The Great Dispersal

An analytical framework for settlement pattern analysis

Michal Michalski

Durham University

2020/02/06

Agenda

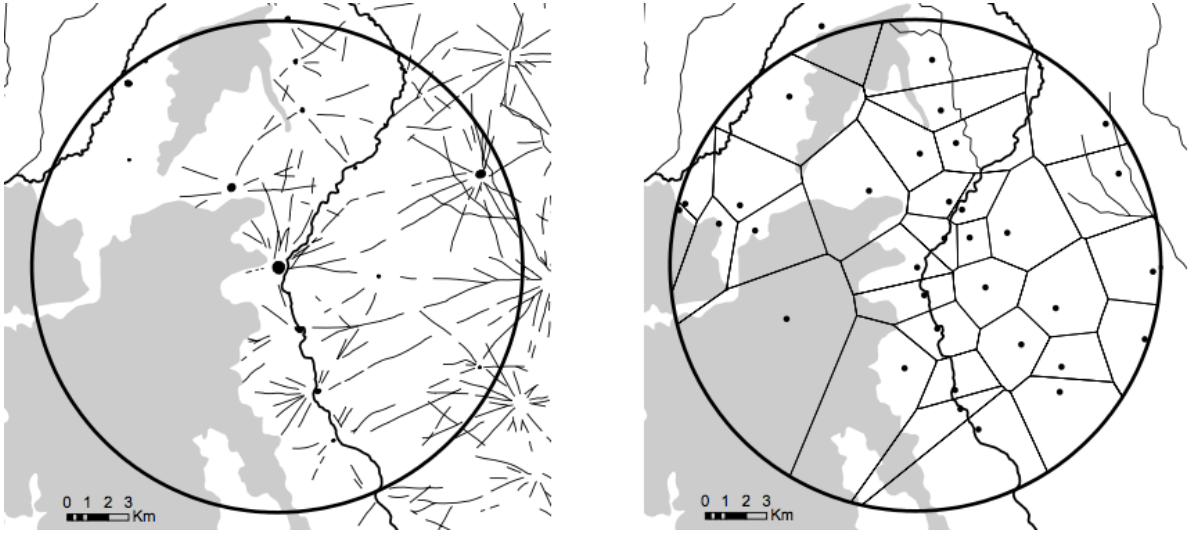
- Say Hello !
- Project
- Methodology
- Exploratory Data Analysis
- Next Steps

Say Hello !

work/fun balance

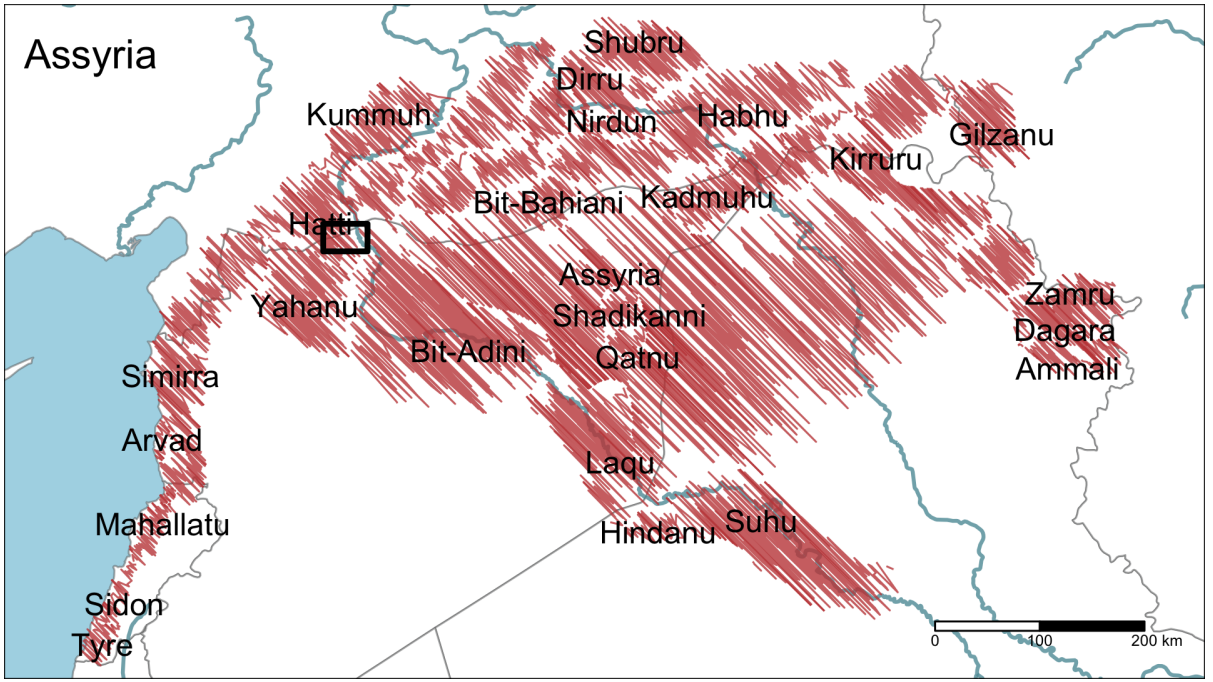
Project

Structural change



Spatial changes in landscape are showing shift from nucleated to dispersed settlement pattern

Where ?



