Investigate human responses to Late-Holocene changes of fluvial landforms through Spatial Point Pattern Analysis (Po Plain, N Italy)

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PhD Project

Linking Environmental Archaeology to Geoheritage: a multifaceted approach to unravel and promote past fluvial landscapes

Study Areas

A (Central Po Plain, Italy)
B (Upper Rhone Valley, Switzerland)
C (Central Apennine valleys, Italy)
D (Ticino River fluvial terraces, Italy)
Ph.D. Workflow

- GIS modelling
- Geopedological data
- Archaeological data
- Historical data

DATA ACQUISITION

PROCESSING

RESULTS

Mapping landscape feature derived from human-environment interaction during the Late-Holocene

Assessing the role of alluvial geomorphology on Late-Holocene settlement strategies

Promoting the conservation and valorisation of landscape features through geocultural itineraries
Assessing the role of alluvial geomorphology for settlement strategies with Spatial 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.
Point Pattern Analysis (PPA)

\[ n(X \cap B) \]

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

Effects of point process intensity → first-order properties
- Intensity
  - constant within the region → (HPP)
  - spatially variable → (IPP)
    - spatial covariates

Correlation → second-order properties
- Spatial interaction of events (X,Y,...)
  - aggregation
  - segregation

HPP                                                                                     IPP
Repulsion                                                                                   Attraction
Regular                                                                                   Clustered
Null hypotheses:

○ $H_a$: At large-scale, the density of Roman/Medieval sites is uniform

○ $H_b$: At small-scale, the distribution of Medieval and Roman sites are spatially independent
Spatial Covariates

- Flood hazard □ Modified Topographic Index (MTI)
- Agriculture suitability □ Soil texture (Soil)
- Distance from via Aemilia □ VAE

- Model 0, Model 1, Model 2 have been created for Roman (R) and Medieval (M) sites.
## Schwarz’s Bayesian Information Criterion (BIC)

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<th>Discarded Covariates</th>
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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.

\[ H_b \text{ hypothesis can be rejected} \]!!!

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.
Social and cultural dynamics played a crucial role in responding to alluvial geomorphological environmental challenges in different times.
Publications: results & data

Research paper

Brandolini, Filippo; Carrer, Francesco, "Terra, Silva et Paludes. Assessing the Role of Alluvial Geomorphology for Late-Holocene Settlement Strategies (Po Plain – N Italy) Through Point Pattern Analysis"
https://doi.org/10.1080/14614103.2020.1740866

Dataset

Brandolini, Filippo, 2020, "Late-Holocene human resilience in a fluvial environment: a geoarchaeological database for the Central Po Plain (N Italy)", https://doi.org/10.7910/DVN/JSYZ3H, Harvard Dataverse, V3

Data paper

Brandolini, Filippo, 2020, "Late-Holocene human resilience in a fluvial environment: a geoarchaeological database for the Central Po Plain (N Italy)", Journal of Open Archaeology Data, in press
THANK YOU FOR YOUR ATTENTION!

CODING

Creating a solution for a problem by creating another problem.