

Spatial Data, Maps and Change Detection in Island Environments



Why are islands ideal laboratories for spatial analysis?

- limited land
- fragile ecosystems
- coastal concentration
- tourism pressure
- climate change
- accessibility constraints





Spatial Thinking

Where?

Why there?

Why changing?

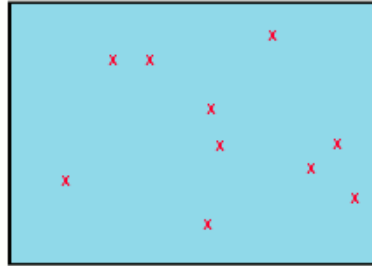
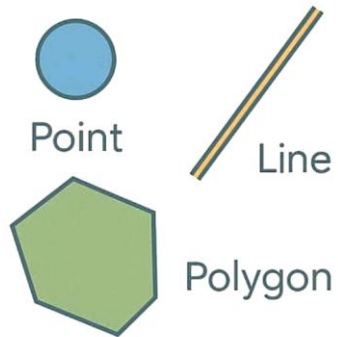
What happens nearby?

What happens through time?

Types of Spatial Data



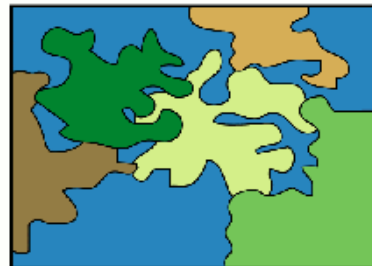
Vector



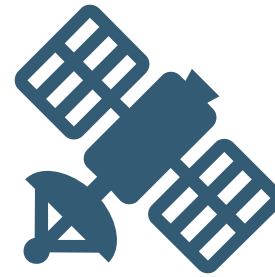
Vector Point Features



Vector Line Features



Vector Polygon Features



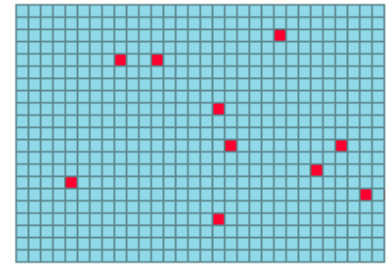
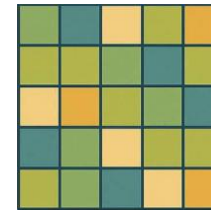
Raster

satellite imagery

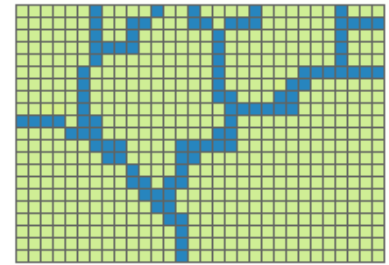
DEM

land cover

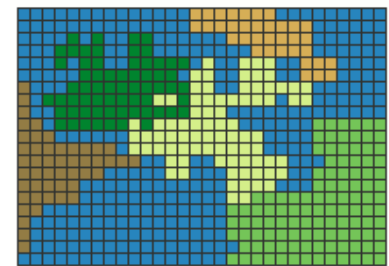
NDVI



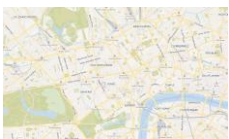
Raster Point Features



Raster Line Features



Raster Polygon Features



EUROPEAN
STATISTICAL
SYSTEM



SENTINEL-2 IMAGERY

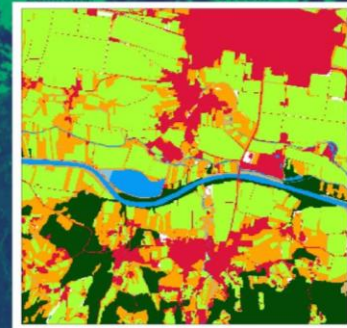


IMAGE CLASSIFICATION



EMODnet



European Marine
Observation and
Data Network



Atmosphere
(CAMS)



Marine Environment
(CMEMS)



Land
(CLMS)



Climate Change
(C3S)



Emergency Management
(EMS)



Security

Spatial Data Sources

Copernicus

CORINE

Sentinel

Landsat

OpenStreetMap

EMODnet

Eurostat

GHSL



Spatial Resolution Matters

10 m



30 m



100 m



1 km



What is Land Cover?

