



# PhD in URBAN PLANNING, DESIGN, AND POLICY - 38th cycle

**PARTENARIATO PNRR Research Field: RE-NATURING CITIES THROUGH GREEN AND BLUE INFRASTRUCTURE DESIGN: OPERATIONALIZING URBAN ECOSYSTEM SERVICES FOR A PERFORMANCE-BASED SPATIAL PLANNING APPROACH**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1195.5**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

## Context of the research activity

**Motivation and objectives of the research in this field**

Understanding the impacts of urbanization on species is vital for an informed spatial planning that minimizes biodiversity loss. Human activities have caused land take and soil sealing phenomena, fragmentation of ecosystems and landscape, exploitation of species, contributing to the reduction and deterioration of biodiversity and its vital contribution to urban well-being. The impacting urbanization process and the aggravating consequences of climate change have affected Ecosystem Services (ES) via the loss of biodiversity, reducing territories' ecological resilience and exposing them to disaster risks. The increasing focus on sustainability and the standard inspired by the UN Sustainable Development Goals prompts a deeper understanding of the contribution of biodiversity in urban environments and on urban design. With species extinction rates soaring and urbanization over natural land continuing, contemporary cities become an essential factor in sustaining biodiversity. In this scenario, a deeper knowledge of soil degradation can be crucial to establishing adequate local policies and implementing planning actions against the decline in urban biodiversity. Among all possible kinds of land use transformation, the urbanization process causes the worst kind of soil degradation, putting biodiversity at risk. The loss of fertile soil results in habitat loss for animals and plant species, reducing and minimizing ES provision, and increasing the risk of other possible disasters that affect



	<p>cities. Moreover, soil degradation create serious environmental unbalances, especially in urban areas affecting the ecosystem's capacity to perform natural biophysical processes and increase the urban system's propensity to be touched by disaster risk events. The research seeks to understand the environmental benefits that urban biodiversity can provide, demonstrating the importance of preserving and creating green areas in urban contexts to promote the ecosystem's balance. The National Recovery and Resilience Plan (PNRR), approved in 2021 as part of the Next Generation EU program, addresses the emergences presented before in its mission two "Green Revolution and Ecological Transition". The research objectives are to adopt the spatial evaluation of Ecosystem Services to support ecological, environmental, and resilient planning. In particular, the research aims at finding methodologies to use the ecosystem's biophysical knowledge to design Green Infrastructure for ecological regeneration and support decision-making.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The management of ecological restoration projects acknowledges the complexity of urban ecosystems, especially in their response to re-naturing, de-sealing or afforestation interventions. The process requires multiple levels of knowledge: i) general knowledge of system conditions to determine whether ecological interventions are placed in continuity/connection with the other green features, and ii) site-specific conditions of the soil, vegetation, and microclimate characteristics for interventions. The Green and Blue Infrastructure (GBI) can be recognized as a strategic and spatial project that prioritizes Nature-Based Solutions. Among the most relevant GBI's objectives there is the regeneration of specific parts of the existing city, the connection of urban green spaces, the mitigation of urbanization processes, the reduction of built-up footprint, the increase of urban biodiversity and the improvement of citizens' health and well-being. This research will operationalize the ES framework to integrate the comprehensive frame of urban ecology and use UGI to re-compose the urban nature-based structure. Therefore, the methods will be developed</p>



	<p>around the spatial assessment and mapping of the performance of multiple ecosystems in providing benefits to human well-being and for climate-proof cities. Moreover, the ES assessment will be practically employed to design the UGI and augment the naturalness of urban soils. The research will test innovative approaches to greening the city by ecologically oriented projects designed to introduce urban biodiversity, assessing different typologies of forest cover by their ecosystem contiguity and efficiency. The investigation method will focus on various approaches to better understand and reinforce biodiversity in the urban environment. An interdisciplinary approach to urban biodiversity will be adopted to define practical applications and guidelines related to urban biodiversity and to set theoretical overviews (case studies relevant to urban biodiversity, and ES projects of GBI). After a literature review of planning experiences increasing urban biodiversity and urban ecology (phase 1), the second step will be dedicated to defining quantitative and qualitative indicators to set the most performance NbS according to a specific need/challenge, also identifying the location where NbS needs to be designed to increase urban naturalness and ecological connectivity, and selecting the best NbS using the framework of the UGI strategy promoted by the European Commission (phase 2). The third phase will be dedicated to testing some solutions to employ performance-based solutions and empirically measuring how these solutions produce urban biodiversity through biophysical benefits. The priority will be given to afforestation, denaturalization and de-permeabilization projects (phase 3).</p>
<b>Educational objectives</b>	<p>The educational objective of this research is to establish an interdisciplinary method of inquiry into social-ecological systems, working at the intersection of urban ecology, soil science and planning. The research addresses the challenge of making cities more resilient in the face of climate change and other environmental hazards while at the same time being more sustainable and healthier. Specifically, the candidate will understand the techniques for planning urban resilience in a changing climate and</p>



