Introduction to R

Creating maps

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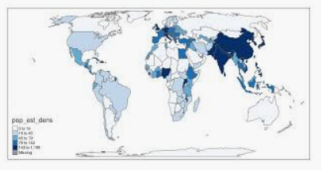
03 März, 2020

The package `tmap`

```
library(tmap)
```

cartography | earthquake | leaflet | bubble | legend | raster | shape | crimes | animated | plot | lines | e walker | london | thematic | mapping | interactive



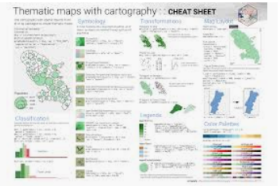
SpatialControl » tmap R package
spatcontrol.net

Mapping to a 't'(map) | R-bloggers
r-bloggers.com

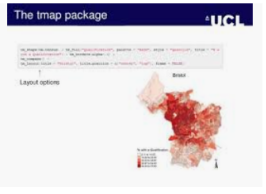
Sharon Machlis on Twitter: "New R package tm...
twitter.com

Packages to simplify mapping in R (Revolu...
blog.revolutionanalytics.com

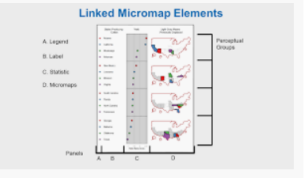
r - How to overlay point co-ordinate...
gis.stackexchange.com



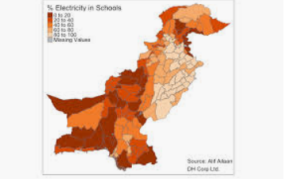
cartography package | R Documentation
rdocumentation.org



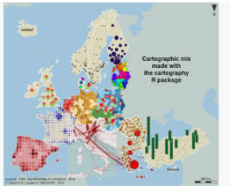
Using R to Visualize Spatial Data: R as GIS ...
slideshare.net



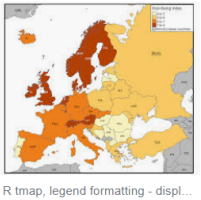
SFS GIS R | Micromap And Tmap
ryan-hill.github.io



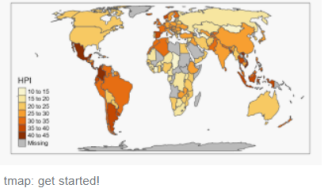
r - How to overlay point co-ordinates on tmap sh...
gis.stackexchange.com



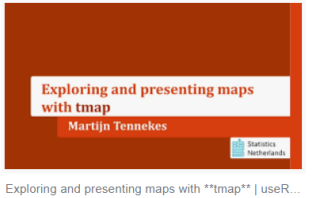
GIS with R
pakillo.github.io



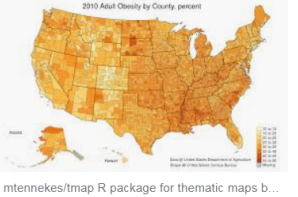
R tmap, legend formatting - displ...
stackoverflow.com



tmap: get started!
cran.r-project.org



Exploring and presenting maps with **tmap** | useR...
channel9.msdn.com



mtennekes/tmap R package for thematic maps b...
devhub.io

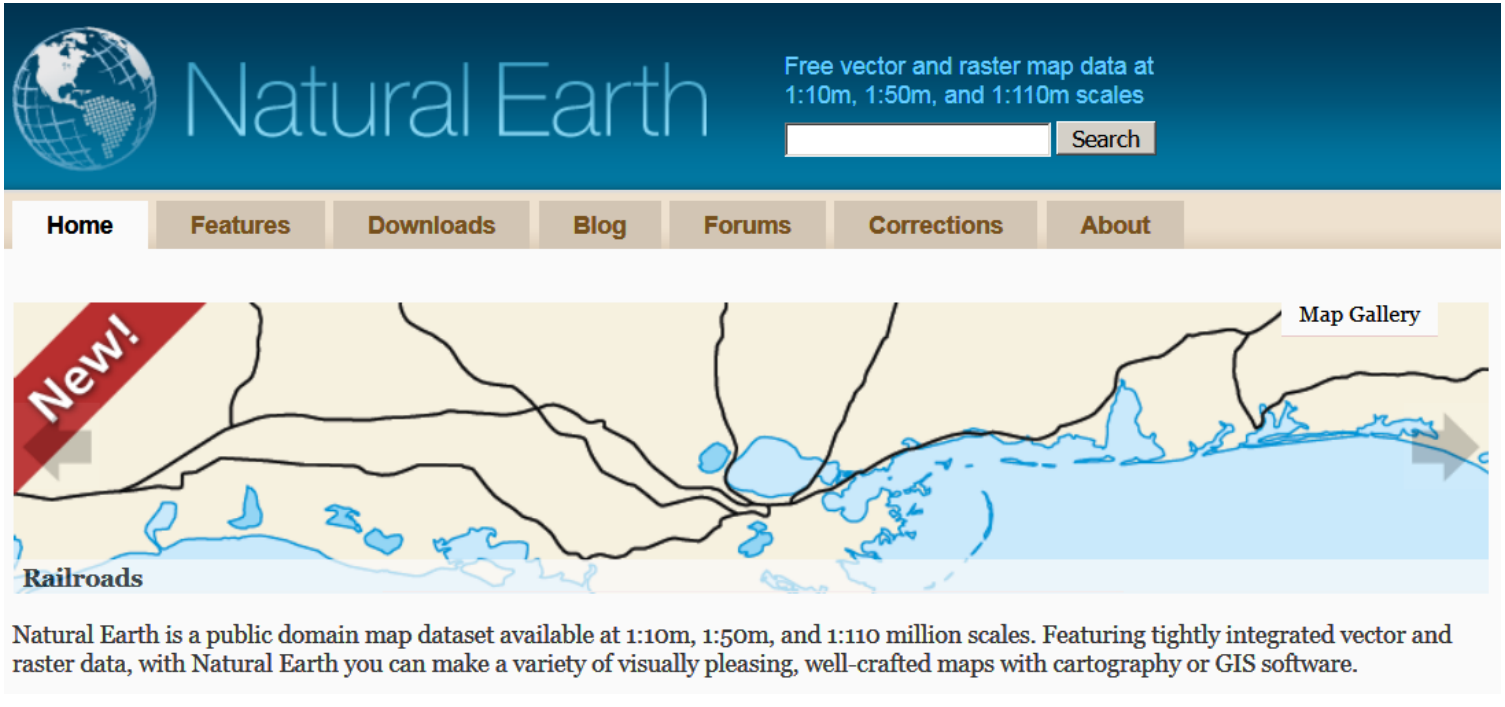
Data Viz 2: Mapping Areas and Context
alex-singleton.com