VS

What is Land Use?

The same land cover may support different land uses

Land Cover

What physically covers the Earth's surface

Forest

Grassland

Water

Buildings

Cropland

Land Use

How people use the land

Forestry

Grazing

Fishing / Recreation

Residential

Agriculture

What is Change Detection?

Change detection is the process of identifying differences in the Earth's surface over time.



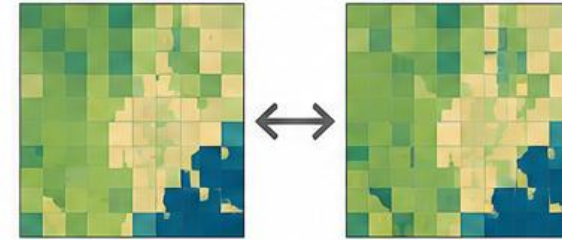
Different dates

Use data from two or more time periods.



Compare

Compare the datasets pixel by pixel or feature by feature.



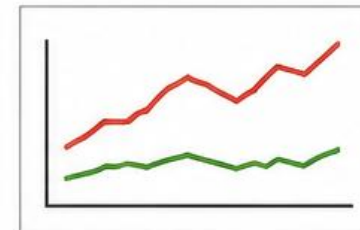
Detect change

Identify areas where changes have occurred.



Interpret

Analyze the meaning, magnitude and patterns of change.



Planning

Use the results to support decision-making and sustainable planning.



Examples of Land Change



urban
expansion



tourism
development



wildfire



abandoned
agriculture



Coastal erosion
/ shoreline
change

Methods of Change Detection



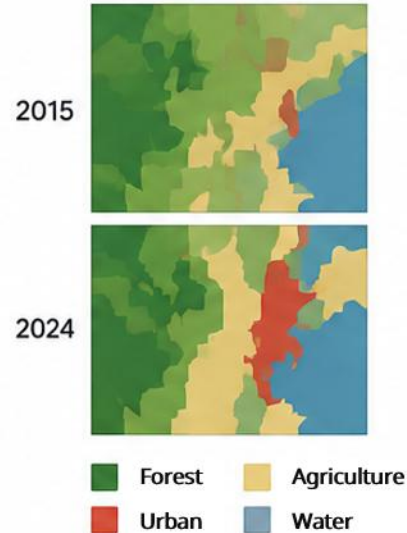
Image Comparison



Visually compare images from different dates to identify visible changes.



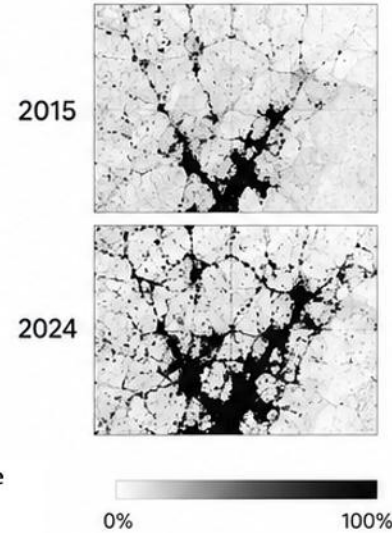
Land Cover Comparison



Compare land cover maps from different years to detect class changes.



