

Advanced Cartography for SDI (Web Cartography with SLD)

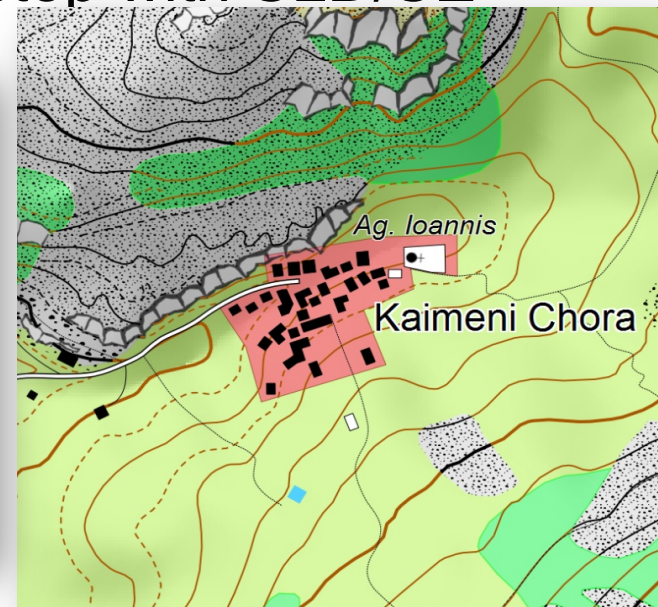
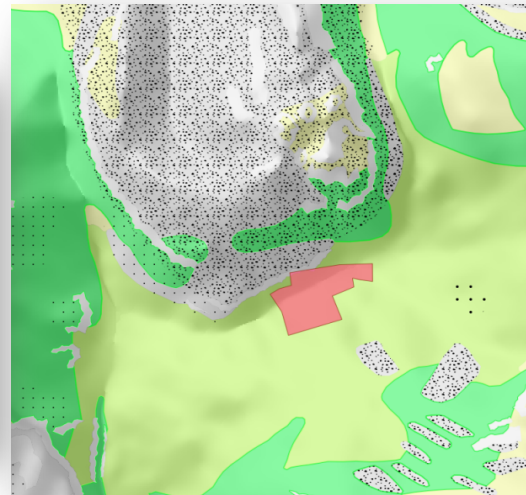
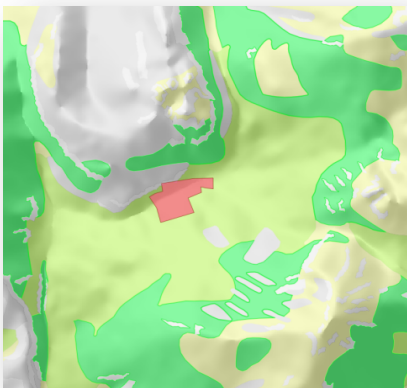
Ionuț Iosifescu

Let's Review the Main Concepts

- **WMS**: produces “maps of spatially referenced data dynamically from geographic information”
- **Map**: “portrayal of geographic information as a digital image file suitable for display on a computer screen”
- **Styled Layer Descriptor (SLD)**: an encoding to allow “user-defined symbolization and coloring” of maps presented through Web Map Services (WMS)
- **Symbology Encoding (SE)**: an “XML encoding that can be used for styling” map data independent of any service interface specification

Cartographic Enhancements

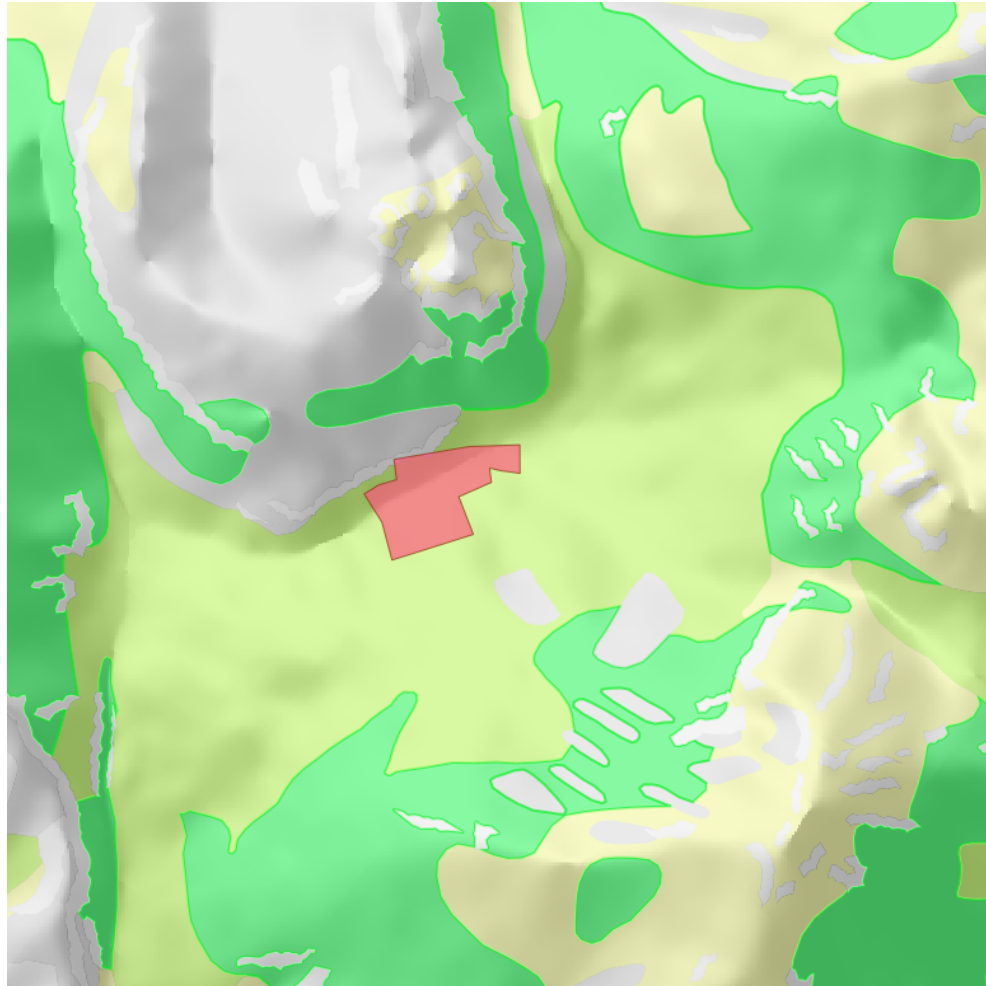
- Designed to Improve WMS Cartographic Symbolization
- Change Request submitted to OGC (SE CR 07-105)
- Introduced with examples from the topographic map of Methana reconstructed step by step with SLD/SE