Politcal landscape of the northern Fertile Crescent at the beginning of the 9th century BCE - after (Baudains et al. 2015).

When ?

- Southern Palestine - 1200 BCE
- Jazireh - 800 BCE
- Northern Levant - 300 BCE
- Upper Euphrates - 400 - 600 CE

Objectives for now ...

- What is the timing of the ‘Great Dispersal’ across the Northern Fertile Crescent?
- Was there one dispersal or many ‘dispersals’? Are these events interrelated?
- What are the processes underpinning the change?
- What are the long-term settlement trajectories in the Northern Fertile Crescent from the Iron Age to the Late Islamic period?

Methodology

How ?

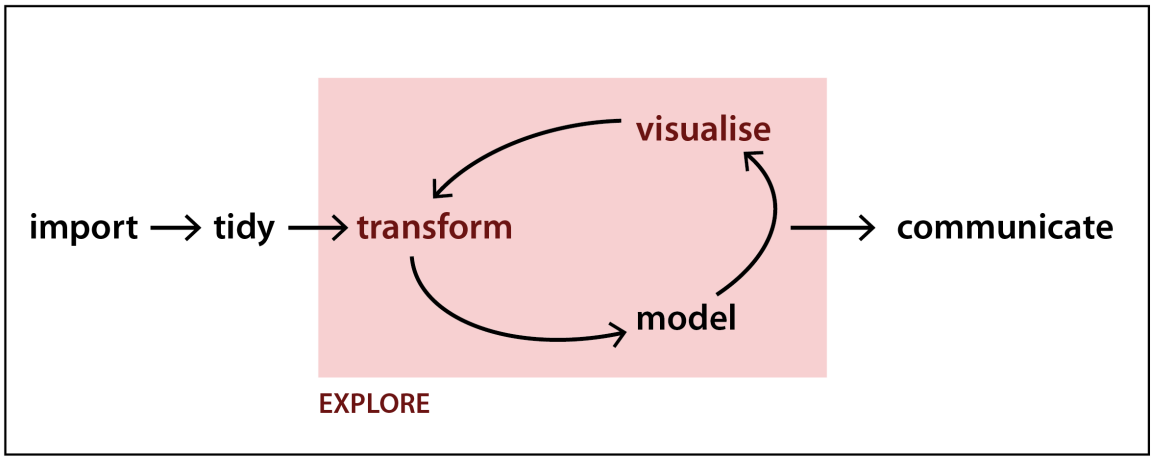
'The question then becomes how best to mine, mix and otherwise analyse a potential embarrassment of riches' (Bevan, 2015)

- deluge of legacy surveys built upon Fragile Crescent and CLaSS project database
- Data Science paradigm:
  - Literate Programming (Knuth, 1983)
  - Open Science: open access + open methods + open data (Marwick et al, 2017)
  - Tool Driven Revolution (Marwick and Shmidt, 2019)
- tools of trade: PostGIS, SQL, R, QGIS, GRASS, WhiteboxTools, Git and Github

Geographic Data Science

'a set of statistical, computational, and analytical techniques and workflows; the set of of interconnected tools developed with such applications in mind; as well as the particular epistomological perspective that sustains these practise'

(Singleton and Arribas-Brl, 2019)



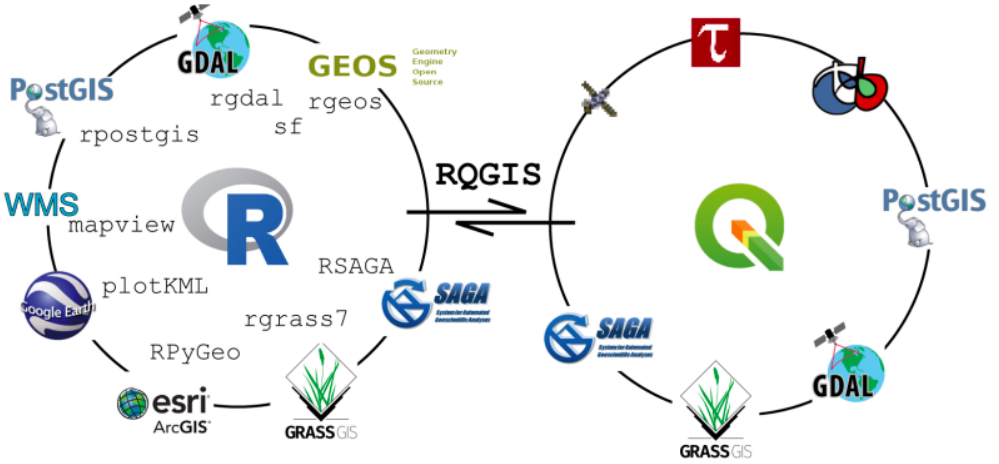
Data Science pipeline - a sequence of processing and analysing steps - is the core of project methodological framework (Grolemund and Wickham 2017).

