

# Package ‘spData’

September 19, 2019

**Title** Datasets for Spatial Analysis

**Version** 0.3.2

## **Description**

Diverse spatial datasets for demonstrating, benchmarking and teaching spatial data analysis. It includes R data of class sf (defined by the package 'sf'), Spatial ('sp'), and nb ('spdep'). Unlike other spatial data packages such as 'rnatuarearth' and 'maps', it also contains data stored in a range of file formats including GeoJSON, ESRI Shapefile and GeoPackage. Some of the datasets are designed to illustrate specific analysis techniques. cycle\_hire() and cycle\_hire\_osm(), for example, is designed to illustrate point pattern analysis techniques.

**Depends** R (>= 3.3.0)

**Suggests** foreign, maptools, raster, rgdal, sf, sp, spDataLarge (>= 0.3.0), spdep, spatialreg

**License** CC0

**RoxygenNote** 6.1.1

**LazyData** true

**URL** <https://nowosad.github.io/spData/>

**BugReports** <https://github.com/Nowosad/spData/issues>

**Additional\_repositories** <https://nowosad.github.io/drat>

**NeedsCompilation** no

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**R topics documented:**

afcon	2
alaska	4
auckland	5
baltimore	6
boston	7
coffee_data	9
columbus	11
congruent	12
cycle_hire	13
cycle_hire_osm	15
eire	16
elect80	18
elev	19
getisord	19
grain	20
hawaii	21
hopkins	22
house	22
huddersfield	24
jenks71	24
lnd	25
nc.sids	26
nydata	27
nz	29
nz_height	31
seine	32
SplashDams	33
state.vbm	34
urban_agglomerations	35
used.cars	36
us_states	37
us_states_df	38
wheat	39
world	40
worldbank_df	41
<b>Index</b>	<b>43</b>

**Description**

The `afcon` data frame has 42 rows and 5 columns, for 42 African countries, excluding then South West Africa and Spanish Equatorial Africa and Spanish Sahara. The dataset is used in Anselin (1995), and downloaded from before adaptation. The neighbour list object `africa.rook.nb` is the `SpaceStat` 'rook.GAL', but is not the list used in Anselin (1995) - `paper.nb` reconstructs the list used in the paper, with inserted links between Mauritania and Morocco, South Africa and Angola and Zambia, Tanzania and Zaire, and Botswana and Zambia. `afxy` is the coordinate matrix for the centroids of the countries.

**Usage**

```
afcon
```

**Format**

This data frame contains the following columns:

- `x` an easting in decimal degrees (taken as centroid of shapefile polygon)
- `y` a northing in decimal degrees (taken as centroid of shapefile polygon)
- `totcon` index of total conflict 1966-78
- `name` country name
- `id` country id number as in paper

**Note**

All source data files prepared by Luc Anselin, Spatial Analysis Laboratory, Department of Agricultural and Consumer Economics, University of Illinois, Urbana-Champaign.

**Source**

Anselin, L. and John O'Loughlin. 1992. Geography of international conflict and cooperation: spatial dependence and regional context in Africa. In *The New Geopolitics*, ed. M. Ward, pp. 39-75. Philadelphia, PA: Gordon and Breach. also: Anselin, L. 1995. Local indicators of spatial association, *Geographical Analysis*, 27, Table 1, p. 103.

**Examples**

```
data(afcon)
if (requireNamespace("spdep", quietly = TRUE)) {
  library(spdep)
  plot(africa.rook.nb, afxy)
  plot(diffnb(paper.nb, africa.rook.nb), afxy, col="red", add=TRUE)
  text(afxy, labels=attr(africa.rook.nb, "region.id"), pos=4, offset=0.4)
  moran.test(afcon$totcon, nb2listw(africa.rook.nb))
  moran.test(afcon$totcon, nb2listw(paper.nb))
  geary.test(afcon$totcon, nb2listw(paper.nb))
}
```

---

`alaska`*Alaska multipolygon*

---

### Description

The object loaded is a `sf` object containing the state of Alaska from the US Census Bureau with a few variables from American Community Survey (ACS)

### Usage

```
alaska
```

### Format

Formal class 'sf' [package "sf"]; the data contains a data.frame with 1 obs. of 7 variables:

- GEOID character vector of geographic identifiers
- NAME character vector of state names
- REGION character vector of region names
- AREA area in square kilometers of units class
- total\_pop\_10 numerical vector of total population in 2010
- total\_pop\_15 numerical vector of total population in 2015
- geometry sfc\_MULTIPOLYGON

The object is in projected coordinates using Alaska Albers (EPSG:3467).

### Source

<https://www.census.gov/geo/maps-data/data/tiger-line.html>

### See Also

See the `tigris` package: <https://cran.r-project.org/package=tigris>

### Examples

```
if (requireNamespace("sf", quietly = TRUE)) {  
  library(sf)  
  data(alaska)  
  
  plot(alaska[["total_pop_15"]])  
}
```

---

auckland

*Marshall's infant mortality in Auckland dataset*

---

### Description

(Use `example(auckland)` to load the data from shapefile and generate neighbour list on the fly). The auckland data frame has 167 rows (census area units — CAU) and 4 columns. The dataset also includes the "nb" object `auckland.nb` of neighbour relations based on contiguity, and the "polylist" object `auckpolys` of polygon boundaries for the CAU. The auckland data frame includes the following columns:

### Usage

```
auckland
```

### Format

This data frame contains the following columns:

- Easting a numeric vector of x coordinates in an unknown spatial reference system
- Northing a numeric vector of y coordinates in an unknown spatial reference system
- M77\_85 a numeric vector of counts of infant (under 5 years of age) deaths in Auckland, 1977-1985
- Und5\_81 a numeric vector of population under 5 years of age at the 1981 Census

### Details

The contiguous neighbours object does not completely replicate results in the sources, and was reconstructed from `auckpolys`; examination of figures in the sources suggests that there are differences in detail, although probably not in substance.

### Source

Marshall R M (1991) Mapping disease and mortality rates using Empirical Bayes Estimators, *Applied Statistics*, 40, 283–294; Bailey T, Gatrell A (1995) *Interactive Spatial Data Analysis*, Harlow: Longman — INFOMAP data set used with permission.

### Examples

```
if (requireNamespace("rgdal", quietly = TRUE)) {  
  library(rgdal)  
  auckland <- readOGR(system.file("shapes/auckland.shp", package="spData"))[1]  
  plot(auckland)  
  if (requireNamespace("spdep", quietly = TRUE)) {  
    library(spdep)  
    auckland.nb <- poly2nb(auckland)  
  }  
}
```

---

baltimore

*House sales prices, Baltimore, MD 1978*

---

**Description**

House sales price and characteristics for a spatial hedonic regression, Baltimore, MD 1978. X,Y on Maryland grid, projection type unknown.

**Usage**

baltimore

**Format**

A data frame with 211 observations on the following 17 variables.

- STATION a numeric vector
- PRICE a numeric vector
- NROOM a numeric vector
- DWELL a numeric vector
- NBATH a numeric vector
- PATIO a numeric vector
- FIREPL a numeric vector
- AC a numeric vector
- BMENT a numeric vector
- NSTOR a numeric vector
- GAR a numeric vector
- AGE a numeric vector
- CITCOU a numeric vector
- LOTSZ a numeric vector
- SQFT a numeric vector
- X a numeric vector
- Y a numeric vector

**Source**

Prepared by Luc Anselin. Original data made available by Robin Dubin, Weatherhead School of Management, Case Western Research University, Cleveland, OH. <http://sal.agecon.uiuc.edu/datasets/baltimore.zip>

**References**

Dubin, Robin A. (1992). Spatial autocorrelation and neighborhood quality. *Regional Science and Urban Economics* 22(3), 433-452.

## Examples

```
data(baltimore)
str(baltimore)

if (requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  baltimore_sf <- baltimore %>% st_as_sf(., coords = c("X","Y"))
  plot(baltimore_sf["PRICE"])
}
```

---

boston

*Corrected Boston Housing Data*

---

## Description

The `boston.c` data frame has 506 rows and 20 columns. It contains the Harrison and Rubinfeld (1978) data corrected for a few minor errors and augmented with the latitude and longitude of the observations. Gilley and Pace also point out that `MEDV` is censored, in that median values at or over USD 50,000 are set to USD 50,000. The original data set without the corrections is also included in package `mlbench` as `BostonHousing`. In addition, a matrix of tract point coordinates projected to UTM zone 19 is included as `boston.utm`, and a sphere of influence neighbours list as `boston.soi`.

