TeMA
Journal of
Land Use, Mobility and Environment

print ISSN 1970-9889 e-ISSN 1970-9870
FedOA press - University of Naples Federico II

DOAJ anvur Rivista scientifica di classe A - 08/F1 Scopus WEB OF SCIENCE

Special Issue 1.2025

Innovation, green infrastructures and urban form

Towards regenerative city models

In the contemporary global context—characterized by increasing environmental pressures, demographic asymmetries, and socio-economic fragmentation and structural inequalities—the relationship between urban form, ecosystem services, and territorial innovation acquires unprecedented strategic value. This Special Issue intends to critically explore and foster a new interdisciplinary debate aimed at rethinking the urban project within a framework of regenerative and systemic transformation.

TeMA is the Journal of Land Use, Mobility and Environment. The Journal publishes papers which adopt unified approach to planning, mobility and environmental sustainability. With the ANVUR resolution of April 2020, TeMA Journal and the articles published from 2016 have been included in the A category of scientific journals. The articles published on TeMA are part of the Core Collection of Web of Science, since 2015, and of Scopus database, since 2023. The journal is in the Sparc Europe Seal of Open Access Journals and the Directory of Open Access Journals.

TeMA Journal of
Land Use, Mobility and Environment

Special Issue 1.2025

Innovation, green infrastructures and urban form.
Towards regenerative city models

Published by
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"

TeMA is realized by CAB - Center for Libraries at “Federico II” University of Naples using Open Journal System

Editor-in-Chief: Rocco Papa
print ISSN 1970-9889 | online ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n°6 of 29/01/2008

Editorial correspondence
Laboratory of Land Use, Mobility and Environment
DICEA - Department of Civil, Building and Environmental Engineering
University of Naples "Federico II"
Piazzale Tecchio, 80
80125 Naples (Italy)

https://serena.sharepress.it/index.php/tema
e-mail: redazione.tema@unina.it

The cover image: Aerial view of River Bay Singapore, 2017, CC0. Source: https://pixabay.com/photos/singapore-asia-landscape-bay-river-2118682/

TeMA - Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include: engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science and complex systems.
With ANVUR resolution of April 2020, TeMA Journal and the articles published from 2016 are included in A category of scientific journals. The articles published on TeMA are included in main international scientific database as Scopus (from 2023), Web of Science (from 2015) and the *Directory of Open Access Journals* (DOAJ). TeMA Journal has also received the *Sparc Europe Seal* for Open Access Journals released by *Scholarly Publishing and Academic Resources Coalition* (SPARC Europe). TeMA is published under a Creative Commons Attribution 4.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists. TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

TeMA Journal of
Land Use, Mobility and Environment

Special Issue 1.2025

Innovation, green infrastructures and urban form.
Towards regenerative city models

Contents

TeMA Journal of Land Use, Mobility and Environment

TeMA Special Issue 1 (2025) 105-115
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6093/1970-9870/11169
Received 17th September 2024, Accepted 28th February 2025, Available online 30th June 2025

www.tema.unina.it

The regeneration of former military sites in the context of ecological transition. The case of Cagliari, Sardinia (Italy)

Anna Maria Colavitti [a], Alessio Floris [b], Sergio Serra [c*]

[a] Department of Civil, Environmental and Architectural Engineering, University of Cagliari, Cagliari, Italy
e-mail: amcolavt@unica.it
ORCID: https://orcid.org/0000-0002-0484-3131

[b] Department of Civil, Environmental and Architectural Engineering, University of Cagliari, Cagliari, Italy
e-mail: alessio.floris@unica.it
ORCID: https://orcid.org/0000-0002-2509-3165

[c] Department of Civil, Environmental and Architectural Engineering, University of Cagliari, Cagliari, Italy
e-mail: sergioserra@unica.it
ORCID: https://orcid.org/0000-0002-2828-7360
* Corresponding author

Abstract
The environmental and ecological dimensions are pivotal in territorial governance, which seeks to mitigate human impact on ecosystems, promote sustainable land use, and strengthen green infrastructure and territorial capital. These goals are embedded within urban and land regeneration policies, which encompass strategies for the redevelopment, enhancement, and reuse of existing settlements. Within this framework, the regeneration of former military sites holds significant importance, emphasizing the repurposing of green spaces to augment the ecological potential of soils through the development of green infrastructure. This approach aims to connect green and natural areas, thereby improving ecological resilience, biodiversity, and the quality of the urban environment. In Sardinia, particularly in Cagliari, a considerable number of unused or decommissioned military facilities have arisen from decreased national defense requirements, with some being transferred to local authorities. The military presence in regions of high environmental and landscape value has had a dual effect: it has contributed to irreversible landscape alterations and environmental pollution, while simultaneously preserving natural resources from urban development. This paper examines the potential role of these assets in urban regeneration strategies, with a focus on ecological networks, territorial rebalancing, and the reconnection of urban fabric, thereby enhancing historical, architectural, and environmental heritage.