Literate Programming

'By coining the phrase “literate programming”, I am imposing a moral commitment on everyone who hears the term; surely nobody wants to admit writing an illiterate program'

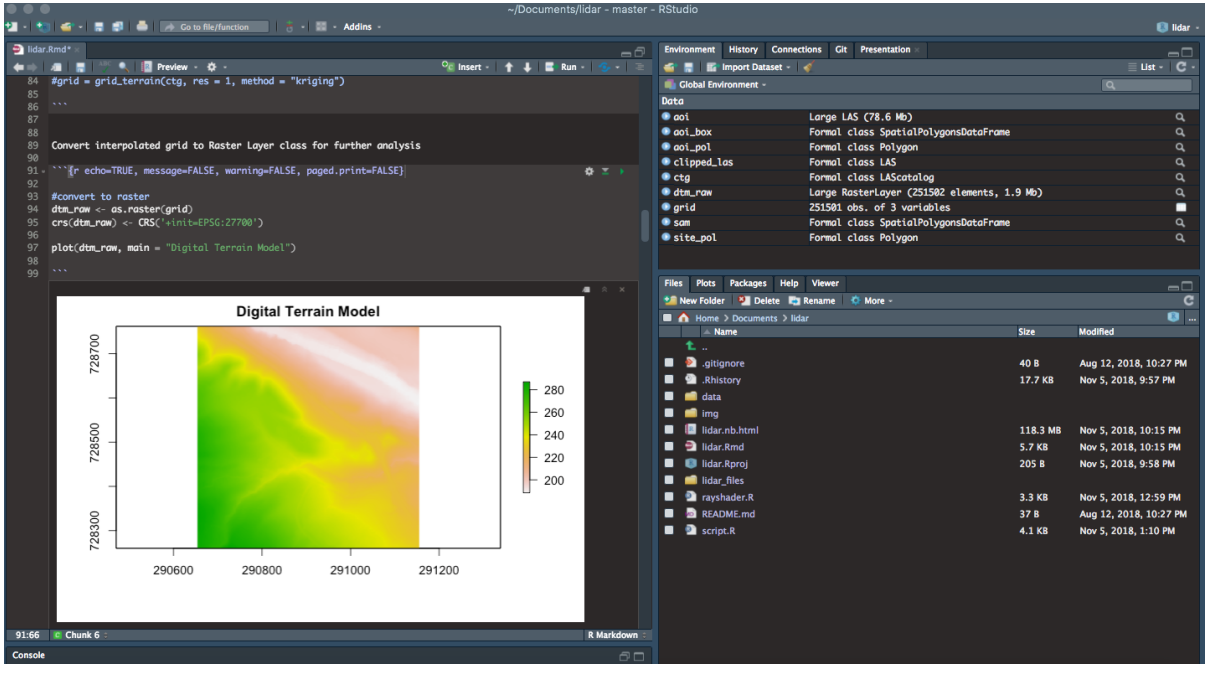
Donald E. Knuth

Ecosystem



State of the art in coupling R language and GIS software (Muenchow,Schratz and Brenning, 2017)

where the magic happens...



RStudio Interface

Tools of trade

Tools for writing code

- Atom - text editor
- RStudio - R IDE

Tools for managing code

- git - for tracking changes to files
- GitHub - for hosting code online

Tools for manging python env

- Anaconda

Tools for literate programming

- R Notebook
- Jupyter Notebook and Jupyter Lab
- rrtools - research compendium
- workflowr

DB and GIS Software

- PostgreSQL with PostGIS
- QGIS 3.8
- GRASS GIS 7.6
- SAGA GIS 2.3

R packages for bridging R and GIS

- rpostgis
- RQGIS 3
- rgrass7
- RSAGA
- rgeoda

R packages for bridging R and Python

- reticulate

Projection

Connect to the Database and extract layer with surveys boundaries

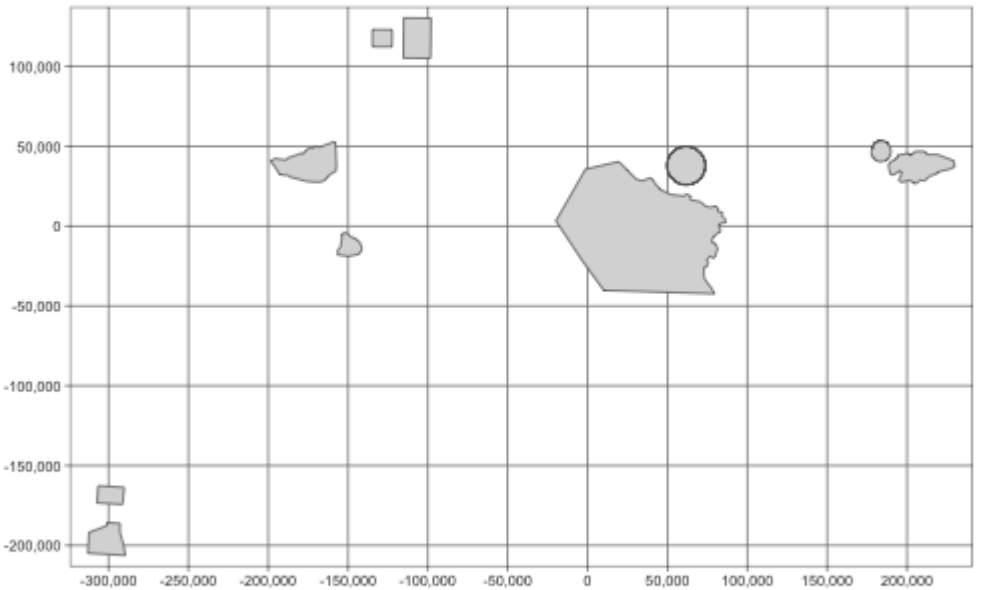
```
library(DBI)
library(rpostgis)
library(sf)
library(tmap)

conn <- RPostgreSQL::dbConnect("PostgreSQL",
                               host = "localhost",
                               dbname = "michal",
                               user = "postgres",
                               password = "postgres")
# load the survey dataset
surveys_wgs <- st_read(conn, layer = "dataset")
```

Projection

Lambert conformal conic (LCC) projections for regions covering thousands of kilometers, with the cone set to keep distance and area properties reasonable between the secant lines.

