QGIS MAP DESIGN

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by Anita Graser and Gretchen N. Peterson

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Foreword

QGIS has come a long way in its fourteen years of life. From humble beginnings as a mere data viewer, it now provides a vast array of GIS functionality, tool integration, extensible plugins, and—cartographic capability.

Slighted in years past for its inability to make a "pretty" map, QGIS now boasts a hefty complement of features that move it to the forefront. In this book, Anita and Gretchen have put together an impressive set of recipes that will help you not only learn new techniques, but really bump up the quality of your maps.

The recipes in the book are tailored for use with the QGIS Long Term Release (LTR), version 2.14. You'll also need a basic familiarity with QGIS, as the authors jump right in to the cartographic waters.

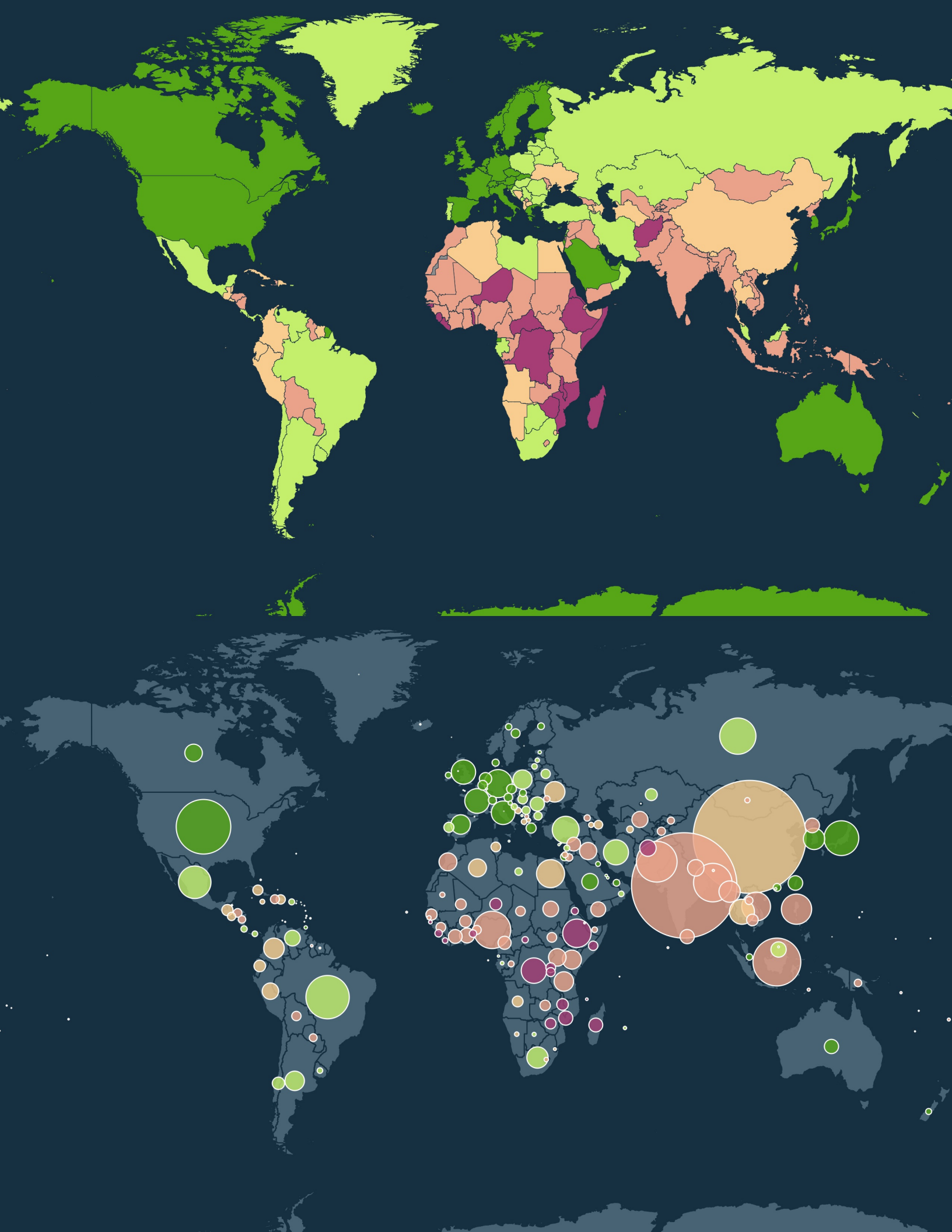
I know you'll learn a lot from the techniques presented within, and be able to adapt and evolve them to get the most out of your mapping projects.