## Format

This data frame contains the following columns:

- `TOWN` a factor with levels given by town names
- `TOWNNO` a numeric vector corresponding to `TOWN`
- `TRACT` a numeric vector of tract ID numbers
- `LON` a numeric vector of tract point longitudes in decimal degrees
- `LAT` a numeric vector of tract point latitudes in decimal degrees
- `MEDV` a numeric vector of median values of owner-occupied housing in USD 1000
- `CMEDV` a numeric vector of corrected median values of owner-occupied housing in USD 1000
- `CRIM` a numeric vector of per capita crime
- `ZN` a numeric vector of proportions of residential land zoned for lots over 25000 sq. ft per town (constant for all Boston tracts)
- `INDUS` a numeric vector of proportions of non-retail business acres per town (constant for all Boston tracts)
- `CHAS` a factor with levels 1 if tract borders Charles River; 0 otherwise
- `NOX` a numeric vector of nitric oxides concentration (parts per 10 million) per town
- `RM` a numeric vector of average numbers of rooms per dwelling
- `AGE` a numeric vector of proportions of owner-occupied units built prior to 1940

- DIS a numeric vector of weighted distances to five Boston employment centres
- RAD a numeric vector of an index of accessibility to radial highways per town (constant for all Boston tracts)
- TAX a numeric vector full-value property-tax rate per USD 10,000 per town (constant for all Boston tracts)
- PTRATIO a numeric vector of pupil-teacher ratios per town (constant for all Boston tracts)
- B a numeric vector of  $1000 * (B_k - 0.63)^2$  where  $B_k$  is the proportion of blacks
- LSTAT a numeric vector of percentage values of lower status population

### Note

Details of the creation of the tract shapefile given in final don't run block; tract boundaries for 1990: [http://www.census.gov/geo/cob/bdy/tr/tr90shp/tr25\\_d90\\_shp.zip](http://www.census.gov/geo/cob/bdy/tr/tr90shp/tr25_d90_shp.zip), counties in the BOSTON SMSA <http://www.census.gov/population/metro/files/lists/historical/63mfips.txt>; tract conversion table 1980/1970: [https://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/7913?q=07913&permit\[0\]=AVAILABLE](https://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/7913?q=07913&permit[0]=AVAILABLE), <http://www.icpsr.umich.edu/cgi-bin/bob/zipcart2?path=ICPSR&study=7913&bundle=all&ds=1&dups=yes>. The shapefile contains corrections and extra variables (tract 3592 is corrected to 3593; the extra columns are:

- unitsnumber of single family houses
- cu5kcount of units under USD 5,000
- c5\_7\_5counts USD 5,000 to 7,500
- C\*\_interval counts
- co50kcount of units over USD 50,000
- medianrecomputed median values
- BBrecomputed black population proportion
- censoredwhether censored or not
- NOXIDNOX model zone ID
- POPtract population

### Source

[http://lib.stat.cmu.edu/datasets/boston\\_corrected.txt](http://lib.stat.cmu.edu/datasets/boston_corrected.txt)

### References

- Harrison, David, and Daniel L. Rubinfeld, Hedonic Housing Prices and the Demand for Clean Air, *Journal of Environmental Economics and Management*, Volume 5, (1978), 81-102. Original data.
- Gilley, O.W., and R. Kelley Pace, On the Harrison and Rubinfeld Data, *Journal of Environmental Economics and Management*, 31 (1996), 403-405. Provided corrections and examined censoring.
- Pace, R. Kelley, and O.W. Gilley, Using the Spatial Configuration of the Data to Improve Estimation, *Journal of the Real Estate Finance and Economics*, 14 (1997), 333-340.
- Bivand, Roger. Revisiting the Boston data set - Changing the units of observation affects estimated willingness to pay for clean air. *REGION*, v. 4, n. 1, p. 109-127, 2017. <http://openjournals.wu.ac.at/ojs/index.php/region/article/view/107>.



**Examples**

```

if (requireNamespace("spdep", quietly = TRUE)) {
  library(spdep)
  data(boston)
  hr0 <- lm(log(MEDV) ~ CRIM + ZN + INDUS + CHAS + I(NOX^2) + I(RM^2) +
            AGE + log(DIS) + log(RAD) + TAX + PTRATIO + B + log(LSTAT), data = boston.c)
  summary(hr0)
  logLik(hr0)
  gp0 <- lm(log(CMEDV) ~ CRIM + ZN + INDUS + CHAS + I(NOX^2) + I(RM^2) +
            AGE + log(DIS) + log(RAD) + TAX + PTRATIO + B + log(LSTAT), data = boston.c)
  summary(gp0)
  logLik(gp0)
  lm.morantest(hr0, nb2listw(boston.soi))
}
## Not run:
library(rgdal)
boston.tr <- readOGR(system.file("shapes/boston_tracts.shp",
                                package="spData")[1])
boston_nb <- poly2nb(boston.tr)

## End(Not run)
## Not run:
if (requireNamespace("spatialreg", quietly = TRUE)) {
  library(spatialreg)
  gp1 <- errorsarlm(log(CMEDV) ~ CRIM + ZN + INDUS + CHAS + I(NOX^2)
                    + I(RM^2) + AGE + log(DIS) + log(RAD) +
                    TAX + PTRATIO + B + log(LSTAT),
                    data=boston.c, nb2listw(boston.soi), method="Matrix",
                    control=list(tol.opt = .Machine$double.eps^(1/4)))
  summary(gp1)
  gp2 <- lagsarlm(log(CMEDV) ~ CRIM + ZN + INDUS + CHAS + I(NOX^2) + I(RM^2)
                  + AGE + log(DIS) + log(RAD) + TAX + PTRATIO + B + log(LSTAT),
                  data=boston.c, nb2listw(boston.soi), method="Matrix")
  summary(gp2)
}

## End(Not run)

```

---

 coffee\_data

*World coffee production data*


---

**Description**

A tiny dataset containing estimates of global coffee in thousands of 60 kg bags produced by country.  
 Purpose: teaching **not** research.

**Usage**

```
coffee_data
```

**Format**

A data frame (tibble) with 58 for the following 12 variables:

- name\_long name of country or coffee variety
- coffee\_production\_2016 production in 2016
- coffee\_production\_2017 production in 2017

**Details**

The examples section shows how this can be joined with spatial data to create a simple map.

**Source**

The International Coffee Organization (ICO). See <http://www.ico.org/> and <http://www.ico.org/prices/m1-exports.pdf>

**Examples**

```
head(coffee_data)
## Not run:
library(tidyverse)
library(sf)
# found by searching for "global coffee data"
u = "http://www.ico.org/prices/m1-exports.pdf"
download.file(u, "data.pdf", mode = "wb")
install.packages("pdftables") # requires api key
pdftables::convert_pdf(input_file = "data.pdf", output_file = "coffee-data-messy.csv")
d = read_csv("coffee-data-messy.csv")
file.remove("coffee-data-messy.csv")
file.remove("data.pdf")
coffee_data = slice(d, -c(1:9)) %>%
  select(name_long = 1, coffee_production_2016 = 2, coffee_production_2017 = 3) %>%
  filter(!is.na(coffee_production_2016)) %>%
  mutate_at(2:3, str_replace, " ", "") %>%
  mutate_at(2:3, as.integer)
world_coffee = left_join(world, coffee_data)
plot(world_coffee[c("coffee_production_2016", "coffee_production_2017")])
b = c(0, 500, 1000, 2000, 3000)
library(tmap)
tm_shape(world_coffee) +
  tm_fill("coffee_production_2017", title = "Thousand 60kg bags", breaks = b,
         textNA = "No data", colorNA = NULL)
tmap_mode("view") # for an interactive version

## End(Not run)
```

---

`columbus`*Columbus OH spatial analysis data set*

---

**Description**

The columbus data frame has 49 rows and 22 columns. Unit of analysis: 49 neighbourhoods in Columbus, OH, 1980 data. In addition the data set includes a `polylist` object `polys` with the boundaries of the neighbourhoods, a matrix of polygon centroids `coords`, and `col.gal.nb`, the neighbours list from an original GAL-format file. The matrix `bbs` is DEPRECATED, but retained for other packages using this data set.