Basic Styling for Polygon Features (1)

```
<Rule xmlns="http://www.opengis.net/sld">
  <Filter xmlns="http://www.opengis.net/ogc">
    <PropertyIsEqualTo xmlns="http://www.opengis.net/ogc">
      <PropertyName xmlns="http://www.opengis.net/ogc">VEGE_TYPE</PropertyName>
      <Literal xmlns="http://www.opengis.net/ogc">barren_land</Literal>
    </PropertyIsEqualTo>
  </Filter>
  <PolygonSymbolizer xmlns="http://www.opengis.net/sld">
    <Fill xmlns="http://www.opengis.net/sld">
      <CssParameter xmlns="http://www.opengis.net/sld" name="fill" >#fdffe4</CssParameter>
    </Fill>
  </PolygonSymbolizer>
</Rule>
<Rule xmlns="http://www.opengis.net/sld">
  <PolygonSymbolizer xmlns="http://www.opengis.net/sld">
    <Stroke xmlns="http://www.opengis.net/sld">
      <CssParameter xmlns="http://www.opengis.net/sld" name="stroke" >#e69972</CssParameter>
      <CssParameter xmlns="http://www.opengis.net/sld" name="stroke-width" >1</CssParameter>
    </Stroke>
    <Fill xmlns="http://www.opengis.net/sld">
      <CssParameter xmlns="http://www.opengis.net/sld" name="fill" >#ffaa7f</CssParameter>
    </Fill>
  </PolygonSymbolizer>
</Rule>
```

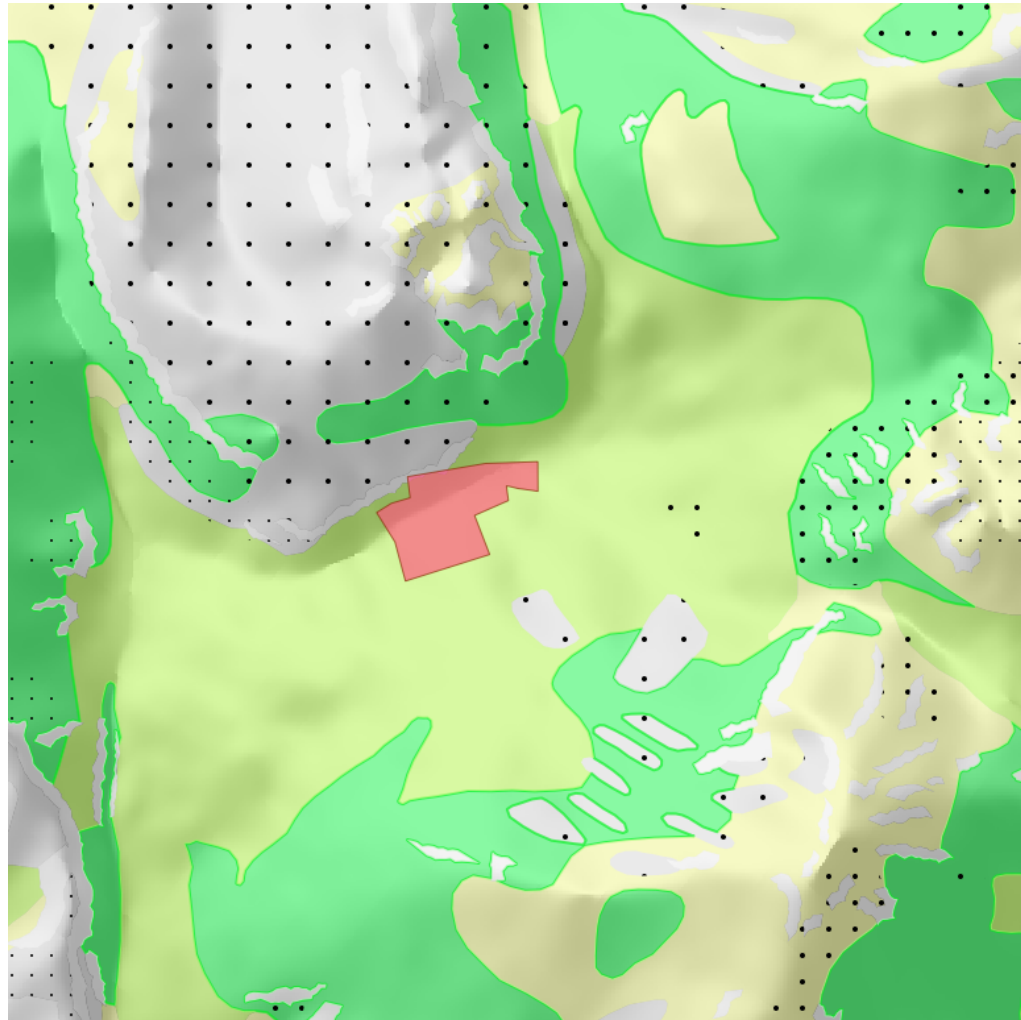

Basic Styling for Polygon Features (2)



Fill Patterns (1)

```
<Rule xmlns="http://www.opengis.net/sld">
  <Filter xmlns="http://www.opengis.net/ogc">
    <PropertyIsEqualTo xmlns="http://www.opengis.net/ogc">
      <PropertyName xmlns="http://www.opengis.net/ogc">SCREE_TYPE</PropertyName>
      <Literal xmlns="http://www.opengis.net/ogc">scree_1</Literal>
    </PropertyIsEqualTo>
  </Filter>
  <PolygonSymbolizer xmlns="http://www.opengis.net/sld">
    <Fill>
      <pattern width="30" height="30" x="0" y="0">
        <g xmlns="http://www.w3.org/2000/svg">
          <circle cx="5" cy="5" r="2" fill="#000000"/>
        </g>
      </pattern>
    </Fill>
  </PolygonSymbolizer>
</Rule>
```

Fill Patterns (2)



Fill Patterns (4)

The image displays a variety of fill patterns used in GIS. The main grid includes patterns such as:

- ste12.svg** to **ste25.svg**: Various dot and irregular shape patterns.
- law12.svg** to **law22.svg**: Line patterns, including wavy and straight lines.
- mur12.svg** to **mur22.svg**: Patterns with irregular, organic shapes.
- ueb04.svg** to **ueb24.svg**: Geometric patterns like horizontal lines, vertical lines, and grids.
- dol21.svg** to **dol31.svg**: Concentric circles and other circular motifs.

 The software interface shows a 'Fill and Stroke' dialog with a 'Fill' tab selected, displaying a pattern of black irregular shapes on a white background. The 'Fill color' is set to black (RGB: 0, 0, 0). The 'Stroke' tab is also visible, showing a white stroke with a width of 1.00 pixels and 100% opacity.

