Nutzung von GeoDaten in den Sozialwissenschaften - Das R-Paket tmap

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Das Paket tmap

- Laden Sie das Paket tmap
- Die folgenden Beispiele sind auf der Vignette des Paketes basiert.

```
# install.packages("tmap")
library(tmap)
```

Schnelle thematische Karte

- qtm - Quick thematic map plot

https://cran.r-project.org/web/packages/tmap/vignettes/tmap-nutshell.html

```
data(Europe)
qtm(Europe)
```

Der Europa-Datensatz

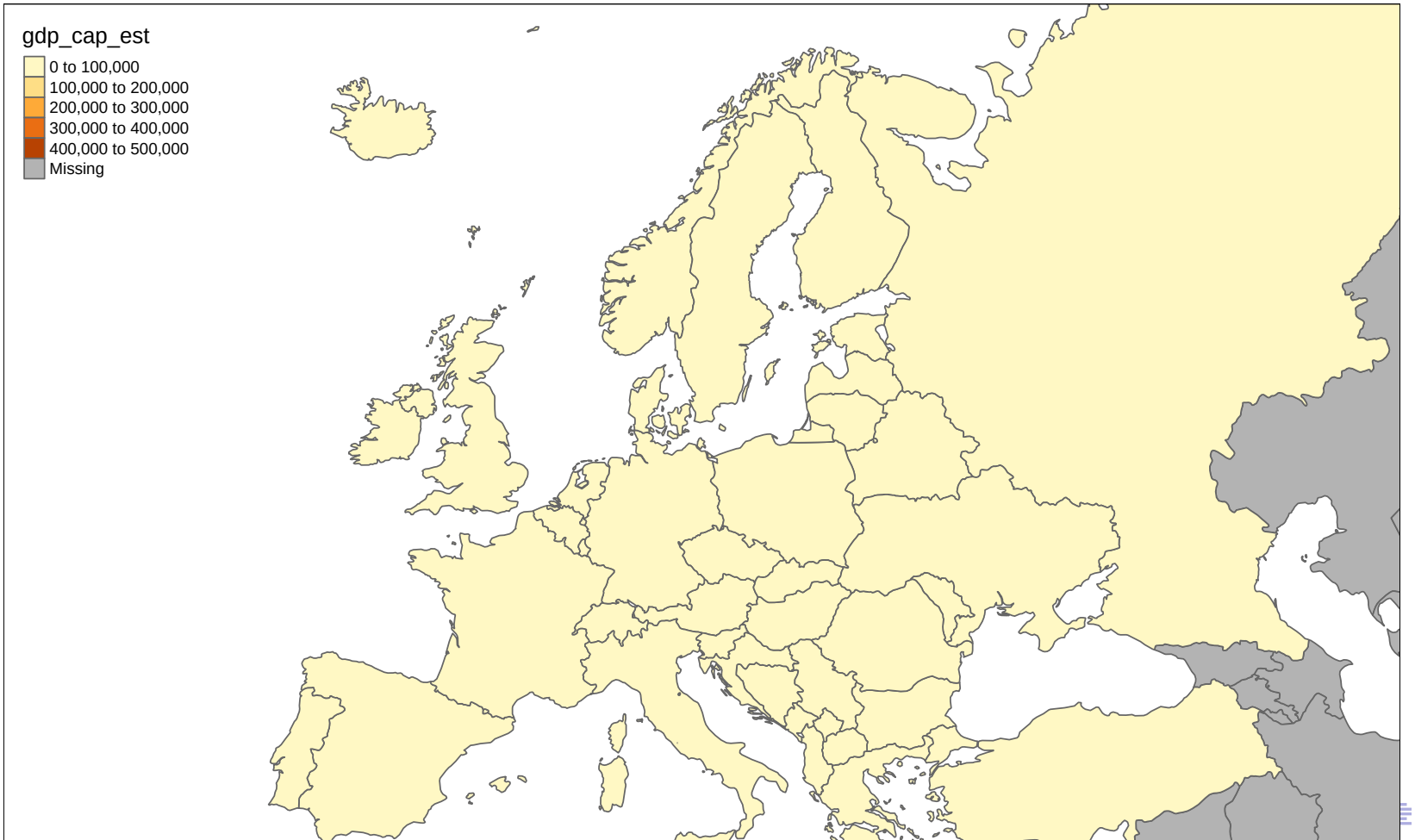
	iso_a3	name	sovereignt	continent
5	ALB	Albania	Albania	Europe
6	ALA	Aland	Finland	Europe
7	AND	Andorra	Andorra	Europe
10	ARM	Armenia	Armenia	Asia
17	AUT	Austria	Austria	Europe
18	AZE	Azerbaijan	Azerbaijan	Asia
20	BEL	Belgium	Belgium	Europe
24	BGR	Bulgaria	Bulgaria	Europe
27	BIH	Bosnia and Herz.	Bosnia and Herzegovina	Europe
29	BLR	Belarus	Belarus	Europe
40	CHE	Switzerland	Switzerland	Europe
57	CZE	Czech Rep.	Czech Republic	Europe
58	DEU	Germany	Germany	Europe
61	DNK	Denmark	Denmark	Europe
63	DZA	Algeria	Algeria	Africa
65	EGY	Egypt	Egypt	Africa

Um mehr Farbe in die Karte zu bekommen

- Visualisierung von Natural Earth Daten

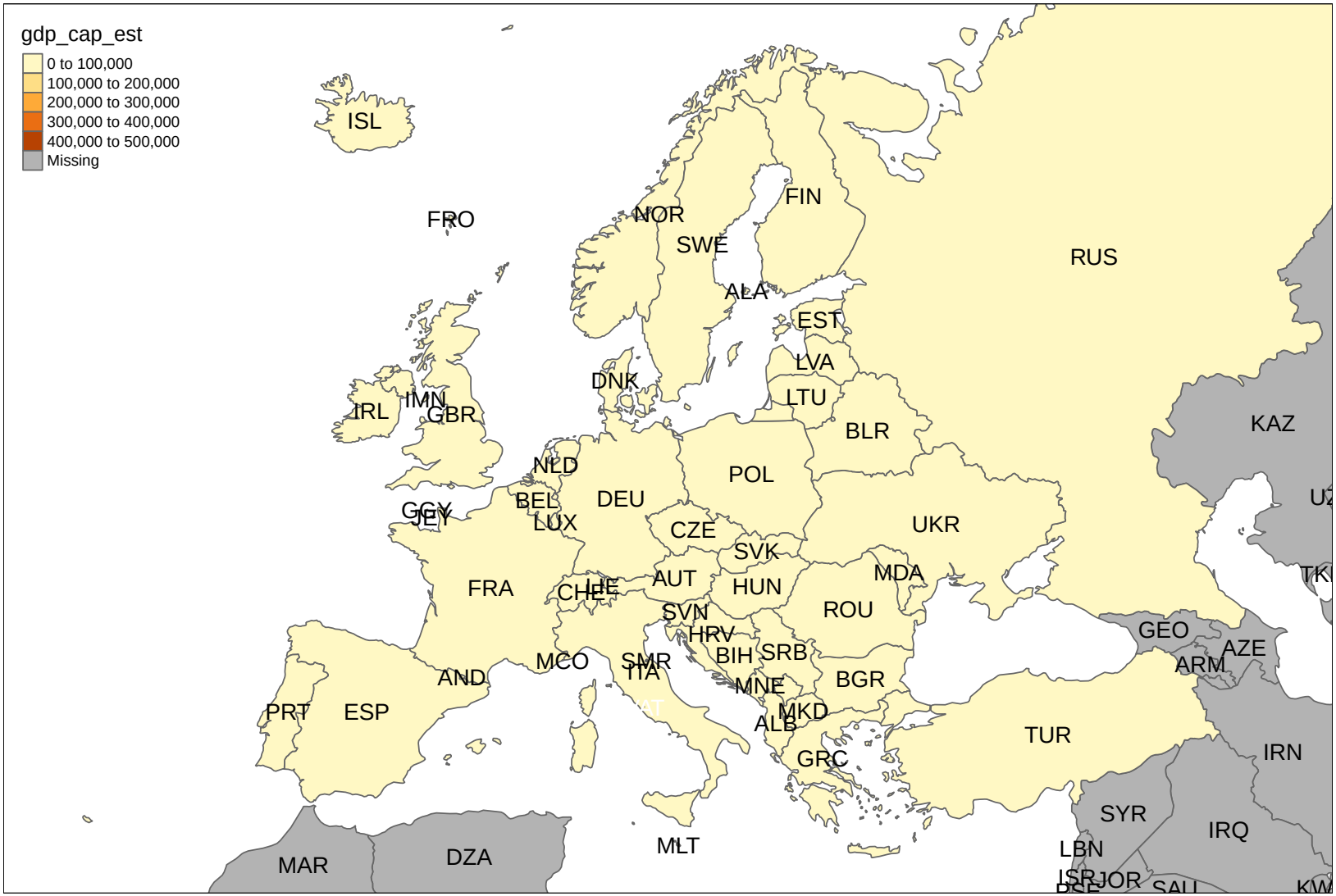
`http://www.naturalearthdata.com/`

```
qtm(Europe, fill="gdp_cap_est")
```