**Usage**`columbus`**Format**

This data frame contains the following columns:

- AREA computed by ArcView
- PERIMETER computed by ArcView
- COLUMBUS\_ internal polygon ID (ignore)
- COLUMBUS\_I another internal polygon ID (ignore)
- POLYID yet another polygon ID
- NEIG neighborhood id value (1-49); conforms to id value used in Spatial Econometrics book.
- HOVAL housing value (in \ \$1,000)
- INC household income (in \ \$1,000)
- CRIME residential burglaries and vehicle thefts per thousand households in the neighborhood
- OPEN open space in neighborhood
- PLUMB percentage housing units without plumbing
- DISCBD distance to CBD
- X x coordinate (in arbitrary digitizing units, not polygon coordinates)
- Y y coordinate (in arbitrary digitizing units, not polygon coordinates)
- NSA north-south dummy (North=1)
- NSB north-south dummy (North=1)
- EW east-west dummy (East=1)
- CP core-periphery dummy (Core=1)
- THOUS constant=1,000
- NEIGNO NEIG+1,000, alternative neighborhood id value

**Details**

The row names of `columbus` and the `region.id` attribute of `polys` are set to `columbus$NEIGNO`.

**Note**

All source data files prepared by Luc Anselin, Spatial Analysis Laboratory, Department of Agricultural and Consumer Economics, University of Illinois, Urbana-Champaign, <http://sal.agecon.uiuc.edu/datasets/columbus.zip>.

**Source**

Anselin, Luc. 1988. Spatial econometrics: methods and models. Dordrecht: Kluwer Academic, Table 12.1 p. 189.

**Examples**

```
if (requireNamespace("rgdal", quietly = TRUE)) {
  library(rgdal)
  columbus <- readOGR(system.file("shapes/columbus.shp", package="spData")[1])
  plot(columbus)
}

if (requireNamespace("spdep", quietly = TRUE)) {
  library(spdep)
  col.gal.nb <- read.gal(system.file("weights/columbus.gal", package="spData")[1])
}
```

---

congruent

*Datasets to illustrate the concept of spatial congruence*

---

**Description**

Sample of old (incongruent) and new (congruent) administrative zones from UK statistical agencies

**Usage**

```
congruent
```

**Format**

Simple feature geographic data in a projected CRS (OSGB) with random values assigned for teaching purposes.

**Source**

[https://en.wikipedia.org/wiki/ONS\\_coding\\_system](https://en.wikipedia.org/wiki/ONS_coding_system)

**Examples**

```

if(requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  plot(aggregating_zones$geometry, lwd = 5)
  plot(congruent$geometry, add = TRUE, border = "green", lwd = 2)
  plot(incongruent$geometry, add = TRUE, border = "blue", col = NA)
  rbind(congruent, incongruent)
}
# Code used to download the data:
## Not run:
devtools::install_github("robinlovelace/ukboundaries")
library(sf)
library(tmap)
library(dplyr)
library(ukboundaries)
sel = grepl("003|004", msoa2011_lds$geo_label)
aggregating_zones = st_transform(msoa2011_lds[sel, ], 27700)
# find lsoas in the aggregating_zones
lsoa_touching = st_transform(lsoa2011_lds, 27700)[aggregating_zones, ]
lsoa_cents = st_centroid(lsoa_touching)
lsoa_cents = lsoa_cents[aggregating_zones, ]
sel = lsoa_touching$geo_code %in% lsoa_cents$geo_code
# same for ed zones
ed_touching = st_transform(ed1981, 27700)[aggregating_zones, ]
ed_cents = st_centroid(ed_touching)
ed_cents = ed_cents[aggregating_zones, ]
incongruent_agg_ed = ed_touching[ed_cents, ]
set.seed(2017)
incongruent_agg_ed$value = rnorm(nrow(incongruent_agg_ed), mean = 5)
congruent = aggregate(incongruent_agg_ed["value"], lsoa_touching[sel, ], mean)
congruent$level = "Congruent"
congruent = congruent[c("level", "value")]
incongruent_cents = st_centroid(incongruent_agg_ed)
aggregating_value = st_join(incongruent_cents, congruent)$value.y
incongruent_agg = aggregate(incongruent_agg_ed["value"], list(aggregating_value), FUN = mean)
incongruent_agg$level = "Incongruent"
incongruent = incongruent_agg[c("level", "value")]
summary(st_geometry_type(congruent))
summary(st_geometry_type(incongruent))
incongruent = st_cast(incongruent, "MULTIPOLYGON")
summary(st_geometry_type(incongruent))
summary(st_geometry_type(aggregating_zones))
devtools::use_data(congruent, overwrite = TRUE)
devtools::use_data(incongruent, overwrite = TRUE)
devtools::use_data(aggregating_zones, overwrite = TRUE)

## End(Not run)

```

**Description**

Points representing cycle hire points accross London.

**Usage**

```
cycle_hire
```

**Format**

FORMAT:

- id Id of the hire point
- name Name of the point
- area Area they are in
- nbikes The number of bikes currently parked there
- nempty The number of empty places
- geometry sfc\_POINT

**Source**

<https://cyclehireapp.com/cyclehirelive/cyclehire.csv>

**Examples**

```
if (requireNamespace("sf", quietly = TRUE)) {  
  library(sf)  
  data(cycle_hire)  
  # or  
  cycle_hire <- st_read(system.file("shapes/cycle_hire.geojson", package="spData"))  
  
  plot(cycle_hire)  
}  
  
## Not run:  
# Download the data  
cycle_hire = readr::read_csv("http://cyclehireapp.com/cyclehirelive/cyclehire.csv",  
  col_names = FALSE, skip = TRUE)  
cycle_hire = cycle_hire[c_names]  
c_names = c("id", "name", "area", "lat", "lon", "nbikes", "nempty")  
cycle_hire = st_sf(cycle_hire, st_multipoint(c_names[c("lon", "lat")]))  
  
## End(Not run)
```

---

cycle_hire_osm	<i>Cycle hire points in London from OSM</i>
----------------	---

---

## Description

Dataset downloaded using the `osmdata` package representing cycle hire points across London.

## Usage

```
cycle_hire_osm
```

## Format

- `osm_id` The OSM ID
- `name` The name of the cycle point
- `capacity` How many bikes it can take
- `cyclestreets_id` The ID linked to cyclestreets' photomap
- `description` Additional description of points
- `geometry` `sfc_POINT`

## Source

<http://www.openstreetmap.org>

## See Also

See the `osmdata` package: <https://cran.r-project.org/package=osmdata>

## Examples

```
if (requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  data(cycle_hire_osm)
  # or
  cycle_hire_osm <- st_read(system.file("shapes/cycle_hire_osm.geojson", package="spData"))

  plot(cycle_hire_osm)
}

# Code used to download the data:
## Not run:
library(osmdata)
library(dplyr)
library(sf)
q = add_osm_feature(opq = opq("London"), key = "network", value = "tfl_cycle_hire")
lnd_cycle_hire = osmdata_sf(q)
cycle_hire_osm = lnd_cycle_hire$osm_points
```

```
nrow(cycle_hire_osm)
plot(cycle_hire_osm)
cycle_hire_osm = dplyr::select(cycle_hire_osm, osm_id, name, capacity,
                              cyclestreets_id, description) %>%
  mutate(capacity = as.numeric(capacity))
names(cycle_hire_osm)
nrow(cycle_hire_osm)

## End(Not run)
```

---

eire

*Eire data sets*


---

### Description

The Eire data set has been converted to shapefile format and placed in the etc/shapes directory. The initial data objects are now stored as a SpatialPolygonsDataFrame object, from which the contiguity neighbour list is recreated. For purposes of record, the original data set is retained. The `eire.df` data frame has 26 rows and 9 columns. In addition, polygons of the 26 counties are provided as a multipart polylist in `eire.polys.utm` (coordinates in km, projection UTM zone 30). Their centroids are in `eire.coords.utm`. The original Cliff and Ord binary contiguities are in `eire.nb`.

