SCIENZE A SISTEMA PER LA SOSTENIBILITÀ
La ricerca al Dipartimento di Biologia Ambientale
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How anthropogenic landforms affect Potential Natural Vegetation in urban ecosystems. The case study of the Eternal City of Rome.

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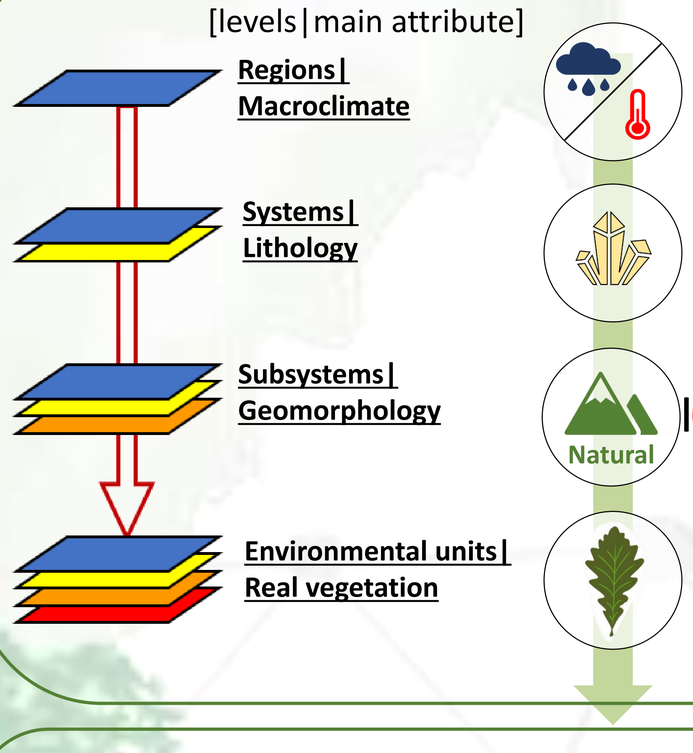
Introduction

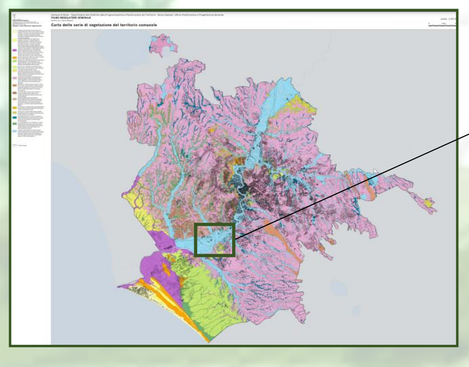
In an era of cities' expansion, increasing density of population poses many challenges upon sustainability of urban ecosystems. The primary role of green urban areas has been already recognised, even though vegetation conditions could be deeply altered, in both structural and compositional terms, with respect to natural reference ecosystems.
In Rome, historical modifications even changed natural land morphology so that surveys are needed to recognise landforms of anthropogenic accumulation and erosion, due to building or mining activities. Understanding where and how morphological modifications affect local Potential Natural Vegetation (PNV) is crucial for planning and designing suitable restoration actions and resilient Nature-based Solutions.

Methodology

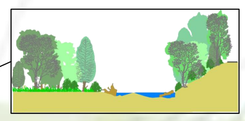
Ecological classification of land
[levels | main attribute]