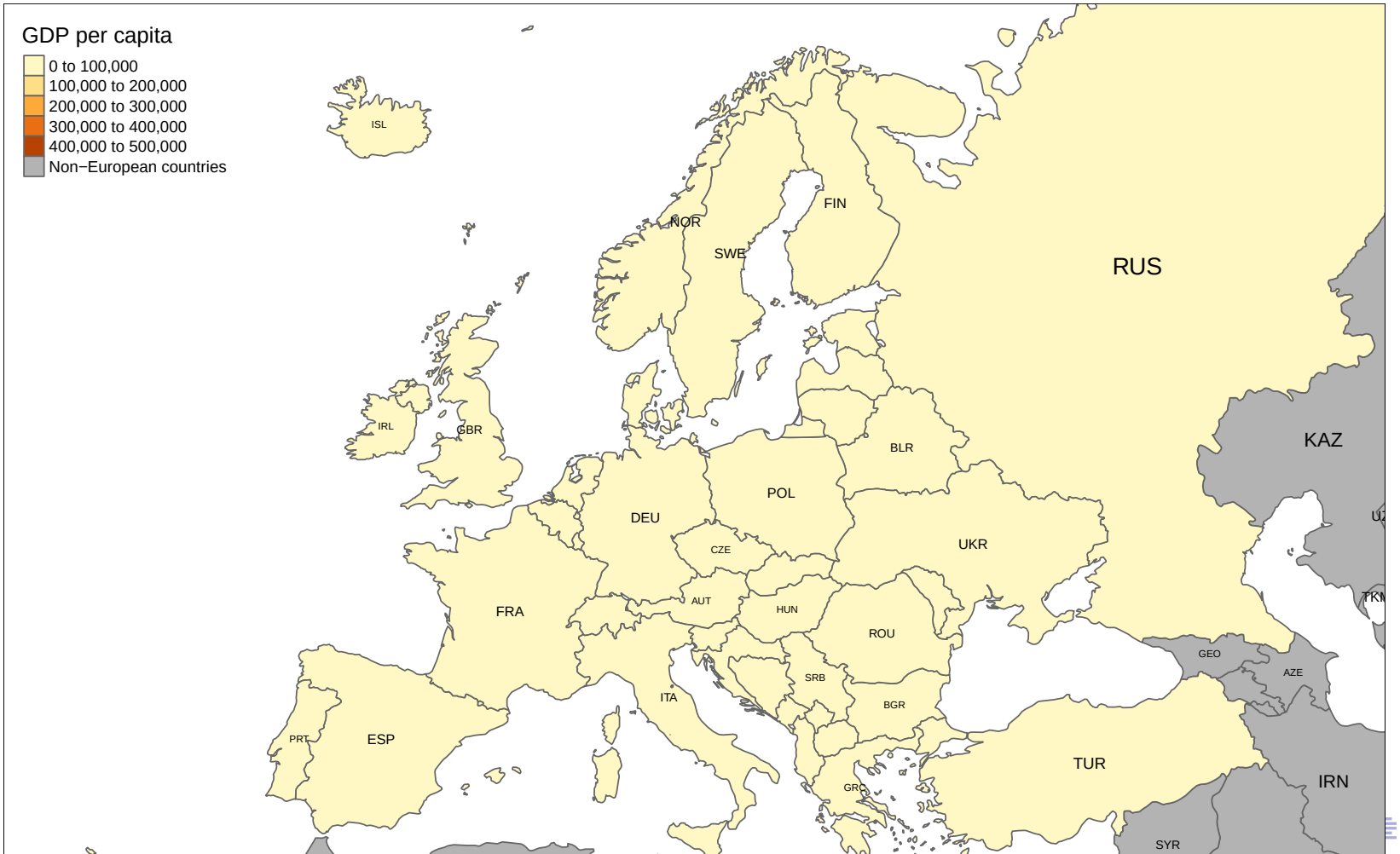
Eine Karte mit Text

```
qtm(Europe, fill="gdp_cap_est", text="iso_a3")
```



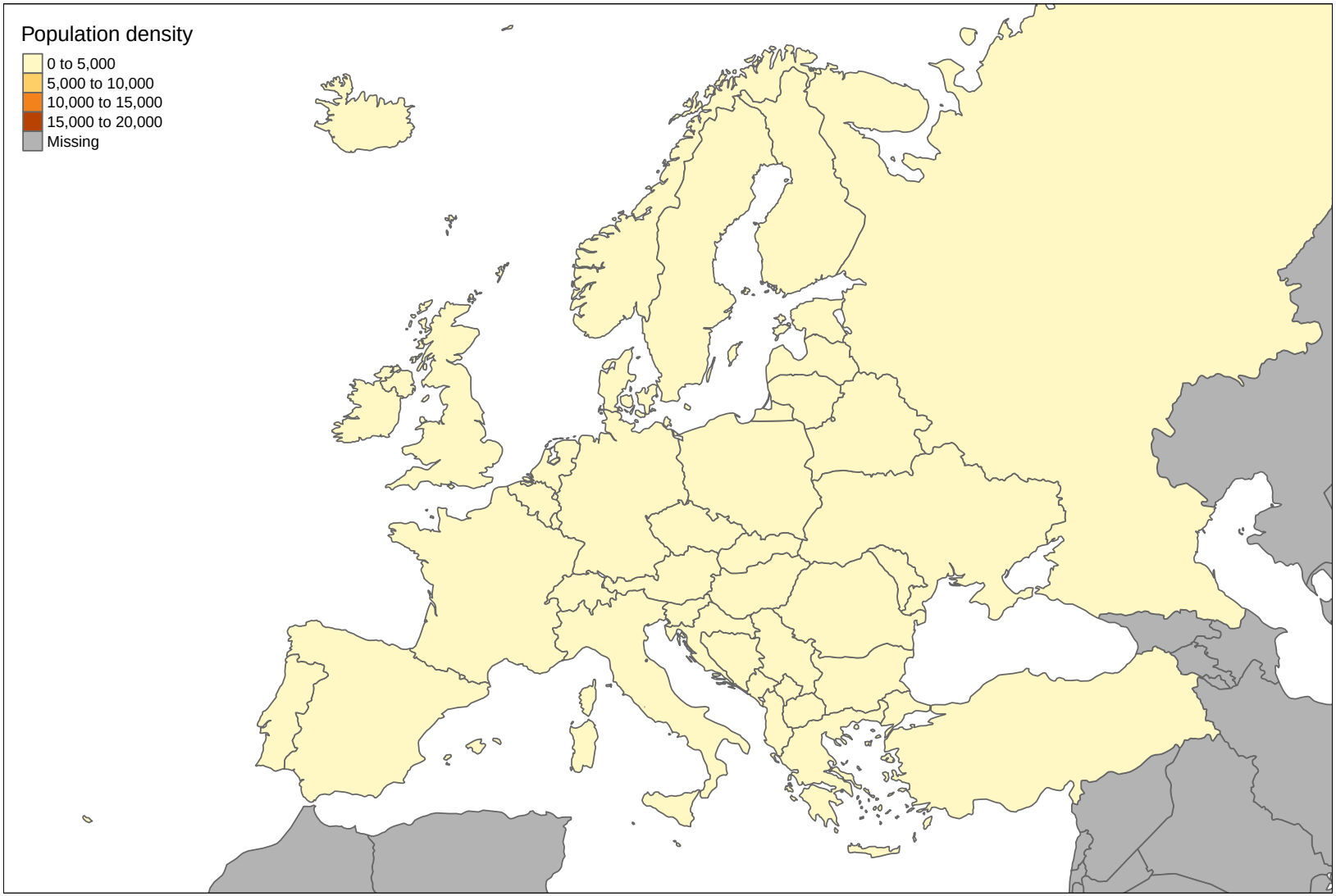
Dieses Schema passt besser:

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



Bevölkerungsdichte

```
qtm(Europe, fill="pop_est_dens", fill.title="Population den
```



Themen des Europa-Datensatzes

- ISO Klassifikation
- Ländername
- Teil Europas
- Fläche, Bevölkerung, Bevölkerungsdichte,
- Bruttoinlandsprodukt
- Bruttoinlandsprodukt zu Kaufkraftparitäten
- Ökonomie, Einkommensgruppe

Namen und Themen

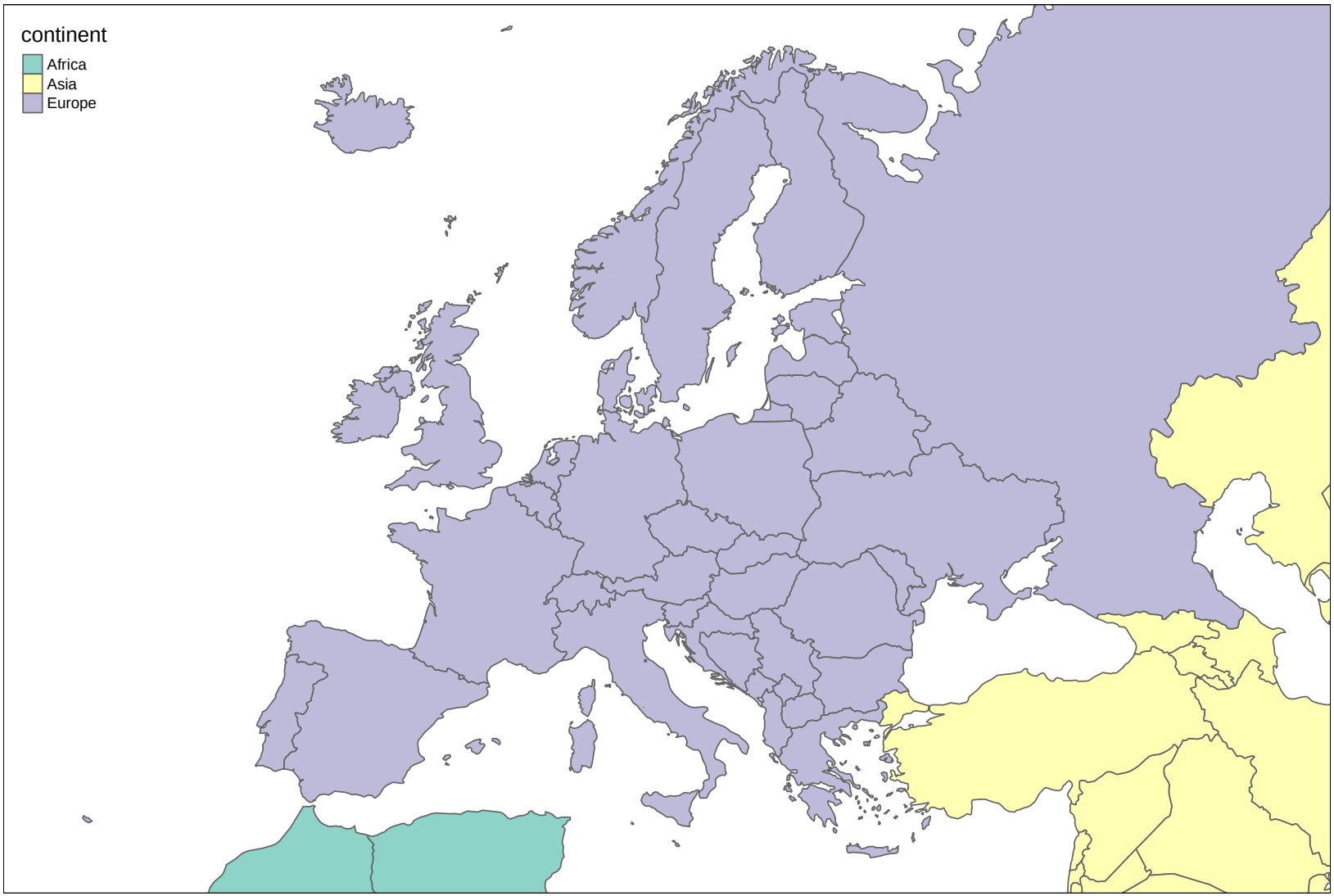
	iso_a3	name	sovereignt	continent	part	
5	ALB	Albania	Albania	Europe	Southern Europe	2
6	ALA	Aland	Finland	Europe	Northern Europe	
7	AND	Andorra	Andorra	Europe	Southern Europe	
10	ARM	Armenia	Armenia	Asia	NA	2
17	AUT	Austria	Austria	Europe	Western Europe	8
18	AZE	Azerbaijan	Azerbaijan	Asia	NA	8
20	BEL	Belgium	Belgium	Europe	Western Europe	3
24	BGR	Bulgaria	Bulgaria	Europe	Eastern Europe	10

