

Un approccio multidisciplinare per la ricostruzione e valorizzazione dei paesaggi del passato: il ruolo dei software open-access GIS

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DIPARTIMENTO DI SCIENZE
DELLA TERRA "ARDITO DESIO"



Why Landscapes ?



- geographic areas perceived by people whose characteristics are the result of the interaction between natural factors and human activities
- public interest role in the cultural, ecological, environmental and social fields, and constitutes a resource favorable to economic activity
- worthwhile dataset about the millennial human-environment interaction

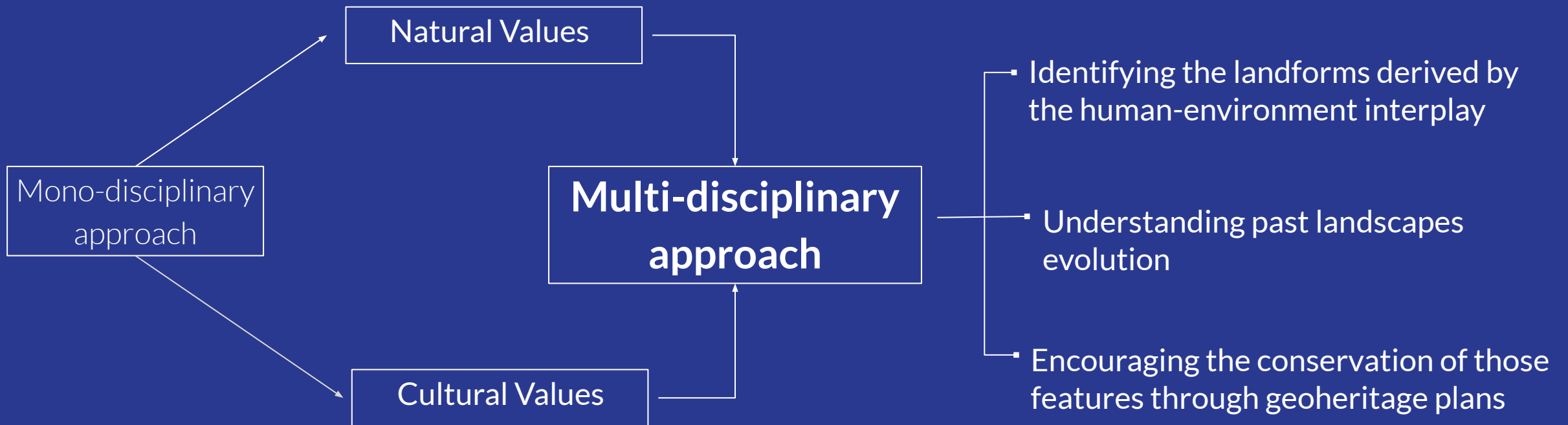
“Horizon 2020 Expert Group on Cultural Heritage report Getting cultural heritage to work for Europe”:

- divide between ‘nature’ and ‘cultural’ heritage in landscape management
- weakness of monodisciplinary approaches.



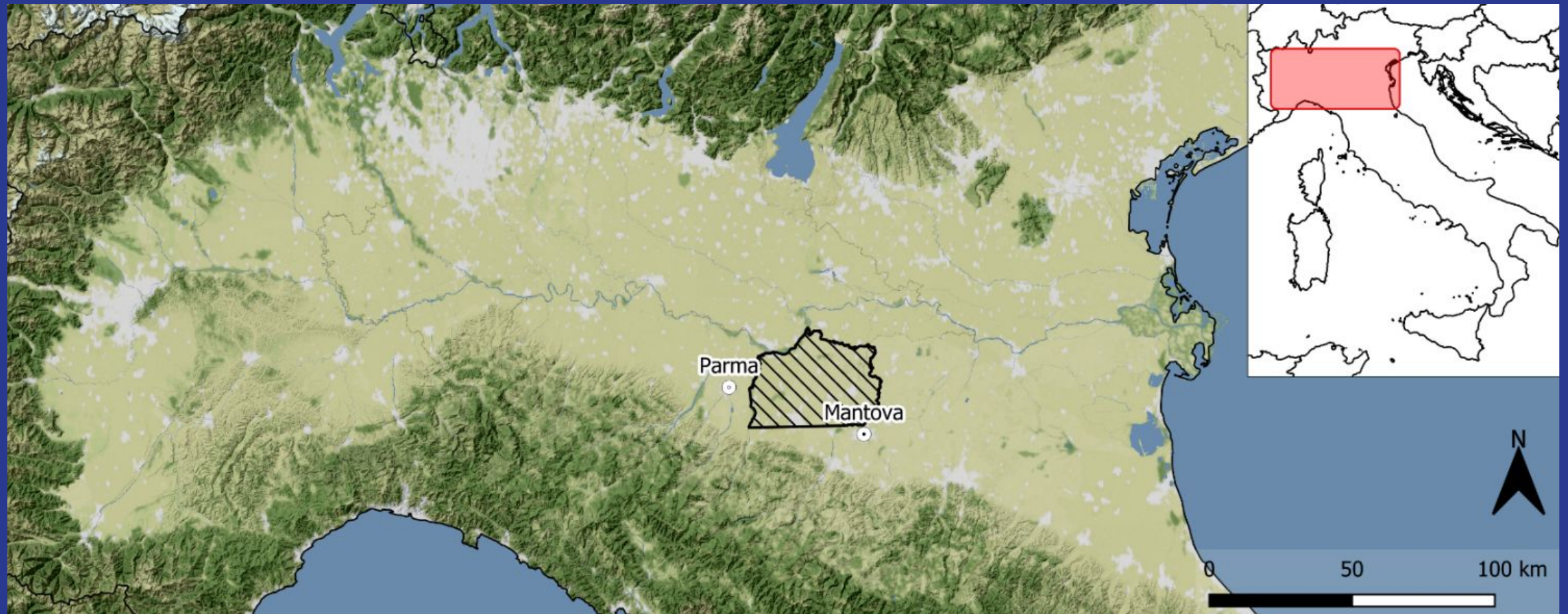
European
Commission

Horizon 2020
European Union funding
for Research & Innovation



Study Area A (Central Po Plain, Italy)

- largest floodplain in Italy
- key area for the interpretation of environmental and cultural influences between the Mediterranean regions and the continental Europe
- complex settlement and land-management history