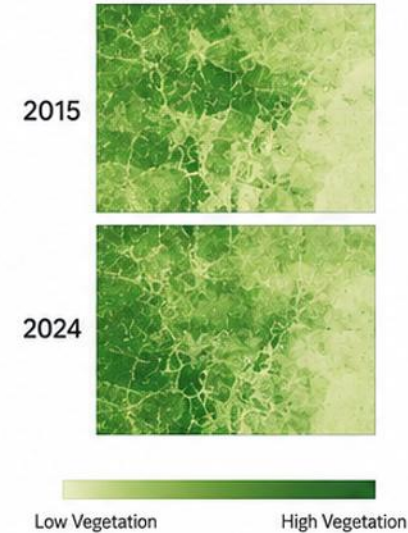
Imperviousness Change



Measure the increase in impervious surfaces (built-up areas) over time.



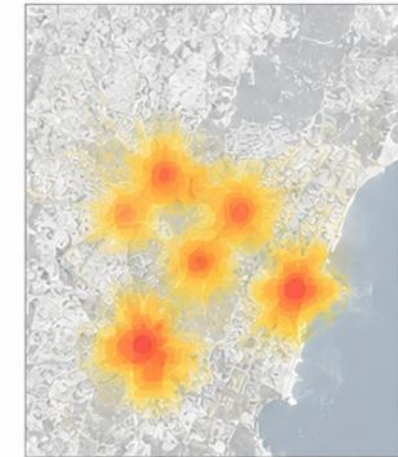
Vegetation Indices



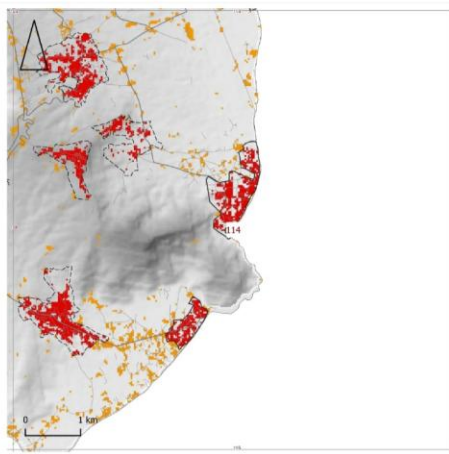
Use indices like NDVI to detect changes in vegetation health and density.



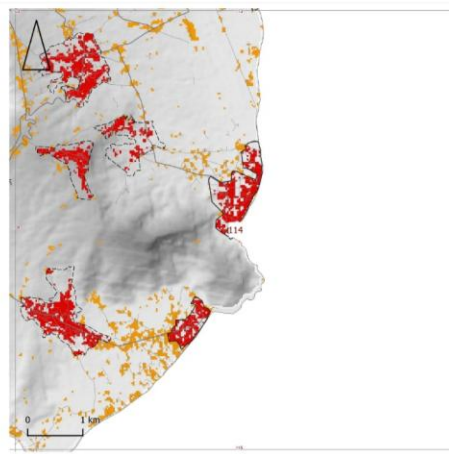
Hotspot Analysis



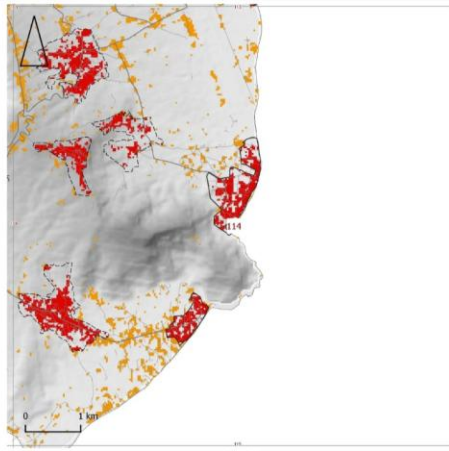
Identify statistically significant areas of high change (hotspots).