### Format

This data frame contains the following columns:

- A Percentage of sample with blood group A
- towns Towns/unit area
- pale Beyond the Pale 0, within the Pale 1
- size number of blood type samples
- ROADACC arterial road network accessibility in 1961
- OWNCONS percentage in value terms of gross agricultural output of each county consumed by itself
- POPCHG 1961 population as percentage of 1926
- RETSALE value of retail sales British Pound000
- INCOME total personal income British Pound000
- names County names

### Source

Upton and Fingleton 1985, - Bailey and Gatrell 1995, ch. 1 for blood group data, Cliff and Ord (1973), p. 107 for remaining variables (also after O'Sullivan, 1968). Polygon borders and Irish data sourced from Michael Tiefelsdorf's SPSS Saddlepoint bundle, originally hosted at: <http://geog-www.sbs.ohio-state.edu/faculty/tiefelsdorf/GeoStat.htm>.



**Examples**

```

## Not run:
library(maptools)
library(rgdal)
library(spdep)
eire <- readOGR(system.file("shapes/eire.shp", package="spData")[1])
eire.nb <- poly2nb(eire)

data(eire)
# Eire physical anthropology blood group data
summary(eire$A)
brks <- round(fivenum(eire$A), digits=2)
cols <- rev(heat.colors(4))
plot(eire, col=cols[findInterval(eire$A, brks, all.inside=TRUE)])
title(main="Percentage with blood group A in Eire")
legend(x=c(-50, 70), y=c(6120, 6050), leglabs(brks), fill=cols, bty="n")

plot(eire)
plot(eire.nb, coordinates(eire), add=TRUE)

lA <- lag.listw(nb2listw(eire.nb), eire$A)
summary(lA)
moran.test(eire$A, nb2listw(eire.nb))
geary.test(eire$A, nb2listw(eire.nb))
cor(lA, eire$A)
moran.plot(eire$A, nb2listw(eire.nb), labels=eire$names)
A.lm <- lm(A ~ towns + pale, data=eire)
summary(A.lm)
res <- residuals(A.lm)
brks <- c(min(res), -2, -1, 0, 1, 2, max(res))
cols <- rev(cm.colors(6))

plot(eire, col=cols[findInterval(res, brks, all.inside=TRUE)])
title(main="Regression residuals")
legend(x=c(-50, 70), y=c(6120, 6050), legend=leglabs(brks), fill=cols, bty="n")

lm.morantest(A.lm, nb2listw(eire.nb))
lm.morantest.sad(A.lm, nb2listw(eire.nb))
lm.LMtests(A.lm, nb2listw(eire.nb), test="LMerr")

# Eire agricultural data
brks <- round(fivenum(eire$OWNCONS), digits=2)
cols <- grey(4:1/5)
plot(eire, col=cols[findInterval(eire$OWNCONS, brks, all.inside=TRUE)])
title(main="Percentage own consumption of agricultural produce")
legend(x=c(-50, 70), y=c(6120, 6050), legend=leglabs(brks), fill=cols, bty="n")

moran.plot(eire$OWNCONS, nb2listw(eire.nb))
moran.test(eire$OWNCONS, nb2listw(eire.nb))
e.lm <- lm(OWNCONS ~ ROADACC, data=eire)
res <- residuals(e.lm)
brks <- c(min(res), -2, -1, 0, 1, 2, max(res))

```

```

cols <- rev(cm.colors(6))
plot(eire, col=cols[findInterval(res, brks, all.inside=TRUE)])
title(main="Regression residuals")
legend(x=c(-50, 70), y=c(6120, 6050), legend=leglabs(brks), fill=cm.colors(6), bty="n")

lm.morantest(e.lm, nb2listw(eire.nb))
lm.morantest.sad(e.lm, nb2listw(eire.nb))
lm.LMtests(e.lm, nb2listw(eire.nb), test="LMerr")
print(localmoran.sad(e.lm, eire.nb, select=1:length(slot(eire, "polygons"))))

## End(Not run)

```

---

elect80

1980 Presidential election results

---

## Description

A data set for 1980 Presidential election results covering 3,107 US counties using geographical coordinates. In addition, three spatial neighbour objects, k4 not using Great Circle distances, d11 using Great Circle distances, and e80\_queen of Queen contiguities for equivalent County polygons taken from file co1980p020.tar.gz on the USGS National Atlas site, and a spatial weights object imported from elect.ford - a 4-nearest neighbour non-GC row-standardised object, but with coercion to symmetry.

## Usage

```
elect80
```

## Format

A SpatialPointsDataFrame with 3107 observations on the following 7 variables.

- FIPS a factor of county FIPS codes
- long a numeric vector of longitude values
- lat a numeric vector of latitude values
- pc\_turnout Votes cast as proportion of population over age 19 eligible to vote
- pc\_college Population with college degrees as proportion of population over age 19 eligible to vote
- pc\_homeownership Homeownership as proportion of population over age 19 eligible to vote
- pc\_income Income per capita of population over age 19 eligible to vote

## Source

Pace, R. Kelley and Ronald Barry. 1997. "Quick Computation of Spatial Autoregressive Estimators", in Geographical Analysis; sourced from the data folder in the Spatial Econometrics Toolbox for Matlab, <http://www.spatial-econometrics.com/html/jplv7.zip>, files elect.dat and elect.ford (with the final line dropped).

**Examples**

```
if (requireNamespace("sp", quietly = TRUE)) {
  library(sp)
  data(elect80)
  summary(elect80)
  plot(elect80)
}
```

---

elev

*Artificial elevation raster data set*


---

**Description**

The raster data represents elevation in meters and uses WGS84 as a coordinate reference system.

**Usage**

```
elev
```

**Format**

An object of class RasterLayer of dimension 6 x 6 x 1.

**Examples**

```
if (requireNamespace("sp", quietly = TRUE)) {
  library(raster)
  data(elev)
  elev
}
```

---

getisord

*Getis-Ord remote sensing example data*


---

**Description**

The `go_xyz` data frame has 256 rows and 3 columns. Vectors `go_x` and `go_y` are of length 16 and give the centres of the grid rows and columns, 30m apart. The data start from the bottom left, `Getis` and `Ord` start from the top left - so their 136th grid cell is our 120th.

**Format**

This data frame contains the following columns:

- x grid eastings
- y grid northings
- val remote sensing values

**Source**

Getis, A. and Ord, J. K. 1996 Local spatial statistics: an overview. In P. Longley and M. Batty (eds) *Spatial analysis: modelling in a GIS environment* (Cambridge: Geoinformation International), 266.

**Examples**

```
data(getisord)
image(go_x, go_y, t(matrix(go_xyz$val, nrow = 16, ncol=16, byrow = TRUE)), asp = 1)
text(go_xyz$x, go_xyz$y, go_xyz$val, cex = 0.7)
polygon(c(195, 225, 225, 195), c(195, 195, 225, 225), lwd = 2)
title(main = "Getis-Ord 1996 remote sensing data")
```

---

grain

*Artificial raster dataset representing grain sizes*

---

**Description**

The ratified raster dataset represents grain sizes with the three classes clay, silt and sand, and WGS84 as a coordinate reference system.

**Usage**

```
grain
```

**Format**

An object of class RasterLayer of dimension 6 x 6 x 1.

**Examples**

```
if (requireNamespace("sp", quietly = TRUE)) {
  library(raster)
  data(grain)
  grain
}
```

---

hawaii	<i>Hawaii multipolygon</i>
--------	----------------------------

---

### Description

The object loaded is a `sf` object containing the state of Hawaii from the US Census Bureau with a few variables from American Community Survey (ACS)

### Usage

```
hawaii
```

### Format

Formal class 'sf' [package "sf"]; the data contains a data.frame with 1 obs. of 7 variables:

- GEOID character vector of geographic identifiers
- NAME character vector of state names
- REGION character vector of region names
- AREA area in square kilometers of units class
- total\_pop\_10 numerical vector of total population in 2010
- total\_pop\_15 numerical vector of total population in 2015
- geometry sfc\_MULTIPOLYGON

The object is in projected coordinates using Hawaii Albers Equal Area Conic (ESRI:102007).