Environmental Land Units/Potential Natural Vegetation

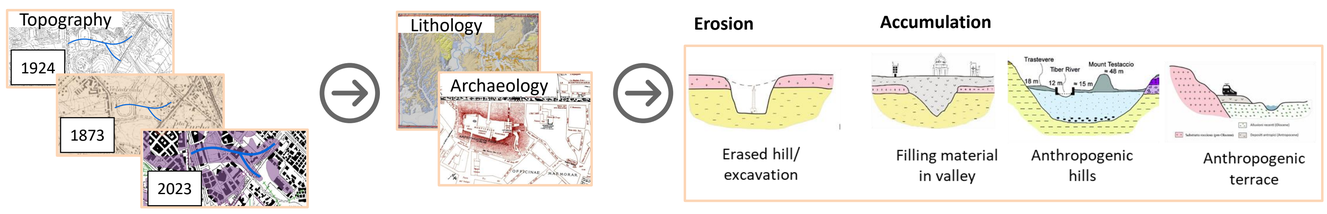


Reference communities and seral models

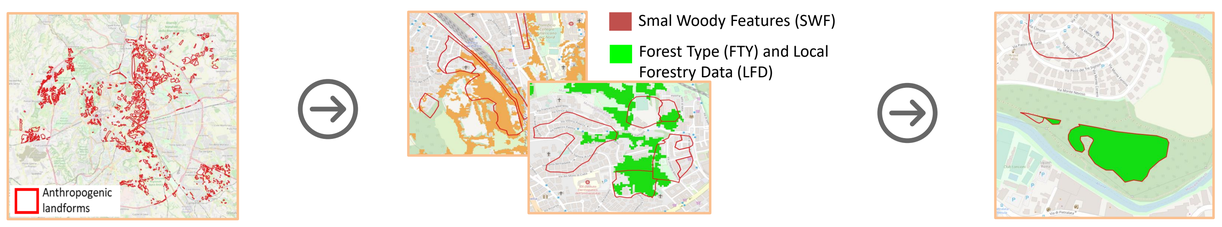


Site-Coherent species
Populus alba L.
Salix alba L.
Quercus cerris L.

1. Surveying and mapping anthropogenic landforms
Multitemporal and multidisciplinary analysis

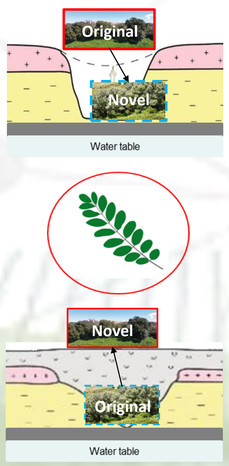


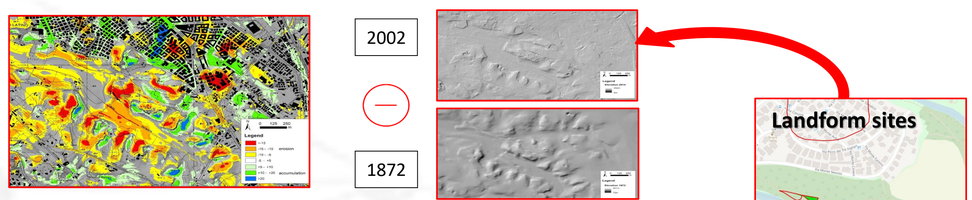
2. Selection of sample test areas (landform sites)



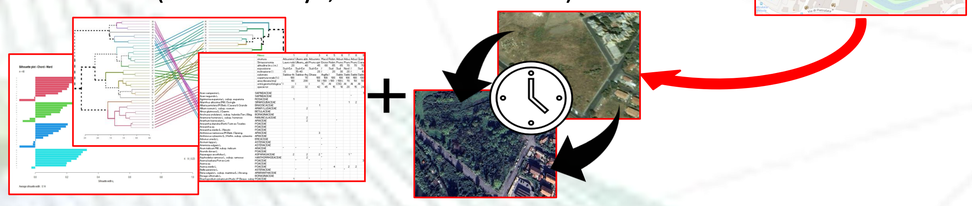
3. Characterization of the anthropogenic transformations
(DoD - DEM of Differences)

Novel ecosystems





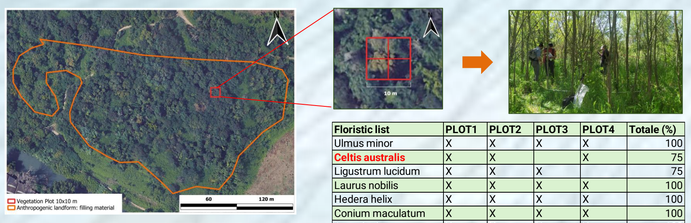
4. Vegetation analyses and multitemporal investigation
(field surveys, statistics and GIS)



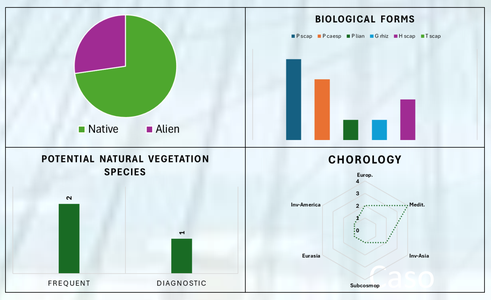
Sample test

Vegetation analyses

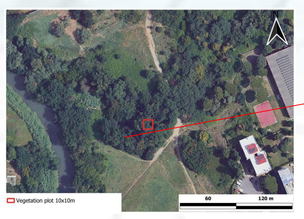
Experimental surveys were carried out in the environmental land unit originally characterised by a PNV with *Quercus robur*, *Ulmus minor* and *Populus* sp.pl. The first vegetation plot was surveyed on an anthropogenic terrace (Aniene valley).