Die ISO Kodierung:

```
##   [1] "AALAND ISLANDS                A
##   [2] "AFGHANISTAN                   A
##   [3] "ALBANIA                       A
##   [4] "ALGERIA                       I
##   [5] "AMERICAN SAMOA                A
##   [6] "ANDORRA                       A
##   [7] "ANGOLA                        A
##   [8] "ANGUILLA                      A
##   [9] "ANTARCTICA                    A
##  [10] "ANTIGUA AND BARBUDA           A
##  [11] "ARGENTINA                     A
##  [12] "ARMENIA                       A
##  [13] "ARUBA                         A
##  [14] "AUSTRALIA                     A
##  [15] "AUSTRIA                       A
##  [16] "AZERBAIJAN                    A
##  [17] "BAHAMAS                       B
##  [18] "BAHRAIN                       B
```

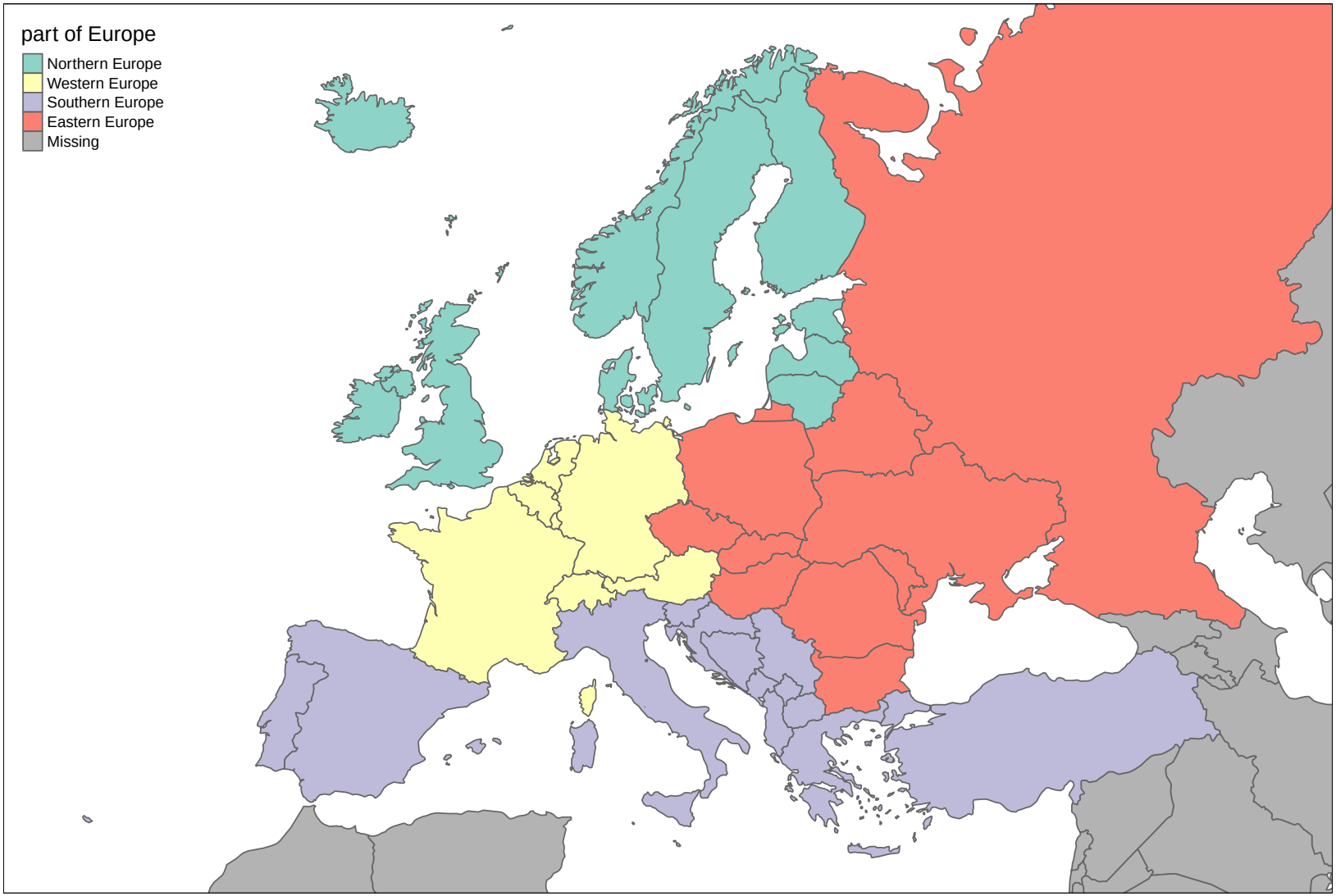
Teil Europas?