I hope you enjoy the book!

Founder of QGIS / Publisher at Locate Press LLC

Part 1

Layer Styling



1. Mapping Economies Using GDP Choropleths or Scaled Symbols

In this recipe, we create a classed choropleth map illustrating the per capita gross domestic product (GDP) of the countries of the world.

> To reproduce this map in QGIS, open the `choropleth_gdp.qgs` project.

1.1 Introduction to Classed Choropleth Maps

Choropleths are a type of thematic map in which areas are shaded or patterned in proportion to a numerical attribute representing a rate or ratio, such as population density or per capita income. Never use choropleths for raw data or counts, such as country population or total GDP. Converting raw data and counts to rates, such as population per area unit or GDP per capita, is necessary, otherwise, all your map would show is that, on average, bigger countries have more inhabitants and a higher GPD than smaller countries.

A general rule of thumb is to stick to three to seven classes for classed choropleth maps. In this recipe, we use five classes to categorize the countries.

1.2 Exploring the Dataset

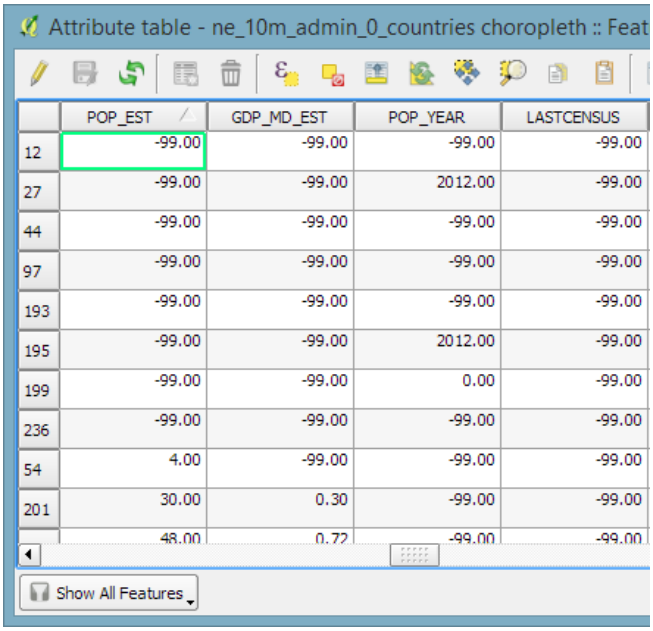
For this map, we load the:

`ne_10m_admin_0_countries.shp`

shapefile into QGIS.

This dataset contains data about country GDP (attribute `GDP_MD_EST` in million US Dollars) and population (attribute `POP_EST`). As shown in Figure 1.1, `GDP_MD_EST` ranges from `-99` (unknown value) to `15094000` for the USA and similarly `POP_EST` ranges from `-99` (unknown value) to `1338612968` for China. For our choropleth map, we use these two attributes to compute the GDP per capita:

```
GDP_MD_EST / POP_EST * 1000000
```



	POP_EST	GDP_MD_EST	POP_YEAR	LASTCENSUS
12	-99.00	-99.00	-99.00	-99.00
27	-99.00	-99.00	2012.00	-99.00
44	-99.00	-99.00	-99.00	-99.00
97	-99.00	-99.00	-99.00	-99.00
193	-99.00	-99.00	-99.00	-99.00
195	-99.00	-99.00	2012.00	-99.00
199	-99.00	-99.00	0.00	-99.00
236	-99.00	-99.00	-99.00	-99.00
54	4.00	-99.00	-99.00	-99.00
201	30.00	0.30	-99.00	-99.00
	48.00	0.72	-99.00	-99.00

Figure 1.1: GDP and population values

To create our choropleth map, we need to deal with the -99 (unknown) values. Additionally, we need to deal with outliers in our data with extraordinarily high GDP per capita, such as, the Vatican and Antarctica. A great way to visualize the distribution of values is the Histogram feature built into the Graduated renderer interface shown in Figure 1.2, on the next page.

