements with the same specified position, the index value determines how close each one is placed to the specified location. The element with the lowest index value is placed closest, and the element with the highest index value is placed farthest away.

style

Changes the appearance of the scale bar. Use **line** to show the scale bar as a line, as shown in the following image.



Use **ruler** to show the scale bar as a segmented bar, as shown in the following image.



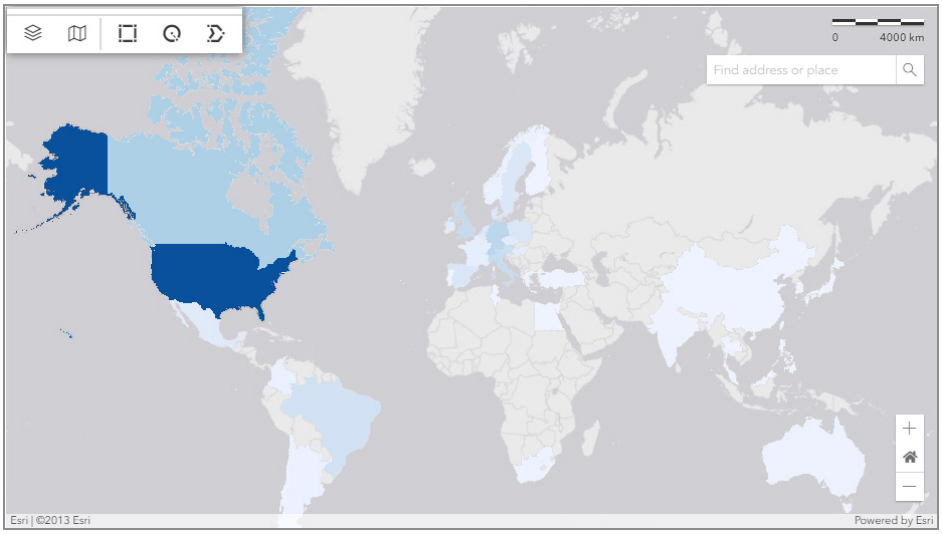
When showing dual units, the scale bar style is always **line**. **Line** is also the default value.

The following syntax example shows the EMBED MAIN section of a multi-layer map request, in which the scale bar has been moved to the top-right and changed to show only metric units with the **ruler** display style.

```
EMBED MAIN
GRAPH FILE CAR
"Markers"
SUM CNT.COUNTRY
IF READLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
```

```
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {

        "baseMapInfo": {
            "customBaseMaps":                  [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        },
        "scalebar": {
       "visible" : true,
       "scalebarUnit": "metric",
       "attachTo": "top-right",
       "scalebarStyle": "ruler"
              }
    }
}
END
EMBED END
```

When run, the map appears as shown in the following image. Notice that the search box, which is typically located in the top-right corner, has automatically been moved down slightly to accommodate the scale bar.

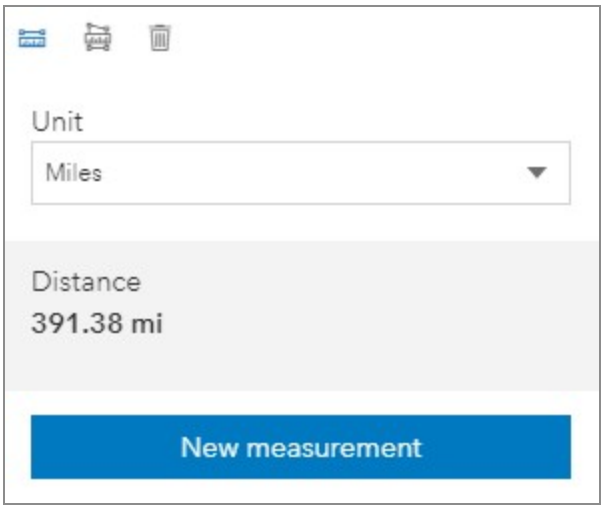


Adding Interactive Options to the Map Toolbar

You can add Esri-integrated interactive options to the map toolbar to provide easy ways for users to navigate and display additional information on the map. The following interactive options are available:

- **Search.** Allows you to search for a location by name. You can search for countries, geographic features, administrative regions, cities, addresses, and business establishments. As you type, search recommendations are provided dynamically. When you select a recommended search result, the map zooms to the location and highlights it with a marker and tooltip. The Search button displays in the map toolbar by default. The Search bar with recommended search results is shown in the following image.

- **Measurements.** Allows you to measure the linear distance or area between multiple selected points. Use the Distance Measurement Tool to draw a segmented line or the Area Measurement Tool to draw a polygon. Click locations on the map to add points to the line or polygon. The distance or area covered is reflected as you add your points to the map. When you are finished drawing your segmented line or polygon, double-click to add the last point. The measured lines or polygon remain on the map until you click **New measurement** or **Clear Measurements** in the measurement tools. The measurement tools are shown in the following image.



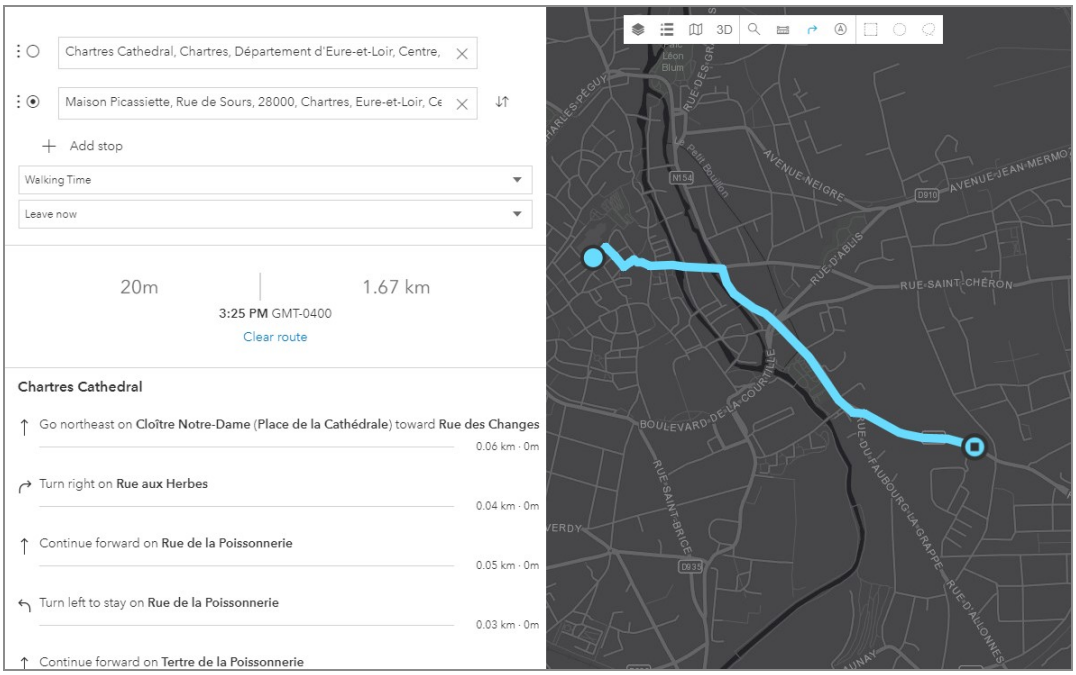
- **Directions.** Provides directions between two or more points based on the lowest time or distance when driving in different scenarios or when walking.

  Once you have entered the start and end locations, the estimated travel duration, distance, and a set of directions display, and a line on the map indicates the suggested route. When you point to a step in the directions, that segment of the route is highlighted on the map. You can click a step to zoom to the associated segment.

  Once the directions have been generated, you can reorder the start and stop points, add or remove destinations from the route, or clear the entire route.

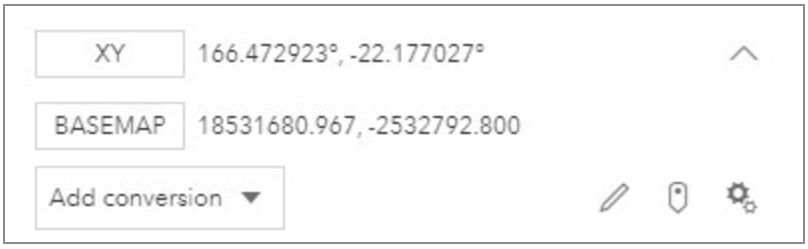
  You must have a connection using the Adapter for Esri ArcGIS configured to use the Directions widget. Driving directions may not be available for locations in all countries.

  The Directions widget with a generated route is shown in the following image.



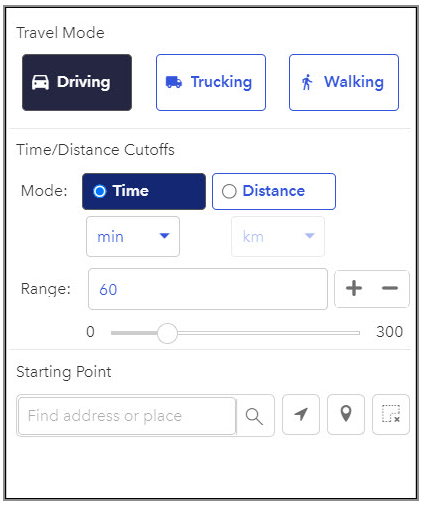
- **Location.** Allows you to see the coordinates of locations on the map. As you move your cursor across the map, the coordinates in the Location widget update to reflect its current location. By default, these coordinates are in degrees of longitude and latitude, provided as decimal values. However, you can change the coordinate system, or change the display of degree values from decimals to minutes and seconds.

  Options are also available to show multiple coordinate systems to facilitate format conversion, type a set of coordinate values to navigate to or whose format you want to convert, pin the coordinates so that they do not update as you move your mouse, and change the display format of values in different coordinate systems. When the coordinates are set to a fixed location, you can easily copy them from the Location widget. The Location widget is shown in the following image.



- **Discover.** Allows you to determine the distance or time from your current location to a selected location. You can select from different travel mode options.

The Discover widget is shown in the following image.



The interactive options that you enable appear in the middle section of the map toolbar, as shown in the following image.

Select one of these options on the toolbar at run time to display the associated tool or widget. By default, these items occupy the same area of the multi-layer map interface, and you can only use one of the interactive options at any one time.

You can set which options to display in the map toolbar, which option to open when the map loads, and the default location in the interface occupied by the selected interactive tool or widget using the extensions:com.ibi.geo.map:interaction options in the EMBED MAIN section of a multi-layer map request, in the format shown below:

```
"interaction": {
                        "default": "default",
                        "attachTo": {
                                "typeAnnotation": "position"
                        },
                        "index": number,
                        "members" : {
                                "search": {
                                        "create": boolean
                                },
                                "measurement": {
                                        "create": boolean
                                },
                                "direction": {
```

```
                                        "create": boolean
                                },
                                "location": {
                                        "create": boolean
                                },
                                "discover": {
                                        "create": boolean
                                }
                        }
                }
```

Where:

default

Is the name of the interactive option to display when the map loads. This can be one of the following values:

- search
- measurement
- direction
- location
- discover

The search bar displays by default if no default option is specified.

position

Is a string specifying the position of the interface element on the map. This can be one of the following values:

- **bottom-leading.** Dynamically positions the element at the bottom of the map, on the leading side. When the text on the page reads left-to-right, this is the left side. When the text reads right-to-left, this is the right side.
- **bottom-trailing.** Dynamically positions the element at the bottom of the map, on the trailing side. When the text on the page reads left-to-right, this is the right side. When the text reads right-to-left, this is the left side.
- **bottom-left.** Positions the element in the lower left corner of the map. This is the default.
- **bottom-right.** Positions the element in the lower right corner of the map.

- **top-leading.** Dynamically positions the element at the top of the map, on the leading side. When the text on the page reads left-to-right, this is the left side. When the text reads right-to-left, this is the right side.
- **top-trailing.** Dynamically positions the element at the top of the map, on the trailing side. When the text on the page reads left-to-right, this is the right side. When the text reads right-to-left, this is the left side.
- **top-left.** Positions the element in the upper left corner of the map.
- **top-right.** Positions the element in the upper right corner of the map.

number

A whole number. When there are multiple map interface elements with the same specified position as the interactive widget, the index value determines how close it is placed to the specified location. The element with the lowest index value is placed closest, and the element with the highest index value is placed farthest away. For information about other map interface elements, see Customizing Multi-Layer Maps.

boolean

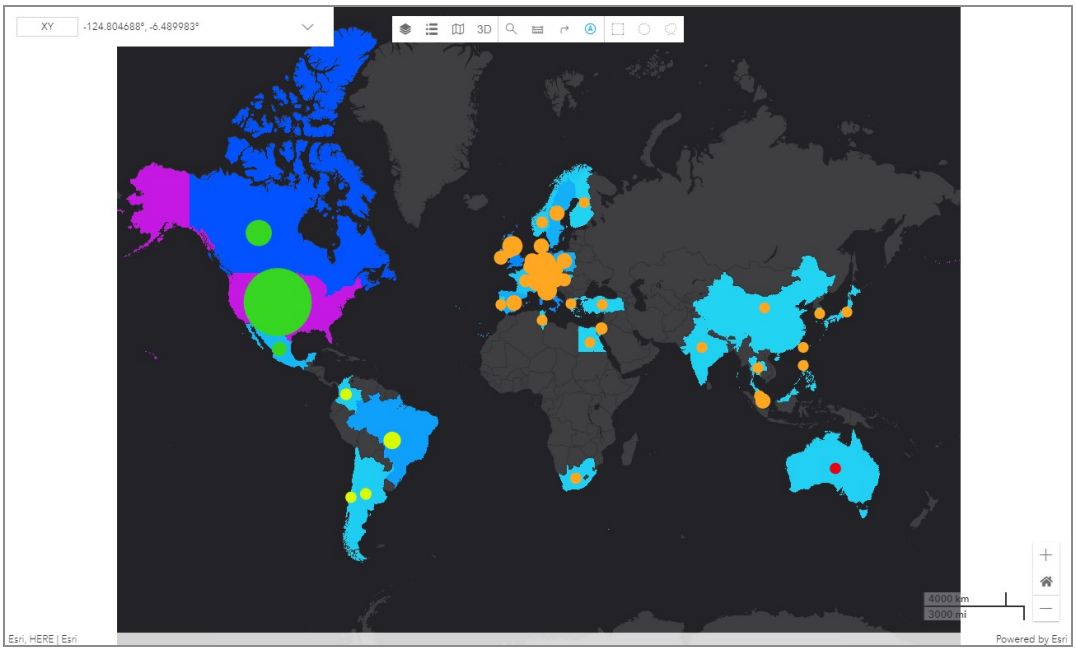
Is a Boolean value to specify whether the associated option should be added to the map toolbar. Use **true** to add the option to the toolbar at run time or **false** to remove it.

The following syntax example shows the EMBED MAIN section of a multi-layer map that adds all interactive options to the map toolbar, loads the Location widget by default, and positions the interactive options in the top-left corner of the map interface.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
SUM FST.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [ {
                "ibiBaseLayer": "dark-gray"
```

```
                    }
                ]
            },
        "interaction": {
            "default": "location",
            "attachTo": {
            "typeAnnotation": "top-left"
                            },
            "index": 1,
            "members" : {
                "direction": {
                    "create": true
                            },
                "measurement": {
                    "create": true
                            },
                            "search": {
                                "create": true
                            },
                            "location": {
                                "create": true
                            }
                        }
                }
    }
}
END
EMBED END
```

When a multi-layer map with this EMBED MAIN section is run, all four interactive options are added to the map toolbar, and the Location widget appears by default, as shown in the following image.



Adding the Locate Button to the Map Toolbar

When you click the Locate button  , the map zooms to your current location and adds a marker there. This makes it easy for users to contextualize the information in your map by centering it on their own location. The Locate button appears to the right of the Toggle 3D view button, as shown in the following image.

The Locate button can only be used when using an HTTPS protocol or running the map on localhost.

To add the Locate button to the map toolbar, set the extensions:com.ibi.geo.map:locate:create property to true in the EMBED MAIN section of the multi-layer map procedure, using the format shown below.

```
"locate": {
       "create": boolean
                }
       }
```

Where:

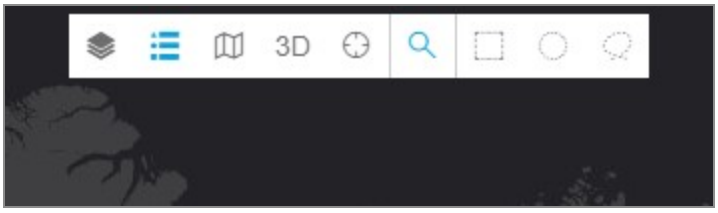
boolean

Is a Boolean value that determines whether the Locate button should be added to the multi-layer map toolbar. Use **true** to add the Locate button to the toolbar or **false** to hide it.

The following syntax example is the EMBED MAIN section of a multi-layer map procedure in which the Locate button has been added to the map toolbar.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
SUM FST.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL
"extensions": {
       "com.ibi.geo.map": {
               "baseMapInfo": {
                       "customBaseMaps": [
                               {
                                       "ibiBaseLayer": "dark-gray"
                               }
                       ]
               },
                "locate": {
                       "create": true
               }
       }
}
END
EMBED END
```

When a multi-layer map using this EMBED MAIN section is run, the Locate button appears on the toolbar at run time, as shown in the following image.



Changing the Position and Visibility of Interface Elements

In addition to the scale bar, you can change the position of the interactive map toolbar options and map interface elements. You can use properties to set whether the search bar, zoom controls, and compass should display in the map interface, and which corner of the map they occupy. These elements always display in the map when they are enabled.

Toolbar options can be shown when in use and hidden when no longer needed. You can set where in the map interface the basemap gallery, search bar, measurement tools, directions widget, and location tool appear when their respective options are selected on the map toolbar. The search bar, measurement tools, directions widget, bookmark widget, and location tool are mutually exclusive and appear in the same location when they are selected, by default. However, each of these interactive toolbar widgets can be set to use their own separate locations in the map interface. Since the other toolbar options and interface elements can all appear on the map simultaneously, setting different locations for each of them can help to maximize space in the map viewing area.

To change the position of the scalebar, zoom controls, compass, basemap gallery, Find my location button, search bar, measurement tools, directions widget, bookmark widget, and location tool, set the following properties under extensions:com.ibi.geo.map in the EMBED MAIN section of the multi-layer map procedure.

```
"scalebar": {
       "visible": boolean,
       "attachTo": "position",
       "index": number
              },
"zoom": {
       "visible": boolean,
       "attachTo": "position"
       "index": number
              },
"compass": {
       "visible": boolean,
       "attachTo": "position",
       "index": number
              },
"layers": {
       "visible": boolean,
       "attachTo": "position",
       "index": number
```

```
                },
"legend": {
       "visible": boolean,
       "attachTo": "position",
       "index": number
                },
"basemaps": {
       "visible": boolean,
       "attachTo": "position",
       "index": number
                },
"bookmarks": {
       "visible": boolean,
       "attachTo": "position",
       "index": number
                },
"search": {
       "attachTo": "position",
       "index": number
                },
"measurement": {
       "attachTo": "position",
       "index": number
                },
"direction": {
       "attachTo": "position",
       "index": number
                },
"location": {
       "attachTo": "position",
       "index": number
                }
```

Where:

boolean

Determines whether an element is visible in the multi-layer map at run time. Use **true** to show an element or **false** to hide it.

If you choose to hide the scalebar, zoom controls, or compass, they always remain hidden at run time. The compass is available only when the multilayer map runs in 3D mode.

If you hide the layer list, legend, or basemap gallery, they remain available from the map toolbar and can be opened at run time, even if they do not appear when the map initially loads.

Since only one of the interactive run-time widgets – the search bar, measurement tools, directions widget, and location widget–can be used at any one time, the visible property is not used. Select an option from the map toolbar at run time to view it, and set a default option to display when the map loads. For more information, see Customizing Multi-Layer Maps.

position

Is a string specifying the position of the interface element on the map. This can be one of the following values:

- **bottom-leading.** Dynamically positions the element at the bottom of the map, on the leading side. When the text on the page reads left-to-right, this is the left side. When the text reads right-to-left, this is the right side.
- **bottom-trailing.** Dynamically positions the element at the bottom of the map, on the trailing side. When the text on the page reads left-to-right, this is the right side. When the text reads right-to-left, this is the left side.
- **bottom-left.** Positions the element in the lower left corner of the map. This is the default.
- **bottom-right.** Positions the element in the lower right corner of the map.
- **top-leading.** Dynamically positions the element at the top of the map, on the leading side. When the text on the page reads left-to-right, this is the left side. When the text reads right-to-left, this is the right side.
- **top-trailing.** Dynamically positions the element at the top of the map, on the trailing side. When the text on the page reads left-to-right, this is the right side. When the text reads right-to-left, this is the left side.
- **top-left.** Positions the element in the upper left corner of the map.
- **top-right.** Positions the element in the upper right corner of the map.

number

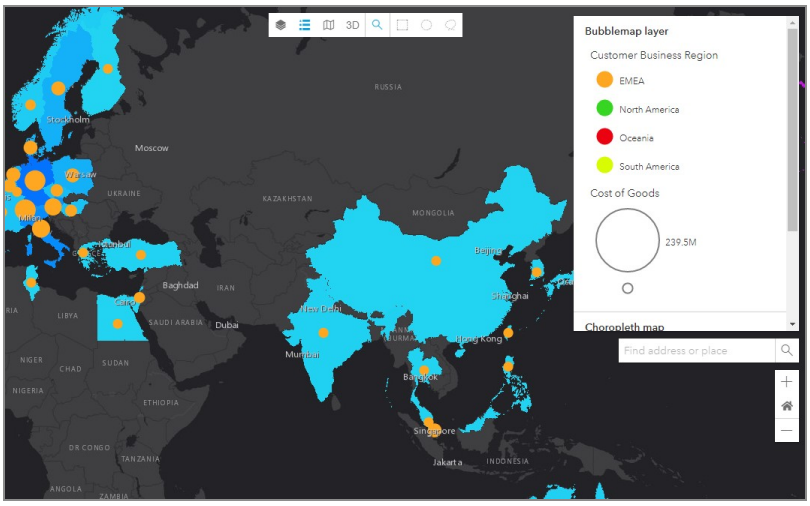
A whole number. When there are multiple map interface elements with the same specified position, the index value determines how close each one is placed to the specified location. The element with the lowest index value is placed closest, and the

element with the highest index value is placed farthest away.

The following syntax example is the EMBED MAIN section of a multi-layer map procedure that hides the scale bar and puts the search bar, zoom controls, and legend in the top-right corner, with the legend closest to the corner due to its lower index value.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
SUM FST.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [ {
                "ibiBaseLayer": "dark-gray"
                    }
                ]
            },
            "scalebar": {
                "visible": false
                    },
            "search": {
                "attachTo": "top-right",
                "index": 1
                    },
            "zoom": {
                "visible": true,
                "attachTo": "top-right",
                "index": 2
                    },
            "legend": {
                "attachTo": "top-right",
                "index": 0
        }
    }
}
END
EMBED END
```

When run, the run-time interface controls are arranged as shown in the following image.



Configuring Marker and Area Selection Styling

When hovering over or selecting markers or polygons in a map, the styling changes. This helps you easily recognize which locations are represented by a tooltip or included in a selection.

By default, when you hover over an area, the marker or polygon fill color fades and a white border is applied. When you select an area, the fill color remains the same, and a black border is applied. You can change these options by using the ttHighlight and selHighlight properties under the extensions:com.ibi.geo.map property in the EMBED MAIN section of a multi-layer map procedure. The ttHighlight property applies to areas of a map that you hover over to view a tooltip, and selHighlight applies to areas that you select or hover over when in selection mode. Selection mode is activated whenever you select an area of a map, by clicking an area or marker or by using a selection tool, and is deactivated when you clear your selections by clicking a blank area of the basemap.

Configure the extensions:com.ibi.geo.map ttHighlight and selHighlight properties as shown below:

```
"ttHighlight" : {
       "color": "hoverFillColor",
       "haloColor": "hoverBorderColor",
       "fillOpacity": hoverFillOpacity,
       "haloOpacity": hoverBorderOpacity

},
```

```
"selHighLight": {
       "color": "selectFillColor",
       "haloColor": "selectBorderColor",
       "fillOpacity": selectFillOpacity,
       "haloOpacity": selectBorderOpacity,
}
```

Where:

hoverFillColor, selectFillColor

A string defining the fill color of the marker or area when you hover over it or select it, respectively. The color string can be a color name, RGB value, hexadecimal value, and more.

hoverBorderColor, selectBorderColor

A string defining the border color of the marker or area when you hover over it or select it, respectively. The color string can be a color name, RGB value, hexadecimal value, and more.

hoverFillOpacity, selectFillOpacity

Is a decimal value between 0 and 1, representing the opacity of the fill color when hovering over or selecting a marker or area of a map. For example, a value of 0 represents full transparency, 1 represents full opacity, and 0.5 represents 50% opacity.

hoverBorderOpacity, selectBorderOpacity

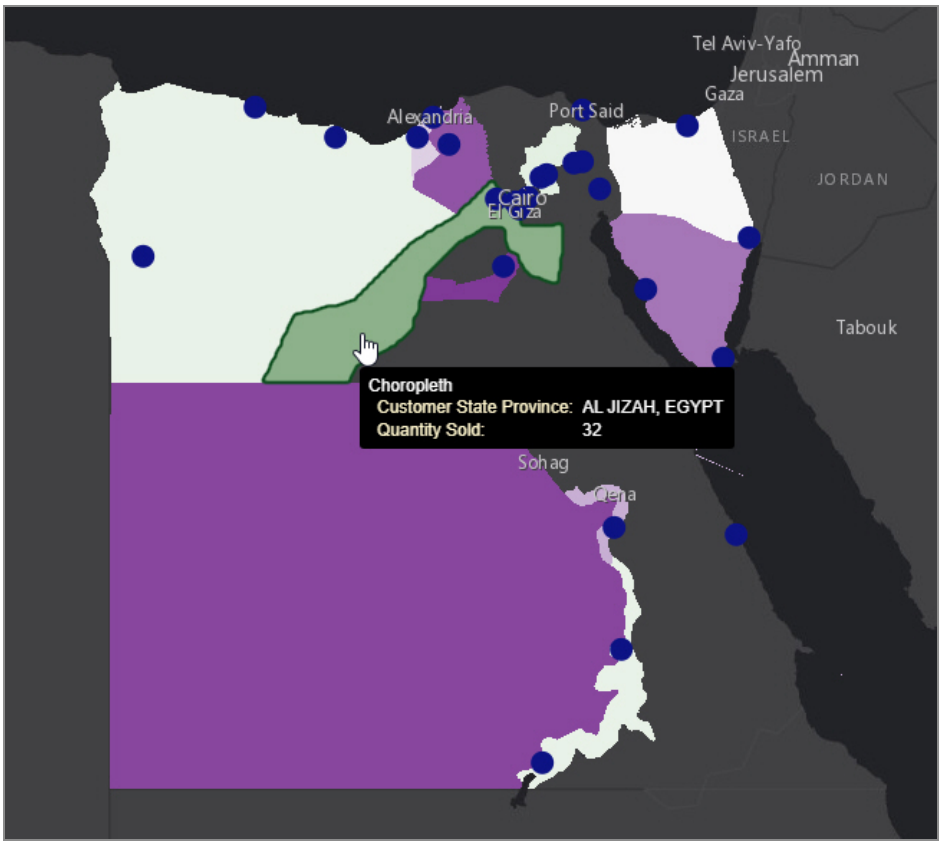
Is a decimal value between 0 and 1, representing the opacity of the border color when hovering over or selecting a marker or area of a map. For example, a value of 0 represents full transparency, 1 represents full opacity, and 0.5 represents 50% opacity.

The following syntax example is the EMBED MAIN section of a multi-layer map procedure with different styles applied on hover and selection.

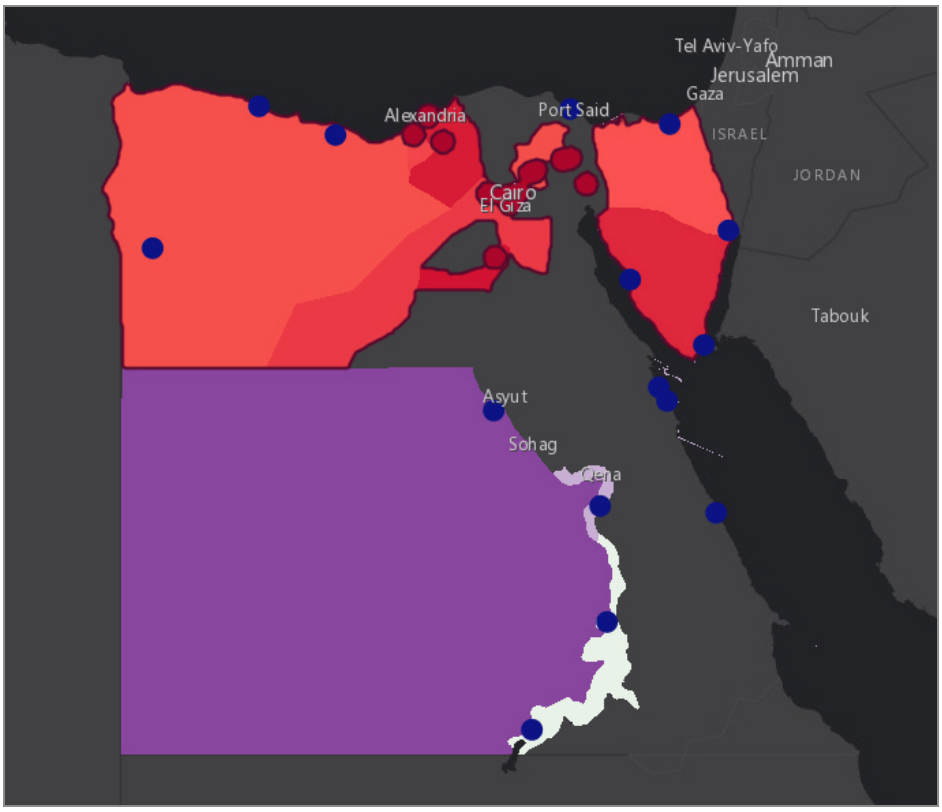
```
EMBED MAIN
GRAPH FILE SYSCOLUM
"This is the chart heading"
SUM FST.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
```

```
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {

        "baseMapInfo": {
            "customBaseMaps":                [
                    {
                "ibiBaseLayer": "dark-gray"
                    }
                ]
        },
        "ttHighlight" : {
               "color": "#53b844",
               "haloColor": "#0f4f20",
               "fillOpacity": 0.5,
            "haloOpacity": 1
},

        "selHighLight": {
               "color": "red",
               "haloColor": "rgb(90,10,45)",
               "fillOpacity": 0.667,
            "haloOpacity": 1
        }
    }
}

END
EMBED END
```

Based on the ttHighlight properties in the example, when a marker or area is pointed to, it has a green border and transparent green fill, as shown in the following image.



Based on the selHighlight properties in the example, when selecting markers or areas on a map, they have a maroon border and transparent red fill, as shown in the following image.



Determining How Layers Are Ordered

By default, when you create a multi-layer map, layers are drawn in the order in which they are listed in the procedure, and placed one on top of the other. This means that the first listed layer displays on the bottom, and the last listed layer displays on top, with all other layers in between. Knowing this order allows you to arrange the layers in your map so that as many can be visible as possible at once. For example, you may want to place bubble map layers on top of choropleth layers, since they typically occupy a smaller area.

If you do not wish to manually set the order in which the layers in you map appear, you can set them to order automatically by setting the extensions:com.ibi.geo.map:layersOrder property to **optimal** in the EMBED MAIN section of the multi-layer map procedure. The optimal setting places external feature layers, such as reference layers and demographic layers, at the bottom, choropleth data layers above those, and bubble map data layers at the top. In most cases, this provides the best visibility of each layer. You can always reorder and hide layers at run time to make it easy to see the layer that you want to analyze.

Set the layersOrder property to **optimal** as shown in the following syntax example.

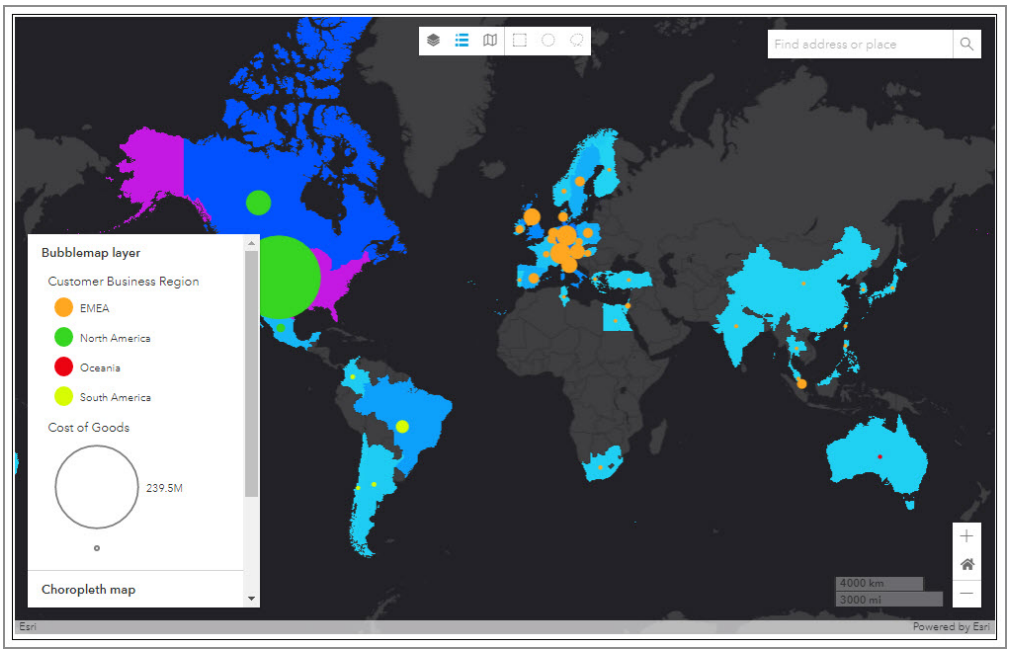
```
"extensions": {
    "com.ibi.geo.map": {
        "layersOrder": "optimal"
    }
}
```

To use the reverse of the order in which the layers are listed in the procedure, which is the default behavior, simply leave out the layersOrder property.

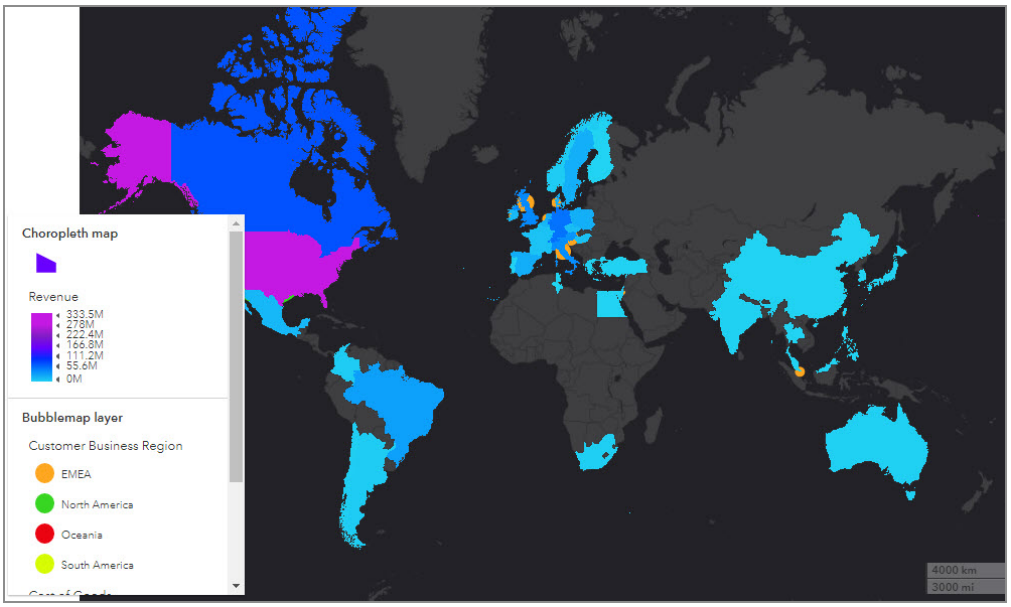
The following is the EMBED MAIN section of a multi-layer map that includes two layers: a bubblemap layer, which is listed first, and a choropleth layer, which is listed second.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
COUNT TBNAME
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL

"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [
                    {
                "ibiBaseLayer": "dark-gray"
                    }
                ]
            },
        "layersOrder": "optimal"
    }
}
END
EMBED END
```

Since the layersOrder is set to **optimal**, the bubblemap layer displays on top even though it is listed first, as shown in the following image.



