Module 5 - OGC Services and Styling in GeoServer

Overview

- Review of Raster Styling in GeoServer

- Raster Styling Demonstration

Raster Symbolizer - Review

```
<Opacity>
<ColorMap type=ramp|values|intervals extended=true|false />
  <ColorMapEntry color="" quantity="" label="" opacity=""/>
<ChannelSelection>
  <RedChannel> <GreenChannel> <BlueChannel>
    <SourceChannelName>
  <GrayChannel>
    <SourceChannelName>
<ContrastEnhancement>
<ShadedRelief> (not implemented in ver 2.0)
<OverlapBehavior> (not implemented in ver 2.0)
<ImageOutline> (not implemented in ver 2.0)
```

Sample Raster SLD for Color Map Examples

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<StyledLayerDescriptor version="1.0.0"
  xsi:schemaLocation="http://www.opengis.net/sld StyledLayerDescriptor.xsd"
  xmlns="http://www.opengis.net/sld"
  xmlns:ogc="http://www.opengis.net/ogc"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

<NamedLayer>
<Name>ElevationData</Name>
  <UserStyle>
    <Name>dem</Name>
    <Title>Simple DEM style</Title>
    <Abstract>Classic elevation color progression</Abstract>
    <FeatureTypeStyle>
      <Rule>
        <RasterSymbolizer>
          <Opacity>1.0</Opacity>
          <ColorMap>
            <ColorMapEntry color="#000000" quantity="-500" label="nodata" opacity="0.0" />
            <ColorMapEntry color="#AAFFAA" quantity="0" label="0" />
            <ColorMapEntry color="#00FF00" quantity="1000" label="1000"/>
            <ColorMapEntry color="#FFFF00" quantity="1200" label="1200" />
            <ColorMapEntry color="#FF7F00" quantity="1400" label="1400" />
            <ColorMapEntry color="#BF7F3F" quantity="1600" label="1600" />
            <ColorMapEntry color="#99CC66" quantity="2000" label="2000" />
            <ColorMapEntry color="#336633" quantity="2500" label="2500" />
```

```
        <ColorMapEntry color="#006600" quantity="3000" label="3000" />
        <ColorMapEntry color="#FFFFFF" quantity="3500" label="3500" />
      </ColorMap>
    </RasterSymbolizer>
  </Rule>
</FeatureTypeStyle>
</UserStyle>


</NamedLayer>
</StyledLayerDescriptor>
```

ColorMap Types

```
<ColorMap> or <ColorMap type="ramp">
```

```
<ColorMap type="intervals">
```

```
<ColorMap type="values">
```

Extend or Not To Extend?

```
<ColorMap type="ramp" extended="false">  = 256 colors in ramp (default)
<ColorMap type="ramp" extended="true"> = 65536 colors in ramp
```

Opacity

Options for defining `opacity` appear in two places in the *raster symbolizer*.

At the level of the entire raster dataset

```
<Opacity>0.5</Opacity>
```

Within a `ColorMapEntry` for a specific color definition within a `ColorMap`

```
<ColorMap>
   <ColorMapEntry color="#000000" quantity="-500" label="nodata" opacity="0.0" />
   <ColorMapEntry color="#AAFFAA" quantity="0" label="0" />
   <ColorMapEntry color="#00FF00" quantity="1000" label="1000"/>
   ...
   <ColorMapEntry color="#FFFFFF" quantity="3500" label="3500" />
</ColorMap>
```

Channel Selection

Many raster datasets contain multiple *bands* of values which may be viewed individually or assigned to the colors *red*, *green*, and *blue* to generate a color image representing a combination of band values. GeoServer allows for the specification of a single band for display as a `GrayChannel` or three bands as `RedChannel`, `GreenChannel`, and `BlueChannel`.