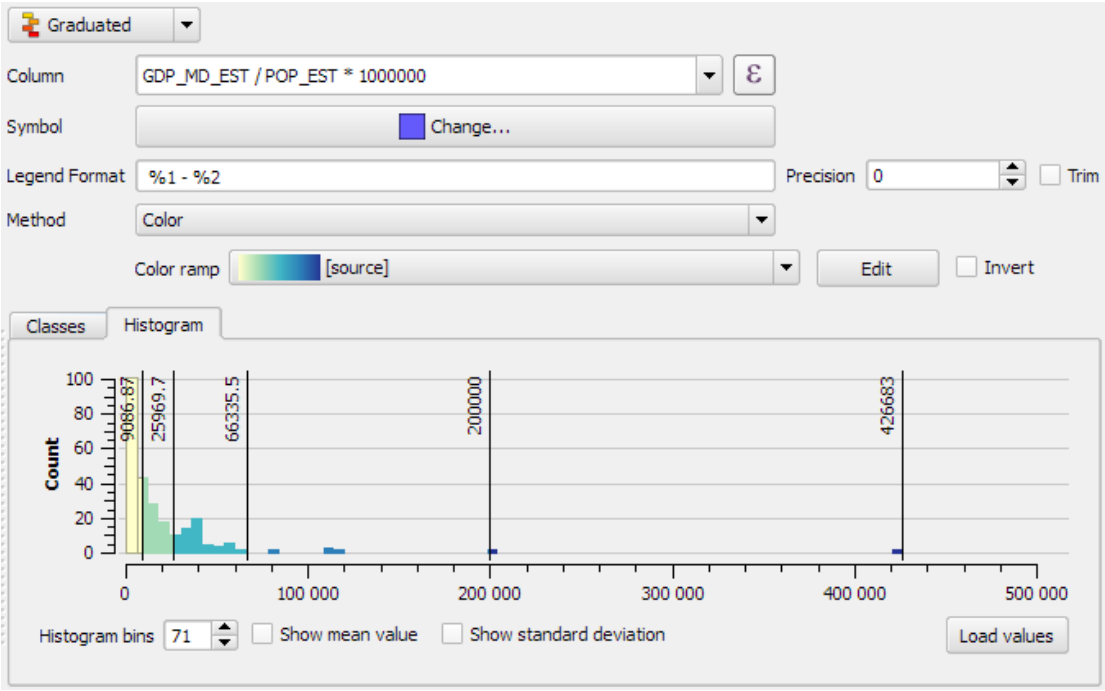


Figure 1.2: The histogram in the Graduated renderer interface visualizes the value distribution

1.3 Setting Up a Classed Choropleth Map

The outliers in our data throw off the automatic classification algorithms, such as Natural Breaks, which is often recommended for choropleth maps. Instead of relying on the automatic classification, we therefore define the classes manually. This gives us much more control over how things are classified. Since we also need to deal with the `-99` (unkown) values, we create a Rule-based renderer instead of a simple Graduated renderer.

The colors used in this recipe are based on a color ramp from Petersons's book "GIS Cartography", from top down: `#a63e75`, `#eaa28a`, `#f9cd90`, `#c4ef6d`, and `#56a617`. The nodata color is `#8d8d8d` and the map background is `#163041`).

To draw the countries with unknown GDP per capita in gray, we create a no data rule. Press the green Add rule button below the rule list to create a new rule and enter the following expression in the rule filter:

```
NOT (GDP_MD_EST > 0 AND POP_EST > 0)
```

Once the no data rule is set up, all other countries will fit the data rule, which is defined using the expression:

```
GDP_MD_EST > 0 AND POP_EST > 0
```

We then divide the countries into five classes: under 1000, 5000, 10000, 20000 and, over 20000 Dollars. To create these classes, we can use the Refine current rule | Add ranges to rule functionality in the rule's context menu shown in Figure 1.3.

