

# Table of Contents

Style Recipes .....	1
Creating Basic Styles .....	1
Creating Strokes .....	4
Creating Fills .....	7
Creating Shapes .....	11
Creating Icons .....	13
Creating Labels .....	14
Creating Transforms .....	19
Creating Gradients .....	21
Creating Unique Values .....	23
Creating Color Maps .....	25
Creating Channel Selection and Contrast Enhancement .....	27
Reading and Writing Styles .....	29

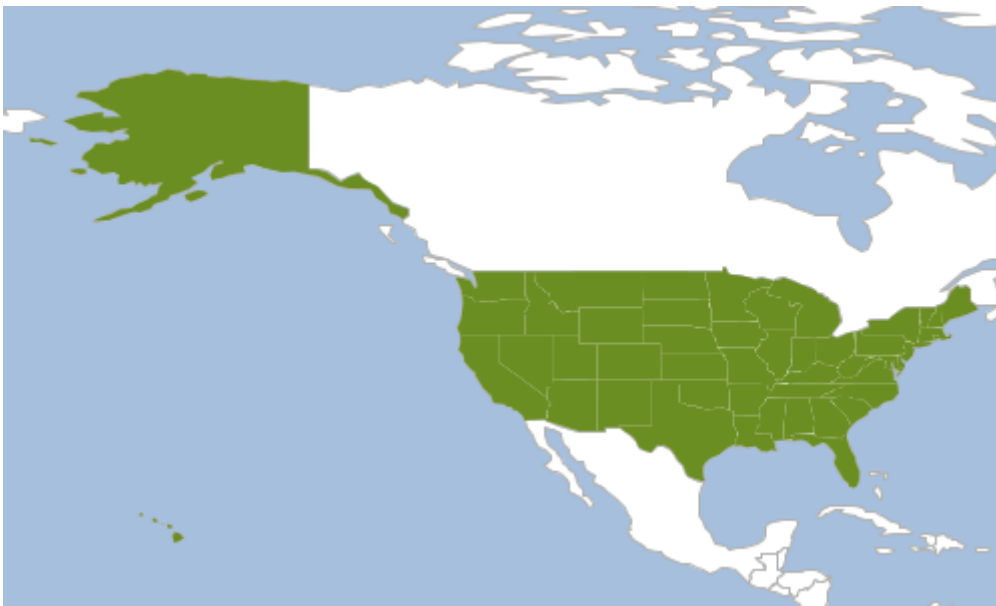
# Style Recipes

Styles are found in the [geoscript.style](#) package.

Styles are made up of Symbolizers and Composites. A Symbolizer is a particular style like Stroke or Fill. Symbolizers also have methods for controlling the drawing order (zindex), the min and max scale (range), and filtering (where).

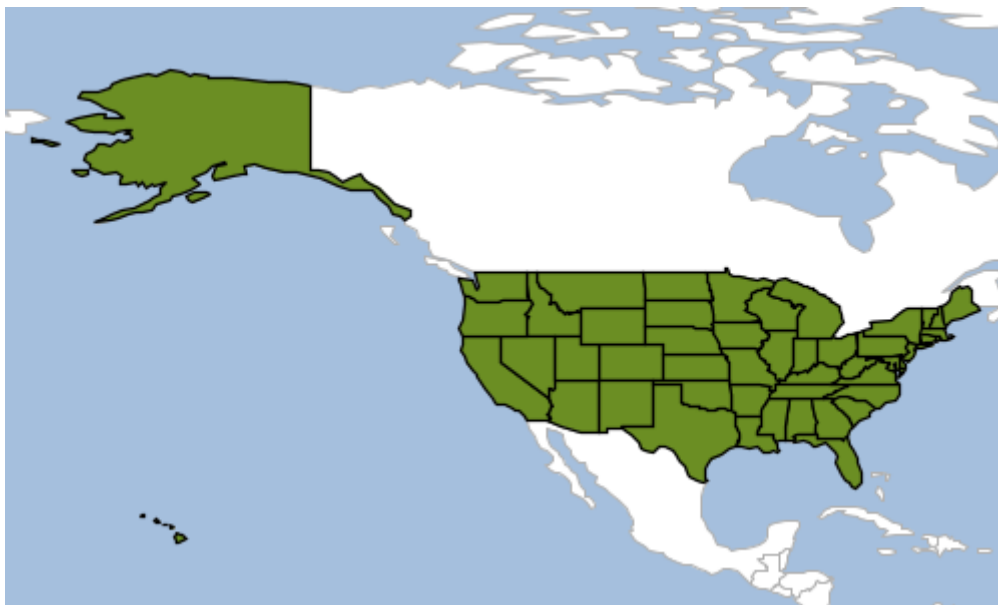
## Creating Basic Styles

```
Fill fill = new Fill("#6B8E23")
```



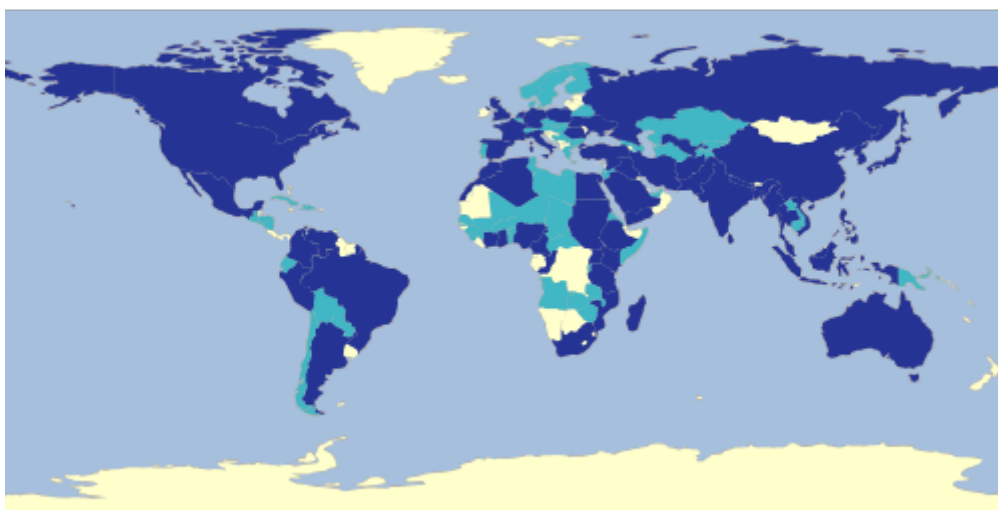
A Composite is simply two or more Symbolizers. So, a Composite would be a combination of a Stroke symbolizer (to style the boundary) and a Fill Symbolizer (to style the interior).

```
Composite composite = new Fill("#6B8E23") + new Stroke("black", 0.75)
```



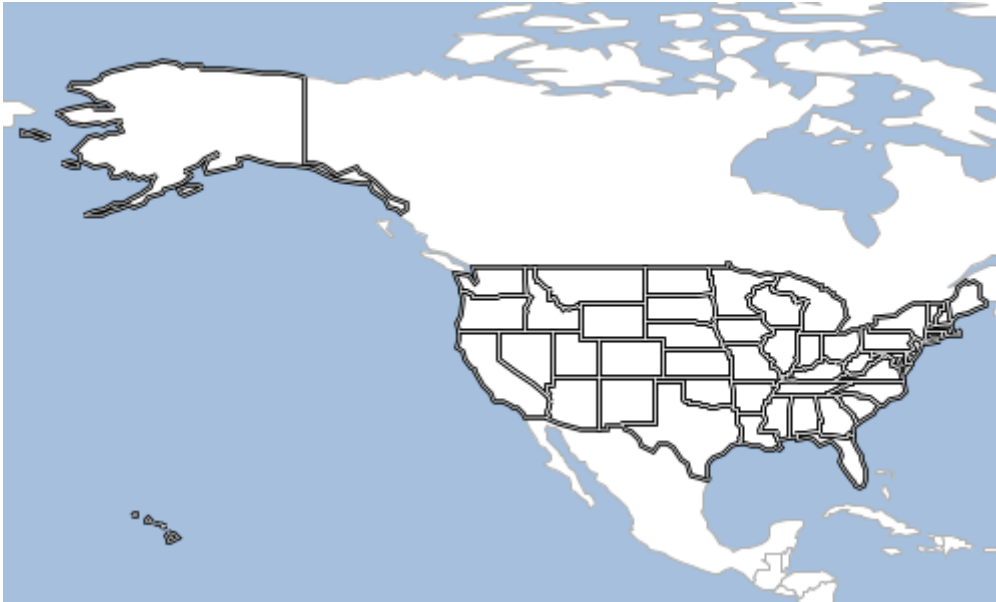
*A Symbolizer can use the where method to restrict which features are styled.*

```
Symbolizer symbolizer = new Fill("#ffffcc").where("PEOPLE < 4504128.33") +
    new Fill("#41b6c4").where("PEOPLE BETWEEN 4504128.33 AND 16639804.33") +
    new Fill("#253494").where("PEOPLE > 16639804.33")
```



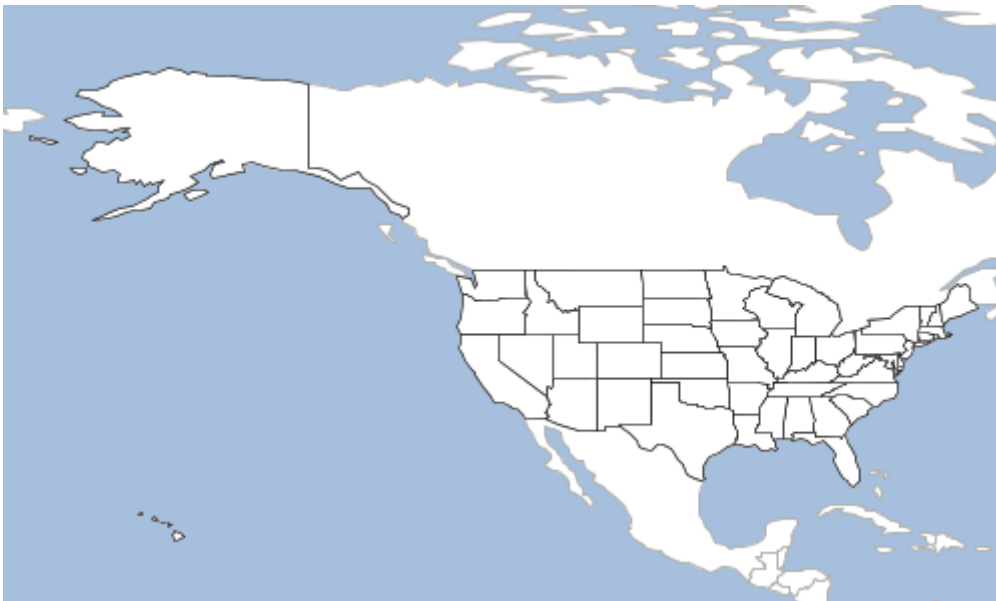
*The zIndex method is used to order Symbolizers on top of each other. In this recipe we use it to create line casings.*