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



Teil Europas?

```
qtm(Europe, fill="part",fill.title="part of Europe")
```

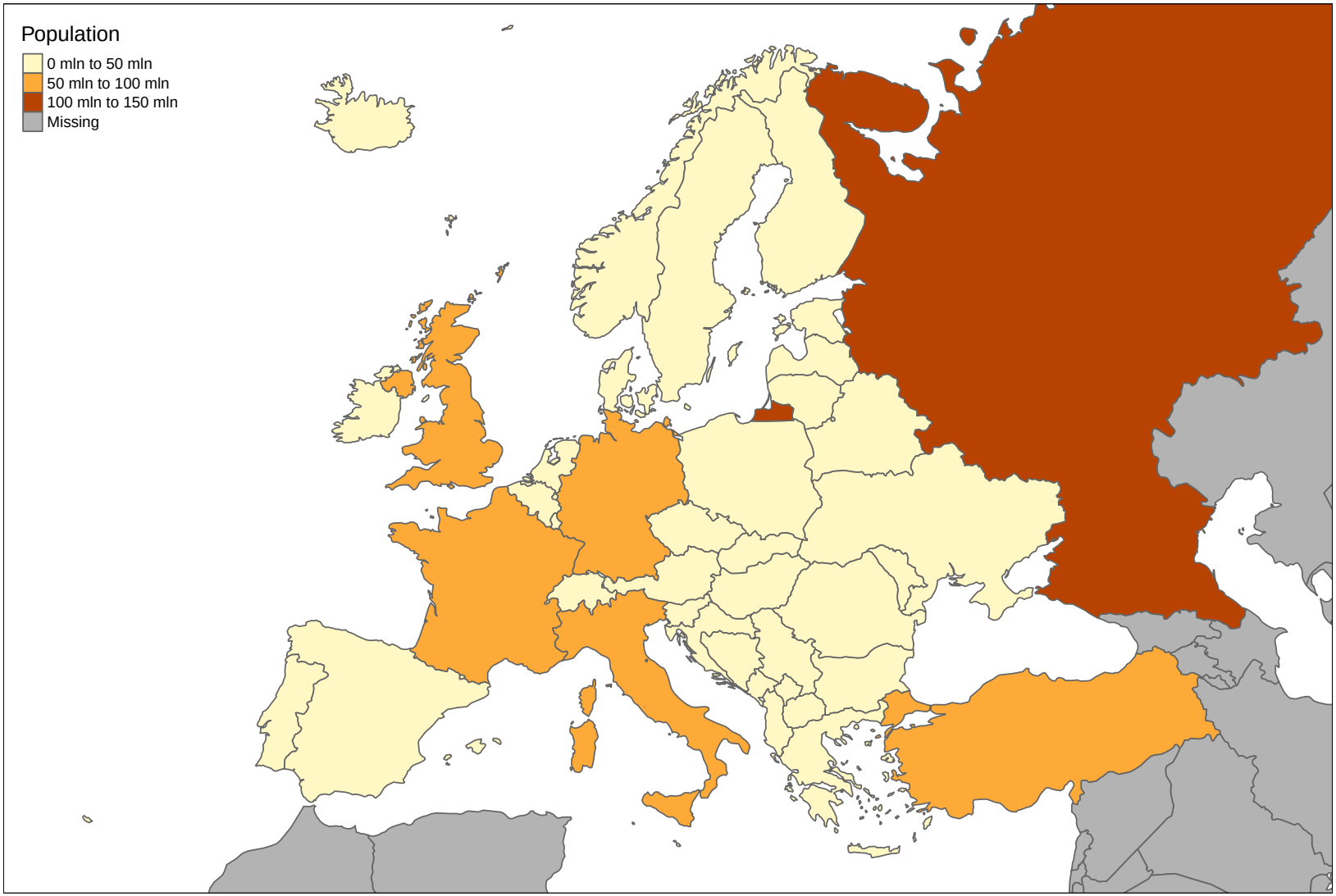


Fläche

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

Bevölkerung

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

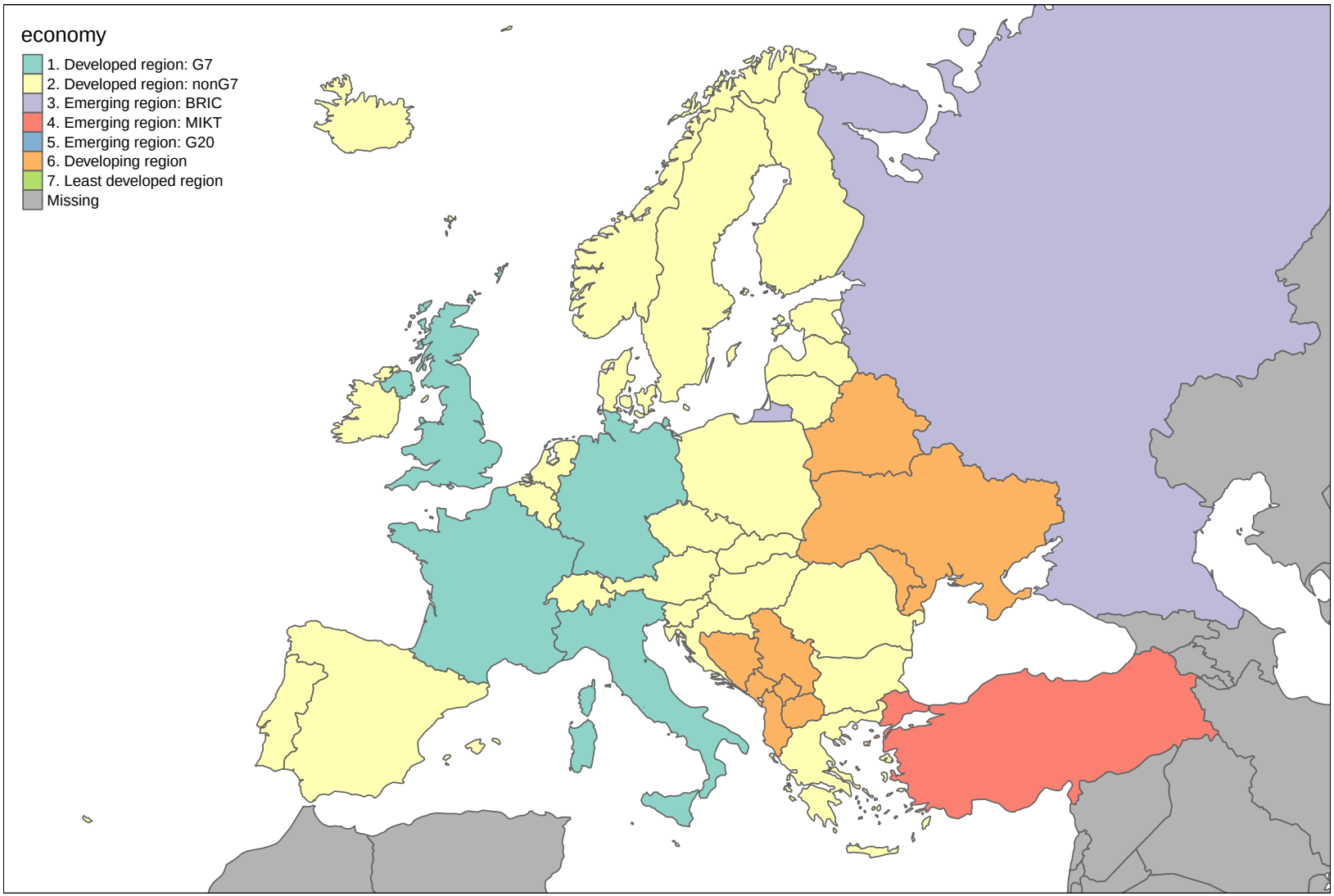


Bevölkerungsdichte

```
qtm(Europe, fill="pop_est_dens",
    fill.title="Population density")
```

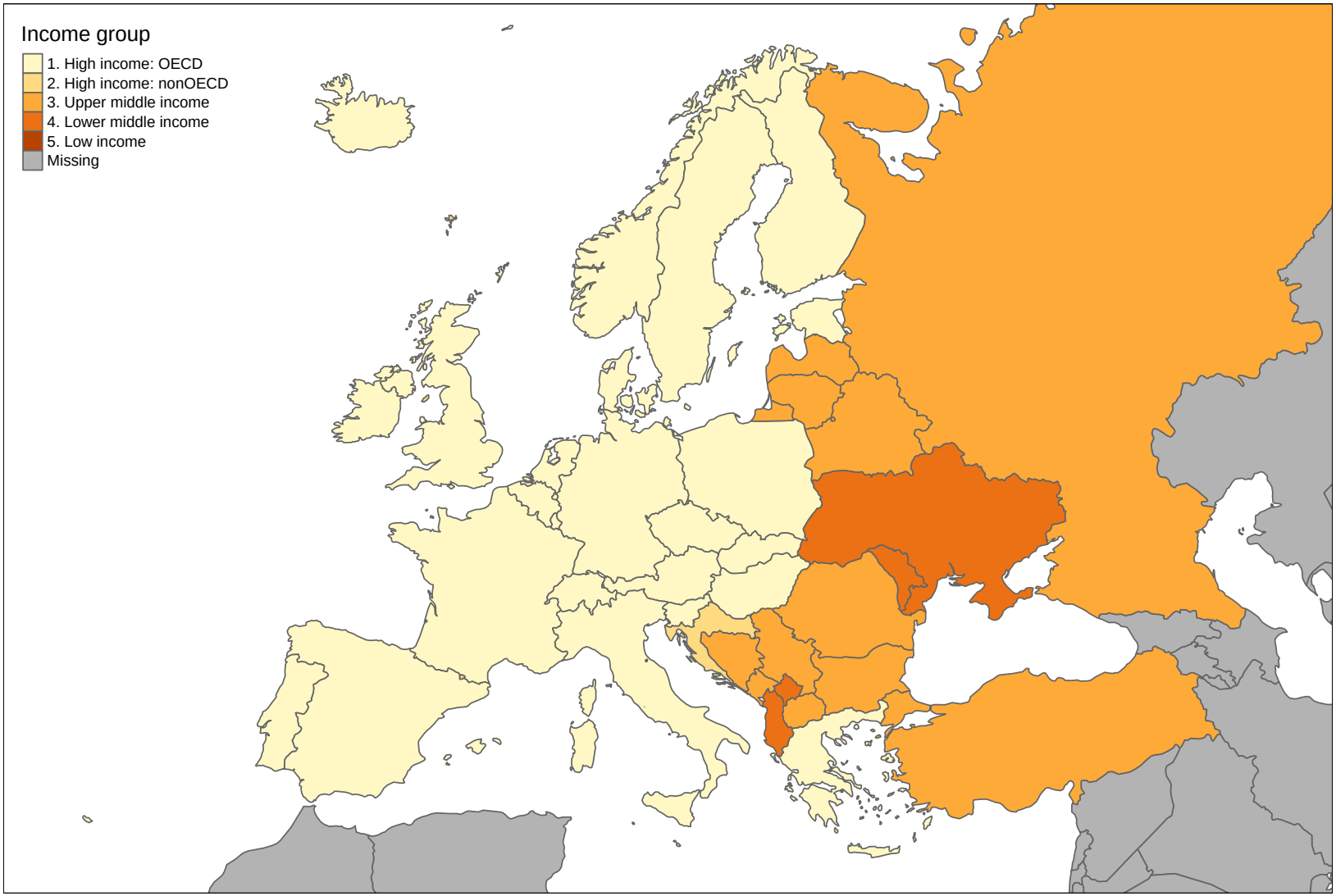
Ökonomie

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



Einkommensgruppe

```
qtm(Europe, fill="income_grp",fill.title="Income group")
```