Keywords
Military sites; Ecological transition; Urban regeneration

How to cite item in APA format
Colavitti, A.M., Floris, A. & Serra, S. (2025). The regeneration of former military sites in the context of ecological transition. The case of Cagliari, Sardinia (Italy). *TeMA - Journal of Land Use, Mobility and Environment*, *SI1*, 105-116. http://dx.doi.org/10.6093/1970-9870/11169

1. Introduction

The urban regeneration policies are aimed at limiting the anthropic pressure on the environment and land resources, promoting the redevelopment and reuse of existing urban areas to protect the soil and its important ecosystem functions (Pileri, 2023). The European Soil Strategy 2030 (ESS), adopted in 2021, sets out a "hierarchy of soil use", giving priority to avoiding land use and sealing, and to promoting the reuse of already compromised and sealed land (EC, 2021). In Italy, the new National Biodiversity Strategy 2030, adopted in 2023 by the Ministry of the Environment and Energy Security in line with the ESS, aims to address the problem of biodiversity loss and the progressive weakening of ecosystems, with the perspective of restoring and making resilient and adequately protected all global ecosystems by 2050. The strategy promotes processes of renaturalisation of degraded land, also in urban and peri-urban areas, with the aim of reducing hydrogeological risks and enhancing environmental resilience (Munafò, 2023). One of the main objectives of the strategy is to counteract the degradation of urban and peri-urban green ecosystems by promoting the use of Nature Based Solutions (NBS) that allow zero net soil consumption, including through the redevelopment and restoration of contaminated and sealed sites. Nature-based solutions (NBS) are central to the ecological transition and internationally recognised as essential for addressing climate and biodiversity challenges (Kabisch et al., 2016). In the past two decades, concepts such as Nature-Based Solutions (NBS) and Green and Blue Infrastructure (GBI) have emerged to facilitate the integrated planning of green spaces (Andersson et al., 2019; Dushkova & Haase, 2020). Promoting their extensive adoption is crucial, particularly with the backing of the EU Green Deal and associated initiatives. However, climate change, land use, environmental degradation and pollution continue to cause systemic damage to biodiversity and ecosystem services, with land use change being the main driver of impacts on terrestrial and aquatic ecosystems (Pultrone, 2024).

The incorporation of Green Blue Infrastructure (GBI) into urban planning can facilitate the advancement of sustainable urban development, enabling the extensive proliferation of urban green spaces through the establishment of interconnected Urban Green Networks that are in harmony with natural ecosystems (Tulisi, 2017). Green infrastructure (GI) offers significant advantages, including the mitigation of climate change, the enhancement of air and water quality, the conservation of biodiversity and the provision of recreational spaces for collective well-being (Beauchamp, Adamowski, 2013). The integration of natural elements into the urban context, including through the ecological regeneration of brownfield and underutilised sites (Ronchi et al., 2023), contributes to the strengthening of cities' resilience to environmental impacts and the improvement of the quality of life of their inhabitants (Atkinson et al., 2014; Giannakidou, Latinopoulos, 2023).

This is also the background of the Nature Restoration Law, approved by the European Council in 2024, which aims to reverse the decline in biodiversity and regenerate natural ecosystems, with the aim of restoring at least 20 per cent of the EU's land and marine areas by 2030 and, for urban ecosystems, a zero net loss of green spaces and tree cover, followed by a steady increase in their total area. This paper explores scenarios for the rehabilitation of public real estate aimed at fostering ecological regeneration within urban environments. It specifically addresses disused military sites, which frequently feature a combination of abandoned or underutilized structures and extensive open areas possessing substantial ecological potential. Regeneration is not limited to the functional rehabilitation of disused buildings and infrastructure, thus providing an opportunity for development without further land take but requires special attention to vacant and undeveloped areas. These soils, which may be either relatively natural or degraded from prior use, often require substantial efforts in renaturation and de-sealing to restore their ecological functions (Garda et al., 2023). In recent decades, the need to find new uses for military real estate has become increasingly urgent, following a process of rationalisation of military assets at a global level. This change has been driven by technological evolution, geopolitical changes and periods of economic recession, which have necessitated a progressive reduction in defence spending. A significant part of military real estate, used for centuries in national defence activities and now surplus to requirements, is being decommissioned and converted to civil

uses (Gastaldi, Camerin, 2017). The redevelopment of former military sites requires a strategic planning approach that diverges from conventional use changes. The complexity of the process is derived from the involvement of multiple stakeholders, the existence of different expectations, and the distinctive environmental conditions of the sites (Bagaeen, 2016). The value of brownfield heritage is frequently overlooked in territorial policies, with economic potential taking precedence over its intrinsic worth as a catalyst for urban development and wider territorial regeneration (Artioli, 2016). A frequently neglected aspect is the processual character of its origins, shaped by a layering of initiatives and settlement dynamics over extended periods. Additionally, in areas of substantial environmental and landscape value, it represents a valuable "common good" of collective interest (Agenzia del Demanio, 2012). The case study of the metropolitan city of Cagliari provides an opportunity to reflect on the opportunities offered by the inclusion of brownfield sites, long excluded from urban dynamics due to their original functions, in the framework of integrated territorial regeneration policies in an ecological key. This reflection comes at a very positive period, coinciding with the ongoing process of adaptation of the Municipal Urban Plan to the Regional Landscape Plan (RLP). The considerable availability of former military sites has the potential to serve as a strategic resource if incorporated into policies designed to address some of the most pressing challenges facing contemporary cities, including land consumption and the loss of environmental and ecosystem resources. In this context, attention is drawn to urban voids and residual open spaces, which are often overlooked regarding the reuse of the built heritage, despite their significant potential for urban planning.

2. Processes of decommissioning and rationalisation of military assets in the metropolitan city of Cagliari

The territory of Sardinia is characterised by a large military servitude, represented by infrastructures and sites that have lost their original functions but are still largely managed by the Ministry of Defence. The present study employs a multi-source approach, integrating bibliographic, documentary, and institutional website data, to reconstruct the historical evolution and actual territorial distribution of military assets. Historical cartographies, aerial photographs and institutional documents have been used to identify military areas and to understand their evolution over time. The cataloguing of military sites was also made possible thanks to the consultation and cross-referenced study of official documentation on conventions, inter-institutional agreements, protocols of agreement and programmes for the decommissioning and alienation of military assets that have been carried out over the years and that have involved the Autonomous Region of Sardinia (RAS), the Ministry of Defence, the State Property Agency and the territorial authorities. The data have been collected in a GIS database, which has allowed a detailed analysis of the characteristics, geographical distribution and current use of the assets, considering their interaction with areas of landscape value and historical-cultural assets.