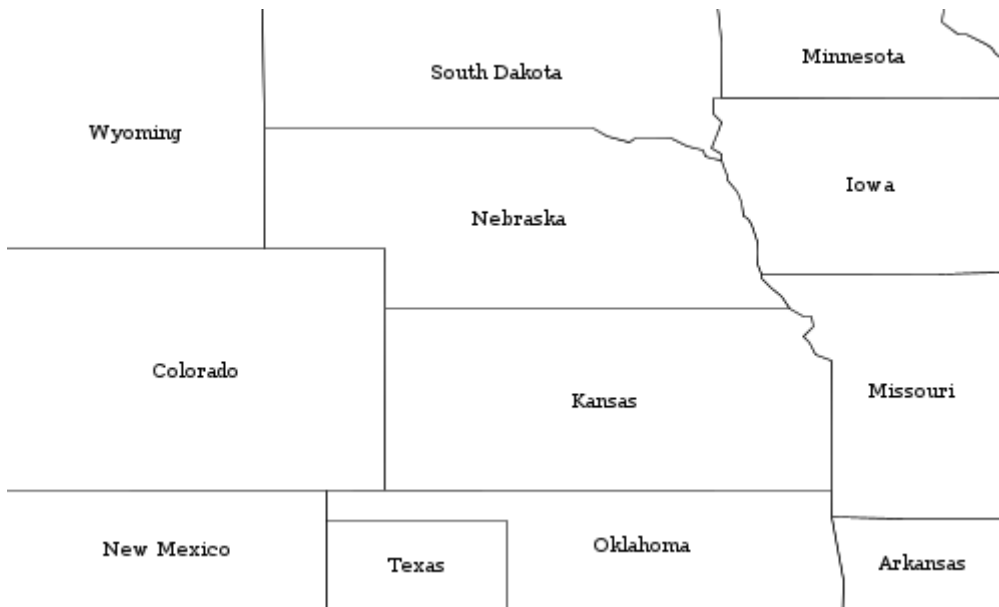
```
Symbolizer symbolizer = new Stroke("black", 2.0).zindex(0) + new Stroke("white", 0.1)
    .zindex(1)
```



*The scale method is used to create Symbolizers that are dependent on map scale.*

```
Symbolizer symbolizer = (new Fill("white") + new Stroke("black", 0.1)) + new Label  
("NAME_1")  
    .point(anchor: [0.5,0.5])  
    .polygonAlign("mbr")  
    .range(max: 16000000)
```





## Creating Strokes

*Create a Stroke Symbolizer with a Color*

```
Stroke stroke = new Stroke("#1E90FF")
```



*Create a Stroke Symbolizer with a Color and Width*

```
Stroke stroke = new Stroke("#1E90FF", 0.5)
```



*Create a Stroke Symbolizer with casing*

```
Symbolizer stroke = new Stroke(color: "#333333", width: 5, cap: "round").zindex(0) +  
    new Stroke(color: "#6699FF", width: 3, cap: "round").zindex(1)
```



*Create a Stroke Symbolizer with Dashes*

```
Stroke stroke = new Stroke("#1E90FF", 0.75, [5,5], "round", "bevel")
```



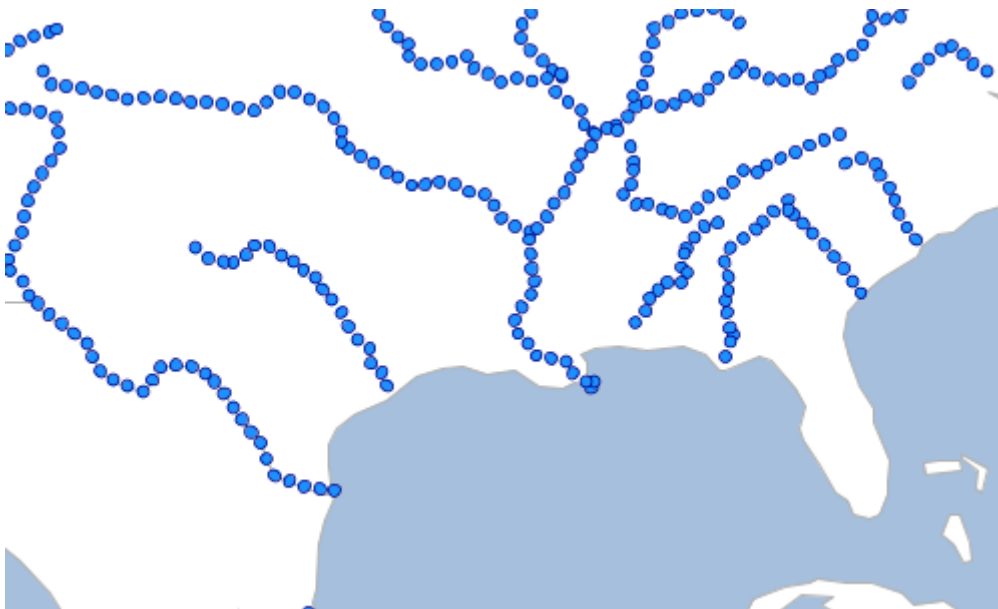
*Create a Stroke Symbolizer with railroad Hatching*

```
Symbolizer stroke = new Stroke("#1E90FF", 1) + new Hatch("vertline", new Stroke(
"#1E90FF", 0.5), 6).zindex(1)
```



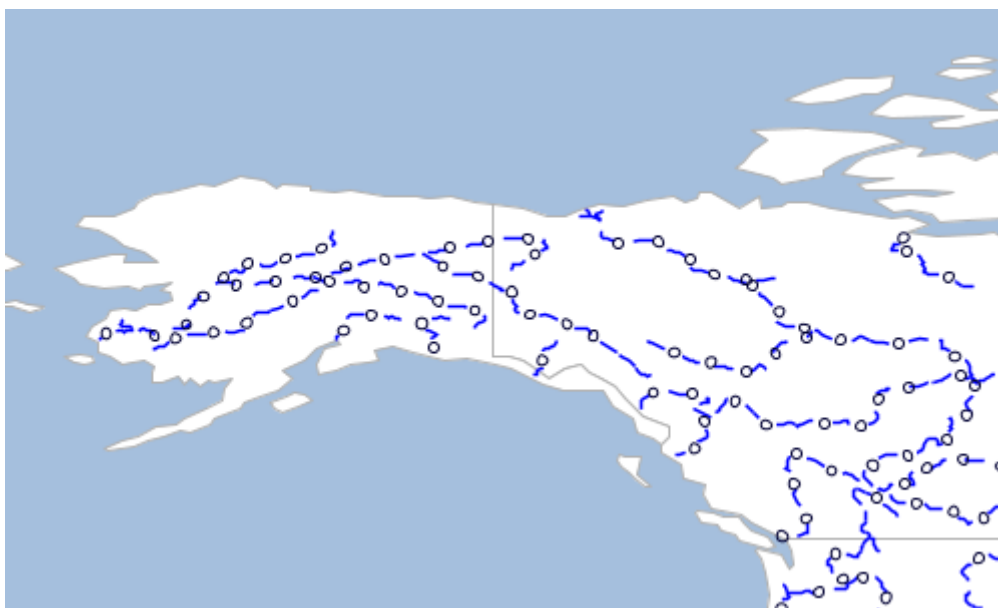
*Create a Stroke Symbolizer with spaced Shape symbols*

```
Symbolizer stroke = new Stroke(width: 0, dash: [4, 4]).shape(new Shape("#1E90FF", 6,
"circle").stroke("navy", 0.75))
```



Create a Stroke Symbolizer with alternating spaced Shape symbols

```
Symbolizer stroke = new Stroke("#0000FF", 1, [10,10]).zindex(0) + new Stroke(null, 0,
[[5,15],7.5])
    .shape(new Shape(null, 5, "circle").stroke("#000033",1)).zindex(1)
```

