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RESEARCH
PROGRAM ON
Forests, Trees and
Agroforestry

A DESIGN STYLE FOR GEOSPATIAL DATA REPRESENTATION

Technical guidelines
(September 2021)

These guidelines and procedures have been developed consistent with the CGIAR Principles on the Management of Intellectual Assets and by the CGIAR's commitment to Open Access and they explain how to implement the geospatial data style for presentation and mapping. This technical guide describes the practical implementation of geospatial data symbology in data publication and dissemination including that used in the FTA's geoportal.

SCOPE

Geospatial data symbology is the use of graphical techniques to represent geographic information on a map. Symbols have been created based on the visual variables, which include colour, shape and size. When designing symbols on a map, the symbol designer or cartographer can use certain combinations of visual variables (e.g., a blue line with a thickness of 0.5 pt.) to represent a particular class of geographical features (e.g., a small river). In general, there are no specific standards in creating symbol designs. However, for technical purposes, we have developed guidelines to assist those creating symbols to understand the meaning of symbols in relation to the real-world phenomena. This guide shows how symbols can be well designed so that they are easily recognisable in relation to geographic features and work well with other symbols. The symbol types covered in this guide are conventional symbols with some adjustments for the CGIAR's FTA mapping.

ROLES AND RESPONSIBILITIES

Project leaders and researchers must:

- ensure that the datasets to be published follow the technical guidelines for symbology design and
- facilitate the creation, change or update of existing symbols.

GIS specialists/producers/curators/cartographers must:

- ensure that each dataset that will be published has the appropriate attributes
- ensure that the data can be used with existing symbols
- be responsible for the implementation of symbol design for mapping products including paper maps and
- provide input and feedback on symbol design and updates.

Geoportal administration will:

- create a style layer descriptor (SLD) for geoportal symbols in accordance with this technical guide, including updates

- ensure that the dataset is well symbolized in the geoportal and
- be responsible for maintaining and updating the symbology in the geoportal in accordance with these technical guidelines

Data users will:

- be responsible for data access including data distribution and use
- provide input and feedback on the symbology if there are errors or inadequacies in the representation of geospatial data on the maps or FTA's geoportal.

TECHNICAL INSTRUCTIONS FOR THE DESIGN OF SYMBOLS FOR DATA PORTRAYAL

- a. Each dataset must have an attribute that indicates the value of the data that will be presented on the map or geoportal. The value of the data could be a classification class such as vegetation cover class (see Annex 1) or a value that shows a number or quantity such as elevation data.
- b. Each value in the data's attribute can be assigned a style. The sample of default styles and the adjustment can be seen in the technical instructions (see Annexes 2 and 3).
- c. The producers or cartographer can create style templates to facilitate certain classifications such as vegetation cover based on the data attributes. This template could help the implementation of styles more consistent with each class.
- d. To stylize in the FTA's geoportal first upload a style layer description (sld) that has been created separately from the datasets. The sld code will represent each data attribute with the appropriate colour on the map. The sld format is an encoding standard created by the Open Geospatial Forum (OGC). The complete examples of this sld can be seen in Annexes 2 and 3.
- e. The geoportal administrators and/or data producers are responsible for ensuring that the default symbols follow the technical guidelines



Annex 1.

Here is an example of assigning a class to a data attribute for vegetation cover and also as a guide to its representation on a map based on the map's scale.

Scale	< 1:1.000.000	1:1.000.000 - 1:250.000	1:250.000 - 1:80.000	1:80.000 - 1:25.000	> 1:25.000			
No	I	II	III	IV	V			
1	Forest Land			Riparian	<i>Eusideroxylon Zwageri</i> forest			
				Primary forest	Mixed forest	Very dense		
						Dense		
						Sparse		
				Lowland forest formation (< 300)	Logged over forest		Industrial logging	
					High secondary forest		Local logging	
						<i>Schima wallichii</i> woodlands		
					Low secondary forest	<i>Ploiarium alternifolium</i> woodlands		
						other		
						Riparian		
						Primary forest	Mixed forest	Very dense
								Dense
								Sparse
					Hill and mountain forest formation (> 300)	Logged over forest		Industrial logging
		High secondary forest		Local logging				
			Piper woodlands					
		Low secondary forest	<i>Ploiarium alternifolium</i> woodlands					
			other					
		Logged over forest area						
2	Shrubland			Thicket				
				Thickets and shrubs	Shrub			
				Shrubs and grasses				
				Hill and mountain formation (> 300)	Thicket			
					Fernland			
					Shrubs and grasses	Fernland		
3	Grassland			Along - alang (<i>Imperata cylindrica</i>)				
				Lowland formation (< 300)	Grassland	other		
				Hill and mountain formation (> 300)	Grassland			