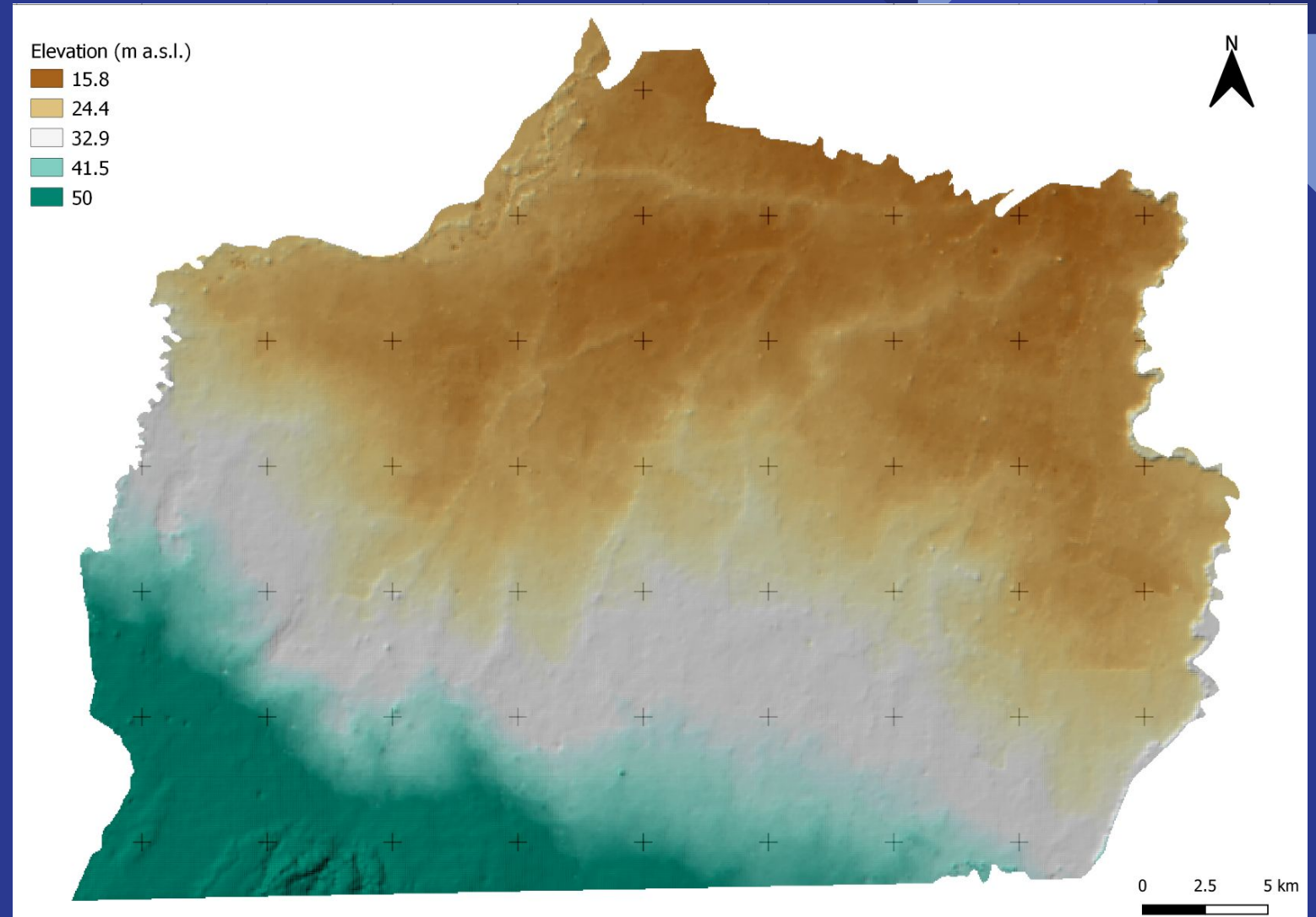
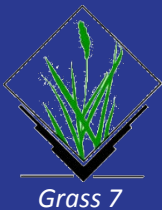
DATA ACQUISITION

Digital Elevation Model

- Elaboration and filtering of 260.953 Regional Elevation checkpoints (m a.s.l.)



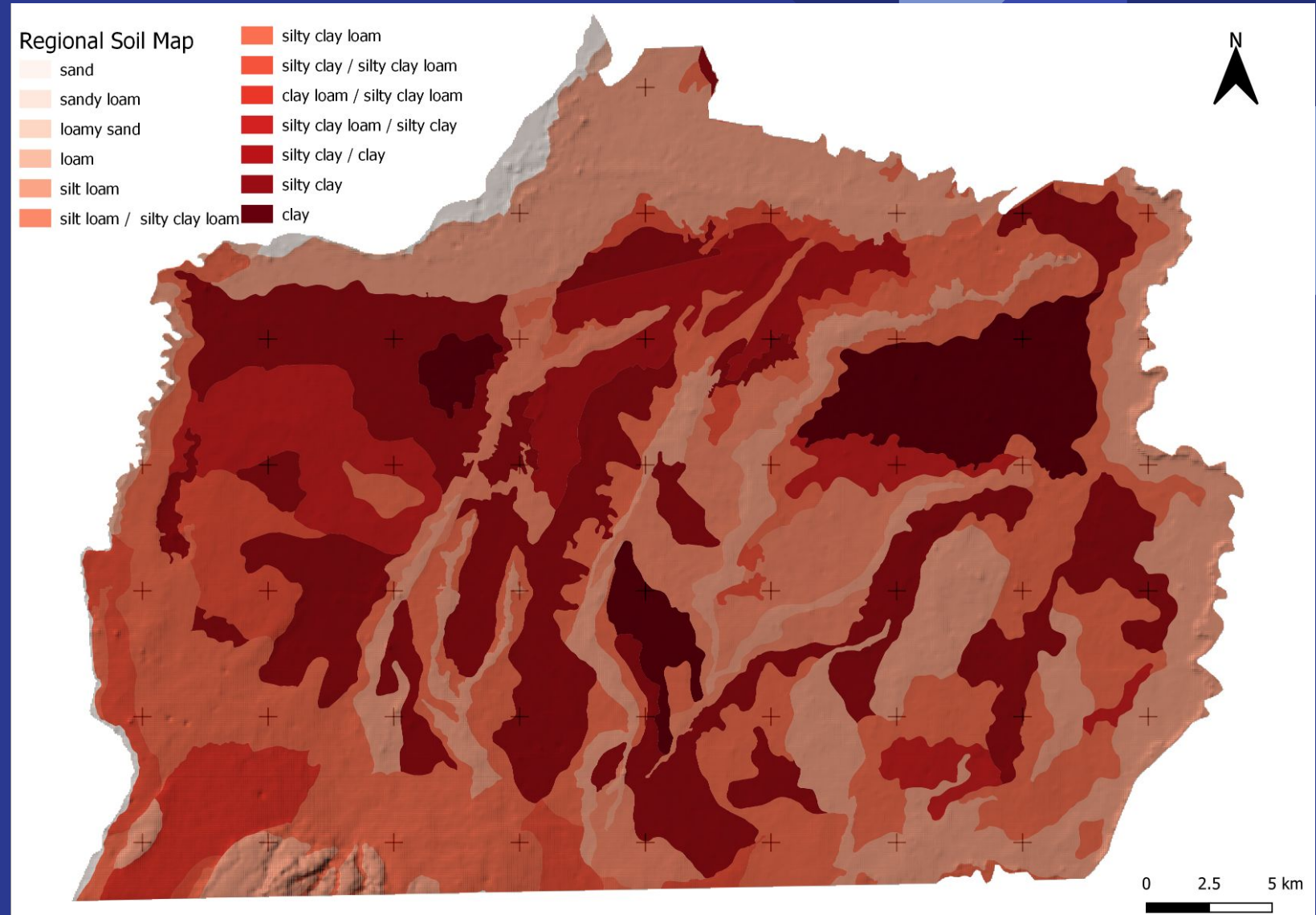
- Interpolation 52.902 Elevation checkpoints (m a.s.l.) with *Inverse Distance Weighting (IDW)* method.