### Source

<https://www.census.gov/geo/maps-data/data/tiger-line.html>

### See Also

See the `tigris` package: <https://cran.r-project.org/package=tigris>

### Examples

```
if (requireNamespace("sf", quietly = TRUE)) {  
  library(sf)  
  data(hawaii)  
  
  plot(hawaii[["total_pop_15"]])  
}
```

---

 hopkins

*Hopkins burnt savanna herb remains*


---

**Description**

A 20m square is divided into 40 by 40 0.5m quadrats. Observations are in tens of grams of herb remains, 0 being from 0g to less than 10g, and so on. Analysis was mostly conducted using the interior 32 by 32 grid.

**Usage**

hopkins

**Format**

num [1:40, 1:40] 0 0 0 0 0 0 0 0 1 ...

**Source**

Upton, G., Fingleton, B. 1985 Spatial data analysis by example: point pattern and quatitative data, Wiley, pp. 38–39.

**References**

Hopkins, B., 1965 Observations on savanna burning in the Olokemeji Forest Reserve, Nigeria. *Journal of Applied Ecology*, 2, 367–381.

**Examples**

```
data(hopkins)
image(1:32, 1:32, hopkins[5:36,36:5], breaks=c(-0.5, 3.5, 20),
      col=c("white", "black"))
```

---

 house

*Lucas county OH housing*


---

**Description**

Data on 25,357 single family homes sold in Lucas County, Ohio, 1993-1998 from the county auditor, together with an nb neighbour object constructed as a sphere of influence graph from projected coordinates.

**Usage**

house

**Format**

Formal class 'SpatialPointsDataFrame' [package "sp"] with 5 slots. The data slot is a data frame with 25357 observations on the following 24 variables.

- price a numeric vector
- yrbuilt a numeric vector
- stories a factor with levels one bilevel multilvl one+half two two+half three
- TLA a numeric vector
- wall a factor with levels stucdrvt ccbtile metlwnyl brick stone wood partbrk
- beds a numeric vector
- baths a numeric vector
- halfbaths a numeric vector
- frontage a numeric vector
- depth a numeric vector
- garage a factor with levels no garage basement attached detached carport
- garagesqft a numeric vector
- rooms a numeric vector
- lotsize a numeric vector
- sdate a numeric vector
- avalue a numeric vector
- s1993 a numeric vector
- s1994 a numeric vector
- s1995 a numeric vector
- s1996 a numeric vector
- s1997 a numeric vector
- s1998 a numeric vector
- syear a factor with levels 1993 1994 1995 1996 1997 1998
- age a numeric vector

Its projection is CRS(+init=epsg:2834), the Ohio North State Plane.

**Source**

Dataset included in the Spatial Econometrics toolbox for Matlab, <http://www.spatial-econometrics.com/html/jplv7.zip>.

**Examples**

```
if (requireNamespace("sp", quietly = TRUE)) {  
  library(sp)  
  data(house)  
  str(house)  
  plot(house)  
}
```

---

huddersfield                      *Prevalence of respiratory symptoms*

---

**Description**

Prevalence of respiratory symptoms in 71 school catchment areas in Huddersfield, Northern England

**Usage**

huddersfield

**Format**

A data frame with 71 observations on the following 2 variables.

- cases Prevalence of at least mild conditions
- total Number of questionnaires returned

**Source**

Martuzzi M, Elliott P (1996) Empirical Bayes estimation of small area prevalence of non-rare conditions, *Statistics in Medicine* 15, 1867–1873, pp. 1870–1871.

**Examples**

```
data(huddersfield)
str(huddersfield)
```

---

jenks71                                      *Illinois 1959 county gross farm product value per acre*

---

**Description**

Classic data set for the choice of class intervals for choropleth maps.

**Usage**

jenks71

**Format**

A data frame with 102 observations on the following 2 variables.

- jenks71 a numeric vector: Per acre value of gross farm products in dollars by county for Illinois in #’ 1959
- area a numeric vector: county area in square miles



**Source**

Jenks, G. F., Caspall, F. C., 1971. "Error on choroplethic maps: definition, measurement, reduction". *Annals, Association of American Geographers*, 61 (2), 217–244

**Examples**

```
data(jenks71)
jenks71
```

---

lnd	<i>The boroughs of London</i>
-----	-------------------------------

---

**Description**

Polygons representing large administrative zones in London

**Usage**

```
lnd
```

**Format**

- NAME Borough name
- GSS\_CODE Official code
- HECTARES How many hectares
- NONLD\_AREA Area outside London
- ONS\_INNER Office for national statistics code
- SUB\_2009 Empty column
- SUB\_2006 Empty column
- geometry sfc\_MULTIPOLYGON

**Source**

<https://github.com/Robinlovelace/Creating-maps-in-R>

**Examples**

```
if (requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  data(lnd)
  summary(lnd)
  plot(st_geometry(lnd))
}
```

nc.sids

*North Carolina SIDS data***Description**

(Use `example(nc.sids)` to read the data set from shapefile, together with import of two different list of neighbours). The `nc.sids` data frame has 100 rows and 21 columns. It contains data given in Cressie (1991, pp. 386-9), Cressie and Read (1985) and Cressie and Chan (1989) on sudden infant deaths in North Carolina for 1974-78 and 1979-84. The data set also contains the neighbour list given by Cressie and Chan (1989) omitting self-neighbours (`ncCC89.nb`), and the neighbour list given by Cressie and Read (1985) for contiguities (`ncCR85.nb`). The data are ordered by county ID number, not alphabetically as in the source tables `sidspolys` is a "polylist" object of polygon boundaries, and `sidscents` is a matrix of their centroids.

**Usage**

```
nc.sids
```

**Format**

This data frame contains the following columns:

- SP\_ID SpatialPolygons ID
- CNTY\_ID county ID
- east eastings, county seat, miles, local projection
- north northings, county seat, miles, local projection
- L\_id Cressie and Read (1985) L index
- M\_id Cressie and Read (1985) M index
- names County names
- AREA County polygon areas in degree units
- PERIMETER County polygon perimeters in degree units
- CNTY\_ Internal county ID
- NAME County names
- FIPS County ID
- FIPSNO County ID
- CRESS\_ID Cressie papers ID
- BIR74 births, 1974-78
- SID74 SID deaths, 1974-78
- NWBIR74 non-white births, 1974-78
- BIR79 births, 1979-84
- SID79 SID deaths, 1979-84
- NWBIR79 non-white births, 1979-84

**Source**

Cressie, N (1991), *Statistics for spatial data*. New York: Wiley, pp. 386–389; Cressie, N, Chan NH (1989) Spatial modelling of regional variables. *Journal of the American Statistical Association*, 84, 393–401; Cressie, N, Read, TRC (1985) Do sudden infant deaths come in clusters? *Statistics and Decisions* Supplement Issue 2, 333–349; <http://sal.agecon.uiuc.edu/datasets/sids.zip>.

**Examples**

```
if (requireNamespace("rgdal", quietly = TRUE)) {
  library(rgdal)
  if (requireNamespace("spdep", quietly = TRUE)) {
    library(spdep)
    nc.sids <- readOGR(system.file("shapes/sids.shp", package="spData")[1])
    proj4string(nc.sids) <- CRS("+proj=longlat +ellps=clrk66")
    row.names(nc.sids) <- as.character(nc.sids$FIPS)
    rn <- row.names(nc.sids)
    ncCC89_nb <- read.gal(system.file("weights/ncCC89.gal", package="spData")[1],
                          region.id=rn)
    ncCR85_nb <- read.gal(system.file("weights/ncCR85.gal", package="spData")[1],
                          region.id=rn)

    plot(nc.sids, border="grey")
    plot(ncCR85_nb, coordinates(nc.sids), add=TRUE, col="blue")
    plot(nc.sids, border="grey")
    plot(ncCC89_nb, coordinates(nc.sids), add=TRUE, col="blue")
  }
}
```

---

nydata

*New York leukemia data*


---

**Description**

New York leukemia data taken from the data sets supporting Waller and Gotway 2004 (the data should be loaded by running `example(NY_data)` to demonstrate spatial data import techniques)

**Usage**

```
nydata
```

**Format**

A data frame with 281 observations on the following 12 variables, and the binary coded spatial weights used in the source.