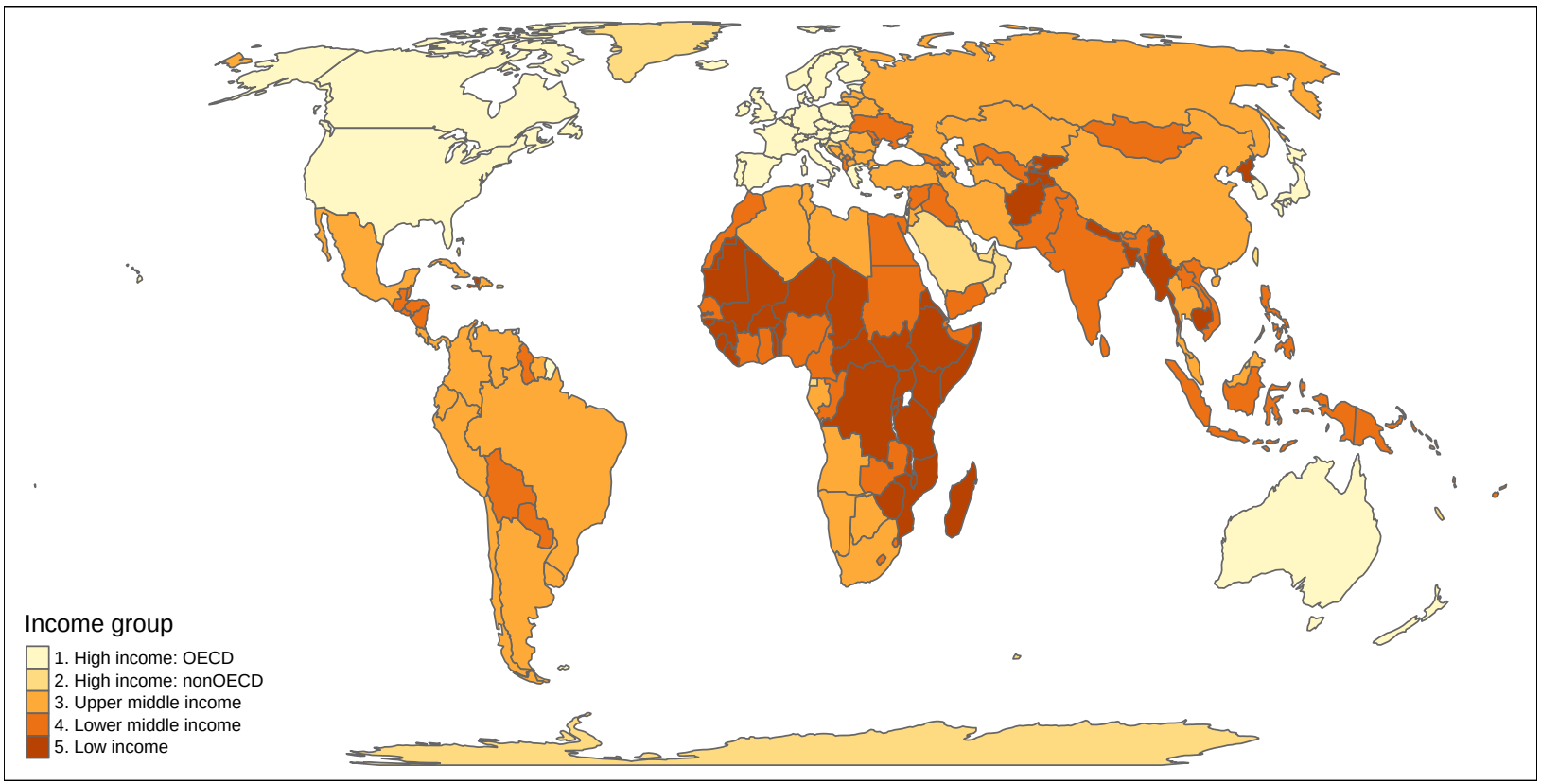


Der Welt-Datensatz im Paket `tmap`

	iso_a3	name	sovereignt	continent
2	AFG	Afghanistan	Afghanistan	Asia
3	AGO	Angola	Angola	Africa
5	ALB	Albania	Albania	Europe
8	ARE	United Arab Emirates	United Arab Emirates	Asia
9	ARG	Argentina	Argentina	South Am
10	ARM	Armenia	Armenia	Asia
12	ATA	Antarctica	Antarctica	Antarctica
14	ATF	Fr. S. Antarctic Lands	France	Seven sea
16	AUS	Australia	Australia	Oceania
17	AUT	Austria	Austria	Europe
18	AZE	Azerbaijan	Azerbaijan	Asia
19	BDI	Burundi	Burundi	Africa
20	BEL	Belgium	Belgium	Europe
21	BEN	Benin	Benin	Africa
22	BFA	Burkina Faso	Burkina Faso	Africa

Welt - Länder nach Einkommensgruppe

```
qtm(World, fill="income_grp",fill.title="Income group")
```

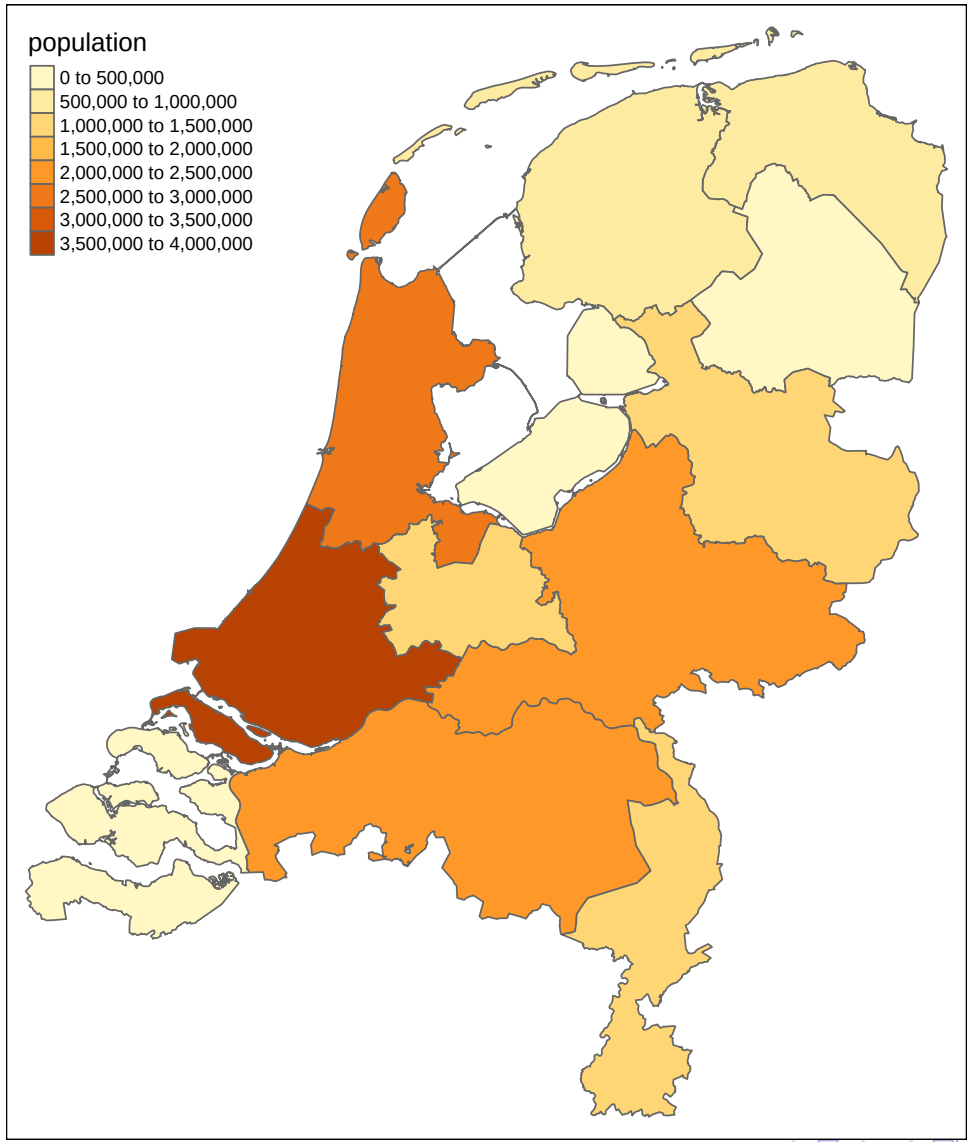


Ein Datensatz zu den Provinzen in den Niederlanden (R-Paket `tmap`)

	code	name	population	pop_men	pop_women
0	20	Groningen	582705	289795	292875
1	21	Friesland	646290	323215	323055
2	22	Drenthe	488970	242225	246755
3	23	Overijssel	1139680	570185	569465
4	24	Flevoland	399885	199940	199940
5	25	Gelderland	2019635	997805	1021790

Niederlande - Bevölkerung in den Provinzen

```
qtm(NLD_prov, fill="population",fill.title="population")
```



Anteile berechnen

```
pop <- NLD_prov@data$population
pop
```

```
##  [1]  582705  646290  488970 1139680  399885 2019635 125
##  [9] 3576960  380610 2479220 1119980
```

```
popmen <- NLD_prov@data$pop_men
popmen
```

