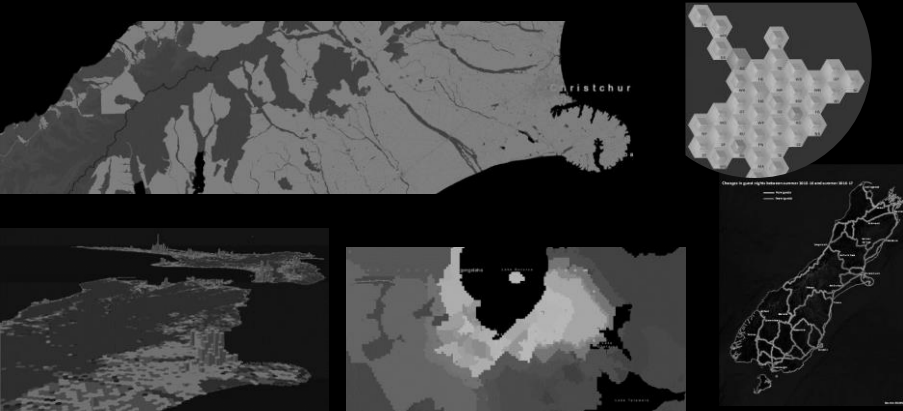


Spatial disaggregation

“Everything is related but near things are more related than distant things”

Waldo Tobler’s first law of geography



Coverage

- Anatomy of a meshblock
- Why we disaggregate
- Spatial disaggregation methods
 - Dasymetric filtering
 - Areal interpolation
 - Pycnophylactic reallocation