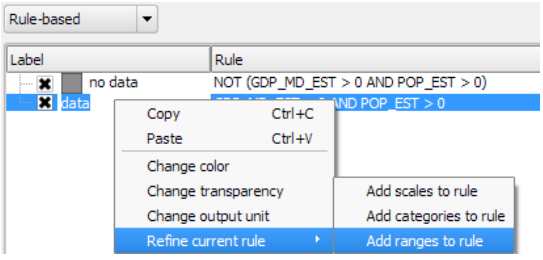


Figure 1.3: Refine the data rule

This opens a Refine a rule to ranges dialog (as shown in Figure 1.4, on the next page) where we can create classes with the same user interface we already know from the Graduated renderer. Use the expression that calculates the GDP per capita and press Classify. Afterwards, just edit the class bounds and colors.

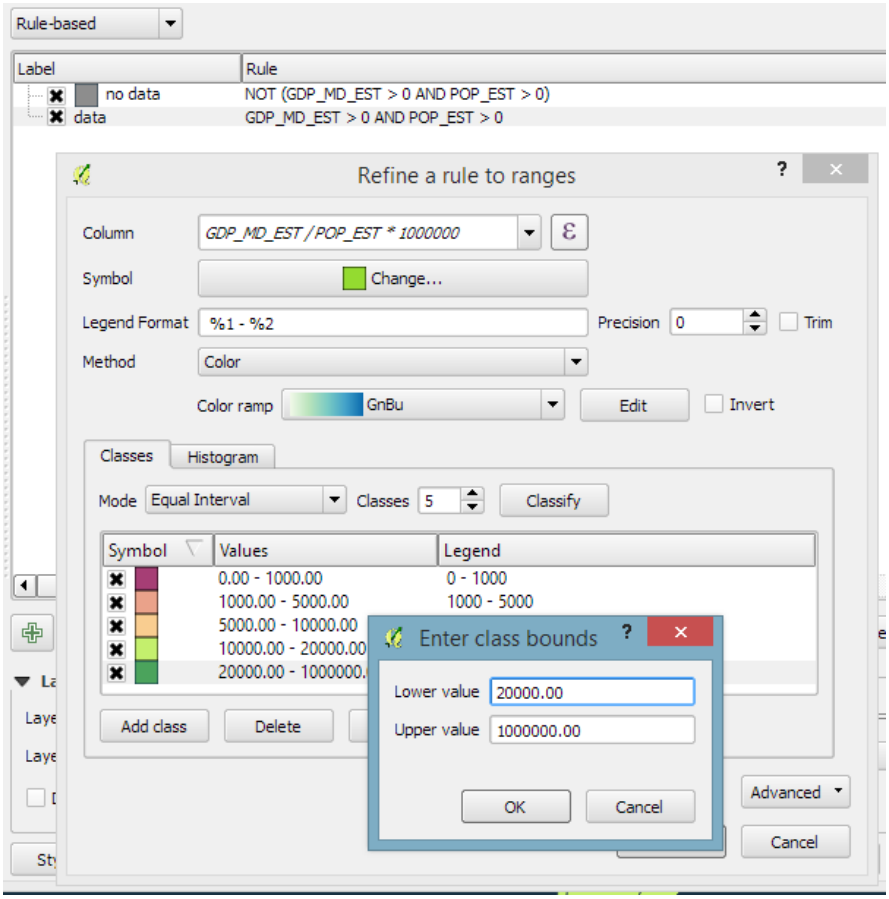


Figure 1.4: Customize the classes to your liking

With a little cleaning, the rule for "under 1000 Dollars" looks like this:

```
GDP_MD_EST / POP_EST * 1000000 > 0 AND
GDP_MD_EST / POP_EST * 1000000 <= 1000
```

The complete set of rules with manually edited labels is shown in Figure 1.5, on the following page.

Figure 1.6, on the next page shows the finished map in World Gall Stereographic (EPSG 54016) projection. One issue with this approach is that big countries and those further away from the equator appear more prominently on the map, irrespective of the number of people that are affected. In the second part of this recipe, we will address this issue using scaled circle symbols.