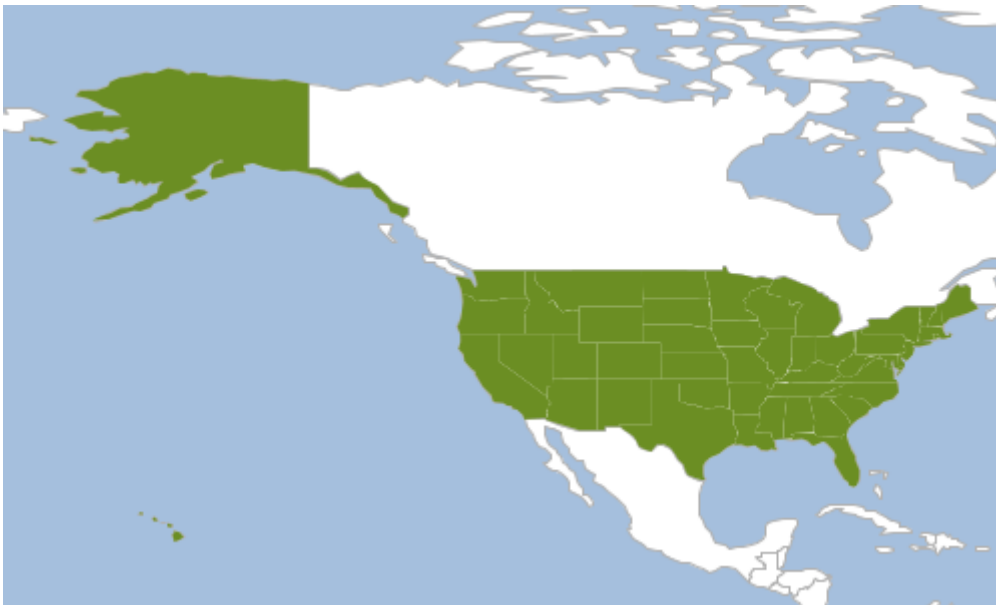


## Creating Fills

Create a Fill Symbolizer with a Color

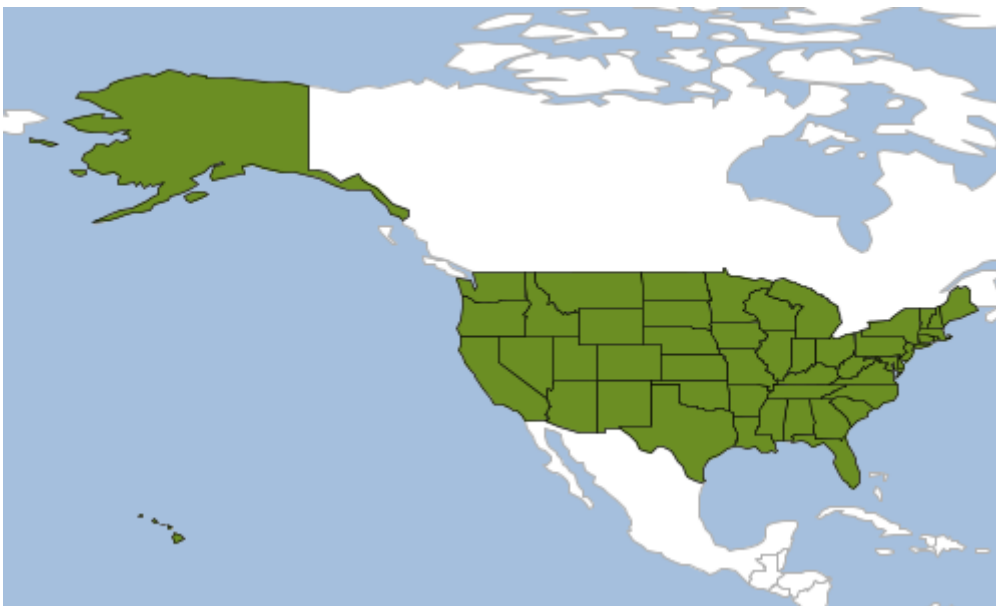
```
Fill fill = new Fill("#6B8E23")
```





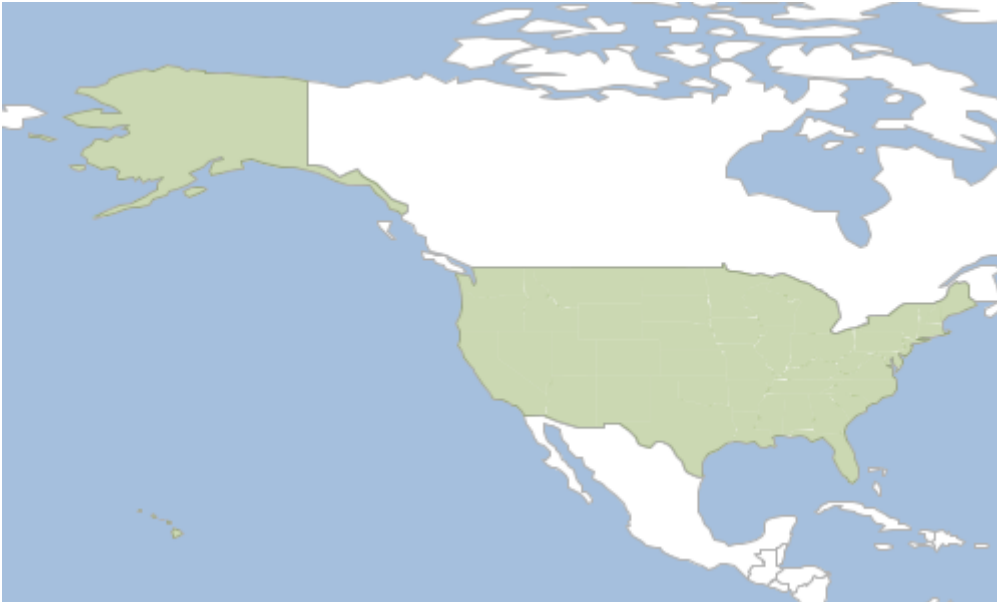
*Create a Fill Symbolizer with a Color and a Stroke*

```
Symbolizer symbolizer = new Fill("#6B8E23") + new Stroke("black", 0.1)
```



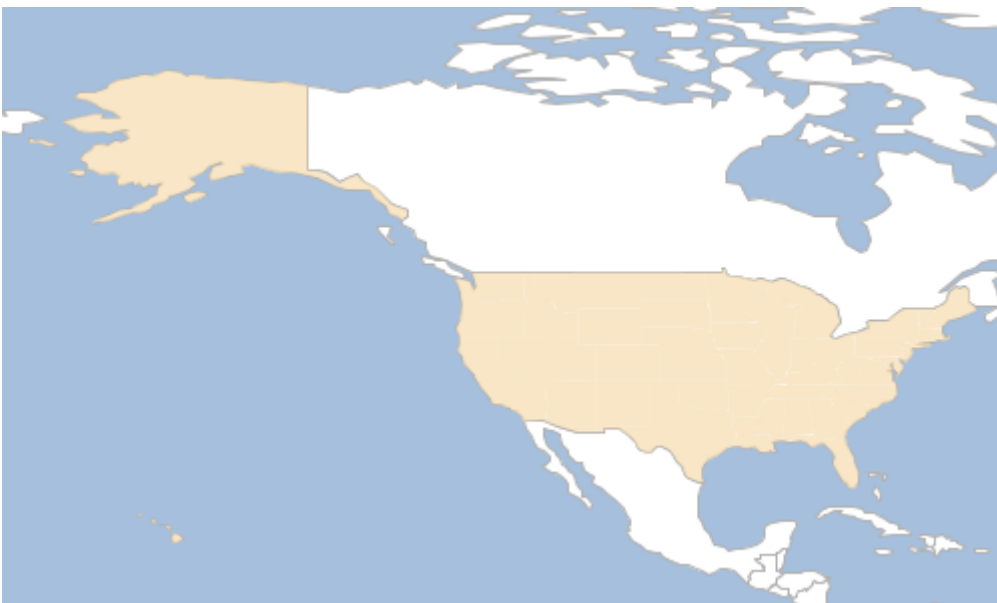
*Create a Fill Symbolizer with a Color and Opacity*

```
Fill fill = new Fill("#6B8E23", 0.35)
```



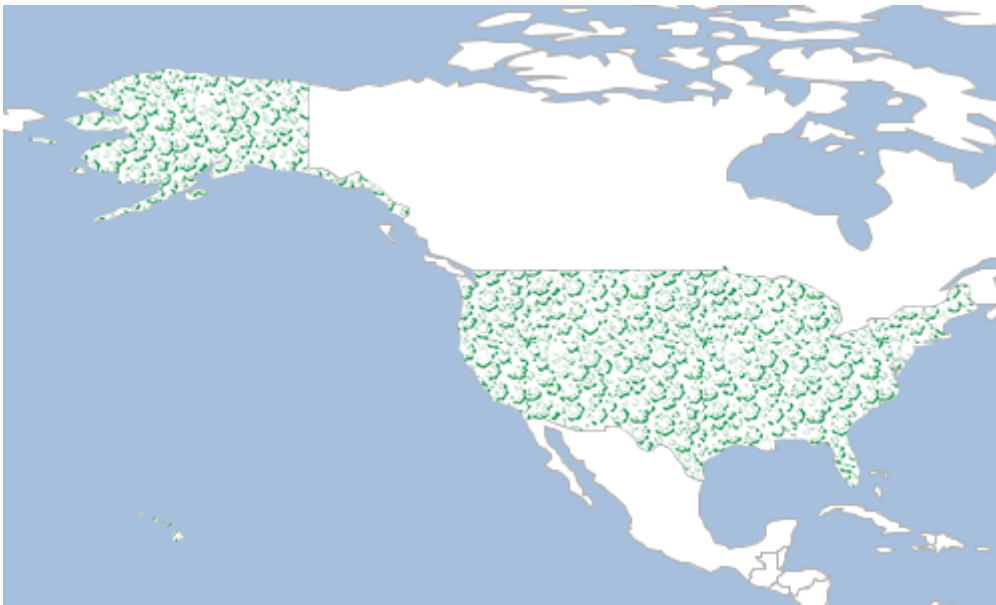
*Create a Fill Symbolizer from named parameters*

```
Fill fill = new Fill(color: "wheat", opacity: 0.75)
```



