Geographical Information Systems

Political Data Science

Anders Woller

March 27, 2018

Considering writing thesis within DPS?

Digital Political Science Group (DPGS) launches event for prospective thesis students

→ May 22nd, 15:00, 4.2.53

1 Motivation
- Conceptual

2 GIS

3 Spatial Objects

4 Vector formats

Initial considerations:

Our brain naturally relates things in space

→ Social science does not! (think regime breakdown)

But introducing space - even if not modelling it explicitly - can be very helpful

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What's the fuss about?

Tobler's 1st law of geography:

"everything is related to everything else, but near things are more related than distant things"

$\Longrightarrow$ spatial relationships characterized by distance decay function: $\mu = \frac{1}{d},\ d > 0$

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Why this is awesome:

→ It allows us to merge data sources that only relates to each other spatially

- Africa: Electricity, crop taxes, or aid to co-ethnics? (geo-EPR)
- Russia: Public companies directed towards pro-Kremlin areas? (geo-vKontakte)
- Pakistan: Does drone strikes affect anti-US sentiment? How much? (geo-Twitter)
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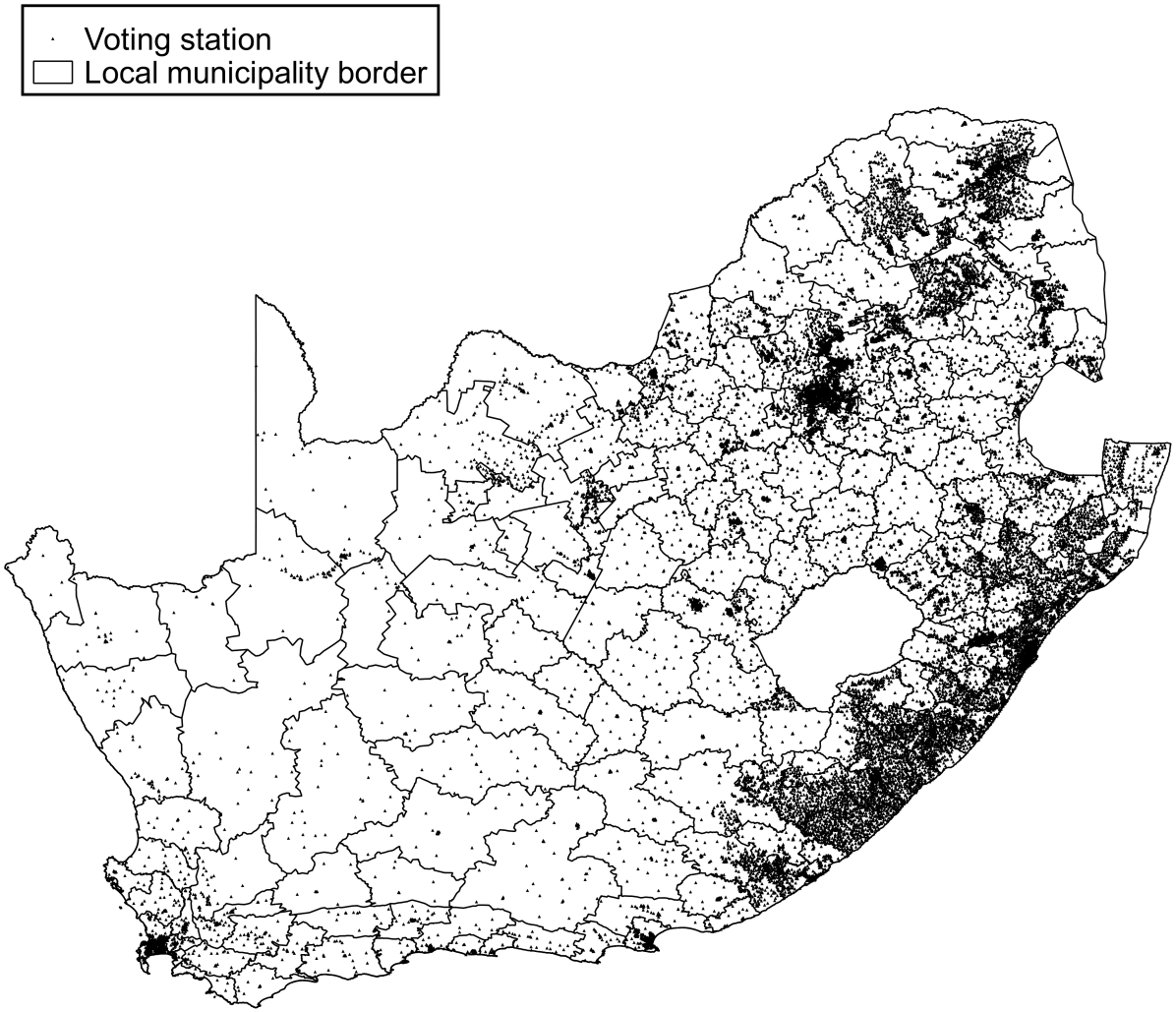
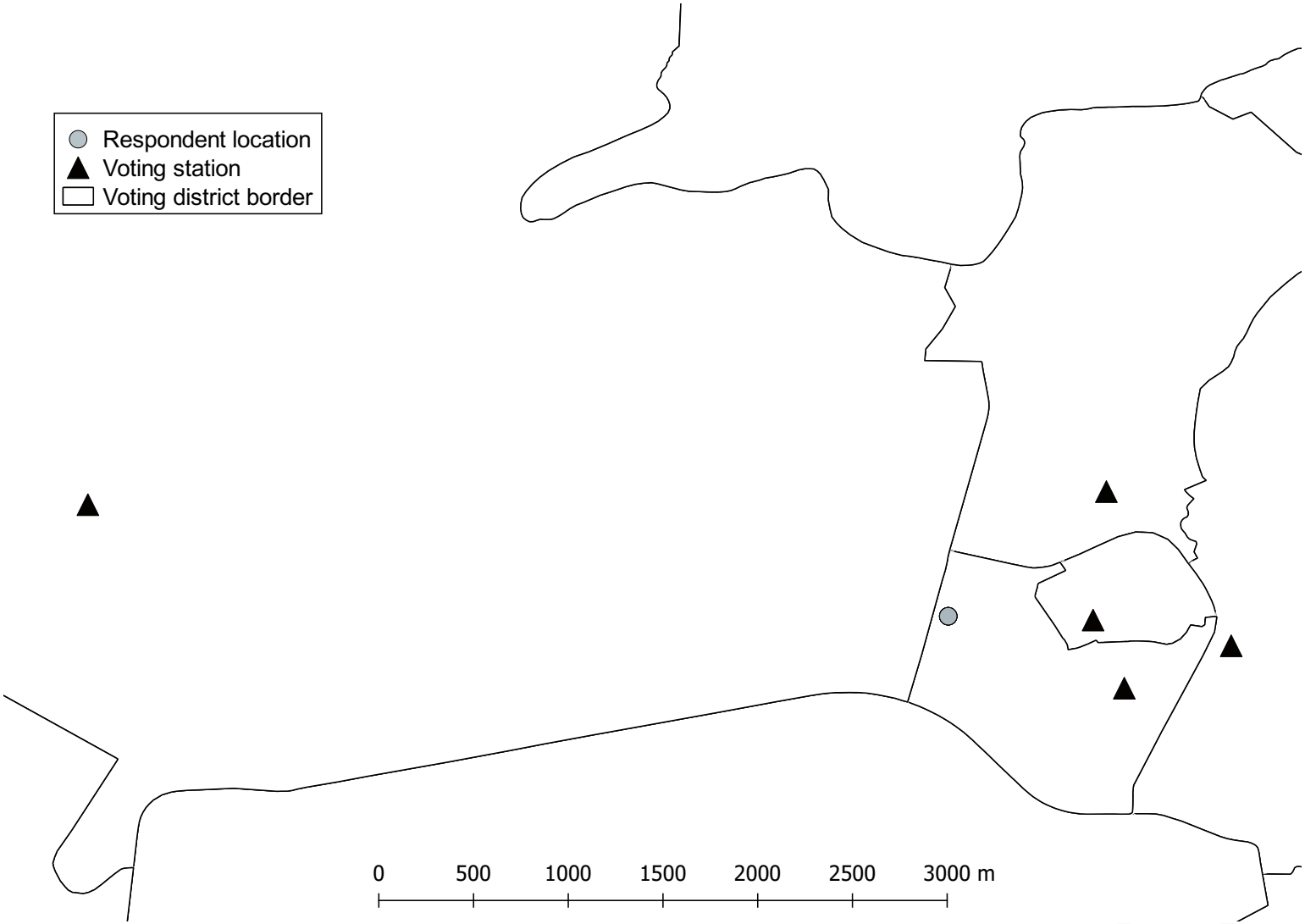
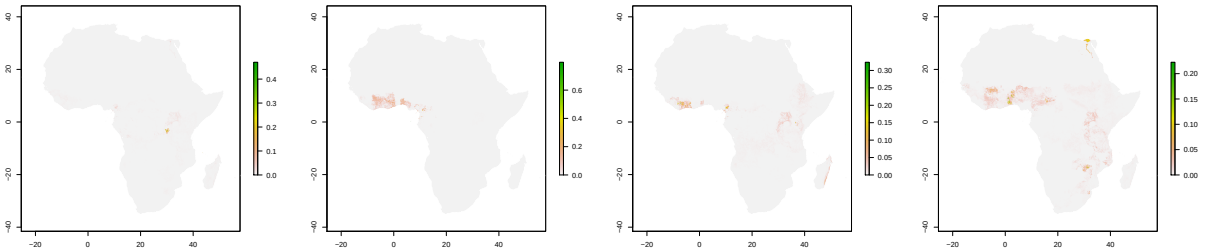
Distance: Clientelism in South Africa