Scale	< 1:1.000.000	1:1.000.000 - 1:250.000	1:250.000 - 1:80.000	1:80.000 - 1:25.000	> 1:25.000		
4	Wetland		Forest	Tidal, mangrove	Mangrove		
					Back mangrove		
				Riparian			
				Alluvium			
				Peat	Dense		
					Sparse		
				Forested	<i>Nypa fruticans</i> formations		
					Padang (low forest on peat) formations		
					Logged over forest	Industrial logging	
						Local logging	
					High secondary forest		
					Low secondary forest	<i>Melaleuca cajupati</i> formations	
						other	
				Vegetated, non-forested formation		Thickets and shrubs	Alluvium
							Peat
					Shrub and grasses		Alluvium
							Peat
					Grassland or fenlands	Alluvium	
		Peat					
Non vegetated		Tidal flats					
		Other					
5	Agriculture		Plantation	Hevea			
				Oil palm			
				Damar tree			
				Pine tree			
				Tea			
				Orchards, mixed garden			
				Secondary growth and cultivation mosaics	Coffee		
					Clove		
					Cinnamon		
					Rubber (small holders)		
				Cropland	Burnt areas (shifting cultivation)		
					Permanent food crops		
					Paddy fields	Irrigated	
						Rainfed	
						Tidal	
6	Water	Lakes					
		Ponds	Fishponds				
		Rivers, streams					
		Estuaries					

Scale	< 1:1.000.000	1:1.000.000 - 1:250.000	1:250.000 - 1:80.000	1:80.000 - 1:25.000	> 1:25.000
7	Barren land	Beaches			
		Mudflats			
		Bare soil			
		Exposed rocks			
8	Urban or built up	Cities			
		Settlements, villages			

Annex 2.

An example of default styles of vegetation cover class and the style layer descriptor (sld) to represent the styles.

Style name	Existing vegetation cover level 1
Default style	Yes
Style abstract	Depending on the value of the data attribute, existing land cover objects can be filled with a colour and a black line around the boundaries. Colour can be styled using a combination of red, green and blue values or by using the hexadecimal code.

Land cover level 1	Colour mixing			Colour	Hex code
	Red	Green	Blue		
Forest	000*	166	000*		#00a600
Shrubland	172	000*	000*		#ac0000
Grassland	204	242	077		#ccf24d
Wetland	166	166	255		#a6a6ff
Agriculture	242	166	077		#f2a64d
Water	000	204	242		#00ccf2
Barren land	204	204	204		#cccccc
Built up area	230	121	155		#e6799b

Note: * 000 in the colour mixing means zero levels of that colour

Some data producers may be willing to make adjustments to the above colour chart in order to provide a better interpretation of the different land cover at first sight. These adjustments should be as limited as possible.

Style name	Existing vegetation cover level 1
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Symbology and example of data portrayal

A sample of the style layer descriptor (SLD) specifying how symbology can be expressed, as below:

```
<?xml version="1.0" encoding="UTF-8"?>
<StyledLayerDescriptor xmlns="http://www.opengis.net/sld" xmlns:gml="http://www.opengis.net/gml"
xmlns:sld="http://www.opengis.net/sld" version="1.0.0" xmlns:ogc="http://www.opengis.net/ogc">
  <UserLayer>
    <sld:LayerFeatureConstraints>
      <sld:FeatureTypeConstraint/>
    </sld:LayerFeatureConstraints>
    <sld:UserStyle>
      <sld:Name>rec_2019</sld:Name>
      <sld:FeatureTypeStyle>
        <sld:Rule>
          <sld:RasterSymbolizer>
            <sld:Opacity>0.427</sld:Opacity>
            <sld:ChannelSelection>
              <sld:GrayChannel>
                <sld:SourceChannelName>1</sld:SourceChannelName>
              </sld:GrayChannel>
            </sld:ChannelSelection>
            <sld:ColorMap type="values">
              <sld:ColorMapEntry quantity="1" label="Water" color="#00ccf2"/>
              <sld:ColorMapEntry quantity="2" label="Agriculture" color="#f2a64d"/>
              <sld:ColorMapEntry quantity="3" label="Grassland" color="#ccf24d"/>
              <sld:ColorMapEntry quantity="4" label="Shrubland" color="#ac0000"/>
              <sld:ColorMapEntry quantity="5" label="Forest" color="#00a600"/>
            </sld:ColorMap>
          </sld:RasterSymbolizer>
        </sld:Rule>
      </sld:FeatureTypeStyle>
    </sld:UserStyle>
  </UserLayer>
</StyledLayerDescriptor>
```



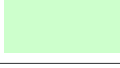












This SLD is distributed in a separate file

Map Scale

< 1: 1,000,000

Annex 3.