If you delete **"layersOrder": "optimal"** from the procedure syntax, since the bubblemap layer in this example is listed before the choropleth layer, it is rendered below it, as shown in the following image.



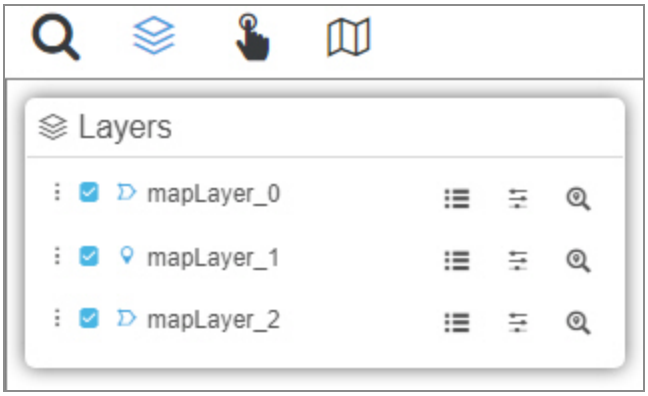
Customizing Map Layers

When creating map layers, you can customize the styling of markers and areas of the map to make it easier to identify the metrics communicated by them, and change the label used by each layer. Each layer is styled separately, so you can specify different properties for each.

Providing a Title for a Map Layer

When you run a multilayer map, you can open the Layers window to see a list of the layers in the map. You can reorder the layers and choose whether to show or hide each one.

By default, each layer is named mapLayer_*n*, where *n* is the order of the layer, starting with 0 for the first layer listed in the request, as shown in the following image.



You can provide a custom name for each layer using the TITLETEXT StyleSheet property.

The following syntax shows how to specify the TITLETEXT property in the StyleSheet section of a request.

```
TYPE=REPORT, CHART-LOOK=com.esri.map, TITLETEXT='Layer Title', $
```

where:

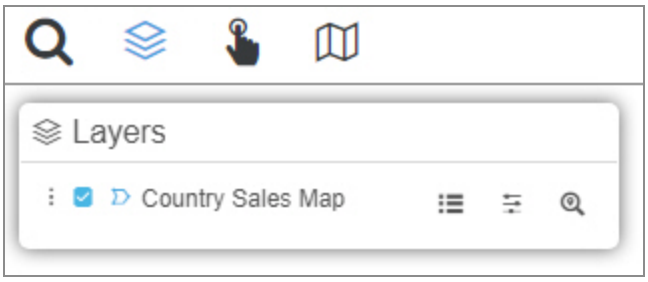
Layer Title

Is the title of the map layer to display in the Layers window at run time.

The following syntax example generates a map layer with the title **Country Sales Map**.

```
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.REVENUE_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, CHART-LOOK=com.esri.map, TITLETEXT='Country Sales Map', $
TYPE=DATA, COLUMN=REVENUE_US, BUCKET=color, $
*GRAPH_SCRIPT
*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
            "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_
CUSTOMER.COUNTRY_NAME"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":
                 [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
},
"agnosticSettings": {
    "chartTypeFullName": "Choropleth"
}
*END
ENDSTYLE
END
```

When you add this request to a multilayer map, the layer list shows the specified name, as shown in the following image.



Setting Initial Layer Visibility

When you run a multilayer map, you can show and hide each layer in order to see different layers more clearly. Similarly, when you create the multilayer map procedure, you can set whether each layer should be visible when the multilayer map first loads, allowing you to emphasize certain layers. At run time, you will still be able to show each layer, even if it is initially hidden, using the Layers list, which is accessible from the run-time toolbar.

To determine whether a layer should be shown or hidden on the initial load, use the extensions:overlayLayers:visible property.

```
"visible": boolean
```

where:

boolean

Is a Boolean value determining whether to display the layer in the multilayer map on initial load. Use true to show the layer, and false to hide it. True is the default.

The following example shows the syntax for a multilayer map with two choropleth layers, one for Quantity Sold and one for Revenue. Since these layers would overlap, the Revenue layer has been hidden by default using the visible property.

```
EMBED BEGIN PCHOLD FORMAT JSCHART


EMBED COMPONENT
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.QUANTITY_SOLD
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
```

```
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Quantity Sold', ORIENTATION=LANDSCAPE,
ARREPORTSIZE=DIMENSION,
       ARFILTER_TARGET='*', CHART-LOOK=com.esri.map, ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N2, BUCKET=color, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
                            "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_
GEOGRAPHY_CUSTOMER.COUNTRY_NAME"
                        }
                    },
                    "visible": true
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "dark-gray"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

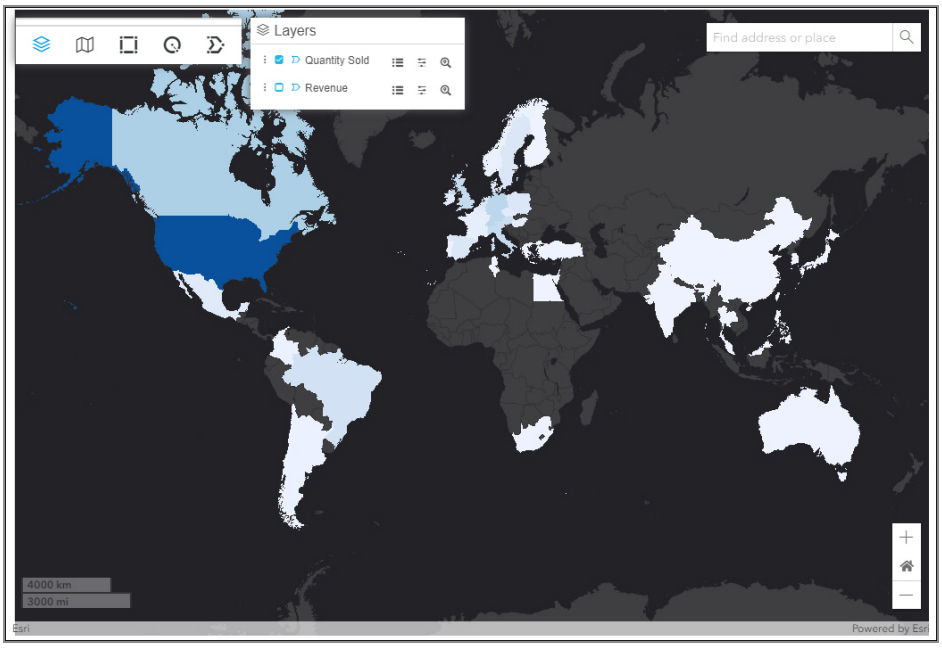
```
EMBED COMPONENT
GRAPH FILE wf_retail_lite
-* Created by Designer for Graph
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.REVENUE_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME
```

```
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Revenue', ORIENTATION=LANDSCAPE,
ARREPORTSIZE=DIMENSION,
       ARFILTER_TARGET='*', CHART-LOOK=com.esri.map, ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N2, BUCKET=color, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
                            "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_
GEOGRAPHY_CUSTOMER.COUNTRY_NAME"
                        }
                    },
                "visible": false
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "dark-gray"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

```
EMBED MAIN
GRAPH FILE SYSCOLUM
SUM FST.TBNAME
```

```
IF RECORDLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
TYPE=DATA, COLUMN=N1, BUCKET=NULL, $
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [
                    {
                "ibiBaseLayer": "dark-gray"
                    }
                ]
            }
        }
    }
END
EMBED END
```

When you run the multilayer map, only one layer displays initially, although you can show and hide each one from the Layers list, as shown in the following image.



Setting Initial Layer Opacity

When you run a multilayer map, you can change the opacity of each layer from the Layer Settings on the Layers list, available from the run-time toolbar. You can use different levels of opacity to enable you to see multiple layers at a time, even when they overlap, or to see details on the basemap. You can set the initial opacity of a layer, which can then be adjusted at run-time.

To set the initial opacity, use the extensions:com.ibi.geo.layer:overlayLayers:opacity property.

```
"opacity": level
```

where:

level

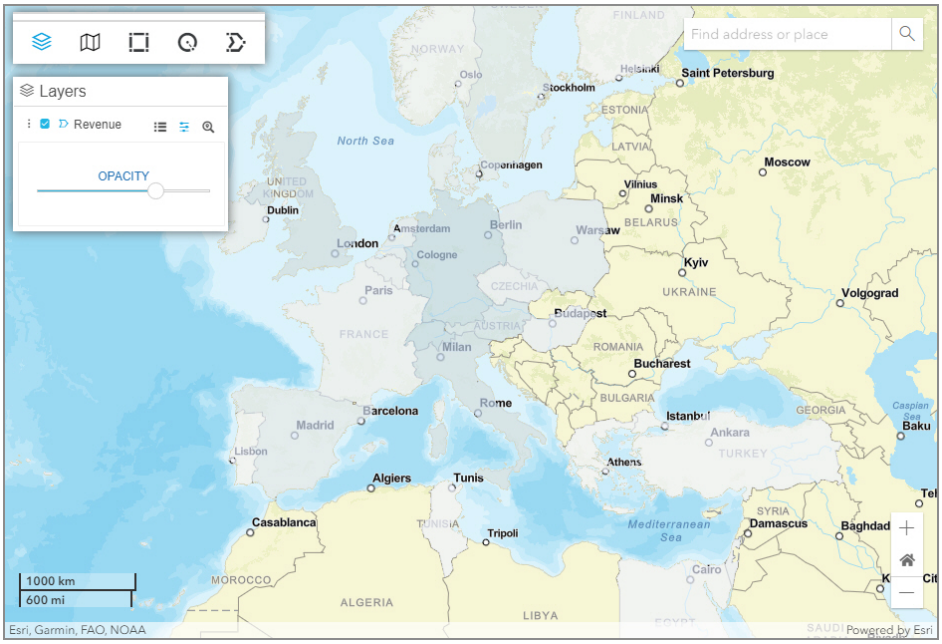
Is a numeric decimal value between 0 and 1. 0 makes the layer fully transparent, 1 makes the layer fully opaque.

The following choropleth map has been set to roughly two-thirds, 0.667, opacity, making it possible to see information on the basemap in areas that are covered by the data layer.

```
GRAPH FILE wf_retail_lite
-* Created by Designer for Graph
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.REVENUE_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Revenue', ORIENTATION=LANDSCAPE,
ARREPORTSIZE=DIMENSION, ARFILTER_TARGET='*', CHART-LOOK=com.esri.map,
ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N2, BUCKET=color, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
```

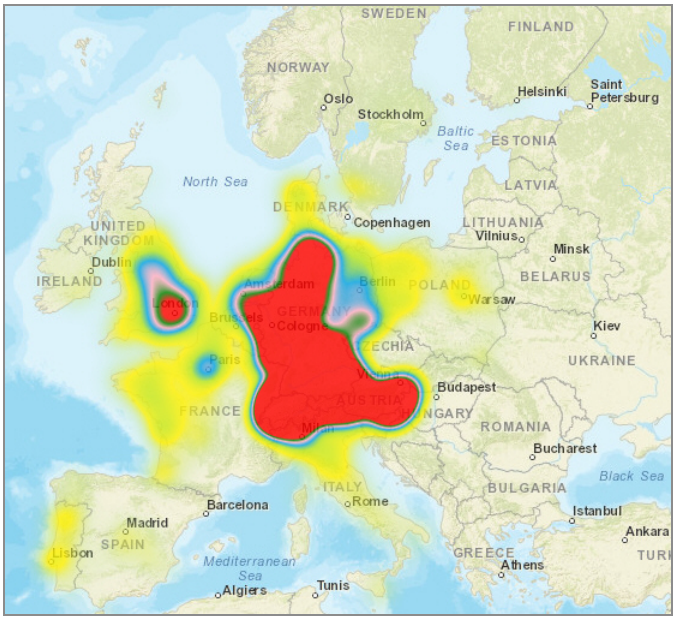
```
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
"map_by_field": "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_
NAME"
                        }
                    },
                "opacity": 0.667
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "streets"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

When the layer is added to a multilayer map procedure, the opacity is applied on initial loading, and information on the basemap can be seen through the data layer.



Enabling and Configuring a Heatmap

When creating a bubble map or point map, you can choose to generate a heatmap of points, making it easy to identify general hotspots. This is especially useful in maps where you have a large number of points. An example of a heatmap is shown in the following image.



You can enable or disable the heatmap at run-time, allowing you to switch between the general overview provided by the heatmap, the more detailed view of individual points, or a detailed view with identifiable hotspots provided by clustering. Only one of these modes can be used at a time. Additionally, you can use a set of properties to configure the generation of the heatmap, including the colors that are used, the density of points required for the high and low end of the heatmap scale, and the radius from which points are included in the heatmap range. Since these densities and ranges are based on visible distances on your screen, the heatmap is reproduced at different zoom levels, so you can continue to identify hotspots on the map as you look at it in more detail.

You can turn on and customize the heatmap using the extensions:com.ibi.geo.layer:overlayLayers:heatmap properties.

```
"heatmap": {
       "enable": boolean,
       "colorRamp": [color1 ... colorn],
       "maxPixelIntensity": max,
       "minPixelIntensity": min,
```

```
        "blurRadius": radius
}
```

where:

boolean

Is a Boolean value to set whether the chart should load as a heatmap or not. Use **true** to show a heatmap initially, or **false** not to show the heatmap. False is the default.

color1 ... colorn

Is an array of color strings, from low intensity to high intensity, to use for different levels in the heatmap. The color strings can be supported by color names, RGB or RGBA values, hexadecimal values, and more.

max

Is a numeric threshold to use as a base for the highest intensity color. The intensity of an area is based on the density of points around each pixel on the map. A higher **max** value threshold means that the density required to display the highest intensity color is higher, so there will be fewer high intensity areas. For more information, see https://developers.arcgis.com/javascript/latest/api-reference/esri-renderers-HeatmapRenderer.html.

min

Is a numeric threshold to use as a standard for inclusion in the heatmap, based on point density. A higher **min** value threshold means that the density required to be included in the heatmap is higher, so there will be fewer areas included in the heatmap.

radius

Is the area around each point within which other points are included for intensity evaluation. A larger radius means more points are likely to be in each other's radii, resulting in a larger heatmap with more high intensity areas.

The following syntax example generates a map layer with the heatmap initially turned on. A color range, maximum and minimum intensity threshold, and blur radius have all been defined. The opacity has been set to 0.8 so that the heatmap is very slightly transparent.

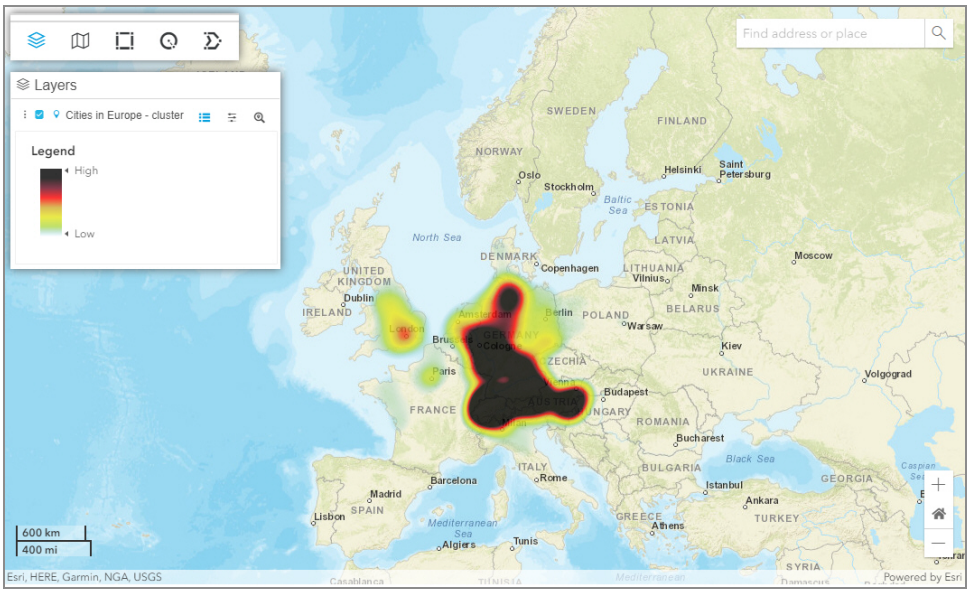
```
GRAPH FILE wf_retail_tiny
SUM WF_RETAIL_TINY.WF_RETAIL_SALES.COGS_US
CNT.WF_RETAIL_TINY.WF_RETAIL_CUSTOMER.ID_CUSTOMER/I3
```

```
BY WF_RETAIL_TINY.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME
WHERE WF_RETAIL_TINY.WF_RETAIL_GEOGRAPHY_CUSTOMER.BUSINESS_SUB_REGION EQ
'Europe';
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET GRWIDTH 1
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, TITLETEXT='Cities in Europe - cluster',
       ORIENTATION=LANDSCAPE, AR_SHOW_MENUBAR=OFF,
       ARREPORTSIZE=DIMENSION, ARFILTER_TARGET='*',
       CHART-LOOK=com.ibi.geo.layer, ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N2, BUCKET=color, $
```

```
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
"map_by_field": "WF_RETAIL_TINY.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME"
                        }
                    },
                    "opacity": 0.8,
                    "heatmap": {
                        "enable": true,
                        "colorRamp": [
      "#4ab3d9", "rgb(176, 217, 74)","rgba(230, 230, 29, 1)",
      "rgba(209, 172, 48, 1)","red","#690a20","black"
                            ],
                        "maxPixelIntensity": 500,
                        "minPixelIntensity": 25,
                        "blurRadius": 10
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                [
```

```
                    {
                        "ibiBaseLayer": "streets"
                    }
                ]
            }
        }
    }

*END
ENDSTYLE
END
```

When run as part of a multilayer map, the layer appears as shown in the following image.



Enabling and Configuring Clustering

When creating a bubble map or point map, you can cluster nearby points together, allowing you to see a more generalized view of your data, in a similar fashion to a heatmap. You can toggle between showing the default view, a heatmap, or clusters at run time, or you can configure the map to load with clustering.

Unlike a heatmap, a cluster is a single point incorporating nearby points, so the distinction of heatmap color ranges do not apply. However, clusters utilize size scaling and provide tooltips, allowing you to quickly identify significant areas on the map while providing some level of precision. Clusters use the same marker style as the other points in the map layer.

Like a heatmap, the clusters are recalculated as you zoom in and out, using the same fixed cluster radius size at all zoom levels. This allows you to zoom in to see smaller clusters within larger ones that are visible when zoomed farther out.

To enable and configure clustering, use the following extensions:com.ibi.geo.layer:overlayLayers:cluster properties.

```
"cluster" : {
       "enable": enable,
       "clusterRadius": "size",
       "clusterCountVisible": showCount,
       "clusterMaxSize": maxSize,
       "clusterMinSize": minSize
                       }
```

where:

enabled

Is a Boolean value to turn on clustering when the map loads. Use **true** to enable clustering, or **false** to load the map without clustering.

size

Is a size string that defines the area within which points are clustered together. A larger cluster radius includes more values in the cluster. The size string should specify a number of units, for example, "50px" or "50pt".

showCount

Is a Boolean value that determines whether a count of points is shown on each cluster. Use **true**, which is the default, to show the number of points represented by each cluster, or use **false** to not show the count.

maxSize, minSize

The maximum and minimum size, respectively, of the cluster markers in a map layer. Provide a numeric value, without quotation marks, determining the maximum and minimum size in points, or provide a size string in double quotation marks, for example, "50px" or "50pt", to specify a different unit. The default clusterMaxSize is 37.5 points, and the default clusterMinSize is 9 points.

Set the clusterMaxSize to a size that is smaller than the clusterRadius to avoid overlapping cluster markers.

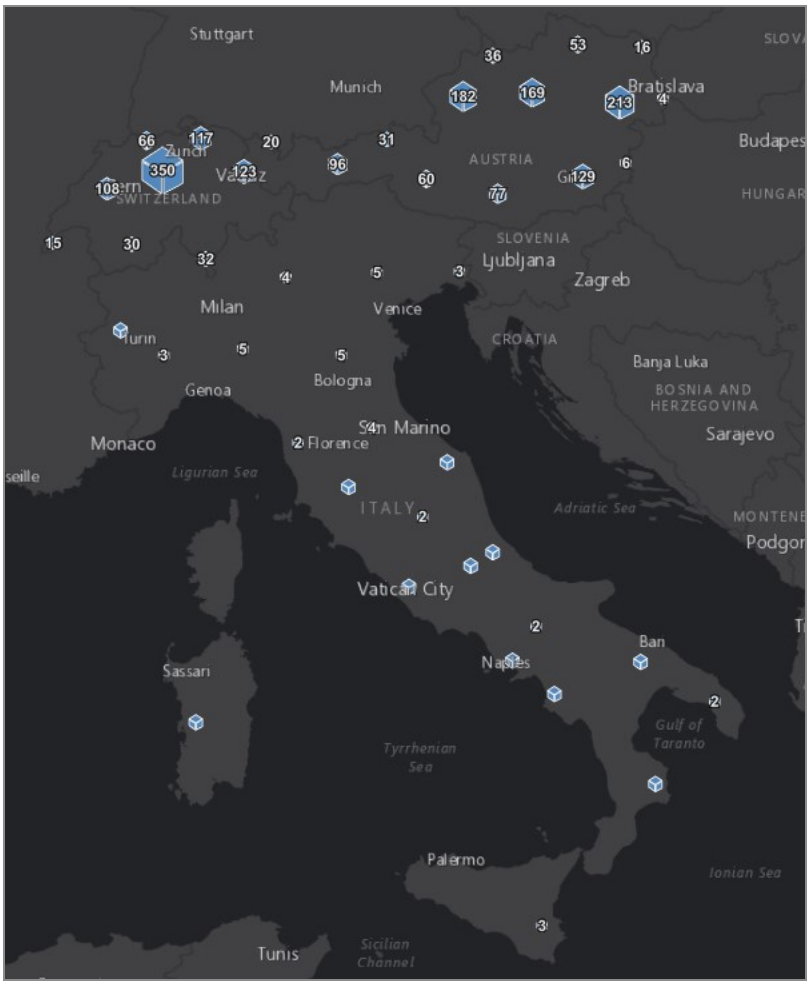
The following procedure example generates a map layer showing customer cities with clustering enabled and a cluster radius of 50 pixels. The count of points in each cluster is marked by a label. The cluster sizes have been set to a range of 7.5 to 30 points. The clusters and all points in the map layer use the same custom SVG marker.

```
GRAPH FILE wf_retail_lite
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME
WHERE WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME EQ
'Austria' OR 'Italy' OR 'Switzerland';
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Chart1', ORIENTATION=LANDSCAPE,
       ARREPORTSIZE=DIMENSION, ARFILTER_TARGET='*',
       CHART-LOOK=com.ibi.geo.layer, ARGRAPHENGINE=JSCHART, $
*GRAPH_SCRIPT
```

```
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
"map_by_field": "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME"
                    }
                },
                                "cluster" : {
                                        "enable": true,
                                        "clusterRadius": "50px",
                                        "clusterCountVisible": true,
                                        "clusterMaxSize": 30,
                                        "clusterMinSize": 7.5
                                                },
"baseMapInfo": {
    "customBaseMaps": [
        {"ibiBaseLayer": "dark-gray"}
                ]
            }
        }
```

```
        ]
        }
    },

"series":     [
        {
            "marker": {
                  "shape":
"M500,181 500,454.5 265,578 265,331 500,181 M500,164 250,322
0,164 250,0 500,164 M235,331 235,578 0,412 0,181 235,331",

                  "rotation" : 0,
                    "border": {
                                              "width": "1pt",
                                              "color" : "white"
                           }
                   },
            "series": "all"
}
]
*END
ENDSTYLE
END
```

When run as part of a multilayer map, the layer appears as shown in the following image. The number of points in the large clusters in Switzerland can be determined by the cluster label and by their larger marker size.



Adding Data Labels to a Map Layer

You can add data labels to a bubble or choropleth map layer to display a measure value or series label for each area or point on the map. This makes it easy to identify the measure values for each location, or the series that they represent. By default, if there is a dimension field in the color bucket, then the series labels display. Otherwise, if there is a measure field or no field in the color bucket, then measure values display as data labels. You can set the content property to **value** to display measure values when there is a dimension field in the color bucket of a bubble map.

Labels are centered on areas in a choropleth map, and placed above and to the right of points in a bubble map. These labels only appear if there is enough space to show them, so your map does not get too cluttered.

To add data labels, specify series:dataLabels properties using the format shown below.

```
"series":     [
                        {
                        "dataLabels": {
                        "visible": true,
                        "color": "rgba(0,0,0,1.0)",
                        "backgroundColor": "rgba(255,255,255,1.0)",
                        "font": "12pt bold line-through 'Ubuntu'",
                        "content": "value"
                        "rotation": 45,
                        "labelPlacement": "center"
                        },
                        "series": "all"
                        }
                ]
```

where:

visible

Is a Boolean value that determineswhether to show data labels when the map loads. Use **true** to show the data labels, or **false** to hide them. When hidden, you can display the data labels at run time by expanding the layer in the Layers panel and selecting the **Show Label** checkbox. The default visible setting is **false**.

color

Is a string defining the label text color. The color strings can be supported color names, RGB or RGBA values, hexidecimal values, and more.

backgroundColor

Is a string defining the background color of the data label text. You can use supported color names like RGB or RGBA values, hexidecimal values, and more. The default background color is transparent.

font

Is a font string defining the style, size, and typeface of the label text. Only Esri-supported fonts are available. For more information, see ArcGIS Maps SDK for JavaScript

Enclose typeface names in single quotation marks. For example, "italic 9pt 'Arial Unicode MS'".

"content": "value"

Optionally, in a bubble map with a dimension field in the color bucket, add the content property with a value of **value** to display measure values, from the field used in the size bucket, instead of series labels.

rotation

Is used to change the angle of the data label text. The default value is zero degree.

labelPlacement

Is used to set the data label text position. The possible options are above-center, above-left, above-right, below-center, below-left, below-right, center, center-left and center-right. The default position is above-right.

The following procedure generates a multilayer map that includes a choropleth layer and a bubble map layer. The choropleth layer represents regions in Italy and has orange data labels, in the font Old Standard TT, showing the revenue of each. The Revenue field is in the Color bucket for this layer. The bubble map layer shows the revenue of each city in Italy with red, italic, Arial labels.

```
EMBED BEGIN PCHOLD FORMAT JSCHART

EMBED COMPONENT
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.REVENUE_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.STATE_PROV_NAME
WHERE WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME EQ
'Italy';
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Chart1', ORIENTATION=LANDSCAPE,
       ARREPORTSIZE=DIMENSION, ARFILTER_TARGET='*',
       CHART-LOOK=com.ibi.geo.layer, ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N2, BUCKET=color, $
*GRAPH_SCRIPT
```

```
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
"map_by_field": "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.STATE_PROV_
NAME"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
},
"series": [
        {
            "dataLabels": {
                            "visible": true,
                                                    "color": "#f07a0c",
                            "font": "9pt 'Old Standard TT'"
                        },
            "series": "all"
        }
]

*END
ENDSTYLE
END
```

```
EMBED COMPONENT
GRAPH FILE wf_retail_lite
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME
WHERE WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME EQ
'Italy';
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
```

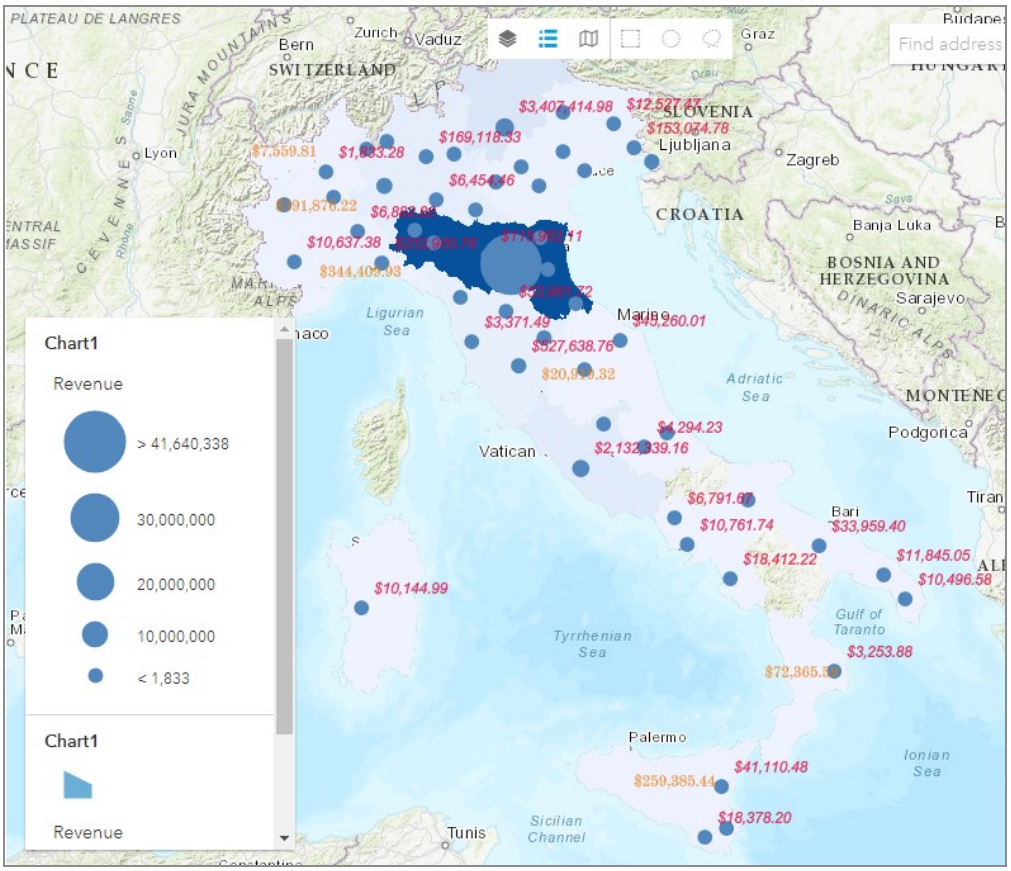
```
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Chart1', ORIENTATION=LANDSCAPE,
       ARREPORTSIZE=DIMENSION, ARFILTER_TARGET='*',
       CHART-LOOK=com.ibi.geo.layer, ARGRAPHENGINE=JSCHART, $
```

```
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
"map_by_field": "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.CITY_NAME"
                        }
                    },
                "scale": {
                    "enable": true,
                        "size": {
                            "min": 3,
                            "max": 60
                                }
                            }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
},
"series": [
        {
            "dataLabels": {

                            "color": "#DE0037",
                            "font": "italic 9pt 'Arial'"
```

```
                        },
            "series": "all"
        }
]

*END
ENDSTYLE
END
```

```
EMBED MAIN

GRAPH FILE CAR
SUM CNT.COUNTRY
IF READLIMIT EQ 1
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps":                [
                    {
                        "ibiBaseLayer": "topo"
                    }
                ]
        }
    }
}
END
EMBED END
```

The labels appear on the map, as shown in the following image. Notice that the labels only display if they can do so without overlapping on other labels.



You can zoom in to the map to see more data labels.

Defining a Color Scale

You can color different markers and areas of a map based on measure values using a color scale. A color scale is a gradient in which each color represents a measure value. You can determine the number of different colors on the color scale, and set each color, from low to high. The color scale is created based on values of the field in the color bucket. If you do not create a custom color scale, a default color scale is used.

To add a measure field to the color bucket, add it to the request as a SUM field, then use the following syntax in the StyleSheet section of the request.

```
TYPE=DATA, COLUMN=fieldname, BUCKET=color, $
```

where:

fieldname

Is the name of a measure field in the map layer request.

Define the color scale colors by adding the following syntax to the *GRAPH_JS_FINAL section of the map layer request.