- AREANAME name of census tract
- AREAKEY unique FIPS code for each tract
- X x-coordinate of tract centroid (in km)

- Y y-coordinate of tract centroid (in km)
- POP8 population size (1980 U.S. Census)
- TRACTCAS number of cases 1978-1982
- PROPCAS proportion of cases per tract
- PCTOWNHOME percentage of people in each tract owning their own home
- PCTAGE65P percentage of people in each tract aged 65 or more
- Z transformed proportions
- AVGIDIST average distance between centroid and TCE sites
- PEXPOSURE "exposure potential": inverse distance between each census tract centroid and the nearest TCE site, IDIST, transformed via  $\log(100*IDIST)$

### Details

The examples section shows how the DBF files from the book website for Chapter 9 were converted into the nydata data frame and the listw\_NY spatial weights list. The shapes directory includes the original version of the UTM18 census tract boundaries imported from BNA format ([http://sedac.ciesin.columbia.edu/ftpsite/pub/census/usa/tiger/ny/bna\\_st/t8\\_36.zip](http://sedac.ciesin.columbia.edu/ftpsite/pub/census/usa/tiger/ny/bna_st/t8_36.zip)) before the OGR/GDAL BNA driver was available. The NY8\_utm18 shapefile was constructed using a bna2mif converter and converted to shapefile format after adding data using writeOGR. The new file NY8\_bna\_utm18.gpkg has been constructed from the original BNA file, but read using the OGR BNA driver with GEOS support. The NY8 shapefile includes invalid polygons, but because the OGR BNA driver may have GEOS support (used here), the tract polygon objects are valid.

### Source

<http://www.sph.emory.edu/~lwaller/ch9index.htm>

### References

Waller, L. and C. Gotway (2004) *Applied Spatial Statistics for Public Health Data*. New York: John Wiley and Sons.

### Examples

```
## NY leukemia
## Not run:
library(foreign)
nydata <- read.dbf(system.file("misc/nydata.dbf", package="spData")[1])
library(sp)
coordinates(nydata) <- c("X", "Y")
plot(nydata)

nyadjmat <- as.matrix(read.dbf(system.file("misc/nyadjwts.dbf",
                                         package="spData")[1])[-1])
ID <- as.character(names(read.dbf(system.file("misc/nyadjwts.dbf",
                                             package="spData")[1]))[-1])
identical(substring(ID, 2, 10), substring(as.character(nydata$AREAKEY), 2, 10))
```

```
library(spdep)
nyadjlw <- mat2listw(nyadjmat, as.character(nydata$AREAKEY))
listw_NY <- nb2listw(nyadjlw$neighbours, style="B")

## End(Not run)
```

---

nz *Regions in New Zealand*

---

### Description

Polygons representing the 16 regions of New Zealand (2018). See [https://en.wikipedia.org/wiki/Regions\\_of\\_New\\_Zealand](https://en.wikipedia.org/wiki/Regions_of_New_Zealand) for a description of these regions and <https://www.stats.govt.nz> for information on the data source

### Usage

```
nz
```

### Format

FORMAT:

- Name Name
- Island Island
- Land\_area Land area
- Population Population
- Median\_income Median income (NZD)
- Sex\_ratio Sex ratio (male/female)
- geom sfc\_MULTIPOLYGON

### Source

<https://www.stats.govt.nz>  
[https://en.wikipedia.org/wiki/Regions\\_of\\_New\\_Zealand](https://en.wikipedia.org/wiki/Regions_of_New_Zealand)

### See Also

See the nzcensus package: <https://github.com/ellisp/nzelect>

## Examples

```

if (requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  summary(nz)
  plot(nz)
}
## Not run:
# Find "Regional Council 2018 Clipped (generalised)"
# select the GeoPackage option in the "Vectors/tables" dropdown
# at https://datafinder.stats.govt.nz/data/ (requires registration)
# Save the result as:
unzip("statsnzregional-council-2018-clipped-generalised-GPKG.zip")
library(sf)
library(tidyverse)
nz_full = st_read("regional-council-2018-clipped-generalised.gpkg")
print(object.size(nz_full), units = "Kb") # 14407.2 Kb
nz = rmapshaper::ms_simplify(nz_full, keep = 0.001, sys = TRUE)
print(object.size(nz), units = "Kb") # 39.9 Kb
names(nz)
nz$REGC2018_V1_00_NAME
nz = filter(nz, REGC2018_V1_00_NAME != "Area Outside Region") %>%
  select(Name = REGC2018_V1_00_NAME, `Land_area` = LAND_AREA_SQ_KM)
# regions basic info
# devtools::install_github("hadley/rvest")
library(rvest)
doc = read_html("https://en.wikipedia.org/wiki/Regions_of_New_Zealand") %>%
  html_nodes("div table")
tab = doc[[3]] %>% html_table()
tab = tab %>% select(Name = Region, Population = `Population[20]`, Island)
tab = tab %>% mutate(Population = str_replace_all(Population, ",", "")) %>%
  mutate(Population = as.numeric(Population)) %>%
  mutate(Name = str_remove_all(Name, "\\([1-9]\\)\\.+"))
nz$Name = as.character(nz$Name)
nz$Name = str_remove(nz$Name, " Region")
nz$Name %in% tab$Name
# regions additional info
library(nzcensus)
nz_add_data = REGC2013 %>%
  select(Name = REGC2013_N, Median_income = MedianIncome2013,
         PropFemale2013, PropMale2013) %>%
  mutate(Sex_ratio = PropMale2013 / PropFemale2013) %>%
  mutate(Name = gsub(" Region", "", Name)) %>%
  select(Name, Median_income, Sex_ratio)
# data join
nz = left_join(nz, tab, by = "Name") %>%
  left_join(nz_add_data, by = "Name") %>%
  select(Name, Island, Land_area, Population, Median_income, Sex_ratio)

## End(Not run)

```

---

nz\_height

*High points in New Zealand*

---

## Description

Top 101 highest points in New Zealand (2017). See <https://data.linz.govt.nz/layer/50284-nz-height-points-to> for details.

## Usage

nz\_height

## Format

FORMAT:

- t50\_fid ID
- elevation Height above sea level in m
- geometry sfc\_POINT

## Source

<https://data.linz.govt.nz>

## Examples

```
if (requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  summary(nz_height)
  plot(nz$geom)
  plot(nz_height$geom, add = TRUE)
}
## Not run:
library(dplyr)
# After downloading data
unzip("lds-nz-height-points-topo-150k-SHP.zip")
nz_height = st_read("nz-height-points-topo-150k.shp") %>%
  top_n(n = 100, wt = elevation)
library(tmap)
tmap_mode("view")
qtm(nz) +
  qtm(nz_height)
f = list.files(pattern = "*nz-height*")
file.remove(f)

## End(Not run)
```

---

seine

*Small river network in France*

---

### Description

Lines representing the Seine, Marne and Yonne rivers.

### Usage

```
seine
```

### Format

FORMAT:

- name name
- geometry sfc\_MULTILINESTRING

The object is in the RGF93 / Lambert-93 CRS.

### Source

<http://www.naturalearthdata.com/>

### See Also

See the `rnatuarearth` package: <https://cran.r-project.org/package=rnatuarearth>

### Examples

```
if (requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  seine
  plot(seine)
}
## Not run:
library(sf)
library(rnatuarearth)
library(tidyverse)

seine = ne_download(scale = 10, type = "rivers_lake_centerlines",
                    category = "physical", returnclass = "sf") %>%
  filter(name %in% c("Yonne", "Seine", "Marne")) %>%
  select(name = name_en) %>%
  st_transform(2154)

## End(Not run)
```



---

SplashDams

*Data for Splash Dams in western Oregon*

---

### **Description**

Data for Splash Dams in western Oregon

### **Usage**

SplashDams

### **Format**

Formal class 'SpatialPointsDataFrame' with 232 obs. of 6 variables:

- streamName
- locationCode
- height
- lastDate
- owner
- datesUsed

### **Source**

R. R. Miller (2010) Is the Past Present? Historical Splash-dam Mapping and Stream Disturbance Detection in the Oregon Coastal Province. MSc. thesis, Oregon State University; packaged by Jonathan Callahan

### **References**

[http://www.fs.fed.us/pnw/lwm/aem/docs/burnett/miller\\_rebecca\\_r2010rev.pdf](http://www.fs.fed.us/pnw/lwm/aem/docs/burnett/miller_rebecca_r2010rev.pdf)

### **Examples**

```
if (requireNamespace("sp", quietly = TRUE)) {  
  library(sp)  
  data(SplashDams)  
  plot(SplashDams, axes=TRUE)  
}
```

---

`state.vbm`*US State Visibility Based Map*

---

**Description**

A `SpatialPolygonsDataFrame` object (for use with the `maptools` package) to plot a Visibility Based Map.