The `World` dataset

Natural Earth

- Dataset contains information from **Natural Earth**

```
data(World)
```



The `qtm` command from the `tmap` package

Fast thematic map

- With the command **qtm** you can create a fast thematic map
- Example from the **Vignette** for the `tmap` package

```
qtm(World)
```

The World-Dataset

The World Dataset in Package `tmap`

RPubs brought to you by RStudio

Show 10 entries Search:

	iso_a3	name	sovereignt	continent	subregion	area	pop_est	pop_est_dens	gdp_md_est	gdp_cap_est	economy	income_grp	life_exp	well_being	HPI
2	AFG	Afghanistan	Afghanistan	Asia	Southern Asia	652860	28400000	43.5009037159575	22270	784.154929577465	7. Least developed region	5. Low income	48.7	4.75838085759722	36.753657778004
3	AGO	Angola	Angola	Africa	Middle Africa	1246700	12799293	10.2665380604797	110300	8617.6634912569	7. Least developed region	3. Upper middle income	51.1	4.20609164016618	33.2014320444336
5	ALB	Albania	Albania	Europe	Southern Europe	27400	3639453	132.826751824818	21810	5992.65878691111	6. Developing region	4. Lower middle income	76.9	5.26893660419411	54.051180370208
8	ARE	United Arab Emirates	United Arab Emirates	Asia	Western Asia	83600	4798491	57.3982177033493	184300	38407.907819354	6. Developing region	2. High income: nonOECD	76.5	7.19680309333638	31.778274185231
9	ARG	Argentina	Argentina	South America	South America	2736690	40913584	14.9500250302373	573900	14027.1260518267	5. Emerging region: G20	3. Upper middle income	75.9	6.44106720496824	54.0550416711541
10	ARM	Armenia	Armenia	Asia	Western Asia	28470	2967004	104.215103617843	18770	6326.24694809983	6. Developing region	4. Lower middle income	74.2	4.36781129220333	46.0031857989857
12	ATA	Antarctica	Antarctica	Antarctica	Antarctica	10866664.4069415	3802	0.000349877373370556			6. Developing region	2. High income: nonOECD			
14	ATF	Fr. S. Antarctic Lands	France	Seven seas (open ocean)	Seven seas (open ocean)	6187.20529564552	140	0.0226273403435523	16	114285.714285714	6. Developing region	2. High income: nonOECD			
16	AUS	Australia	Australia	Oceania	Australia and New Zealand	7682300	21262641	2.76774416515887	800200	37634.0831790369	2. Developed region: nonG7	1. High income: OECD	81.9	7.40561614869191	41.9798119494163
17	AUT	Austria	Austria	Europe	Western Europe	82409	8210281	99.6284507760075	329500	40132.6093467446	2. Developed region: nonG7	1. High income: OECD	80.9	7.34603595780621	47.0851352018778

To get more color in the map

economic development status

```
qtm(World, fill="economy")
```

A map with text

Population

```
qtm(World, fill="pop_est", text="iso_a3")
```

This Scheme is better:

GDP

```
qtm(World, fill="gdp_cap_est", text="iso_a3",
    text.size="AREA", root=5, fill.title="GDP per capita",
    fill.textNA="Non-European countries", theme="Europe")
```

Topics of the World dataset

Available variables in the data set

- **ISO classification**
- country name
- Area, population, population density,
- **Gross Domestic Product**
- Gross domestic product **at purchasing power parities**
- Economy, income group