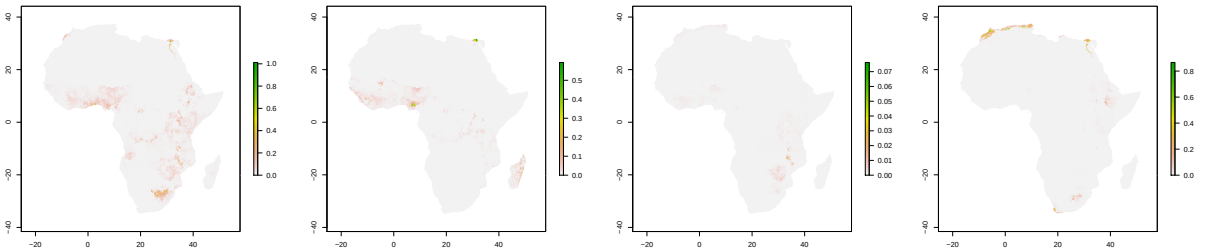
Distance: GIS and Causal Identification



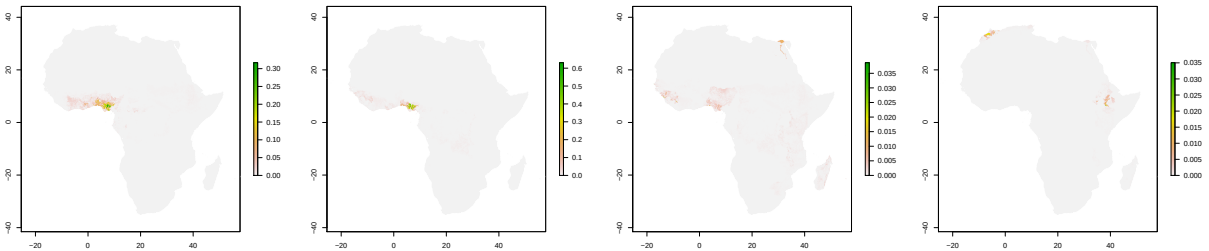
Mapoverlaying: Redistributive Politics



(a) Banana **(b)** Cocoa **(c)** Coffee **(d)** Cotton



(e) Maize **(f)** Rice **(g)** Tobacco **(h)** Wheat



(i) Yam **(j)** Palm Oil **(k)** Mango **(l)** Lentils

1 Motivation

2 GIS
- Intro

3 Spatial Objects

4 Vector formats

What is GIS?

$\rightsquigarrow$ A system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data

Two objectives within GIS

1) Spatial co-variates
2) Spatial econometrics

Tools: ArcGIS, QGIS, R

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1) Spatial co-variates $\rightsquigarrow$ this is us!
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Tools: ArcGIS, QGIS, **R**

Concepts when working with GIS

1) **Coordinates**: x, y, and z (longitude, latitude, and elevation)
2) → **Features**: points, lines, polygon
3) **Data types**: shapefile, raster
4) **Projections**
   - Maps are 2 dimensional - the earth's surface is not
   - Data used together MUST HAVE identical projections
   - Check projections using proj4string()