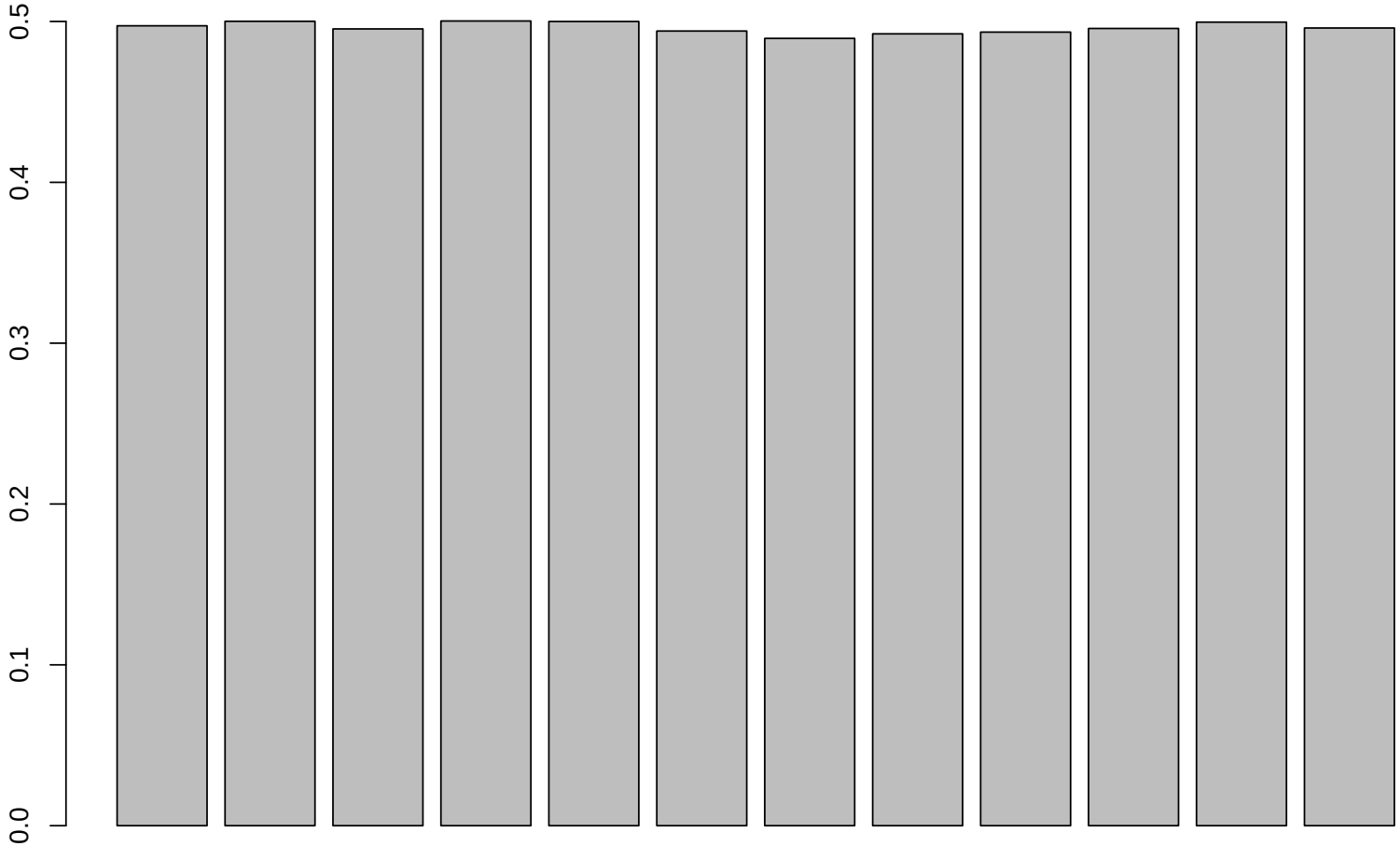
```
##  [1]  289795  323215  242225  570185  199940  997805  61
##  [9] 1764855  188655 1238600  555450
```

```
prop <- popmen/pop
prop
```

```
##  [1] 0.4973271 0.5001083 0.4953780 0.5003027 0.4999937 0
##  [8] 0.4923212 0.4933952 0.4956649 0.4995926 0.4959464
```

Exkurs: Barplot vom Männeranteil

```
barplot(prop)
```

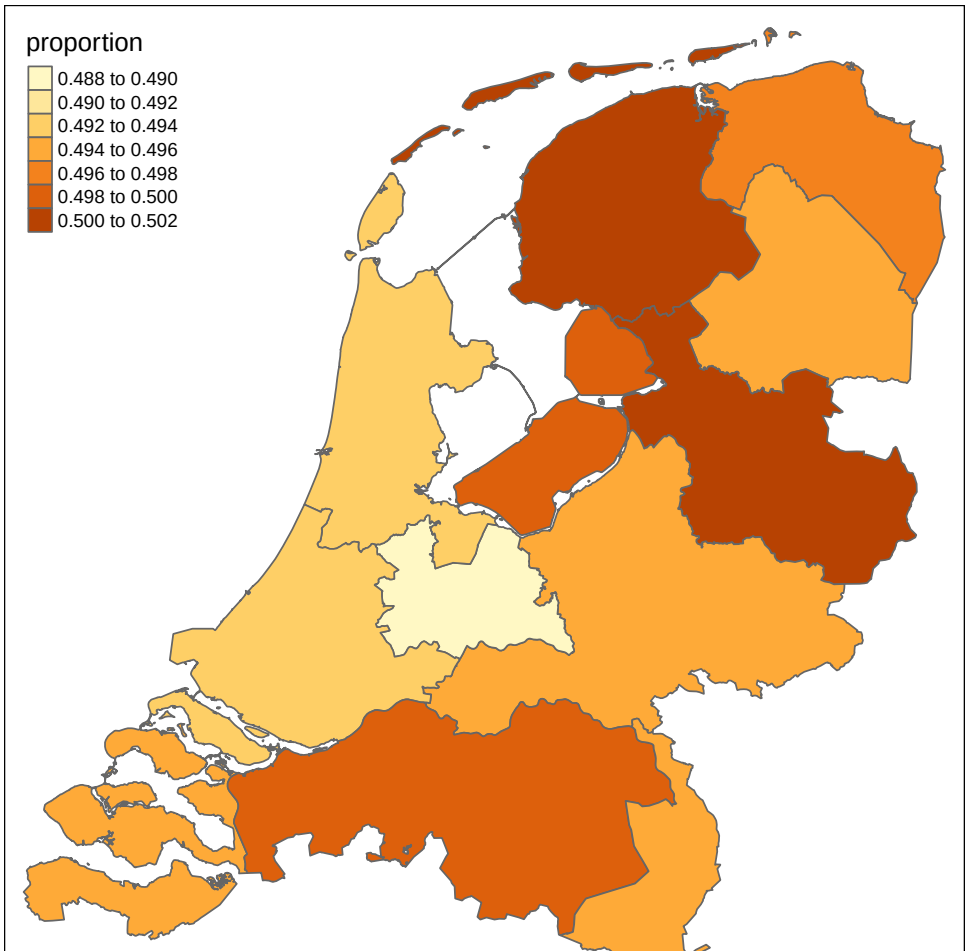


Niederlnade - Anteil Männer

Information in Datensatz einspeisen

```
NLD_prov@data$proportion <- prop
```

```
qtm(NLD_prov, fill="proportion",fill.title="proportion")
```



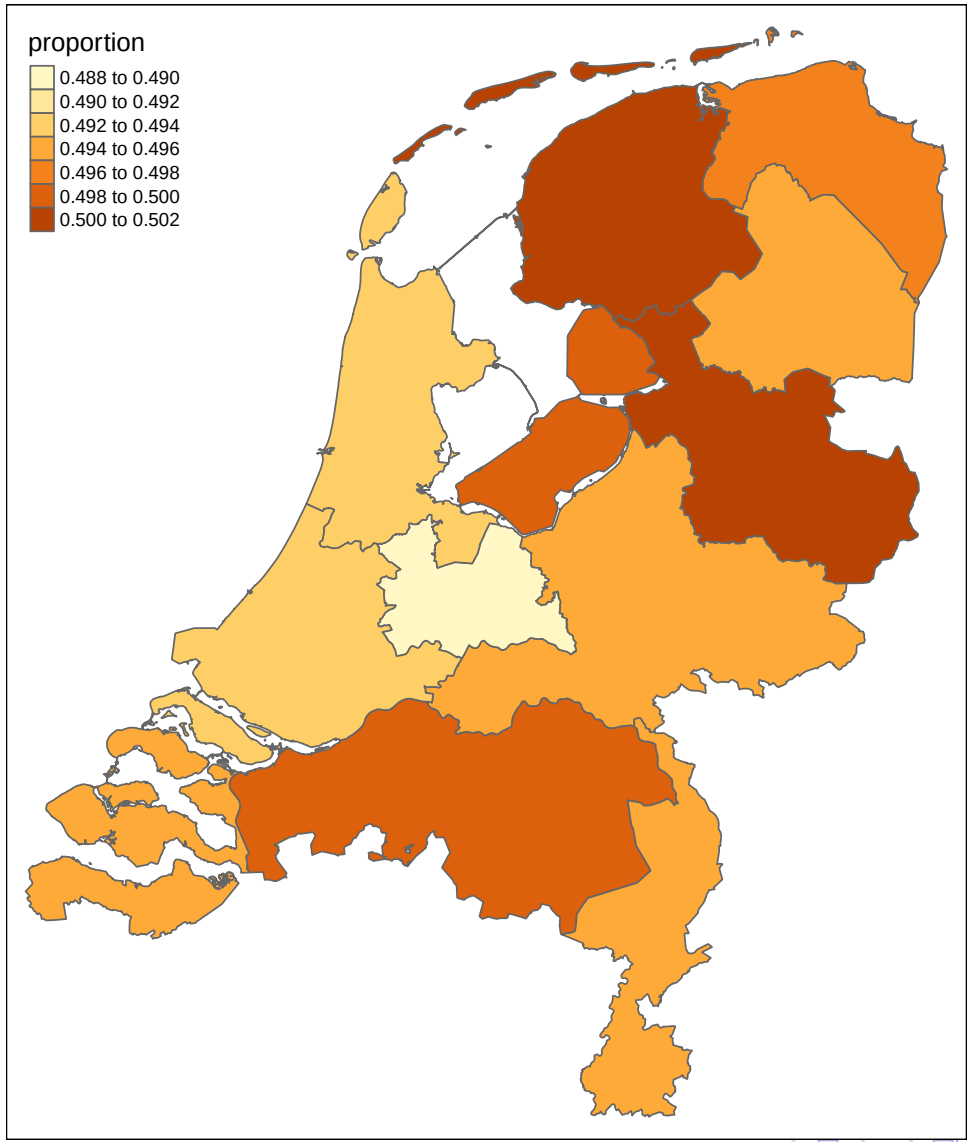
Niederlande - Anteil der Personen 65 plus

(kleiner Trick notwendig - Die Daten hatten sich verändert)

```
ant <- runif(length(NLD_prov),.18,.28)
NLD_prov@data$pop_65plus <- round(NLD_prov@data$population*
pop65plus <- NLD_prov@data$pop_65plus
prop65plus <- pop65plus/pop
NLD_prov@data$proportion65plus <- prop65plus
```

Den Anteil der über 65-jährigen visualisieren

```
qtm(NLD_prov, fill="proportion",fill.title="proportion")
```