A significant proportion of military servitudes are situated within the metropolitan area of Cagliari, encompassing an area of approximately 332 hectares between the municipalities of Cagliari and Elmas. These servitudes are distributed across the city, extending from the historic centre to peripheral areas such as Monte Urpinu and the promontories of Calamosca and Sant'Elia. In the wetland area of Molentargius, along the eastern part of the city, there are several military sites affecting an area of high landscape and environmental value, some of which decommissioned from time and currently unused, on which the Region of Sardinia has expressed its interest in the reuse, for example proposing the creation of an environmental centre. On the other hand, the largest and most important military facilities are concentrated on the Calamosca promontory, both in terms of extension and size of buildings, with a strong link to the historical defensive functions of the territory. These areas, once considered peripheral and mainly intended for agricultural and productive activities, have gradually been incorporated into urban settlement. However, their military function has helped to preserve their high landscape and environmental value, limiting intensive urbanisation. In this context, there

are also buildings of historical and cultural interest, such as a hillfort and a lighthouse, among the oldest in Sardinia. Most of the existing military buildings (barracks, residences, warehouses and other defence support infrastructures) are now in a state of abandonment or underused. Since 2006, the Region of Sardinia has carried out a census of military areas and buildings at regional level and has formalised a series of agreements with the Ministry of Defence to launch a programme of disposal of unused military areas, returning a significant proportion of these areas to the community. Due to the complexity of the administrative procedures required for the property transfer of assets, which are based on inter-institutional negotiations and require the investment of considerable resources in terms of cost and time, only a few assets have been transferred to the management of the local authorities (Colavitti, Serra, Usai, 2016).

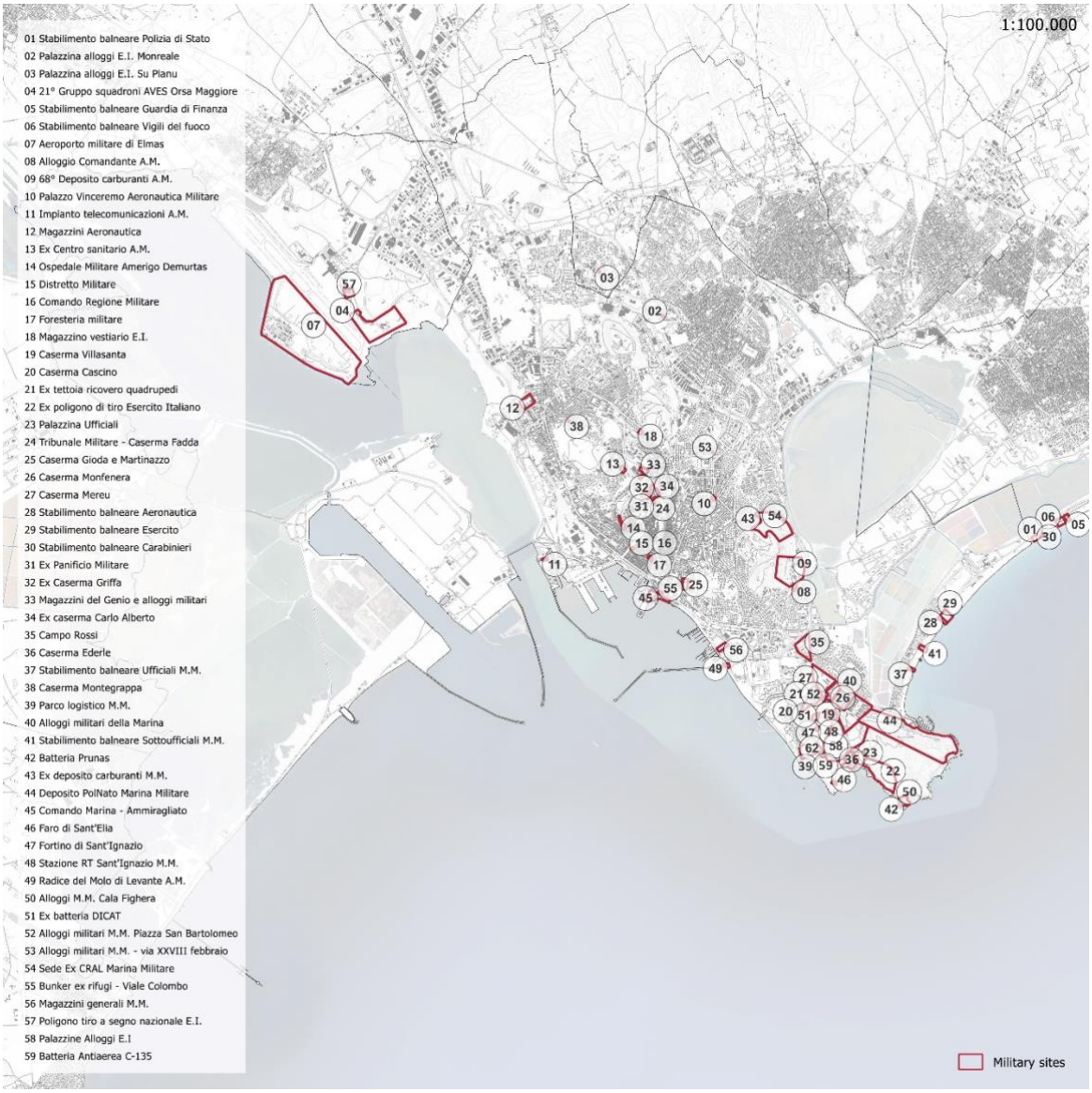

Fig.1 Military sites in the urban area of Cagliari

Some are decommissioned but formally used by the Ministry of Defence, while others are considered ready for transfer to the regional authority, as allowed by regional autonomy. Many abandoned military sites need new uses, and their progressive deterioration is not only a waste of resources but also a burden on local communities. Nowadays, projects mainly focus on the reuse of individual assets and prioritise their economic and use values, with the purpose of new functions linked to the provision of public services such as education, health, sport and leisure. In addition to the lack of projects, strategies and overall visions for the rehabilitation