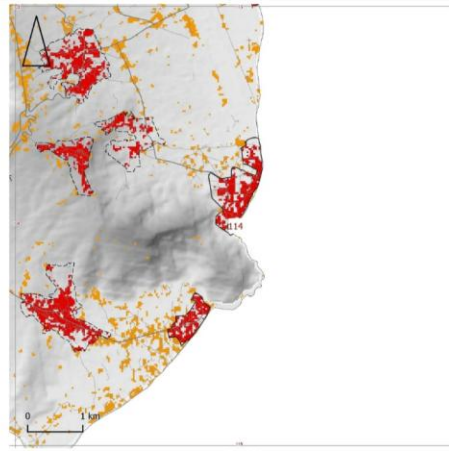
2000



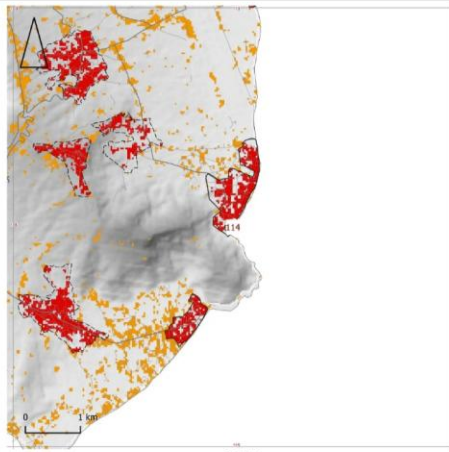
2005



2010

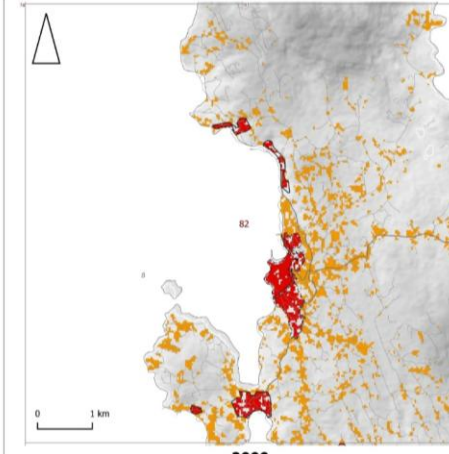


2015

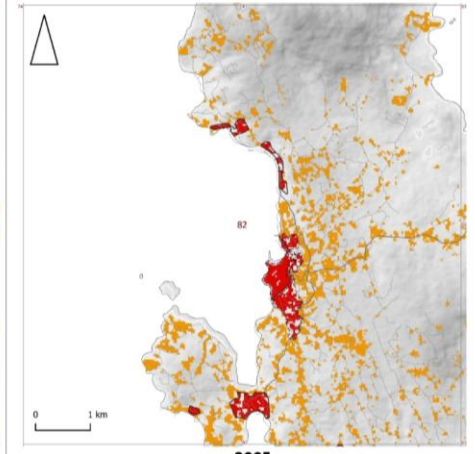


2020

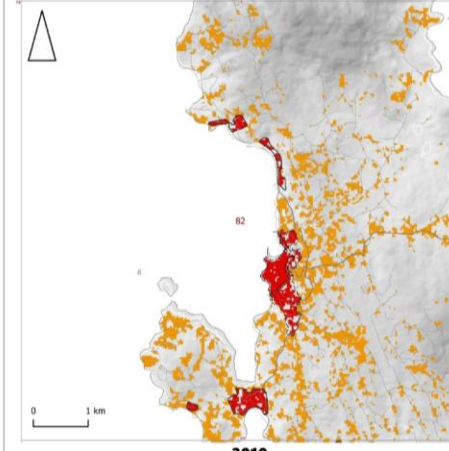
- Όριο Οικισμών
- Όριο Παραδοσιακών Οικισμών
- Οδικό Δίκτυο**
- Κύριο
- Τοπικό
- Δόμηση**
- Εντός Ορίων Οικισμών
- Εκτός Ορίων Οικισμών