Geopedological Data

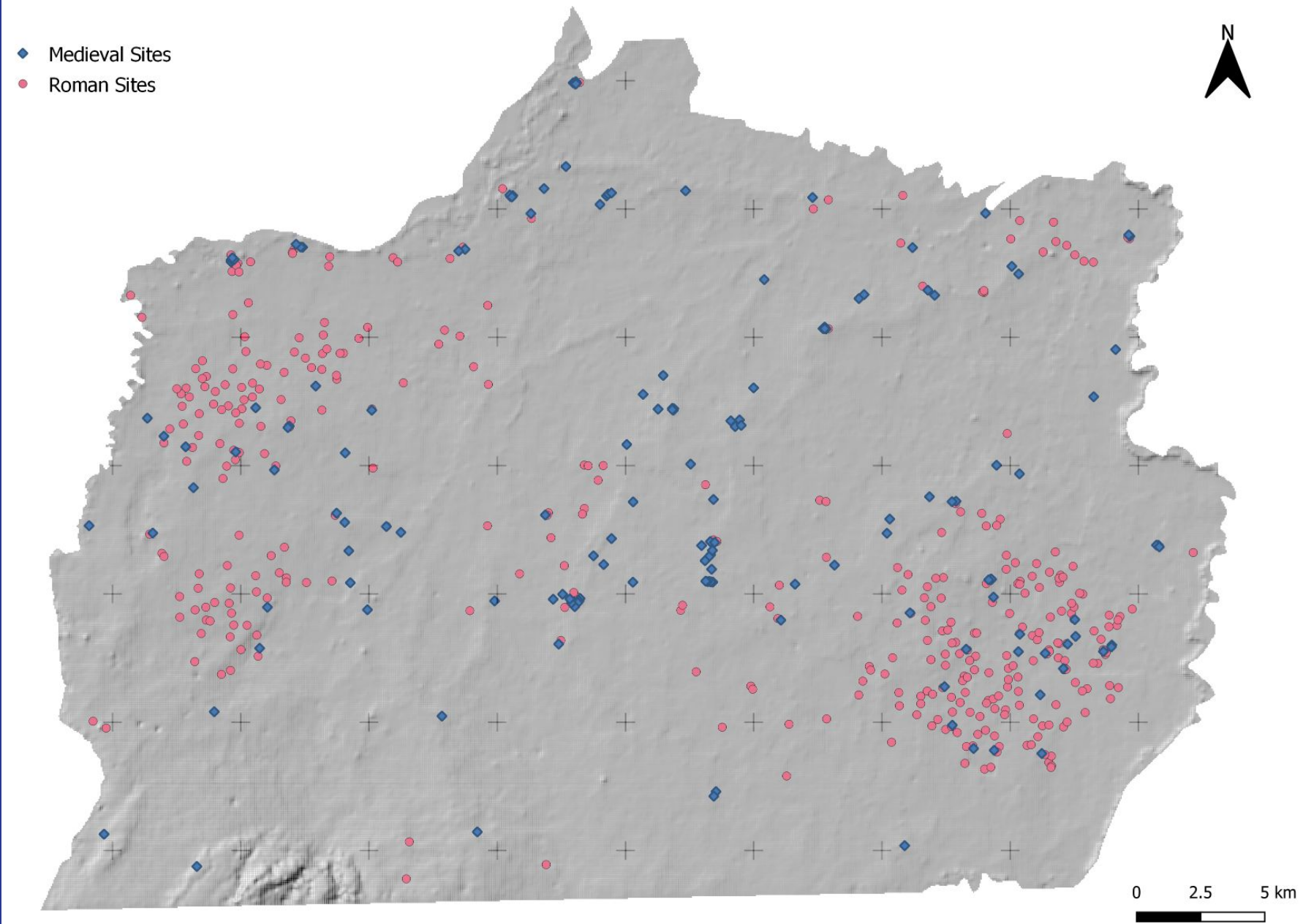
Digitization and classification of the Regional Soil Map.