and recovery of these brownfield sites, little attention is paid to the historical, cultural and landscape context in which they are placed. Public planning has historically prioritised large urban facilities within the consolidated fabric, as in the case of the transformation of the former Royal Arsenal into a museum, or the valorisation of assets of historical and cultural importance. Alongside these institutional initiatives, informal and grassroots practices of great importance have emerged, such as the creation of natural and archaeological routes, developed in collaboration between citizens, environmental associations and military institutions, have helped to preserve collective access to a valuable territorial heritage (Perelli & Sistu, 2015).

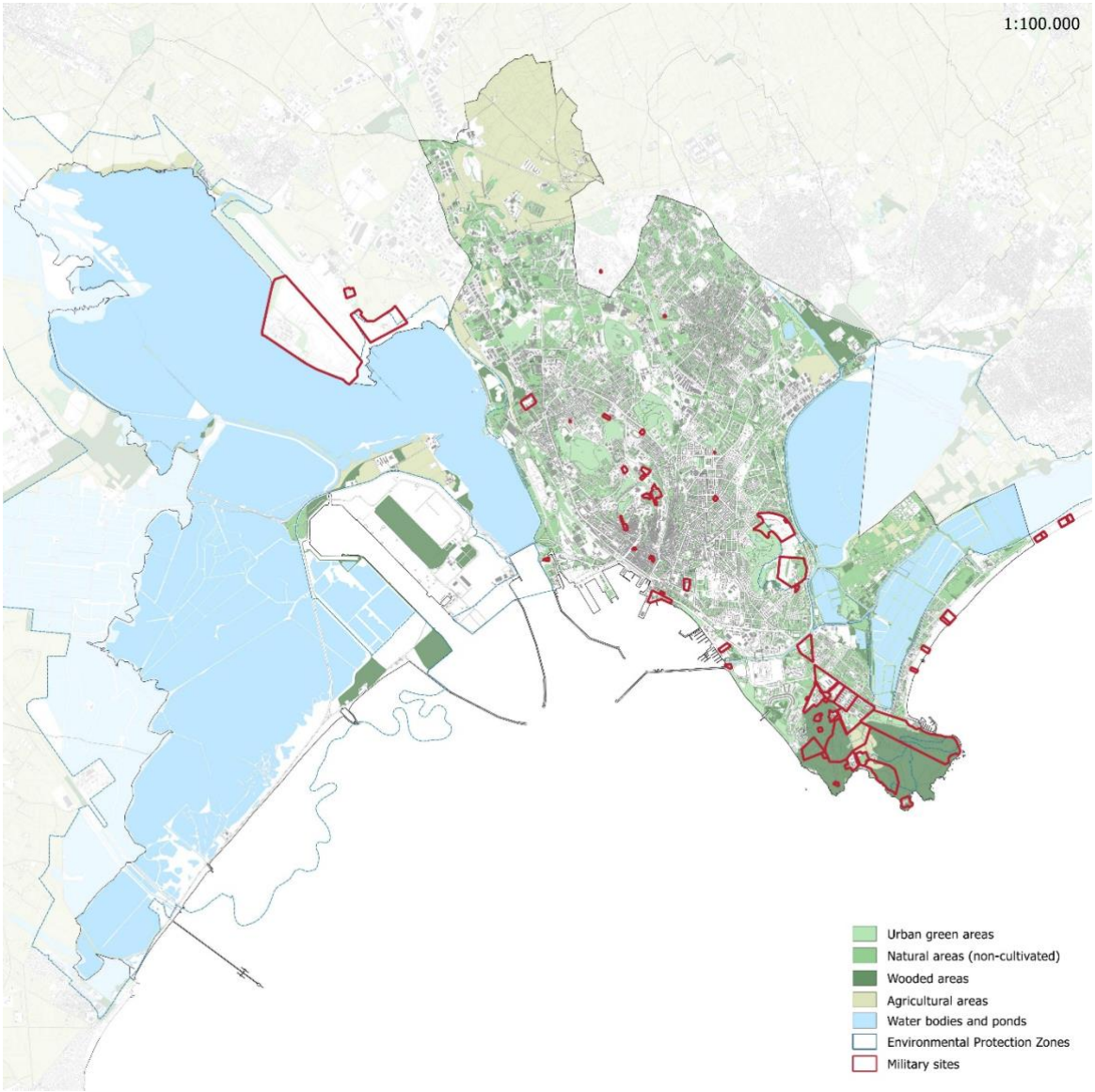

Fig.2 The ecological network in the urban area of Cagliari

The distinctive character of the Cagliari case can be attributed to the location of military sites within a landscape shaped by significant territorial invariants and environmental features, as delineated by the Regional Landscape Plan (PPR). The environmental components include the wetlands of the Santa Gilla Lagoon at the southern end of the Campidano plain and the coastal-territorial complex of Poetto and Stagno di Molentargius in the south-eastern area of the capital city, as well as the structural ridge of hills. These areas are managed under a range of environmental protection regulations that impose strict limits on development, such as Sites of Community Importance (SCI) and Special Protection Areas (SPA), where the conservation of natural habitats and species of flora and fauna must be ensured in accordance with EU directives. In this context, the