Anatomy of a meshblock



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Anatomy of a meshblock

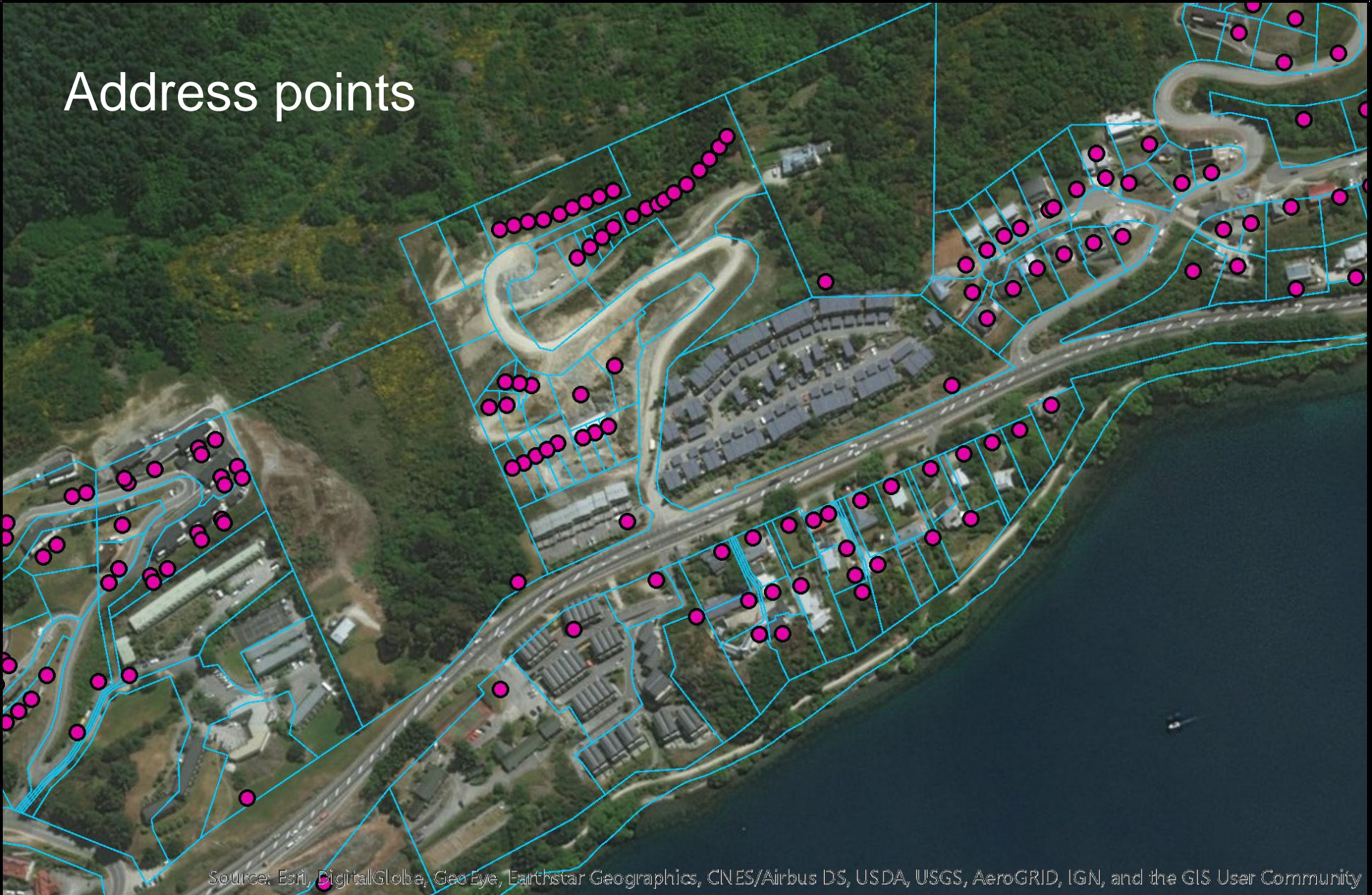
Land parcels



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

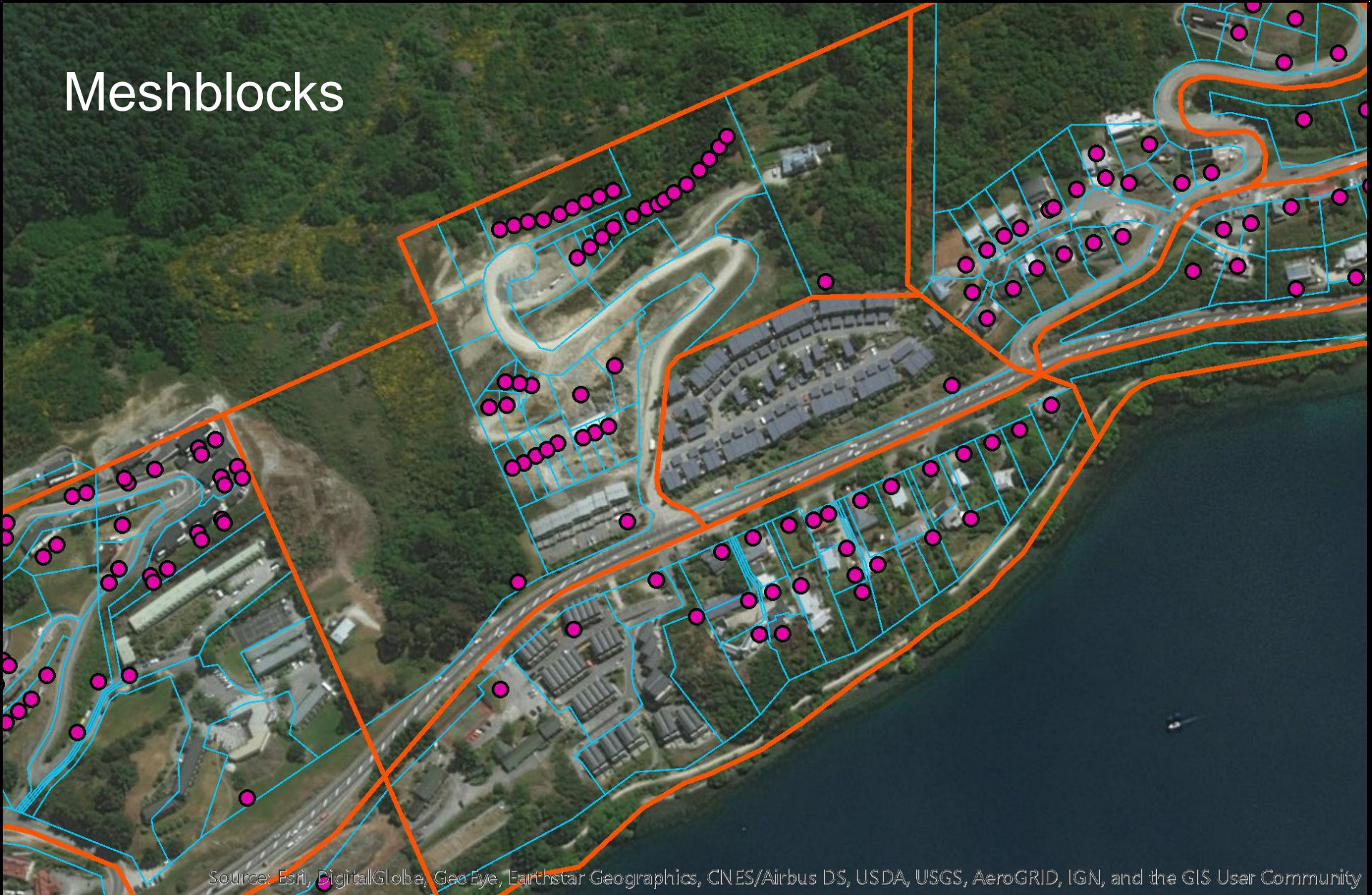
Anatomy of a meshblock

Address points



Anatomy of a meshblock

Meshblocks



Why we disaggregate

- To get more value out of the data we've got
- To improve spatial accuracy and precision
- To generate data for smaller areas
- To help those who want to re-zone our data
- To overcome some “flaws” in our data design

Flaws you say?

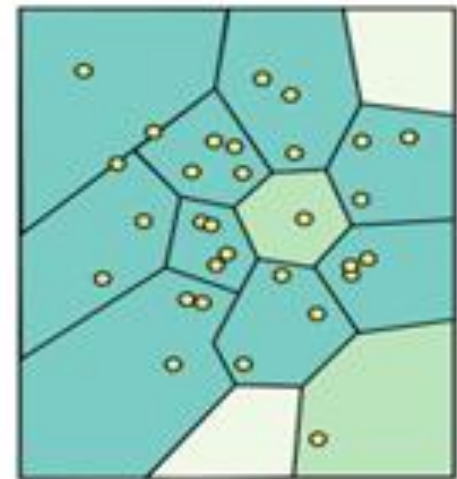
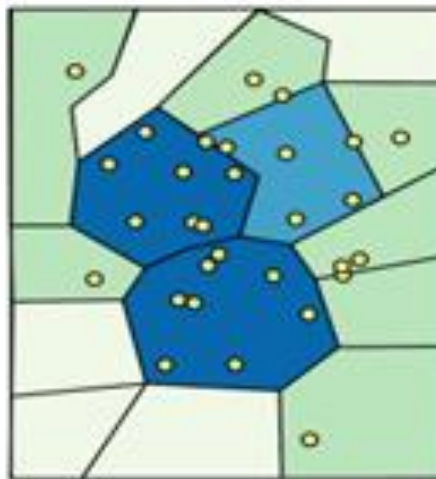
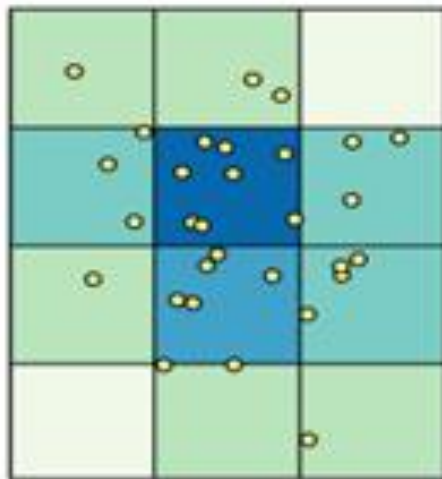
- Meshblocks created for population data collection
- Meshblocks vary in size and area over time
- Data is rounded
- Boundaries follow artificial features
- Meshblocks contain more than just population
- Suffers from the Modifiable Areal Unit Problem (MAUP)