Here is an example of the adjustments to the class of vegetation cover styles based on the default styles and the style layer descriptor (sld) to represent the styles in the geoportal.

Style name	Existing land cover level 2					
Default style	No					
Style abstract	<p>Depending on the value of the data attribute, existing land cover objects can be filled with a colour and a black line around the boundaries. The colour can be adjusted from the colour chart of existing land cover level 1 with limitations. For example, a forest area may be differentiated from hill forest and lowland forest and barren land may be differentiated from other forms, etc.</p> <p>The possible adjustments are given below:</p>					
	Land cover level 2	RGB mixture			Colour	Hex code
		Red	Green	Blue		
	1. Forest	000*	166	000*		#00a600
	1.1. Hill forest	077	255	000*		#4dff00
	1.2. Lowland forest	204	255	204		#ccffcc
	2. Shrubland	172	000	000*		#ac0000
	3. Grassland	204	242	077		#ccf24d
	4. Wetland	166	166	255		#a6a6ff
	4.1. Wetland forested	230	230	255		#e6e6ff
	5. Agriculture	242	166	077		#f2a64d
	5.1. Oil palm plantation	242	166	150		#f2a696
	6. Water	000*	204	242		#00ccf2
	6.1. Lakes	128	242	230		#80f2e6
	7. Barren land	204	204	204		#cccccc
	7.1. Beaches	230	230	230		#e6e6e6
	8. Built up area	230	121	155		#e6799b
	8.1. Settlement	255	166	255		#ffa6ff

Note: * 000 in the colour mixing means zero levels of that colour

Style name	Existing land cover level 2
Symbology and example of data portrayal	<p>A sample of the style layer descriptor (SLD) specifying how symbology can be expressed, as below:</p> <pre data-bbox="384 203 1492 1144"> <?xml version="1.0" encoding="UTF-8"?> <StyledLayerDescriptor xmlns="http://www.opengis.net/sld" xmlns:gml="http://www.opengis.net/gml" xmlns:sld="http://www.opengis.net/sld" version="1.0.0" xmlns:ogc="http://www.opengis.net/ogc"> <UserLayer> <sld:LayerFeatureConstraints> <sld:FeatureTypeConstraint/> </sld:LayerFeatureConstraints> <sld:UserStyle> <sld:Name>rec_2019</sld:Name> <sld:FeatureTypeStyle> <sld:Rule> <sld:RasterSymbolizer> <sld:Opacity>0.427</sld:Opacity> <sld:ChannelSelection> <sld:GrayChannel> <sld:SourceChannelName>1</sld:SourceChannelName> </sld:GrayChannel> </sld:ChannelSelection> <sld:ColorMap type="values"> <sld:ColorMapEntry quantity="1" label="Water" color="#00ccf2"/> <sld:ColorMapEntry quantity="2" label="Agriculture" color="#f2a64d"/> <sld:ColorMapEntry quantity="3" label="Grassland" color="#ccf24d"/> <sld:ColorMapEntry quantity="4" label="Shrubland" color="#ac0000"/> <sld:ColorMapEntry quantity="5" label="Forest" color="#00a600"/> <sld:ColorMapEntry quantity="6" label="Lake" color="#80f2e6"/> <sld:ColorMapEntry quantity="7" label="Palm oil plantation" color="#f2a696"/> <sld:ColorMapEntry quantity="8" label="Beaches" color="#e6e6e6"/> <sld:ColorMapEntry quantity="9" label="Settlement" color="#ffa6ff"/> <sld:ColorMapEntry quantity="10" label="Lowland Forest" color="#ccffcc"/> </sld:ColorMap> </sld:RasterSymbolizer> </sld:Rule> </sld:FeatureTypeStyle> </sld:UserStyle> </UserLayer> </StyledLayerDescriptor> </pre> <p>This SLD is distributed in a separate file</p>
Map Scale	1: 1,000,000 – 1:250,000