

# Identifying changes in longitudinal or latitudinal dispersion of the world population between 1950 and 2100

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*Report Applied Scripting*  
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The script can display the population for different years per longitude or latitude degree. This can be done as a percentage of the total world population for that year or as a total number of world citizens for that degree. The script allows overlays of multiple years for comparison. The purpose of the script is to visualize the geographical allocation of the world population and changes in the total population number and allocation.

The look of the output and an understanding of what the data shows feels very natural and it can be a great way of visualization in discussions that touch the subject of world population changes.

## Project Source Data

- Population data for countries of the world between 1950 and 2100<sup>1</sup>
  - Attributes of population per year between 1950 and 2100
  - ISO country code
- Shapefile with polygons of countries of the world, with ISO<sup>2</sup>
  - ISO country code
  - Area per polygon (Area per country, FAO statistics)

The population data is a small csv-file and is downloaded together with the script. The zip-file containing the Shapefile is downloaded and unpacked in the script in the folder where the scripts can be found.

User input parameters:

Latitude or Longitude (orient). This configures if the data visualization shows the population per longitude or latitude degree.

Percentage or Total (SettingY). This configures if the data visualization shows the population per degree as a percentage of the total population of the world for that year or as a total number of people per degree for that year.

Years (years). A vector that includes all years that the user wants the population to have displayed.

## Data processing

The attribute of population for the chosen years is converted to numerical data and joined to the SpatialPolygonsDataFrame. The population data is converted to average population per square kilometre per country .

The SPDF is rasterized for 360 cells wide (degrees longitude) and 180 cells long (degrees latitude). The value of the raster is the population per square kilometre. When multiple polygons are found within one raster the average value is used.

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<sup>1</sup> Source: United Nations, Department of Economic and Social Affairs, Population Division: World Population Prospects DEMOBASE extract. 2011:  
<https://docs.google.com/spreadsheets/ccc?key=0AonYZs4MzIZbcGhOdG0zTG1EWkVOB3FVbVRpa0Y5REE>

<sup>2</sup> Source: [http://thematicmapping.org/downloads/world\\_borders.php](http://thematicmapping.org/downloads/world_borders.php)

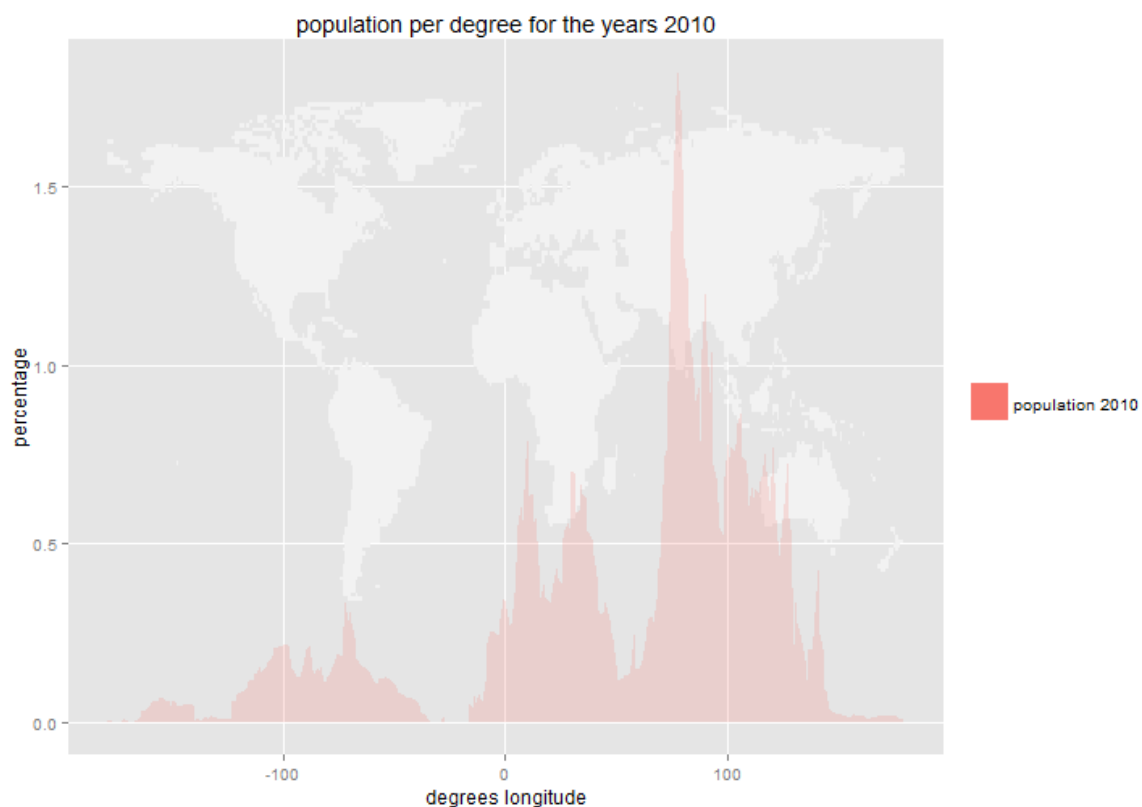
This is done for every chosen year. The population density value is multiplied by the average number of kilometres per raster cell to get the total number of people per raster cell. When the user has selected that the data will be displayed as a percentage, the value per raster is divided by the sum of the raster and multiplied by 100.