**Usage**

```
state.vbm
```

**Format**

An object of class `SpatialPolygonsDataFrame` with 50 rows and 2 columns.

**Details**

A `SpatialPolygonsDataFrame` object (for use with the `maptools` package) to plot a map of the US states where the sizes of the states have been adjusted to be more equal. This map can be useful for plotting state data using colors patterns without the larger states dominating and the smallest states being lost. The original map is copyrighted by Mark Monmonier. Official publications based on this map should acknowledge him. Commercial publications of maps based on this probably need permission from him to use.

**Author(s)**

Greg Snow <[greg.snow@imail.org](mailto:greg.snow@imail.org)> (of this compilation)

**Source**

The data was converted from the maps library for S-PLUS. S-PLUS uses the map with permission from the author. This version of the data has not received permission from the author (no attempt made, not that it was refused), most of my uses I feel fall under fair use and do not violate copyright, but you will need to decide for yourself and your applications.

**References**

<http://www.markmonmonier.com/index.htm>, <http://www.math.yorku.ca/SCS/Gallery/bright-ideas.html>

**Examples**

```
if (requireNamespace("sp", quietly = TRUE)) {  
  library(sp)  
  data(state.vbm)  
  plot(state.vbm)
```

```

tmp <- state.x77[, 'HS Grad']
tmp2 <- cut(tmp, seq(min(tmp), max(tmp), length.out=11),
            include.lowest=TRUE)
plot(state.vbm, col=cm.colors(10)[tmp2])
}

```

---

urban\_agglomerations *Major urban areas worldwide*

---

### Description

Dataset in a 'long' form from the United Nations population division with projections up to 2050. Includes only the top 30 largest areas by population at 5 year intervals.

### Usage

```
urban_agglomerations
```

### Format

Selected variables:

- year Year of population estimate
- country\_code Code of country
- urban\_agglomeration Name of the urban agglomeration
- population\_millions Estimated human population
- geometry sfc\_POINT

### Source

<https://esa.un.org/unpd/wup>

### Examples

```

if (requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  data(urban_agglomerations)
}
# Code used to download the data:
## Not run:
download.file(destfile = "WUP2014-F11a-30_Largest_Cities.xls",
url = "https://esa.un.org/unpd/wup/CD-ROM/WUP2014_XLS_CD_FILES/WUP2014-F11a-30_Largest_Cities.xls")
library(dplyr)
library(sf)
urban_agglomerations = readxl::read_excel("WUP2014-F11a-30_Largest_Cities.xls", skip = 16) %>%
  st_as_sf(coords = c("Longitude", "Latitude"), crs = 4326)
names(urban_agglomerations) <- gsub(" ", "_", tolower(names(urban_agglomerations))) %>%
  gsub("\\(|\\)", "", .)

```

```

devtools::use_data(urban_agglomerations, overwrite = TRUE)
file.remove("WUP2014-F11a-30_Largest_Cities.xls")

## End(Not run)

```

---

used.cars                      *US 1960 used car prices*

---

### Description

The `used.cars` data frame has 48 rows and 2 columns. The data set includes a neighbours list for the 48 states excluding DC from `poly2nb()`.

### Usage

```
used.cars
```

### Format

This data frame contains the following columns:

- `tax.charges` taxes and delivery charges for 1955-9 new cars
- `price.1960` 1960 used car prices by state

### Source

Hanna, F. A. 1966 Effects of regional differences in taxes and transport charges on automobile consumption, in Ostry, S., Rhymes, J. K. (eds) *Papers on regional statistical studies*, Toronto: Toronto University Press, pp. 199-223.

### References

Hepple, L. W. 1976 A maximum likelihood model for econometric estimation with spatial series, in Masser, I (ed) *Theory and practice in regional science*, London: Pion, pp. 90-104.

### Examples

```

if (requireNamespace("spdep", quietly = TRUE)) {
  library(spdep)
  data(used.cars)
  moran.test(used.cars$price.1960, nb2listw(usa48.nb))
  moran.plot(used.cars$price.1960, nb2listw(usa48.nb),
             labels=rownames(used.cars))
  uc.lm <- lm(price.1960 ~ tax.charges, data=used.cars)
  summary(uc.lm)

  lm.morantest(uc.lm, nb2listw(usa48.nb))
  lm.morantest.sad(uc.lm, nb2listw(usa48.nb))
  lm.LMtests(uc.lm, nb2listw(usa48.nb))
}

```

```

if (requireNamespace("spatialreg", quietly = TRUE)) {
  library(spatialreg)
  uc.err <- errorsarlm(price.1960 ~ tax.charges, data=used.cars,
                      nb2listw(usa48.nb), tol.solve=1.0e-13,
                      control=list(tol.opt=.Machine$double.eps^0.3))
  summary(uc.err)
  uc.lag <- lagsarlm(price.1960 ~ tax.charges, data=used.cars,
                   nb2listw(usa48.nb), tol.solve=1.0e-13,
                   control=list(tol.opt=.Machine$double.eps^0.3))
  summary(uc.lag)
  uc.lag1 <- lagsarlm(price.1960 ~ 1, data=used.cars,
                    nb2listw(usa48.nb), tol.solve=1.0e-13,
                    control=list(tol.opt=.Machine$double.eps^0.3))
  summary(uc.lag1)
  uc.err1 <- errorsarlm(price.1960 ~ 1, data=used.cars,
                      nb2listw(usa48.nb), tol.solve=1.0e-13,
                      control=list(tol.opt=.Machine$double.eps^0.3))
  summary(uc.err1)
}
}

```

---

us\_states

*US states polygons*


---

### Description

The object loaded is a sf object containing the contiguous United States data from the US Census Bureau with a few variables from American Community Survey (ACS)

### Usage

```
us_states
```

### Format

Formal class 'sf' [package "sf"]; the data contains a data.frame with 49 obs. of 7 variables:

- GEOID character vector of geographic identifiers
- NAME character vector of state names
- REGION character vector of region names
- AREA area in square kilometers of units class
- total\_pop\_10 numerical vector of total population in 2010
- total\_pop\_15 numerical vector of total population in 2015
- geometry sfc\_MULTIPOLYGON

The object is in geographical coordinates using the NAD83 datum.

**Source**

<https://www.census.gov/geo/maps-data/data/tiger-line.html>

**See Also**

See the tigris package: <https://cran.r-project.org/package=tigris>

**Examples**

```
if (requireNamespace("sf", quietly = TRUE)) {  
  library(sf)  
  data(us_states)  
  
  plot(us_states["REGION"])  
}
```

---

us\_states\_df

*the American Community Survey (ACS) data*

---

**Description**

The object loaded is a `data.frame` object containing the US states data from the American Community Survey (ACS)

**Usage**

```
us_states_df
```

**Format**

Formal class 'data.frame': the data contains a data.frame with 51 obs. of 5 variables:

- state character vector of state names
- median\_income\_10 numerical vector of median income in 2010
- median\_income\_15 numerical vector of median income in 2010
- poverty\_level\_10 numerical vector of number of people with income below poverty level in 2010
- poverty\_level\_15 numerical vector of number of people with income below poverty level in 2015

**Source**

<https://www.census.gov/programs-surveys/acs/>

**See Also**

See the tidycensus package: <https://cran.r-project.org/package=tidycensus>

**Examples**

```
data(us_states_df)

summary(us_states_df)
```

---

wheat	<i>Mercer and Hall wheat yield data</i>
-------	---

---

**Description**

Mercer and Hall wheat yield data, based on version in Cressie (1993), p. 455.