The Modifiable Areal Unit Problem

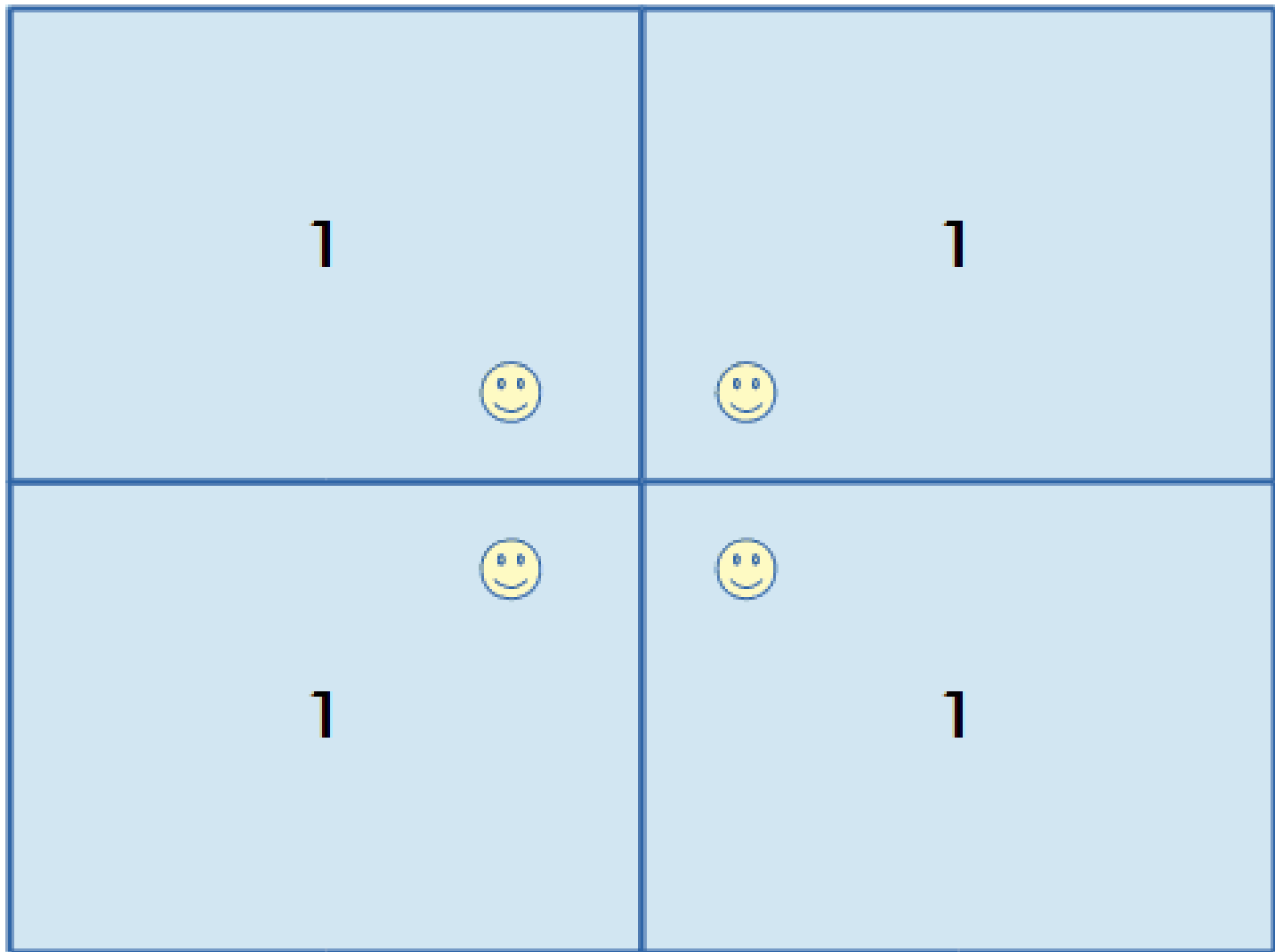
The Sydney Morning Herald

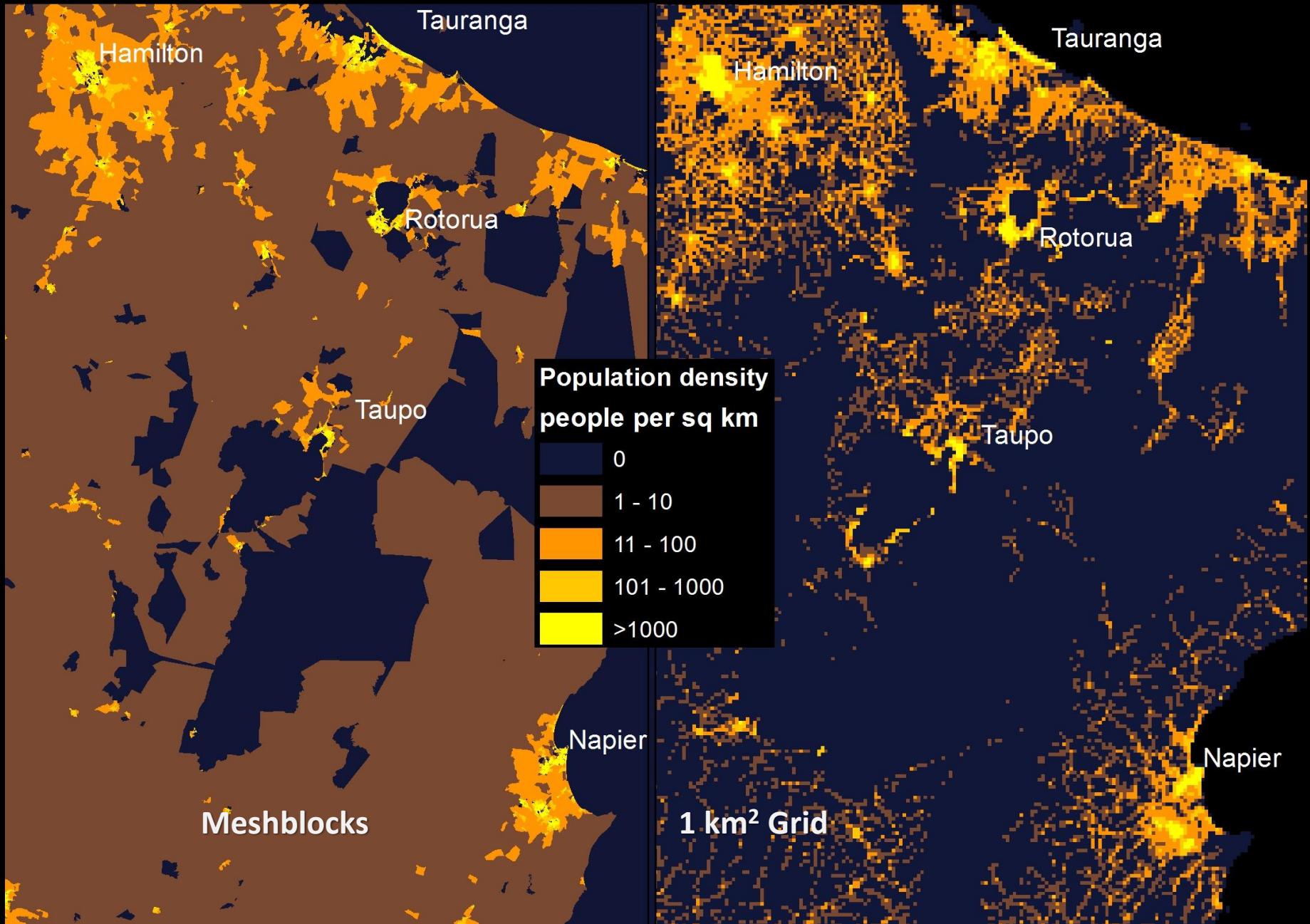
COMMENT NATIONAL OPINION

How maps can lie, hiding disease in our suburbs

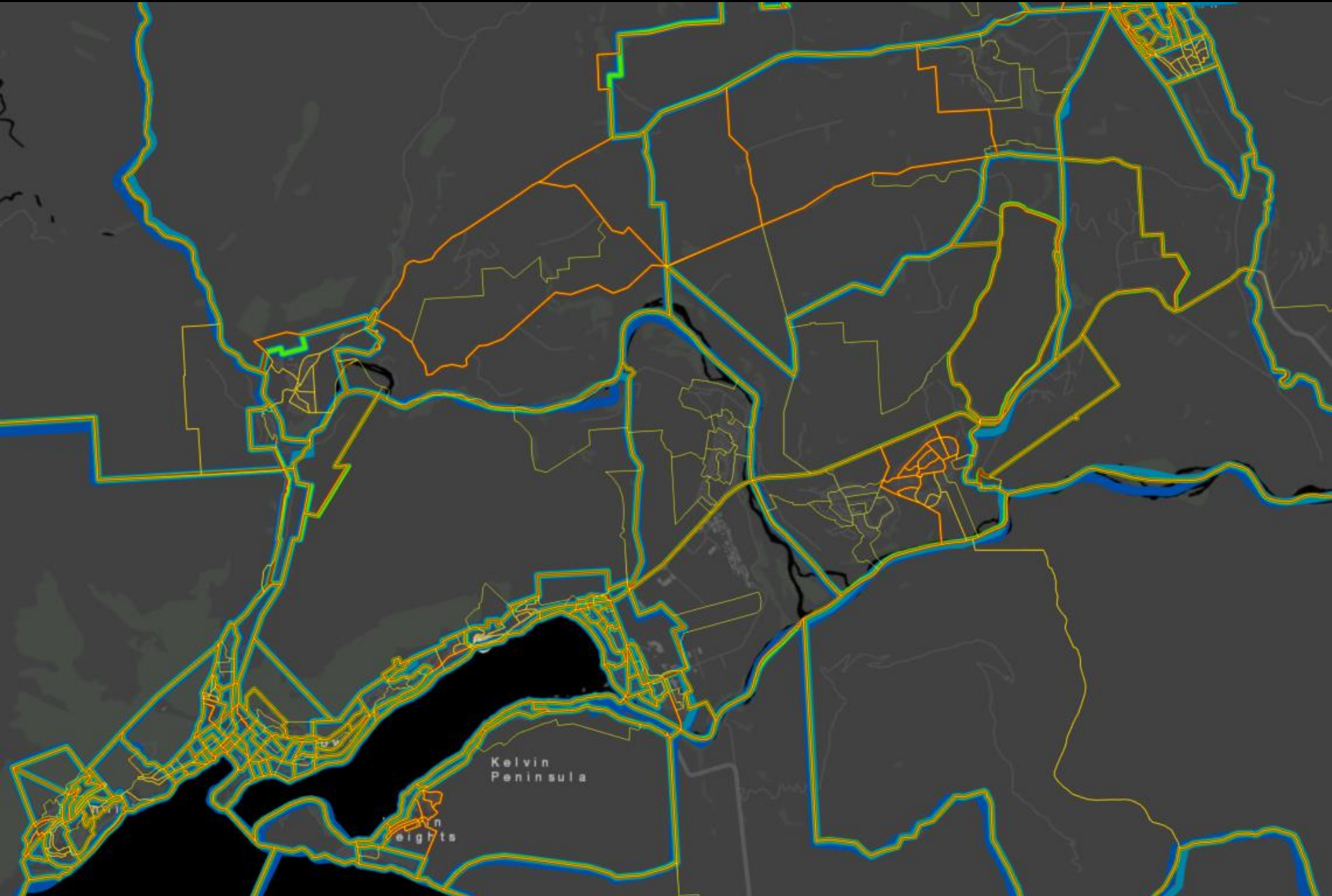


The Modifiable Areal Unit Problem





Meshblock changes 1991-2018

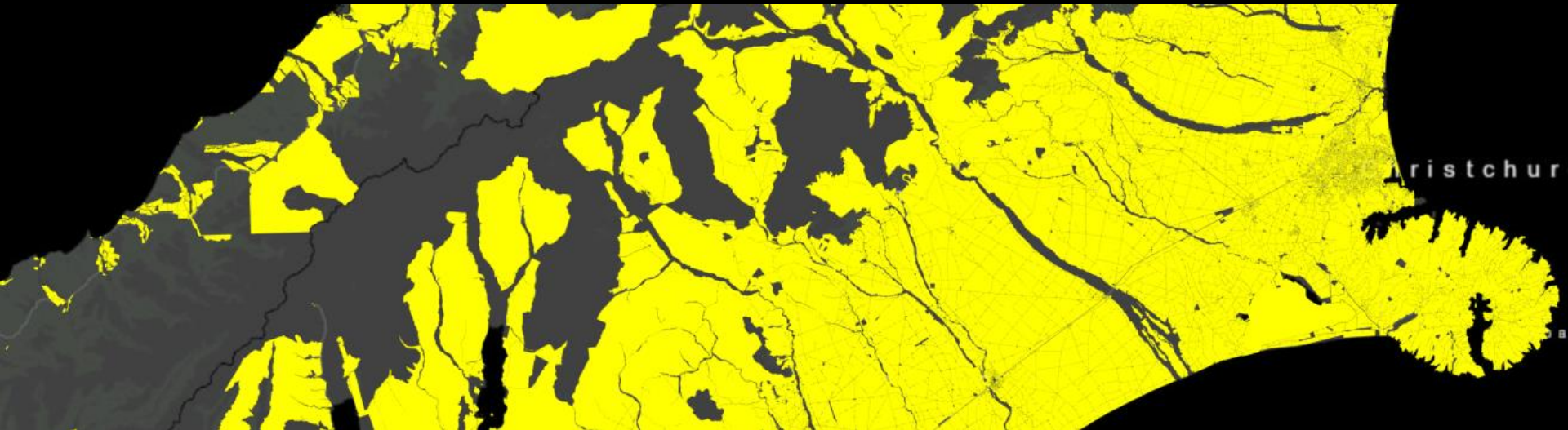


Spatial disaggregation



Dasymetric filtering

- Remove all unpopulated land from an SA
 - Water bodies – lakes, rivers, estuaries, wetlands..., forests, parks, properties without address points, roads
- Using ancillary sources like...
 - Land Cover Database
 - Cadastre and address points (LINZ, SLR)
 - Protected areas (PAN-NZ)



Literature

Author(s)	Year	Algorithm	Study Area	Ancillary Data	Accuracy Assessment
Wright	1936	Dasymetric map	Cape Cod, MA	USGS Quad Map	No
Tobler	1979	Smooth pycnophylactic interpolation	Ann Arbor, MI	n/a	No
Goodchild & Lam	1980	Simple areal weighting	London, UK	n/a	Yes
