Between green areas and built-up space: climatic adaptation strategies through the Aniene River Corridor

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Abstract
The Aniene River Corridor is a fundamental green & blue resource for the north-east quadrant of the City of Rome and in addition to its aesthetic and recreational functions, it helps mitigating the pollution of the various environmental matrices (air, water, soil), improving microclimate and maintaining biodiversity. To date, however, these functions and benefits are poorly integrated in local urban planning, especially in the perspective of climate change. A review of the Corridor's borders was made to classify built/unbuilt margins to propose specific interventions between green areas and built-up spaces. The river corridor must not be considered only an unbuilt space, but must be understood and managed as a fundamental component of the quality of life and urban sustainability, thanks to the multiple services and benefits - not only environmental - that it provides. The proposed eco-systemic planning approach is a contribution to a better understanding of the multifunctionality of these urban green areas and their potential. The ongoing research carries out a clustering activity by classifying the different areas crossed by the river corridor to collect and evaluate territorial data through which to search for homogeneous elements and interactions of built space and natural space. The aim is thus to rediscover territories crossed by the river corridor and to evaluate anthropic pressure, risks and opportunities. These outputs can be used to develop targeted interventions and recommendations for this specific context, with potential for expansion to wider contexts.

Keywords:
Waterfront; Aniene river corridor; adaptive landscapes; water-wise cities; indicators

Introduction

Article 9 of the Italian Constitution protects the landscape, as a primary value including the meaning of protection, custody and care of an environment rich in multiple values. The natural environment, however, is threatened by pollution and unsustainable behaviours that cause impacts especially with respect to climate change (CC) to which many countries are trying to respond.
At the European level, initiatives have been developed with the aim of improving preparedness for the impacts of CC related to water resources and green infrastructures (GI) are being considered to improve resilience to disasters. There is a particular need to make strong connections between spatial planning, the Water Framework Directive requirements and flood risk management, in the context of climate adaptation and mitigation measures (EEA, 2016).
As evidently shown during the pandemic and reported by the World Health Organization the presence of green spaces in urban areas can prevent negative impacts on health (WHO, 2016). As stated also by Chiesura et al. green areas protection represents an effective action to fight climate change impacts, as well as the events of intense precipitation, extreme temperature events and heat waves that increasingly affect our cities (Chiesura et al., 2019).
The research is part of a recent trend of adaptation strategies, which recognize the uncertainties of CC and develop the essential institutional capacity to intervene in the anthropized environment.
The most suitable place for these interventions to be carried out is the public space that can lead to effective adaptation undertakings (Matos Silva and Costa, 2018), restructuring cities to meet the demand of a new climate regime (Short and Farmer, 2021).
The United Nations Goal 11, "Making cities inclusive, safe, resilient and sustainable" intends to promote the management and sustainable use of natural resources, strengthen the resilience of cities also through the development of quality infrastructure and spatial planning, adopting and implementing ecosystem-based approaches, supporting investments based on a proactive approach to risk.

The context

The Metropolitan City of Rome according to the Italian Institute for Environmental Protection and Research is severely affected by hydraulic hazard: there are 164.870 people at risk of floods and also 270 Cultural heritage sites (Trigila et al. 2018).

The Aniene River, Tiber River's main tributary in the Lazio Region, is a fundamental green&blue resource for the north-east quadrant of the City of Rome.

The ecosystem services provided by the Aniene River Corridor are poorly integrated in local urban planning, particularly in the perspective of CC. By overcoming the dichotomy with built space the research intends to support the vision that open spaces can be configured as a connective and a fertile opportunity for urban enhancement and regeneration. Inside Rome the river is inserted in the Protected Natural Area (EUAP1045) defined as the Regional Natural Reserve of the Aniene Valley (UNEP-WCMC 2021).

Figure 1– The Aniene waterfront

Objectives

The research aims to investigate the value of green and blue infrastructures in the redevelopment of urban areas subjected to CC. The general objective is to improve knowledge on the interaction between these infrastructures and neighboring urbanized areas by acting on the prevention of criticalities along the waterfronts caused by the extreme climate.

As detailed and published in 2020 (Monardo et al., 2020) we believe in incorporating adaptation strategies into planned actions as an effective way to ensure that damages (and costs) due to climate criticalities are minimized. The transversal dimension of the river landscape is investigated with respect to the complex environmental, social and economic issues. The specific objectives concern the understanding of problems and potential and the improvement of the ecosystem services offered by the Corridor. The work aims, therefore, to carry out an exhaustive review of the margins of the Reserve.

Waterfronts imply a thickness that is full of meanings and the dimension of the transition, of a non-hermetic closing relationship between the parts (Zanini, 1997). This thickness consequently should be treated to guarantee a good urban quality and resilience suggesting Public Authorities specific adaptive interventions mainly with retrofitting actions.

Materials and methods

The ongoing research carries out a clustering activity by classifying the different areas crossed by the river corridor (agricultural areas, infrastructural network, archaeological sites, built-up areas, areas of social marginalization) to collect and evaluate territorial data through which to carry out analyzes of the homogeneous elements and interactions. The approach is meant to integrate available data with new evaluations done both through functional use and qualitative characteristics of the waterfronts.

In line with the IWA approach of the "Principles for Water-Wise Cities", it provides, in fact, assistance to leaders who want to develop and implement sustainable urban water visions. As addressed by the H2020 MSCA Project SOS Climate Waterfront(1), the IWA Principles underlie resilient planning and design for more liveable cities in the face of the dual pressures of climate change and population growth.

The existing Park Plan defines 4 different protection levels to be put into a system with the urban surroundings: integral reserve, general reserve, protection zone, economic-social promotion zone.