1.4 Scaled Circle Symbols

Using circle symbols, we visually relate the GDP per capita to the affected population instead of the affected area. This map design combines a clean global countries map in a uniform color with colorful circles, which are created using the Diagrams functionality in the Layer Properties. We use the same five-entry classification as in the classed choropleth map in order to keep the resulting maps comparable.

It is useful to customize the rule labels in the renderer dialog because this way the rules will be labeled correctly in the layer list as well as in print map legends.

First, make sure the Diagram type is set to Pie chart. Then, we configure the diagram size. To scale the diagram size according to the affected population, we use the Scaled size option configured to the `POP_EST` attribute, as shown in Figure 1.7, on the following page.

Next, we want to make sure that all country diagrams are shown. To do this, activate the

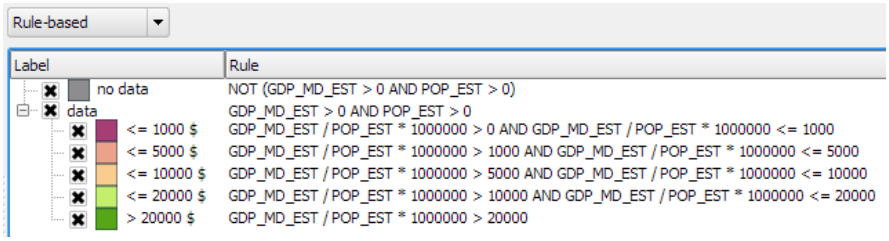


Figure 1.5: Complete set of rules for the choropleth map

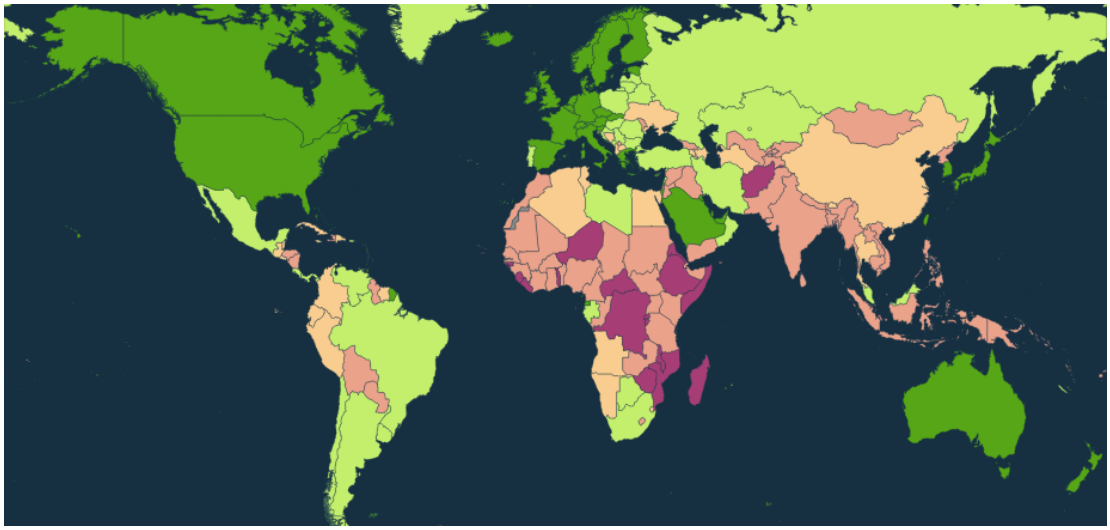


Figure 1.6: Final choropleth map

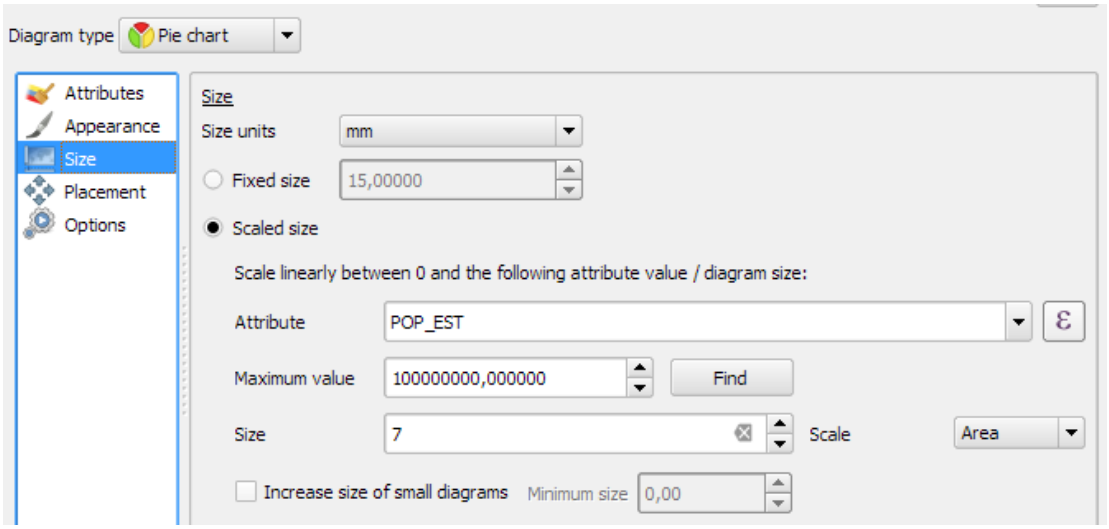


Figure 1.7: Diagram size scales with population

Show all diagrams option in the Appearance section. In addition, we set the Placement to Over Centroid (as shown in Figure 1.8) to ensure that diagrams are placed at a location that is easy to associate with the corresponding country.

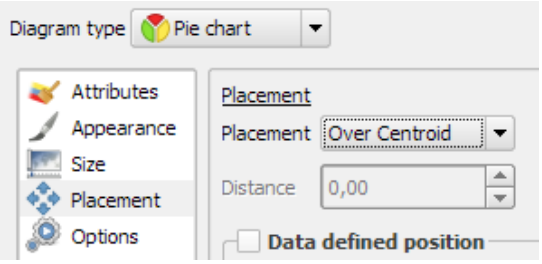


Figure 1.8: Place the diagrams on the country centroids

So far, these settings place an empty circle diagram (black outline only) into each country feature. In order to control the diagram fill color, we use the rule expressions we created for the choropleth map in the first part of this recipe. To add these expressions to the pie chart settings, as shown in Figure 1.9, on the following page, press the Add expression button. This opens the expression builder dialog where we can enter our expressions, such as:

```
GDP_MD_EST / POP_EST * 1000000 > 20000
```

for the highest GDP per capita class. To finish the configuration, we need to add the expressions, adjust the colors and customize the legend labels.

Once all five expressions are added, the diagrams will be filled with our class colors as shown in Figure 1.10, on the next page. The diagram placement algorithm makes sure that smaller diagrams are drawn on top of larger diagrams.

To finish the style, change the diagram Line color to white and set the Transparency to 20% to make underlying country features shine through. The country features themselves are styled with a simple Single Symbol renderer in a neutral color.

This way of representing GDP per capita provides a much clearer perspective on the global economic situation and the affected population than the default choropleth map could provide.

This recipe uses diagrams rather than a centroid fill because currently the centroid fill renderer puts a centroid marker into each part of the multipart polygon.

The country color on this map is #486373.