Line Patterns

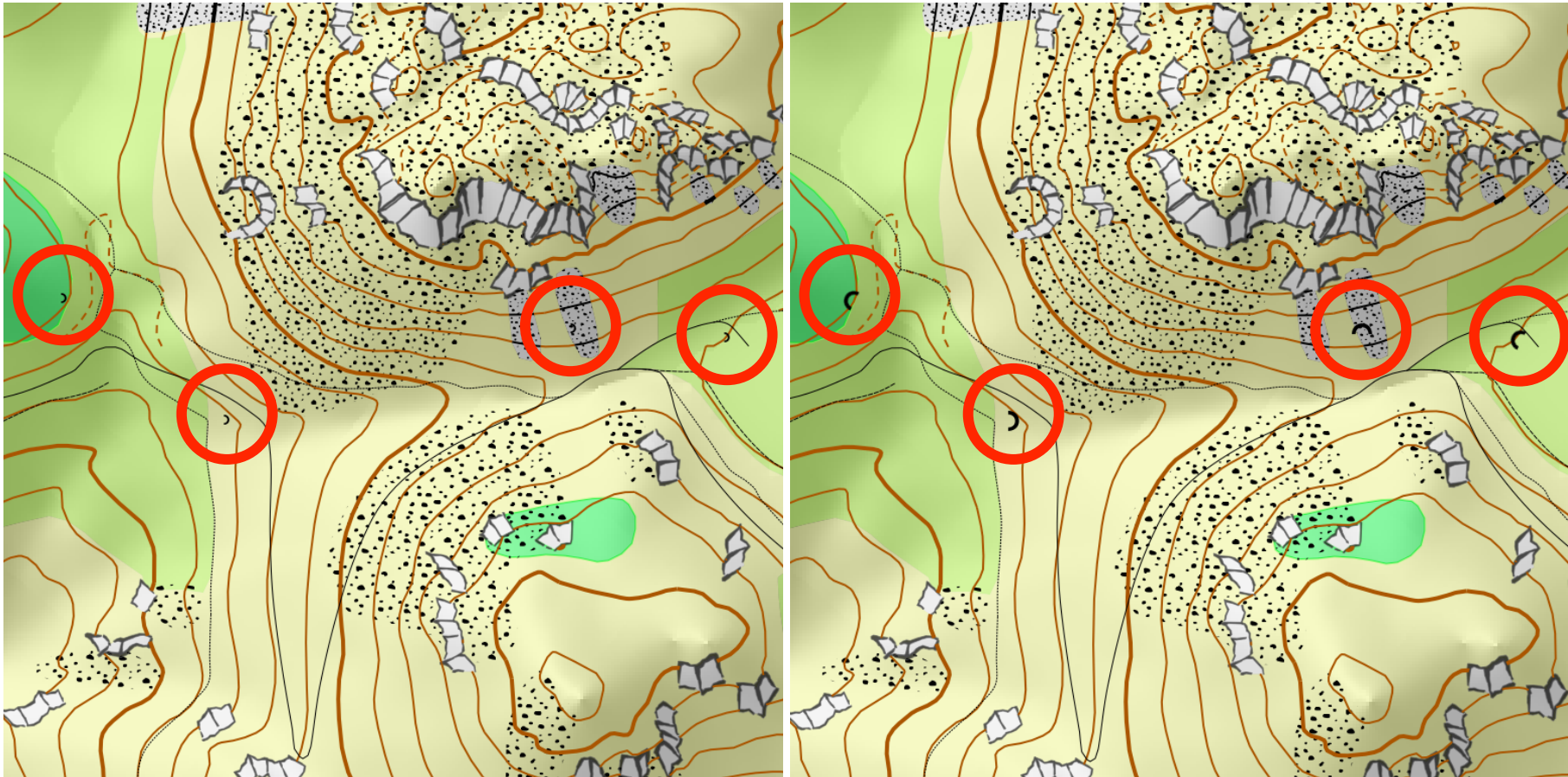


```
<LineSymbolizer xmlns="http://www.opengis.net/sld">  
  <Stroke xmlns="http://www.opengis.net/sld">  
    <CssParameter xmlns="http://www.opengis.net/sld" name="stroke" >#aa5500</CssParameter>  
    <CssParameter xmlns="http://www.opengis.net/sld" name="stroke-dasharray" >4 3</CssParameter>  
    <CssParameter xmlns="http://www.opengis.net/sld" name="stroke-width" >1</CssParameter>  
  </Stroke>  
</LineSymbolizer>
```

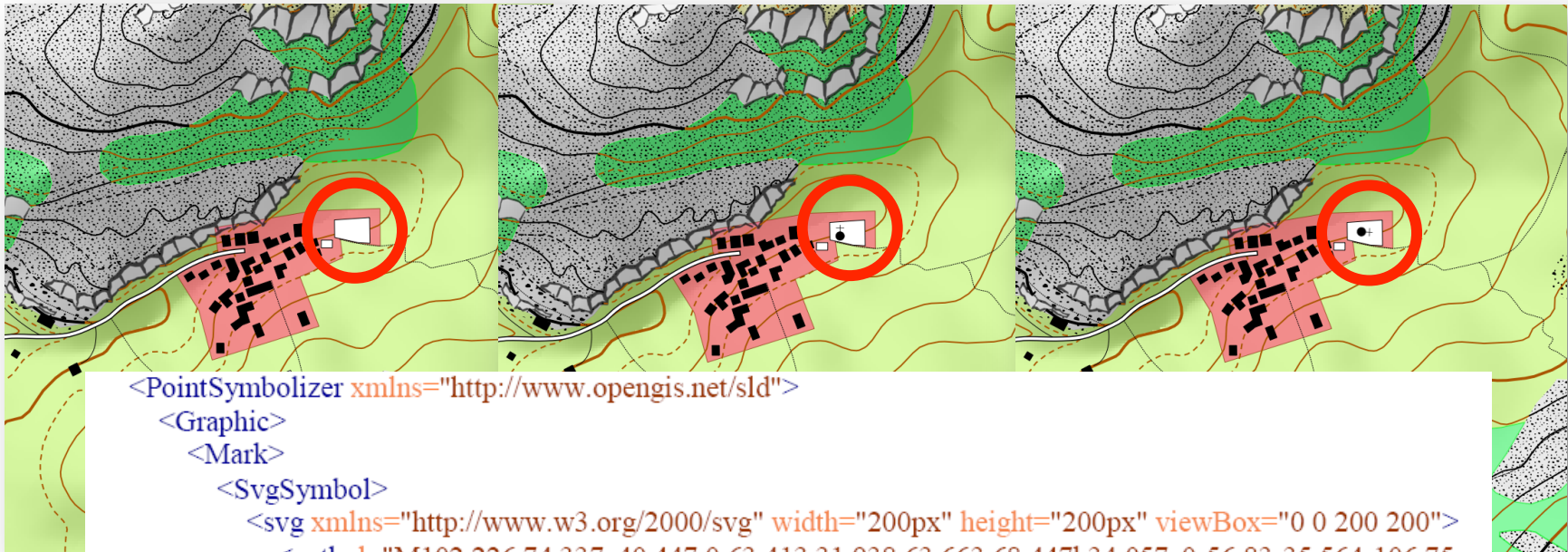
Custom Point Symbols



Custom Point Symbols (2)