- an indication of waterlogged areas before Renaissance land reclamation (Geomorphology)
- a solid proxy for agricultural suitability (Land-use)



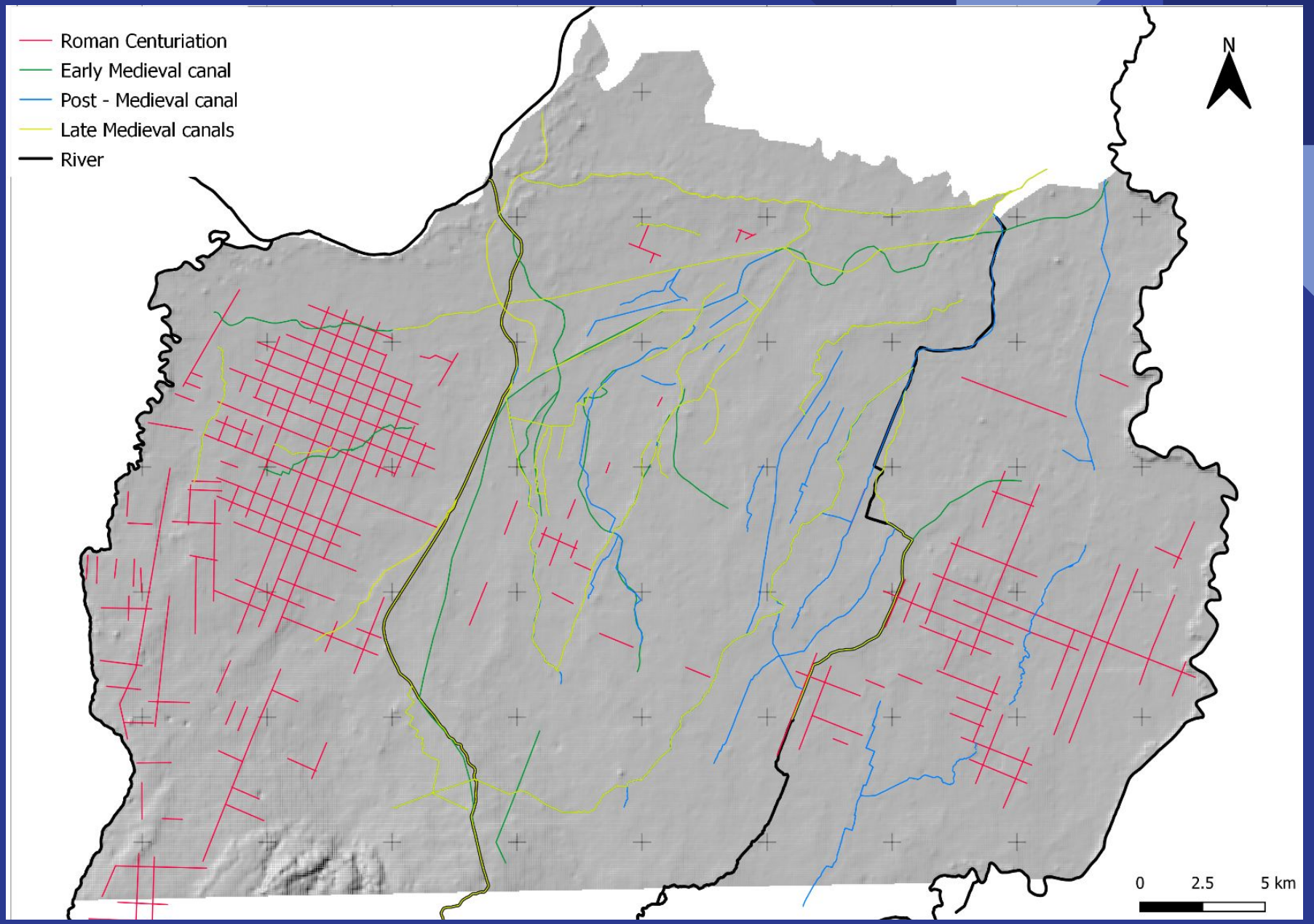
Archeological Data

- 379 Roman sites
- 160 Medieval sites



Historical Cartography

- Roman *centuriatio* (2nd BCE – 5th century CE)
- Early Medieval canals (5th – 10th century CE)
- Late Medieval flood management (10th – 15th century CE)
- Post Medieval land reclamation (>15th century CE)

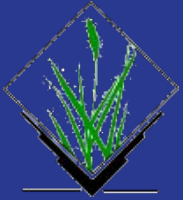


Historical cartography: georeferencing



Es. Cartografia Austriaca della Provincia di Reggio Emilia [scala 1:50.000, 1:86.400 - edizione 1830, 1850]

Assessing the role of alluvial geomorphology for settlement strategies: *Point Pattern Analysis*



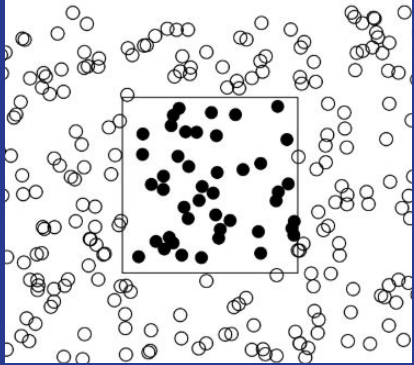
AIMS

- estimating if the different water management strategies in the Roman and Medieval periods influenced the spatial distribution of sites
- evaluating the relative importance of agricultural suitability over flood risks in the two historical phases.

METHOD

- Point Pattern Analysis (PPA).

Point Pattern Analysis (PPA)