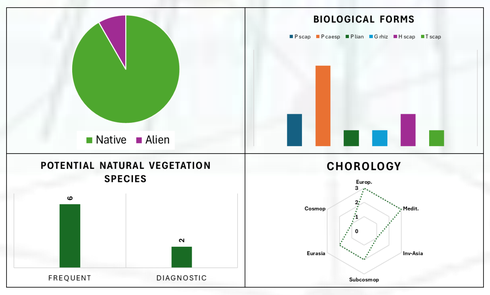
Floristic list	PLOT1	PLOT2	PLOT3	PLOT4	Totale (%)
Ulmus minor	X	X	X	X	100
Celtis australis	X	X		X	75
Ligustrum lucidum	X	X	X		75
Laurus nobilis	X	X	X	X	100
Hedera helix	X	X	X	X	100
Conium maculatum	X	X	X	X	100
Arum italicum	X	X	X	X	100
Rubus ulmifolious		X		X	50
Alliaria petiolata			X	X	50
Ailanthus altissima			X	X	50
Robinia pseudoacacia			X		25



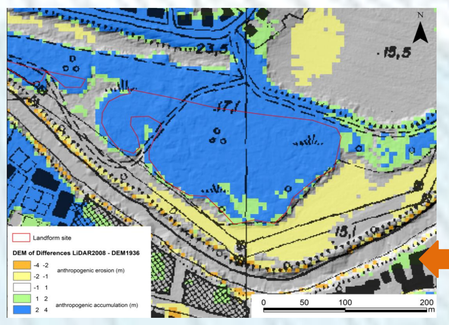
The control plot was surveyed in the same environmental land unit but over the natural landform of alluvial plain.



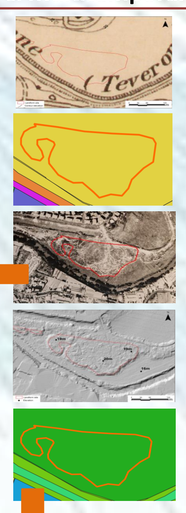
Floristic list	PLOT1	PLOT2	PLOT3	PLOT4	Totale (%)
Ulmus minor	X	X	X	X	100
Rubus caesius	X	X	X	X	100
Hedera helix	X	X	X	X	100
Sambucus nigra	X	X			50
Laurus nobilis		X		X	50
Conium maculatum		X		X	50
Arum italicum	X	X	X	X	100
Rubus ulmifolious	X	X	X	X	100
Populus nigra	X	X		X	75
Ligustrum lucidum			X		25
Urtica dioica	X				25
Solanum nigrum				X	25



Landform characterisation & Multitemporal analyses



The map algebra raster difference between actual and 1936 Digital Elevation models, DEM of differences (fig. Dod LiDAR 2008-1936), highlights an anthropogenic accumulation polygon (landform sites) **2m to 4m thick**, with relative uplift from the water table (10 m deep, *Hydrogeological Map of the City of Rome, 2015*)



Multitemporal analysis performed comparing historical topography (I.G.M. 1936, elevation at landform site)
1954, Land Use: Arable land alternated with permanent grassland

Anthropogenic accumulation works in the '70s of last century (1970, stereophoto S.I.A.T.)

Actual topography (2008, Lidar Lazio)

1980 till now, Land Use: Green urban area

Conclusions

The case study highlights how the anthropogenic landform shifted the vegetation community assembled over 50 years from the natural baseline. The abundance of generalist exotic plants and the impoverishment of frequent and diagnostic PNV species could be signals of a permanent altered condition, to be explored with further and comparative studies. Thus, anthropogenic erosion and accumulation have to be carefully considered in forestation actions over artificial morphology, by selecting better adapted native species.

Del Monte, M., D'Orefice, M., Luberti, G. M., Marini, R., Pica, A., & Vergari, F. (2016). Geomorphological classification of urban landscapes: the case study of Rome (Italy). *Journal of Maps*, *12*(sup1), 178-189. (and refs. therein); Farris, E., Filibeck, G., Marignani, M., & Rosati, L. (2010). The power of potential natural vegetation (and of spatial-temporal scale): a response to Carrión & Fernández (2009). Journal of Biogeography, 37(11), 2211-2213. ; MASE. (2021). Piano di forestazione urbana ed extraurbana nell'ambito del Piano Nazionale di Ripresa e Resilienza Misura 2 - Componente 4 - Investimento 3.1 "Tutela e valorizzazione del verde urbano ed extraurbano". https://www.mase.gov.it/bandi/avviso-i-progetti-di-forestazione-nelle-citta-metropolitane; Frondoni, R., Mollo, B., & Capotorti, G. (2011). A landscape analysis of land cover change in the Municipality of Rome (Italy): Spatio-temporal characteristics and ecological implications of land cover transitions from 1954 to 2001. *Landscape and Urban planning*, *100*(1-2), 117-128.; Blasi, C., Capotorti, G., & Frondoni, R. (2005). Defining and mapping typological models at the landscape scale. *Plant Biosystems-An International Journal Dealing with all Aspects of Plant Biology*, *139*(2), 155-163.

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