Custom Point Symbols (3)

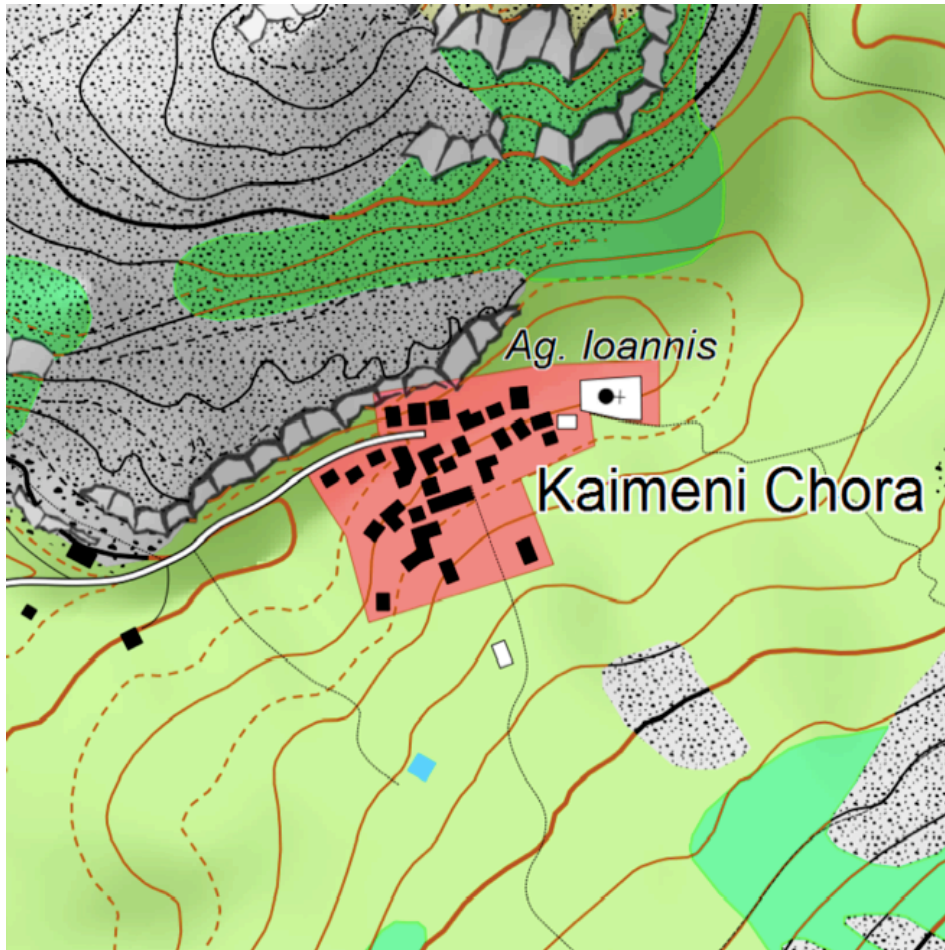


```

<PointSymbolizer xmlns="http://www.opengis.net/sld">
  <Graphic>
    <Mark>
      <SvgSymbol>
        <svg xmlns="http://www.w3.org/2000/svg" width="200px" height="200px" viewBox="0 0 200 200">
          <path d="M102.226,74.337c40.447,0,63.413,31.938,63.663,68.447h34.057c0-56.83-35.564-106.75-98.445-106.75S0.554,85.954,0.554,142.784h36.393C37.215,106.275,61.776,74.337,102.226,74.337z"/>
        </svg>
      </SvgSymbol>
    </Mark>
    <Size>20</Size>
    <Rotation>
      <PropertyName xmlns="http://www.opengis.net/ogc">ET_ANGLE</PropertyName>
    </Rotation>
  </Graphic>
</PointSymbolizer>