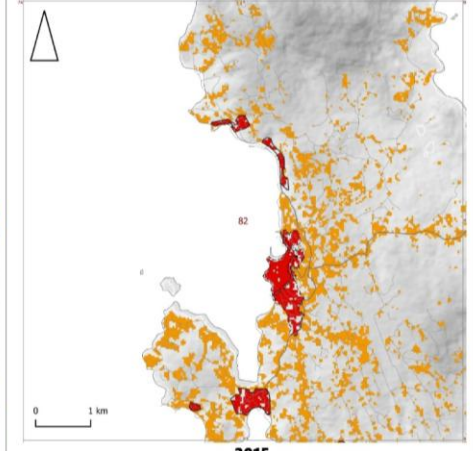
2000



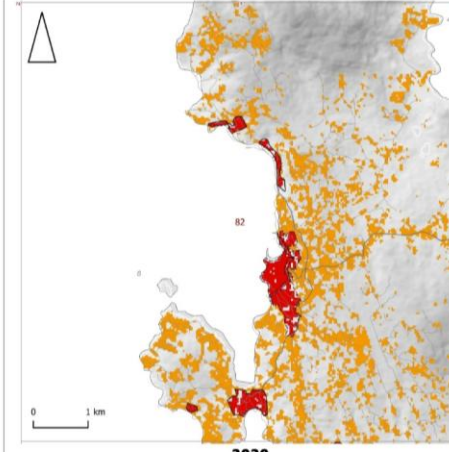
2005



2010



2015



2020

- Όριο Οικισμών
- Όριο Παραδοσιακών Οικισμών
- Οδικό Δίκτυο**
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- Εκτός Ορίων Οικισμών

Soil Sealing on Islands



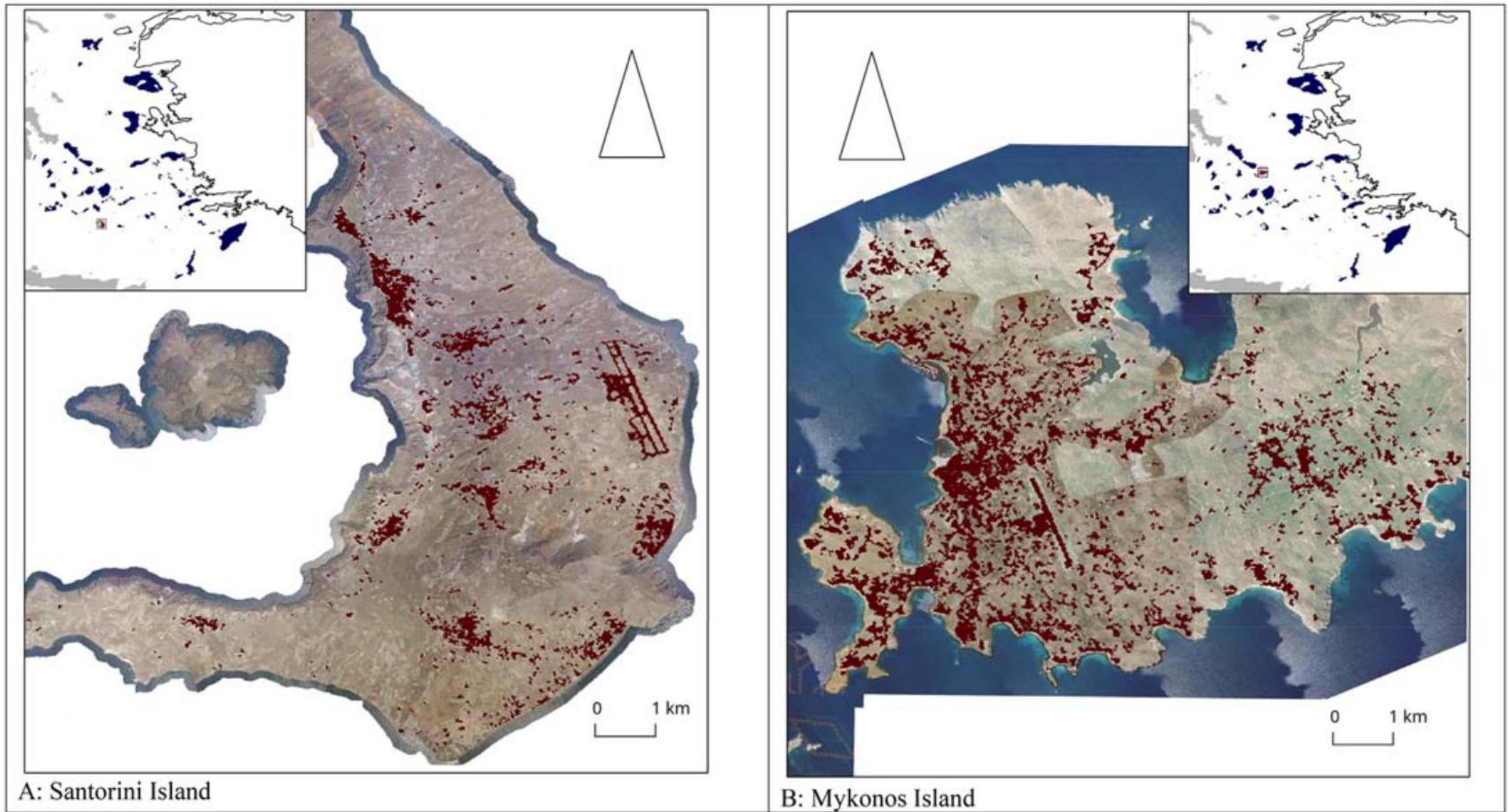
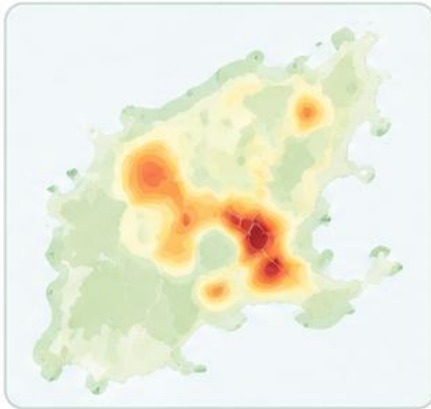