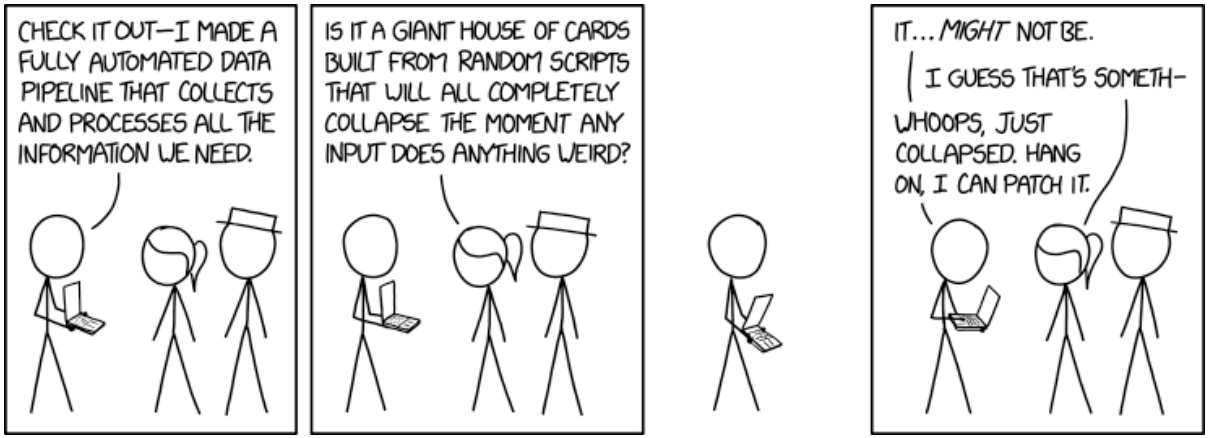
```
#compute a centre using sites wgs
surveys_center = surveys_wgs %>%
  st_union() %>% # union into one geometry
  st_centroid() %>%
  st_transform(4326) %>%
  st_coordinates()
# create a lcc projection
crs_lcc = paste0("+proj=lcc",
                 " +lat_0=", surveys_center[, 2],
                 " +lon_0=", surveys_center[, 1],
                 " +lat_1=", surveys_center[, 2])
# reproject sites dataset to new custom projection
surveys_lcc = st_transform(surveys_wgs, crs_lcc)
```

Projection


100,000
50,000
0
-50,000
-100,000
-150,000
-200,000
-300,000
-250,000
-200,000
-150,000
-100,000
-50,000
0
50,000
100,000
150,000
200,000