```
"colorScale": {
       "colors": ["color1", "color2", ... "colorn"]
}
```

where:

"color1", "color2", ... "colorn"

Are an array of color strings. The lowest values are represented by *color1*, and the highest values by *colorn*. The color strings can be of the following types:

- A color name (for example, "red").

  For a list of supported color names, see http://www.w3.org/TR/css3-color/#svg-color.

- Three RGB values, or three RGB values and a transparency setting:

  ```
  "rgb (r,g,b)"
  ```

  or

  ```
  "rgba(r,g,b,a)"
  ```

  The values **r**, **g**, and **b** represent the intensity (from 0 to 255) of red, green, and blue.

  Transparency defines how the object blends into the background, expressed as a number between 0.0 (fully transparent) and 1.0 (fully opaque).

  For example, the color black can be described as "rgb(0,0,0)"

- Three Hue-Saturation-Lightness (HSL) values, or three HSL values and a transparency setting:

  ```
  "hsl(h,s,l)"
  ```

  or

```
"hsla(h,s,l,a)"
```

  - Hue is expressed as an angle on the color wheel. Red is at the top and is defined as 0 or 360°, green is 120°, and blue is 240°.
  - Saturation defines how pure the hue is, as a percentage, including a percent symbol (%). A pure color is 100% saturated, while grays are unsaturated.
  - Lightness defines how light or dark the hue is, as a percentage, including a percent symbol. White is 100% lightness, while black is 0% lightness.
  - Transparency defines how the object blends into the background, expressed as a number between 0.0 (fully transparent) and 1.0 (fully opaque).

- A hexadecimal color value:

  ```
  "#hexvalue"
  ```

  The hexadecimal color value starts with a pound sign (#), then has two hexadecimal digits each for the combination of red, green, and blue color values (RGB). The lowest value for each component is 0 (hex 00). The highest value is 255 (hex FF).

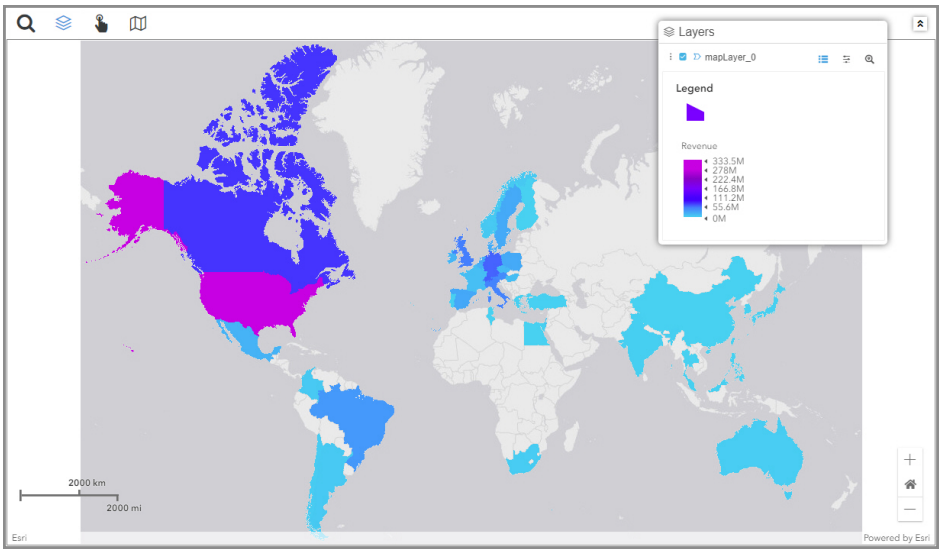
  For example, black is #000000, which corresponds to rgb(0,0,0). Red is #FF0000, which corresponds to rgb(255,0,0). White is #FFFFFF, which corresponds to rgb (255,255,255).

The following syntax example generates a choropleth map layer where a custom color scale of six colors is used for the Revenue field.

```
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.REVENUE_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Chart1', CHART-LOOK=com.esri.map, $
TYPE=DATA, COLUMN=REVENUE_US, BUCKET=color, $
*GRAPH_SCRIPT
*GRAPH_JS_FINAL
"extensions": {
```

```
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
            "map_by_field": "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_
CUSTOMER.COUNTRY_NAME"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":
                 [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
},
"colorScale": {
    "colors": ["#22d3f2", "#058aff", "#002fff",
               "#6a00ff", "#831ec7", "#c519e3"]},
"agnosticSettings": {
    "chartTypeFullName": "Choropleth"
}
*END
ENDSTYLE
END
```

The layer, when added to a multilayer map, is shown in the following image.



Customizing Point Markers

In a bubble map, each point is represented by a circular marker whose size and color can change based on measure values. As an alternative, you can use custom, static images, default marker shapes, or a custom SVG shape as markers. These marker options can be set using the series:marker properties.

Using Images as Point Markers

You can use an image from an external website or saved to your WebFOCUS Repository as markers on a map. These image markers can be sized based on a measure field, but cannot use a color scale or series colors. Using marker images gives you more freedom in styling your map layer and can help communicate what the points in it represent.

You can also style markers in a 3D map. For more information, see Creating 3D Maps.

To specify marker images, use the following series:marker properties:

```
"series": [
       {
              "marker": {

                     "shape":  "url(path_to_image)",
```

```
                        "width": "width",
                        "height": "height",
                        "rotation": angle
                    },
            "series": "all"
}
]
```

path_to_image

A URL or path pointing to an image to use as markers on your map. You can use the IBFS path to reference an image saved in your WebFOCUS Repository, or use an external URL pointing to an image hosted on an Esri domain.

width

An optional string representing the width of the image, such as "40px" or "40pt".

height

An optional string representing the height of the image, such as "40px" or "40pt".

angle

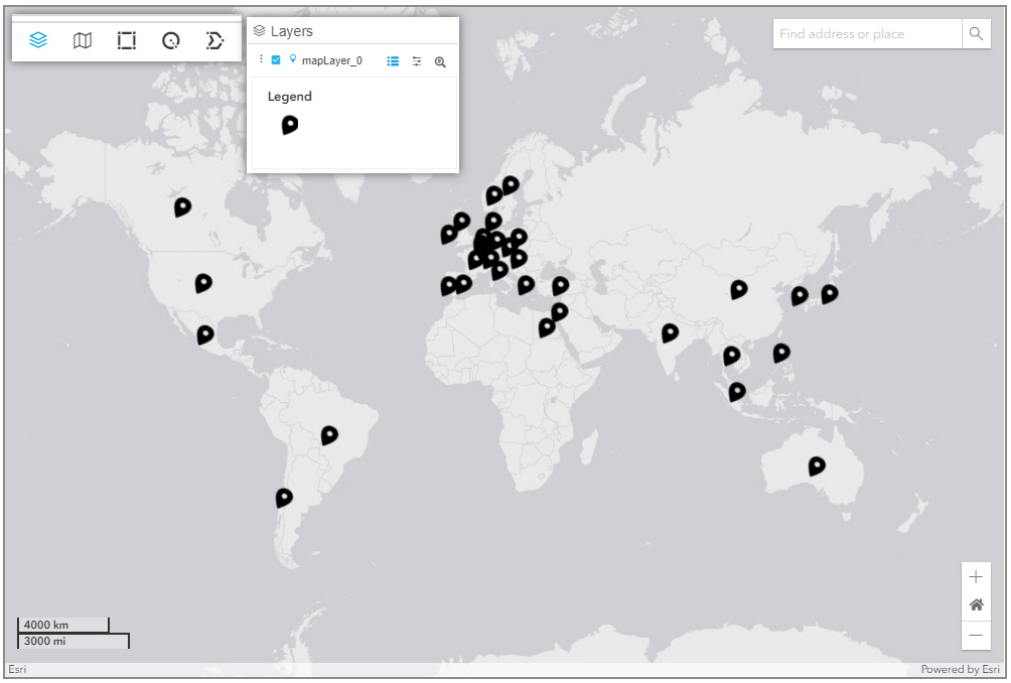
A numeric value representing the number of degrees of clockwise rotation to apply to the image.

In the following syntax example, each country is represented by a pin Material icon that has been converted to .png format and uploaded to the WebFOCUS repository. The image has been resized and rotated 30 degrees.

```
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.COGS_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $
*GRAPH_SCRIPT
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers": [
        {
```

```
            "ibiDataLayer": {
                "map-metadata": {
                    "map_by_field":
                "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME"
                    }
                }
            }
        ],
"baseMapInfo": {
    "customBaseMaps": [
        {"ibiBaseLayer": "gray"}
                ]
            }
        }
    },

"series":     [
        {
            "marker": {
"shape":  "url(IBFS:/WFC/Repository/My_Workspace/~user/place-24px.png)",
                        "height": "25px",
                        "width": "20px",
                        "rotation": 30

                    },
            "series": "all"
}
]
*END
ENDSTYLE
END
```

The layer, when added to a multilayer map, is shown in the following image.



Using Marker Shapes in a Point Map

A set of preset shapes are available for use as point markers. You can set which shape to use and change its rotation, size, color, and border.

To select a shape marker, set the value of the series:marker:shape property to one of the preset shape options, and configure other options using the following properties:

```
"series": [
       {
               "marker": {

                       "shape":  "shape",
                       "size": "size",
                       "rotation": angle,
                       "color": "fillColor",
                       "border": {
                               "width": "width",
                               "color": "borderColor"
                       }
                  },
           "series": "all"
```

```
}
]
```

shape

A preset marker shape, which can be one of the following:

- circle
- square
- diamond
- triangle

size

An optional string representing the height and width of the image, such as "40px" or "40pt".

angle

A numeric value representing the number of degrees of clockwise rotation to apply to the marker.

fillColor, borderColor

A string defining the color of the marker or its border. The color strings can be supported color names, RGB or RGBA values, hexidecimal values, and more.

width

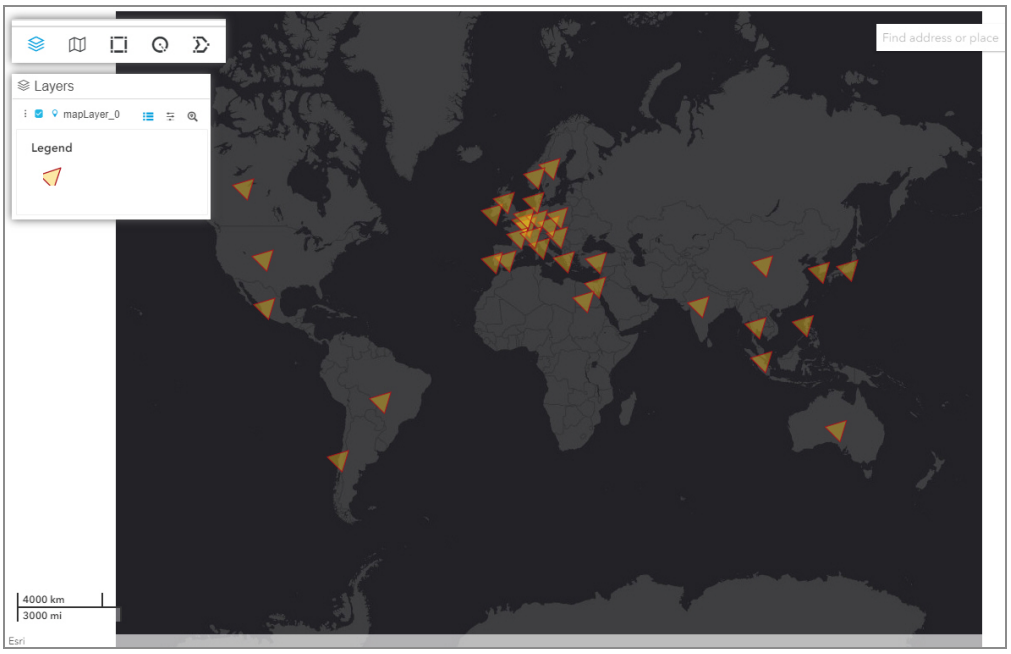
A string setting the width of the marker border, such as "2px" or "2pt".

In the following syntax example, each country is represented by a triangle. The triangles are semi-transparent yellow with a red border, and are rotated 45 degrees.

```
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.COGS_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $
*GRAPH_SCRIPT
```

```
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers": [
        {
            "ibiDataLayer": {
                "map-metadata": {
                    "map_by_field":
                "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME"
                    }
                },
"baseMapInfo": {
    "customBaseMaps": [
        {"ibiBaseLayer": "gray"}
                ]
            }
        }
        ]
        }
    },

"series":     [
        {
            "marker": {
                        "shape": "triangle",
                        "rotation" : 45,
                        "size"  : "25px",
                        "color" : "rgba(250,200,32,.4)",
                        "border": {
                            "width": "1pt",
                            "color" : "#ac101d"
                            }
                    },
            "series": "all"
}
]
*END
ENDSTYLE
END
```

The layer, when added to a multilayer map, is shown in the following image.



Using Custom SVG Graphics as Point Markers

You can use a custom SVG as a map layer marker. This SVG is provided as the value of the series:marker:shape property as an SVG path string.

Use the following properties to use and configure an SVG marker:

```
"series": [
        {
       "color": "_color_"
      "marker": {
        "shape": "_SVG_path_",
        "size": "_n_px",
        "rotation": _n_ ,
      "border": {
      "color" : "_color_"
        "width": "_n_px"
        }
        },
        "series":  _n_
        }
```

color

A string defining the color of the icon. The color strings can be supported color names, RGB or RGBA values, hexadecimal values, and more.

shape

Is an SVG path that defines the marker shape. You can find the path of an SVG file in the attribute in the SVG code.

size

An optional string displaying the height and width of the marker, such as '40 pixels' or '40 point'.

rotation

A numeric value representing the number of degrees of clockwise rotation to apply to the SVG.

border

width

A string setting the width of the SVG border, such as "2px" or "2pt".

color

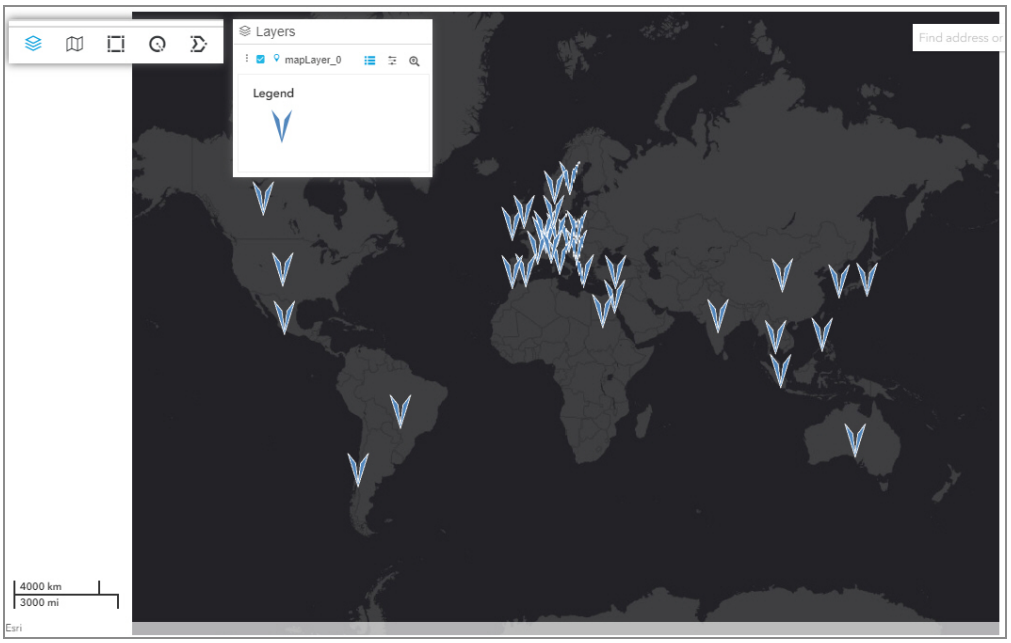
A string defining the color of the SVG border. The color strings can be supported color names, RGB or RGBA values, hexadecimal values, and more.

In the following syntax example, each country is represented by a V shaped SVG marker. The size of the marker is set to 30 points, and each marker has a 1-point white border.

```
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.COGS_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $
*GRAPH_SCRIPT
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers": [
```

```
        {
            "ibiDataLayer": {
                "map-metadata": {
                    "map_by_field":
                "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME"
                    }
                },
"baseMapInfo": {
    "customBaseMaps": [
        {"ibiBaseLayer": "dark-gray"}
                ]
            }
        }
        ]
        }
    },

"series":     [
        {
            "marker": {
                   "shape": "M250,701 189,238 7,8 250,800 493,8 311,245z
",
                     "rotation" : 0,
                     "size"  : "30pt",
                     "border": {
                                                "width": "1pt",
                                                "color" : "white"
                             }
                     },
            "series": "all"
}
]
*END
ENDSTYLE
END
```

The layer, when added to a multilayer map, is shown in the following image.



Specifying Markers for Different Values

As an alternative to specifying a single marker style for all values in a point or bubble layer, you can use a DEFINE field with IF ... THEN ... ELSE syntax, placed into the icon bucket in a map layer, to specify different marker values for different points, based on their values. These values can be their locations, or they can represent other information, such as measure values.

To set different markers for values associated with different points, create a DEFINE field using IF ... THEN ... ELSE syntax that sets a point marker using an image path, a default marker shape, or an SVG path, as described in the sections above. This DEFINE field may use the following format:

```
DEFINE_NAME/A100 = IF field EQ 'value1' THEN 'marker1'
ELSE IF field EQ 'value2' THEN 'marker2'
...
ELSE IF field EQ 'valuen' THEN 'markern'
ELSE 'markerOther' ;
```

where:

DEFINE_NAME

Is the name of the DEFINE field that sets marker shapes or images for each point.

field

Is the field whose values are used to determine which marker to use for different points in the map layer. This field need not be used in the map layer procedure, but must be in the data source used for it.

value1, value2, valuen

Are values in the specified field that correspond to different points in the map layer.

marker1, marker2, markern, markerOther

Are markers to use for points that match the specified value. These markers can be an image path, as described in Customizing Map Layers, a default marker shape, as described in Customizing Map Layers, or an SVG path, as described in Customizing Map Layers.

The template above uses a field format of A100, in the assumption that each of the marker names, paths, or strings is less than 100 characters long. You can increase the format length as needed, but should continue to use an alphanumeric field format.

The syntax template above also uses an EQ (equal to) relationship to set field values. Alternatively, you may use other relationship operators like LE (less than or equal to), GE (greater than or equal to), LT (less than), GT (greater than), CONTAINS, and more. For more information, see Chapter 4, *Selecting Records for Your Report*, in the *Creating Reports With ibi™ WebFOCUS® Language* technical content.

Once you have specified the markers that should be associated with each value, add the DEFINE field to the procedure as a SUM, PRINT, or BY field, and add it to the icon bucket in the map layer, using the following StyleSheet syntax:

```
TYPE=DATA, COLUMN=DEFINE_NAME, BUCKET=>icon, $
```

where:

DEFINE_NAME

Is the name of the DEFINE field in which the markers for each value have been specified.

Finally, use the JSON series property for the map layer to set the marker shape to **{{icon}}**, as follows:

```
"series": [
       {
              "series": "all",
              "marker": {
                     "shape": "{{icon}}",
                     "size": "size",
                     "rotation": angle
              }
       }
]
```

where:

size

An optional string representing the height and width of the marker, such as "40px" or "40pt".

angle

A numeric value representing the number of degrees of clockwise rotation to apply to the markers.

The following request creates a map layer that uses a different icon for each business region. Stores in the EMEA region are represented by a pin image icon saved to the WebFOCUS Repository, stores in the North America region are represented by a geometric shape created as an SVG path, stores in the South America region are represented by a triangle marker, and all other stores are represented by the flag of Australia, referenced from an external website. The base marker size is set to 15 points, and all markers are rotated 30 degrees clockwise.

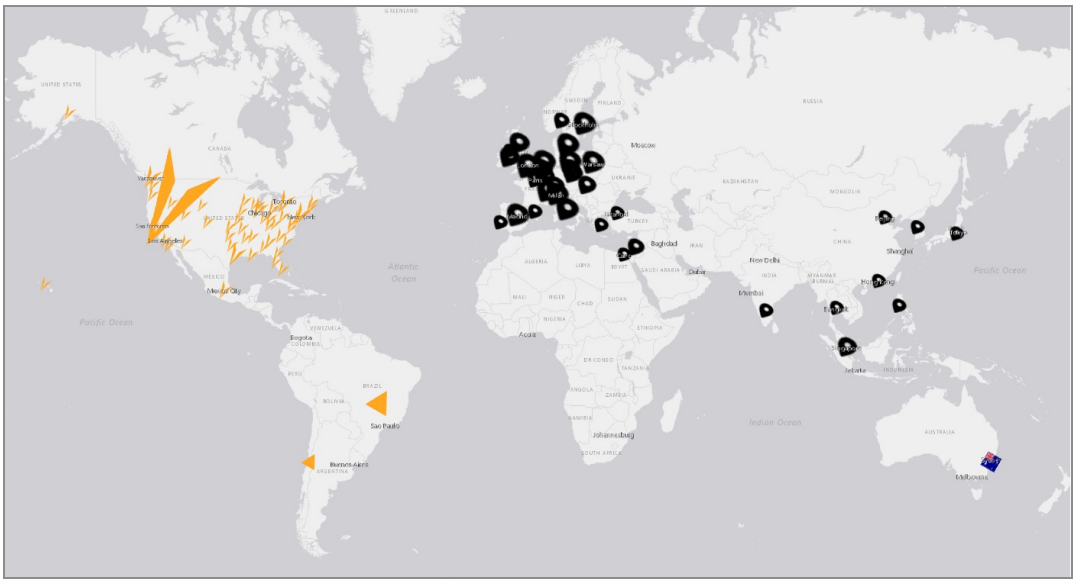
```
DEFINE FILE retail_samples/WF_RETAIL
REGION_MARKER/A100 =
IF WF_RETAIL.WF_RETAIL_GEOGRAPHY_STORE.BUSINESS_REGION EQ 'EMEA'
       THEN 'url(IBFS:/WFC/Repository/My_Workspace/~user/place-24px.png)'
ELSE IF WF_RETAIL.WF_RETAIL_GEOGRAPHY_STORE.BUSINESS_REGION EQ 'North
America'
       THEN 'M250,701 189,238 7,8 250,800 493,8 311,245z '
ELSE IF  WF_RETAIL.WF_RETAIL_GEOGRAPHY_STORE.BUSINESS_REGION EQ 'South
America'
       THEN 'triangle'
ELSE 'url(https://upload.wikimedia.org/wikipedia/en/b/b9/Flag_of_
Australia.svg)';
END
```

```
GRAPH FILE retail_samples/wf_retail
SUM  REVENUE_US
BY  WF_RETAIL.WF_RETAIL_STORE_SALES.STORE_NAME
BY REGION_MARKER
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Custom/Alex_theme/theme.sty,$
TYPE=REPORT, TITLETEXT='Unique images', CHART-LOOK=com.ibi.geo.layer, $
TYPE=DATA, COLUMN=REVENUE_US, BUCKET=size, $
TYPE=DATA, COLUMN=REGION_MARKER, BUCKET=>icon, $
*GRAPH_SCRIPT
```

```
*GRAPH_JS_FINAL
"extensions": {
       "com.ibi.geo.layer": {
               "overlayLayers": [      {
                       "ibiDataLayer": {
                               "map-metadata": {
                                       "map_by_field":
"WF_RETAIL.WF_RETAIL_STORE_SALES.STORE_NAME"
                                       }
                               },
                               "baseMapInfo": {
                                       "customBaseMaps": [
                                               {"ibiBaseLayer": "gray"}
                                       ]
                               }
                       }
               ]
       }
},
"series": [
       {
               "series": "all",
                       "marker": {
                               "shape": "{{icon}}",
                               "size": "15pt",
                               "rotation": 30
    }
                       }
               ]
*END
```

```
ENDSTYLE
END
```

When run, the location of each store shows a different marker depending on its region, as shown in the following image.



Resizing Markers at Different Zoom Levels

When you zoom out of a point-based map, if the markers for each point do not shrink in size, they may appear to be tightly clustered together or block out large areas of the basemap, making it difficult to identify the location represented by each one. To avoid this, you can set the markers to shrink as you zoom out, and set a maximum and minimum size for your markers.

Marker scaling overrides absolute sizes set in the marker properties. If you set the height and width of a marker, the absolute size becomes that of the scaling size, but the height to width ratio is maintained.

To configure marker resizing, specify a marker image, shape, or SVG path for the layer, and configure the following properties under the extensions:com.ibi.geo.layer:overlayLayers:scale property:

```
"scale": {
       "enable": boolean,
       "size": {
               "min": minSize,
               "max": maxSize
               }
       }
```

where:

boolean

Is a Boolean value. Use **true** to enable zoom scaling, and **false** to disable zoom scaling. False is the default.

minSize

Is an integer defining the minimum height, in pixels, of the marker image.

maxSize

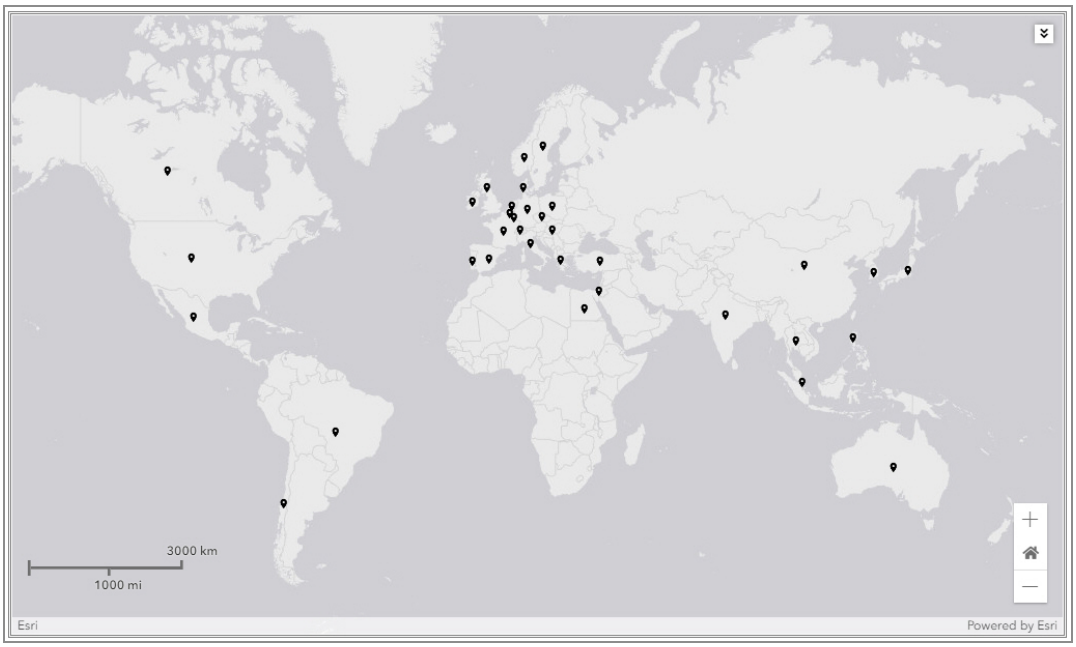
Is an integer defining the maximum height, in pixels of the marker image.

In the following syntax example, each country is represented by a pin Material icon that has been converted to .png format and uploaded to the WebFOCUS repository. The minimum size has been set to 5, and the maximum has been set to 60.

```
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.COGS_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $
*GRAPH_SCRIPT
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers": [
        {
            "ibiDataLayer": {
                "map-metadata": {
                    "map_by_field":
                "WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.COUNTRY_NAME"
```

```
                    }
                },
            "scale" : {
                "enable": true,
                "size": {
                   "min": 5,
                   "max": 60
                    }
                }
            }
        ],
"baseMapInfo": {
    "customBaseMaps": [
        {"ibiBaseLayer": "gray"}
                ]
            }
        }
    },

"series":     [
        {
            "marker": {
                        "visible"  : true,
                        "shape":  "url(IBFS:/WFC/Repository/My_
Workspace/~user/place-24px.png)",
                        "height": "25px",
                        "width": "20px"
                    },
            "series": "all"
}
]
*END
ENDSTYLE
END
```

When added to a multilayer map procedure, the following image shows the size of the markers at initial loading.



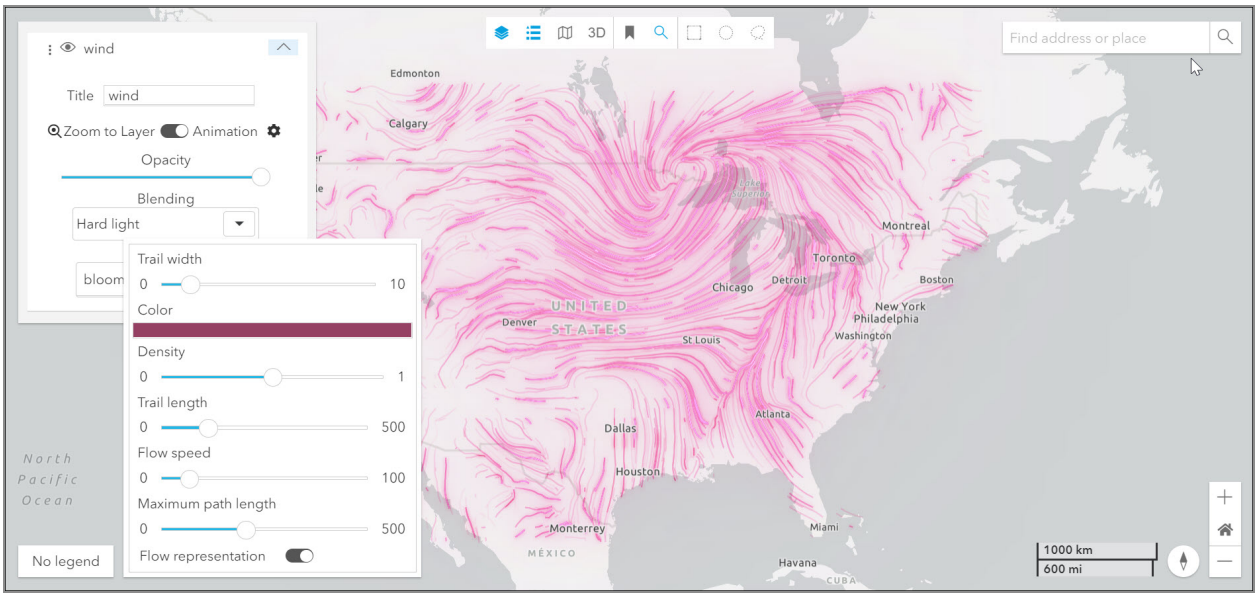
As you zoom into the map, the marker images increase in size, as shown in the following image.

Customizing Animations for an Esri ImageryTileLayer

You can customize the display of an ImageryTileLayer that supports animations. This allows you to present weather-related layers, such as wind and currents, with real-time animation.

Expand an animated layer type from the list, toggle to **animation** in the layer widget, click the gear icon to display settings, and use a slider scale to adjust the individual property values from low to high.

An example of an animated layer is shown in the following image.



You can set these animation properties using the syntax represented below:

```
"renderer": {
        "type": "flow",
        "density": number,
        "maxPathLength": number,
        "color": [rgb],
        "trailLength": number,
        "flowSpeed": number,
        "trailWidth": number
         }
```

where

"density" number

Is the amount of space that appears between flow lines.

"maxPathLength" number

Is the maximum length of a flow line.

rgb

Is a comma-separated rgb code representing the color of the flow lines.

"trailLength" number

Is the length of the flow line trail.

"flowSpeed" number

Is the speed of the flow animation.

"trailWidth" number

Is the width of the flow line trail.

The following example shows the syntax of a map layer that shows an animated layer called wind, with specified flow animation properties assigned.