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- The basics

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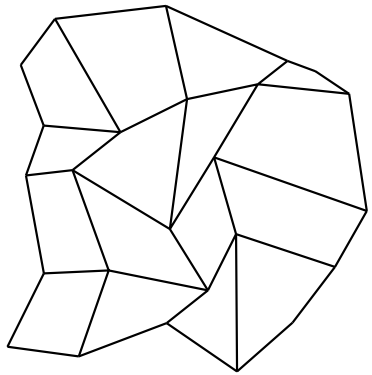
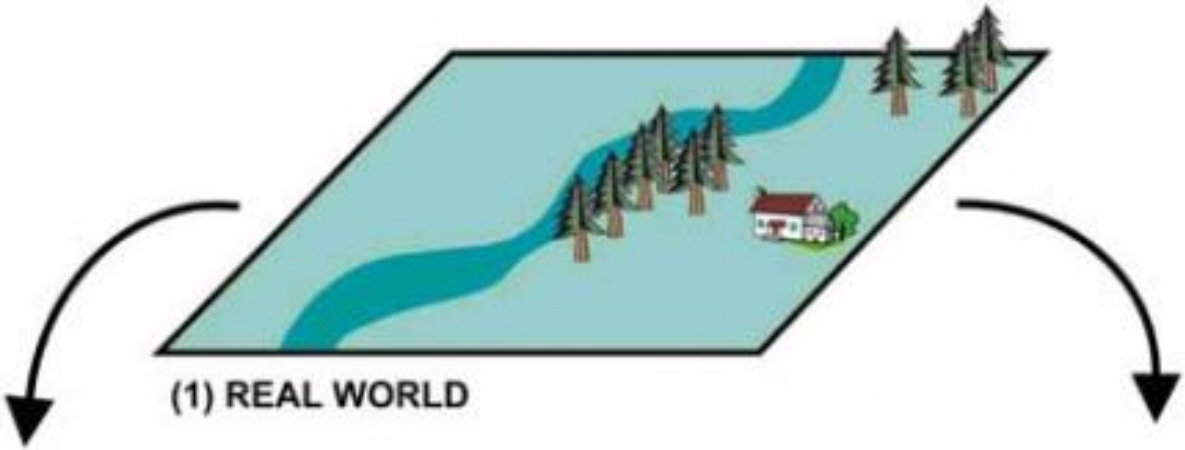
Spatial objects