Exploratory Data Analysis

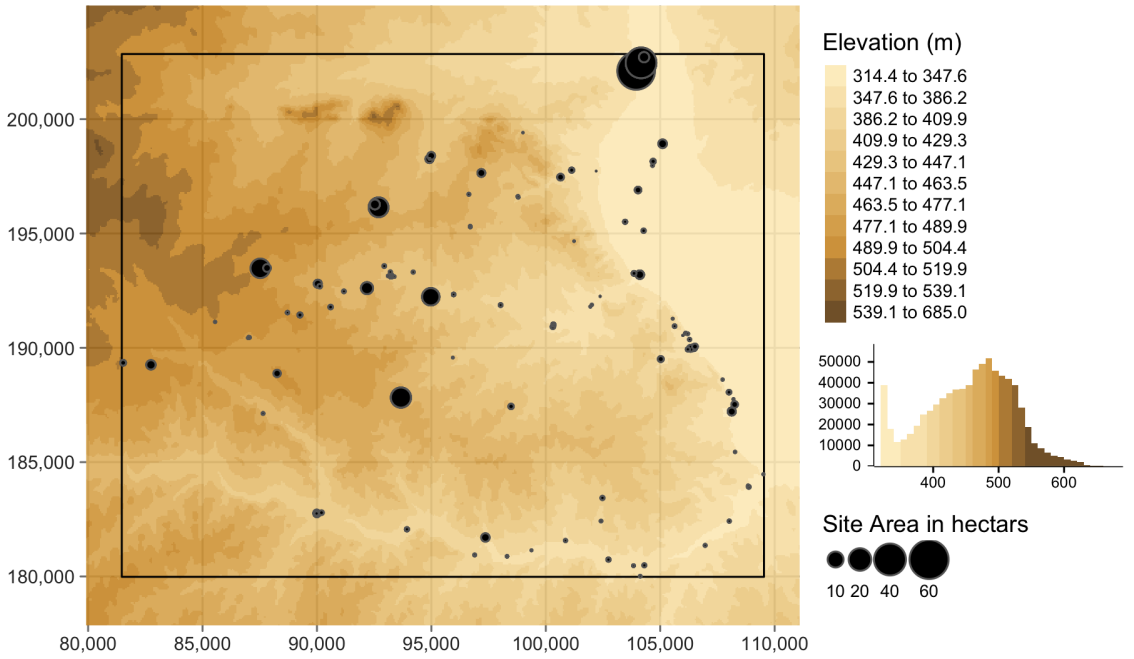
One Size fits All



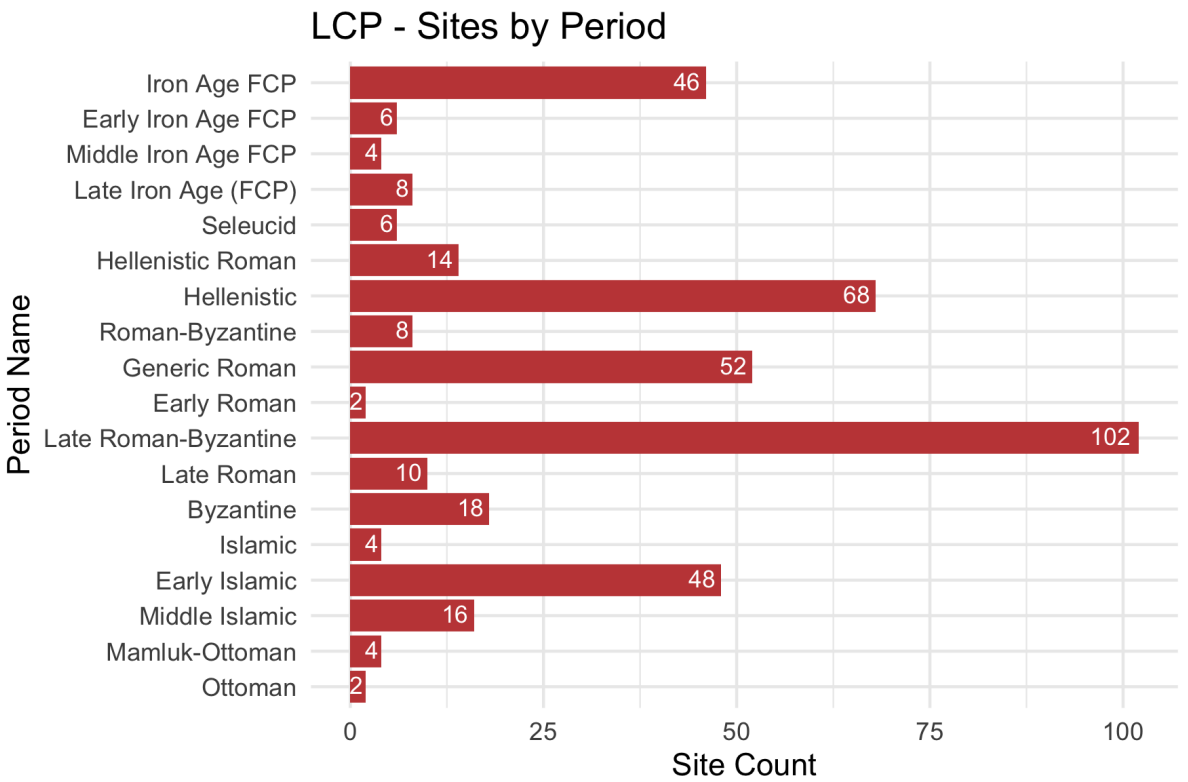
Source: XKCD at https://xkcd.com/2054/

Land of Carchemish

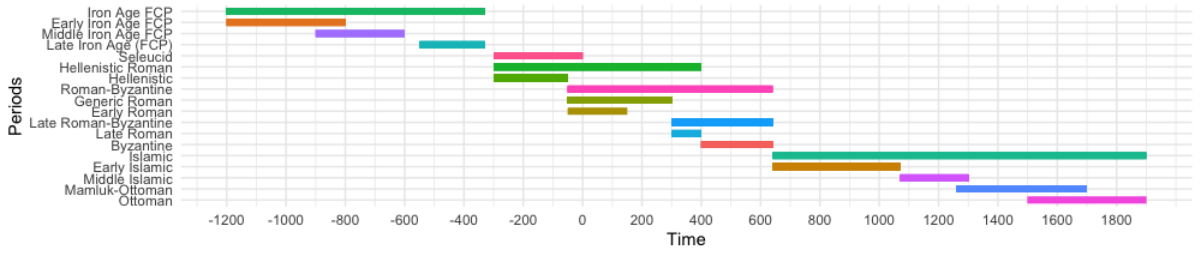