```
GRAPH FILE SYSCOLUM
SUM CNT.TBNAME
IF RECORDLIMIT EQ 1
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH EXTENSION
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.layer, $
type=data, column=n1, bucket=null, $

*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.layer": {
        "overlayLayers":             [
                {
                    "ibiAddLayer": "wind"
                }
            ],
        "title": "Wind USA",
        "blendMode": "hard-light",
```

```
        "renderer": {
           "type": "flow",
               "density" : 0.5,
               "fadeDuration" : 100,
               "color" : [180,15,120],
               "length" : "200px",
               "speed" : 10,
               "Width" : "1.5"     }

    }
}
*END
ENDSTYLE
END
```

Adding Drill-Down Links to Content

Drilldowns are a powerful feature that allows users to navigate from one content item to another, providing access to additional, related information at run-time. Drill-down links can also be used to pass parameters, so that the target content is automatically filtered for the value that a user selects, allowing you to maintain context between items. By linking content with drilldowns, you can vastly expand the amount of information that is available from a single chart or report.

In a report, drill-down links are provided as hyperlinked values. In a chart, drill-down links are executed when you click a section of the chart. When you add multiple drill-down links to a single field, you can select one from the tooltip menu that results when you click a report hyperlink or point to an area of a chart.

You can create different types of drill-down links to connect to different types of target items. You can use the link to open a selected content item or page, connect to a URL, or execute a JavaScript function.

Interacting With Multilayer Maps at Run Time

When you run a multilayer map, you can use a powerful set of run-time options to navigate the map and interact with map layers. Standard zoom and pan options allow you to focus on specific areas, and a robust search utility leveraging Esri geolocation data allows you to quickly navigate to precise locations.

Layer options allow you to view, hide, and reorder layers, as well as adjust the opacity of each layer and enable heatmaps and clustering for point layers.

You can show or hide the legend, which provides information on what the different colors and marker sizes represent in the map. The legend only displays information for layers that are currently visible.

You can change the basemap that the multilayer map uses at run time. Different basemaps provide different color schemes, different focuses on contextual geographic information, and different levels of detail and precision.

The map toolbar also includes the option to toggle between a two-dimensional and three-dimensional view. In the 3D view, points and areas are plotted on a globe, and a height attribute is added to further represent measure values in the map. For more information about 3D mapping, see Creating 3D Maps.

You can quickly zoom to your current location, helping you to quickly see what information about your vicinity is available in the map.

You can provide a set of Esri-integrated interactive options that make it easy for users to navigate the map and extract additional information from it. These are the Search, Measurements, Directions, and Location options.

Selection options allow you to select areas of your map based on different criteria, such as locations within an area that you draw on the map, or within a certain distance of a selected point. These selections allow you to pass the selected data values from the map to other procedures on a page through drilldowns.

Layer, legend, basemap, dimensionality, current location, interaction, and selection options are all available on the map toolbar. The map toolbar is shown in the following image.

Navigating a Multilayer Map

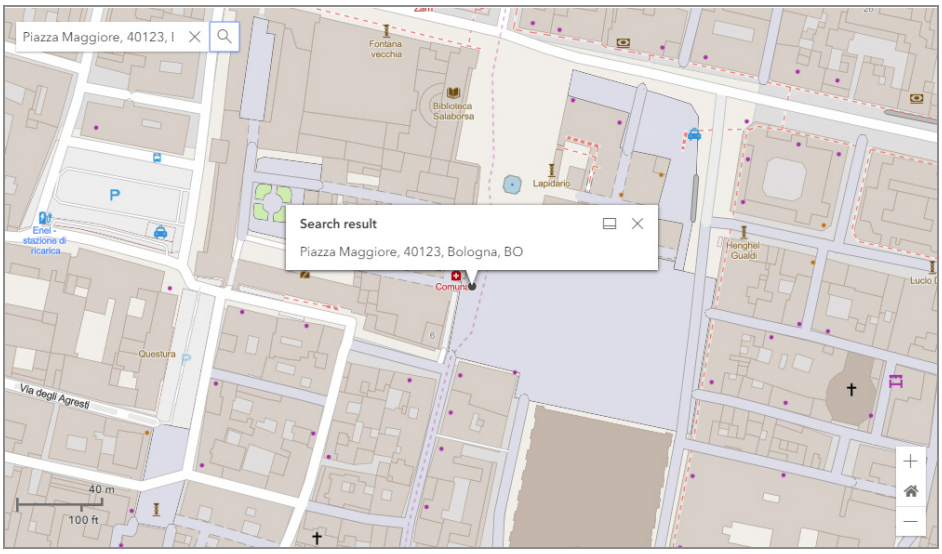
You can use zoom and pan options to find different locations on a map and change the area that is visible at a given point in time. Displaying the entire Earth on a map may allow you to view all of your data at once for more context, but may make it difficult to view more detailed information, while zooming in to a small area may show more detailed information, but could leave out the wider context that can be gained from other areas of your map. The ability to zoom and pan around the map allows you to see the larger picture as well as analyze specific details.

Point to an area of the map and double-click it, or scroll up using the scroll wheel on your mouse to zoom in to it. Hold the Ctrl key and double-click, or scroll down using the scroll wheel to zoom out. You can also click the **Zoom In** and **Zoom Out** buttons to zoom in and out. Once you have zoomed in or out on the map, you can click the **Reset Extent** button to zoom out to the full extent of the map, displaying all areas of all map layers. To zoom to the extent of a single, specific layer, expand the layer in the layer list and click **Zoom to Layer**, as shown in the following image.

You can navigate the map at the current zoom level by panning. Click and drag with your mouse, or select the map and use the Arrow keys to move the visible area of the map.

You can enable options on the map toolbar that make it easy to zoom to specific locations on the map. One of these options is the Locate button . When you click the **Locate** button, the map zooms to the current location of your machine and places a marker there. This makes it easy to see the information in your map layers in the area around your current location.

Alternatively, to immediately move the map and zoom to a specific location, click **Search** on the map toolbar, which uses Esri search functionality. Type a location-based query into the search bar. This can be a country, administrative region, geographic feature, city, address, or business establishment. Select one of the suggested locations that appear as you type, or complete your query and press the Enter key. The location displays and is identified by a tooltip, as shown in the following image.



The Directions and Location options on the map toolbar also allow you to navigate to different locations in a map. When you click **Directions** on the map toolbar, you can use the directions widget to generate a route between two or more points. When you select a start and end point, similar to using the search bar, a route between those points is drawn on the map, and the map zooms to show it. You can click a step in the directions to zoom to that section of the route.

The Location widget allows you to navigate to a location by coordinates. Click **Location** on the map toolbar and then click the **Input coordinate** button . If you select the **Go to coordinate** check box, then when you type a coordinate in the selected coordinate system and press the Enter key, the map zooms to that location.

The Discover widget allows you to determine the distance or time from your current location to a selected location. Click **Discover** on the map toolbar. You can select from different travel mode options. Layers with drilldowns can run drilldown target content directly within the discover widget, if the target is set to mlm_discover.

Interacting With Layers on a Map

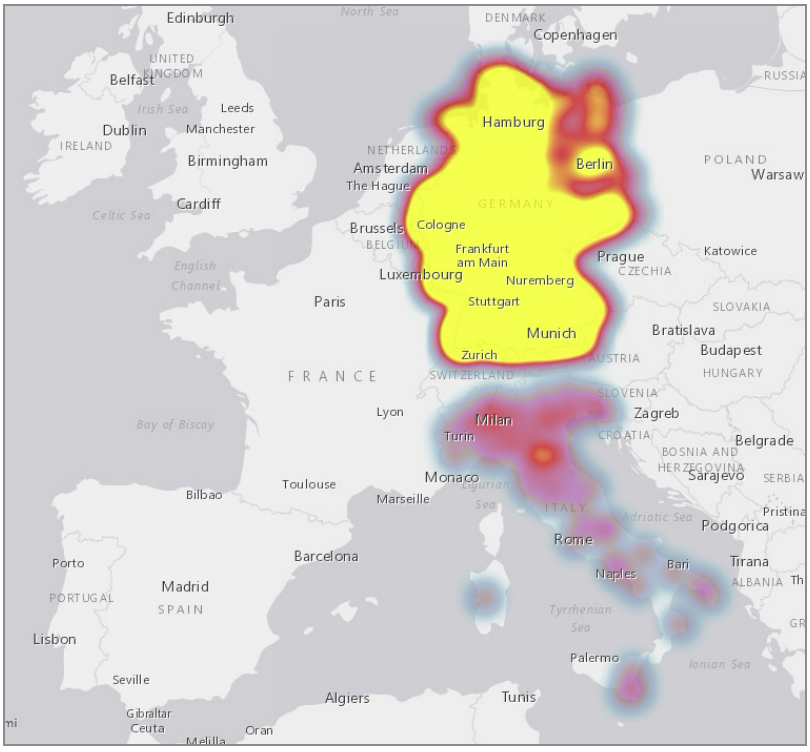
You can view and modify the display of layers using the options in the Layers window. To access these options, click **Layers** on the map toolbar.

The Layers window shows a list of the layers in your map. You can use the handles on the left to reorder layers by dragging them, allowing you to see different layers more clearly when they overlap on the map. By default, layers are arranged from front to back, in the

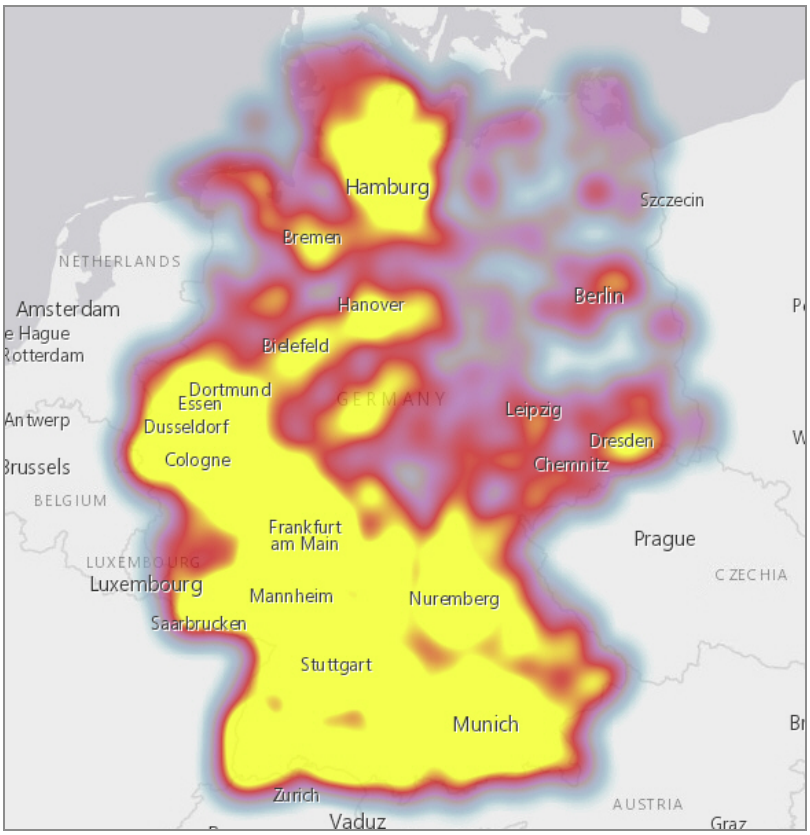
reverse of the order in which they are listed in the syntax of the FOCEXEC procedure. Each subsequent layer in the syntax is placed on top of the previously listed layer, and the layer defined last is displayed in front of all of the other layers. In the layer list, the front-most layer is listed first, followed by each layer below that one.

You can also click the **Layer View** icon to hide or display a layer, giving you more options to see different layers more easily in a multilayer map. When you hide a layer, it is also hidden from the map legend.

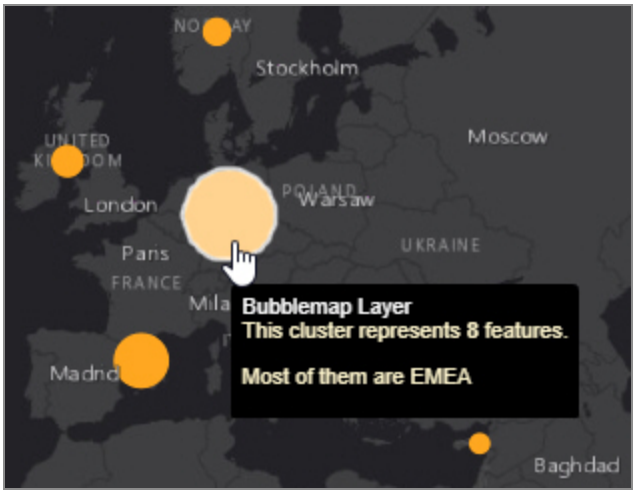
Expand a layer in the layers panel to see options related to it. You can zoom to see the full extent of the layer, change its opacity, allowing you to see the layers underneath it without removing it entirely, or change a point or bubblemap layer into a heatmap or cluster map, allowing you to see a more generalized distribution of points on a map to quickly identify hotspots. Select **Density** from the Type menu to view a point or bubblemap layer as a heatmap. The following image shows a heatmap generated from a point map layer of customer cities in Germany and Italy. From the heatmap, you can quickly determine that customer city locations are more densely distributed in Germany than in Italy, with slightly lower density in the northeastern part of the country.



As you zoom in closer to Germany, you can see a more precise heatmap, which shows that the general areas of the Rhineland, Baden-Württemberg, and Bavaria contain a particularly high number of data points.



Select **Cluster** from the Type menu to cluster points in a point or bubblemap layer. Nearby points are clustered together to provide a more general view of points in the map layer. When you change the display type to Cluster, the Show Cluster Count check box appears, allowing you to show or hide labels that display the number of points represented by each cluster marker. If you point to a cluster marker on the map, a tooltip informs you how many points that cluster represents, and provides some categorical information if the map layer uses series colors, as shown in the following image.



For information on customizing the display of heatmaps and clusters, see Customizing Map Layers and Customizing Map Layers.

To jump to a holistic view of a map layer, click the **Zoom to layer** icon . The map zooms and pans to the minimum size required to show all of the points or areas in the selected layer.

Click the **Legend** icon on the map toolbar to show or hide the legend. The legend includes information such as series colors, color scales, and marker sizes that visually communicate metrics and provide contextual information about a geographic area. The legend displays this information for all layers that are currently visible on a map. If you hide a layer, it is hidden from the legend.

To view more detailed information about an area that is part of a data layer, point to it on the map. A tooltip appears with the name of the layer, the location that you are pointing to, and related measure and dimension values used to create the map layer request.

Applying Feature Effects Using Filters

You can emphasize or de-emphasize multilayer map features, instead of removing them completely, by applying css effects to your map. This filtering method lets you still see layers that have been filtered out, allowing for greater context. Applying css effects does not require the map to reload, which results in faster performance.

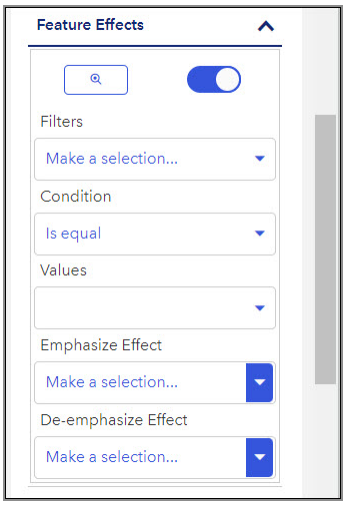
Apply Feature Effects at Runtime

You can select the layer you want to filter, and then select the values and effects you want to apply.

Procedure

1. Run a multilayer map.
2. Click the Layers icon on the map toolbar.

   The layer dialog opens.
3. Expand the layer on which you want to filter.
4. Expand the Feature Effects panel, as shown in the following image.



5. Select the filter values and effects you want to apply.
    a. From the Filters drop-down, select the field you want to filter on.
    b. From the Condition drop-down, select the filter relationship. **Is equal** is the default setting.
    c. From the Values drop-down, set the filter value.

> **Note:**
> If you are using a numeric field with a **greater than**, **less than**, **greater than or equal to**, or **less than or equal to** condition, a slider appears instead of a drop-down.

    d. From the Emphasize Effect and the De-emphasize Effect drop-downs, select the values that meet and do not meet your specified criteria.

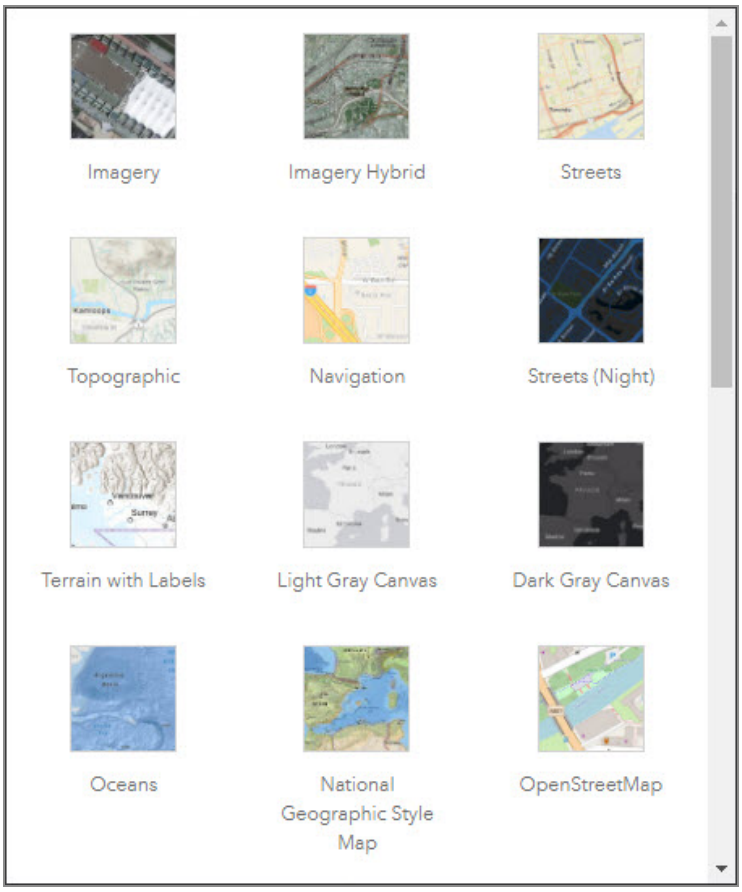
> **Note:**
> You can select preset effects from the drop-down lists, or type in css filter functions.

Changing the Basemap at Run Time

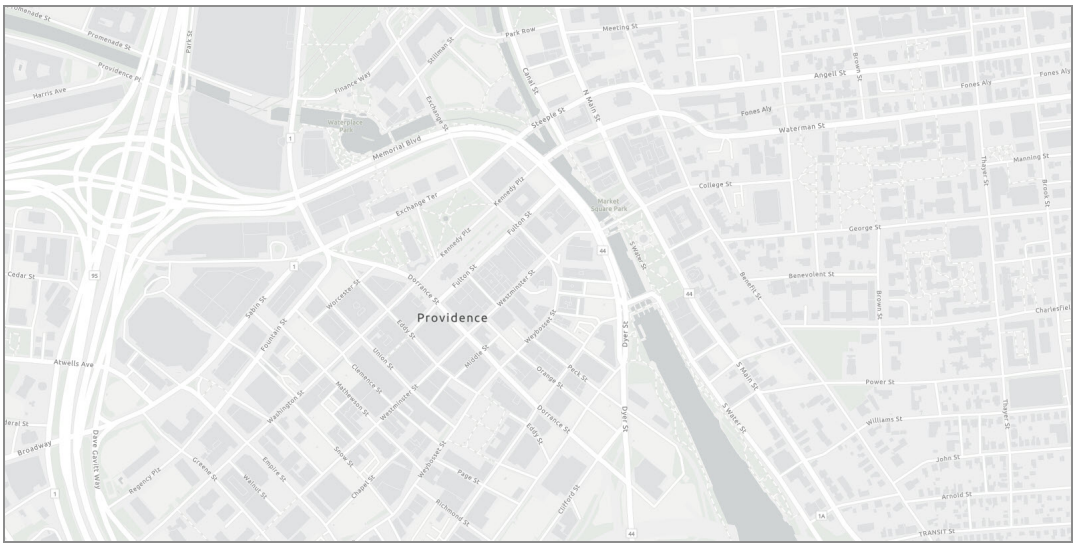
When you run a multi-layer map, you can change the basemap to provide different contextual information to complement your data layers. The basemap serves as the background of your map layers. The markers and areas in each layer are drawn in relation

to the basemap so that they accurately reflect the geographic location of each value. Basemaps typically include contextual information such as administrative areas, cities, streets, geographic features, landmarks, and other named locations.

While the default basemap can be set by the map developer, you can change the basemap at run time by clicking **Base maps** and then selecting a basemap from the basemap window. The list of basemaps is the default list of basemaps available in the ArcGIS map viewer at https://www.arcgis.com/home/webmap/viewer.html. Available options include basic street maps, topographic maps, satellite imagery maps, novelty basemaps, and more. The basemap window is shown in the following image.

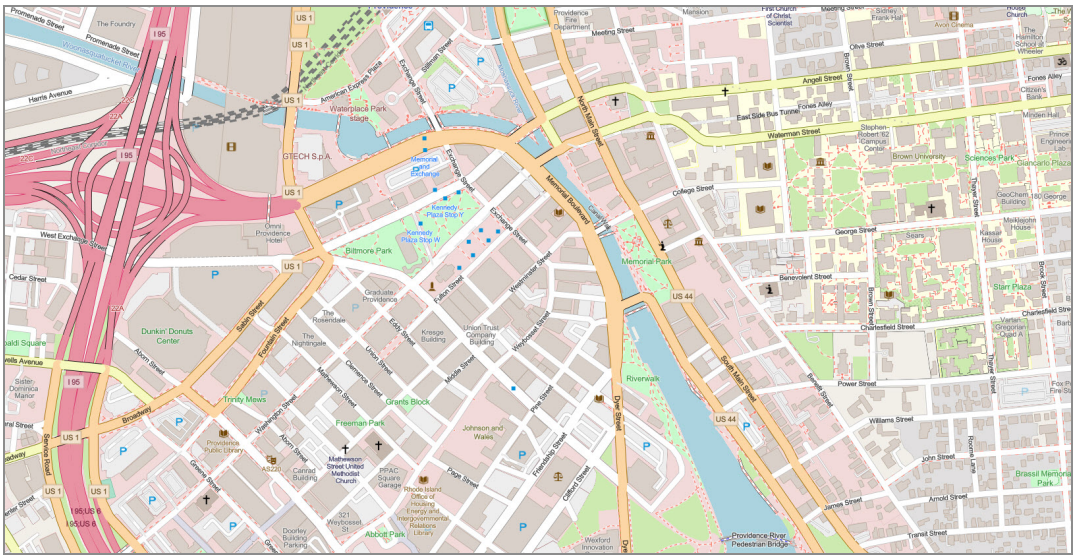


Different basemaps provide different levels of detail and context. The following images show the same area of Providence, Rhode Island using three different basemaps. The default Light Grey Canvas basemap:



The Imagery basemap:

The OpenStreetMap basemap:



Notice the different amounts of abstraction and labeling in each.

The basemaps are applied in both the two-dimensional and three-dimensional views of the map.

Measuring Distance on a Map

In order to better understand the relationship between locations on a map, you can use a couple of tools to determine the distance between them.

One quick but less exact way is to use the scalebar that appears in the map interface. The scalebar shows what a certain distance on the map represents in terms of miles or kilometers, allowing you to roughly estimate the distance between two points. You can customize the scalebar to specify the units that it uses and add segments to it to more easily judge smaller distances. For more information, see Customizing Multi-Layer Maps.

To more precisely measure the linear distance between points or the area of a polygon, click **Measurements** to open the Measurement tools. The Distance Measurement Tool evaluates the linear distance between multiple points on a map. Click the map to add a point. Multiple points are connected together in a segmented line, and the length of the line displays in the measurement tools. Double-click to add the last point.

Similarly, using the Area Measurement Tool, click multiple points on the map to add them as vertices in a polygon. As you add points, the measurement tools show the current area and perimeter of the resulting shape. Double-click the add the last point and close the polygon. To remove the line or polygon from the map, click **Clear Measurements**, or click **New measurement** to remove the existing points and create a new line or polygon.

Finally, you can use the directions widget to evaluate the driving or walking distance between two locations. Click **Directions** on the map toolbar, search for two or more locations by name, and then select a travel mode. The travel distance and duration of the generated route displays in the directions widget, as do the distances of each step in the directions.

Switching Between the Two-Dimensional and Three-Dimensional View of a Map

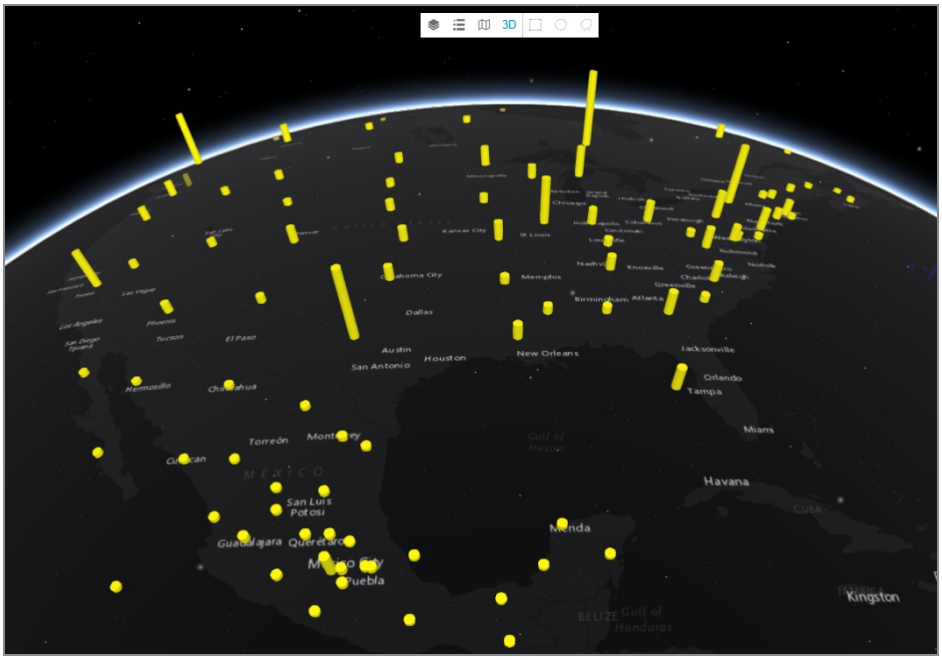
You can set a multi-layer map to use a two-dimensional or three-dimensional viewer on-demand at run-time. The 3D view mode removes the distortion present in cylindrical map projection systems, and may be more visually engaging than the 2D view. However, the 2D view allows you to see all points on the map at once, and is more familiar to most users.

To switch between the 2D and 3D views, click the **Toggle 3D view** button 3D on the map toolbar, shown in the following image.

Note: The 3D map viewer requires WebGL and hardware acceleration in your browser and system in order to load.

No changes need to be made to a multi-layer map procedure for it to be available in both 2D and 3D view. In the 3D view, the multi-layer map is plotted on a globe, which you can zoom into and pan around, similar to a two-dimensional map. A height aspect is added as a further representation of measure values for each point or area. The height of each point replaces the size aspect of point layers, and represents the same measure field used for the color scale in choropleth layers. For example, the following image shows a 2D map that contains a bubble map layer.

The following image shows the same map in the 3D view.



The same color scale, series colors, and basemap are used in both views of the map. The radius of the base of each point marker is the same in the 3D map. Instead, the measure values for each point are communicated by the height of the marker. Although many

properties are carried over from the 2D map into the 3D map, and vice versa, there are some 3D-specific properties that you can set in the multi-layer map procedure that do not have any impact on the 2D view of the map. For more information, see Creating 3D Maps.

Adding Bookmarks to a Map

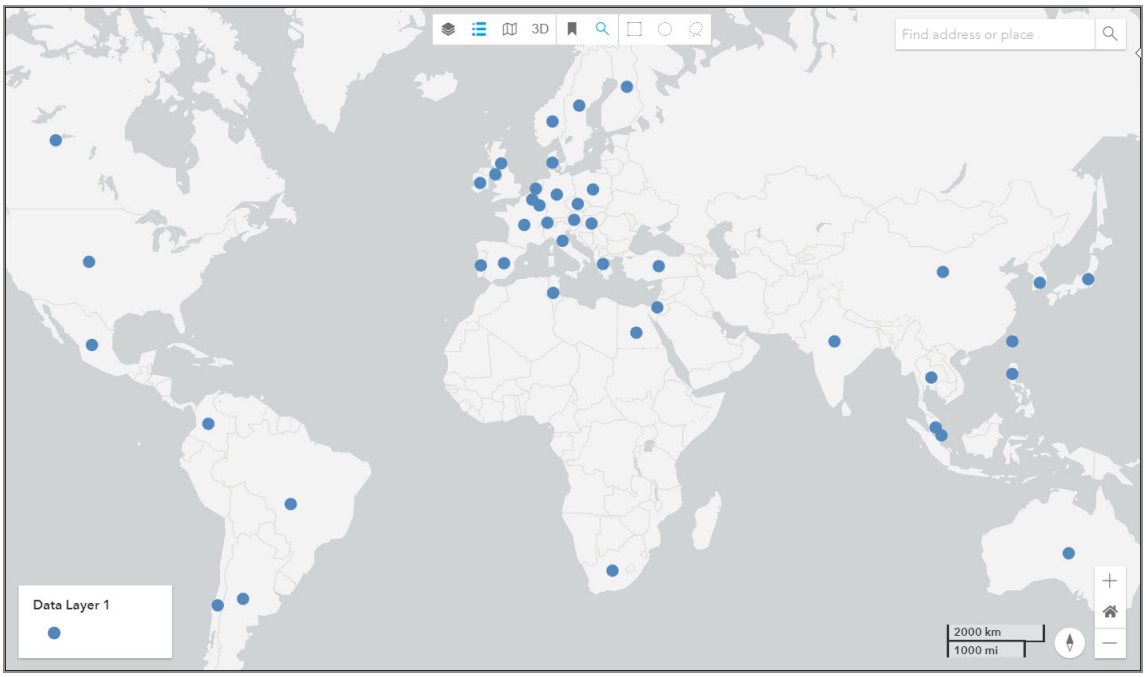
If you change the properties of maps or map layers, you may want to add your changes as a bookmark, so you can easily return to them at another time. Bookmarks are customizations that are automatically saved and reloaded on a per-user basis.

Changes to layer properties include: effect, blending mode, title, opacity, and visibility. Changes to renderer properties include: animation flow and raster stretch. If you group layers, modify a basemap, or change a map viewpoint with zooming or centering, you can also add these changes as a bookmark.

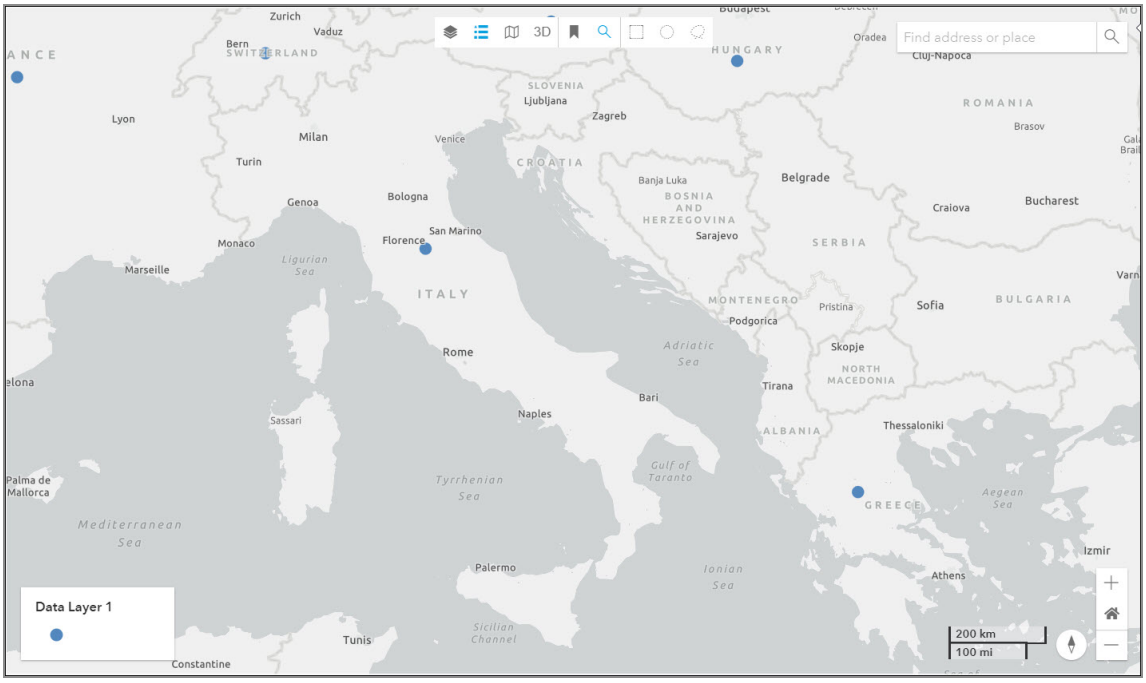
Note: Bookmarks are not supported in 3D view.

To add a bookmark, click the Bookmarks button on the map toolbar, as shown in the following image.

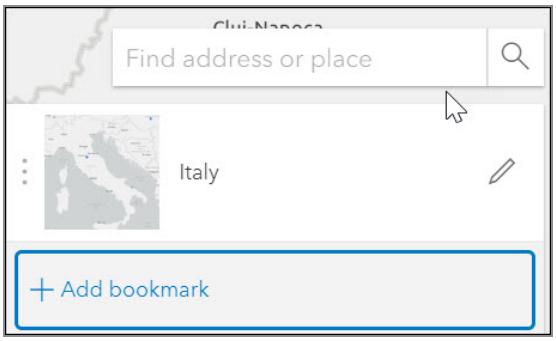
In the following example, the map displays global sales locations.



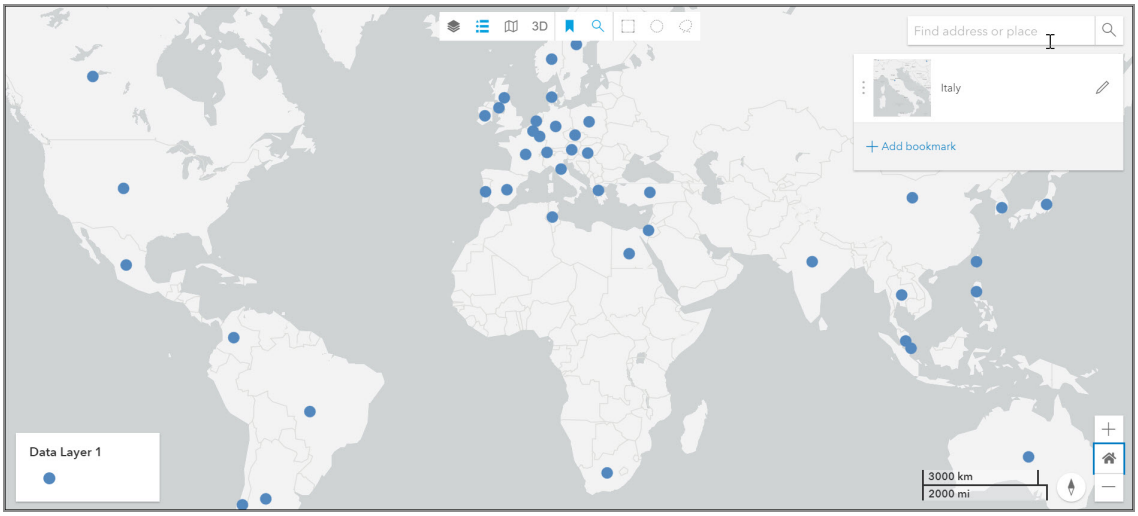
You may want to zoom to a specific area of a map that you are interested in, as shown in the following image.



To add a bookmark of this viewpoint, click the bookmarks icon in the map toolbar. The bookmark widget opens. Click **Add bookmark**, then enter a title for your bookmark, and then click **Add**. Your customized bookmark is now saved. You can edit your bookmark or add additional bookmarks within the widget.



You can now click the bookmark within the widget to return to that customized view of the map.



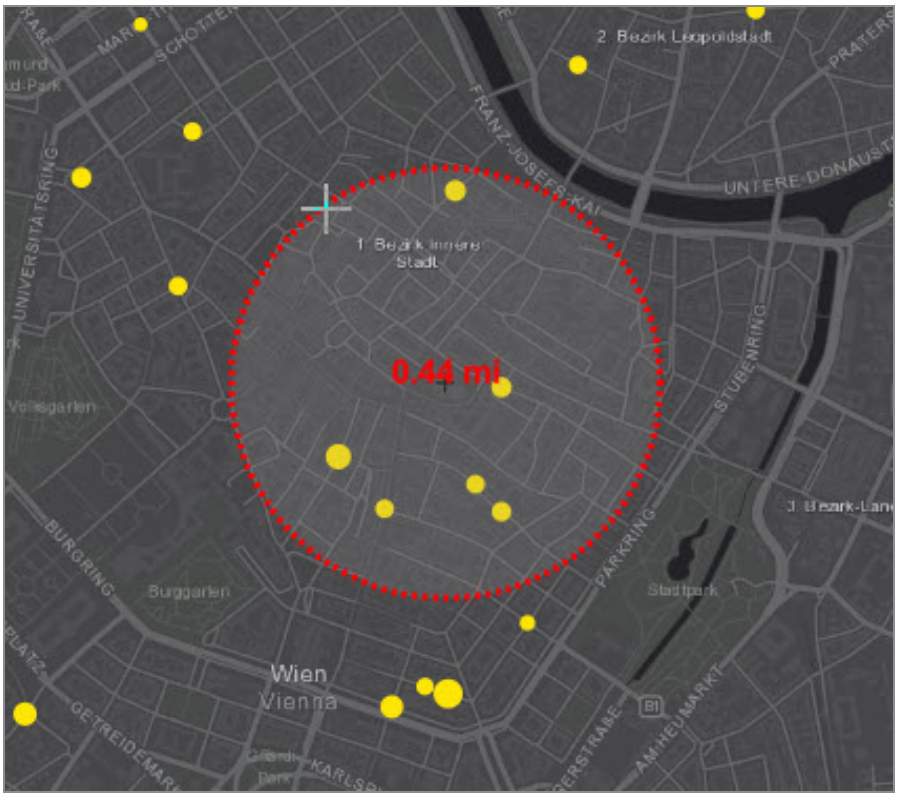
Selecting Areas of a Map

You can select points and areas of a multi-layer map to pass the values they represent to other content using drilldowns. For example, if you add a multi-layer map to a page, and one of the layers has a JavaScript drilldown using the portalDispatch drillRefresh function that points to another container with a chart or report, you can use the selection tools in the map to select and pass location values to parameters in the target content item. The selection tool in this case behaves similarly to standard drill-down hyperlinks, but has the special ability to pass multiple values at once. For more information about creating a drilldown like this, see the *How to Use a JavaScript Drilldown to Run a Chart or Report in a Target Panel on a Page* example in the *Adding Drill-Down Links to Content* topic on the WebFOCUS KnowledgeBase.

Selection is applied to all visible layers on the map, regardless of the layer type. Four different selection modes are available: rectangle, radial, free-hand, and layer-polygon. Activate selection by clicking one of these selection buttons on the right side of the map toolbar, shown in the following image.

When using the rectangle selection mode , you select points and areas within a rectangle that you draw on the map starting from one corner and extending to the opposite corner. The dimensions of the rectangle display within it as you draw the rectangle, as shown in the following image.

In radial mode , you draw a circle starting from the middle. The radius of the circle displays within it, as you draw the circle, as shown in the following image.



You can use free-hand mode to draw an irregular polygon surrounding the locations that you want to select, enabling more precise selection on the map. Selection completes when you return to the point where you started the selection, completing the polygon. An example of free-hand selection is shown in the following image.

A fourth option, layer-polygon selection mode , is available when you have multiple layers in a map, and one of them is a choropleth layer. This option allows you to select all points or polygons that are located within a polygon in another layer, making it easy, for example, to select all cities in a specific state without drawing a complex polygon in free-hand mode. To do so, select the **Layer-Polygon Selection** option on the map toolbar, and then click an area of a choropleth layer in the map. All points or areas in other map layers that are within the borders of the area that you click are selected.

The locations that you select on a map are shaded and outlined in order to differentiate them from the un-selected points. By default, all points and areas are slightly faded, and outlined in black. For information on setting custom selection and hover styling in a multi-layer map, see Customizing Multi-Layer Maps.

Creating 3D Maps

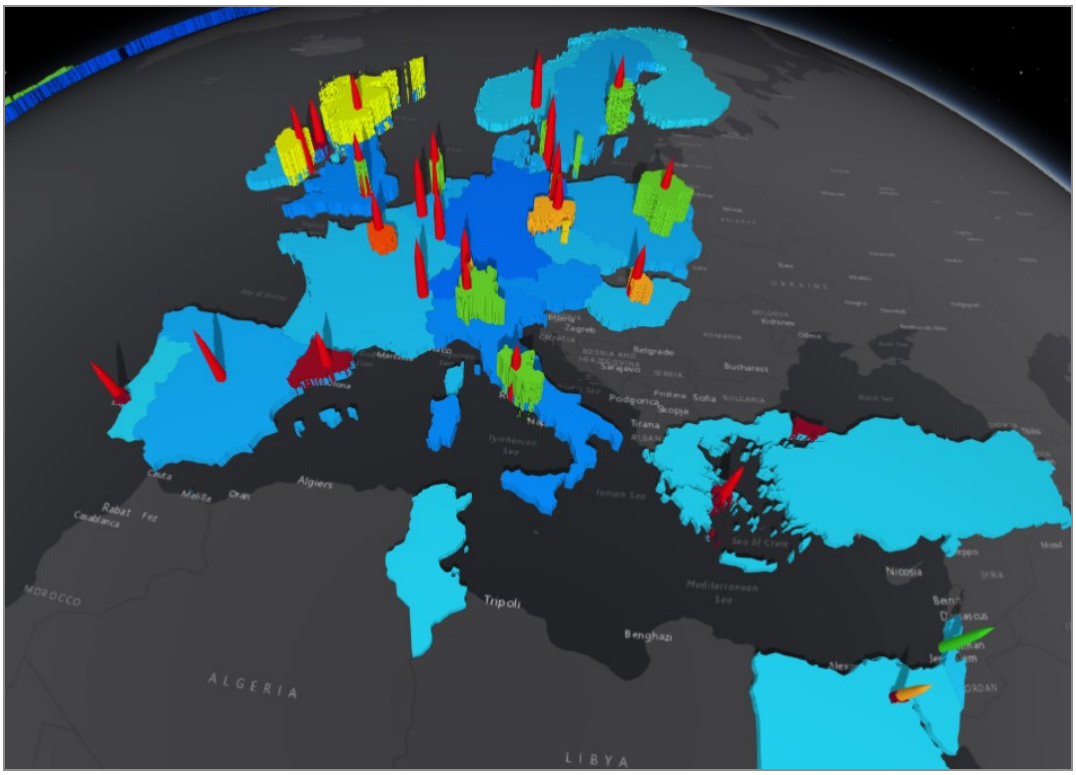
Multi-layer maps, which are two-dimensional by default, can easily be converted to three-dimensional (3D) maps, which are plotted on a globe instead of a flat surface. 3D maps can use the same map layers used in regular multi-layer maps, but also have some unique configuration options and properties that you can use to control the display of your map layers, specifically when they are used in a 3D map. You can convert a two-dimensional

map to a 3D map when you create the map, by specifying that it should use the 3D view by default, and you can also toggle between two-dimensional and 3D view at run time by clicking the **Toggle 3D view** button 3D on the map toolbar.

Note: WebGL and hardware acceleration must be supported by your browser and system to view 3D maps.

Layers on a 3D map are plotted as three-dimensional shapes, with a height dimension based on a measure field. For bubble layers, the height is based on the measure field in the size bucket, which is used to determine the diameter of markers in a two-dimensional map. In 3D maps, the size bucket is only used for the marker height, as each 3D marker has the same radius. For choropleth layers, the height is based on the measure field in the color bucket. This measure field is therefore reflected in both the color and height of each area. You can also turn extrusion off for each layer to remove the height aspect, and draw it exactly as it would appear on a two-dimensional map.

When using the default extrusion option, each layer is plotted starting at ground level. Layers in the same area therefore intersect rather than stacking. That means that unlike in two-dimensional maps, where the visibility of a layer is determined by the layer order, the visibility of markers and areas in a 3D map depend entirely on surface area and height. You can set the minimum and maximum heights of different layers to ensure that all points and areas are visible in your 3D multi-layer maps. Due to their smaller area, it is recommended to set point markers as the tallest layers, followed by smaller areas, such as cities, counties, or states. Countries, continents, or custom groups of countries represented in choropleth layers can sit the lowest since they generally occupy the largest surface area, and are thus less likely to be completely subsumed by a taller layer. You can also hide layers in a multi-layer map at run-time to make it easier to see other layers that may be obscured by them. The following image shows a 3D map in which states and provinces have been elevated above countries to allow them to display, and in which points have been elevated above both for the same reason.



Two functionalities are available to allow you to navigate the map. When a 3D map loads, it is placed into pan mode by default. Clicking and dragging within the map turns the globe, allowing you to see different areas within the viewing window. When in rotate mode, you can click and drag to change the angle at which you are viewing the map, allowing you to tilt and swivel your perspective in different directions. To activate rotate mode, click and drag the map while holding the right mouse button. You can also use the navigation mode widget to switch from pan mode to rotate mode .

3D maps include the same built-in run-time functionalities as regular two-dimensional multi-layer maps. Point to a marker or area on the map to see a tooltip with the name of the location and the exact measure values that it represents. You can use the selection tools on the map toolbar to select all markers and areas within the selection region. These can be used, for example, to select drill-down values when the map is part of a page. The selection area, whether it is created using the rectangle, circle, or free-hand selection tool, follows the contours of the Earth's surface, so the selection area may appear slightly distorted depending on the angle from which you are viewing the map, which you can adjust using the rotate navigation mode.

Activating the 3D View

You can convert a two-dimensional multi-layer map procedure into a 3D map using a single property that you add to the EMBED MAIN section of the request. A 3D map can use the same choropleth and bubble layers as a two-dimensional map, making it easy to reuse layers in both types of multi-layer maps. Once converted, certain elements may display differently. For example, the color field in a choropleth layer is also automatically used to set the height of each area of the map. The option to toggle between the two-dimensional and 3D views is available at run time regardless of which view is the default in the multi-layer map procedure.

To create a 3D map, set the viewType property, within the extensions:com.ibi.geo.map properties in the EMBED MAIN section of the procedure, to **3d**, in the following format.

