

GEOG 5680

Introduction to R

12: Spatial data in R

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Spatial data in R

From Cressie (1991):

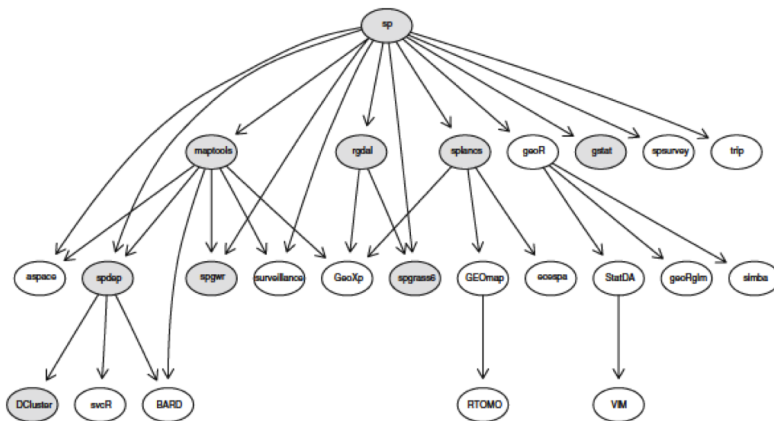
- Point processes (occurrences of events in space)
- Areal or lattice — discrete variation of values aggregated across regular or irregular regions
- Geostatistical — continuous variation of values

Expressed as geometric features:

- Points/Lines/Areal units (polygons)/Regular grids
- In a plane, or, less frequently, on a surface

Spatial data in R

Packages in R dealing with spatial data (from Bivand et al)



Spatial data in R

Key spatial packages:

- **sp** provides the class information to deal with spatial data
- **raster** — raster data and analysis
- **rgdal**: GDAL API interface for import/export
- **rgeos**: spatial geometry operations
- **maptools** provides many functions for read and transforming data

Most other spatial analysis packages depend on these!

- **spatstat** — analysis of spatial point processes
- **spatdep** — spatial dependency
- **spatialreg** — spatial regression models
- **gstat** — geostatistical analysis

Spatial data classes in **sp**

Class	Data type
SpatialPoints	Point locations
SpatialPointsDataFrame	Point locations with values
SpatialPolygons	Polygon vertices
SpatialPolygonsDataFrame	Polygons with values
SpatialGrid	Grid or raster
SpatialGridDataFrame	Grid/raster with values
SpatialPixel	Grid stored as point data
SpatialPixelDataFrame	Point grid with values

Note also **ppp** (point process objects) in **spatstat** package

Spatial data classes in **sp**

Each Spatial* object has a series of *slots* which contain both data and metadata about the object:

- Coordinates
- Bounding box
- Coordinate Reference System
- Grid topology
- Data
 - This is a data frame and can be accessed with indices, conditional selection, `subset()`
- Etc. . .

Spatial data classes in **sp**

```
oregon = readOGR("oregon/orotl.shp")
```

```
## OGR data source with driver: ESRI Shapefile
```

```
## Source: "/Users/u0784726/Dropbox/DB Docs/Classes/GEOG5680/Modules/12 Spatial data in R/oregon/orotl.shp"
```

```
## with 36 features
```

```
## It has 1 fields
```

```
slotNames(oregon)
```

```
## [1] "data"          "polygons"      "plotOrder"     "bbox"          "proj4string"
```

```
slot(oregon, "data")
```

```
##      NAME
```

```
## 0    Clatsop
```

```
## 1    Columbia
```

```
## 2    Umatilla
```

```
## 3    Wallowa
```

```
## 4    Morrow
```

```
## 5    Union
```

```
## 6    Gilliam
```

Spatial data classes in **sp**

```
names(oregon)
```

```
## [1] "NAME"
```

```
oregon$NAME
```

```
## [1] "Clatsop"      "Columbia"     "Umatilla"     "Wallowa"      "Morrow"
## [6] "Union"        "Gilliam"      "Tillamook"    "Washington"   "Sherman"
## [11] "Multnomah"    "Hood River"   "Wasco"        "Clackamas"    "Yamhill"
## [16] "Marion"       "Baker"        "Polk"         "Wheeler"      "Lincoln"
## [21] "Grant"        "Jefferson"    "Linn"         "Benton"       "Crook"
## [26] "Malheur"      "Deschutes"    "Lane"         "Harney"       "Douglas"
## [31] "Klamath"      "Lake"         "Coos"         "Jackson"      "Curry"
## [36] "Josephine"
```

```
subset(oregon, NAME=="Columbia")
```

```
## An object of class "SpatialPolygonsDataFrame"
## Slot "data":
##      NAME
## 1 Columbia
```


Raster data

- Area divided into regular cells or pixels with associated values
- Used extensively with environmental data (climate, soils, RS images, etc)
- Often large data files
- **raster** package
- Allows import and export of most widely used raster data formats
- Includes functions for raster algebra and analysis
- Can work of disk, avoiding memory limits

Raster data

```
library(raster)
r = raster("air.mon.ltm.nc", varname="air")
r

## class      : RasterLayer
## band       : 1 (of 12 bands)
## dimensions  : 73, 144, 10512 (nrow, ncol, ncell)
## resolution  : 2.5, 2.5 (x, y)
## extent     : -1.25, 358.75, -91.25, 91.25 (xmin, xmax, ymin, ymax)
## crs        : NA
## source     : /Users/u0784726/Dropbox/DB Docs/Classes/GEOG5680/Modules/12 Spatial data in R/air.mon.ltm
## names      : Monthly.Long.Term.Mean.Air.Temperature.at.sigma.level.0.995
## z-value    : 0000-12-30
## zvar      : air
```

Raster data

NCEP NCAR January LTM Tair