$$n(X \cap B)$$

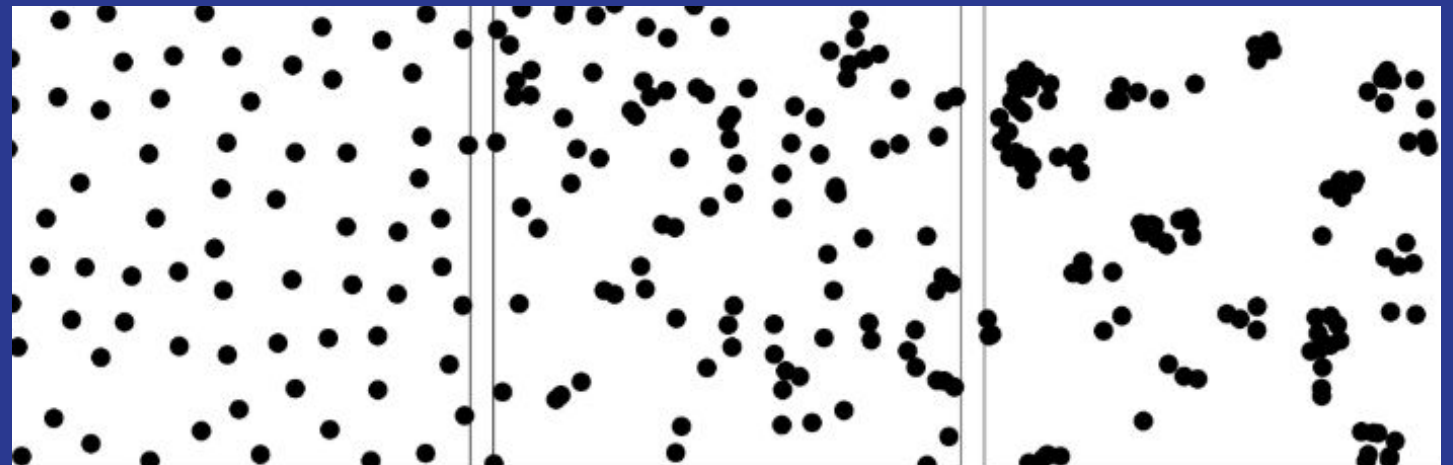
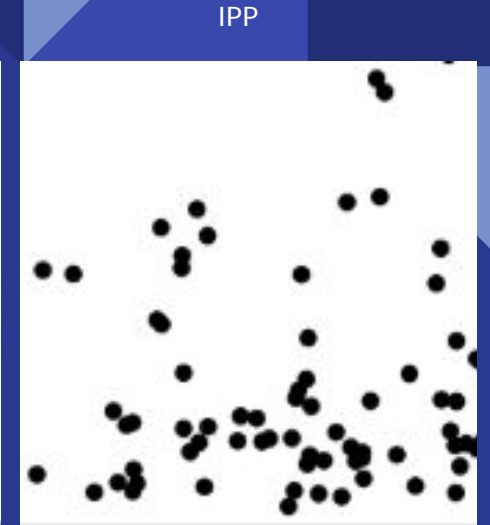
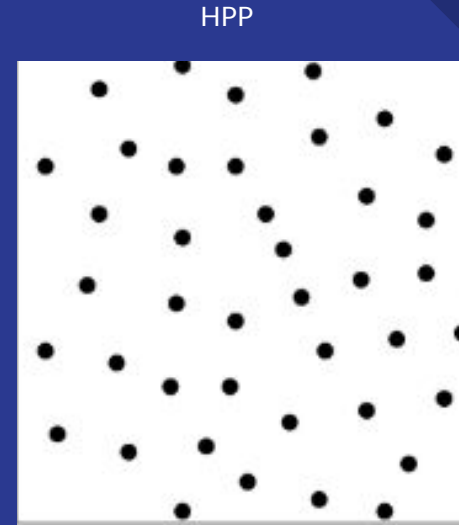
n = point pattern
 X = point process (Poisson)
 B = bounded region

Effects of point process intensity \rightarrow first-order properties

- Intensity
 - constant within the region \rightarrow (HPP)
 - spatially variable \rightarrow (IPP)
 - spatial covariates

Correlation \rightarrow second-order properties

- Spatial interaction of events (X,Y,...)
 - aggregation
 - segregation



Regular

Repulsion

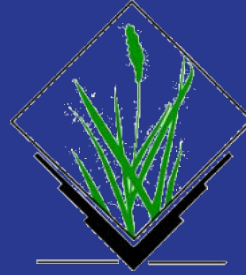
CSR

Attraction

Clustered

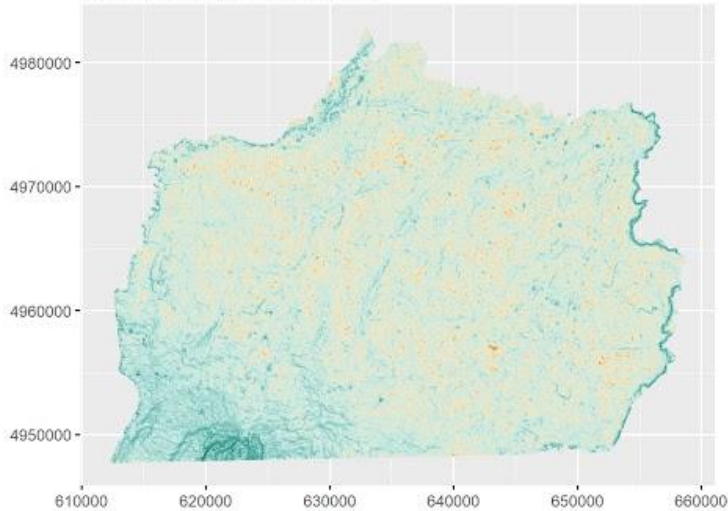
Spatial Covariates

- flood hazard □ Modified Topographic Index (MTI)
- agriculture suitability □ Soil texture (Soil)
- distance from *via Aemilia* □ VAE