```
"extensions": {
    "com.ibi.geo.map": {
                "viewType": "3d"
       }
}
```

The following syntax example is the EMBED MAIN section of a multi-layer map that has been set to show in 3D. The layers are a standard choropleth and a standard bubble layer, with height properties added. These layers can still be run in the default two-dimensional view without any issues.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
COUNT *
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [
                    {
                "ibiBaseLayer": "dark-gray"
                    }
```

```
                ]
            },
        "viewType": "3d"
    }
}
END
EMBED END
```

When run, the basemap and layers display on a three-dimensional globe, as shown in the following image.

Styling Markers and Areas in 3D Maps

By default, when you create a 3D multi-layer map, measure values are represented by the height of a marker or area. For choropleth maps, the field in the color bucket is also used to set the height of each location. For bubble maps, the field in the size bucket is used for the height of each marker instead of its area.

You can set the following properties within the extensions:com.ibi.geo.layer:overlayLayers:extrusionEffect property to style markers and areas in 3D maps.

```
"extrusionEffect": {
       "units": "unit",
       "minHeight": minimum,
       "maxHeight": maximum,
       "radius": radius,
       "shape": "shape",
       "castShadows": shadow,
       "bExtrudeValue": extrude
                    }
```

where:

unit

Is the unit in which the minHeight, maxHeight, and radius values are expressed. The following unit values can be used:

- feet
- meters
- km (kilometers)
- mi (miles)

The minimum and maximum heights and radii of the markers or areas generated by a layer directly reflect the values set for the minHeight, maxHeight, and radius, in the selected unit. For example, if the unit is set to feet and the maxHeight is set to 20000, then the height of the tallest marker or area is drawn at 20,000 feet above sea level. Therefore, it may be useful to consider the approximate radius of the Earth in each unit:

- 20,902,000 feet
- 6,371,000 meters
- 6,371 kilometers
- 3958.8 miles

Approaching or exceeding these values for the height or radius of any of the markers or areas of a map layer will make it difficult to identify locations on the map. Also keep in mind the distance between locations plotted on the map when setting the radius for point markers to avoid overlap.

minimum

Is the minimum height of markers and areas in a map layer, in the unit specified by the unit property. The locations with the lowest measure values have this height.

maximum

Is the maximum height of markers and areas in a map layer, in the unit specified by the units property. The locations with the highest measure values have this height.

radius

For bubble map layers in a 3D map, is the radius of each marker, in the unit specified by the units property. Since the size bucket is used to set the height of markers when a bubble map layer is incorporated into a 3D map, all markers in the layer have the same radius.

shape

For bubble map layers in a 3D map, is the shape of each marker. The following shapes are available:

- **cylinder.** Creates cylindrical markers. The width of the cylinder is based on the value of the radius property, while the height is determined by a measure value.
- **cone.** Creates conical markers. The width of the base of the marker is determined by the value of the radius property, while the height is determined by a measure value.
- **sphere.** Creates dome-shaped markers. The width of the base of the marker is determined by the value of the radius property, while the height is determined by a measure value.
- **cube.** Creates markers that are rectangular prisms. The width is based on the value of the radius property, while the height is determined by a measure value.
- **diamond.** Creates pyramidal markers. The width of the base is dependent on the value of the radius property, while the height is determined by a measure value.
- **inverted-cone.** Creates upside-down conical markers. The width of the base at the top of the marker is determined by the value of the radius property, while the height is determined by a measure value.
- **tetrahedron.** Creates tetrahedral markers, similar to the **diamond** setting except that the base is a triangle. The span of the base is dependent on the value of the radius property, while the height is determined by a measure value.

Cylinder is the default.

shadow

A Boolean value to determine whether to show a shadow behind a marker or area. Use **true**, which is the default value, to create a shadow, or **false** to not show a shadow. The shadow created by a marker or area points away from the equator.

extrude

A Boolean value to determine whether to draw markers and areas with a height dimension, or to leave them flat. **True**, which is the default, draws three-dimensional markers and areas with a height dimension. The height dimension is based on the field in the size bucket for bubble map layers, and is based on the field in the color bucket for choropleth layers. **False** draws two-dimensional, flat markers and areas. When using the shape property with bubble map layers in a 3D map, the shape of the non-extruded marker is the base of the marker if extrusion were turned on. For example, if the shape is set to **tetrahedron** and extrusion is turned off, then the markers are drawn as flat triangles.

In the following example, the same area and marker color properties that were used in the two-dimensional display of each layer have been retained. Additionally, properties have been added to set the maximum and minimum height of the areas and markers in each layer. The heights of the markers in the bubble map layer have been set to higher values than those of the areas in the choropleth layer, so that the markers can be seen protruding from the areas. Since they cover less surface area, if the point markers were not taller than the choropleth areas, they would not be visible at all. Additionally, the marker shape has been set to **diamond**, and shadows are turned on. The following syntax example is a complete, functional procedure, comprising two layers with unique styling properties. The 3D display mode is enabled in the EMBED MAIN section.

```
EMBED BEGIN PCHOLD FORMAT JSCHART


EMBED COMPONENT
GRAPH FILE wf_retail_lite
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.REVENUE_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
```

```
TYPE=REPORT, TITLETEXT='Choropleth map', CHART-LOOK=com.esri.map, $
TYPE=DATA, COLUMN=REVENUE_US, BUCKET=color, $
*GRAPH_SCRIPT
```

```
*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
            "map_by_field":
"WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_CUSTOMER.COUNTRY_NAME"
                        }
                    },
                    "extrusionEffect": {
                           "units": "km",
                           "minHeight": 50,
                           "maxHeight": 200,
                                  "castShadows": true,
                       "bExtrudeValue": true
                }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":
                 [
                    {
                        "ibiBaseLayer": "gray"
                    }
                ]
        }
    }
},
"colorScale": {
    "colors": ["#22d3f2", "#058aff", "#002fff",
               "#6a00ff", "#831ec7", "#c519e3"]},
"agnosticSettings": {
    "chartTypeFullName": "Choropleth"
}
*END
ENDSTYLE
END
```

```
EMBED COMPONENT
GRAPH FILE wfretail82/wf_retail_lite
-* Created by Designer for Graph
SUM WF_RETAIL_LITE.WF_RETAIL_SALES.COGS_US
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.CONTINENT_NAME
BY WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.CITY_NAME
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Bubblemap layer', ORIENTATION=LANDSCAPE,
       ARREPORTSIZE=DIMENSION, ARFILTER_TARGET='*', CHART-LOOK=com.esri.map,
       ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N1, BUCKET=color, $
TYPE=DATA, COLUMN=N3, BUCKET=size, $
*GRAPH_SCRIPT
```

```
*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
                            "map_by_field":
"WF_RETAIL_LITE.WF_RETAIL_GEOGRAPHY_STORE.CITY_NAME"
                        }
                    },
                    "extrusionEffect": {
       "units": "km",
       "minHeight": 250,
       "maxHeight": 1000,
       "radius": 30,
       "shape": "diamond",
       "castShadows": true,
```

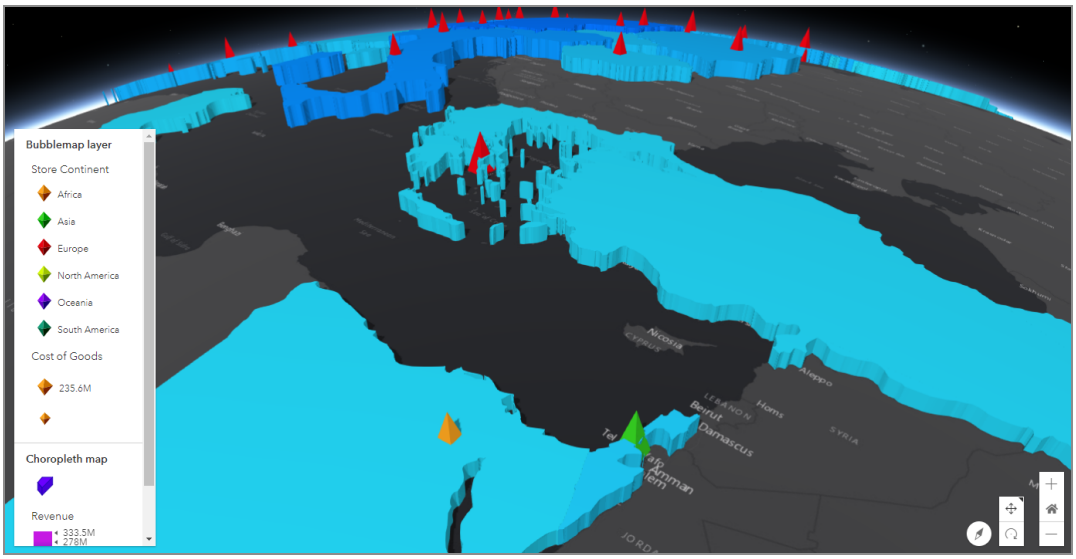
```
        "bExtrudeValue": true
                    }
                }
            ],
         "baseMapInfo": {
             "customBaseMaps":                 [
                     {
                         "ibiBaseLayer": "gray"
                     }
                 ]
         }
    }
},
```

```
"series":     [
        {
            "color": "rgba(255, 167, 32, 1)",
            "series": 0
        },
        {
            "color": "rgba(55, 214, 34, 1)",
            "series": 1
        },
        {
            "color": "rgba(235, 3, 18, 1)",
            "series": 2
        },
        {
            "color": "rgba(215, 252, 4, 1)",
            "series": 3
        },
        {
            "color": "rgba(152, 4, 252, 1)",
            "series": 4
        },
        {
            "color": "rgba(21, 162, 124, 1)",
            "series": 5
        }
    ],
"pieProperties": {
    "holeSize": "0%"
},
"agnosticSettings": {
    "chartTypeFullName": "Bubblemap"
}
```

```
*END
ENDSTYLE
END
```

```
EMBED MAIN
GRAPH FILE SYSCOLUM
COUNT *
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL

"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [
                    {
                "ibiBaseLayer": "dark-gray"
                    }
                ]
            },
        "viewType": "3d"
    }
}
END
EMBED END
```

When run, areas and markers appear in 3D, plotted on a globe, as shown in the following image.



Setting the Initial View of a 3D Map

Since 3D maps may wrap around the globe, it is not possible to automatically show the entire span of the data in all 3D map layers. Therefore, it is recommended to specify the initial view of your 3D maps. To achieve this, you can set the properties of the field of view, direction, tilt, altitude, longitude, and latitude at which the map is shown when it initially loads. If you do not set these properties, 3D maps load fully zoomed in at 0° N, 0°W, where the equator and prime meridian converge off the coast of Africa.

To set the initial view of the map, provide values for the extensions:com.ibi.geo.map:baseLayer:camera properties, in the following format.

```
"baseLayer": {
       "camera": {
               "fov": scope,
               "heading": direction,
               "tilt": tilt,
               "position":{
                       "latitude": latitude,
                       "longitude": longitude,
                       "z": altitude
                }
            }
        }
```

where:

scope

Is the focal length of the lense with which you view the map. Provide a numeric value between 0 and 170. 0 generates a very narrow field of view that focuses on the area around the coordinates on which the map is centered. 170 generates an ultra wide angle, or fisheye, view that allows you to see a very large distance from the center of the map, but with lots of distortion around the edges. Fifty-five is the default.

direction

Is the compass direction that the top of the map is facing, in degrees. Use either 0 and 360 degrees to point north, 90 to point east, 180 to point south, and 270 to point west. 0, due north, is the default value.

tilt

Is the vertical angle toward which the viewer points from the center of the map. Provide a number between 0 and 90. A value of 0, which is the default, faces straight down toward the longitude and latitude defined as the center of the map. A value of 90 faces directly toward the horizon in the direction in which the compass is facing.

latitude, longitude

Are the latitude and longitude where the map is centered. These should be provided as standard geographic coordinates, with negative values used for the Southern and Western Hemispheres.

altitude

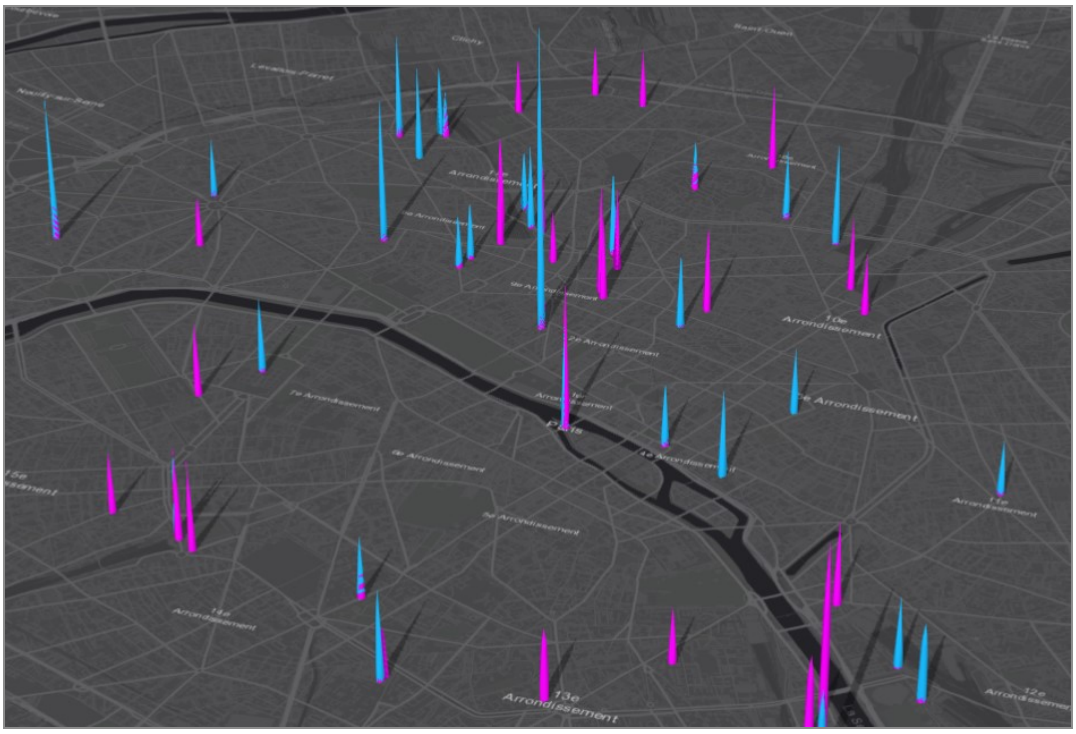
Is the altitude of the viewer above sea level, in meters.

The following is the EMBED MAIN section of a multi-layer map procedure in which the data has been filtered to show only addresses in Paris, France. Accordingly, the camera properties have been adjusted so that Paris is the initial focus when the 3D map loads.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
COUNT *
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL
```

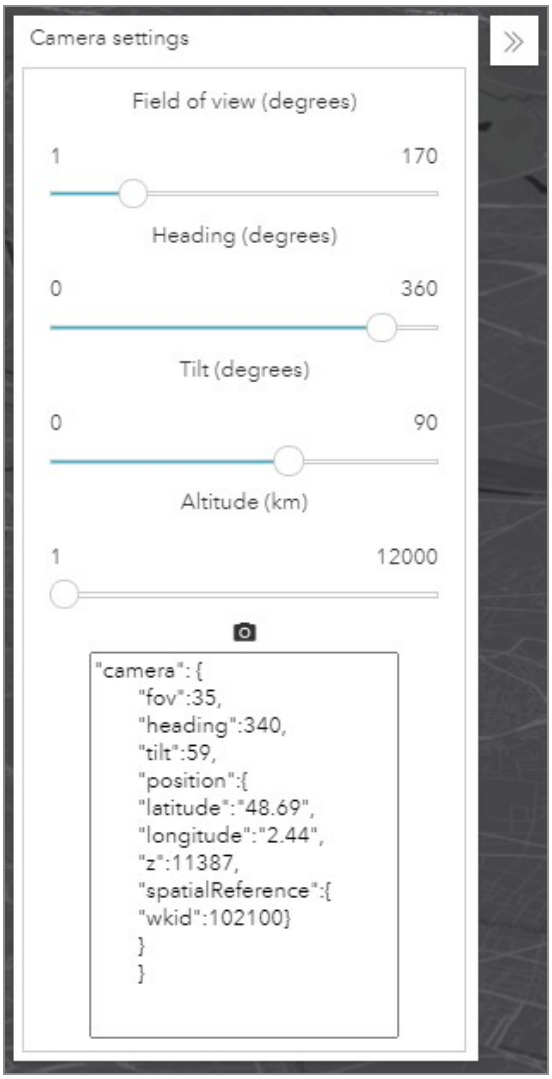
```
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [
                    {
                "ibiBaseLayer": "dark-gray"
                    }
                ]
            },
        "viewType":"3d",
        "baseLayer": {
             "camera": {
                "fov":35,
                "heading": 340,
                "tilt": 60,
                "position": {
                    "latitude": 48.7,
                    "longitude": 2.43,
                    "z": 12000
                }
            }
        }
    }
}
END
EMBED END
```

When the map is run, the markers, representing addresses in Paris, are clearly visible on initial loading, as shown in the following image.



Using the Developer Tools Interface to Determine Initial View Settings

Some of the properties used to set the initial view of a 3D map may be difficult to understand or conceptualize, or may be highly precise, so that small changes dramatically affect the area that is visible when the map loads. To assist in determining the camera properties that, you want to use, a set of developer tools are available that reflect the value of each property as you navigate a 3D map at run-time. Once you have set your run-time view to the one that you want to use when it is initially loaded, you can capture and copy the necessary JSON properties to add to your map procedure, as described previously. The developer tools for camera settings are shown in the following image.



When the 3D Map loads with the developer tools enabled, click the **Developer Tools** icon to access the interface. You can use the sliders in the interface or the regular map controls to change your view of the map. The slider for the Altitude setting is not available. Instead, use the scroll wheel on your mouse, or the zoom controls in the map interface. When you have found a perspective that you want to use when the 3D map loads, capture the current state by clicking the **Copy camera settings** icon , which updates and copies the JSON syntax shown in the text box. You can then paste that syntax within the extensions:com.ibi.geo.map:baseLayer property in the EMBED MAIN section of your procedure to use the captured view.

To enable the developer tools, use the extensions:com.ibi.geo.map:devTools properties, arranged in the following format.

```
"devTools": {
       "create": enable,
       "attachTo": "position",
       "index": order,
       "extOptions": {
              "showCameraJSON": showJSON
       }
}
```

where:

enable

Is a Boolean value. Use **true** to enable the developer tools at run-time, or **false** to hide them. The tools are hidden by default.

position

Is a string specifying the position of the developer tools in the map window. This can be one of the following values:

- **bottom-leading.** Dynamically positions the element at the bottom of the map, on the leading side. When the text on the page reads left-to-right, this is the left side. When the text reads right-to-left, this is the right side.
- **bottom-trailing.** Dynamically positions the element at the bottom of the map, on the trailing side. When the text on the page reads left-to-right, this is the right side. When the text reads right-to-left, this is the left side.
- **bottom-left.** Positions the element in the lower left corner of the map.
- **bottom-right.** Positions the element in the lower right corner of the map.
- **top-leading.** Dynamically positions the element at the top of the map, on the leading side. When the text on the page reads left-to-right, this is the left side. When the text reads right-to-left, this is the right side.
- **top-trailing.** Dynamically positions the element at the top of the map, on the trailing side. When the text on the page reads left-to-right, this is the right side. When the text reads right-to-left, this is the left side.
- **top-left.** Positions the element in the upper left corner of the map.
- **top-right.** Positions the element in the upper right corner of the map. This is the default.

order

Is a whole number. When there are multiple multi-layer map interface elements with the same specified position, the index value determines how close each one is placed to the specified location. The element with the lowest index value is placed closest, and the element with the highest index value is placed farthest away.

showJSON

Is a Boolean value. Use **true** to show the JSON syntax representing the current view of the map, or **false** to hide the syntax. Even if the syntax is not visible in the developer tools, clicking the **Copy camera settings** icon will copy it into your clipboard to paste into your 3D map procedure. JSON syntax is hidden by default.

The following is an example of the EMBED MAIN section of a 3D multi-layer map in which the developer tools have been enabled.

```
EMBED MAIN
GRAPH FILE SYSCOLUM
COUNT *
ON GRAPH HOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH BUBBLEMAP
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.ibi.geo.map, $
type=data, column=n1, bucket=null, $
*GRAPH_JS_FINAL
"extensions": {
    "com.ibi.geo.map": {
        "baseMapInfo": {
            "customBaseMaps": [
                    {
                "ibiBaseLayer": "osm"
                    }
                ]
            },
            "devTools": {
                       "create": true,
                       "index": 1,
                       "attachTo": "top-right",
                       "extOptions": {
                           "showCameraJSON": true
                       }
                  },
        "viewType": "3d",
        "baseLayer": {
```