```

Finishing the Map

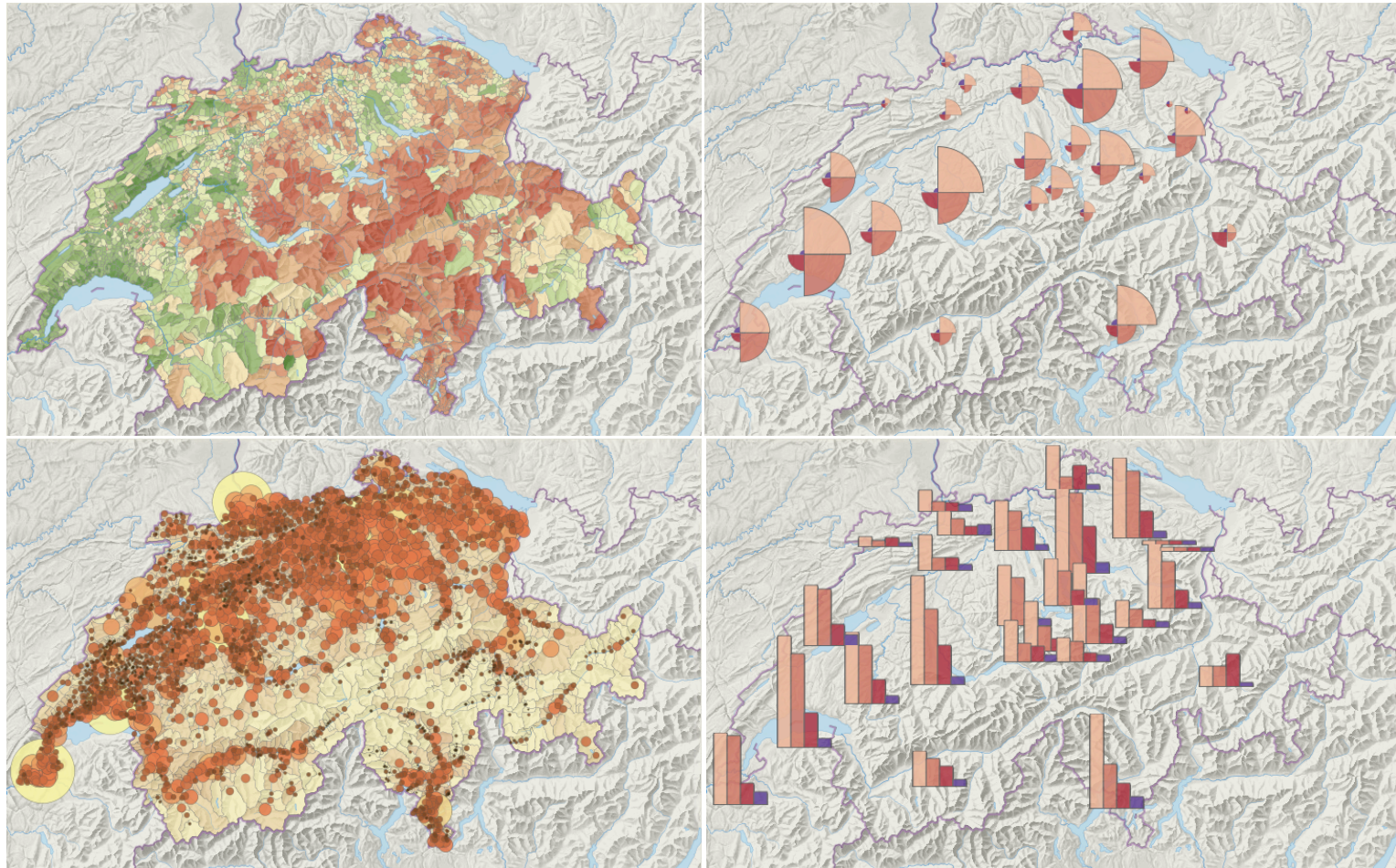


```

<TextSymbolizer>
  <Geometry>
    <ogc:PropertyName>LABELPOS</ogc:PropertyName>
  </Geometry>
  <Label>
    <ogc:PropertyName>Name</ogc:PropertyName>
  </Label>
  <Font>
    <SvgParameter name="font-family">Arial</SvgParameter>
    <SvgParameter name="font-family">Sans-Serif</SvgParameter>
    <SvgParameter name="font-style">italic</SvgParameter>
    <SvgParameter name="font-size">26</SvgParameter>
  </Font>
  <Halo>
    <Radius>1</Radius>
    <Fill>
      <SvgParameter name="fill">#ffffff</SvgParameter>
    </Fill>
  </Halo>
  <Fill>
    <SvgParameter name="fill">#000000</SvgParameter>
  </Fill>
</TextSymbolizer>

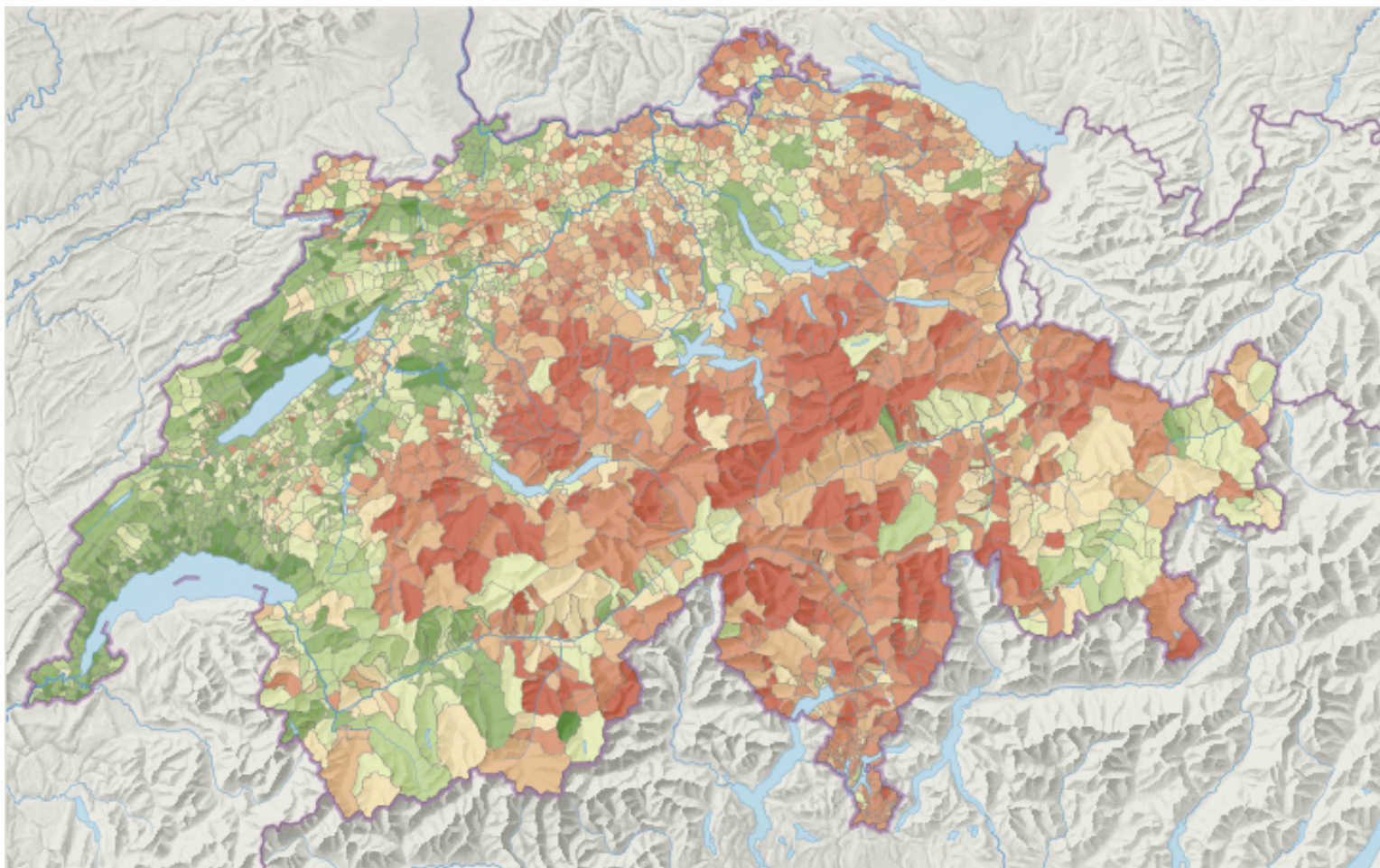
```