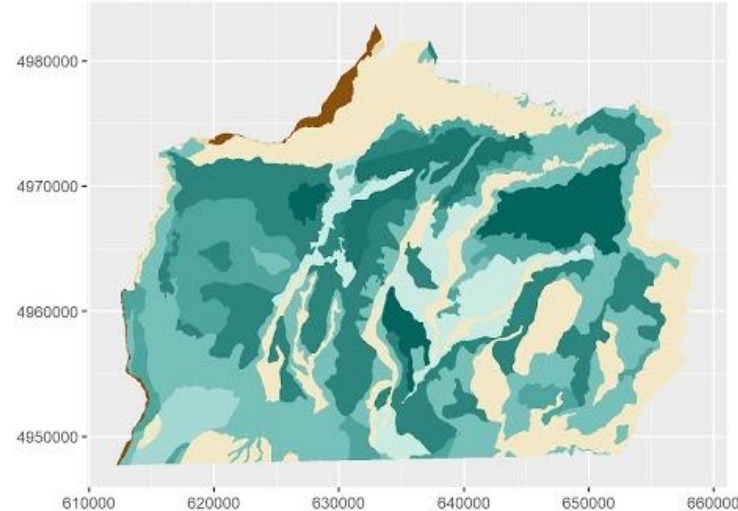


Grass 7

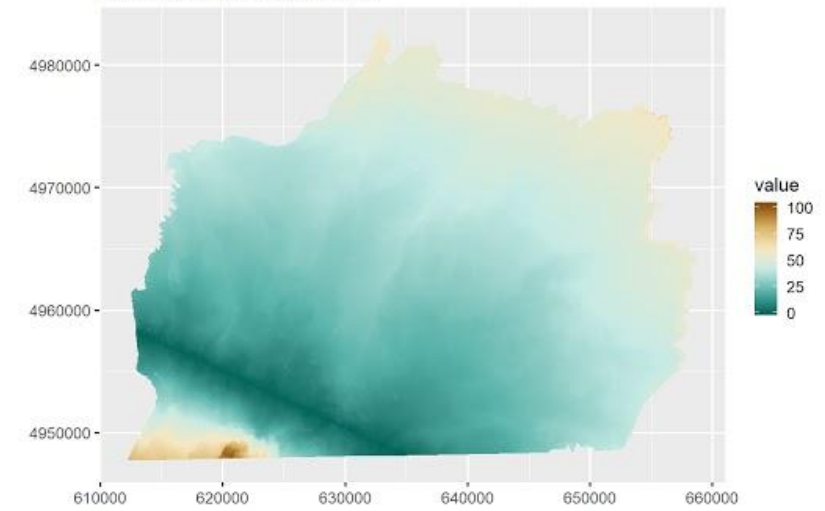
Modified Topographic Index



Soil Texture



Distance from Via Aemilia



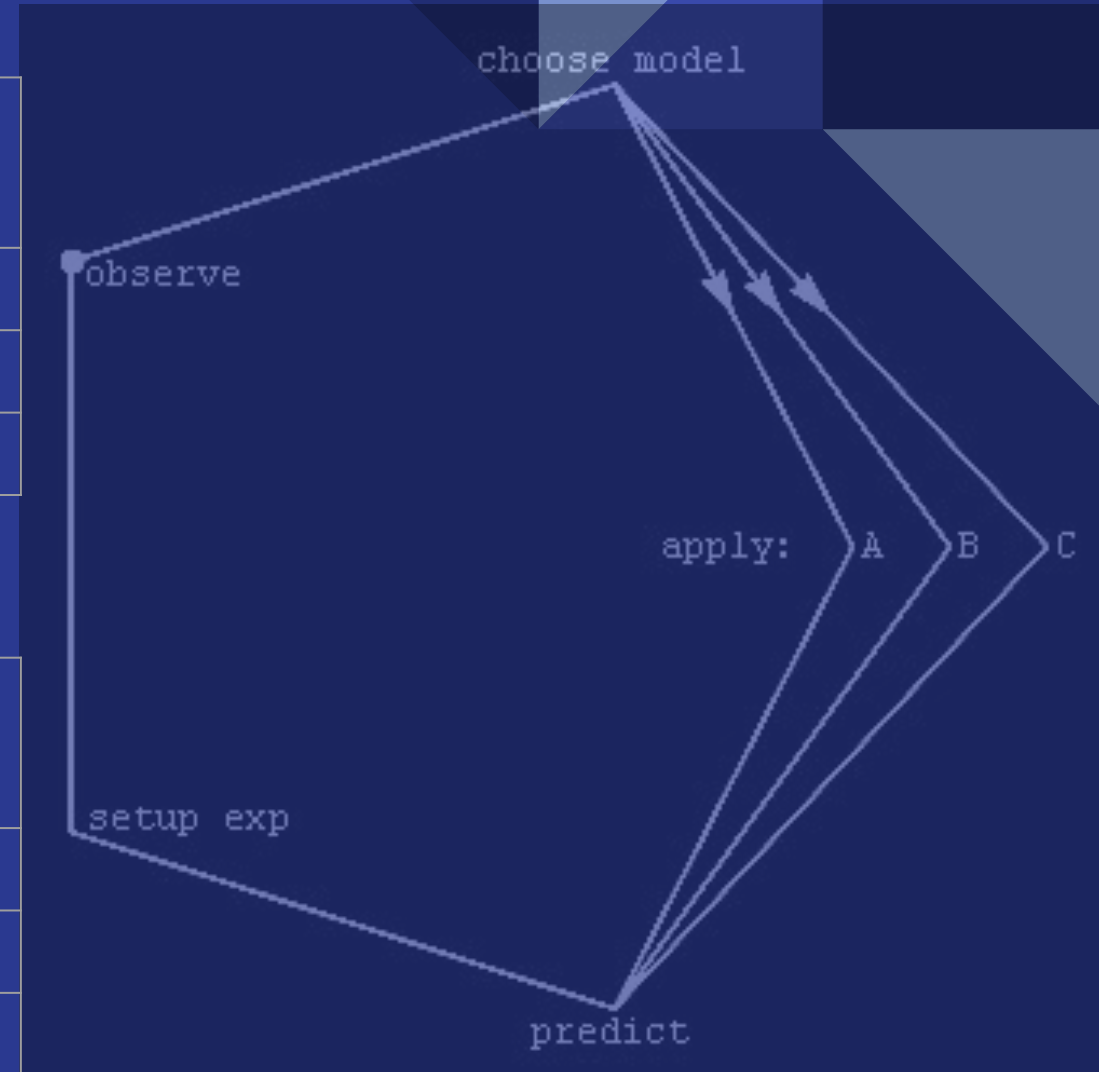
- Model 0, Model 1, Model 2 have been created for Roman (R) and Medieval (M) sites.