Land of Carchemish



Land of Carchemish

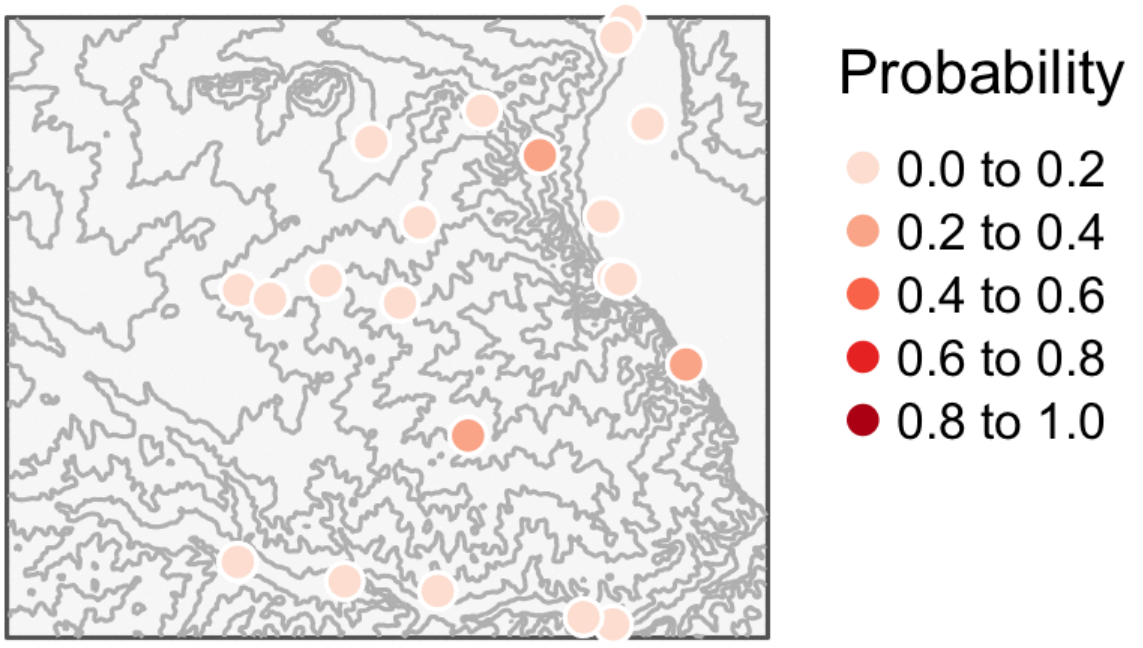


Land of Carchemish

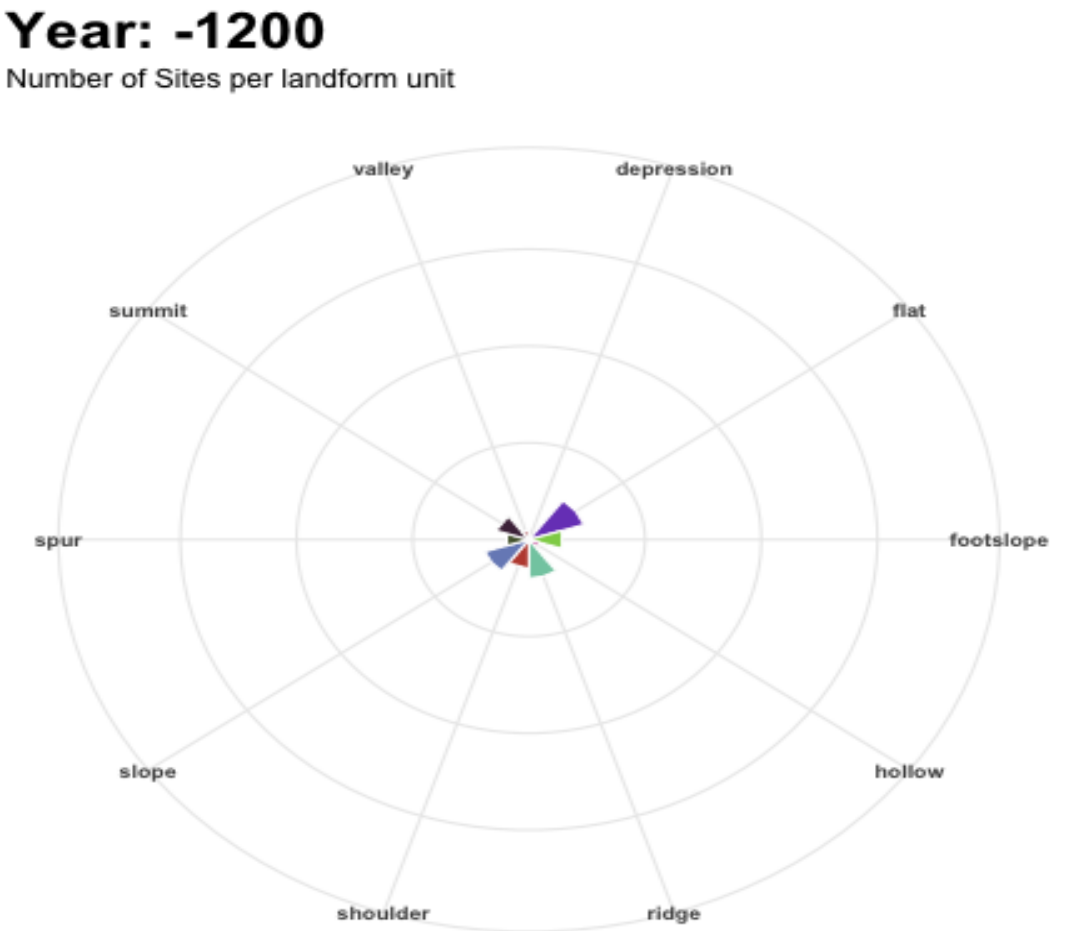


Land of Carchemish

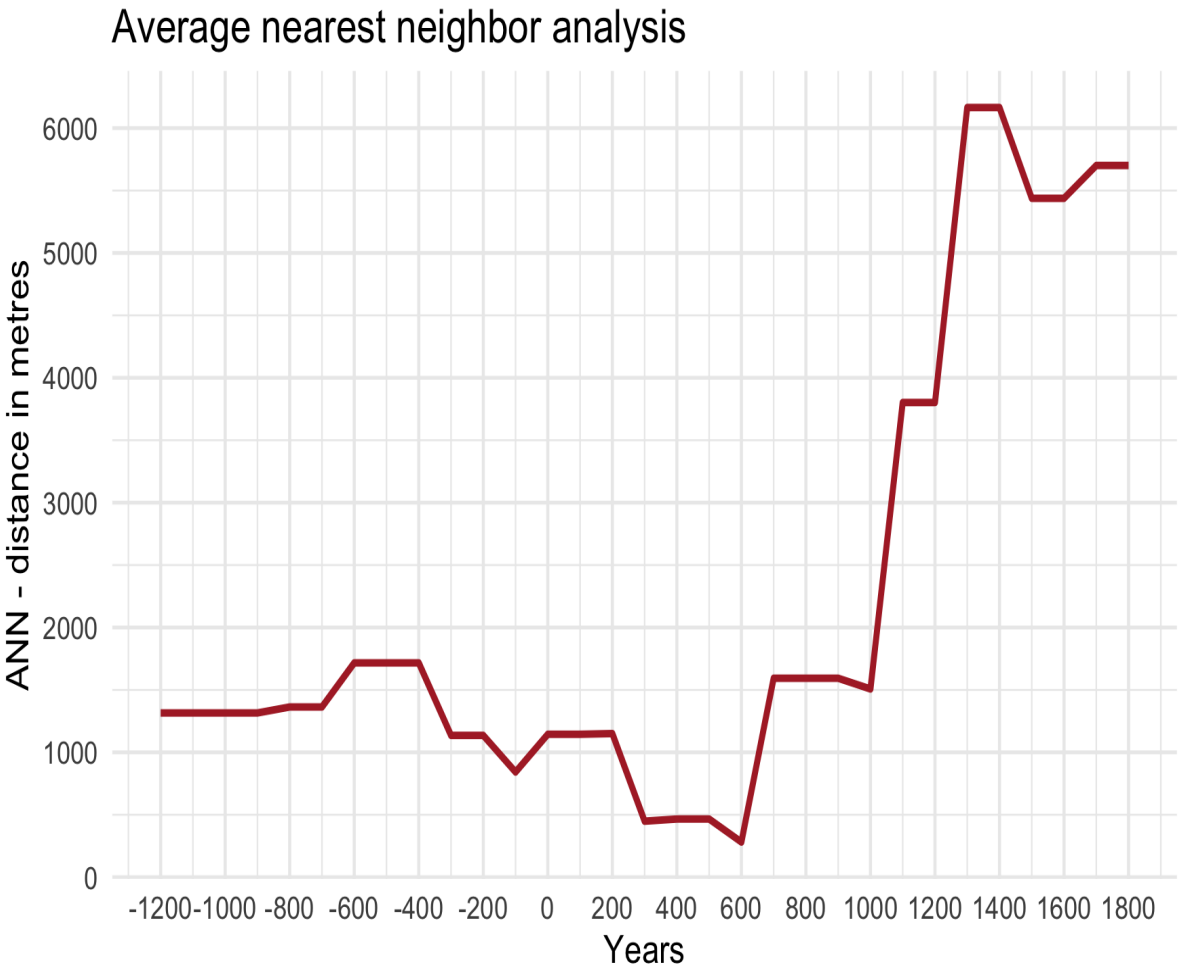
-1200



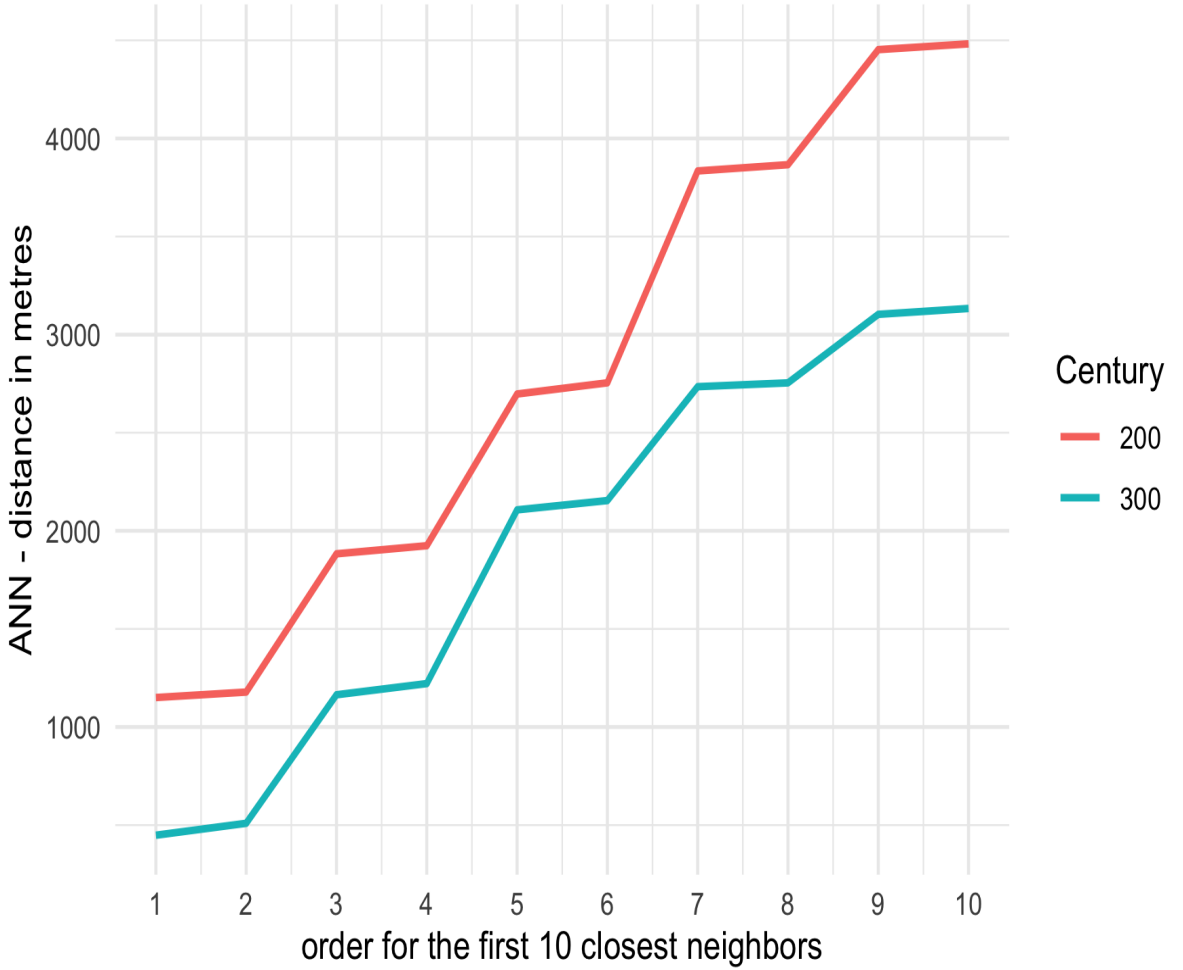