```xml
<?xml version="1.0" encoding="ISO-8859-1"?>
<StyledLayerDescriptor version="1.0.0"
  xsi:schemaLocation="http://www.opengis.net/sld StyledLayerDescriptor.xsd"
  xmlns="http://www.opengis.net/sld"
  xmlns:ogc="http://www.opengis.net/ogc"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

<NamedLayer>
<Name>DOQQBands</Name>
  <UserStyle>
    <Name>DOQQ321</Name>
    <Title>Simple DEM style</Title>
    <Abstract>Classic elevation color progression</Abstract>
    <FeatureTypeStyle>
      <Rule>
        <RasterSymbolizer>
         <ChannelSelection>
          <RedChannel>
            <SourceChannelName>3</SourceChannelName>
          </RedChannel>
          <GreenChannel>
            <SourceChannelName>2</SourceChannelName>
          </GreenChannel>
          <BlueChannel>
            <SourceChannelName>1</SourceChannelName>
          </BlueChannel>
         </ChannelSelection>
        </RasterSymbolizer>
      </Rule>
    </FeatureTypeStyle>
  </UserStyle>


</NamedLayer>
</StyledLayerDescriptor>
```

Contrast Enhancement

Some raster data may need adjustment to increase the contrast (the range between the darkest and lightest values) displayed. GeoServer provides three options for contrast enhancement, each of which have a different effect on the resulting image.

Histogram The values are stretched so that an equal number of pixels fall into each color in the range
Normalize The minimum and maximum brightness values are mapped to the minimum and maximum raster values
Gamma The image is brightened or darkened by a specified factor (negative numbers darken, positive numbers brighten)

Sample Contrast Enhancement SLD for Examples

```xml
<RasterSymbolizer>
  <Opacity>1.0</Opacity>
```

```xml
<ChannelSelection>
  <RedChannel>
    <SourceChannelName>1</SourceChannelName>
    <ContrastEnhancement>
    <Histogram/>
    </ContrastEnhancement>
  </RedChannel>
  <GreenChannel>
    <SourceChannelName>2</SourceChannelName>
    <ContrastEnhancement>
    <Histogram/>
    </ContrastEnhancement>
  </GreenChannel>
  <BlueChannel>
    <SourceChannelName>3</SourceChannelName>
    <ContrastEnhancement>
    <Histogram/>
    </ContrastEnhancement>
  </BlueChannel>
</ChannelSelection>
</RasterSymbolizer>


<ContrastEnhancement>
  <Normalize/>
</ContrastEnhancement>


<ContrastEnhancement>
  <Histogram/>
</ContrastEnhancement>


<ContrastEnhancement>
  <GammaValue>.5</GammaValue>
</ContrastEnhancement>
```

GeoServer Demo/Q&A

Class GeoServer Instance: http://geog485.unm.edu:8080/geoserver/web/

Epilogue - Geography 485L/585L Closing Comments and Next Steps

What We've Done ...

- Developed basic web pages
- Learned how to publish our content using GitHub
- Developed basic interactive maps based on the Google Maps API and OpenLayers
- Learned about the key data visualization and data access standards from the Open Geospatial Consortium

    – WMS, WFS, WCS

- Used those visualization and data access services in desktop GIS applications
- Published data using those standards, and done basic styling of those data

Whew!!! That's a bunch of work for 16 weeks. Good Job.

Where Do You Go From Here?

- Establish your own identity on the internet by getting your own domain name (e.g. Hover.com, GoDaddy and many others
- Build your personal web site focusing on what interests you (published through GitHub or any other web hosting provider)
- Continue experimenting with interactive mapping - using the Google Maps API, OpenLayers or another framework that interests you. Some additional candidates include:
    - The ArcGIS Javascript API
    - Leaflet Javascript Framework
- Publish your own data (you will need a server e.g. Amazon EC2, Cari.net, MapServerPro, AcuGIS, Geocortex) using GeoServer or another platform like:
    - MapServer
    - ArcGIS Server
    - ArcGIS Online