Xie	1995	Overlaid network	Amherst, NY	Street TIGER lines	Yes
Fisher & Langford	1996	Dasymetric map using binary mask delineating residential areas	Charnwood, Leicester, Oadby & Wigston, UK	LANDSAT TM	Yes
Yuan et al.	1997	Dasymetric map using statistical regression	Faulkner, Lonoke, Pulaski & Saline Counties, AR	LANDSAT TM	No
Eicher & Brewer	2001	Limiting variable dasymetric map	Pennsylvania, Maryland, District of Columbia, West Virginia & Virginia	USGS LULC dataset	Yes
Mennis	2003	Dasymetric map using weighted urban densities	Philadelphia & Southeast PA	Urban density classes	No
Riebel & Buffalino	2005	Street weighting areal interpolation	Los Angeles County, CA	Street TIGER lines	Yes

Table 1. Summary of major contributions to areal interpolation and dasymetric mapping.

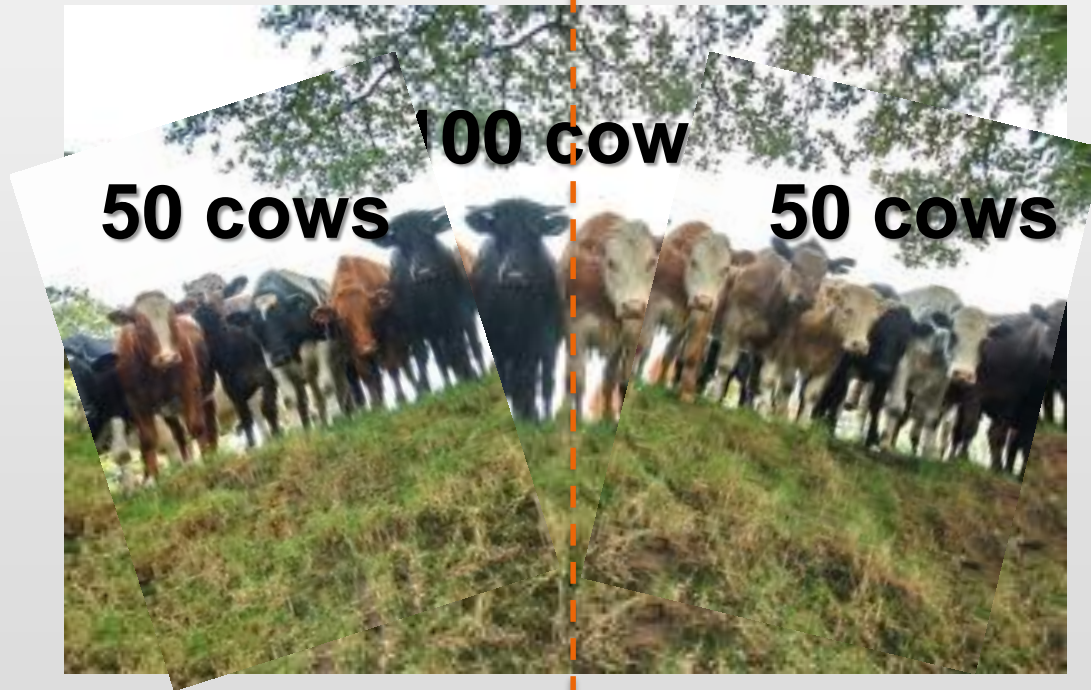
From: *“Areal Interpolation and Dasymetric Mapping Methods Using Local Ancillary Data Sources”*