The World Dataset - Variables and what's behind

iso_a3 name sovereignt continent area

AFG Afghanistan Afghanistan Asia 652860.000 [km^2] AGO Angola Angola Africa 1246700.000 [km^2] ALB Albania Albania Europe 27400.000 [km^2] ARE United Arab Emirates United Arab Emirates Asia 71252.172 [km^2] ARG Argentina Argentina South America 2736690.000 [km^2] ARM Armenia Armenia Asia 28470.000 [km^2] ATA Antarctica Antarctica Antarctica 12259213.973 [km^2] ATF Fr. S. Antarctic Lands France Seven seas (open ocean) 7257.455 [km^2]

The variable `continent`

```
qtm(World, fill="continent")
```

The variable `area`

```
qtm(World, fill="area") # Russia is huge
```

Population

```
qtm(World, fill="pop_est",fill.title="Population")
```

Two maps

Population and level of development

```
tm_shape(World) + tm_fill(c("pop_est", "economy"),
        title=c("Population", "Economy"))
```

Visualize only one country

```
tm_shape(World[World$name=="Austria", ]) +
    tm_polygons()
```

Load example data

Data source Eurostat

- Data about unemployment in Europe

```
url1<-"https://raw.githubusercontent.com/Japhilko/GeoData/"
url2<-"master/2015/data/Unemployment07a13.csv"
url <-paste0(url1,url2)
Unemp <- read.csv(url)
```

An overview of the data

```
X  GEO     Val2007M12   Val2013M01
```

9316 EU28 6.9 10.9 9325 EU27 6.9 10.9 9334 EU25 6.9 11.0 9343 EU15 6.9 11.1
9352 EA 7.3 12.0 9361 EA19 7.3 12.0 9370 EA18 7.4 12.0 9379 EA17 7.4 12.0
9388 EA16 7.4 12.0 9397 EA15 7.3 12.0

Excursus: the command `match`

Create two example vectors

```
vec_a <- c("A",2,6,1,"C")
vec_b <- c(1,"C",2)
```

Bringing the two vectors together

- With the function `match` you can see which element of the first vector matches the second vector.

```
match(vec_a,vec_b)
```

```
## [1] NA  3 NA  1  2
```

Use the package `tmap` with your data

```
library("tmap")
```

Match the data

```
iso_a2<- substr(World$iso_a3,1,2)
ind <- match(iso_a2,Unemp$GEO)
World$Val2007M12 <- Unemp$Val2007M12[ind]
World$Val2013M01 <- Unemp$Val2013M01[ind]
```

Plot a map

```
qtm(World,c("Val2007M12","Val2013M01"))
```

Exercise: Visualisation of Eurostat data

First part - plot a map

- Download and import the data `unemprate_by_sex.csv` from ILIAS.
- Link the data with map data .
- Visualise the linked data in a map.

If you have that:

- Search for example **here** for datasets containing the country name and visualize the data with `tmap`.

The first law of geography (TFLG)

> "All things are related, but nearby things are more related than distant things" [Tobler, 1970]

A map of Africa

```
library(maptools)
data(wrld_simpl)
Africa <- wrld_simpl[wrld_simpl@data$REGION==2,]
plot(Africa)
```

The center of a polygon

```
library(sp)
Af <- coordinates(Africa)
plot(Africa)
points(x=Af[1,1],y=Af[1,2],col="red",pch=20)
```

Find the nearest neighbours

```
library(spdep)
Af_nb <- tri2nb(Af)
```

Neighbours for the first country:

```
Af_nb[1]
```

```
## [[1]]
## [1] 24 26 27 32 48
```

Find the neighbours

```
plot(Africa)
plot(Africa[1,],col="red",add=T)
plot(Africa[Af_nb[1][[1]],],col="orange",add=T)
```

Find ten next neighbours

```
IDs <- row.names(as(Africa, "data.frame"))
Af10_nb <- knn2nb(knearneigh(Af, k = 10), row.names = IDs)
plot(Africa)
plot(Africa[1,],col="red",add=T)
plot(Africa[Af10_nb[1][[1]],],col="orange",add=T)
```

Compute the distance

```
Af <- coordinates(Africa) # get centroid
library(raster)
pointDistance(Af[1:4,], lonlat=TRUE) # compute distance
```

```
##         [,1]    [,2]    [,3] [,4]
## [1,]       0      NA      NA   NA
## [2,] 4763231       0      NA   NA
## [3,] 2055609 2954497       0   NA
## [4,] 3484053 1295173 1839191    0
```

Calculate/draw a distance matrix

```
Dist_Af <- pointDistance(Af, lonlat=TRUE)
Af_color <- Dist_Af[,1]
Af_color <- Af_color/max(Af_color)
Af_color <- rgb(Af_color,0,0)
plot(Africa,col=Af_color)
```

Links to read on

- Raster, CMSAF and solaR

https://procomun.wordpress.com/2011/06/17/raster-cmsaf-and-solar/

- Getting rasters into shape from R

https://johnbaumgartner.wordpress.com/2012/07/26/getting-rasters-into-shape-from-r/