**Usage**

```
wheat
```

**Format**

The format of the object generated by running `data(wheat)` is a three column data frame made available by Hongfei Li. The example section shows how to convert this to the object used in demonstrating the `ap1e` function, and is a formal class `'SpatialPolygonsDataFrame'` [package "sp"] with 5 slots; the data slot is a data frame with 500 observations on the following 6 variables.

- lat local coordinates northings ordered north to south
- yield Mercer and Hall wheat yield data
- r rows south to north; levels in distance units of plot centres
- c columns west to east; levels in distance units of plot centres
- lon local coordinates eastings
- lat1 local coordinates northings ordered south to north

**Note**

The value of 4.03 was changed to 4.33 (`wheat[71,]`) 13 January 2014; thanks to Sandy Burden; cross-checked with <http://www.itc.nl/personal/rossiter/teach/R/mhw.csv>, which agrees.

**Source**

Cressie, N. A. C. (1993) *Statistics for Spatial Data*. Wiley, New York, p. 455.

**References**

Mercer, W. B. and Hall, A. D. (1911) The experimental error of field trials. *Journal of Agricultural Science* 4, 107-132.

**Examples**

```
## Not run:
data(wheat)
wheat$lat1 <- 69 - wheat$lat
wheat$r <- factor(wheat$lat1)
wheat$c <- factor(wheat$lon)
wheat_sp <- wheat
coordinates(wheat_sp) <- c("lon", "lat1")
wheat_spg <- wheat_sp

gridded(wheat_spg) <- TRUE
wheat_spl <- as(wheat_spg, "SpatialPolygons")
df <- as(wheat_spg, "data.frame")
row.names(df) <- sapply(slot(wheat_spl, "polygons"),
                        function(x) slot(x, "ID"))
wheat <- SpatialPolygonsDataFrame(wheat_spl, data=df)

## End(Not run)

if (requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  wheat <- st_read(system.file("shapes/wheat.shp", package="spData"))
  plot(wheat)
}
```

---

world

*World country polygons*


---

**Description**

The object loaded is a sf object containing a world map data from Natural Earth with a few variables from World Bank

**Usage**

```
world
```

**Format**

Formal class 'sf' [package "sf"]; the data contains a data.frame with 177 obs. of 11 variables:

- iso\_a2 character vector of ISO 2 character country codes
- name\_long character vector of country names
- continent character vector of continent names
- region\_un character vector of region names
- subregion character vector of subregion names
- type character vector of type names



- area\_km2 integer vector of area values
- pop integer vector of population in 2014
- lifeExp integer vector of life expectancy at birth in 2014
- gdpPercap integer vector of per-capita GDP in 2014
- geom sfc\_MULTIPOLYGON

The object is in geographical coordinates using the WGS84 datum.

### Source

<http://www.naturalearthdata.com/>

<http://data.worldbank.org/>

### See Also

See the rnaturalearth package: <https://cran.r-project.org/package=rnaturalearth>

### Examples

```
if (requireNamespace("sf", quietly = TRUE)) {
  library(sf)
  data(world)
  # or
  world <- st_read(system.file("shapes/world.gpkg", package="spData"))

  plot(world)
}
```

---

worldbank\_df

*World Bank data*

---

### Description

The object loaded is a data.frame object containing data from World Bank

### Usage

```
worldbank_df
```

### Format

Formal class 'data.frame'; the data contains a data.frame with 177 obs. of 7 variables:

- name character vector of country names
- iso\_a2 character vector of ISO 2 character country codes
- HDI human development index (HDI)
- urban\_pop urban population

- unemployment unemployment, total (% of total labor force)
- pop\_growth population growth (annual %)
- literacy adult literacy rate, population 15+ years, both sexes (%)

**Source**

<http://data.worldbank.org/>

**See Also**

See the wbstats package: <https://cran.r-project.org/web/packages/wbstats>

**Examples**

```
data(worldbank_df)
# or
worldbank_df <- read.csv(system.file("misc/worldbank_df.csv", package="spData"))

summary(worldbank_df)
```

# Index

## \*Topic **datasets**

- afcon, [2](#)
- alaska, [4](#)
- auckland, [5](#)
- baltimore, [6](#)
- boston, [7](#)
- coffee\_data, [9](#)
- columbus, [11](#)
- congruent, [12](#)
- cycle\_hire, [13](#)
- cycle\_hire\_osm, [15](#)
- eire, [16](#)
- elect80, [18](#)
- elev, [19](#)
- getisord, [19](#)
- grain, [20](#)
- hawaii, [21](#)
- hopkins, [22](#)
- house, [22](#)
- huddersfield, [24](#)
- jenks71, [24](#)
- Ind, [25](#)
- nc.sids, [26](#)
- nydata, [27](#)
- nz, [29](#)
- nz\_height, [31](#)
- seine, [32](#)
- SplashDams, [33](#)
- state.vbm, [34](#)
- urban\_agglomerations, [35](#)
- us\_states, [37](#)
- us\_states\_df, [38](#)
- used.cars, [36](#)
- wheat, [39](#)
- world, [40](#)
- worldbank\_df, [41](#)

## \*Topic **foreign**

- nydata, [27](#)

## \*Topic **misc**

- coffee\_data, [9](#)
- getisord, [19](#)
- hopkins, [22](#)
- huddersfield, [24](#)
- jenks71, [24](#)

## \*Topic **raster**

- elev, [19](#)
- grain, [20](#)

## \*Topic **sf**

- alaska, [4](#)
- baltimore, [6](#)
- congruent, [12](#)
- cycle\_hire, [13](#)
- cycle\_hire\_osm, [15](#)
- hawaii, [21](#)
- Ind, [25](#)
- nz, [29](#)
- nz\_height, [31](#)
- seine, [32](#)
- urban\_agglomerations, [35](#)
- us\_states, [37](#)
- wheat, [39](#)
- world, [40](#)

## \*Topic **spdep**

- afcon, [2](#)
- boston, [7](#)
- columbus, [11](#)
- eire, [16](#)
- nc.sids, [26](#)
- nydata, [27](#)
- used.cars, [36](#)

## \*Topic **sp**

- auckland, [5](#)
- columbus, [11](#)
- eire, [16](#)
- elect80, [18](#)
- house, [22](#)
- SplashDams, [33](#)
- state.vbm, [34](#)

afcon, 2  
africa.rook.nb (afcon), 2  
afx (afcon), 2  
aggregating\_zones (congruent), 12  
alaska, 4  
auckland, 5  
auckpolys (auckland), 5  
  
baltimore, 6  
bbs (columbus), 11  
boston, 7  
  
coffee\_data, 9  
col.gal.nb (columbus), 11  
columbus, 11  
congruent, 12  
coords (columbus), 11  
cycle\_hire, 13  
cycle\_hire\_osm, 15  
  
dll (elect80), 18  
  
e80\_queen (elect80), 18  
eire, 16  
elect80, 18  
elect80\_lw (elect80), 18  
elev, 19  
  
getisord, 19  
go\_x (getisord), 19  
go\_xyz (getisord), 19  
go\_y (getisord), 19  
grain, 20  
  
hawaii, 21  
hopkins, 22  
house, 22  
huddersfield, 24  
  
incongruent (congruent), 12  
  
jenks71, 24  
  
k4 (elect80), 18  
  
listw\_NY (nydata), 27  
lnd, 25  
LO\_nb (house), 22  
  
nc.sids, 26  
ncCC89.nb (nc.sids), 26  
ncCR85.nb (nc.sids), 26  
new\_zealand (nz), 29  
NY\_data (nydata), 27  
nydata, 27  
nz, 29  
nz\_height, 31  
  
paper.nb (afcon), 2  
polys (columbus), 11  
  
rivers (seine), 32  
  
seine, 32  
sidscents (nc.sids), 26  
sidspolys (nc.sids), 26  
SplashDams, 33  
state.vbm, 34  
  
trMat (house), 22  
  
urban\_agglomerations, 35  
us\_states, 37  
us\_states\_df, 38  
usa48.nb (used.cars), 36  
used.cars, 36  
  
wheat, 39  
world, 40  
worldbank\_df, 41  
wrld (world), 40