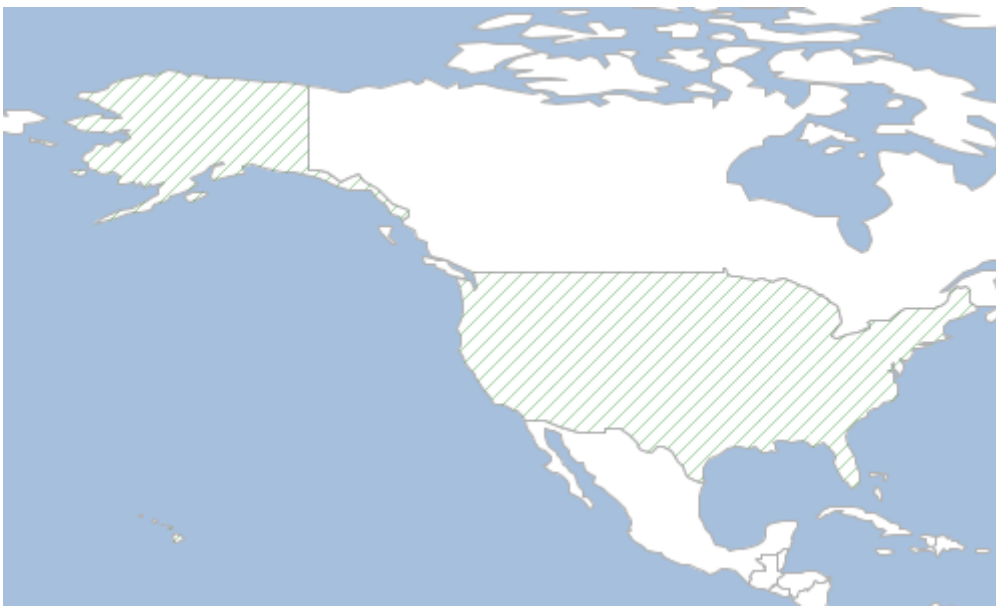
*Create a Fill Symbolizer with an Icon*

```
Fill fill = new Fill("green").icon('src/main/resources/trees.png', 'image/png')
```



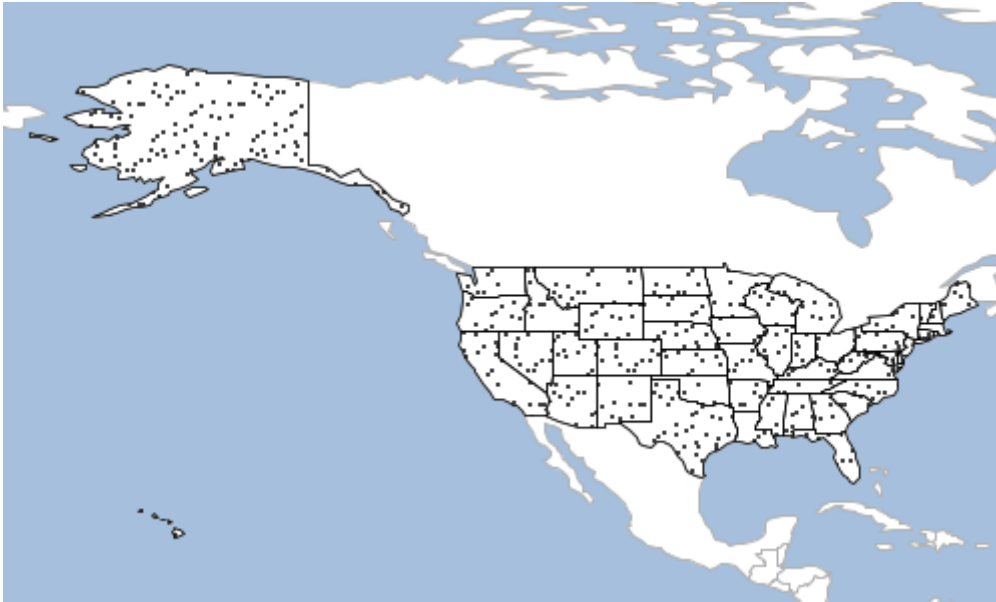
*Create a Fill Symbolizer with a Hatch*

```
Fill fill = new Fill("green").hatch("slash", new Stroke("green", 0.25), 8)
```



*Create a Fill Symbolizer with a random fill*

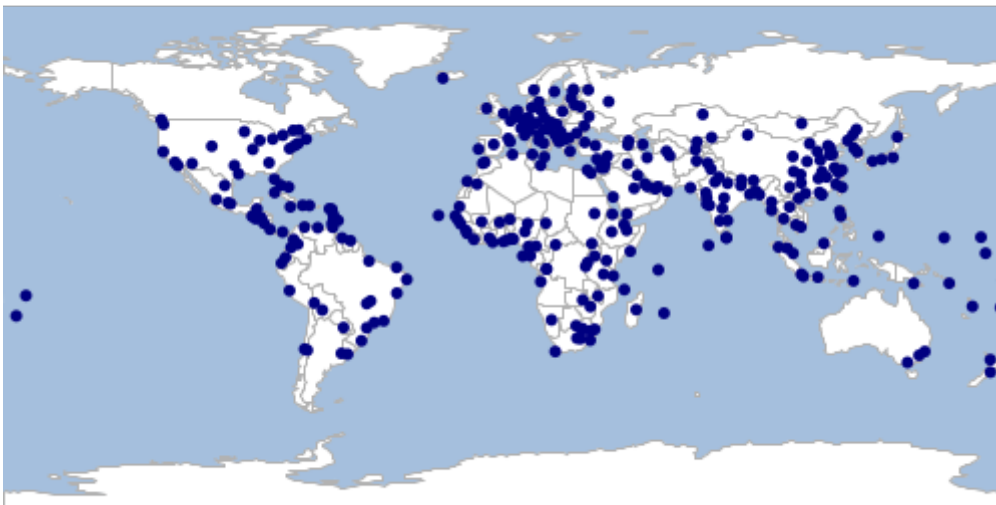
```
Symbolizer symbolizer = new Fill("white").hatch("circle", new Fill("black"), 2).
random(
    random: "free",
    seed: 0,
    symbolCount: 50,
    tileSize: 50,
    rotation: "none"
) + new Stroke("black", 0.25)
```



## Creating Shapes

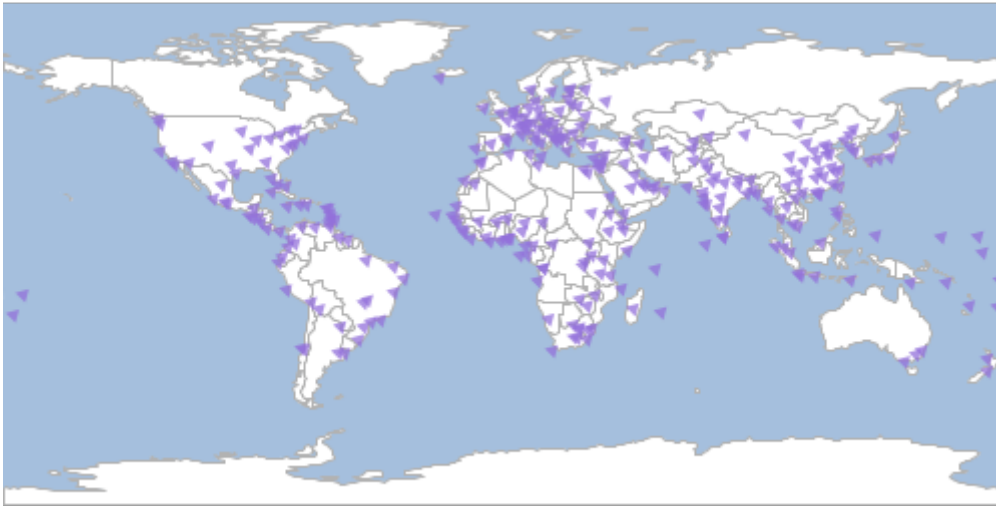
*Create a Shape Symbolizer with a Color*

```
Shape shape = new Shape("navy")
```



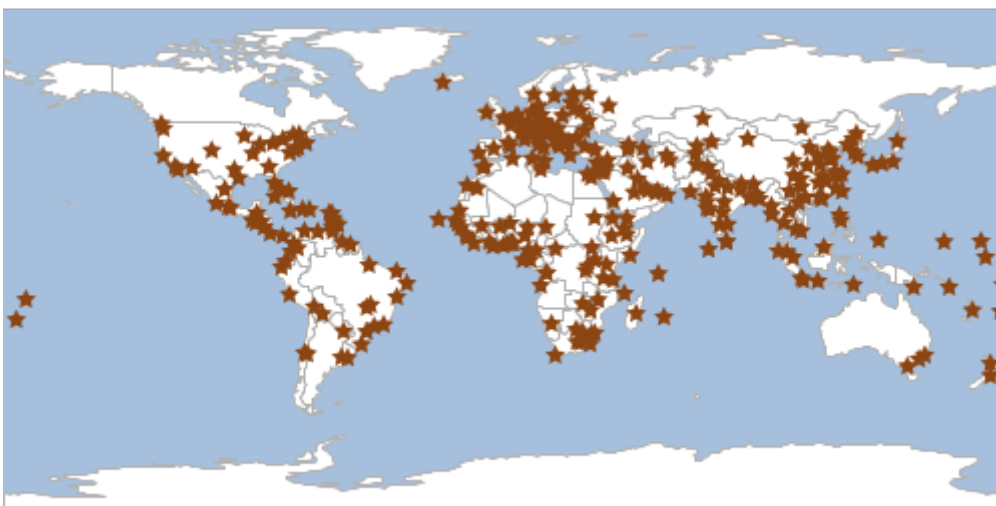
*Create a Shape Symbolizer with a color, size, type, opacity and angle*

```
Shape shape = new Shape("#9370DB", 8, "triangle", 0.75, 45)
```



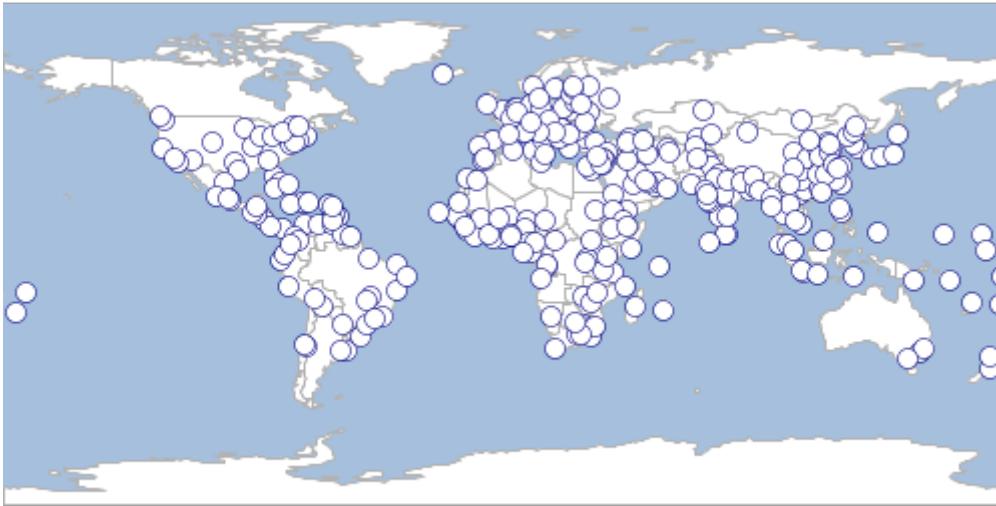
*Create a Shape Symbolizer with named parameters*

```
Shape shape = new Shape(color: "#8B4513", size: 10, type: "star", opacity: 1.0,  
rotation: 0)
```