```
              "camera": {
                 "fov": 30,
                 "heading": 0,
                 "tilt": 0,
                 "position": {
                     "latitude": -8.9,
                     "longitude": -140,
                     "z": 250000
                 }
              }
          }
     }
}
END
EMBED END
```

Configuring and Administering Mapping Services

The default installation of WebFOCUS includes a powerful set of built-in mapping features, allowing you to map locations from the most common administrative levels, use a broad selection of basemaps, and enhance your content with a variety of demographic and reference layers. However, you can expand the resources provided by these features by adding custom geographic roles, context layers, basemaps, and more.

You can add these custom resources using the WebFOCUS Server Console. In the WebFOCUS Server Console, click the **Tools** menu and then click **Workspace**. In the Workspace view, click **Settings** and point to **Geo Services**. Click **Edit Configuration** to add new geographic roles based on shapefiles or enable new basemaps and context layers hosted on a map service such as Esri ArcGIS.

Configuring Geographic Information

Geographic roles have been unified to access 58 world administrative boundaries down to the postal code level, out of the box.

The list of geographic roles has been simplified and unified by adding hierarchical levels of keys in the server geographic configuration file. Your request that provides the geography dimension must provide the hierarchical keys needed to identify each target geography. For example, if your geographic role is City, you must also provide values for State and Country.

The following is the list of unified geographic roles is available for generating maps:

- Point of Interest.
- City.
- Continent.
- Country.
- County.

- Geometry line.
- Postal code.
- State.

The server has a geographic configuration editor for customizing the list of geographic roles, basemaps, reference layers, and demographic layers. A customized geographic role can reference either an uploaded shapefile or an existing Esri Feature Layer.

Note:

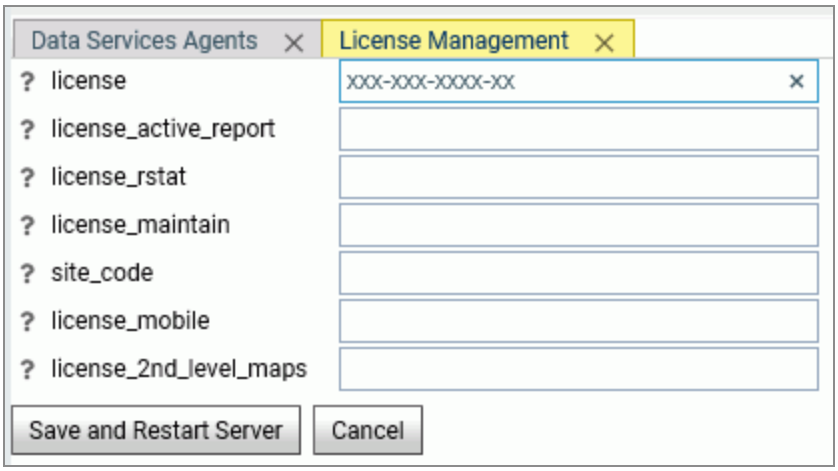
- You must configure the Adapter for ESRI ArcGIS in order to use many of the geographic features. For more information on configuring the adapter, see the *ibi™ WebFOCUS® Adapter Administration* manual.
- Many names of geographic locations include special characters. To map them, the server must be configured for Unicode.

Access Second Level Licensed Geographies for Esri Maps

Procedure

1. Click **Workspace** on the WebFOCUS® Reporting Server browser interface sidebar.
2. Click **License** on the ribbon.

   The License Management pane opens, as shown in the following image.



3. Enter your Esri second level license code in the **license_2nd_level_maps** field.
4. Click **Save and Restart Server**.

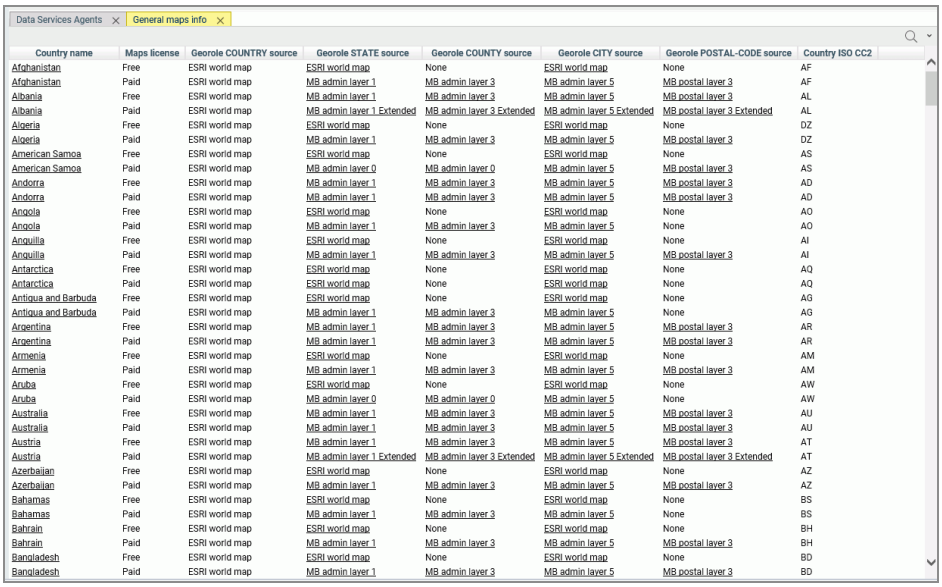
Result

Once the second level license is enabled, you can use the standard administrative and postal geographic roles to access these additional geographic boundaries.

Note: The server must be configured for Unicode if Unicode characters exist in the data.

First and Second Level Licensed Geographies

The WebFOCUS Server Console provides a list of first and second level map administrative regions. You can open the list by clicking the **Settings** menu on the Workspace page ribbon, pointing to **Geo Services** and selecting **General maps info**. This opens the list of administrative regions and postal levels, as shown in the following image.



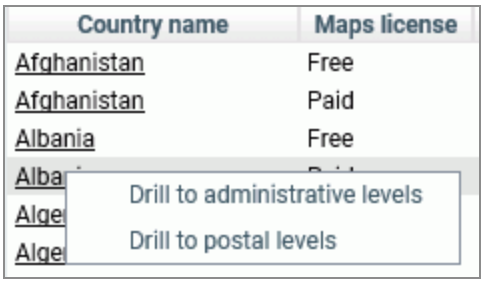
Data Services Agents | General maps info

Country name	Maps license	Georole COUNTRY source	Georole STATE source	Georole COUNTY source	Georole CITY source	Georole POSTAL-CODE source	Country ISO CC2
Afghanistan	Free	ESRI world map	ESRI world map	None	ESRI world map	None	AF
Afghanistan	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AF
Albania	Free	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AL
Albania	Paid	ESRI world map	MB admin layer 1 Extended	MB admin layer 3 Extended	MB admin layer 5 Extended	MB postal layer 3 Extended	AL
Algeria	Free	ESRI world map	ESRI world map	None	ESRI world map	None	DZ
Algeria	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	DZ
American Samoa	Free	ESRI world map	ESRI world map	None	ESRI world map	None	AS
American Samoa	Paid	ESRI world map	MB admin layer 0	MB admin layer 0	MB admin layer 5	MB postal layer 3	AS
Andorra	Free	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AD
Andorra	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AD
Angola	Free	ESRI world map	ESRI world map	None	ESRI world map	None	AO
Angola	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	None	AO
Anguilla	Free	ESRI world map	ESRI world map	None	ESRI world map	None	AI
Anguilla	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AI
Antarctica	Free	ESRI world map	ESRI world map	None	ESRI world map	None	AQ
Antarctica	Paid	ESRI world map	ESRI world map	None	ESRI world map	None	AQ
Antigua and Barbuda	Free	ESRI world map	ESRI world map	None	ESRI world map	None	AG
Antigua and Barbuda	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	None	AG
Argentina	Free	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AR
Argentina	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AR
Armenia	Free	ESRI world map	ESRI world map	None	ESRI world map	None	AM
Armenia	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AM
Aruba	Free	ESRI world map	ESRI world map	None	ESRI world map	None	AW
Aruba	Paid	ESRI world map	MB admin layer 0	MB admin layer 0	MB admin layer 5	None	AW
Australia	Free	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AU
Australia	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AU
Austria	Free	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AT
Austria	Paid	ESRI world map	MB admin layer 1 Extended	MB admin layer 3 Extended	MB admin layer 5 Extended	MB postal layer 3 Extended	AT
Azerbaijan	Free	ESRI world map	ESRI world map	None	ESRI world map	None	AZ
Azerbaijan	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	AZ
Bahamas	Free	ESRI world map	ESRI world map	None	ESRI world map	None	BS
Bahamas	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	None	BS
Bahrain	Free	ESRI world map	ESRI world map	None	ESRI world map	None	BH
Bahrain	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	BH
Bangladesh	Free	ESRI world map	ESRI world map	None	ESRI world map	None	BD
Bangladesh	Paid	ESRI world map	MB admin layer 1	MB admin layer 3	MB admin layer 5	MB postal layer 3	BD

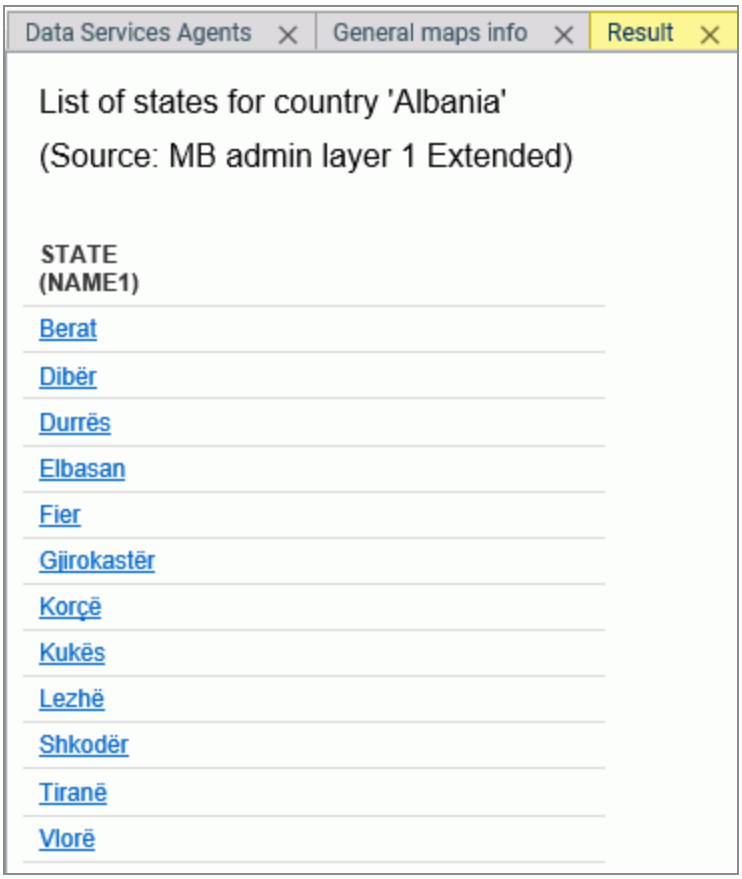
The regions that say *Paid* in the Maps license column are the additional regions you can access with a second level license.

- The source for the country administrative level is provided by the Esri World map. Country is administrative level 0.
- The source for the State georole can be provided by the Esri World map or by shape files. When there is a second level license, the state administrative level can be level 1 or level 2.
- The source for the County georole can be provided by the Esri World map or by shape files. When there is a second level license, the county administrative level can be level 3 or level 4.
- The source for the City georole can be provided by the Esri World map or by shape files. When there is a second level license, the city administrative level is level 5.
- The source for the Postal Code georole can be provided by the Esri World map or by shape files. When there is a second level license, the postal code administrative level can be 3, 4, or 5.

Some georoles may not be applicable to specific countries. You can see the details of each country and its administrative levels by right-clicking the country name and clicking **Drill to administrative levels** or **Drill to postal levels**, as shown in the following image.

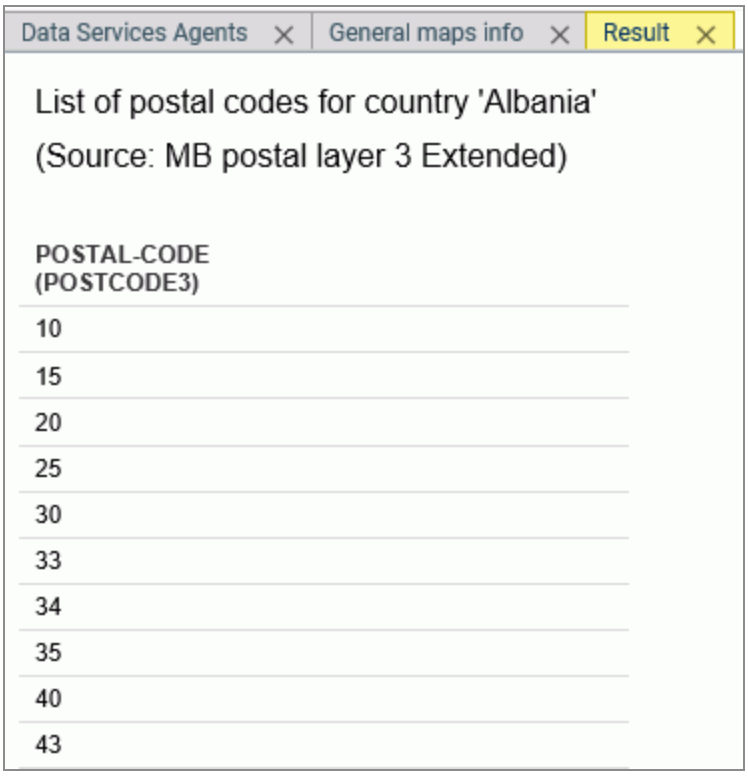


Clicking **Drill to administrative levels** opens the list of States for the country, as shown in the following image.

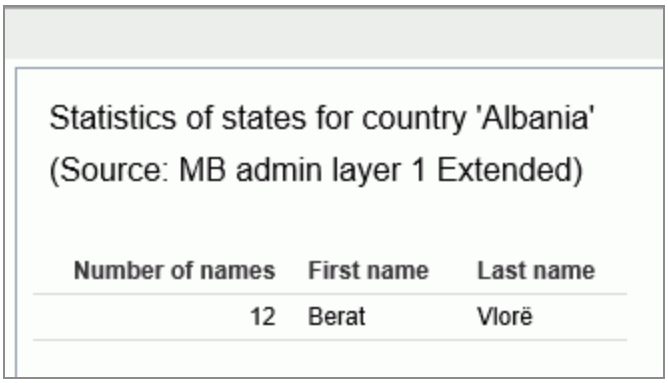


Clicking any link opens information about the next level georole.

Clicking Drill to postal levels opens the list of postal levels for the country, as shown in the following image.



Right-clicking a link in any georole column other than the Country column opens a summary of the values for that georole, as shown in the following image.



Using a Second Level License to Map French Postal Codes

The request used in this example references data about French state names, city names, and postal codes. This data is readily available online. The data in this example was downloaded from https://www.aggdata.com/free/france-postal-codes which is available for

free using a Creative Commons Attribution 4.0 license detailed at https://creativecommons.org/licenses/by/4.0/. Once you download the data, you can upload it to the server to create the data file and synonym for use in requests. This example assumes that the data and synonym are in the ibisamp application on the server.

> **Note:** Cloud Software Group takes no responsibility for the accuracy or continued existence of this data on this site. It is being used only as an example of the detailed administrative boundaries available with a second level license.

The Master File for the uploaded data follows. The Master File generated by the upload procedure was edited to change the first field name to COUNTRY and to remove the folder declarations.

```
FILENAME=FR_POSTAL_CODES, SUFFIX=DFIX    ,
 DATASET=ibisamp/fr_postal_codes.ftm (LRECL 1140 RECFM V, BV_
NAMESPACE=OFF, $
  SEGMENT=FR_POSTAL_CODES, SEGTYPE=S0, $
    FIELDNAME=COUNTRY, ALIAS=E01, USAGE=A50V, ACTUAL=A50V,
      TITLE='Country for State',
      GEOGRAPHIC_ROLE=COUNTRY,  $
    FIELDNAME=STATE, ALIAS=E02, USAGE=A21V, ACTUAL=A21V,
      MISSING=ON,
      TITLE='State',
      GEOGRAPHIC_ROLE=STATE,  $
    FIELDNAME=COUNTY, ALIAS=E03, USAGE=A25V, ACTUAL=A25V,
      MISSING=ON,
      TITLE='County',
      GEOGRAPHIC_ROLE=COUNTY,  $
    FIELDNAME=CITY, ALIAS=E04, USAGE=A48V, ACTUAL=A48V,
      MISSING=ON,
      TITLE='City',
      GEOGRAPHIC_ROLE=CITY,  $
    FIELDNAME=POSTAL_CODE, ALIAS=E05, USAGE=A16V, ACTUAL=A16V,
      MISSING=ON,
      TITLE='Postal Code',
      GEOGRAPHIC_ROLE=POSTAL-CODE,  $
    FIELDNAME=PLACE_NAME, ALIAS=E06, USAGE=A56V, ACTUAL=A56V,
      MISSING=ON,
      TITLE='Place Name', $
    FIELDNAME=GEO_POINT, ALIAS=E07, USAGE=A150, ACTUAL=A150,
      TITLE='GIS Point',
      GEOGRAPHIC_ROLE=GEOMETRY_POINT,  $
```

The Access File for the uploaded data follows.

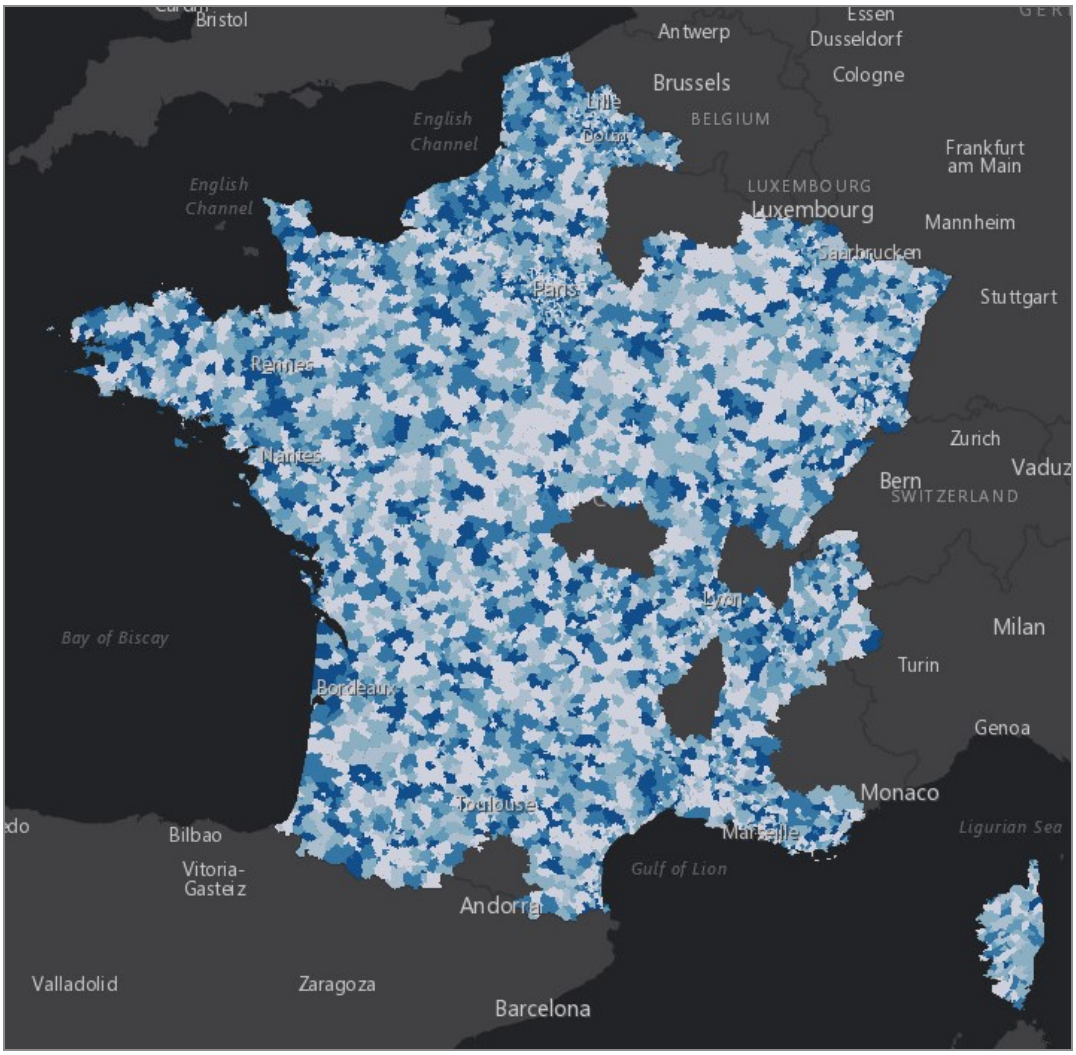
```
SEGNAME=FR_POSTAL_CODES,
  DELIMITER=',',
  CDN=COMMAS_DOT,
  CONNECTION=<local>, $
```

The following WebFOCUS Procedure generates a choropleth map that shows the postal codes from the uploaded data source. The DEFINE field is used to assign different numeric values to each field. When used in the Color bucket, this DEFINE field makes it easier to differentiate the different postal code areas.

```
DEFINE FILE fr_postal_codes
 FOURTH_CHAR/I1 ( TITLE = 'Fourth,Character' ) =SUBSTRING(FR_POSTAL_
CODES.FR_POSTAL_CODES.POSTAL_CODE, 4, 1);
END

SET COMPONENT=TableChart_1
SET ARVERSION=2
-DEFAULTH &WF_TITLE='WebFOCUS Report';

GRAPH FILE fr_postal_codes
SUM FOURTH_CHAR
BY FR_POSTAL_CODES.FR_POSTAL_CODES.POSTAL_CODE
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET VZERO OFF
ON GRAPH SET GRWIDTH 1
ON GRAPH SET HAXIS 1008.0
ON GRAPH SET VAXIS 768.0
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET EMBEDHEADING ON
ON GRAPH SET AUTOFIT ON
ON GRAPH SET STYLE *
INCLUDE=IBFS:/WFC/Global/Themes/Standard/Default/theme.sty,$
TYPE=REPORT, TITLETEXT='Chart1', ORIENTATION=LANDSCAPE,
ARREPORTSIZE=DIMENSION,
       ARFILTER_TARGET='*', CHART-LOOK=com.esri.map, ARGRAPHENGINE=JSCHART, $
TYPE=DATA, COLUMN=N2, BUCKET=color, $
*GRAPH_SCRIPT

*GRAPH_JS_FINAL
"extensions": {
    "com.esri.map": {
        "overlayLayers":             [
                {
                    "ibiDataLayer": {
                        "map-metadata": {
```

```
"map_by_field": "FR_POSTAL_CODES.FR_POSTAL_CODES.POSTAL_CODE"
                        }
                    }
                }
            ],
        "baseMapInfo": {
            "customBaseMaps":                 [
                    {
                        "ibiBaseLayer": "dark-gray"
                    }
                ]
        }
    }
}

*END
ENDSTYLE
END
```

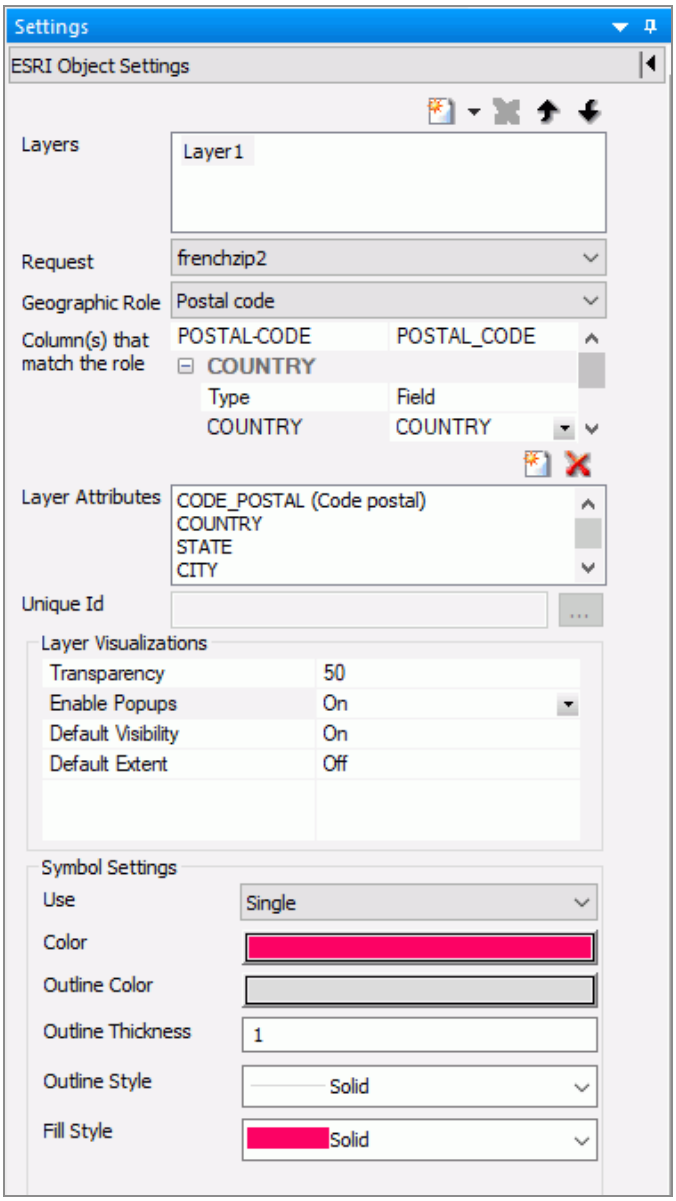
When you run this procedure, the map displays postal codes in France, as shown in the following image.



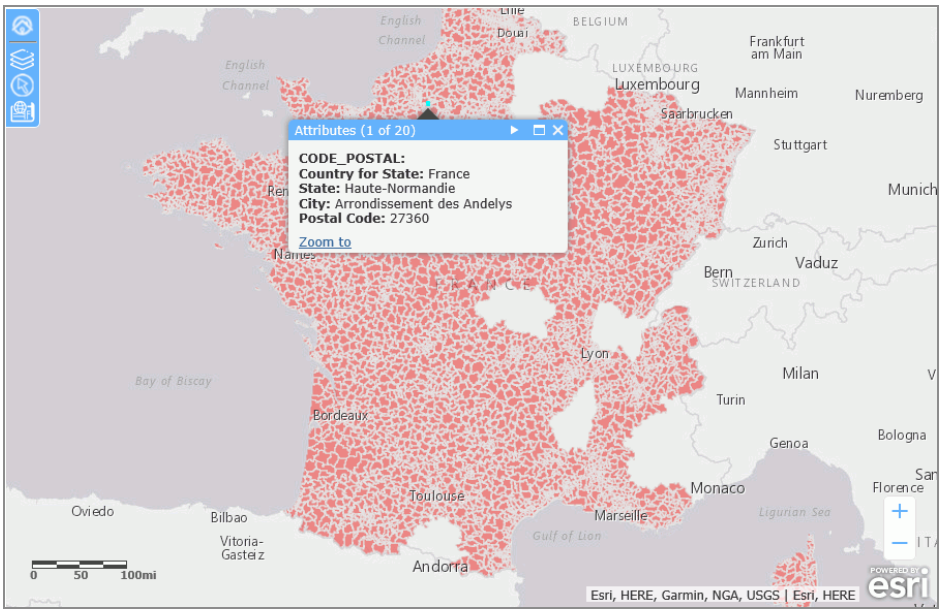
When creating a map ibi™ WebFOCUS® App Studio, the following request named frenchzip2.fex creates the XML file with the postal code data that is passed to the HTML page with the Esri component.

```
TABLE FILE ibisamp/fr_postal_codes
PRINT COUNTRY STATE CITY POSTAL_CODE
ON TABLE PCHOLD FORMAT XML
END
```

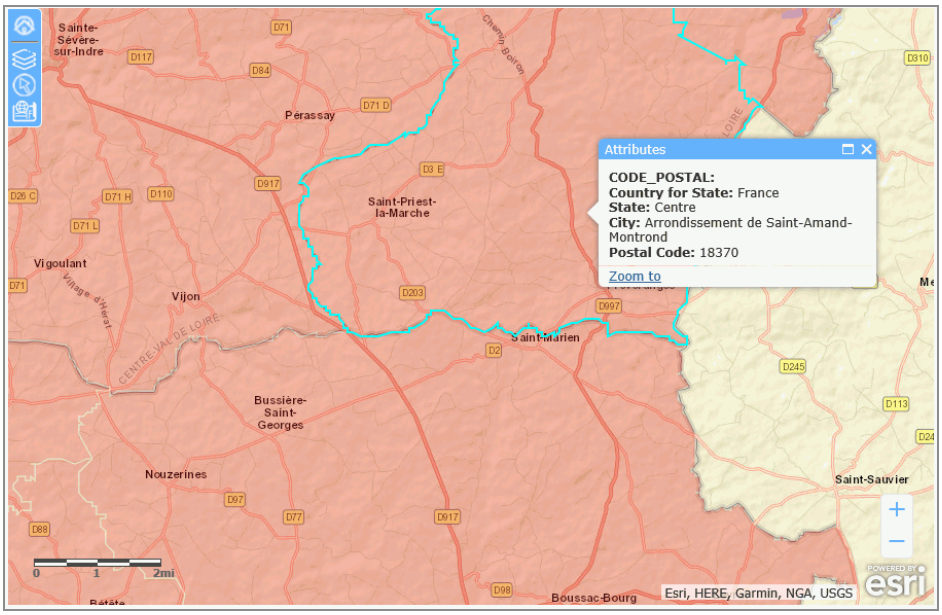
Configure the Server with a second level license. Create an HTML page, add an Esri component, and select the **frenchzip2** request in the Requests & Data Sources panel. Then configure the Settings panel to use the request and the Postal code geographic role, as shown in the following image.



Run the HTML page. The output is shown in the following image, with one of the postal codes clicked to display the popup.



You can zoom in to see the boundaries of individual postal codes and change to a basemap that shows more detail, such as the World Street Map, as shown in the following image (the layer transparency has also been changed to 30% using the Table of Contents widget, to see the background detail more clearly).



Using Geographic Administrative Boundaries

Administrative boundaries for the United States are automatically included by Esri.

The following table lists the Level 1 countries and their Level 1 and Level 2 administrative levels. For some countries, no additional administrative levels are added with a second level license.

Country	Postal Code	Level 1 Administrative Level (Number of Values)	Level 2 Administrative Level (Number of Values)
Albania	2 - digit	Qarke (12)	Bashkia (61)
Andorra	5 - digit	Parroquies (7)	
Argentina	5 - digit	Departamentos (525)	
Australia	4 - digit	Local Government Areas (569)	
Austria	4 - digit	Gemeinden (2120)	
Belarus	6 - digit	Woblaszi (7)	Raioni (129)
Belgium	4 - digit	Communes (589)	
Bosnia and Herzegovina	5 - digit	Kantone (18)	Opstine (142)
Brazil	5 - digit	Municipios (5565)	
Canada	3 - digit	Census Divisions (293)	Census Subdivisions (5243)
Chile	2 - digit	Provincias (54)	
China	2 - digit	Counties City	

Country	Postal Code	Level 1 Administrative Level (Number of Values)	Level 2 Administrative Level (Number of Values)
		Districts (2855)	
Costa Rica	2 - digit	Cantones (81)	Distritos (473)
Croatia	2 - digit	Zupanije (21)	Opcine (556)
Cyprus	2 - digit	Eparchia (6)	Dimoi (615)
Czech Republic	2 - digit	Orp (206)	Obce (6253)
Denmark	4 - digit	Kommuner (99)	
Estonia	5 - digit	Maakonnad (15)	Vallad (213)
Finland	5 - digit	Seutukunnat (70)	Kunnat (317)
France	5 - digit	Cantons (1972)	Communes (36571)
Germany	5 - digit	Municipilaties	
Gibraltar	3/4/5 - digit		
Greece	5 - digit	Nomoi (75)	Dimoi (326)
Holy See (Vatican City State)	5 - digit		
Hong Kong	6 - digit	Shih Zizhiqu (18)	
Hungary	2 - digit	Kistersegek (175)	Telepulesek

Country	Postal Code	Level 1 Administrative Level (Number of Values)	Level 2 Administrative Level (Number of Values)
			(3177)
Iceland	2 - digit	Landsvaedi (8)	Sveitarfelog (74)
India	6 - digit	Districts (640)	Subdistricts (5783)
Italy	5 - digit	Provincias (110)	Comuni (8047)
Japan	3 - digit	Prefectures (47)	Municipalities (1901)
Kenya	1 - digit	Wilaya (47)	Districts (158)
Korea, Republic of	3 - digit	Si Gun (230)	
Latvia	2 - digit	Rajons (33)	Novadi (119)
Liechtenstein	4 - digit	Landschaften (2)	Gemeinden (11)
Lithuania	2 - digit	Apskritys (10)	Savivaldybes (60)
Luxembourg	4 - digit	Cantons (12)	Communes (105)
Macedonia, the former Yugoslav Republic of	2 - digit	Statisticki Regioni (8)	Opstini (80)
Malta	3 - digit	Districts (6)	Local Councils (68)
Mexico	3 - digit	Estados (32)	

Country	Postal Code	Level 1 Administrative Level (Number of Values)	Level 2 Administrative Level (Number of Values)
Monaco	5 - digit	Quartiers (9)	
Montenegro	2 - digit	Opstina (21)	
Netherlands	4 - digit	Gemeenten (380)	
New Zealand	4 - digit	Territorial Authorities (68)	Area Units (1911)
Norway	4 - digit	Okonomisk regioner (89)	Kommuner (428)
Poland	5 - digit	Gminy (2479)	Gminy Miasta (3119)
Portugal	4 - digit	Concelhos (308)	Freguesias (3092)
San Marino	5 - digit	Castelli (9)	
Serbia	5 - digit	National (1)	
Singapore	2 - digit	Regions (5)	Planning Areas (55)
Slovakia	2 - digit	Okresy (79)	Obce (2927)
Slovenia	2 - digit	Statisticne Regije (12)	Obcina (212)
South Africa	2-digit	Municipalities (234)	
Spain	5 - digit	Provincias (52)	Municipios (8122)

Country	Postal Code	Level 1 Administrative Level (Number of Values)	Level 2 Administrative Level (Number of Values)
Sweden	5 - digit	Kommuner (290)	
Switzerland	4 - digit	Gemeinden (2225)	
Taiwan	3 - digit	Township Districts (368)	
Turkey	5 - digit	Iller (81)	Ilceler (970)
United Kingdom	4 - digit	Districts (391)	

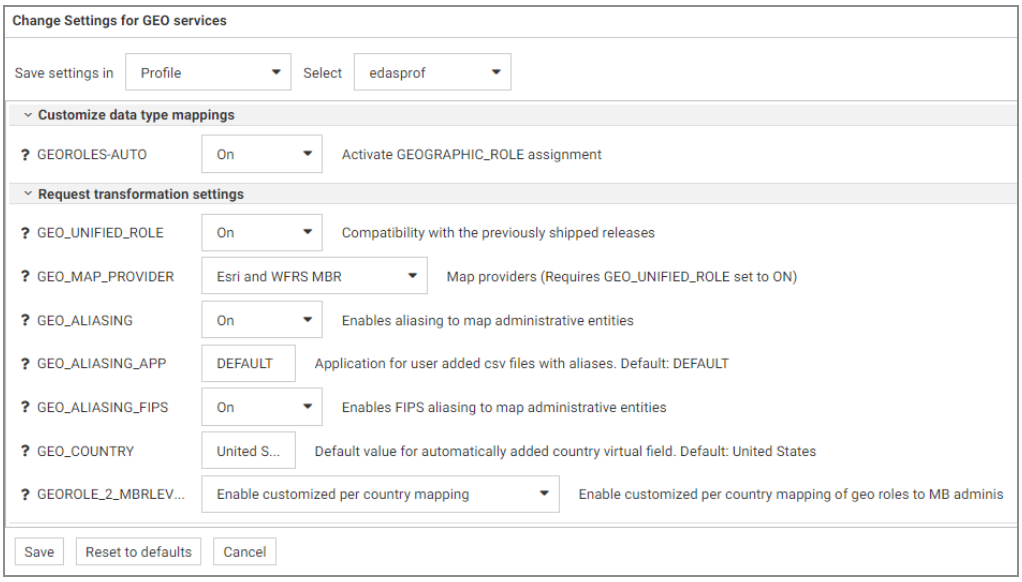
Edit Geographic Configuration Settings

By default, the server is configured for unified geographic roles. This configuration is controlled by the following settings.

Procedure

1. Navigate to the Workspace page, click **Settings**, point to **Geo Services**, and click **Edit settings**.

   The Change Settings for GEO services page opens, as shown in the following image.



2. The following setting controls whether geographic role assignments are automatically assigned using field name analysis.

   GEOROLES-AUTO. The default value is On. For example, if an alphanumeric field has the name COUNTRY, it is assigned the geographic role Country.

3. The following settings control unified geographic roles.

   - **GEO_UNIFIED_ROLE.** This compatibility setting must be turned on (the default) to activate unified geographic roles. Turn it off to use geographic roles from prior releases. On indicates that the new shorter set of geographic roles that combines subsets of previously used roles will be used. Off will use geographic roles from previously shipped releases.
   - **GEO_MAP_PROVIDER.** Assigns names of the providers of geographic maps. The list of names should be separated with slashes to be used by the transformation code for mapping. Default is *Esri and WFRS MBR*. The currently supported set of providers includes WebFOCUS Reporting Server (WFRS) (geographic boundaries distributed in the WebFOCUS Reporting Server) and ESRI.
   - **GEO_ALIASING.** On enables aliasing to map administrative entities. Aliasing is a mechanism to support alternative names/spellings to the administrative names used as keys to find the corresponding geometry. Caution, incorrect results will be reported on a map in the case where the column data contains variations of names/spellings for the same administrative entity (resolved to the same key).

Alias names are stored in .csv files. Shipped aliasing files are located in the geomaps sub-directory of the etc folder under EDAHOME. The naming convention is geo_srv_dbl_**geo_role**. Each data file has an associated synonym with the same name. Aliasing is currently supported for the four geo roles COUNTRY, STATE, COUNTY, and CITY. The STATE aliasing data file includes the valid country name for each state. COUNTY and CITY files include valid country and state names. *Valid* means the actual key value used to fetch a geometry. The default value is On.

- **GEO_ALIASING_APP.** Sets an application name for user-added .csv files with aliases. DEFAULT means no user files. User-added alias data files are supported for the four geo roles COUNTRY, STATE, COUNTY, and CITY (see the description for the GEO_ALIASING setting). The default value is DEFAULT, which uses the server aliasing files.

  The best practice is to copy the desired. csv file from the _ edahome/etc/geomaps folder to the application folder named in this setting, and edit it, changing aliases or adding records with new ones. There are four focexecs named geo_srv_mapkey_<geo_role> that have a mandatory parameter ISO2 country name. The following is a request example that reports city names for South Africa sorted by state/province name.