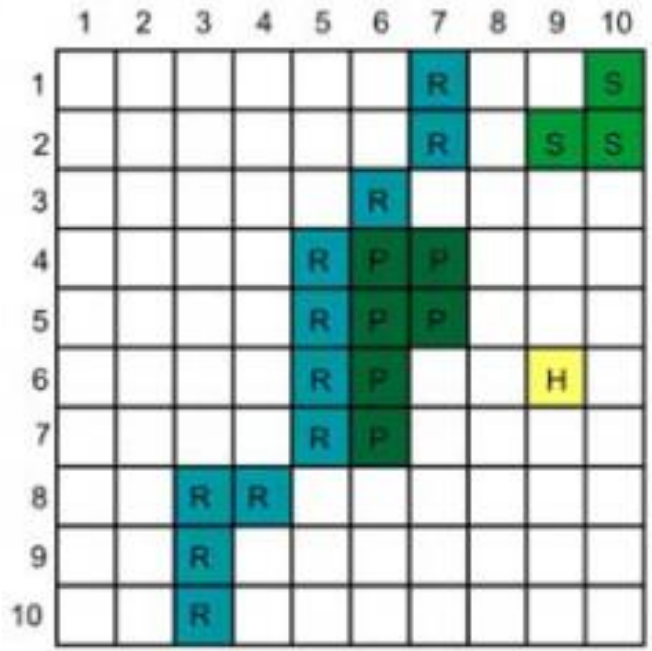
Vector format (.shp) → EPRgeo, GADM

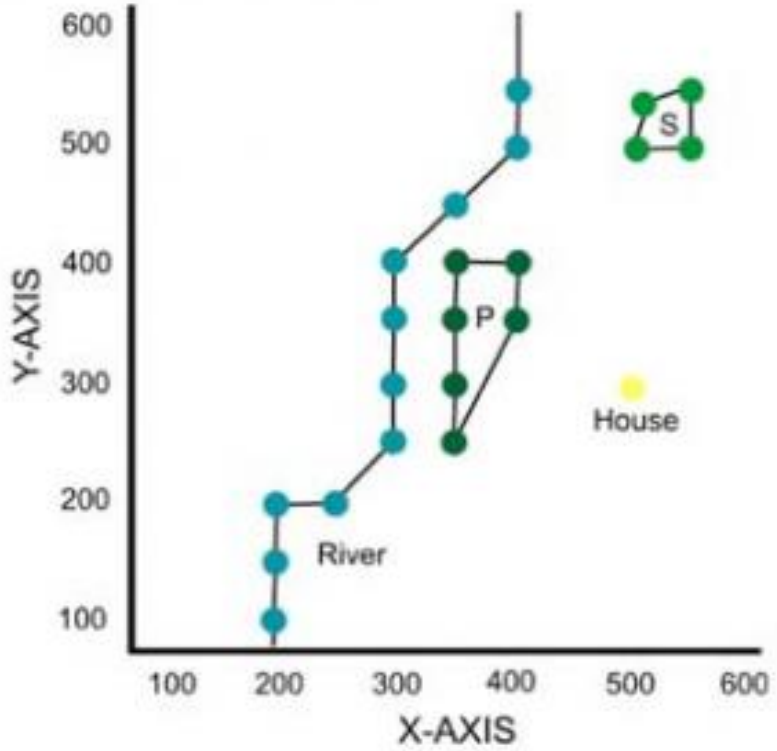


Raster format (.tif) → luminosity, crops

2	8	9	3
2	9	3	8
4	3	8	4
1	2	2	5


(1) REAL WORLD


1 2 3 4 5 6 7 8 9 10
R
S
P
H
(2) RASTER REPRESENTATION


600
500
400
300
200
100
Y-AXIS
S
P
House
River
100 200 300 400 500 600
X-AXIS
(3) VECTOR REPRESENTATION

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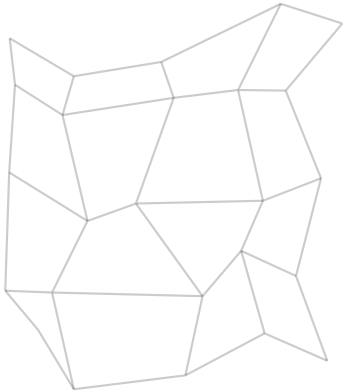
- shapefiles

A closer look at shapefiles



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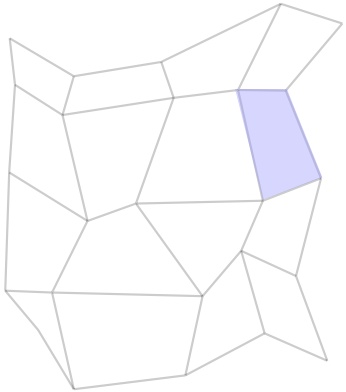

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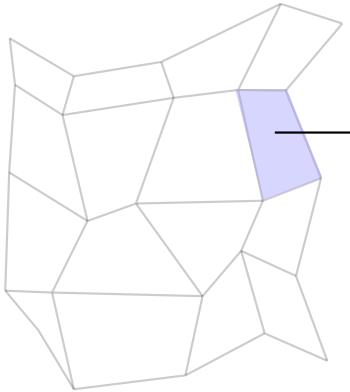

Data frame element, shp@data and shp$var

ID	Pop	Area size	Country
Ain Benian	120.000	23	Algeria
Ain Bouihi	70.000	12	Algeria
Arib	90.000	16	Algeria

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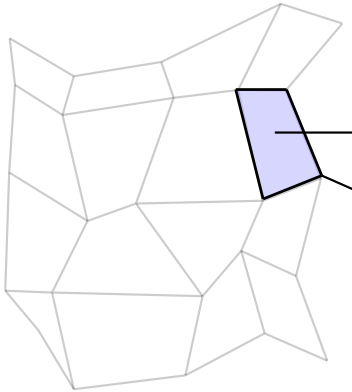

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Polygon element (coordinates)

coords	(x,y; x2,y2; x3,y3; x4,y4)
coords	(x,y; x2,y2; x3,y3; x4,y4)
coords	(x,y; x2,y2; x3,y3; x4,y4)

How to: packages

rgdal::	readOGR(), writeOGR()
sp::	over(), proj4string(), plot()
raster::	raster(), extract(), writeRaster(), crop()
geosphere::	distHaversine(), area()
tmap, tmaptools::	tm_shape(), tm_polygons(), save_tmap()

rgeos, ggmap & sf