Anna F. Tapp

Areal Interpolation

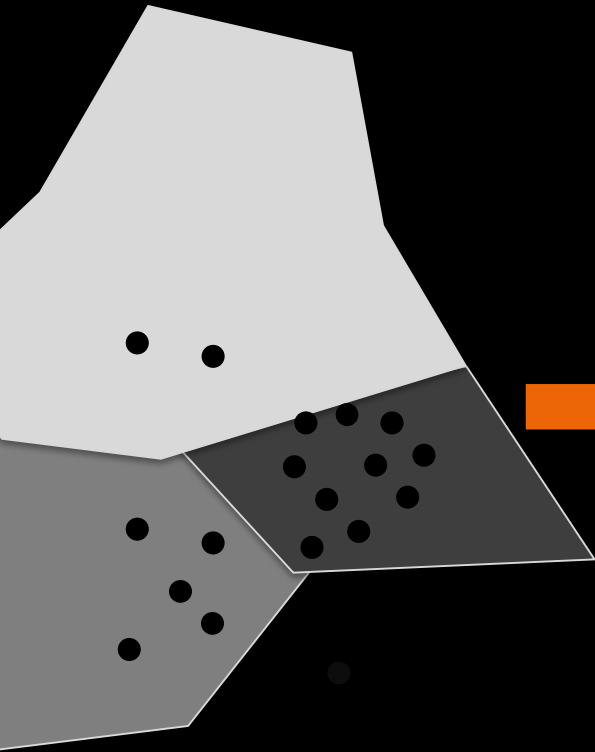
- Assign SAX values to new areas based on density
- Assign SAX values to individual features based on counts
 - Interpolate values between discrete features

Assigning data to new areas based on density

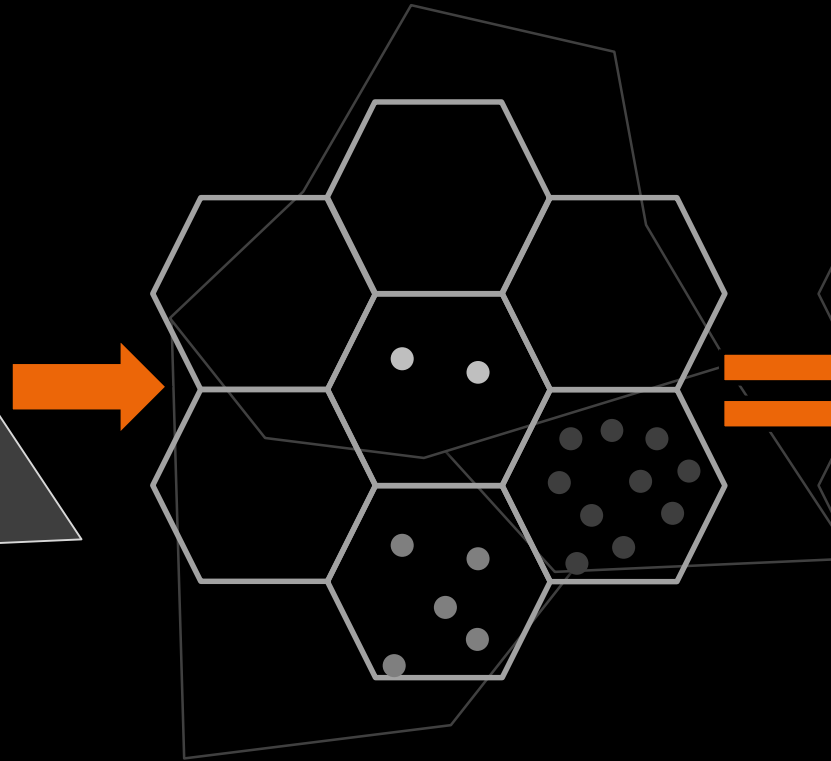


Assigning areal data to discrete location features

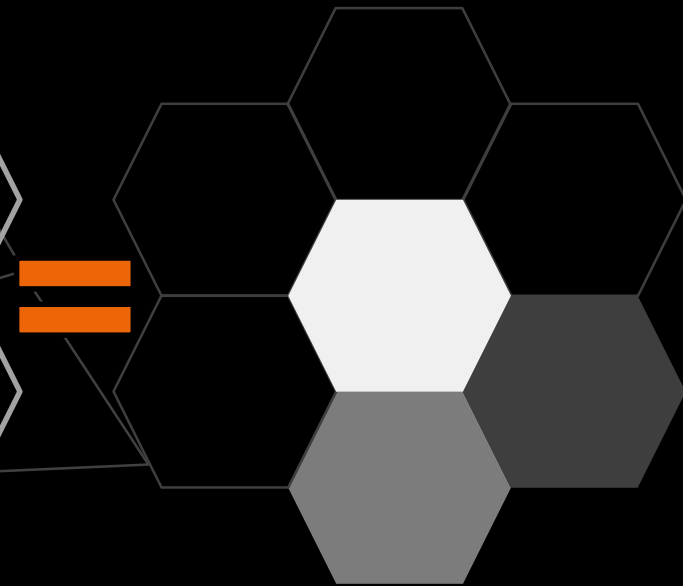
Statistics by area



Assign area values to locations



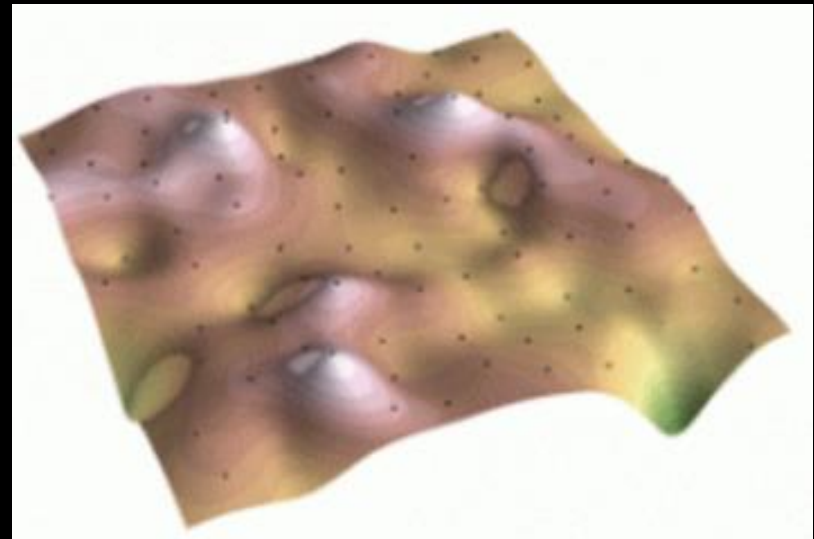
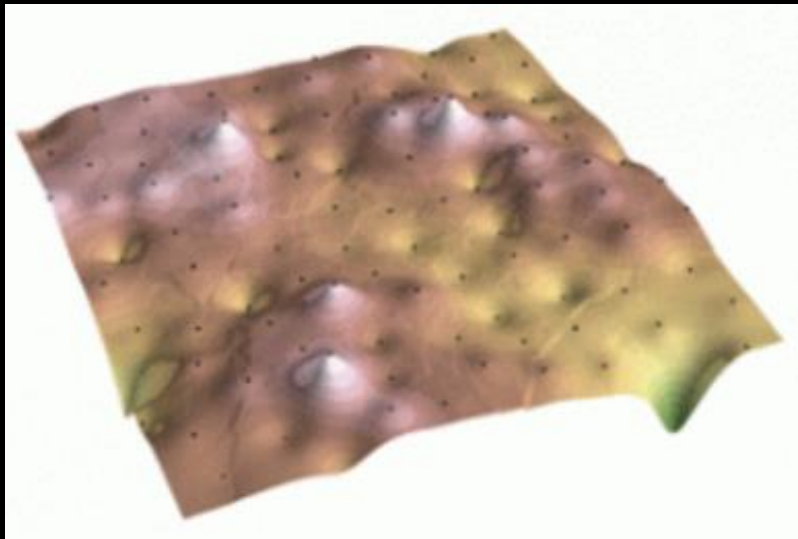
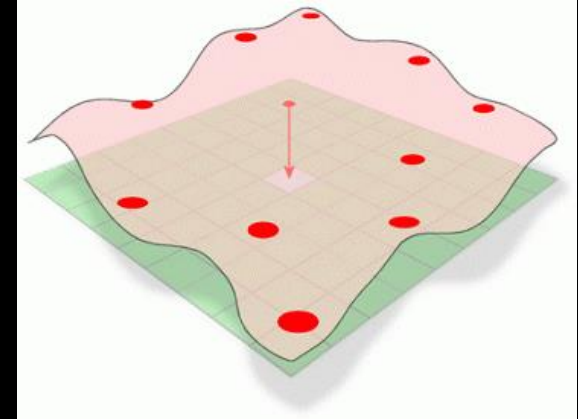
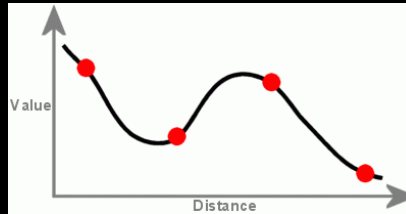
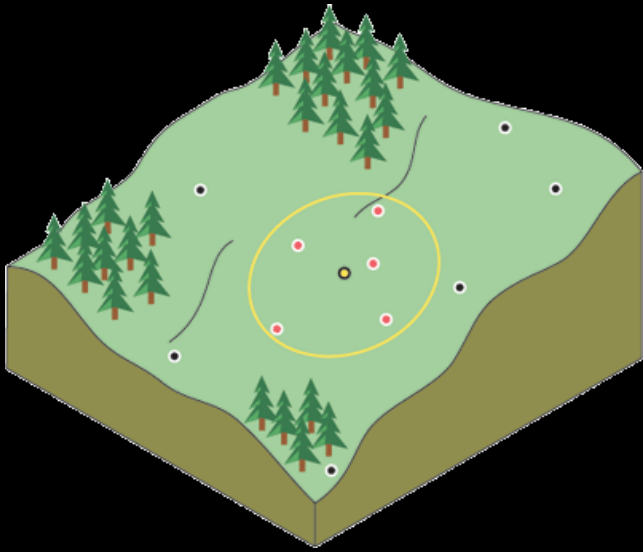
Aggregate locations to cells