Schwarz's Bayesian Information Criterion (BIC)

Model R	Selected Covariates	Discarded Covariates	BIC	df	Weights Model 0-1	Weights Model 0-2
0	-	-	12105.69240972	0	0.2120797	0.201900
1	Soil	MTI	12103.06753956	1	0.7879203	0.750103
2	VAE		12108.56572157	1	-	0.047996

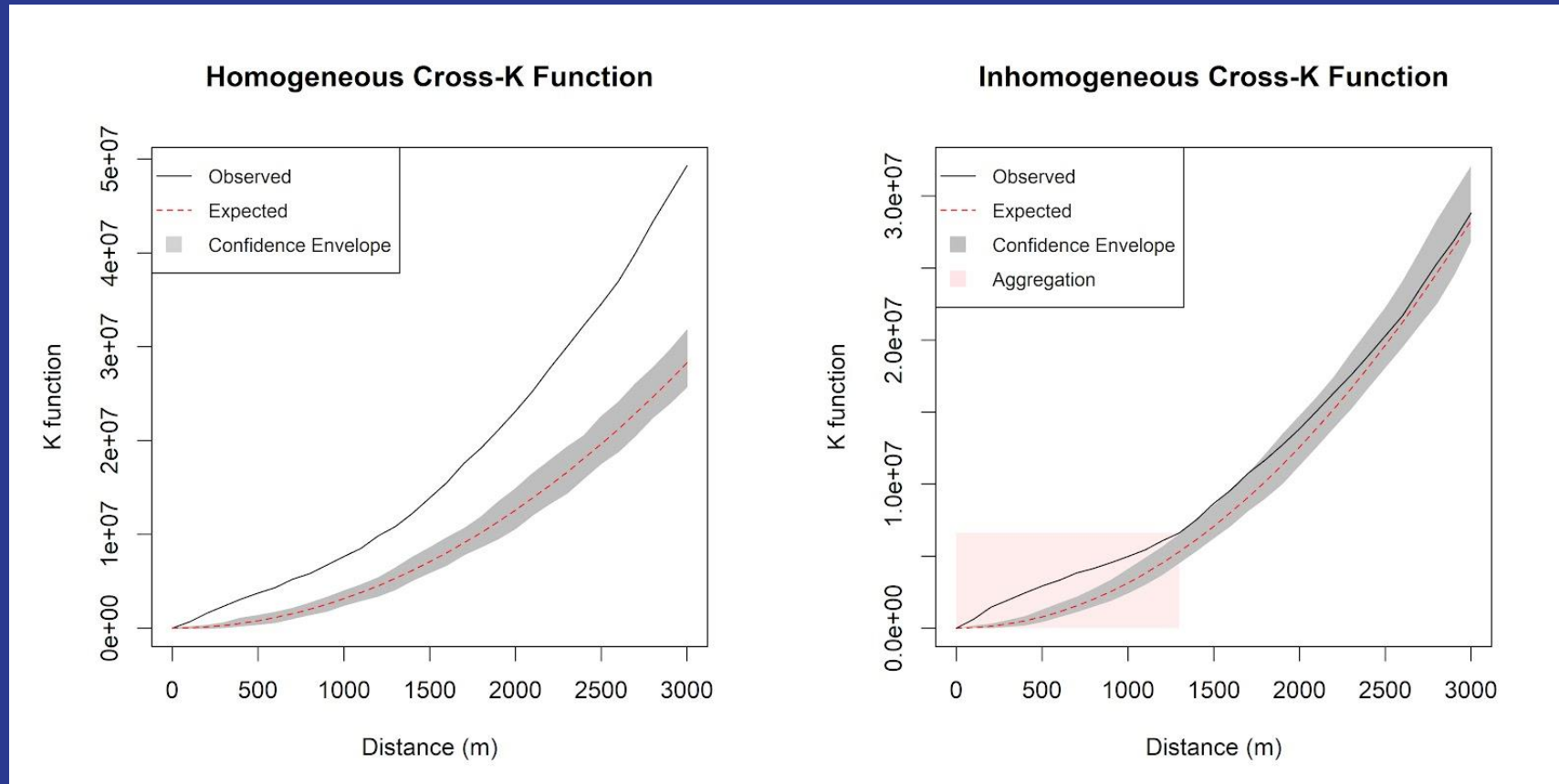
Model M	Selected Covariates	Discarded Covariates	BIC	df	Weights Model 0-1	Weights Model 0-2
0	-	-	5389.107074615	0	0	0
1	MTI, Soil	-	5328.237281848	2	1	1
2	VAE		5384.960433685	1	-	0



“The scientific observation cycle” (© Wikimedia Commons)

Assessing the spatial interaction of Medieval and Roman sites using cross-K function

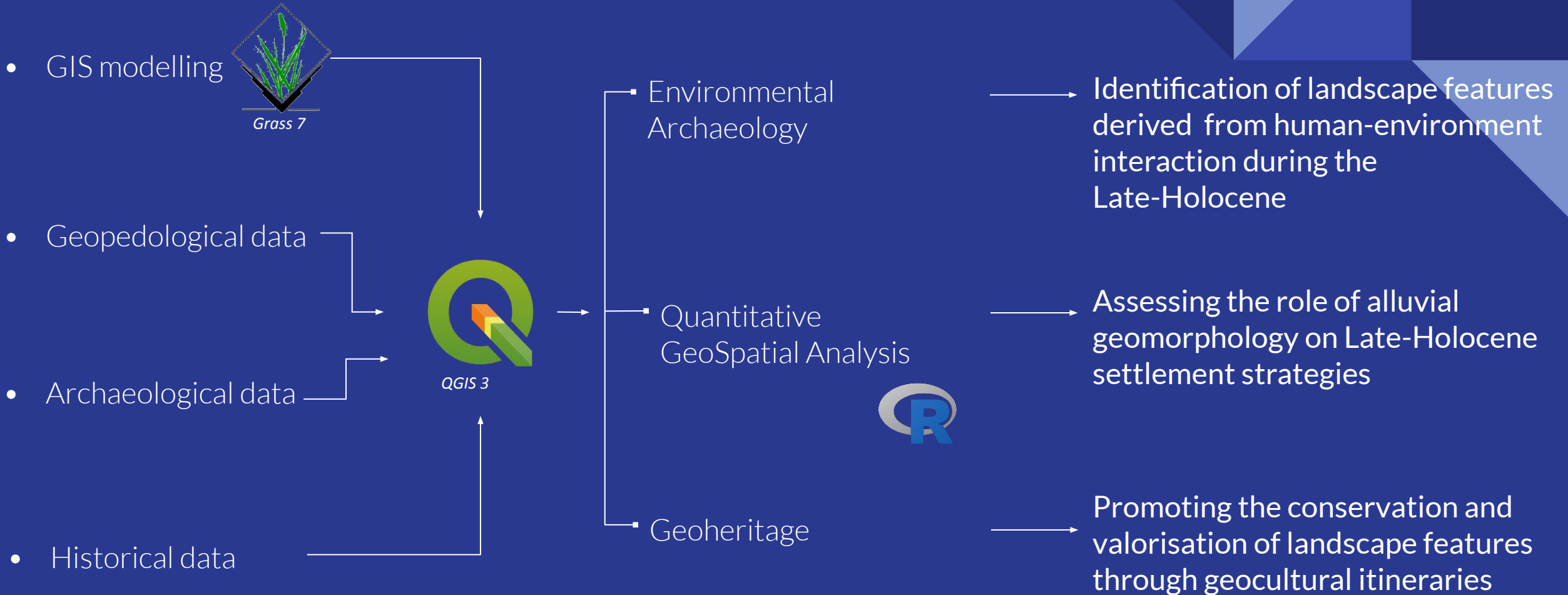
The inhomogeneous cross-K function shows a significant deviation of the observed values from the confidence envelope between 0 and 1.2 km.