Thematic Cartography

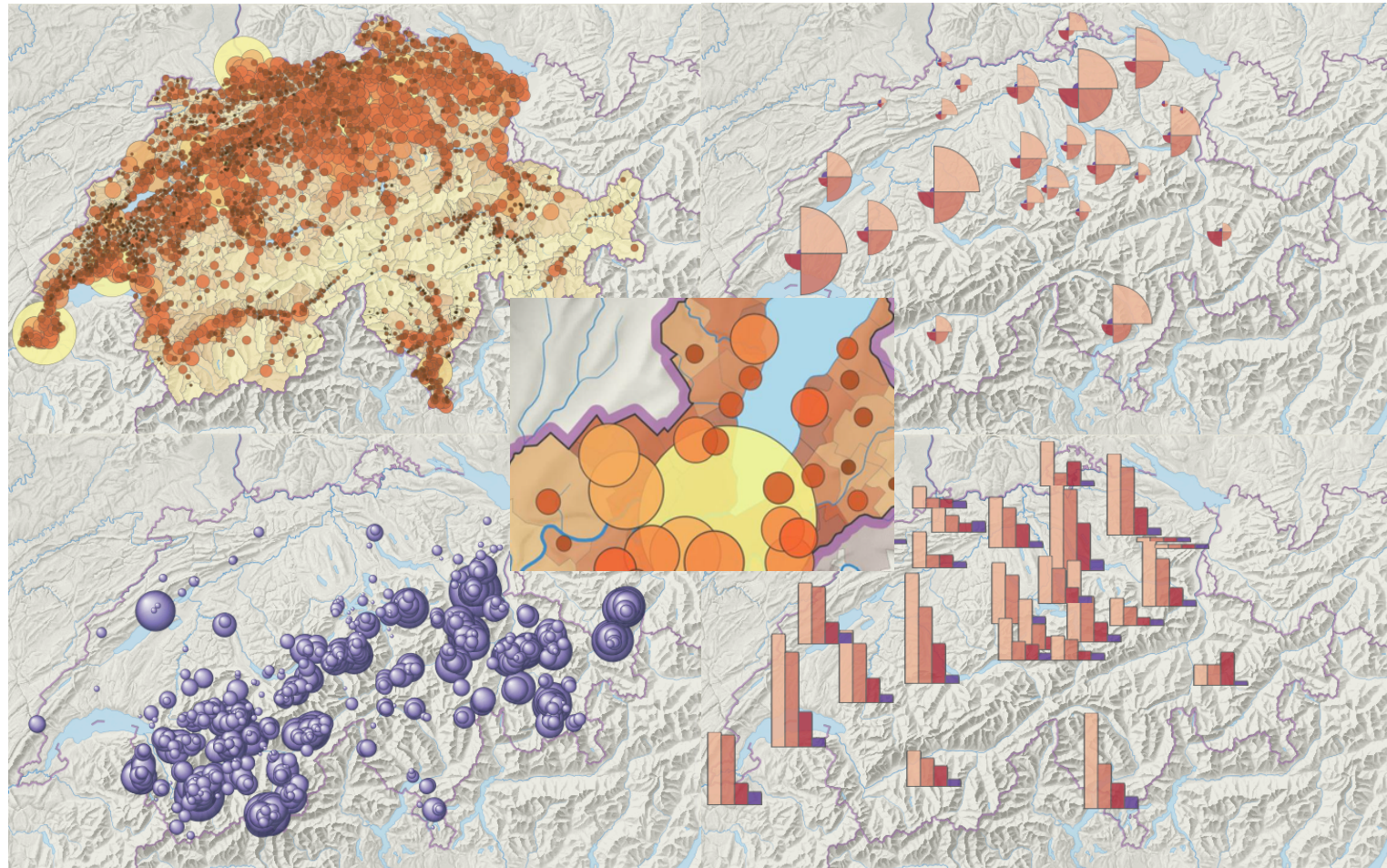


Images modified from Ortner, 2011 and similar to Atlas of Switzerland v3

Choropleths

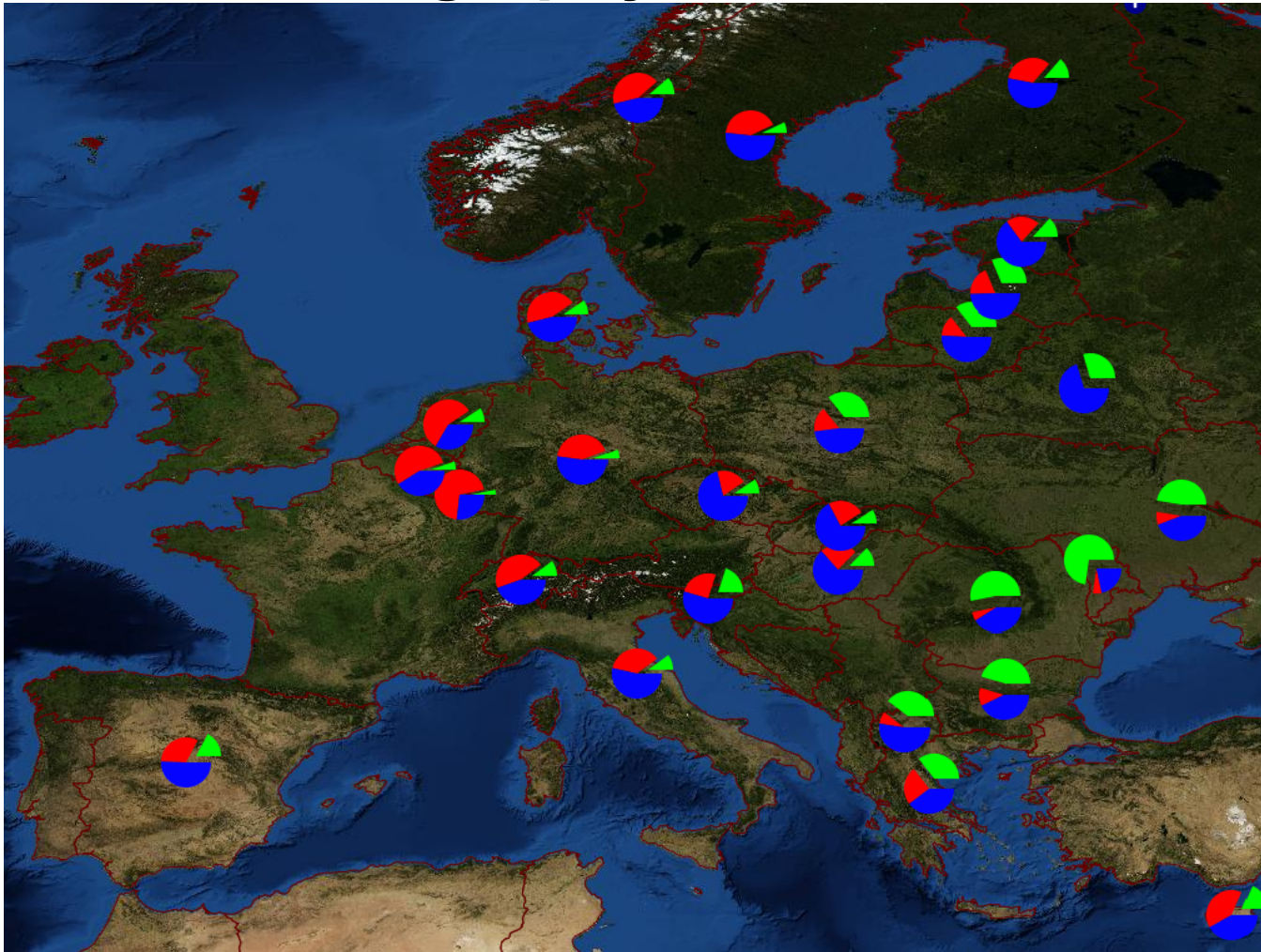


Proportional Symbol Maps



Images modified from Ortnet, 2011 and similar to Atlas of Switzerland v3

Note: Good Cartography is Time-consuming!



Outlook: Descriptive Data Manipulation

```
<xsd:element name="Intersection"  
type="ogc:GeometrySpatialOpType" substitutionGroup="ogc:spatialOps"/>  