*Create a Shape Symbolizer with Stroke outline*

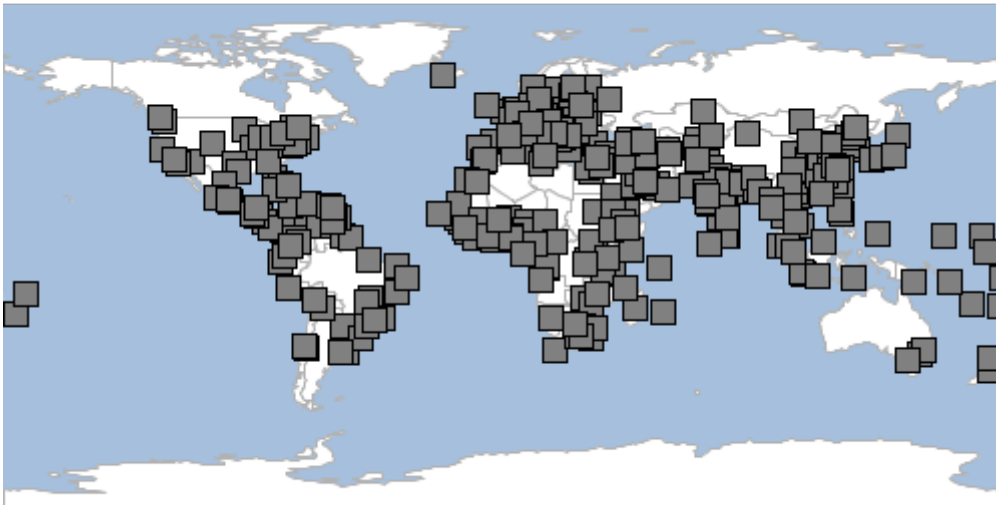
```
Symbolizer symbolizer = new Shape("white", 10).stroke("navy", 0.5)
```



## Creating Icons

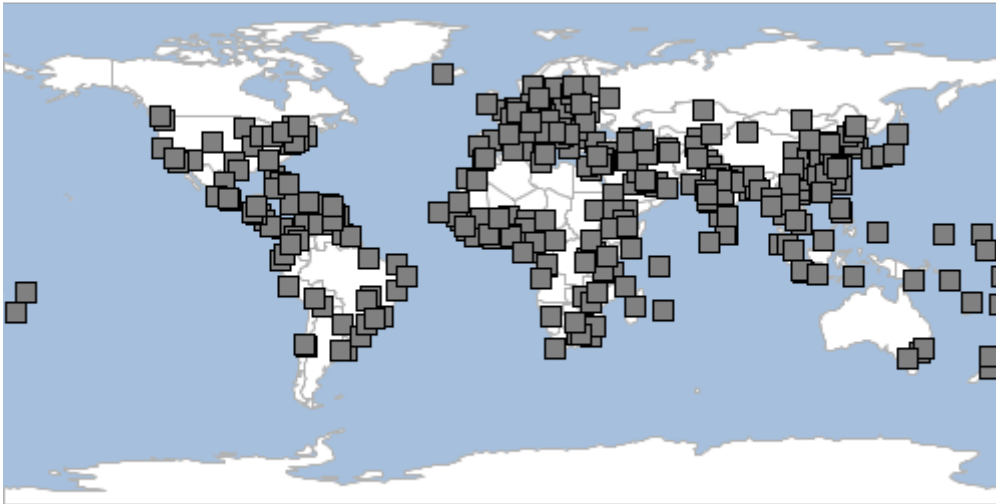
*Create an Icon Symbolizer*

```
Symbolizer symbolizer = new Icon("src/main/resources/place.png", "image/png", 12)
```



*Create an Icon Symbolizer*

```
Symbolizer symbolizer = new Icon(url: "src/main/resources/place.png", format:  
"image/png", size: 10)
```

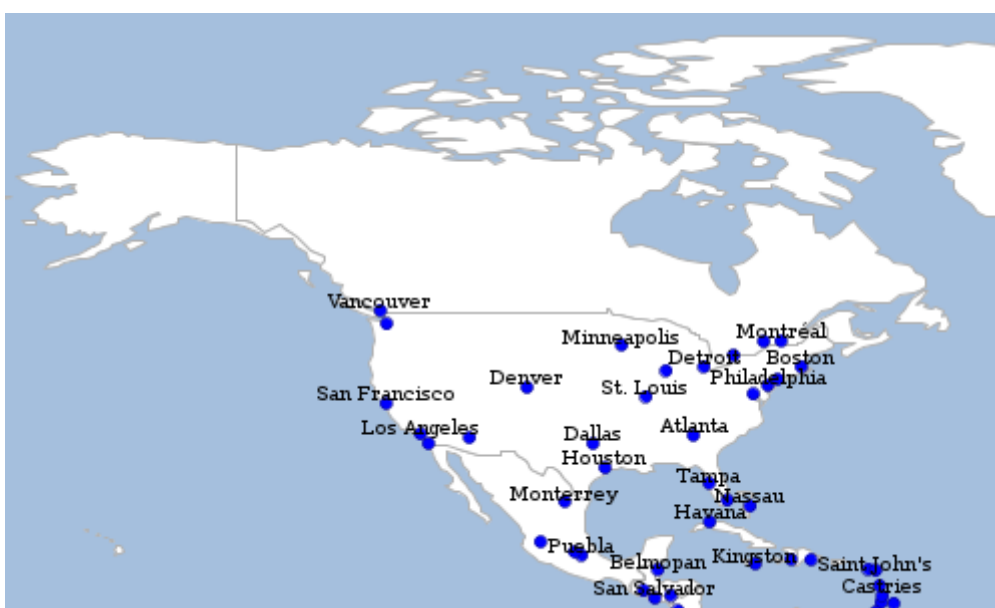


## Creating Labels

Create a Label for a Point Layer

```
Symbolizer symbolizer = new Shape("blue", 6).stroke("navy", 0.5) + new Label("NAME"
).point(
    [0.5, 0.5], ①
    [0, 5.0], ②
    0 ③
)
```

- ① anchor
- ② displacement
- ③ rotation



### Create a Label for a Point Layer with a Font

```
Symbolizer symbolizer = new Shape("blue", 6).stroke("navy", 0.5) + new Label("NAME")
).point(
    [0.5,0.5],
    [0, 5.0],
    0
) + new Font(
    "normal",    ①
    "bold",      ②
    12,          ③
    "Arial"      ④
)
```

- ① style (normal, italic, oblique)
- ② weight (normal, bold)
- ③ size (8,12,16,ect..)
- ④ family (serif, arial, verdana)



### Create a Label for a Point Layer with Halo

```
Symbolizer symbolizer = new Shape("blue", 6).stroke("navy", 0.5) + new Label("NAME")
).point(
    [0.5,0.5],
    [0, 5.0],
    0
).fill(new Fill("white")) + new Halo(new Fill("navy"), 2.5)
```





*Create a Label for a Polygon Layer*

```
Symbolizer symbolizer = new Fill("white") + new Stroke("black", 0.1) + new Label
("NAME_1")
    .point(anchor: [0.5,0.5])
    .polygonAlign("mbr")
```



*Create a Label for a Polygon Layer using an Expression*

```
Symbolizer symbolizer = new Fill("white") + new Stroke("black", 0.1) + new Label
(Expression.fromCQL("strToLowerCase(NAME_1)"))
    .point(anchor: [0.5,0.5])
    .polygonAlign("mbr")
```



Create a Label for a Polygon Layer using an Expression that concatenates properties and strings.

```
Expression expression = Expression.fromCQL("Concatenate(z, '/', x, '/', y)")
Symbolizer symbolizer = new Stroke("black", 1.0) + new Label(expression)
```



Create a Label for a Polygon Layer with strike through style.

```
Symbolizer symbolizer = new Fill("white") + new Stroke("black", 0.1) + new Label(
  "NAME_1")
  .point(anchor: [0.5,0.5])
  .polygonAlign("mbr")
  .strikethrough(true)
```



Create a Label for a Polygon Layer with word and character spacing.

```
Symbolizer symbolizer = new Fill("white") + new Stroke("black", 0.1) + new Label
("NAME_1")
    .point(anchor: [0.5,0.5])
    .polygonAlign("mbr")
    .wordSpacing(8)
    .characterSpacing(5)
```



Create a Label for a Polygon Layer with underlining.

```
Symbolizer symbolizer = new Fill("white") + new Stroke("black", 0.1) + new Label
("NAME_1")
    .point(anchor: [0.5,0.5])
    .polygonAlign("mbr")
    .underline(true)
```



Create a Label for a Line Layer

```
Symbolizer symbolizer = new Stroke("blue", 0.75) + new Label("name")
    .fill(new Fill("navy"))
    .linear(follow: true, offset: 50, displacement: 200, repeat: 150)
    .maxDisplacement(400).maxAngleDelta(90)
    .halo(new Fill("white"), 2.5)
    .font(new Font(size: 10, weight: "bold"))
```