H₀ hypothesis can be rejected !

The distinct Roman and Medieval settlement strategies do not explain the proximity of Medieval and Roman sites when sites are closer than 1.2 km.

Ph.D. Workflow



DATA ACQUISITION

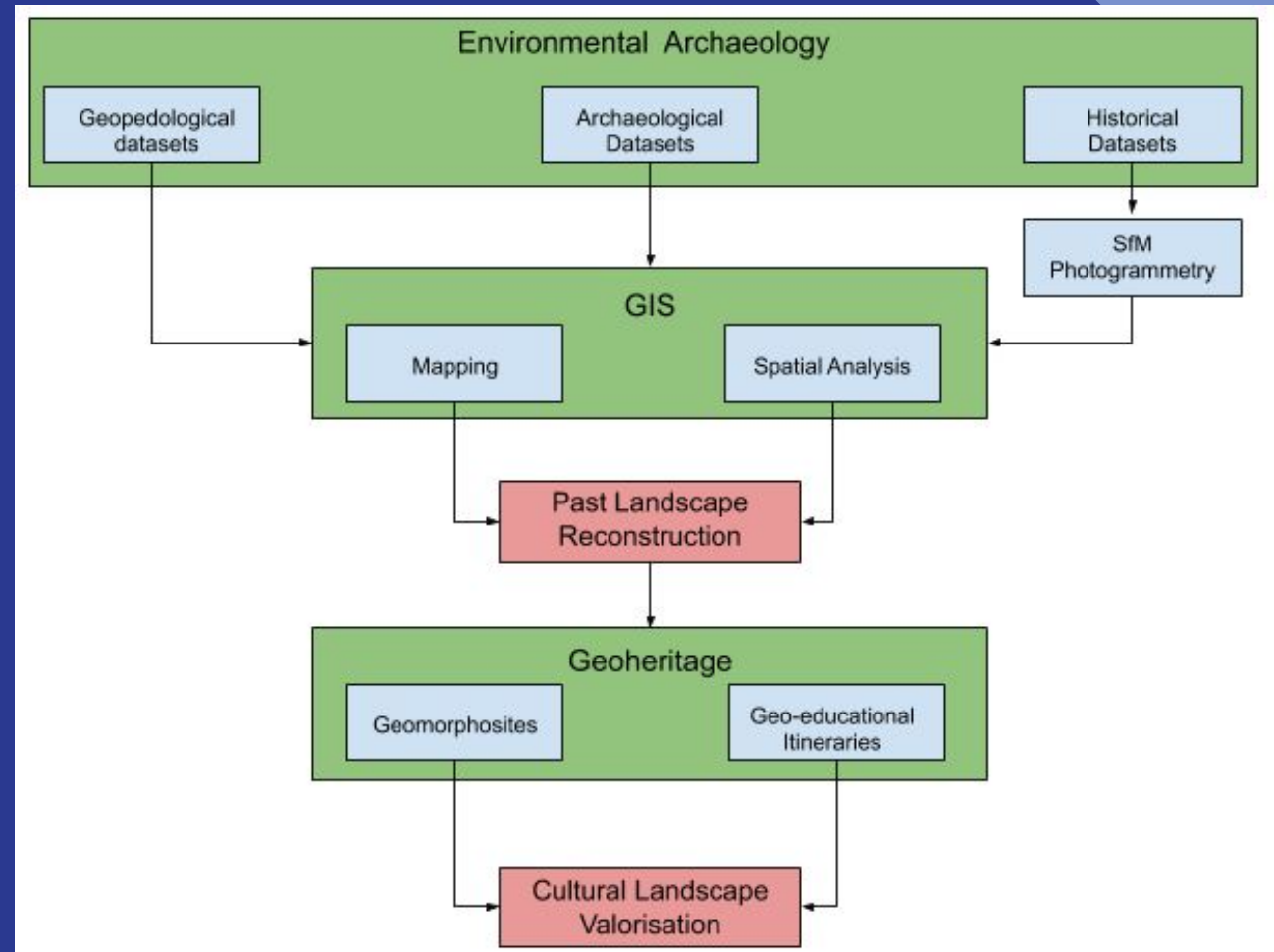
PROCESSING

RESULTS

PhD Project General Conclusion

This PhD project assesses the potentiality of the multidisciplinary approach in landscape studies.

- *Environmental archaeology* to reconstruct past landscape
- *Geoheritage* to promote landscape conservation and public engagement
- Limits: heterogeneity of data.
 - GIS software to:
 - manage all the various data needed
 - quantify the role of humans and environment in shaping landforms
 - map the cultural landscape palimpsest



.... *Future Perspectives*

- sustainability of landscapes: soil loss and degradation.
- sustainable conservation of past landscapes in fragile ecosystems.
- transformative model for interdisciplinary research



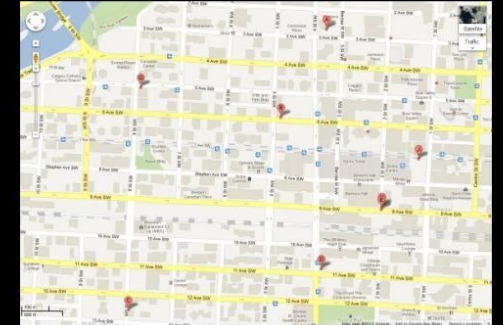
GIS



What my friends think I do



What my mom thinks I do



What society thinks I do

Thank you for
your attention!



What my clients think I do



What I think I do



What I really do