  ```
  EX geo_srv_mapkey_city ISO2='ZA'
  ```

  Following is an example of user-created records (based on the obtained report):

  ```
  "South Africa", "Gauteng", "Johannesburg", "City of
  Johannesburg" "South Africa", "Western Cape", "Paarl",
  "Drakenstein"
  ```

- **GEO_ALIASING_FIPS.** On enables FIPS aliasing to US map administrative entities. This setting requires GEO_ALIASING to be on. The data file with the United State FIPS aliases is processed as an extension to the main aliases data file The default value is off.
- **GEO_COUNTRY.** Assigns a default value for an automatically added DEFINE field with GEOGRAPHIC_ROLE 'Country'. This mechanism is in effect during the create metadata process when the setting GEOROLES-AUTO is ON and a column with geo role COUNTRY is not detected. The generated DEFINE field will

be used to create geo hierarchies required in mapping. The default value is 'United States'.

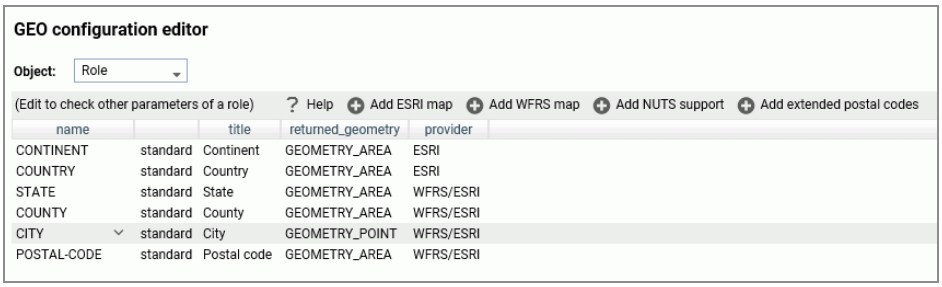
- **GEOROLE_2_MBRLEVEL.Enable customized per country mapping** enables customized per country mapping of the geo roles (STATE, COUNTY, and CITY) to the MBR administrative levels. This is the default value. **Disable customized per country mapping** sets uniform mapping of geo roles (STATE, COUNTY, and CITY) for all countries to the MBR administrative levels (1, 3, and 5 respectively). There is a geo_role2mbrlev focexec to list countries with customized admin levels. The report does not depend on this setting.

4. Click **Save**.

Editing the Geographic Configuration

The GEO configuration editor provides a tool for editing or adding properties for geographic roles, basemaps, reference layers, and demographic layers. In addition, it enables you to add maps and shape files to the configuration.

Go to the **Workspace** page. Click **Settings**, point to **Geo Services**, then click **Edit Configuration**. The **GEO configuration editor** opens displaying the configured geographic roles, as shown in the following image.



You can select the following objects from the Object drop-down list.

- Role.
- Basemap.
- ContextLayer.

You can edit the properties for a basemap or context layer (reference layer or demographic layer), or add a new one. You cannot edit the properties of a standard geographic role. To add a customized geographic role, you first add an Esri map or a shapefile (WebFOCUS Reporting Server map) and assign the geographic role to the map or shapefile.

Editing the List of Geographic Roles

The following standard unified geographic roles are configured by default and cannot be changed. These geographic roles create a hierarchy that can be used to drill down or up between levels of administration in maps, reports, or charts.

- CONTINENT.
- COUNTRY.
- STATE.
- COUNTY.
- CITY.
- POSTAL CODE.

To add a geographic role to the configuration, you can add a new Esri map or a shapefile hosted by the Server and associate a geographic role with the new map. You can also implement NUTS geographic roles support.

Note: Some users may not be able to run maps with custom geographic roles when the default WebFOCUS Reporting Server security configuration is in place. To allow a user to run content with custom geographic roles, on the Access Control page of the WebFOCUS Reporting Server browser interface, right-click the role that the user privileges are based on and click **Directory/File Privileges**, then enable both the Execute and List privileges for geo_services_user.xml.

Configuring Properties of Geographic Roles

The following describes columns for geographic roles in the configuration editor.

name

Is the unique name of the geographic role. It cannot have spaces, but it can have underscores (_).

Next to the name is an indicator of whether the role is a standard role or a customized role.

title

Is the description of the geographic role that is displayed in reports and in drop-down lists in the WebFOCUS tools.

returned_geometry

Is the type of geographic data returned from the map service for rendering on the map.

Valid values include:

- GEOMETRY_AREA
- GEOMETRY_POINT
- GEOMETRY_LINE

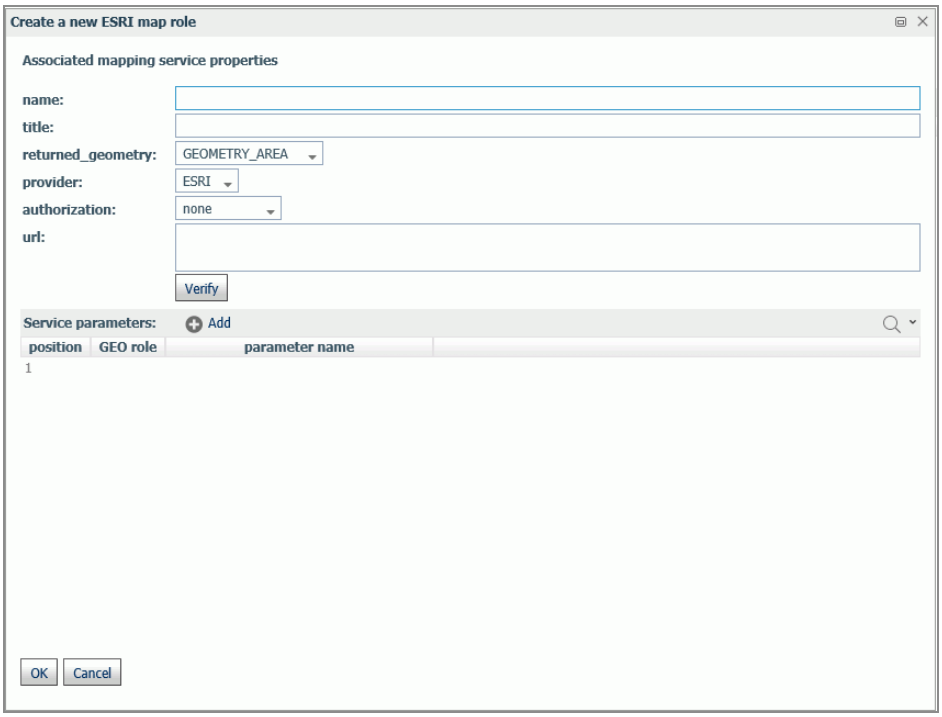
When you have configured the properties, click **OK** to return to the Geo Configuration Editor.

The new role will display on the list of roles, Click **Save** to save it in the geographic configuration.

Adding a New Role for an Esri Map

To add an Esri geographic role, click **Add ESRI map** on the Geographic Configuration Editor.

The **Create a new ESRI map role** dialog box opens, as shown in the following image.



Configure the following map service properties.

name

Is a name for the geographic role.

title

Is a title to display in the WebFOCUS tools.

returned_geography

Select the type of geometry that is returned from the map service for this role. Valid values are:

- **GEOMETRY_AREA.** Returns JSON polygon definitions.
- **GEOMETRY_LINE.** Returns JSON line definitions.
- **GEOMETRY_POINT.** Returns a JSON point.

url

Is the URL to the map service that provides the geographic data.

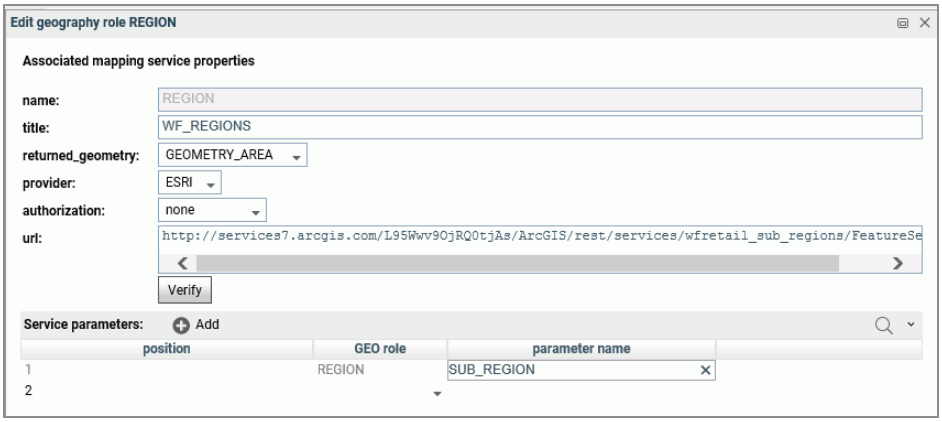
Click **Verify** after entering the URL to verify that the map service is available by going to the specified URL.

Service Parameters

Add as parameters any additional geographic roles needed to identify the exact location of the new role. For example, a city name needs state and country parameters.

Adding the ibi WebFOCUS Regions Geographic Role

The following properties add the WebFOCUS Regions role to the configuration.

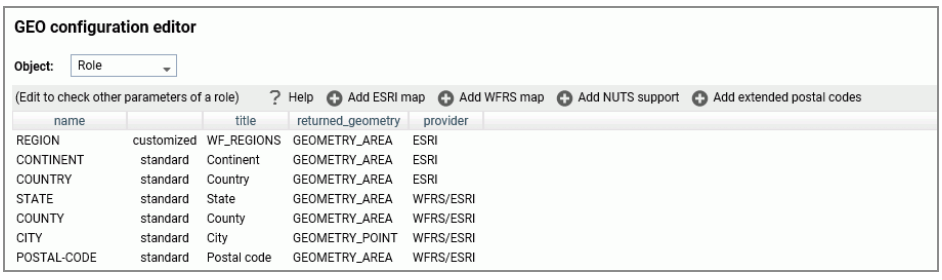


Note: The *parameter name* corresponds to the field name in the FeatureLayer referenced in the following URL:

```
http://services7.arcgis.com/L95Www9OjRQ0tjAs/ArcGIS/rest/services/wfreta
il_sub_regions/FeatureServer/0
```

Click **OK** when you have finished configuring the properties.

The new role is added to the configuration as a customized role, as shown in the following image.

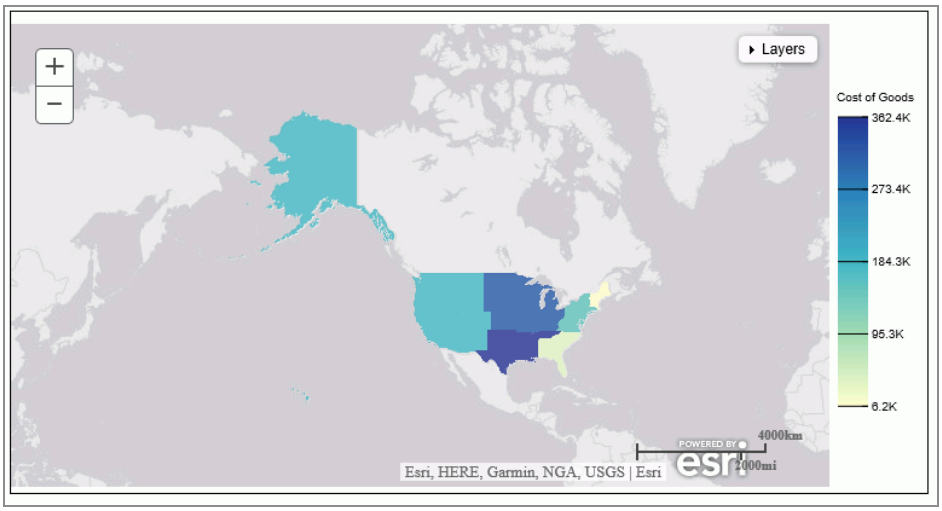


Click **Save** to save this role to the configuration.

The following request uses the WebFOCUS Regions geographic role in a map request.

```
DEFINE FILE WF_RETAIL_LITE

REGION/A50 (GEOGRAPHIC_ROLE=REGION) = BUSINESS_SUB_REGION;
END

GRAPH FILE WF_RETAIL_LITE
SUM COGS_US
BY REGION
WHERE COUNTRY_NAME EQ 'United States'
ON GRAPH PCHOLD FORMAT JSCHART
ON GRAPH SET LOOKGRAPH CHOROPLETH
ON GRAPH SET STYLE *
TYPE=REPORT, CHART-LOOK=com.esri.map, $
TYPE=DATA, COLUMN=N2, BUCKET=color, $
*GRAPH_JS_FINAL
"extensions": {
"com.esri.map": {
"overlayLayers":
[
{
"ibiDataLayer": {
"map-metadata": {
"map_by_field": "
REGION"
}
}
}
],
"baseMapInfo":
{
"customBaseMaps":
[
{
"ibiBaseLayer": "gray"
}
]
}
}
}
*END
ENDSTYLE
END
```

The output is shown in the following image.



Adding a New Role for a Server-Hosted Map

A server-hosted map is based on a shapefile. You must upload the shapefile (.dbf) to an application folder accessible to the server. The server will transform it to ibijson format.

An ESRI shape file is actually a collection of at least four files:

- **.dbf file.** The .dbf file is a standard database file used to store attribute data and object IDs. A .dbf file is mandatory for shape files.
- **.shp file.** The .shp file is a mandatory Esri file that gives features their geometry. Every shapefile has its own .shp file that represents spatial vector data.
- **.shx file.** The .shx file is a mandatory Esri shape index position file. This type of file is used to search forward and backward.
- **.prj file.** The .prj file is an optional file that contains the metadata associated with the shapefiles coordinate and projection system.

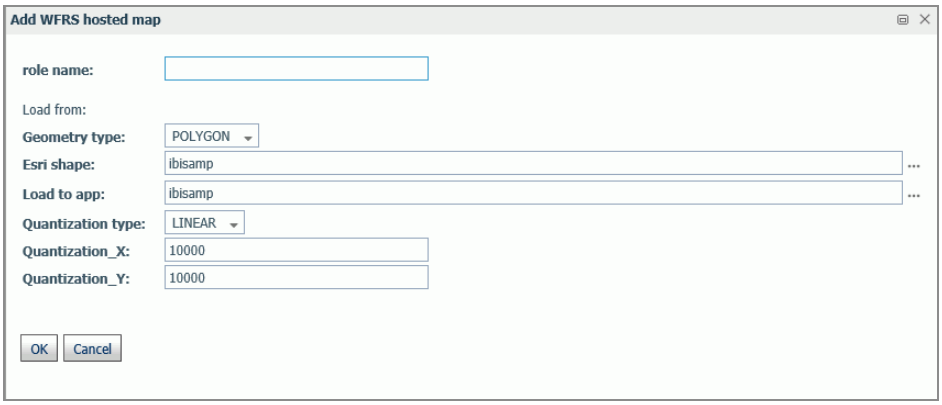
All files must have exactly the same name and to be located in the same directory. If they are not, the shapefile conversion will fail. Additionally, the names must not contain spaces.

When there are several possible keys associated with a geometry, a drop-down list of detected key names will be displayed. Select any one of these fields. No selection is required when there is a single geometry key.

The shapefile should only be in the GCS_WGS_1984 - World Geodetic System 1984 (decimal degrees) coordinate system.

To add a geographic role for a Server-hosted map, click **Add WFRS map** on the Geographic Configuration Editor.

The **Add WFRS hosted map** dialog box opens, as shown in the following image.



Configure the following properties.

role name

Is a name for the geographic role.

Geometry type

Select either POLYGON or POINT from the drop-down list.

Esri shape

Enter the name of the application directory where the shapefile resides, or click the ellipsis (...) to navigate to the application directory. Then select the .dbf file for the role.

Load to app

Enter the name of the application directory where you want to place the ibijson file, or click the ellipsis (...) to navigate to the application directory.

Quantization type

Quantization is the process of transforming a large set of input values to a smaller set of values. When transforming the shapefile, the server will quantize points that are too close together in order to optimize map rendering performance. Two methods are available for quantization, LINEAR or GRID. The default is LINEAR.

Quantization_X

Is the threshold value for the x-axis.

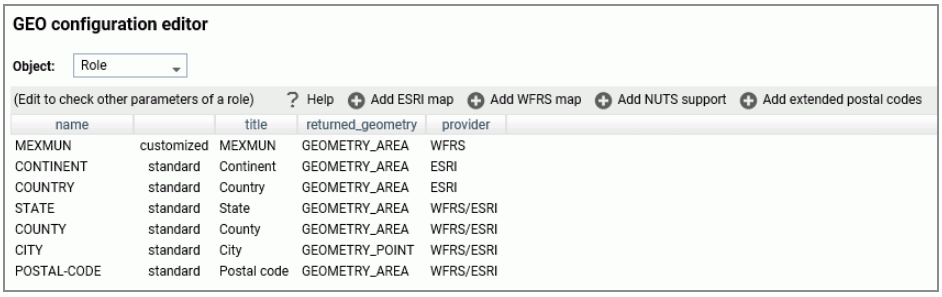
Quantization_Y

Is the threshold value for the y-axis.

If the map has multiple keys, a drop-down list displays so that you can select one.

Click **OK** when you have finished configuring the properties.

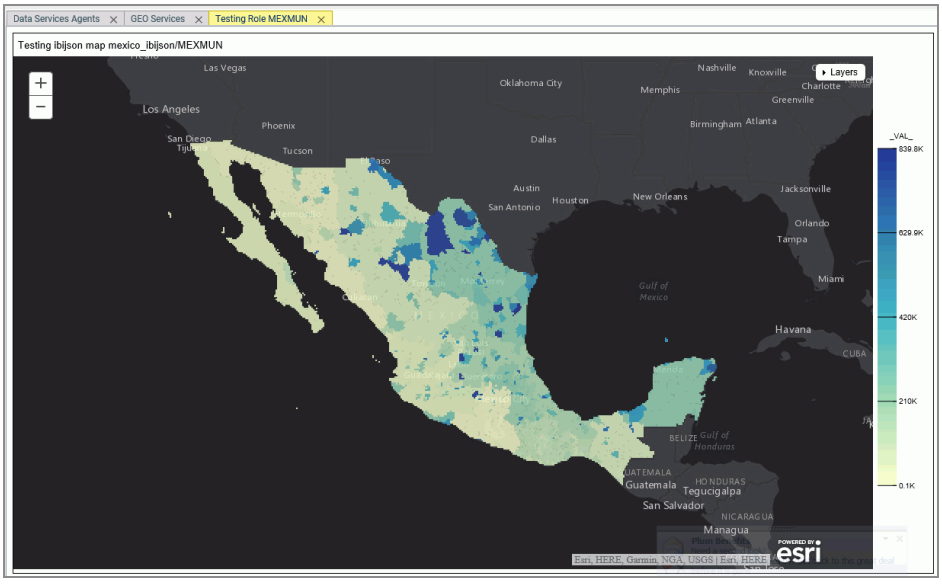
The new role is added to the configuration as a customized role, as shown in the following image.



name		title	returned_geometry	provider
MEXMUN	customized	MEXMUN	GEOMETRY_AREA	WFRS
CONTINENT	standard	Continent	GEOMETRY_AREA	ESRI
COUNTRY	standard	Country	GEOMETRY_AREA	ESRI
STATE	standard	State	GEOMETRY_AREA	WFRS/ESRI
COUNTY	standard	County	GEOMETRY_AREA	WFRS/ESRI
CITY	standard	City	GEOMETRY_POINT	WFRS/ESRI
POSTAL-CODE	standard	Postal code	GEOMETRY_AREA	WFRS/ESRI

Click **Save** to save this role to the configuration.

You can test the role by right-clicking the role in the configuration editor and clicking **Test**. A sample map will be generated, as shown in the following image.

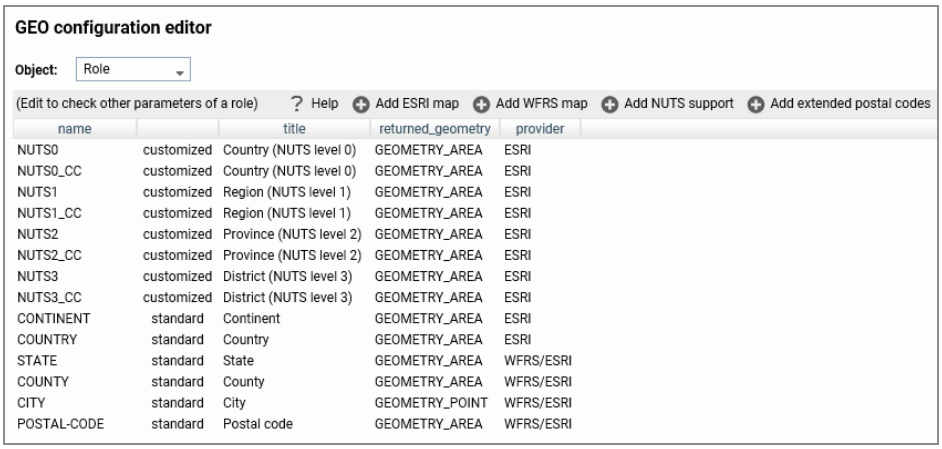


Adding NUTS Support

Nomenclature of territorial units for statistics (NUTS) are geographic roles specific to the European Union.

To add NUTS geographic roles to the configuration, click **Add NUTS support** on the Geographic Configuration Editor.

The NUTS geographic roles are added, as shown in the following image.


GEO configuration editor

Object: Role

(Edit to check other parameters of a role) Help Add ESRI map Add WFRS map Add NUTS support Add extended postal codes

name		title	returned_geometry	provider
NUTS0	customized	Country (NUTS level 0)	GEOMETRY_AREA	ESRI
NUTS0_CC	customized	Country (NUTS level 0)	GEOMETRY_AREA	ESRI
NUTS1	customized	Region (NUTS level 1)	GEOMETRY_AREA	ESRI
NUTS1_CC	customized	Region (NUTS level 1)	GEOMETRY_AREA	ESRI
NUTS2	customized	Province (NUTS level 2)	GEOMETRY_AREA	ESRI
NUTS2_CC	customized	Province (NUTS level 2)	GEOMETRY_AREA	ESRI
NUTS3	customized	District (NUTS level 3)	GEOMETRY_AREA	ESRI
NUTS3_CC	customized	District (NUTS level 3)	GEOMETRY_AREA	ESRI
CONTINENT	standard	Continent	GEOMETRY_AREA	ESRI
COUNTRY	standard	Country	GEOMETRY_AREA	ESRI
STATE	standard	State	GEOMETRY_AREA	WFRS/ESRI
COUNTY	standard	County	GEOMETRY_AREA	WFRS/ESRI
CITY	standard	City	GEOMETRY_POINT	WFRS/ESRI
POSTAL-CODE	standard	Postal code	GEOMETRY_AREA	WFRS/ESRI

Click **Save** to save these roles to the configuration.

Adding Support for Extended Postal Codes

Click **Add extended postal codes** to add support for Level 1 and Level 2 postal codes used in certain countries.

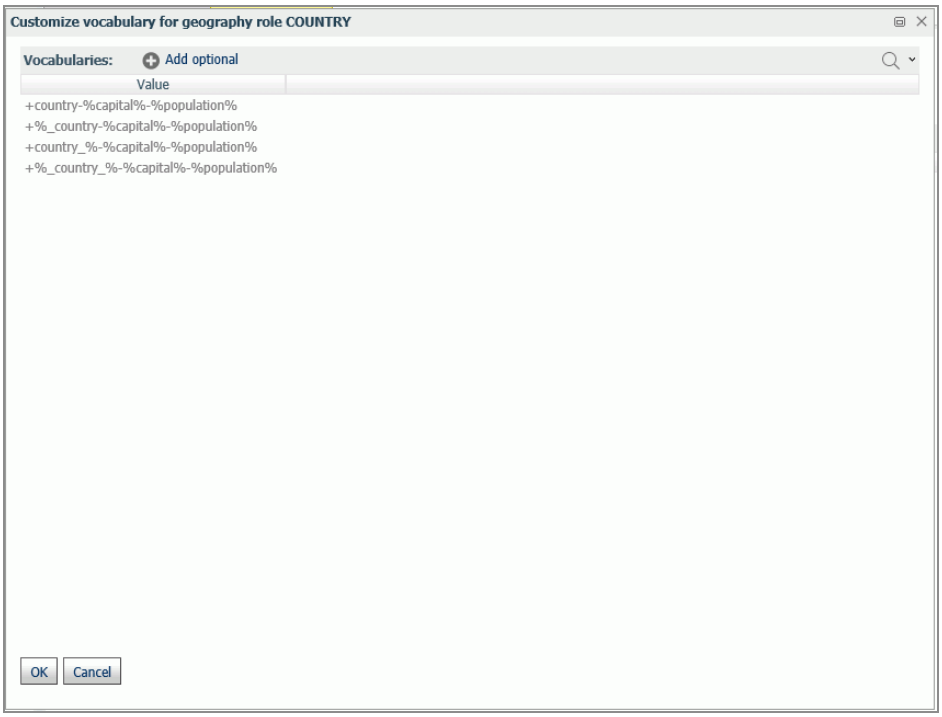
Customizing Vocabulary Rules

For each geographic role, a set of vocabulary rules define how to recognize when a field name should automatically be assigned to that role. If you right-click a role, you can click **Customize vocabulary** from the shortcut menu.

Elements in a rule are connected by the Boolean logic operation OR (only one needs to be satisfied). Each vocabulary element contains words enclosed with special characters. Words in the rule element are connected by the Boolean logic operation AND (all need to be satisfied).

A word may be prefixed and/or suffixed with the percent character (%), which is a placeholder for any sequence of characters. If an element contains more than one word, each word has to be prefixed by the character plus (+) or minus (-). Plus indicates that the word must be found in the column name. Minus indicates that the word must not be found in the column name.

For example, the following are the vocabulary rules for the role COUNTRY.



To add another rule, click **Add optional**.

When you are finished, click **OK**.

Click **Save** to save these rules to the configuration.

Customizing the List of Basemaps

You can edit an existing basemap definition or add a custom basemap.

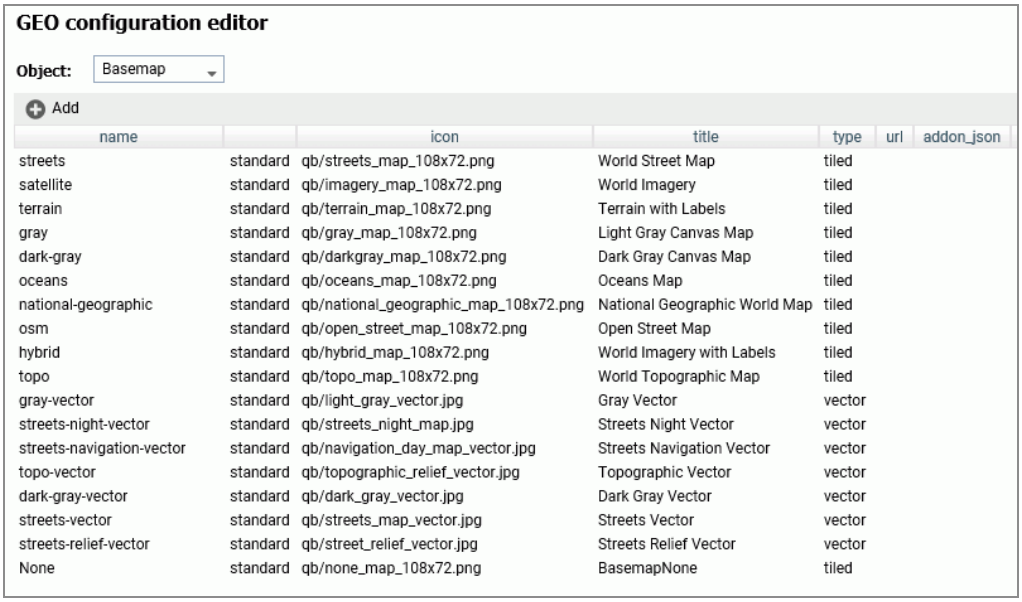
Basemaps that are not vector maps are pre-rendered image tiles. Vector basemaps are delivered from ArcGIS Online as vector tiles that are rendered on the client based on a style file that is delivered with the vector tiles. This provides customization options not available with pre-rendered image tiles.

A default set of vector basemaps is configured in the GEO configuration editor in the Server. However, you can configure additional vector basemaps as needed. You can find the basemap URLs and Style URLs at http://www.arcgis.com.

Using Standard Basemaps

To add a new basemap or customize an existing basemap, select **Basemap** from the Object drop-down list.

The following image shows the GEO configuration editor with the Basemap object selected, showing the list of standard basemaps.



GEO configuration editor

Object: Basemap

Add

name		icon	title	type	url	addon_json
streets	standard	qb/streets_map_108x72.png	World Street Map	tiled		
satellite	standard	qb/imagery_map_108x72.png	World Imagery	tiled		
terrain	standard	qb/terrain_map_108x72.png	Terrain with Labels	tiled		
gray	standard	qb/gray_map_108x72.png	Light Gray Canvas Map	tiled		
dark-gray	standard	qb/darkgray_map_108x72.png	Dark Gray Canvas Map	tiled		
oceans	standard	qb/oceans_map_108x72.png	Oceans Map	tiled		
national-geographic	standard	qb/national_geographic_map_108x72.png	National Geographic World Map	tiled		
osm	standard	qb/open_street_map_108x72.png	Open Street Map	tiled		
hybrid	standard	qb/hybrid_map_108x72.png	World Imagery with Labels	tiled		
topo	standard	qb/topo_map_108x72.png	World Topographic Map	tiled		
gray-vector	standard	qb/light_gray_vector.jpg	Gray Vector	vector		
streets-night-vector	standard	qb/streets_night_map.jpg	Streets Night Vector	vector		
streets-navigation-vector	standard	qb/navigation_day_map_vector.jpg	Streets Navigation Vector	vector		
topo-vector	standard	qb/topographic_relief_vector.jpg	Topographic Vector	vector		
dark-gray-vector	standard	qb/dark_gray_vector.jpg	Dark Gray Vector	vector		
streets-vector	standard	qb/streets_map_vector.jpg	Streets Vector	vector		
streets-relief-vector	standard	qb/street_relief_vector.jpg	Streets Relief Vector	vector		
None	standard	qb/none_map_108x72.png	BasemapNone	tiled		

Configuring Basemap Properties

The following is a description of the properties used for basemap configuration.

name

Is the name of the basemap.

Next to the name is an indicator of whether the basemap is a standard basemap or a customized basemap.

icon

Is the name of the thumbnail for the basemap (for a standard basemap) or the URL to the thumbnail (for a customized basemap) that will appear on the Basemap drop-down list in the WebFOCUS tools or the Change Basemap map widget.

title

Is a title to display on the Basemap drop-down list in the WebFOCUS tools or the Change Basemap map widget.

url

Is the URL to the map service that provides the basemap, for a customized basemap. The map service URL can be copied from the URL field on the page showing a custom basemap. For a standard basemap, the URL is already stored in the server geographic configuration file and is not displayed.

type

Valid values are tiled and vector.

addon_json

Specifies additional JSON properties for rendering the map. For a custom vector basemap, enter the basemap map service URLs and Style URLs needed for rendering the map. The map can consist of an array of layers, each with a URL and its style URL. The style URL for each layer can be found by clicking **View Style** on the page showing the map layer. The map service URL for each layer can be copied from the URL field on the page showing the map layer. Enter the information in the following format.

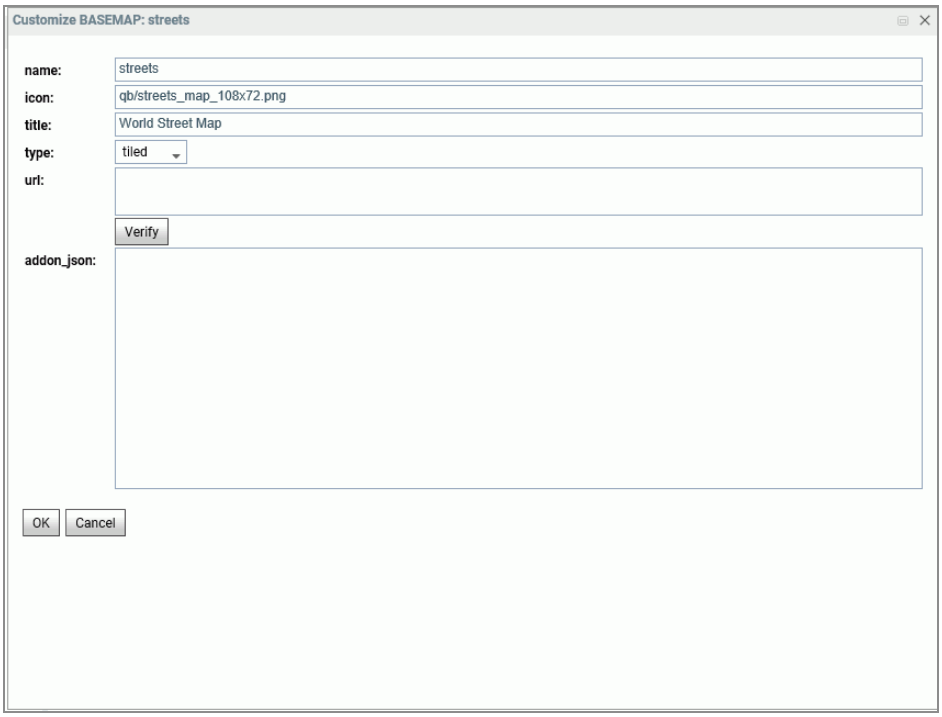
```
{"baseMapLayers":
 [
   {"url": "url_to_map_service", "styleUrl": "url_to_style"},
   {"url": "url_to_map_service", "styleUrl": "url_to_style"},
    ...
 ]
}
```

Note: If the vector basemap has multiple layers, its page on ArcGIS online will have links to each layer.

Editing the Properties of a Standard Basemap

To customize the properties of an existing basemap, right-click the basemap line and click **Customize BASEMAP**.

The Customize Basemap dialog box opens, as shown in the following image.



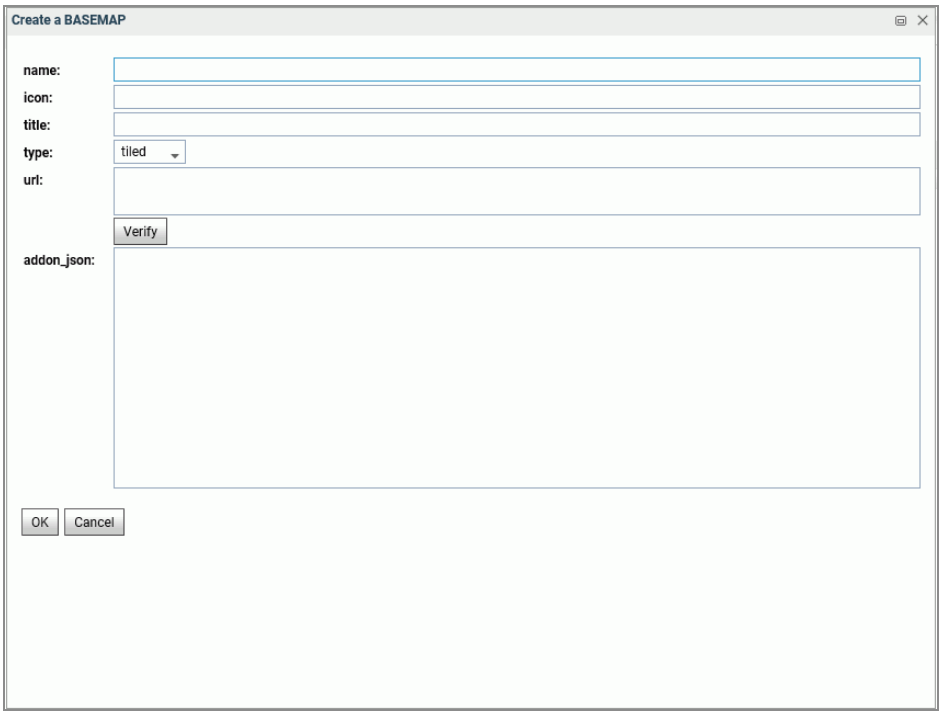
Edit the properties you want to change. If you change the URL, you can click **Verify** to make sure the map service is valid and accessible.

When you are finished, click **OK**, then click **Save** on the GEO configuration editor Basemaps page.

Adding a Custom Basemap

To add a new basemap to the configuration, click **Add**.

The **Create a BASEMAP** dialog box opens, as shown in the following image.



Enter a name for the basemap, a URL to the thumbnail, a title to display, and the URL to the map service that provides the basemap, and click **Verify**.

When you have configured the properties, click **OK**, then click **Save** on the GEO configuration editor Basemap page.

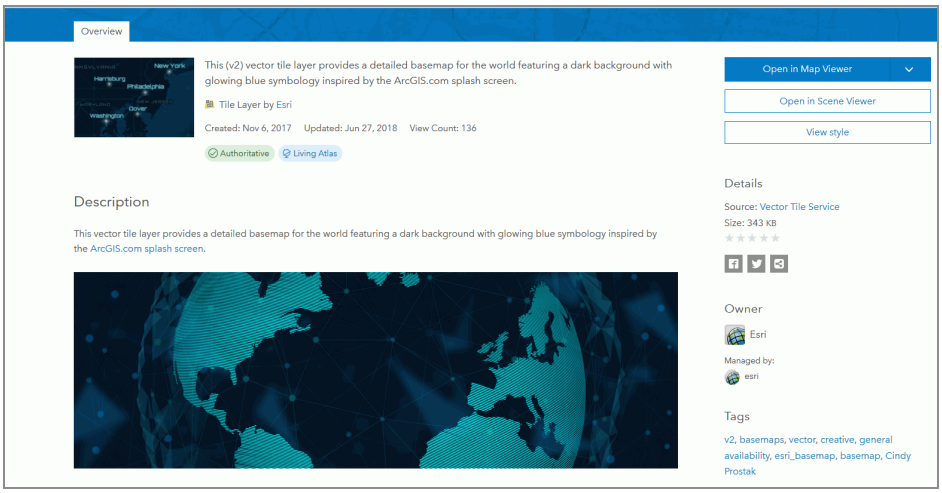
Configuring the Nova Vector Basemap

The following steps are needed to determine the properties associated with the Nova vector basemap.

1. Navigate to the following URL for the Nova basemap.

   https://www.arcgis.com/home/item.html?id=75f4dfdff19e445395653121a95a85db.

   The Nova basemap page is shown in the following image.



In the addon_json syntax, you need the styleUrl for each basemap URL defined in the vector basemap.

2. Click the **View Style** button to retrieve the styleUrl. In this case, it is the following URL.

   https://www.arcgis.com/sharing/rest/content/items/75f4dfdff19e445395653121a95a85db/resources/styles/root.json?f=pjson

3. Add the following URL for the Esri vector map service in both the url field in the GEO configuration editor and in the addon_json syntax for this basemap. You can copy this location from the URL field on the lower right of the Nova basemap page.

   https://basemaps.arcgis.com/arcgis/rest/services/World_Basemap_v2/VectorTileServer

4. The icon value must be a URL reference. This example uses the one referenced in the thumbnail of the webmap, which is the following URL (retrieved by right-clicking the thumbnail image at the top of the page and copying the image location).

   https://www.arcgis.com/apps/mapviewer/index.html?layers=75f4dfdff19e445395653121a95a85db

Add these properties in the GEO configuration editor to define the Nova vector basemap, which consists of a single layer. Add the name, type, and a title, as follows.

name: Nova

icon:
https://www.arcgis.com/apps/mapviewer/index.html?layers=75f4dfdff19e445395653121a95a85db

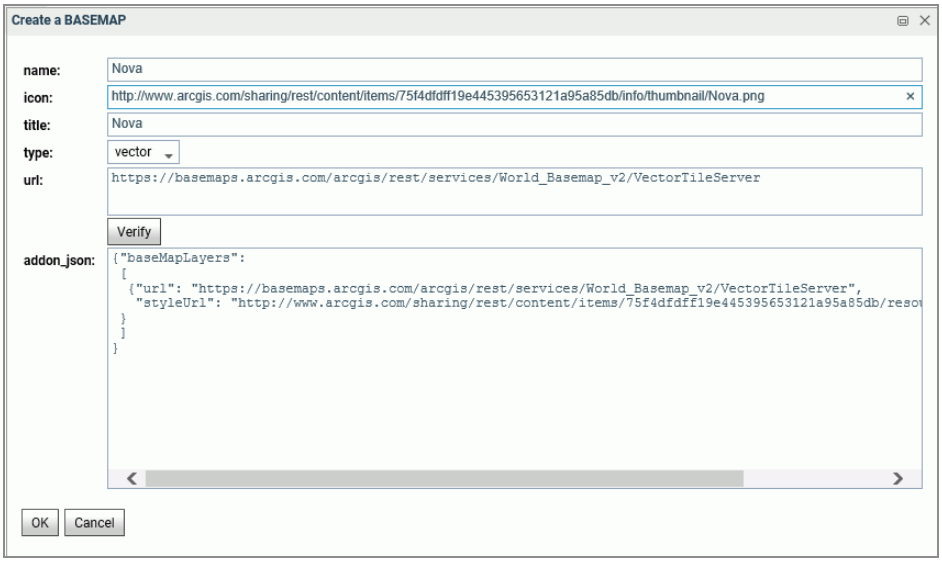
title: Nova

url:https://basemaps.arcgis.com/arcgis/rest/services/World_Basemap_v2/VectorTileServer

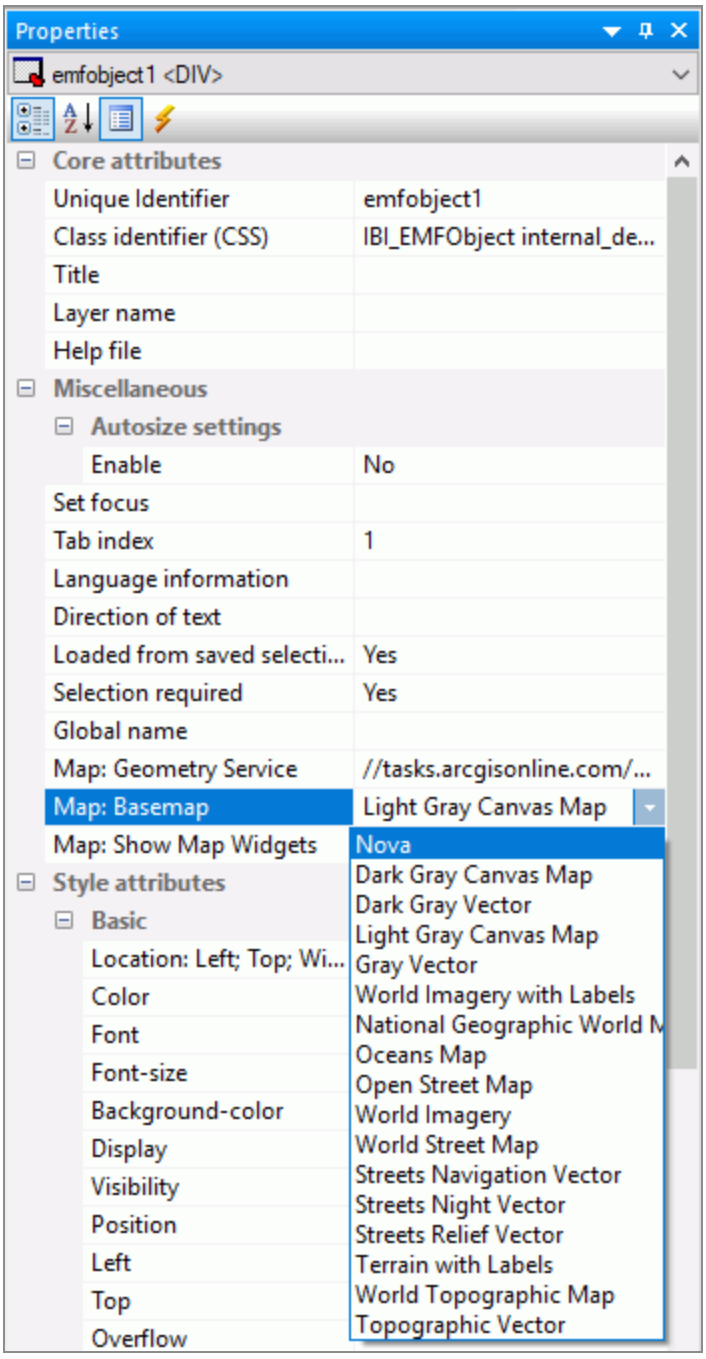
addon_json:

```
{"baseMapLayers":
[
{"url": "https://basemaps.arcgis.com/arcgis/rest/services/World_Basemap_
v2/VectorTileServer",
 "styleUrl":
"http://www.arcgis.com/sharing/rest/content/items/75f4dfdff19e4453956531
21a95a85db/resources/styles/root.json"
 }
]
}
```

The following image shows the Create a BASEMAP page for configuring the Nova vector basemap in the WebFOCUS Reporting Server GEO configuration editor.



After clicking **OK**, then **Save**, the custom vector basemap becomes available for selection in the WebFOCUS® App Studio Properties panel for the Esri map component, as shown in the following image.



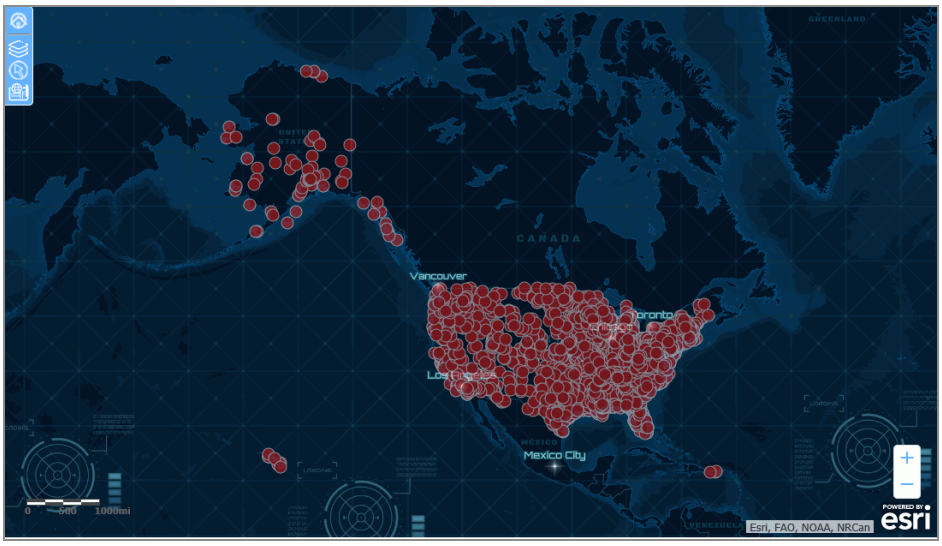
The WebFOCUS App Studio Esri component in this example uses the following request, named customer_locations.fex.

```
TABLE FILE WF_RETAIL_LITE
PRINT
     ID_CUSTOMER
```

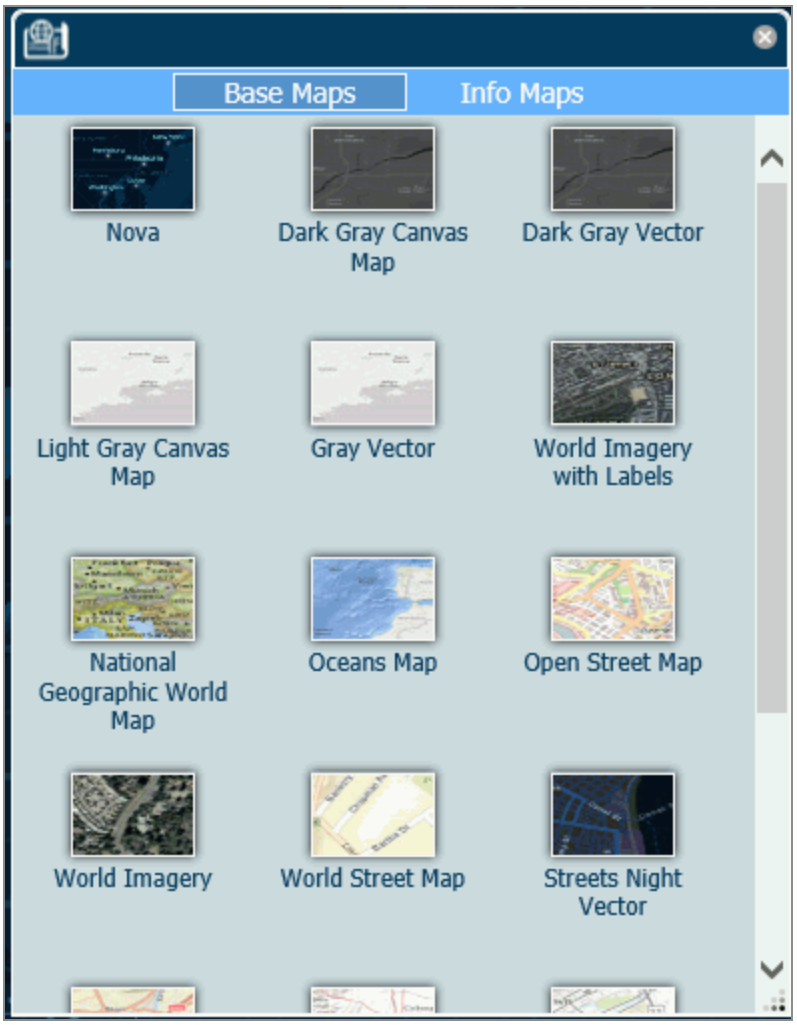
```
      COGS_US
         QUANTITY_SOLD
      COMPUTE LONGITUDE/D12.2 =CUSTOMER_LONGITUDE;
      COMPUTE LATITUDE/D12.2 = CUSTOMER_LATITUDE;
BY  STATE_PROV_NAME
BY  ID_CUSTOMER NOPRINT
WHERE COUNTRY_NAME EQ 'United States';
ON TABLE NOTOTAL
ON TABLE PCHOLD FORMAT XML
END
```

Configure the Settings panel for the Esri map to use this request for a Point of Interest layer.

Running the HTML page generates the following map, with the Nova vector basemap as the base layer.



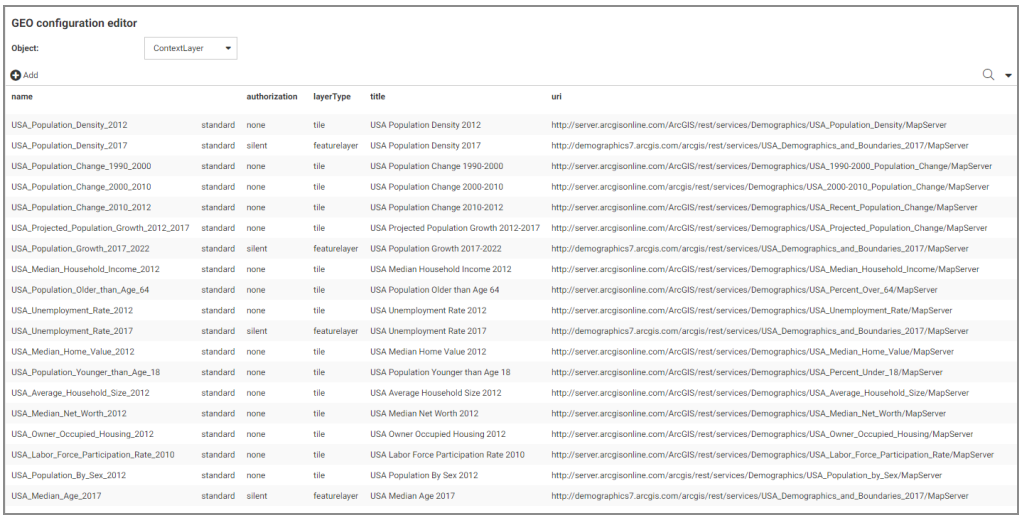
The Nova vector basemap is also available in the Change Basemap widget, as shown in the following image.



Customizing the List of Context Layers

To add a new context layer or customize an existing context layer, select **ContextLayer** from the Object drop-down list.

The following image shows the GEO configuration editor with the ContextLayer object selected.



GEO configuration editor

Object: ContextLayer

Add

name		authorization	layerType	title	uri
USA_Population_Density_2012	standard	none	tile	USA Population Density 2012	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Population_Density/MapServer
USA_Population_Density_2017	standard	silent	featurelayer	USA Population Density 2017	http://demographics7.arcgis.com/arcgis/rest/services/USA_Demographics_and_Boundaries_2017/MapServer
USA_Population_Change_1990_2000	standard	none	tile	USA Population Change 1990-2000	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_1990-2000_Population_Change/MapServer
USA_Population_Change_2000_2010	standard	none	tile	USA Population Change 2000-2010	http://server.arcgisonline.com/arcgis/rest/services/Demographics/USA_2000-2010_Population_Change/MapServer
USA_Population_Change_2010_2012	standard	none	tile	USA Population Change 2010-2012	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Recent_Population_Change/MapServer
USA_Projected_Population_Growth_2012_2017	standard	none	tile	USA Projected Population Growth 2012-2017	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Projected_Population_Change/MapServer
USA_Population_Growth_2017_2022	standard	silent	featurelayer	USA Population Growth 2017-2022	http://demographics7.arcgis.com/arcgis/rest/services/USA_Demographics_and_Boundaries_2017/MapServer
USA_Median_Household_Income_2012	standard	none	tile	USA Median Household Income 2012	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Median_Household_Income/MapServer
USA_Population_Older_than_Age_64	standard	none	tile	USA Population Older than Age 64	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Percent_Over_64/MapServer
USA_Unemployment_Rate_2012	standard	none	tile	USA Unemployment Rate 2012	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Unemployment_Rate/MapServer
USA_Unemployment_Rate_2017	standard	silent	featurelayer	USA Unemployment Rate 2017	http://demographics7.arcgis.com/arcgis/rest/services/USA_Demographics_and_Boundaries_2017/MapServer
USA_Median_Home_Value_2012	standard	none	tile	USA Median Home Value 2012	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Median_Home_Value/MapServer
USA_Population_Younger_than_Age_18	standard	none	tile	USA Population Younger than Age 18	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Percent_Under_18/MapServer
USA_Average_Household_Size_2012	standard	none	tile	USA Average Household Size 2012	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Average_Household_Size/MapServer
USA_Median_Net_Worth_2012	standard	none	tile	USA Median Net Worth 2012	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Median_Net_Worth/MapServer
USA_Owner_Occupied_Housing_2012	standard	none	tile	USA Owner Occupied Housing 2012	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Owner_Occupied_Housing/MapServer
USA_Labor_Force_Participation_Rate_2010	standard	none	tile	USA Labor Force Participation Rate 2010	http://server.arcgisonline.com/ArcGIS/rest/services/Demographics/USA_Labor_Force_Participation_Rate/MapServer
USA_Population_By_Sex_2012	standard	none	tile	USA Population By Sex 2012	http://server.arcgisonline.com/arcgis/rest/services/Demographics/USA_Population_by_Sex/MapServer
USA_Median_Age_2017	standard	silent	featurelayer	USA Median Age 2017	http://demographics7.arcgis.com/arcgis/rest/services/USA_Demographics_and_Boundaries_2017/MapServer

Configuring Context Layer Properties

Following is a description of the properties used for context layer configuration.

name

Is the name of the context layer.

Next to the name is an indicator of whether the context layer is a standard context layer or a customized context layer.

authorization

Is the type of authentication needed to access this context layer. Valid values are:

- **silent.** Credentials for your ArcGIS application are provided in the connection string of the Adapter for Esri ArcGIS.

  > **Note:** For instructions for configuring the Adapter for Esri ArcGIS, see the *ibi™ WebFOCUS® Adapter Administration* manual.

- **none.** No authorization is needed.
- **named.** User credentials are provided in the connection string of the Adapter for Esri.
- **on premises.** User credentials for a locally hosted ArcGIS server are provided in the connection string of the Adapter for Esri.

layer type

Is the type of context layer. For a cached layer, the layer type is tile. For a layer that is rendered dynamically, the layer type is featurelayer.

title

Is a title to display on the demographic layer drop-down list in the WebFOCUS tools.

addon_json

Specifies additional JSON properties that can be used to control the rendering of the context layer. For example, smartMapping properties define the border styles within the context layer.

You no longer need to supply the addon_json property when configuring a layer. Instead, in the URI property, you can reference a layer by service URL, or by portal ID.

Depending on the type of context layer, the addon_json properties may resemble the following:

```
"layerObjectType" : "esri/layers/ArcGISDynamicMapServiceLayer",
    "smartMapping": { "webMapInfo": {
        "queryString" : "id:id",
        "itemDataUrl" : "url",
        "layerTypeEx" : "layerType"
}}
```

where:

esri/layers/ArcGISDynamicMapServiceLayer

Identifies the context layer as a dynamic map service.

id

Is the ID of the context layer on Esri ArcGIS. This can be found in the URL for the layer on the Esri ArcGIS site, or as the value of the "serviceItemId" property in the JSON properties accessible from the service URL of the layer.

If there is no layer ID, then this property can be omitted.

url

Is the map service URL for the layer. This should match the value that you provide for the uri field.

layerType

Specifies the type of context layer. It can be one of the following values:

- **group.** Identifies the context layer as a group layer composed of multiple feature layers. For more information, see https://developers.arcgis.com/javascript/latest/api-reference/esri-layers-GroupLayer.html.
- **map-image.** Identifies the context layer as a map image layer, which can contain multiple sub-layers rendered as images rather than features. For more information, see https://developers.arcgis.com/javascript/latest/api-reference/esri-layers-MapImageLayer.html.
- **feature.** Identifies the context layer as a feature layer, which is a single layer created from a map service or feature service. For more information, see https://developers.arcgis.com/javascript/latest/api-reference/esri-layers-FeatureLayer.html.
- **imagery-tile.** Identifies the context layer as an imagery tile layer, created from a tiled image service. For more information see https://developers.arcgis.com/javascript/latest/api-reference/esri-layers-ImageryTileLayer.html.
- **imagery.** Identifies the context layer as an imagery layer, created from an image service. For more information, see https://developers.arcgis.com/javascript/latest/api-reference/esri-layers-ImageryLayer.html.
- **elevation.** Identifies the context layer as an elevation layer used in a 3D SceneView. For more information, see https://developers.arcgis.com/javascript/latest/api-reference/esri-layers-ElevationLayer.html.
- **streaming.** Identifies the context layer as a streaming layer. For more information, see https://developers.arcgis.com/javascript/latest/api-

reference/esri-layers-StreamLayer.html

- **tile.** Identifies the context layer as a tile layer, created from a cached map service. For more information, see https://developers.arcgis.com/javascript/latest/api-reference/esri-layers-TileLayer.html.
- **web-map.** Identifies a complete, two-dimensional WebMap. For more information, see https://developers.arcgis.com/javascript/latest/api-reference/esri-WebMap.html.
- **web-scene.** Identifies a complete, 3D web scene. For more information, see https://developers.arcgis.com/javascript/latest/api-reference/esri-WebScene.html.

For example, the add-on JSON for a map image layer may resemble the following:

```
"layerObjectType" : "esri/layers/ArcGISTiledMapServiceLayer",
"smartMapping": { "webMapInfo": {
    "queryString" : "id:1234567890abcdefghij1234567890ab",
    "itemDataUrl" :

"https://services5.arcgis.com/1234567890abcdef/arcgis/rest/services/L
ayer_Name/FeatureServer",
    "layerTypeEx" : "map-image"
    }
}
```

uri

Is the URL to the map service that provides the context layer.

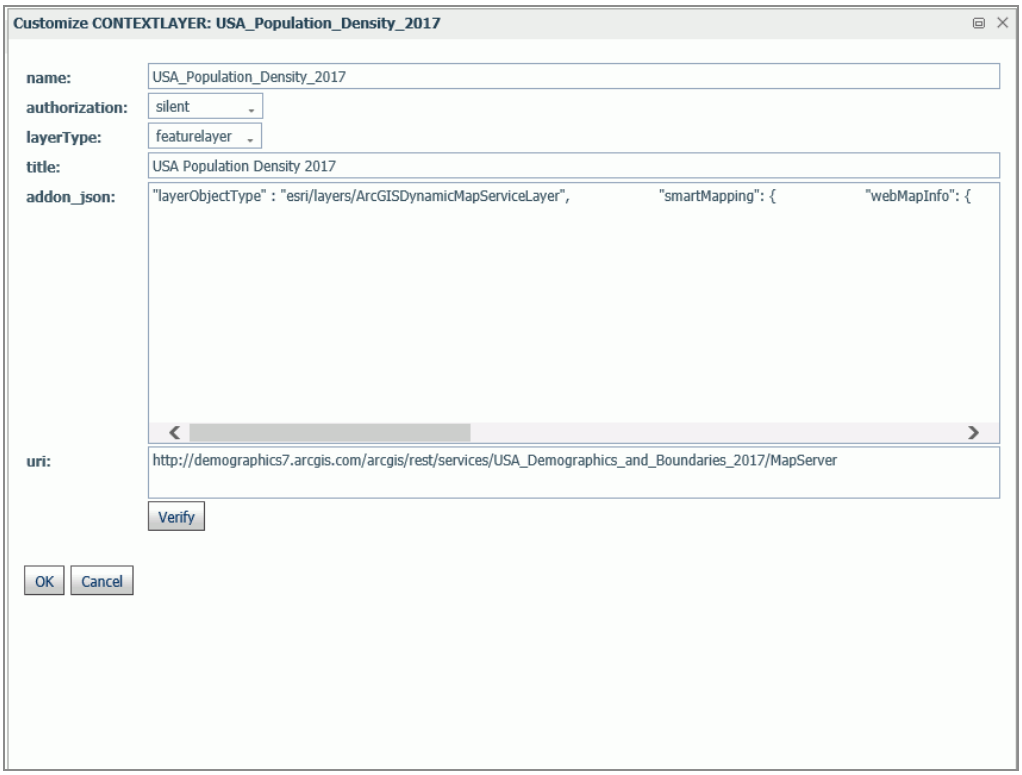
The uri field should contain one of the following:

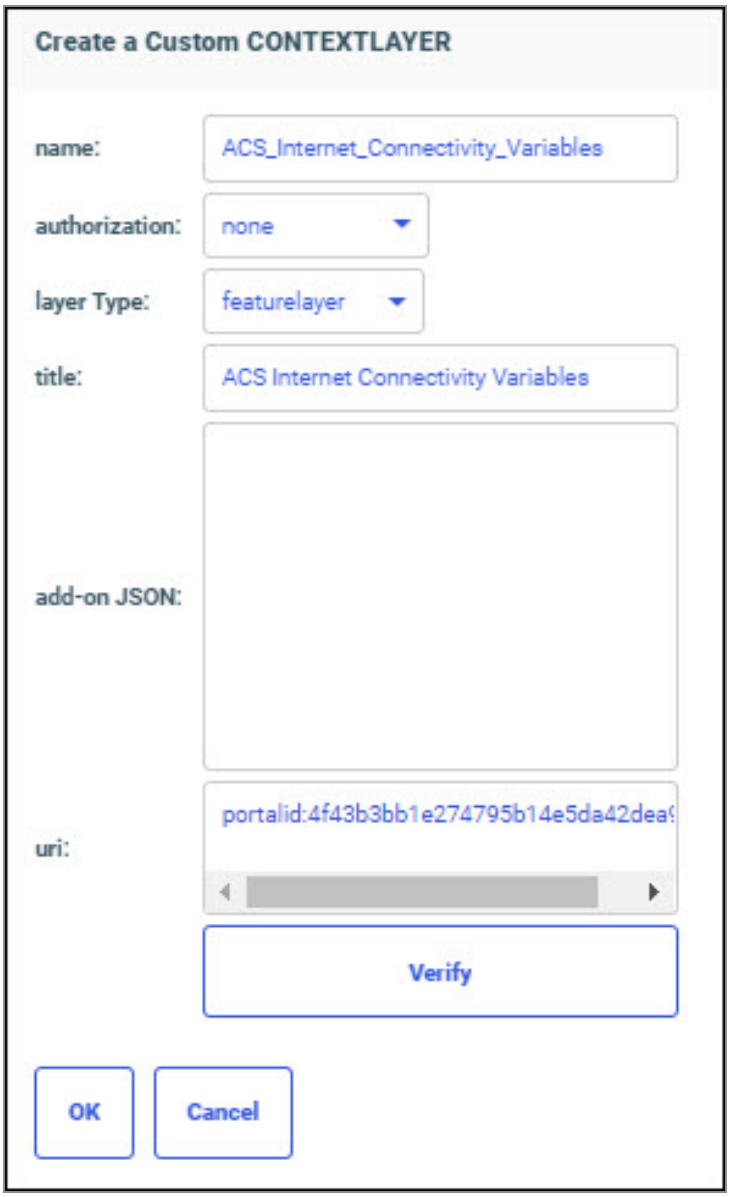
- The service URL for the layer
- If the layer does not require authentication, the portal ID for the layer, prefixed by portalid:. For example, portalid:abc123efg567
- If the layer does require authentication, either silent or named, the portal ID for the layer, prefixed by portalid: followed by the base URL for the layer, prefixed by urlprefix:, separated by a semicolon. For example, portalid:abc123efg456;urlprefix:https://host.arcgis.com

Customizing the Properties of an Existing Context Layer

To customize the properties of an existing context layer, click the down arrow next to a context layer name or right-click the context layer line and click **Customize context layer**.

The Create a Custom CONTEXTLAYER dialog box opens. The completed dialog box may resemble the one shown in the following image.





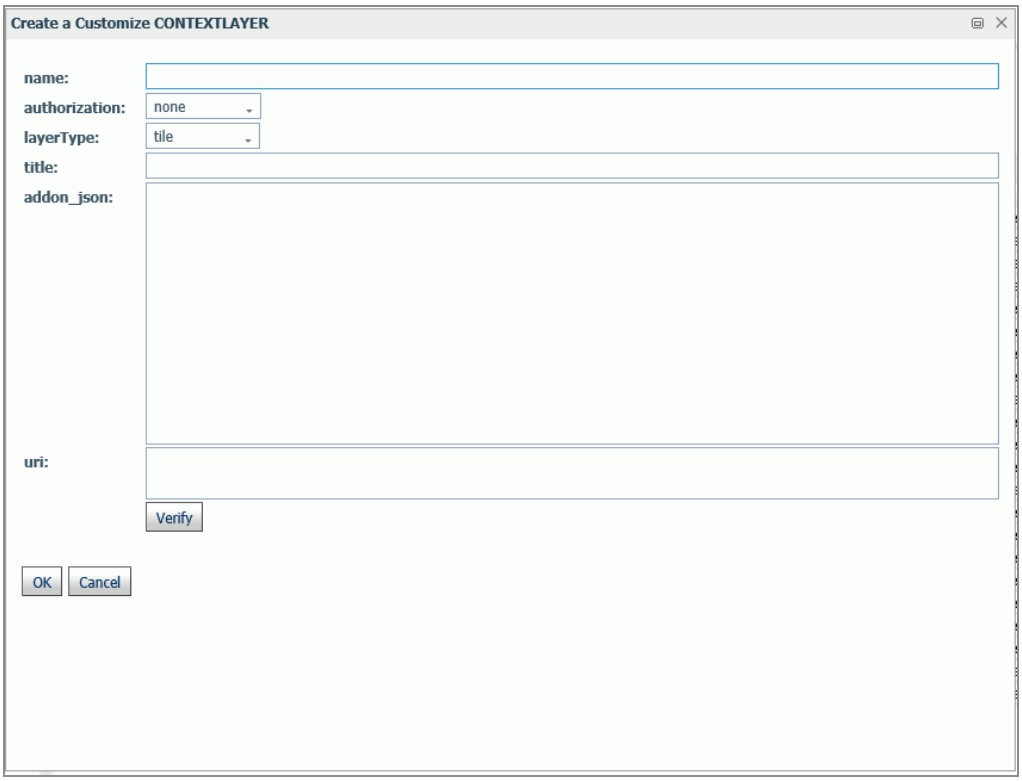
Edit the properties you want to change. If you change the URI, you can click **Verify** to make sure the map service is valid and accessible.

When you are finished, click **OK**, then click **Save** on the GEO configuration editor Context Layers page.

Adding a New Context Layer

To add a new context layer to the configuration, click **Add**.

The **Create a Customized CONTEXTLAYER** dialog box opens, as shown in the following image.



Enter a name for the context layer, the authorization type, a layer type, a title to display, any additional JSON needed for rendering the context layer, and the URI to the map service that provides the context layer, and click **Verify**.

When you have configured the properties, click **OK**, then click **Save** on the GEO configuration editor Context Layer page.

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