## Creating Transforms

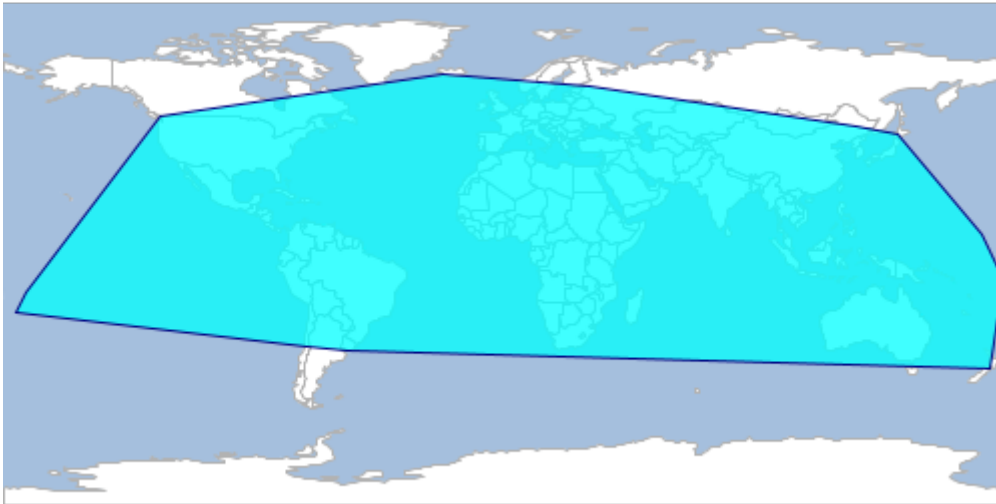
Create a normal Transform symbolizer that styles a polygon as a point by calculating it's centroid

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
Symbolizer symbolizer = new Transform("centroid(the_geom)") +
    new Shape(color: "red", size: 10, type: "star")
countries.style = symbolizer
```



Create a rendering Transform symbolizer that styles a point layer by calculating the convex hull

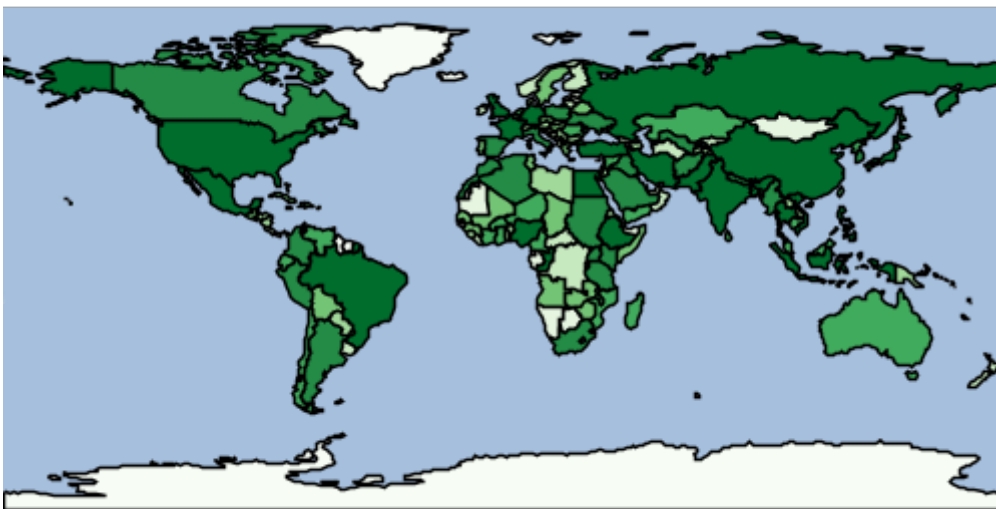
```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer places = workspace.get("places")
Process process = new Process("convexhull",
    "Create a convexhull around the features",
    [features: geoscript.layer.Cursor],
    [result: geoscript.layer.Cursor],
    { inputs ->
        def geoms = new GeometryCollection(inputs.features.collect{ f -> f.geom})
        def output = new Layer()
        output.add([geoms.convexHull])
        [result: output]
    }
)
Function function = new Function(process, new Function("parameter", new Expression
("features")))
Symbolizer symbolizer = new Transform(function, Transform.RENDERING) + new Fill
("aqua", 0.75) + new Stroke("navy", 0.5)
places.style = symbolizer
```



## Creating Gradients

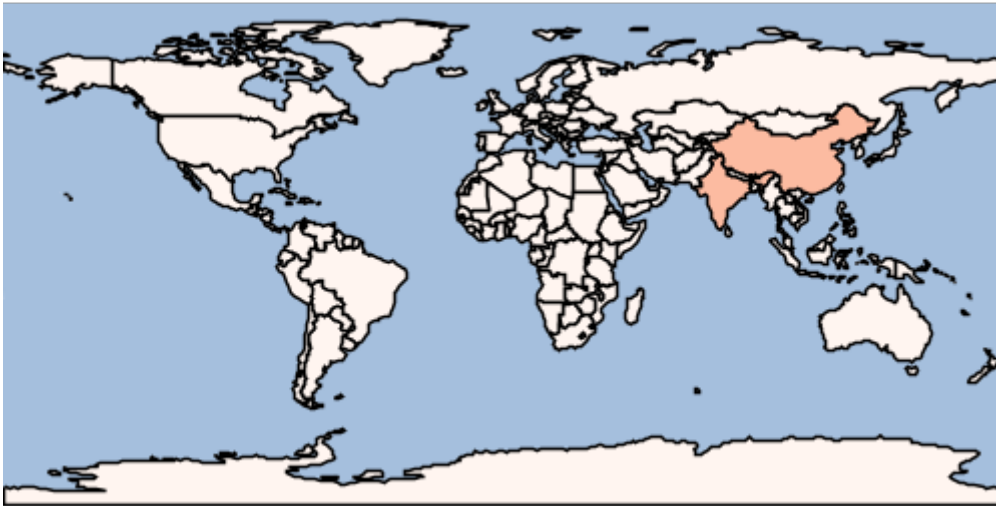
*Create a Gradient Symbolizer from a Layer's Field using quantile method*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
Gradient gradient = new Gradient(countries, "PEOPLE", "quantile", 8, "Greens")
countries.style = gradient
```



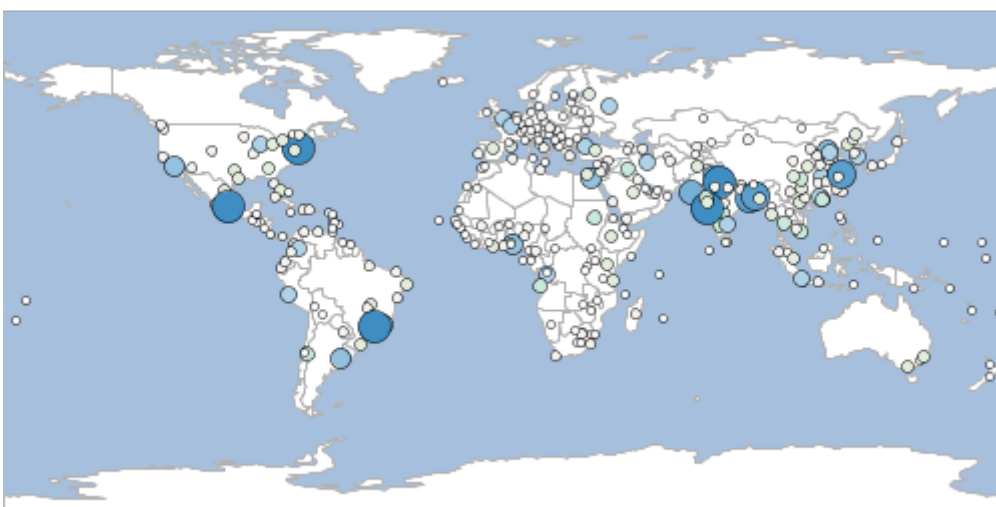
*Create a Gradient Symbolizer from a Layer's Field using equal interval method*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
Gradient gradient = new Gradient(countries, "PEOPLE", "equalinterval", 3, "Reds")
countries.style = gradient
```



Create a custom Gradient Symbolizer between Symbolizers and values

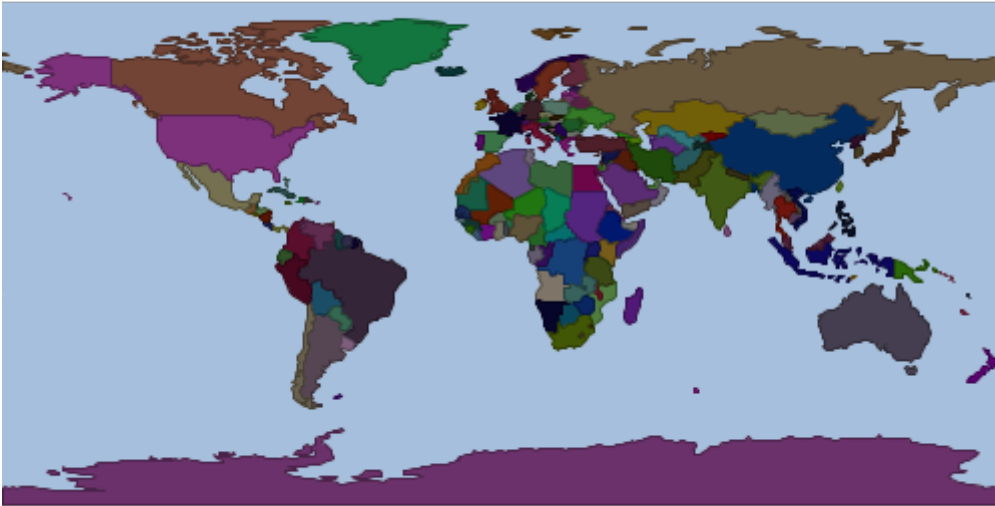
```
Gradient gradient = new Gradient(
  new Property("POP2020"),
  [0, 10000, 20000, 30000],
  [
    new Shape("white", 4).stroke("black", 0.5),
    new Shape("#b0d2e8", 8).stroke("black", 0.5),
    new Shape("#3e8ec4", 16).stroke("black", 0.5),
    new Shape("#08306b", 24).stroke("black", 0.5)
  ],
  5,
  "linear"
)
```



# Creating Unique Values

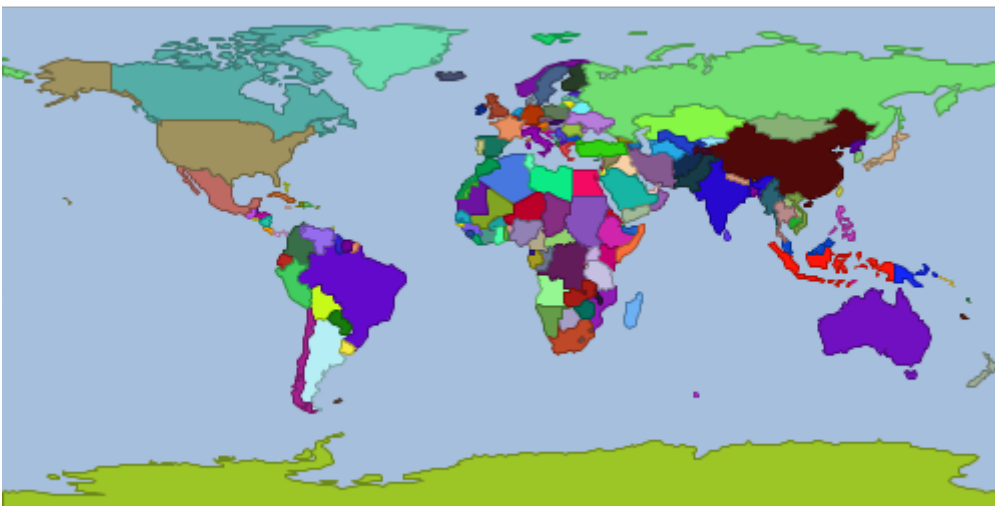
*Create a Unique Values Symbolizer from a Layer's Field*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
UniqueValues uniqueValues = new UniqueValues(countries, "NAME")
countries.style = uniqueValues
```