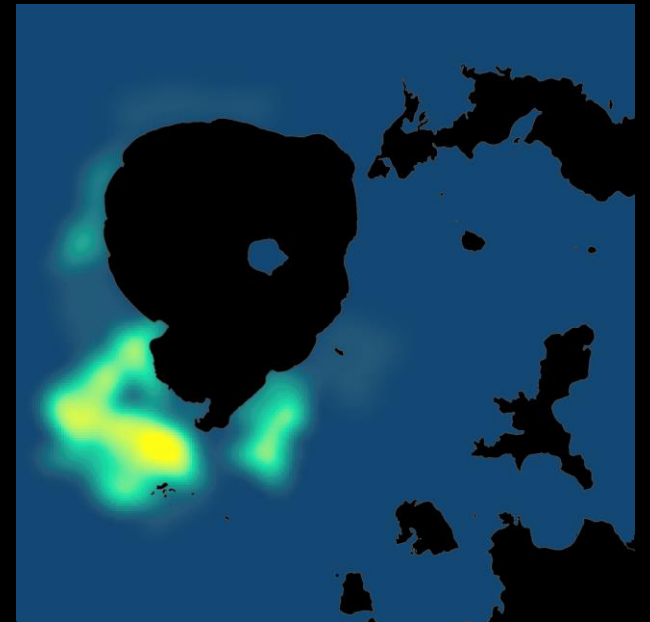
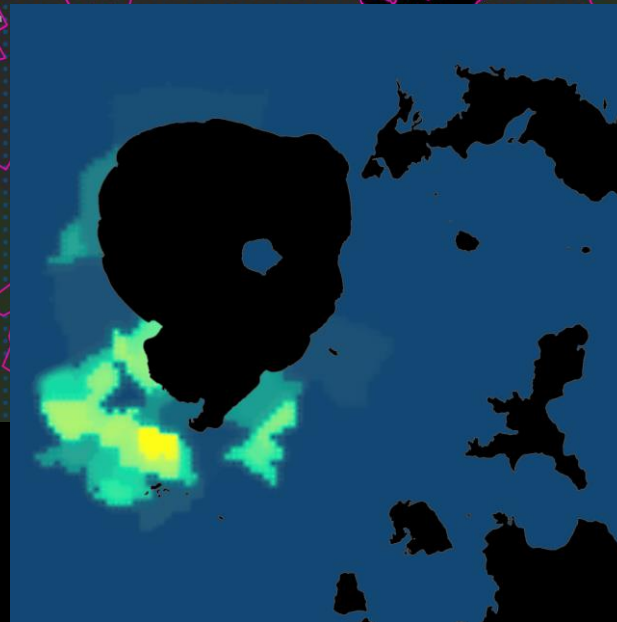
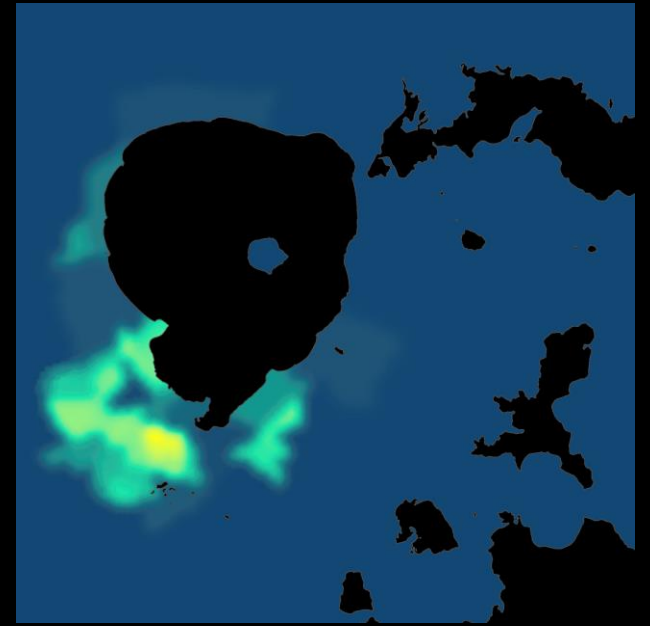


Population-weighted centroid vs geographic centre



Interpolation





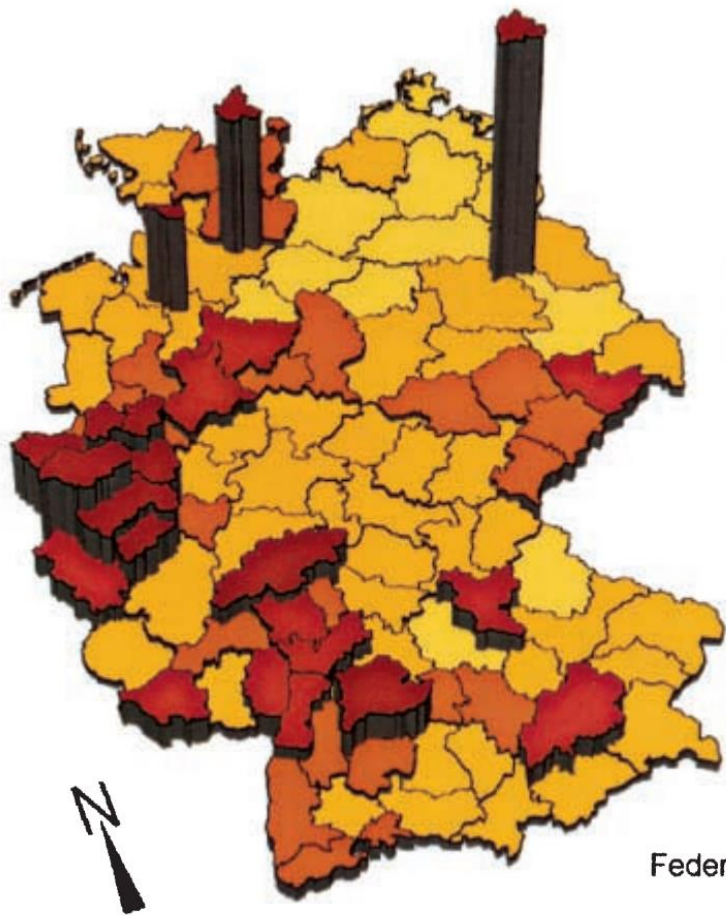
Pycnophylactic reallocation

“Philosophically it is based on the notion that people are gregarious, influence each other, are mobile, and tend to congregate.