preservation of large areas of medium to high naturalness within or adjacent to military zones is particularly important, as these areas account for almost 40% of the military zones in the municipalities of Cagliari and Elmas. This high level of naturalness underlines the environmental value of these areas, despite their military use, and highlights the importance of maintaining ecological integrity and biodiversity in such strategic areas. In general, the issue of public real estate regeneration does not seem to find an adequate place in metropolitan development policies and urban planning. The adaptation of urban planning instruments to the PPR is very slow and suffers from the lack of sharing processes between the different stakeholders, experts and municipalities, which is usually the only apparently expected practice of this procedure. As a result, there is a lack of coherent strategies for the conversion of disused areas to civilian use. Cagliari's current urban plan identifies disused military areas as transformation areas, mostly for general services and sports, leisure, cultural and social facilities, often integrated into urban parks. The approach to the redevelopment of disused military areas has often privileged individual initiatives aimed at responding to specific problems or social demands, which have proved ineffective in the absence of coordination of interventions within an overall strategic framework.

3. The recovery of military brownfields for the ecological regeneration of the metropolitan area

The importance of military heritage at metropolitan level suggests the potential benefits of a regeneration strategy focused on enhancing environmental and ecosystem values, balancing the relationship between built and unbuilt land through the preservation and protection of land and natural areas. The development of settlements is a long-term historical process involving the community and the territory, based on a virtuous relationship between anthropic activity and environmental resources, conceived globally as a territorial ecosystem. Urban growth has been historically conditioned by the environmental dominants of hills and coastal wetlands, affecting the original forms of the natural landscape. The infrastructure system has often altered environmental processes, disrupting the hydrographic networks that feed coastal wetlands, although they remain an important reservoir of biodiversity and naturalness. The dynamics of metropolitan development have resulted in the convergence of settlements with significant implications for the health of urban ecosystems and the ecological corridors that facilitate communication between wetlands and environmental matrices. The regeneration of ecological corridors and networks connecting urbanised areas with agro-ecosystems has the potential to enhance the quality of living and production space, while also redefining the limits of urbanised areas (Magnaghi, 2000). This strategy reflects the design guidelines expressed in the Regional Landscape Plan (RLP), which assumes the priority objective of regenerating the Molentargius and Santa Gilla wetlands through the reactivation of environmental and productive uses with park-based forms of management. In particular, the RLP makes explicit the need for systemic management of the environmental components within the territorial macro-context, which are related in a relationship of mutual reciprocity, constituting a continuum of structural invariants of natural and ecological value, partially compromised over time by phenomena of anthropization and landscape modification (RLP, 2006). In line with these guidelines, the Municipal Preliminary Urban Plan aims to promote the connection between the Sant' Elia district and the coastal areas, proposing the regeneration and reuse of disused areas and buildings, including those owned by the State and the military that are currently being decommissioned.

The military servitudes located in the Calamosca and Monte Urpinu areas represent an opportunity to create an integrated and unified system of environmental and ecological protection, including wetlands and hills. This system would allow to counteract the process of urban expansion and the loss of green spaces by preserving green wedges and peri-urban agricultural areas.

For a long time, military use has isolated these areas from the surrounding urban fabric, preserving their natural characteristics and protecting them from processes of territorial transformation and the consequent

loss of ecological and environmental value. It has also preserved a significant number of areas free of buildings, particularly in the Calamosca area and, to a lesser extent, in the Monte Urpinu area. These regions are characterised by extensive permeable surfaces and a limited number of built volumes, which have often resulted in relatively low levels of soil degradation. However, it is essential to consider the potential for contamination resulting from long-term military use, as this could impact the quality of the environment and landscape, necessitating environmental restoration, remediation, and rehabilitation efforts. The strategy for regenerating these regions should encompass the enhancement of natural capital, aiming to both preserve and reinforce the ecological network that spans from the coastal zone, through wetlands, to connect with the ridge and urban parks of the Cagliari area, extending ultimately into the expansive peri-urban agricultural region to the north. This would ensure the preservation of the natural character of the areas in question, maintain a balance between urban development and nature, counteract anthropogenic pressures and promote biodiversity and ecosystem services. The de-militarisation of previously restricted areas would facilitate public access while ensuring compliance with environmental constraints and adherence to landscape and urban planning guidelines. Interventions should give priority to improving accessibility, removing perimeter fences that are no longer necessary and improving links with the main road network, including through a system of low-impact cycle and pedestrian routes. The planning of routes, considering the historical and cultural heritage of the area, will encourage the use of resources that have been isolated and difficult to access.