*Create a Unique Values Symbolizer from a Layer's Field and a Closure*

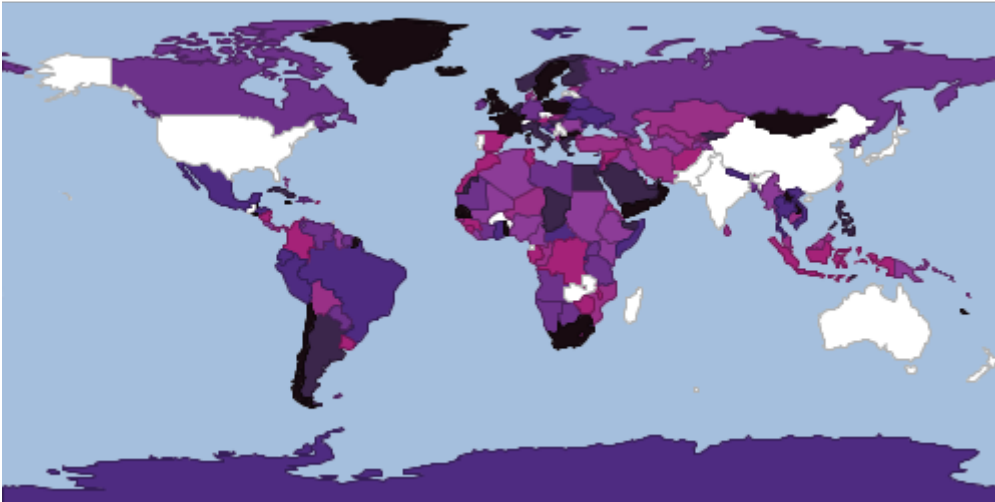
```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
UniqueValues uniqueValues = new UniqueValues(countries, "NAME", {int index, String
value -> Color.getRandom()})
countries.style = uniqueValues
```





*Create a Unique Values Symbolizer from a Layer's Field and a color palette*

```
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
UniqueValues uniqueValues = new UniqueValues(countries, "NAME",
"LightPurpleToDarkPurpleHeatMap")
countries.style = uniqueValues
```

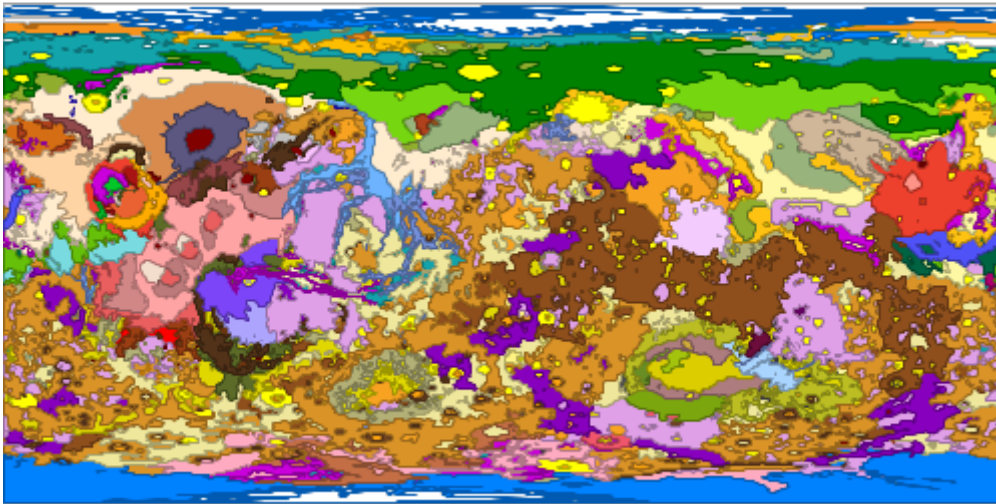


*Create a Unique Values Symbolizer from a File with a color per value*

```
Workspace workspace = new Directory("src/main/resources/mars")
Layer marsGeology = workspace.get("geo_units_oc_dd")

File uniqueValuesFile = new File
("src/main/resources/mars/I1802ABC_geo_units_RGBlut.txt")
UniqueValuesReader styleReader = new UniqueValuesReader("UnitSymbol", "polygon")
Symbolizer symbolizer = styleReader.read(uniqueValuesFile)
```

```
Unit,R,G,B
AHa,175,0,111
AHat,192,54,22
AHcf,150,70,72
AHh,109,13,60
AHpe,232,226,82
AHt,99,0,95
AHT3,233,94,94
Aa1,255,236,207
Aa2,145,73,76
Aa3,254,212,164
Aa4,212,109,19
Aa5,175,66,28
```



## Creating Color Maps

Create a ColorMap Symbolizer for a Raster using a list of Colors

```
Format format = new GeoTIFF(new File('src/main/resources/pc.tif'))
Raster raster = format.read()
ColorMap colorMap = new ColorMap([
    [color: "#9fd182", quantity:25],
    [color: "#3e7f3c", quantity:470],
    [color: "#133912", quantity:920],
    [color: "#08306b", quantity:1370],
    [color: "#ffffff5", quantity:1820],
])
raster.style = colorMap
```



*Create a ColorMap Symbolizer for a Raster using a list of Colors with opacity*

```
Format format = new GeoTIFF(new File('src/main/resources/pc.tif'))
Raster raster = format.read()
ColorMap colorMap = new ColorMap([
    [color: "#9fd182", quantity:25],
    [color: "#3e7f3c", quantity:470],
    [color: "#133912", quantity:920],
    [color: "#08306b", quantity:1370],
    [color: "#ffffff5", quantity:1820],
]).opacity(0.25)
raster.style = colorMap
```



*Create a ColorMap Symbolizer for a Raster using a color palette*

```
Format format = new GeoTIFF(new File('src/main/resources/pc.tif'))
Raster raster = format.read()
ColorMap colorMap = new ColorMap(
    25,           ①
    1820,         ②
    "MutedTerrain", ③
    5             ④
)
println colorMap
raster.style = colorMap
```

- ① min value
- ② max value
- ③ color palette name
- ④ number of categories



*Create a ColorMap Symbolizer with intervals for a Raster using a list of Colors*

```
Format format = new GeoTIFF(new File('src/main/resources/pc.tif'))
Raster raster = format.read()
ColorMap colorMap = new ColorMap([
    [color: "#9fd182", quantity:25],
    [color: "#3e7f3c", quantity:470],
    [color: "#133912", quantity:920],
    [color: "#08306b", quantity:1370],
    [color: "#ffffff5", quantity:1820],
], "intervals", true)
raster.style = colorMap
```



## Creating Channel Selection and Contrast Enhancement

*Create a Raster Symbolizer using ChannelSelection and ContrastEnhancement using the normalize method*

```
Format format = new GeoTIFF(new File('src/main/resources/pc.tif'))
Raster raster = format.read()
Symbolizer symbolizer = new ChannelSelection()
    .gray("1", new ContrastEnhancement("normalize"))
raster.style = symbolizer
```



*Create a Raster Symbolizer using ChannelSelection and ContrastEnhancement using the histogram method*

```
Format format = new GeoTIFF(new File('src/main/resources/pc.tif'))
Raster raster = format.read()
Symbolizer symbolizer = new ChannelSelection()
    .gray("1", new ContrastEnhancement("histogram", 0.65))
raster.style = symbolizer
```





# Reading and Writing Styles

Style Readers and Writers are found in the [geoscript.style.io](https://geoscript.style.io) package.

## Finding Style Readers and Writers

### *List all Style Writers*

```
List<Writer> writers = Writers.list()
writers.each { Writer writer ->
    println writer.class.simpleName
}
```

```
SLDWriter
ColorTableWriter
YSLDWriter
```

### *Find a Style Writer*

```
Writer writer = Writers.find("sld")
println writer.class.simpleName
```

```
SLDWriter
```

### *List all Style Readers*

```
List<Reader> readers = Readers.list()
readers.each { Reader reader ->
    println reader.class.simpleName
}
```

```
SLDReader
CSSReader
ColorTableReader
YSLDReader
SimpleStyleReader
```

### *Find a Style Reader*

```
Reader reader = Readers.find("sld")
println reader.class.simpleName
```

```
SLDReader
```

## SLD

GeoScript Groovy can read and write Style Layer Descriptor (SLD) documents.