This leads to neighboring and adjacent places being similar.

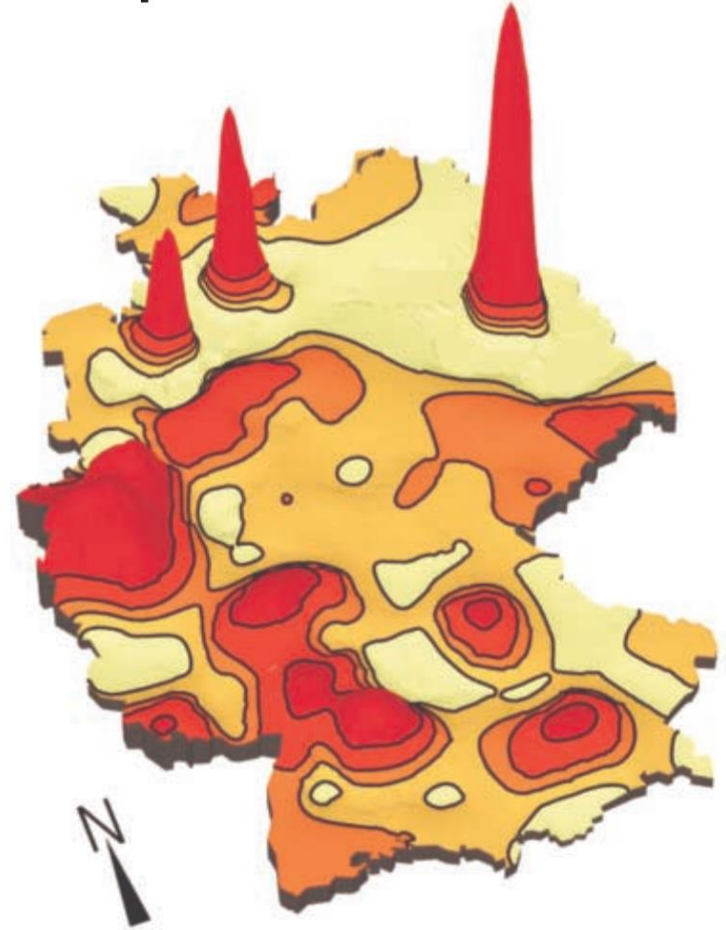
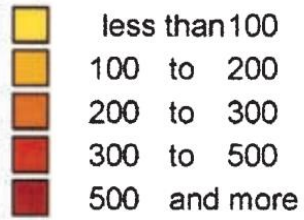
Mathematically this translates into a smoothness criterion”

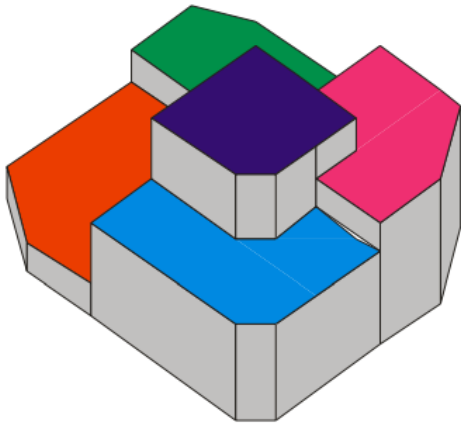
Waldo Tobler



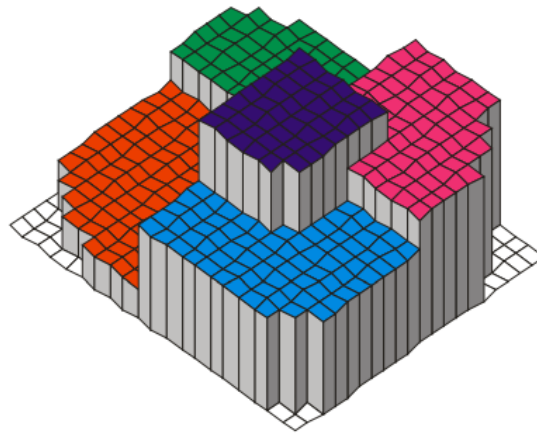
Federal Planning Regions

Inhabitants/km²

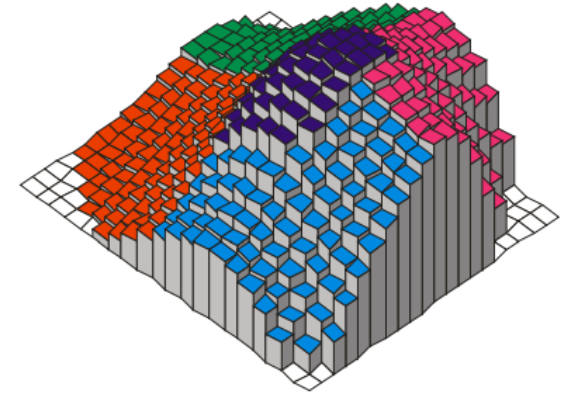




a) Prisms

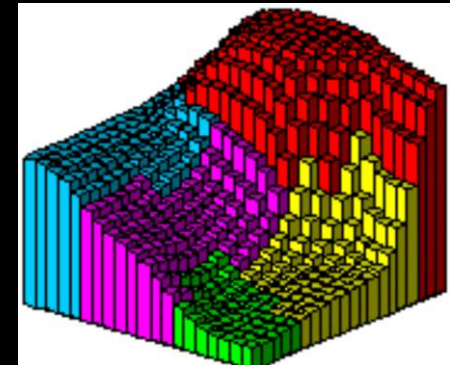
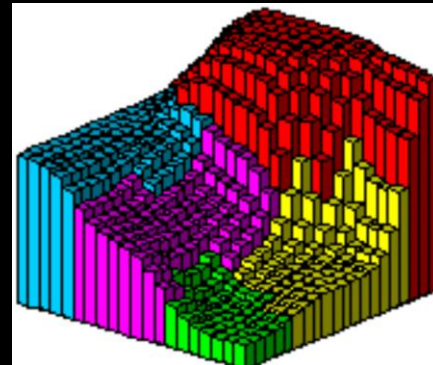
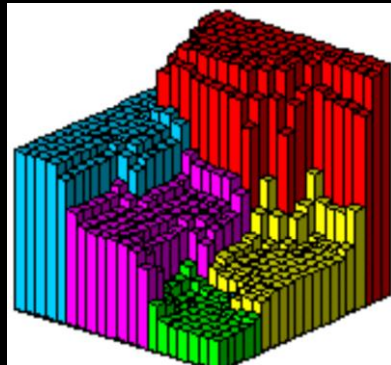
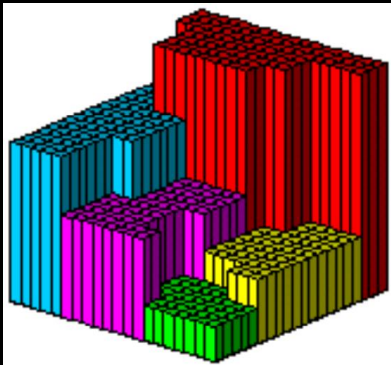