<xsd:element name="Union"  
type="ogc:GeometrySpatialOpType" substitutionGroup="ogc:spatialOps"/>  
<xsd:element name="Difference"  
type="ogc:GeometrySpatialOpType" substitutionGroup="ogc:spatialOps"/>  
<xsd:element name="SymDifference"  
type="ogc:GeometrySpatialOpType" substitutionGroup="ogc:spatialOps"/>  
<xsd:element name="Distance"  
type="ogc:GeometrySpatialOpType" substitutionGroup="ogc:spatialOps"/>
```

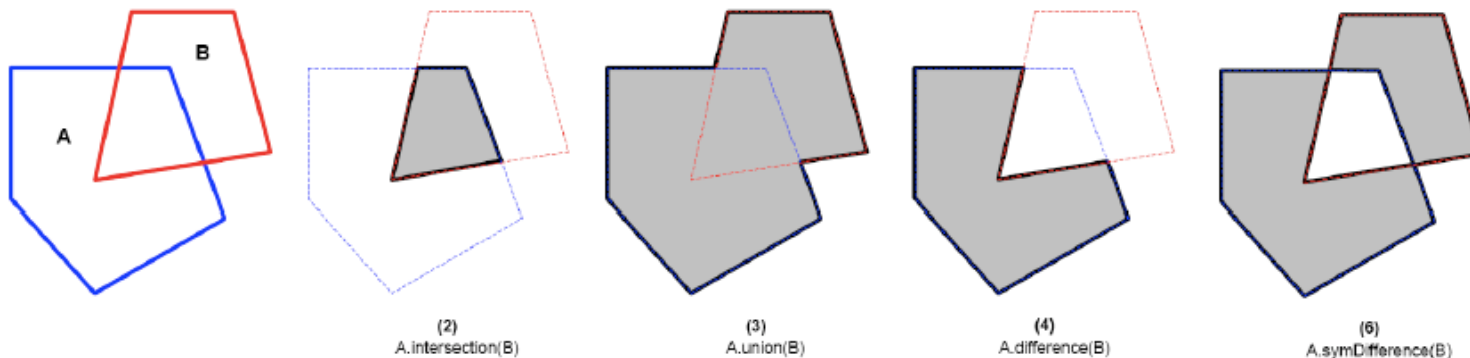
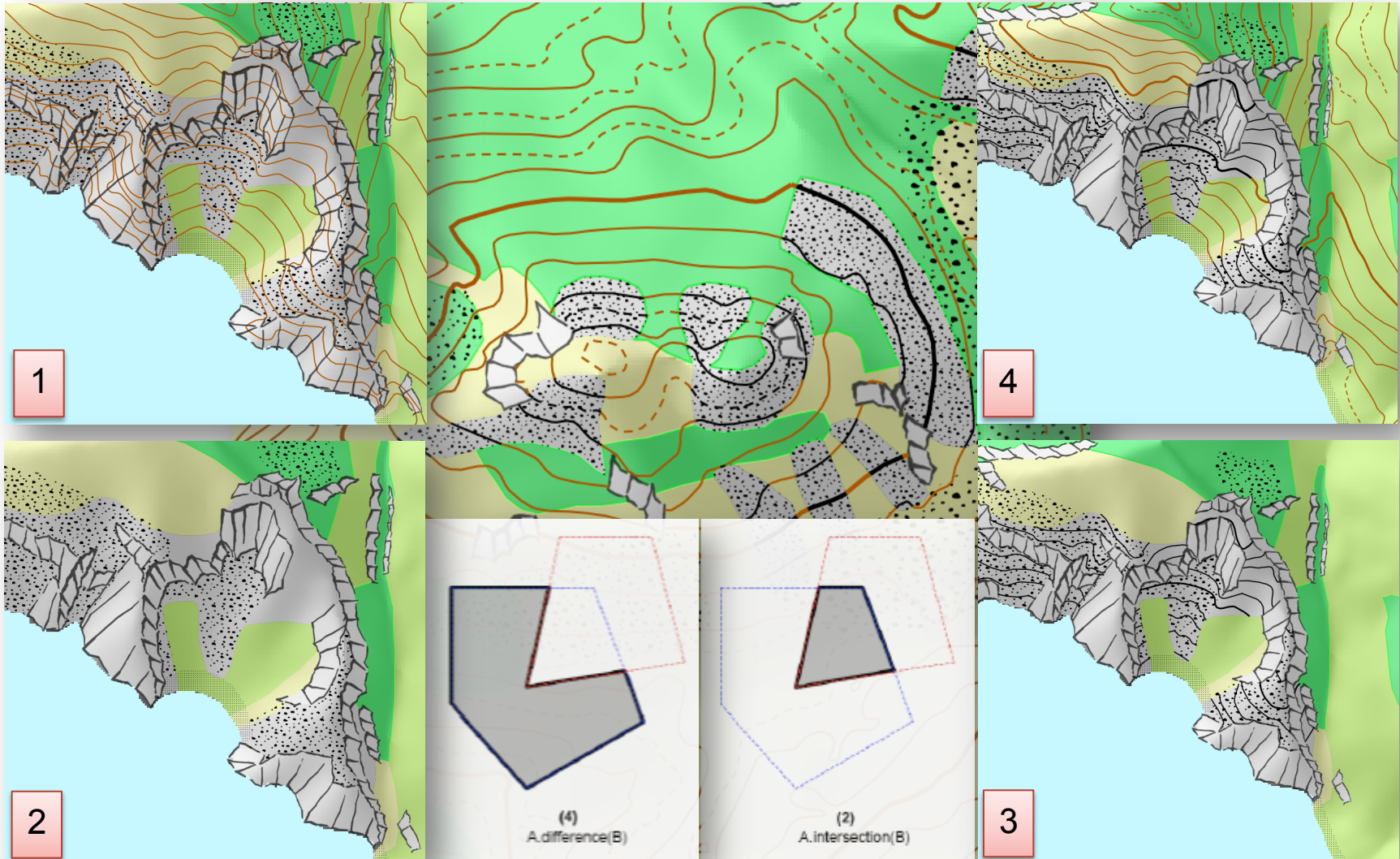