*Write a Symbolizer to SLD*

```
Symbolizer symbolizer = new Fill("white") + new Stroke("black", 0.5)
SLDWriter writer = new SLDWriter()
String sld = writer.write(symbolizer)
println sld
```

```
<?xml version="1.0" encoding="UTF-8"?><sld:StyledLayerDescriptor
xmlns="http://www.opengis.net/sld" xmlns:sld="http://www.opengis.net/sld"
xmlns:gml="http://www.opengis.net/gml" xmlns:ogc="http://www.opengis.net/ogc"
version="1.0.0">
  <sld:UserLayer>
    <sld:LayerFeatureConstraints>
      <sld:FeatureTypeConstraint/>
    </sld:LayerFeatureConstraints>
    <sld:UserStyle>
      <sld:Name>Default Styler</sld:Name>
      <sld:FeatureTypeStyle>
        <sld:Name>name</sld:Name>
        <sld:Rule>
          <sld:PolygonSymbolizer>
            <sld:Fill>
              <sld:CssParameter name="fill">#ffffff</sld:CssParameter>
            </sld:Fill>
          </sld:PolygonSymbolizer>
          <sld:LineSymbolizer>
            <sld:Stroke>
              <sld:CssParameter name="stroke-width">0.5</sld:CssParameter>
            </sld:Stroke>
          </sld:LineSymbolizer>
        </sld:Rule>
      </sld:FeatureTypeStyle>
    </sld:UserStyle>
  </sld:UserLayer>
</sld:StyledLayerDescriptor>
```

```
String sld = "<?xml version='1.0' encoding='UTF-8'?>
<sld:StyledLayerDescriptor xmlns='http://www.opengis.net/sld'
xmlns:sld='http://www.opengis.net/sld' xmlns:ogc='http://www.opengis.net/ogc'
xmlns:gml='http://www.opengis.net/gml' version='1.0.0'>
  <sld:UserLayer>
    <sld:LayerFeatureConstraints>
      <sld:FeatureTypeConstraint/>
    </sld:LayerFeatureConstraints>
    <sld:UserStyle>
      <sld:Name>Default Styler</sld:Name>
      <sld:FeatureTypeStyle>
        <sld:Name>name</sld:Name>
        <sld:Rule>
          <sld:PolygonSymbolizer>
            <sld:Fill>
              <sld:CssParameter name='fill'>#ffffff</sld:CssParameter>
            </sld:Fill>
          </sld:PolygonSymbolizer>
          <sld:LineSymbolizer>
            <sld:Stroke>
              <sld:CssParameter name='stroke'>#000000</sld:CssParameter>
              <sld:CssParameter name='stroke-width'>0.5</sld:CssParameter>
            </sld:Stroke>
          </sld:LineSymbolizer>
        </sld:Rule>
      </sld:FeatureTypeStyle>
    </sld:UserStyle>
  </sld:UserLayer>
</sld:StyledLayerDescriptor>
"""

SLDReader reader = new SLDReader()
Style style = reader.read(sld)

Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = style
```





## CSS

GeoScript Groovy can only read CSS documents.

*Read a Style from an CSS String*

```
String css = ""
* {
  fill: #eeeeee;
  fill-opacity: 1.0;
  stroke: #000000;
  stroke-width: 1.2;
}
""

CSSReader reader = new CSSReader()
Style style = reader.read(css)

Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = style
```



## YSLD

GeoScript Groovy can read and write YAML Style Layer Descriptors (YSLD) documents.

*Write a Symbolizer to YSLD*

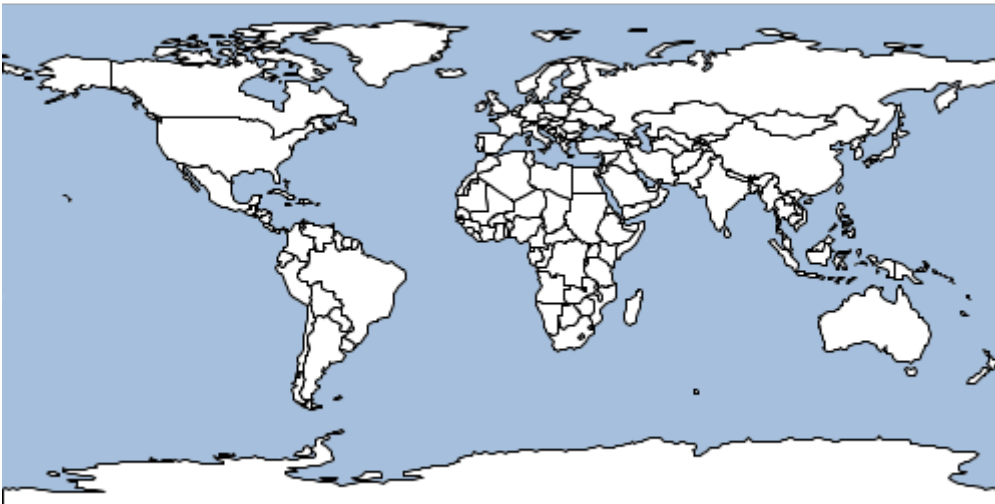
```
Symbolizer symbolizer = new Fill("white") + new Stroke("black", 0.5)
YSLDWriter writer = new YSLDWriter()
String ysl = writer.write(symbolizer)
println ysl
```

```
name: Default Styler
feature-styles:
- name: name
  rules:
  - scale: [min, max]
    symbolizers:
    - polygon:
        fill-color: '#FFFFFF'
    - line:
        stroke-color: '#000000'
        stroke-width: 0.5
```

```
String ysl = ""
name: Default Styler
feature-styles:
- name: name
  rules:
  - scale: [min, max]
    symbolizers:
    - polygon:
        fill-color: '#FFFFFF'
    - line:
        stroke-color: '#000000'
        stroke-width: 0.5
""

YSLDReader reader = new YSLDReader()
Style style = reader.read(ysl)

Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer countries = workspace.get("countries")
countries.style = style
```



## Simple Style Reader

A SimpleStyleReader that can easily create simple Styles using Maps or Strings.

- Fill properties: fill and fill-opacity
- Stroke properties: stroke, stroke-width, stroke-opacity
- Shape properties: shape, shape-size, shape-type
- Label properties: label-size, label-style, label-weight, label-family

*Read a Style with fill and stroke properties from a Simple Style String*

```
String str = "fill=#555555 fill-opacity=0.6 stroke=#555555 stroke-width=0.5"  
SimpleStyleReader reader = new SimpleStyleReader()  
Style style = reader.read(str)  
  
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')  
Layer countries = workspace.get("countries")  
countries.style = style
```



*Read a Style with fill, stroke, and label properties from a Simple Style String*

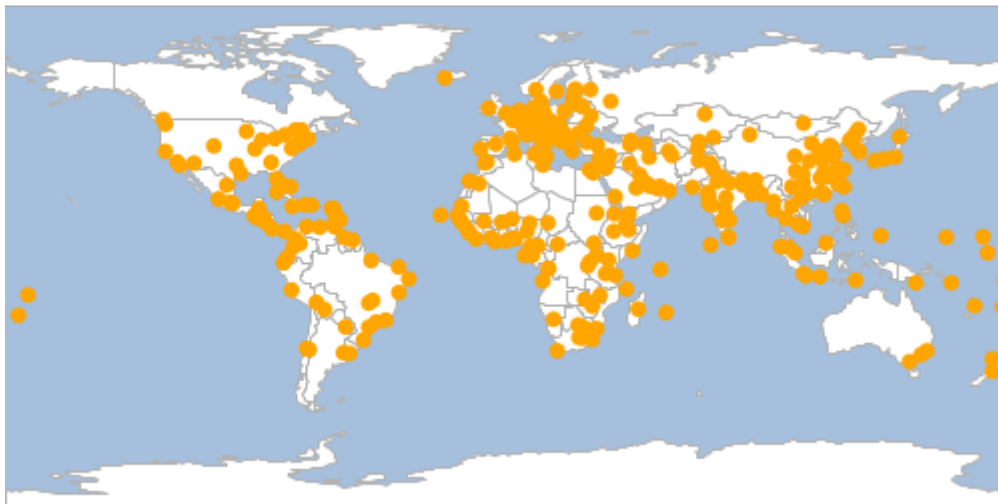
```
String str = "fill=white stroke=navy label=NAME label-size=10"  
SimpleStyleReader reader = new SimpleStyleReader()  
Style style = reader.read(str)  
  
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')  
Layer countries = workspace.get("countries")  
countries.style = style
```



*Read a Style with shape properties from a Simple Style String*

```
String str = "shape-type=circle shape-size=8 shape=orange"
SimpleStyleReader reader = new SimpleStyleReader()
Style style = reader.read(str)
println style

Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')
Layer places = workspace.get("places")
places.style = style
```



### *Read a Style with fill and stroke properties from a Simple Style Map*

```
Map map = [  
    'fill': '#555555',  
    'fill-opacity': 0.6,  
    'stroke': '#555555',  
    'stroke-width': 0.5  
]  
SimpleStyleReader reader = new SimpleStyleReader()  
Style style = reader.read(map)  
  
Workspace workspace = new GeoPackage('src/main/resources/data.gpkg')  
Layer countries = workspace.get("countries")  
countries.style = style
```



## Color Table

GeoScript Groovy can read and write color table strings and files. This format can be used with ColorMaps to style Rasters.

### *Write a ColorMap to a color table string*

```
ColorMap colorMap = new ColorMap(25, 1820, "BoldLandUse", 5)  
ColorTableWriter writer = new ColorTableWriter()  
String str = writer.write(colorMap)  
println str
```

```
25.0 178 156 195  
473.75 79 142 187  
922.5 143 146 56  
1371.25 193 132 55  
1820.0 181 214 177
```

### Read a ColorMap from a color table string

```
Format format = new GeoTIFF(new File('src/main/resources/pc.tif'))
Raster raster = format.read()
ColorTableReader reader = new ColorTableReader()
ColorMap colorMap = reader.read("""25.0 178 156 195
473.75 79 142 187
922.5 143 146 56
1371.25 193 132 55
1820.0 181 214 177
""")
raster.style = colorMap
```