Figure 2. Soil sealing of (a) Santorini and (b) Mykonos, Cyclades. [Colour figure can be viewed at wileyonlinelibrary.com]

From Maps to Planning



**Where is
pressure?**



Identify areas under
environmental or
development pressure.



**Where is
growth?**



Detect areas experiencing
urban or land cover
growth.



**Where is
vulnerability?**



Locate areas exposed
to natural hazards
and environmental risk.



**Where should
policy intervene?**



Prioritize areas for
sustainable and
effective intervention.



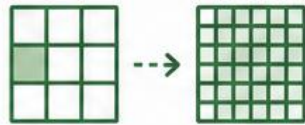
Maps show us where things are.



Spatial analysis shows us where to act.

Common Pitfalls

Be aware of these to avoid misleading results.



Wrong Resolution

Using data that are too coarse or too fine for the question.



Too coarse



Appropriate



Wrong Classification

Misclassifying land cover leads to wrong conclusions.



Incorrect



Correct



Outdated Data

Outdated data may not reflect current conditions.



Old
(2015)



New
(2024)



Confusing Land Cover with Land Use

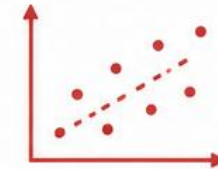
They are different concepts and answer different questions.



Land Cover
(what is there)



Land Use
(how it is used)



Correlation $\neq$ Causation

A relationship on a map or in data does not mean one causes the other.