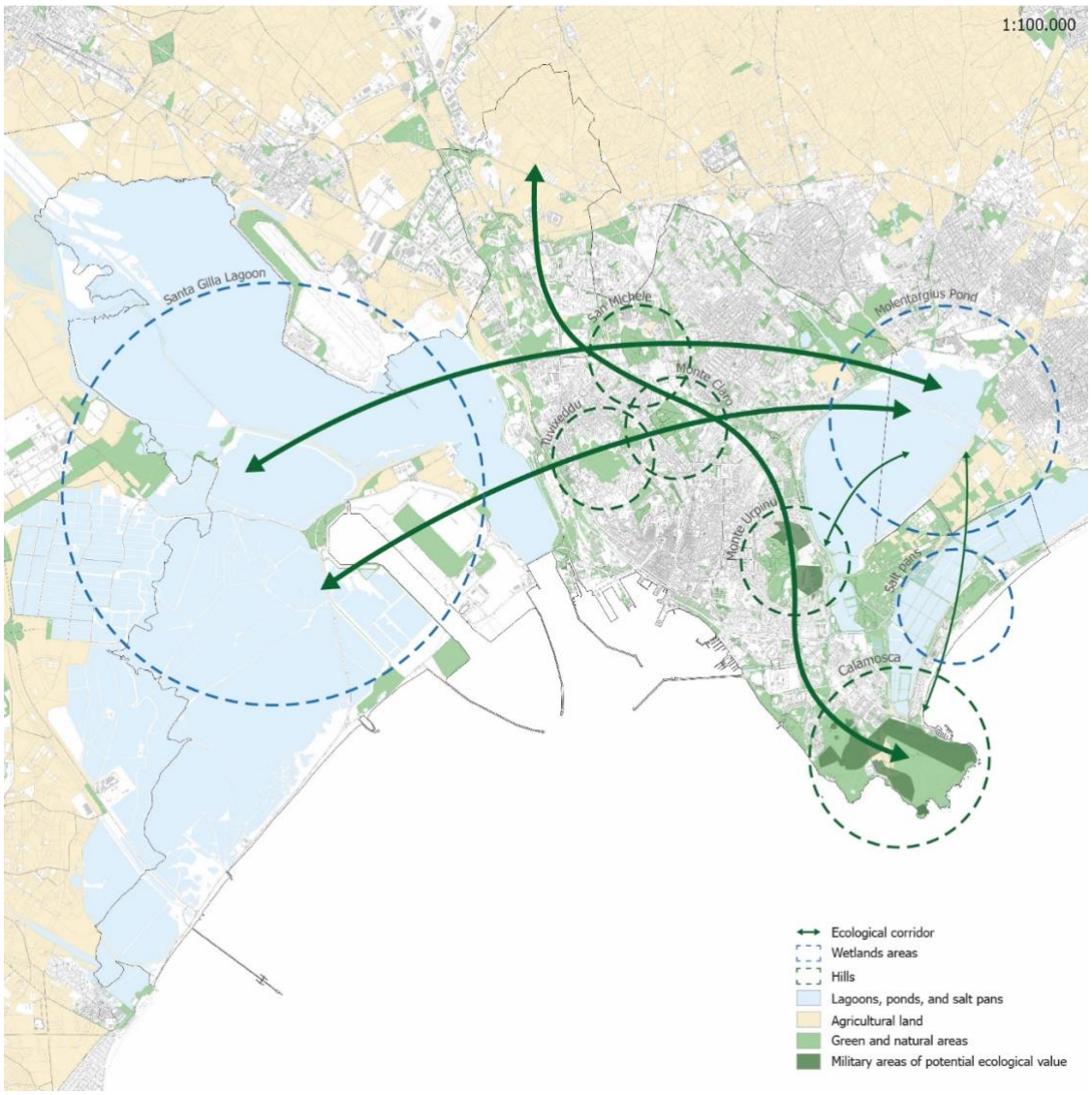

Fig.3 The strategies for the regeneration of disused military sites in the urban area of Cagliari

The safeguarding of disused military sites and the natural environment is significant at the territorial level, not only in terms of strengthening the ecological network of the metropolitan area, but also in enhancing the urban quality of surrounding neighbourhoods and potentially new districts in highly urbanised areas. In this way, disused public assets are reclaimed by the community for uses that enhance ecological functionality and facilitate territorial regeneration.

Strategies for the ecological regeneration of military land envisage a different approach for the historic barracks on the promontory of Calamosca, an autonomous urban system but currently separated from the urban context by walls and physical barriers. The removal of these delimitations is essential to favour the redevelopment and collective use of the spaces, improving the connection with the surrounding urban fabric.

The redevelopment of the military areas also includes the modernisation of the road network, with the integration of pedestrian and cycle paths and connections to public transport, promoting sustainable mobility. The objective of this intervention is to establish a novel integrated mobility structure that will facilitate connectivity between the city's residential and coastal areas, while leveraging the proximity of existing infrastructure, such as the recently inaugurated tram network.

The conversion of the military buildings, which were mainly intended for personnel accommodation, will allow the recovery and functional adaptation of spaces, avoiding the consumption of new land. The redevelopment will follow a functional mix criterion, introducing residential, commercial and service spaces, creating an integrated context both physically and socially. This transformation will also benefit neighbouring districts, such as Sant'Elia, characterised by public housing and a lack of public services.

The implementation of these strategies necessarily requires the co-participation and convergence of various public and private stakeholders, whose coordination can be facilitated by the design of instruments that provide a certain and shared basis to guarantee the satisfaction of the collective interest and, at the same time, the economic sustainability of the interventions. In this context, the public-private partnership model emerges as an effective approach for managing the financial planning of the intervention. It enables the provision of a housing stock designated for social housing at reduced rents, addressing the evolving social dynamics within the Cagliari area. This model meets the housing demands of middle-class residents, the elderly, and students, while ensuring a balanced social composition. Simultaneously, it allocates a portion of the housing to the free market to maintain economic viability, supported by the engagement of private investors.

In conclusion, the strategies described seek to combine economic profitability, recovery and a virtuous reinterpretation of these heritages with the objective of redefining the structure and organisation of certain parts of the urban and territorial system. This is to be achieved by calibrating the decision-making process in preparation for the definition of new uses and functions for these areas, with recognition of their collective and not exclusively physical dimension.

4. Conclusions

The EU Green Deal shapes policies for equitable and sustainable development by prioritizing both the ecological and digital transitions, which, though complementary, present distinct challenges and dynamics. The ecological transition, aimed at achieving climate neutrality and sustainability, demands extensive political and societal engagement, whereas the digital transition is a continually evolving technological process, predominantly driven by the private sector. In this context, cities are central and require innovative urban development strategies and planning approaches that integrate ecosystem services and promote urban sustainability (Moraci et al., 2024). In urban contexts, the promotion of biodiversity and ecological transition is closely linked to urban and regional planning at the local level, where the provision of new Green and Blue Infrastructures (GBIs) or the enhancement of existing ones can be implemented. The regeneration of Cagliari's urban areas affected by military servitude offers an opportunity to integrate the design of GBIs into the urban planning process, thereby promoting the restoration of environmentally, socially and economically fragile and

endangered ecosystems. The availability of timely and accurate geospatial data is critical for informed decision-making, improved understanding of ecosystem services and effective GBI planning (Giaimo et al., 2023).