Image modified after VividSolution, JTS Topology Suite

Masking Example (1)

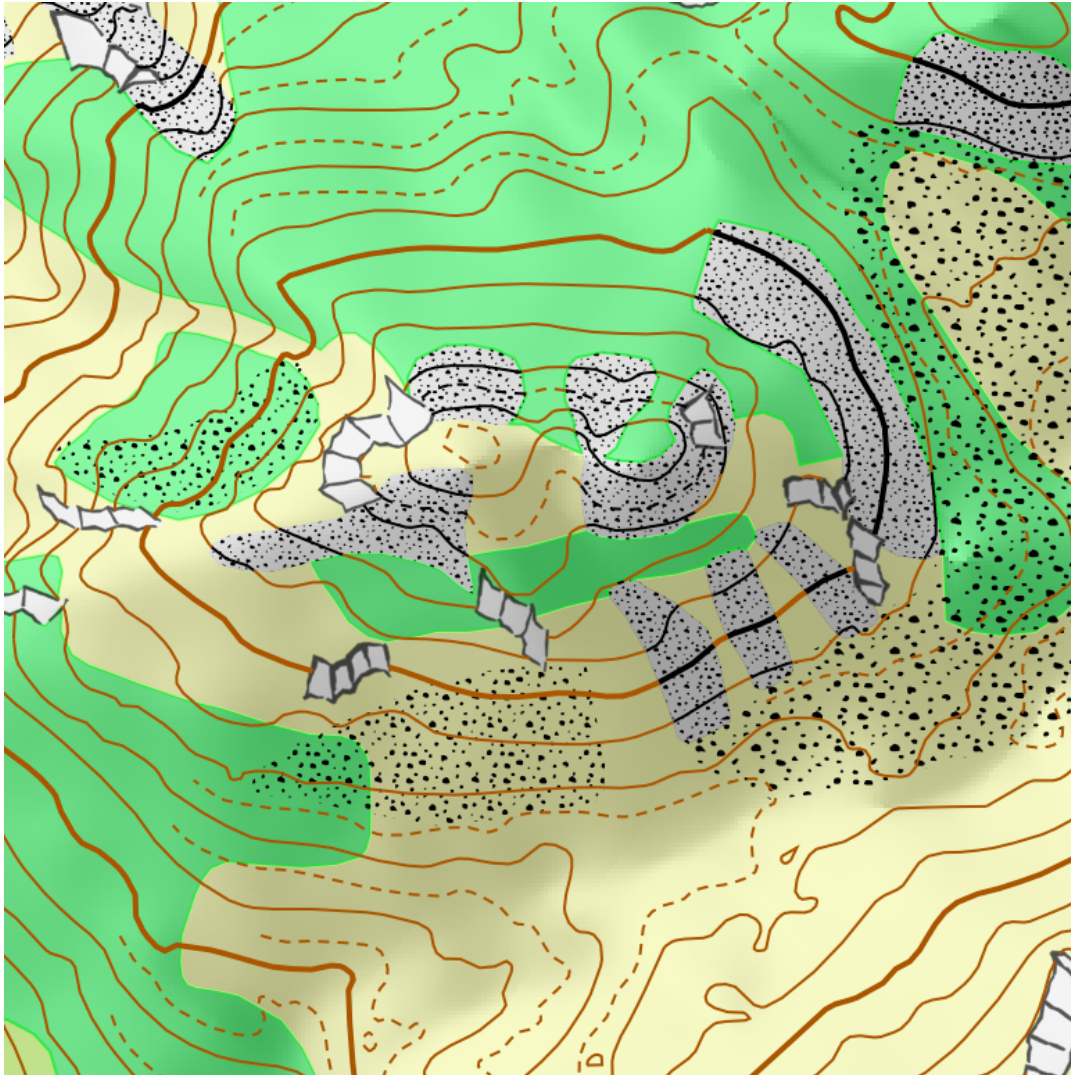


Masking Example (2)

```

<Filter xmlns="http://www.opengis.net/ogc">
  <And>
    <Difference>
      <NamedLayer xmlns="http://www.opengis.net/sld">
        <Name xmlns="http://www.opengis.net/sld">Vegetation</Name>
        <UserStyle xmlns="http://www.opengis.net/sld">
          <FeatureTypeStyle xmlns="http://www.opengis.net/sld">
            <Rule xmlns="http://www.opengis.net/sld">
              <Filter xmlns="http://www.opengis.net/ogc">
                <PropertyIsEqualTo xmlns="http://www.opengis.net/ogc">
                  <PropertyName xmlns="http://www.opengis.net/ogc">VEGE_TYPE</PropertyName>
                  <Literal xmlns="http://www.opengis.net/ogc">rock</Literal>
                </PropertyIsEqualTo>
              </Filter>
            </FeatureTypeStyle>
          </UserStyle>
        </NamedLayer>
      </Difference>
      <Intersection>
        <NamedLayer xmlns="http://www.opengis.net/sld">
          <Name xmlns="http://www.opengis.net/sld">Vegetation</Name>
          <UserStyle xmlns="http://www.opengis.net/sld">
            <FeatureTypeStyle xmlns="http://www.opengis.net/sld">
              <Rule xmlns="http://www.opengis.net/sld">
                <Filter xmlns="http://www.opengis.net/ogc">
                  <PropertyIsEqualTo xmlns="http://www.opengis.net/ogc">
                    <PropertyName xmlns="http://www.opengis.net/ogc">VEGE_TYPE</PropertyName>
                    <Literal xmlns="http://www.opengis.net/ogc">barren_land</Literal>
                  </PropertyIsEqualTo>
                </Filter>
              </FeatureTypeStyle>
            </UserStyle>
          </NamedLayer>
        </Intersection>
      </And>
    </Filter>
  
```

Masking Example (3)



Questions



Exercise 7

- Advanced Map Styling with SLD:
 - Feature Filtering
 - Advanced Point Symbolization
 - Advanced Area Symbolization

Exercise 8

- Thematic Maps:
 - Authoring and publishing of thematic layers
 - Understand and extend the exported SLD