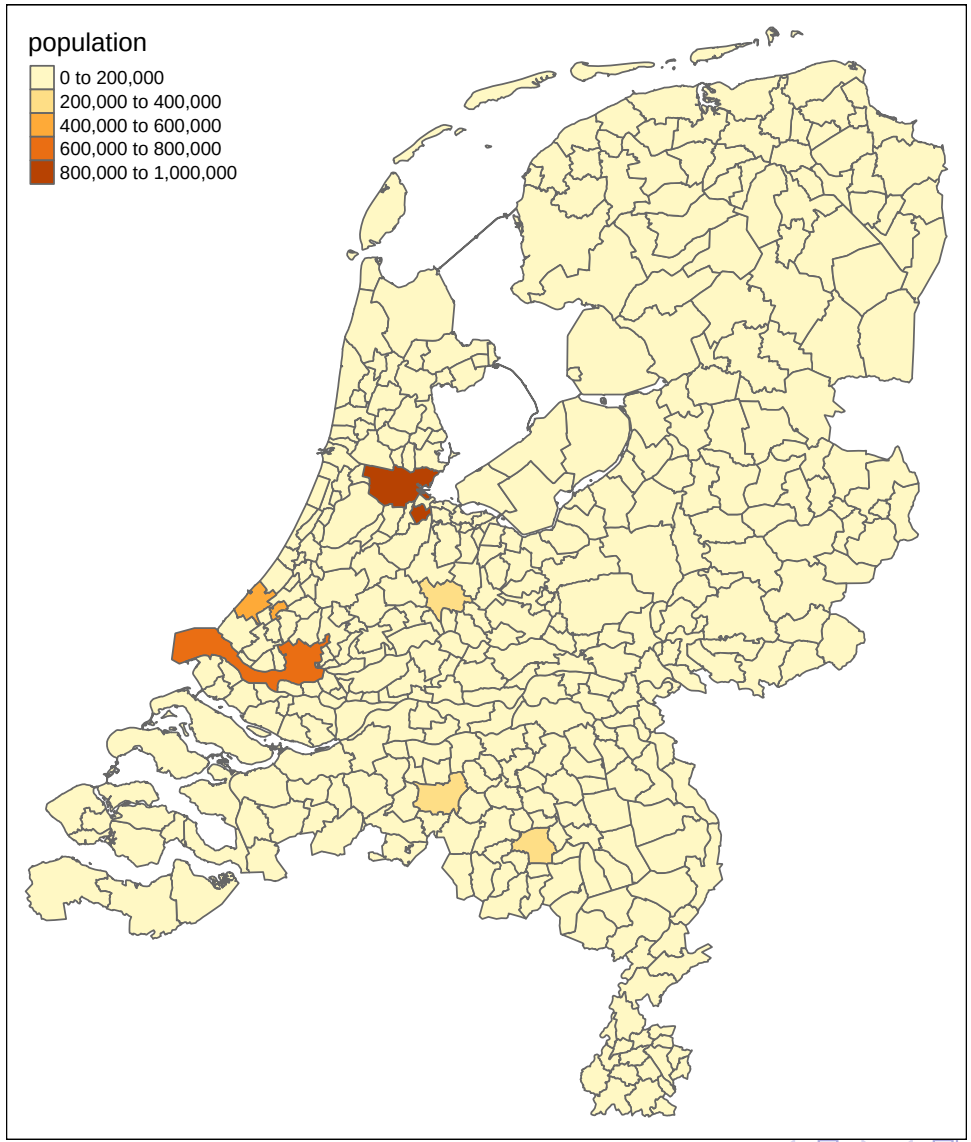
Ein Datensatz zu den Gemeinden in den Niederlanden (R-Paket `tmap`)

```
data(NLD_muni)
```

	name	province	population
0	Appingedam	Groningen	12065
1	Bedum	Groningen	10495
2	Bellingwedde	Groningen	8920
3	Ten Boer	Groningen	7480
4	Delfzijl	Groningen	25695
5	Groningen	Groningen	198315
6	Grootegast	Groningen	12165
7	Haren	Groningen	18780
8	Hoogezand-Sappemeer	Groningen	34305
9	Leek	Groningen	19595
10	Loppersum	Groningen	10195
11	Marum	Groningen	10375
12	Almere	Flevoland	196010

Bevölkerung der Gemeinden in den Niederlanden

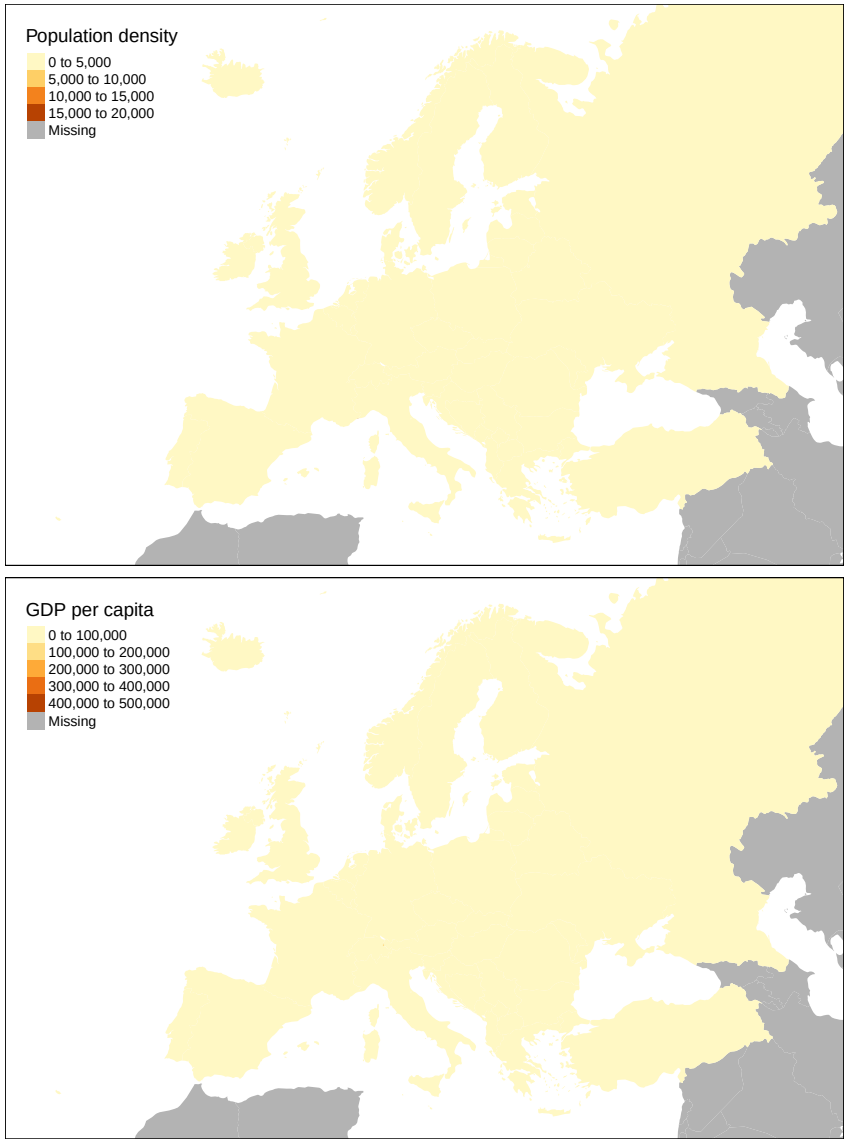
```
qtm(NLD_muni, fill="population")
```



Zwei Karten

```
tm_shape(Europe) +
    tm_fill(c("pop_est_dens", "gdp_cap_est"),
        title=c("Population density", "GDP per capita"))
# + tm_layout_Europe()
```