A critical aspect involves aligning urban and neighbourhood-level projects with broader metropolitan and regional strategies and policies. Planning instruments need to work in concert, introducing measures to link environmental components and protect remaining natural, peri-urban agricultural and interstitial areas, to limit urban sprawl and maintain the continuity of the metropolitan ecological network. Military sites, by virtue of their size and strategic location, serve as new nodes within the metropolitan ecological network, contributing to the continuity of coastal systems and agricultural landscapes, while protecting important ecological corridors, including those connecting the two wetlands. Given the importance of this issue, it would be beneficial for local governments to develop a sector-specific strategic tool for the management and enhancement of urban green spaces. In Italy, the Green Plan has often fulfilled this role by integrating the objectives, strategies and actions of traditional urban plans, while identifying areas of significant landscape and biodiversity value for protection and enhancement. This tool helps to improve the ecological and ecosystem conditions of both urban and peri-urban areas, while promoting ecological connectivity (Lazzarini et al., 2024). Numerous studies have shown that urban green spaces are essential for providing cultural ecosystem services (CES) such as recreation, a sense of belonging, well-being and aesthetic values. Urban and spatial planning should consider the presence of UGS with significant ecosystem value within or near urban areas, as well as their accessibility and usability, to improve the overall performance of the urban environment in response to the needs of residents (Pantaloni, 2024).

The military presence has driven lasting processes of territorialisation, resulting in settlement contexts characterised by a combination of material and immaterial values embedded in local imagery. The case study of Cagliari illustrates the importance of ecological and environmental factors in shaping design scenarios for the reuse of decommissioned military assets. The processes of decommissioning of military assets in Sardinia is still hampered by bureaucratic complexity, regulatory constraints and high reclamation costs. The need for coordination between different institutions slows down the process, while regeneration requires huge economic resources that are often unavailable. In addition, social resistance and difficulties in exploring sustainable alternative uses contribute to leaving many areas in a state of neglect, limiting their potential for the community and the local economy.

The paper highlights the potential of real estate assets inherited from the military presence to contribute to a comprehensive strategy for ecological regeneration, beyond a mere focus on the reuse of existing built heritage. The protection of remaining undeveloped areas is crucial to maintaining an appropriate balance between the built and natural environment. The redevelopment of military sites, due to their scale and strategic location, provides an opportunity to enhance the existing ecological network of the city. This continuity can be restored through multi-scalar planning and the strategic integration of collective facilities, which are essential for improving the quality of residential and industrial areas. In this way, these under-utilised public assets can be repurposed for community uses and functions that not only improve the ecological functionality of the sites but also contribute to wider territorial regeneration.

References

Agenzia del Demanio. (2012). *Politiche e strumenti per la valorizzazione economica e sociale del territorio attraverso il miglior utilizzo degli immobili pubblici. Guida alle innovazioni legislative. Vademecum on line dell'Agenzia del demanio per la valorizzazione degli immobili pubblici*. Retrieved from: http://www.agenziademanio.it/

Andersson, E., Langemeyer, J., Borgström, S., McPhearson, T., Haase, D., Kronenberg, J., Barton, D. N., Davis, M., Naumann, S., Röschel, L., & Baró, F. (2019). Enabling green and blue infrastructure to improve contributions to human well-being and equity in urban systems. *BioScience, 69*(7), 566–574. https://doi.org/10.1093/biosci/biz058

Artioli, F. (2016). Le aree militari nelle città italiane: patrimonio pubblico e rendita urbana nell'era dell'austerity e della crisi. *La Rivista delle Politiche Sociali, Italian Journal of Social Policy, 1*, 89–113. Ediesse. Retrieved from: https://halshs.archives-ouvertes.fr/halshs-01562516

Atkinson, G., Doicka, K. J., Burningham, K., & France, C. (2014). Brownfield regeneration to greenspace: Delivery of project objectives for social and environmental gain. *Urban Forestry & Urban Greening, 13*, 586–594. https://doi.org/10.1016/j.ufug.2013.04.002

Bagaeen, S. (2016). Framing military brownfields as catalyst for urban regeneration. In S. Bagaeen & C. Clark (Eds.), *Sustainable regeneration of former military sites* (1–18). Routledge.

Beauchamp, P., & Adamowski, J. (2013). An integrated framework for the development of green infrastructure: A literature review. *European Journal of Sustainable Development, 2* (3), 1–24. https://doi.org/10.14207/ejsd.2013.v2n3p1

Colavitti, A. M., Floris, A., Pirinu, A., & Serra, S. (2021). From the recognition of the identity values to the definition of urban regeneration strategies: The case of the military landscapes in Cagliari. In G. Passerini & S. Ricci (Eds.), *The Sustainable City XV* (Vol. 258, 131–144). WIT Press.

Colavitti, A. M., Floris, A., & Serra, S. (2023). Gli insediamenti militari urbani nella città di Cagliari. La complessa "geografia" del patrimonio militare tra spazio pubblico e privato. In E. Strazzera & G. Sistu (Eds.), *Zone militari: limiti invalicabili? L'impatto della presenza militare in Sardegna* (229–258). Gangemi Editore.

Colavitti, A. M., Serra, S., & Usai, A. (2016). Demanio militare e "beni comuni": regolazione dei rapporti interistituzionali e coinvolgimento della società civile nei processi di valorizzazione della Regione Sardegna. In *Commons/Comune: geografie, luoghi, spazi, città. Società di studi geografici. Memorie geografiche, 14*, 559–565.