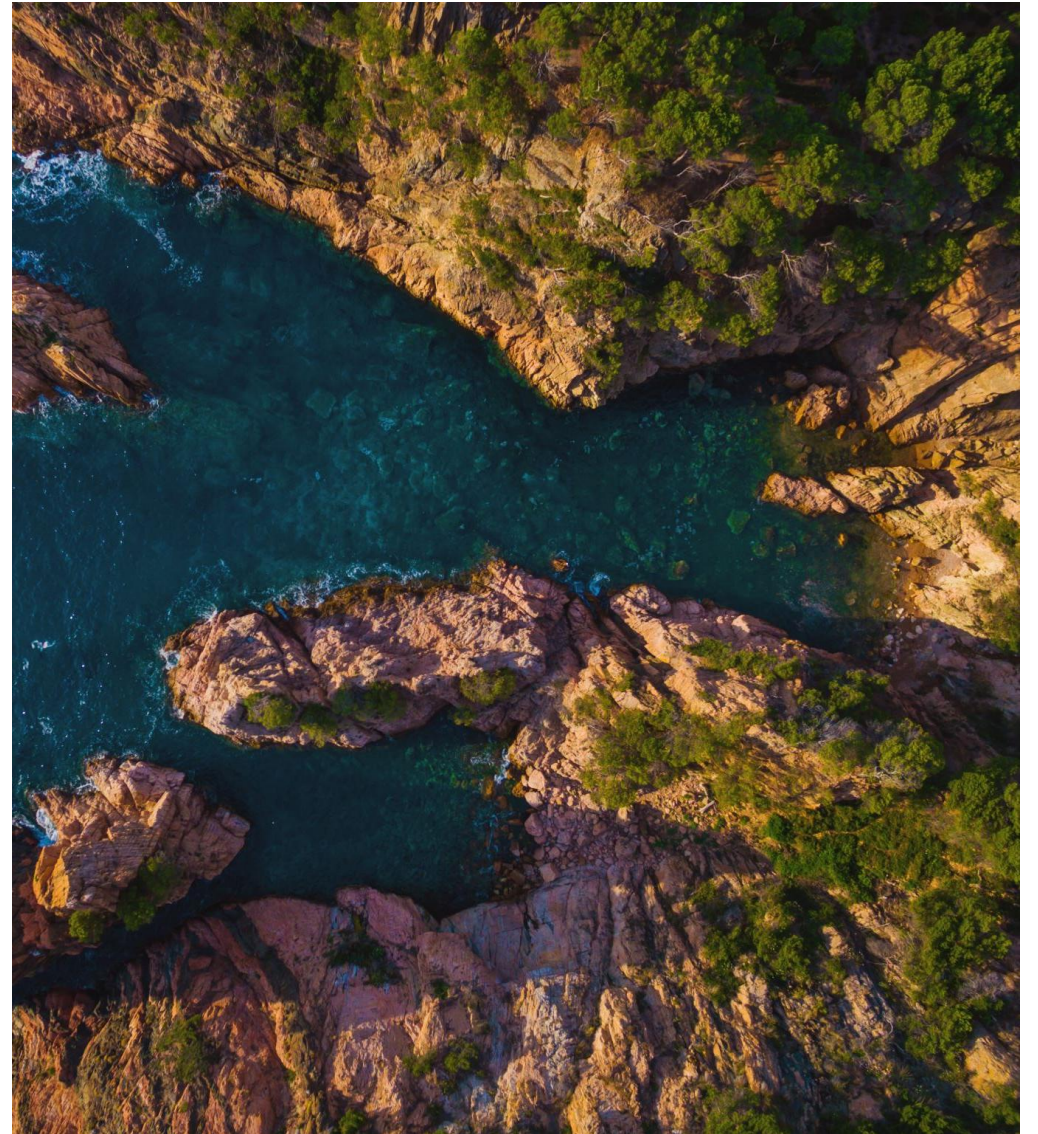
Related, but not caused by each other.



Good spatial analysis starts with **good data**, **clear methods**, and **critical thinking**.

Key Messages

- Islands change rapidly
- Spatial data help us measure change
- GIS supports evidence-based planning
- Better maps lead to better decisions



Transition to Lab



explore land cover



identify changes



create maps



discuss planning
implications