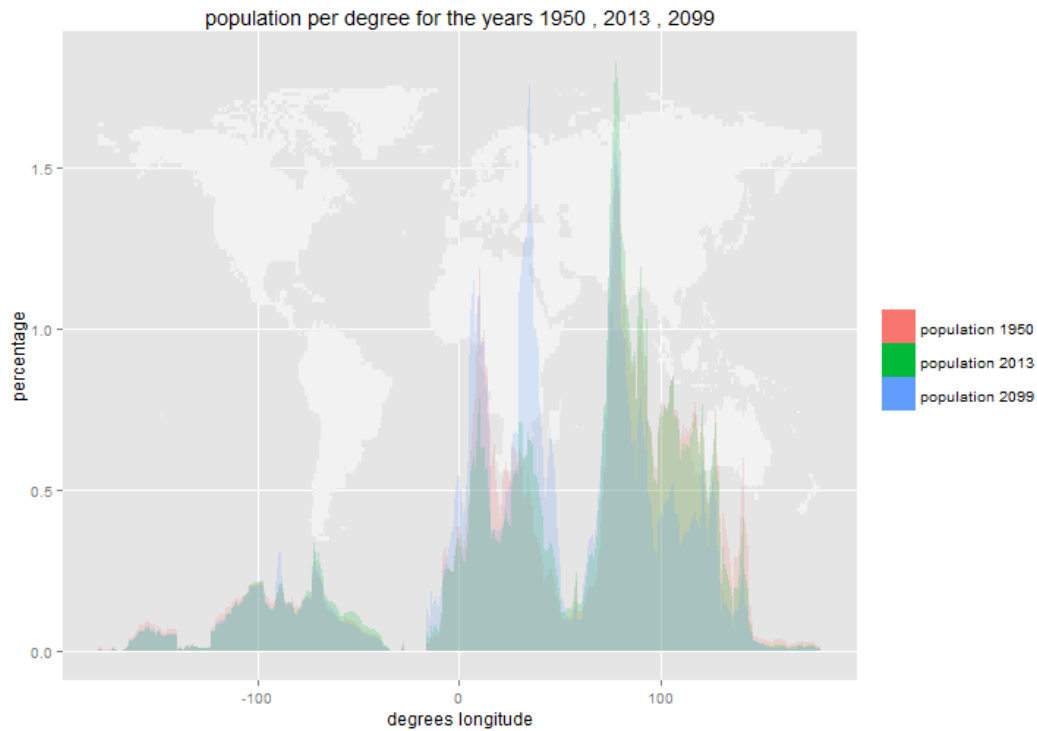
Then, depending on the input of the user, the total value per row (latitude) or per column (longitude) is calculated for every raster. All these vectors are merged into one DataFrame, converted to a DataFrame format that can be read by the ggplot2 package and visualized by plotting the data as a geom\_area object over the world raster as a background.