Land of Carchemish



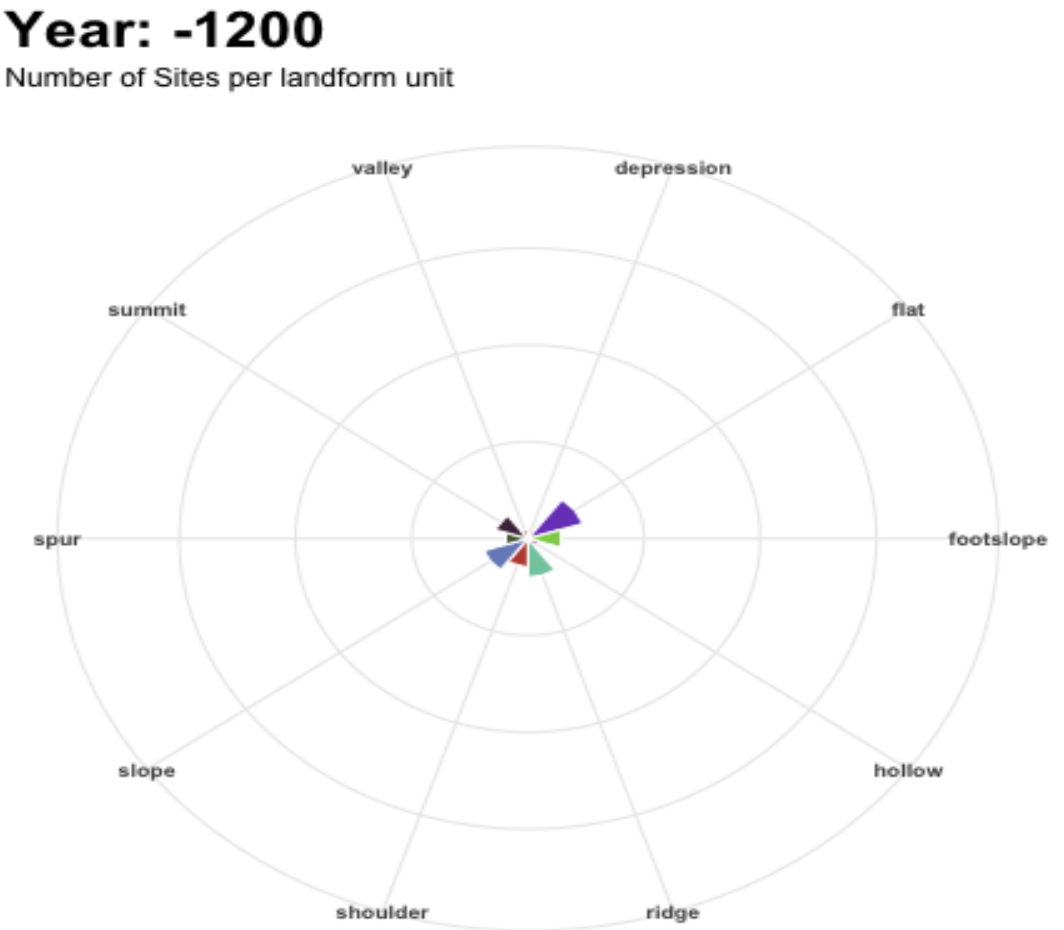
Land of Carchemish



Land of Carchemish



Land of Carchemish



Land of Carchemish

potentials of population - stock of population weighted by distance

Next Steps

'The numbers have no way of speaking for themselves. We speak for them. We imbue them with meaning'

Nate Silver

Thank you

Me:

@topographos2

michal.m.michalski@durham.ac.uk

Website:

topographos.rbind.io

dispersal.rbind.io