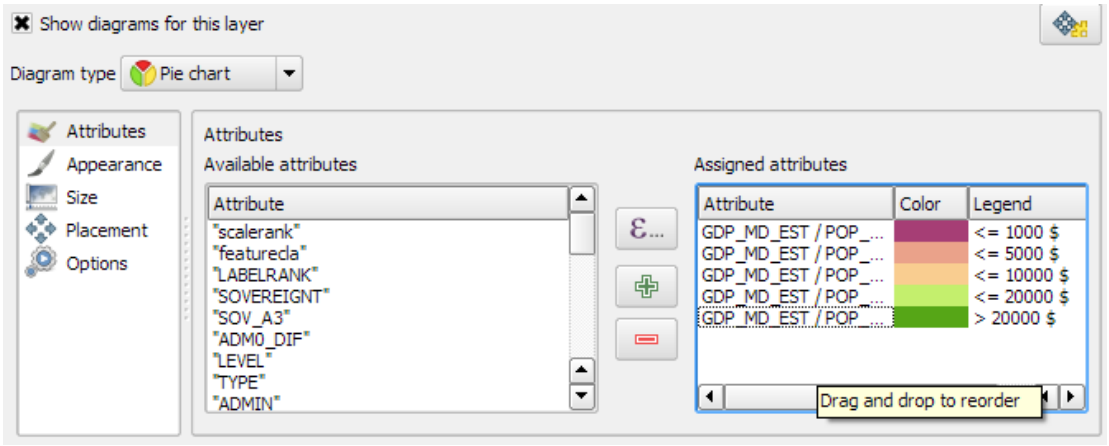


Figure 1.9: Diagram color depends on GDP per capita

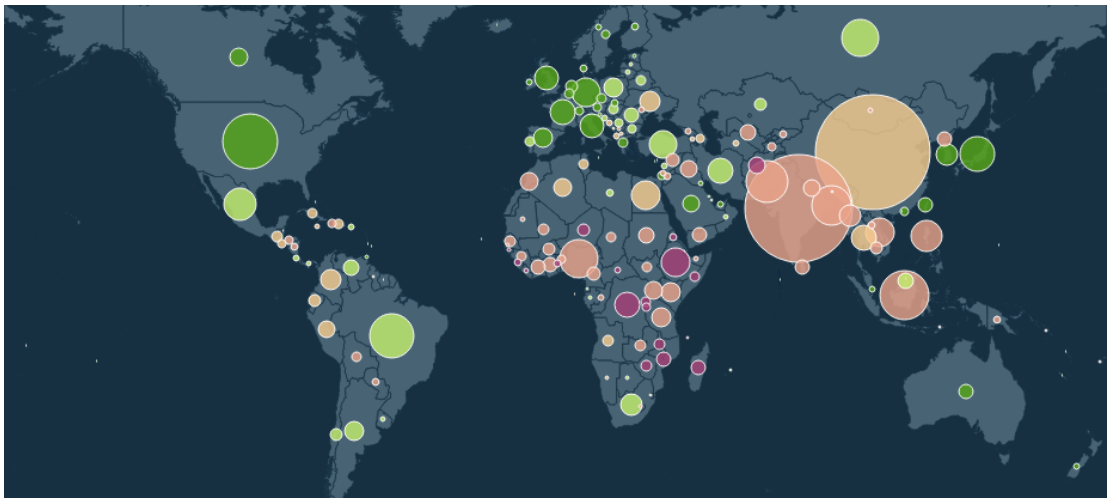


Figure 1.10: Final map with scaled circle symbols

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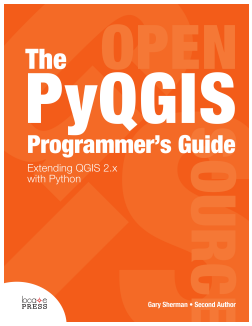
The PyQGIS Programmer's Guide is compatible with the version 2.0 API released with QGIS 2.x. All code samples and data are freely available from the book's website. Get started learning PyQGIS today!



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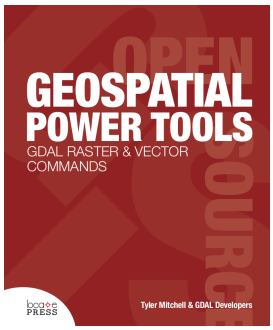

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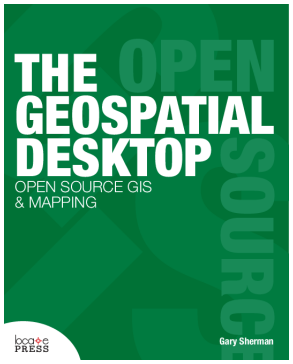

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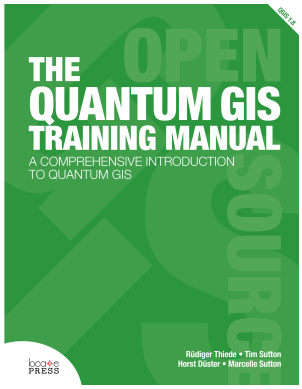
Works with QGIS 1.8



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