Zwei Karten

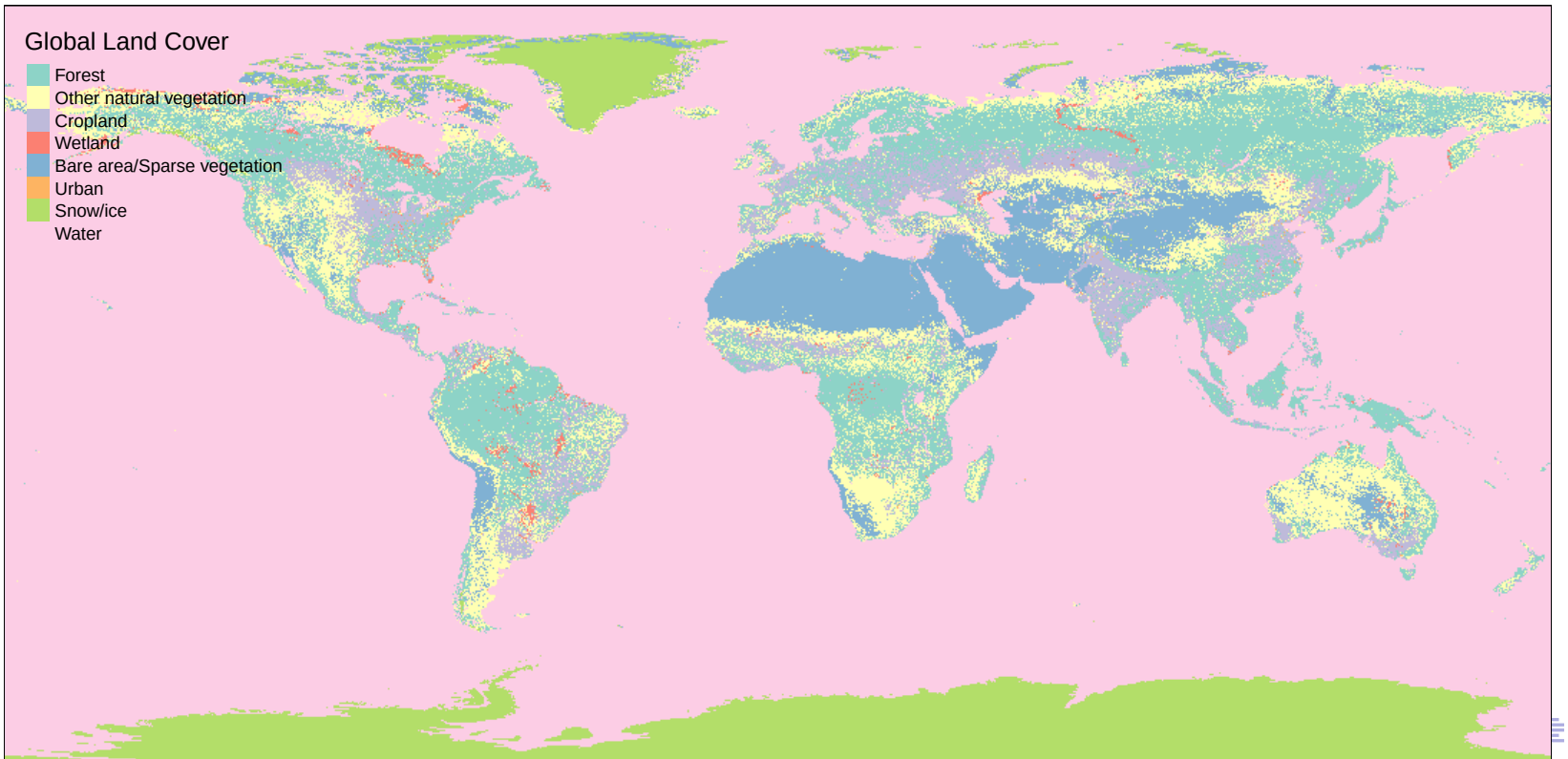

Population density
0 to 5,000
5,000 to 10,000
10,000 to 15,000
15,000 to 20,000
Missing
GDP per capita
0 to 100,000
100,000 to 200,000
200,000 to 300,000
300,000 to 400,000
400,000 to 500,000
Missing

Räumliche Daten zur Flächennutzung

cover	cover_cls	trees	elevation
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA
Water bodies	Water	NA	NA

Weltweite Flächennutzung

```
data(land)
data(World)
tm_shape(land,  relative=FALSE) +
    tm_raster("cover_cls", title="Global Land Cover")
```

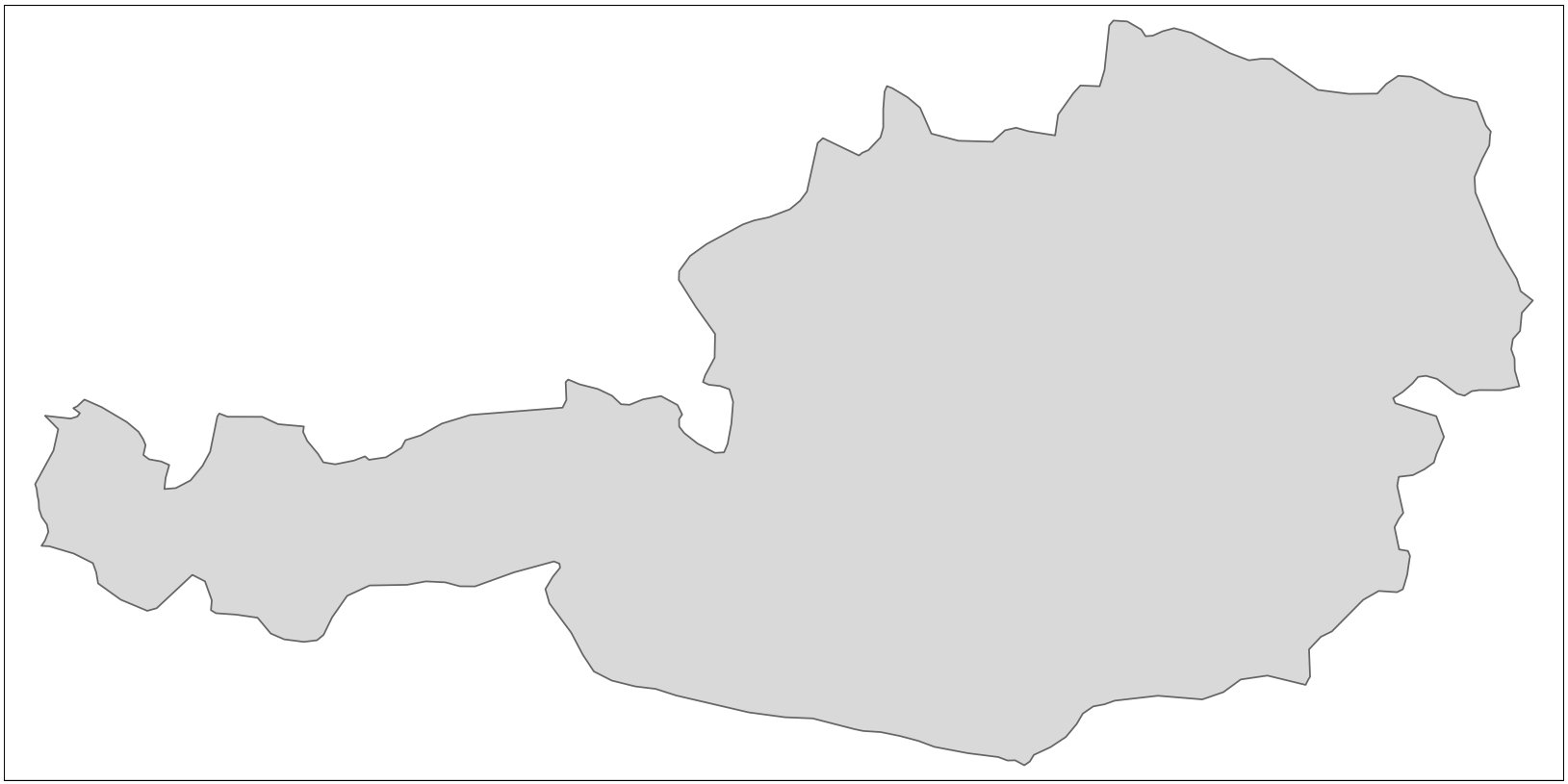


Räumliche Daten zu Metropolregionen

	name	name_long	iso_a3	pop195
2	Kabul	Kabul	AFG	17078
8	Algiers	El Djazair (Algiers)	DZA	51645
13	Luanda	Luanda	AGO	13841
16	Buenos Aires	Buenos Aires	ARG	509761
17	Cordoba	Cordoba	ARG	42924
25	Rosario	Rosario	ARG	55448
32	Yerevan	Yerevan	ARM	34143
33	Adelaide	Adelaide	AUS	42927
34	Brisbane	Brisbane	AUS	44171
37	Melbourne	Melbourne	AUS	133196
39	Perth	Perth	AUS	31075
41	Sydney	Sydney	AUS	168993
42	Vienna	Wien (Vienna)	AUT	161505
43	Baku	Baku	AZE	89676
49	Chittagong	Chittagong	BGD	28885
51	Dhaka	Dhaka	BGD	33576

Nur ein Land visualisieren

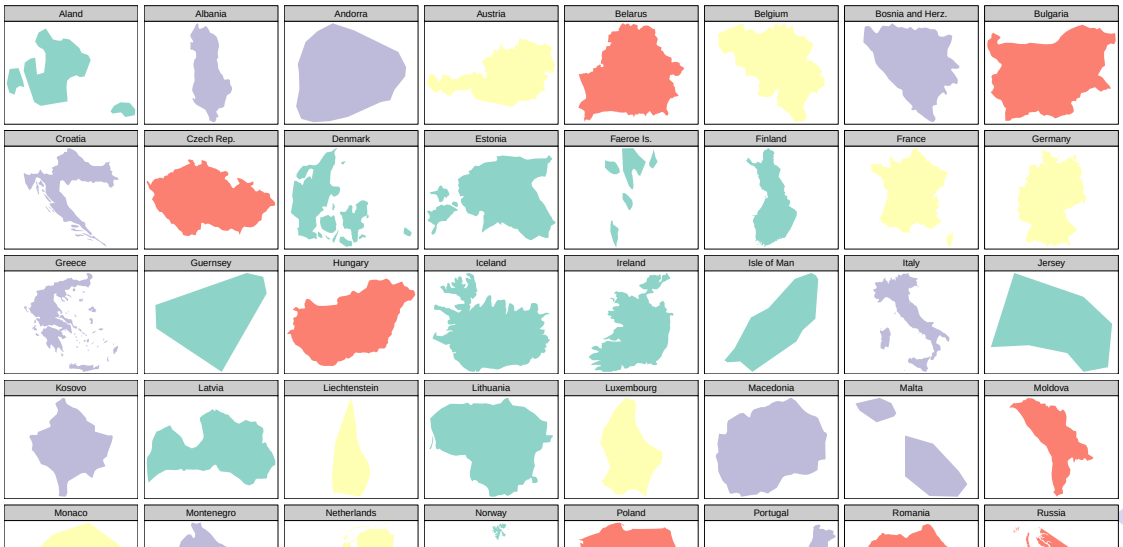
```
tm_shape(Europe[Europe$name=="Austria", ]) +
    tm_polygons()
```



Kleine und viele Karten

```
tm_shape(Europe[Europe$continent=="Europe",]) +
    tm_fill("part", thres.poly = 0) +
    tm_facets("name", free.coords=TRUE, drop.shapes=TRUE) +
tm_layout(legend.show = FALSE, title.position = c("center",
          title.size = 2)
```

```
## Warning: The argument drop.shapes has been renamed to dr
## therefore deprecated
```



tmap zitieren

```
citation("tmap")
```

```
##
## To cite package 'tmap' in publications use:
##
##   Martijn Tennekes (2016). tmap: Thematic Maps. R packag
##   1.4. https://CRAN.R-project.org/package=tmap
##
## A BibTeX entry for LaTeX users is
##
##   @Manual{,
##     title = {tmap: Thematic Maps},
##     author = {Martijn Tennekes},
##     year = {2016},
##     note = {R package version 1.4},
##     url = {https://CRAN.R-project.org/package=tmap},
##   }
```