b) Rectangular columns

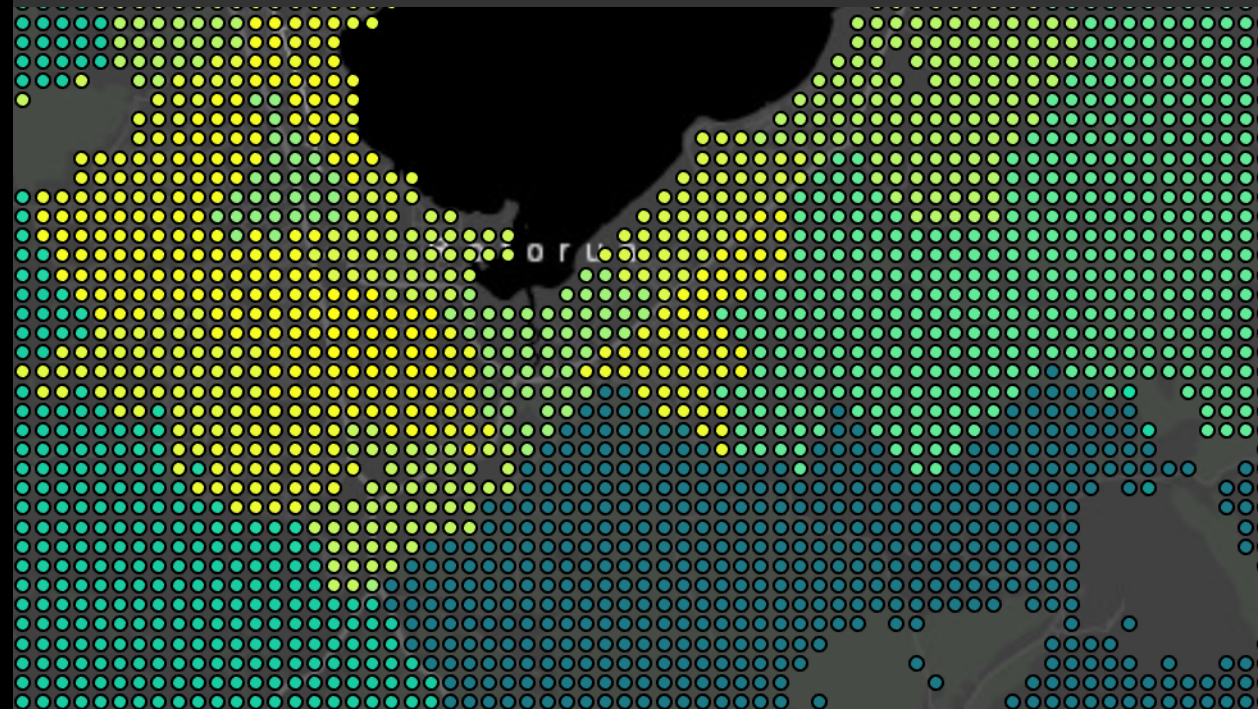
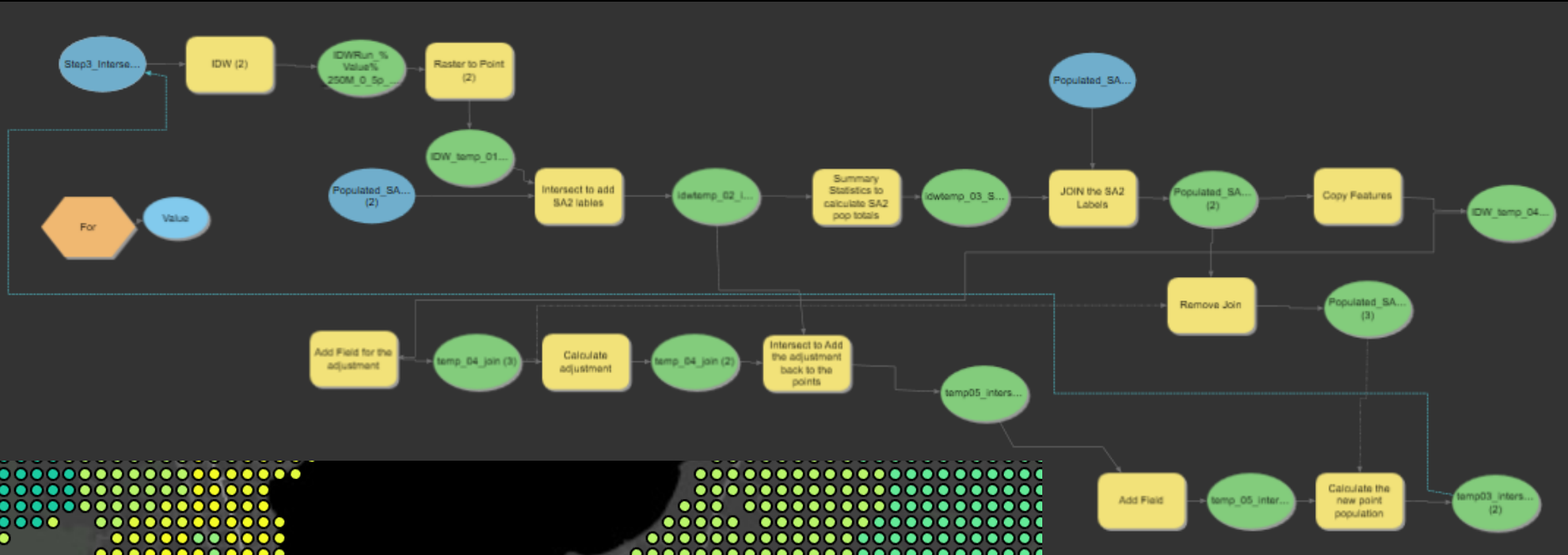


c) Smooth surface

Figure 29 Main steps in the volume-preserving interpolation procedure



The GIS recipe

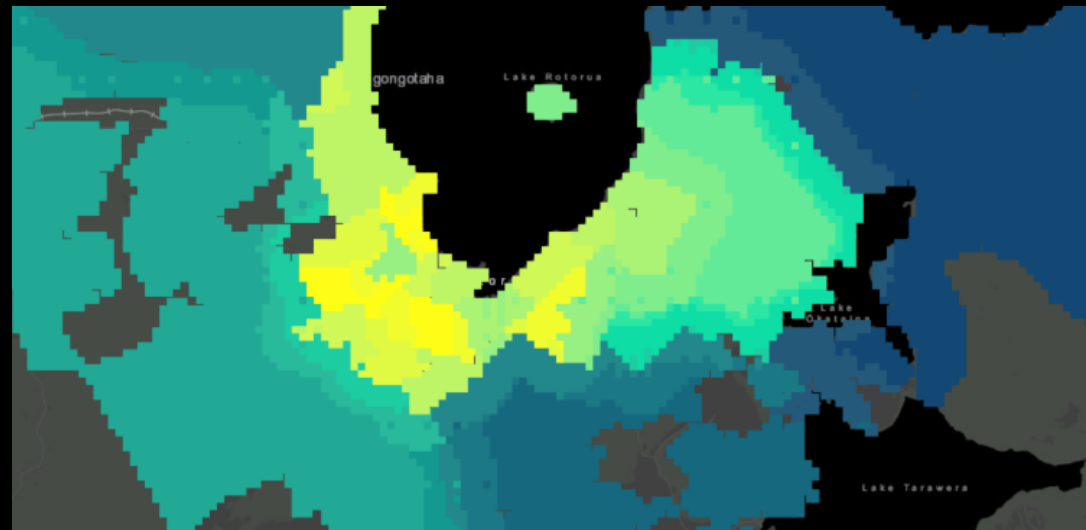


Early doors testing

From this...



...to this



Summary

- Techniques that can be applied to publicly-available data
- It's disaggregation, not reverse-engineering
- Preserving volumes helps re-zoning
- Makes data beautiful