The Park Plan proposed interventions are articulated in the protection of wetlands and landscape restoration, the reconfiguration of an area close to residential buildings, the requalification of the system of urban gardens, the enhancement of geotopes, the reclamation and reconfiguration of some areas, the landscape strengthening of panoramic points, the restoration of the meadow-pasture, the reconstitution of orchards, the interventions for the mitigation of traffic impacts, the reintegration of the image of the access routes to the farmhouses, the landscape strengthening of the ascent and the valley floor routes, the strengthening of agricultural rows, the reconfiguration of the image of the consular roads and threes planting.

In order to make the city more resilient and able to face the challenges of CC the waterfront assessment and an efficient system of monitoring indicators is needed to propose and verify concrete local measures to be carried out in the public and private sectors. The assessment is done both through waterfront's functional use and qualitative analysis.

Results

The waterfronts functions along the river, are therefore divided into residential, mixed use (with commercial on the ground floor and residential use on the upper floors), industrial use, public equipment, tertiary (offices) and other uses (mainly abandoned buildings). Waterfronts are continuous especially in the first half of the total extension of the Reserve starting from the confluence while they become discontinuous and with dispersed buildings in the final part within the Great Ring Road express way. On the left bank the Reserve is bordered by important infrastructures such as the highway and the railway line that connect to the northern territories of the Lazio Region. The analysis shows that most of buildings have residential use (38,3 %), followed by tertiary use (18,8 %), other uses (18,2 %), mixed use (10,7 %), public equipment (9,8 %) and industrial use (4,2 %).

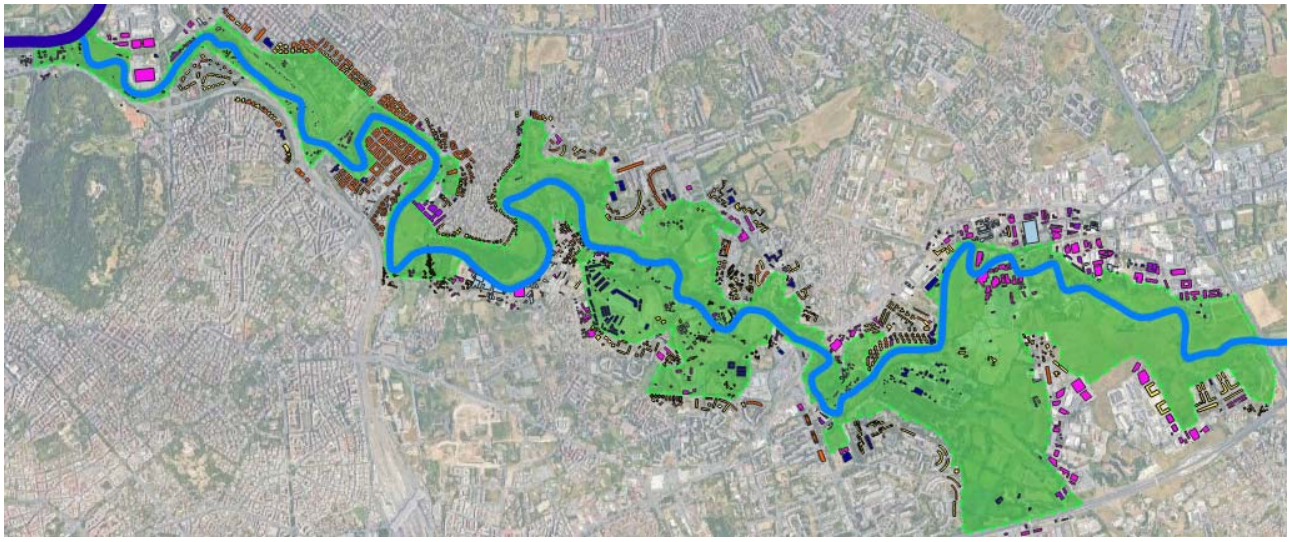

Figure 5. The River corridor in its urban path with the highlighted waterfronts: Aniene in light blu, Tiber in blue, the Reserve in light green

Conclusions and open issues

This study set out to understand the positive impacts of River restoration and how it can offer mutual benefits from flood control and ecological functions to recreational value and raising the quality of life in urban areas (EEA 2016).

The marginal areas, observed from the point of view of risk and resilience to climate change, represent potential structuring materials for the contemporary city not only because they play the role of mediating the tensions between urban and rural, but also because they fulfill environmental and landscape functions (Di Giacomo, 2019).

Next steps will be to integrate the different emerged aspects that describe the Aniene landscape in order to define Strategic actions to be put in place about citizen awareness, environmental safety and education, promoting renewal interventions on existing buildings, planning open areas in urban areas as green infrastructures promoting urban resilience.

The research therefore acts in providing consultancy to the local planning authority to help establishing a framework of interventions because the multifunctional urban restoration measures are able to help deliver synergies and to implement strategic policies in addressing CC.

The proposed method has interdisciplinary characteristics, starting from the investigation of the benefits offered by the presence of the reserve to the built surrounding environment to verify the added value of open spaces in neighboring urban areas and promote adaptive landscapes transforming existing waterfronts, where needed, towards urban fabrics demolishing of no more useful buildings (with the Building Back Better strategy) or adding public equipment where not sufficient. Transformation can thus be developed through direct actions (IWA Water-Wise Cities' Action 1 and 2) or through indirect planning tools (IWA Water-Wise Cities' Action 3 and 4). The relationship between the Aniene River Corridor and green areas and built-up space can prove to be crucial in the response to climate change especially in urban areas and for limiting the impacts of the hydro geological instability phenomena.

Notes

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1. 'SOS Climate Waterfront' Project, Horizon2020, MSC RISE,2018-2021, G.A.No823901

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