apply UGI as a framework to select and design nature-based solutions. The research will emphasize problem-driven, collaborative research that combines qualitative and quantitative methods with spatial analysis. The research will address the challenges posed by climate change from an adaptive and resilient perspective. In this sense, the educational objectives of the research program aimed at building a profile of a qualified researcher capable of addressing the environmental and ecological challenges of the city in terms of design and spatial planning solutions, acquiring skills in environmental and ecological assessment, and innovative planning tools' implementation. In particular, the researcher will acquire specific knowledge of theoretical and practical features in the design and planning methodologies aimed at improving the conditions of urban naturalness and biodiversity and enhancing the permeability of urban soils through sustainable urban drainage technics and using Nature-based solutions (NBS). The ES spatial assessment will be carried on by integrating traditional knowledge with digital modelling in a geo-spatial environment. Maps and ancillary documents will be used to suggest the spaces that provide the most relevant services for regulating the urban water cycle, such as runoff mitigation - which is useful for reducing the stormwater volume and attenuating and delaying peak flow - and water treatment for decreasing the concentration and load of pollutants. Furthermore, the candidate is expected to learn how to use specialized GIS tools to map and evaluate ecosystem services, define ecological sustainability indicators as support to compare different planning scenarios and give coherence to the design solutions within an overall spatial planning framework. In this sense, the trained researcher will acquire skills to work with other environmental and ecological disciplines necessary for evaluating the ecosystemic functions of urban soils and the definition of intervention methods aimed at increasing urban naturalness and water management. Therefore, the training objective is to acquire reflective technical knowledge about the design of urban open spaces and the definition of green and blue networks as a design tool to support actions aimed at the ecological transition.



<b>Job opportunities</b>	According to the educational objectives and its international orientation, the PhD programme in Urban Planning, Design and Policy trains highly qualified researchers and professionals in the fields of spatial planning and environmental assessment, design and management of GBI projects, and urban governance. Researchers with such profiles may be employed by Italian and international academic institutions, public bodies and research centres, public and private development agencies, and other private firms.
<b>Composition of the research group</b>	12 Full Professors 13 Associated Professors 0 Assistant Professors 45 PhD Students
<b>Name of the research directors</b>	Andrea Arcidiacono, Stefano Salata, Silvia Ronchi

<b>Contacts</b>	
<p><b>Research supervisor:</b>  <i>Prof. Andrea Arcidiacono</i>  <i>Email: andrea.arcidiacono@polimi.it</i></p> <p><b>PhD program coordinator:</b>  <i>prof. Luca Gaeta</i>  <i>e-mail: luca.gaeta@polimi.it</i>  <i>phone +39/02/2399.5426</i></p> <p><b>Contact in the PhD Office at DASTU:</b>  <i>dr. Marina Bonaventura</i>  <i>E-mail: marina.bonaventura@polimi.it;</i>  <i>phone +39/02/2399.5165</i></p> <p><i>Further information is available at: Handbook a.y. 2018/2019 of the PhD Program in Urban Planning, Design and Policy (UPDP): <a href="https://www.dastu.polimi.it/dottorato-urbanplanning/">https://www.dastu.polimi.it/dottorato-urbanplanning/</a></i></p>	

<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--



Scholarship Increase for a period abroad	
Amount monthly	597.76 €
By number of months	6

**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

Individual funds are available to purchase books and material, participate in summer schools, workshops and conferences:

1<sup>st</sup> year: max 1.624,30 euros per student

2nd year: max 1.624,30 euros per student

3rd year: max 1.624,30 euros per student

Various forms of financial aid are available for both research and teaching activities. PhD students are encouraged to take part in these activities within the limits allowed by the regulations.

In the PhD room workstations are available for shared use connected with a printer. All PhD students can use their own laptop with a wireless connection. Workstations and other equipment are available in the various laboratories linked with the doctoral programme.