Dushkova, D., & Haase, D. (2020). Not simply green: Nature-based solutions as a concept and practical approach for sustainability studies and planning agendas in cities. *Land, 9* (1), 19. https://doi.org/10.3390/land9010019

European Commission: Directorate-General for Environment. (2021). *EU soil strategy for 2030: Towards healthy soils for people and the planet*. Publications Office. Retrieved from: https://data.europa.eu/doi/10.2779/02668

Garda, E., Marucci, A., & Falasca, F. (2023). De-sealing, soil recovery and (re)activation of ecosystem services: The role of regeneration interventions on large brownfield sites in urban areas. *TRIA, 31*(2), 107–126.

Gastaldi, F., & Camerin, F. (2019). *Aree militari dismesse e rigenerazione urbana. Potenzialità di valorizzazione del territorio, innovazioni legislative e di processo*. Siracusa, Letteraventidue.

Gastaldi, F., & Camerin, F. (2017). Verso una nuova fase del processo di valorizzazione del patrimonio militare italiano? *Territorio, 80*, 151–156.

Giaimo, C., Giudice, B., Pantaloni, G., & Voghera, A. (2023). Ecosystem services and territorial resilience: The role of green and blue infrastructure. In G. Brunetta et al. (Eds.), *Post Un-Lock, The Urban Book Series* (45–59). https://doi.org/10.1007/978-3-031-33894-6_4

Giannakidou, A., & Latinopoulos, D. (2023). Identifying spatial variation in the values of urban green at the city level. *TeMA - Journal of Land Use, Mobility and Environment, 16*(1), 83–104. https://doi.org/10.6093/1970-9870/9290

Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., Haase, D., Knapp, S., Korn, H., Stadler, J., Zaunberger, K., & Bonn, A. (2016). Nature-based solutions to climate change mitigation and adaptation in urban areas: Perspectives on indicators, knowledge gaps, barriers, and opportunities for action. *Ecology and Society, 21* (2), 39. https://doi.org/10.5751/ES-08373-210239

Lazzarini, L., Mahmoud, I., & Pastore, M. C. (2024). Urban planning for biodiversity: An assessment of green plans in Northern Italy. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 45–60. https://doi.org/10.6093/1970-9870/10197

Magnaghi, A. (2000). *Il progetto locale. Verso la coscienza di luogo*. Torino, Bollati Boringhieri.

Moraci, F., Bevilacqua, C., & Pizzimenti, P. (2024). Planning the transition of cities: Innovative research approaches and trajectories. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 109–127. https://doi.org/10.6093/1970-9870/10430

Munafò, M. (Ed.). (2023). *Consumo di suolo, dinamiche territoriali e servizi ecosistemici. Edizione 2023*. Report SNPA 37/23. Retrieved from: https://www.snpambiente.it/snpa/consumo-di-suolo-dinamiche-territoriali-e-servizi-ecosistemici-edizione-2023/

Pantaloni, M., Botticini, F., & Marinelli, G. (2024). Assessment of urban green spaces proximity to develop the green infrastructure strategy: An Italian case study. *TeMA - Journal of Land Use, Mobility and Environment, 17*(3), 67–81. https://doi.org/10.6093/1970-9870/10919

Perelli, C., & Sistu, G. (2015). Ammainare le bandiere? I beni militari e pianificazione urbana a Cagliari. *Documenti geografici, 1*, 57–76.

Pileri, P. (2024). *Dalla parte del suolo. L'ecosistema invisibile*. Laterza.

Pultrone, G. (2024). Transform active cities facing the ecological transition. *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 79–96. https://doi.org/10.6093/1970-9870/10210

Ronchi, S., Salata, S., Arcidiacono, A., & Pecol, E. (2023). The impact of land taken by logistics in two Italian regions. *TeMA - Journal of Land Use, Mobility and Environment, 16* (3), 523–544. https://doi.org/10.6092/1970-9870/10112

Tulisi, A. (2017). Urban green network design: Defining green network from an urban planning perspective. *TeMA - Journal of Land Use, Mobility and Environment, 10* (2), 179–192. https://doi.org/10.6092/1970-9870/5156

Image Sources

Images have been processed by the authors

Fig.1: Military sites in the urban area of Cagliari.

Fig.2: The ecological network in the urban area of Cagliari.

Fig.3: The strategies for the regeneration of disused military sites in the urban area of Cagliari.

Author's profile

Anna Maria Colavitti

She is Full Professor of Urban and Regional Planning at the University of Cagliari (DICAAR), where she teaches Urban Planning across several degree programs. Her long research activity has mainly focused on the role and functions of local territorial heritage in planning processes at different scales. She leads major international and national initiatives, serving as the scientific director for European projects (Horizon 2023), national research activities (PRIN), and cooperative agreements aimed at fostering the development of inner areas (UNICA_ARiA-UNIMOL).

Alessio Floris

He is an architect, urban planner and research fellow at the Department of Civil, Environmental and Architectural Engineering (DICAAR) of the University of Cagliari, where he conducts academic research and provides teaching support in the fields of Urban and Regional Planning. His research interests focus on urban regeneration strategies, public real estate management, recovery of historic centers, and ecosystem services, with a particular emphasis on inner areas and marginalized territories.

Sergio Serra

He is Assistant Professor (tenure track position) in Urban and Regional Planning at the Department of Civil, Environmental, and Architectural Engineering (DICAAR) of the University of Cagliari. His research focuses on the tools for rent capture and urban plan management with a view to urban regeneration and the containment of land consumption, policies for the protection and enhancement of historical, cultural and landscape heritage, and plans and programmes for local development. He has acted as a consultant for local authorities in the drafting of municipal urban plans and detailed plans for historic centres.