### Used skills learned during lessons:

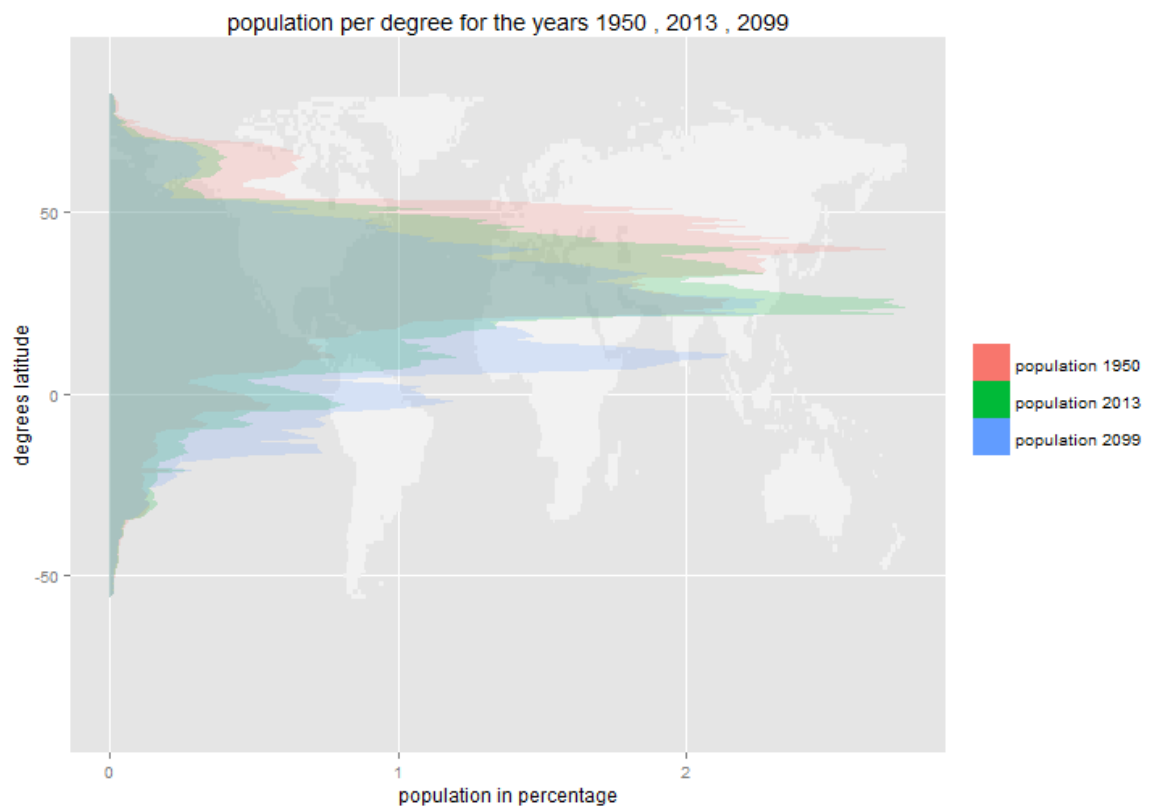
- Building functions for converting factor to numerical data, also using string-formatting for installing packages and loading packages only when needed, etc.
- Handling Spatial Polygon data (retrieving the data from the SPDF)
- Handling Raster data (using the rasterize function, calculation of raster values)
- Creating Graphical output (using many functions of ggplot2)
- Automatically download –and unzip– data

### Output





Observe that the prognosis of the UN is that the population in the longitude area of China will probably decrease. Also, the relative population in mid-Africa or Europe has decreased since 1950.



From this plot it is clear that the population has and will continue to move south over the years.