The Legacy of Experience: Reflections on Climate Transition Strategies in Medium-Sized Italian Cities

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Abstract
This study examines Climate Transition Strategies in medium-sized Italian cities (Bergamo, Brescia, Mantua), funded by Fondazione Cariplo. It investigates how urban nature is conceptualized and integrated, and the impact of these strategies on urban planning instruments. Despite varying visions – from human-centered 'oasis cities' to technical performance and integrated eco-climatic planning – direct actions across the CTS converge on (re)naturalization, (re)forestation, depaving, maintenance, and extension in urban spaces. A key finding is the significant influence of CTS on urban governance, integrating climate objectives into planning instruments. Competitive funding catalyses these experimental approaches in resource-constrained cities. The research highlights a shift towards integrating urban nature but notes challenges like fragmented actions and the need to assess long-term socio-ecological effectiveness and equitable benefit distribution.

Keywords: Climate Transition Strategies; Urban Nature; Medium-sized Cities; Climate Adaptation; Climate Mitigation

Introduction

Human activity is the primary driver of global warming and climate change (CC), significantly contributing to the increase in extreme weather events (Lynas et al., 2021; IPCC, 2023). Globally, 2023 was the hottest year since 1961, and in Europe it ranked as the second warmest on record (SNPA, 2024). Italy experienced comparable trends, with 2023 being its second hottest year on record and marked by significant deviations in rainfall patterns compared to historical norms (SNPA, 2024). Particularly in the northern regions of Italy, there has been an uninterrupted rise in average annual temperatures, coinciding with strong fluctuations in monthly precipitation (SNPA, 2024). Urban areas are amongst the most vulnerable to the impacts of CC, due to their high population density. The consequences of climate change for urban life are numerous. These include rising temperatures, worsening air quality and an increased risk of flooding or intense rainfall (OECD/EC, 2020). Consequently, there is an increasing need to develop effective strategies for climate mitigation and adaptation (Tang, 2024), as well as identifying mechanisms to finance the climate transition (WEF, 2025). A notable category of interventions involves Nature-based Solutions (NbS), which rely on natural processes to address specific challenges while delivering multiple co-benefits (Sowińska-Świerkosza & García, 2022). Despite the capacity of NbS to produce social, environmental, and economic value (Bockarjova et al., 2022), the concept of 'naturalness' has the poten tial to perpetuate a dichotomy between the natural and artificial, thereby diverting attention from their genuine functionality and effectiveness (Osaka et al., 2021).

Nature has played an integral role in shaping urban environments, particularly through the presence of natural green spaces. The discipline of urban planning has historically sought to reintroduce a natural environment into urban settings, thereby reflecting ongoing efforts to define the relationship between humans and green spaces. The role of nature has been subject to evolution since the late 19th century, as evidenced by the Barcelona Extension Plan (Urban, 2016), the Garden City movement (Howard, 1902), and more recent climate-focused projects. Early urban interventions were primarily concerned with public health and sanitation (Benevolo, 1971). In contrast, contemporary planning acknowledges the integration of cities with natural systems, with the objective of achieving goals such as biodiversity, climate regulation, stormwater management, and recreation. Recently, a growing number of European cities have adopted new planning approaches to support the climate transition. The overarching objective of these strategies is to rethink urban-nature relations and promote sustainable practices. Approximately 60% of Europe's population inhabits small to medium-sized cities (with 10,000–250,000 inhabitants) (Selada et al., 2010), which frequently encounter climate-related challenges with constrained financial

and human resources. For these cities, external funding – frequently obtained through competitive calls from public or private institutions – can provide vital support. Strategic plans that emerge from such funding are integrated into municipal planning frameworks with a view to promoting sustainability and climate resilience, while also outlining concrete actions. These strategies, particularly the ones originating from competitive funding programmes, frequently resort to experimental approaches (Broto and Bulkeley, 2013). Nevertheless, such approaches are not without critical issues (Caprotti and Cowley, 2017), and it becomes essential to evaluate both their social-ecological effectiveness and their influence on urban governance. The study draws on the concept of Social Nature (Castree and Braun, 2001) to investigate how different ideologies, imaginaries, and objectives shape the framing of nature. It highlights how climate strategies produce a 'socionature' (Swyngedouw, 1996) – a hybrid of social and ecological processes.

The present research focuses on the legacy of strategic climate plans, evaluating both the implementation outcomes and their impact on planning instruments. The present study explores varying interpretations of nature's role in Climate Transition Strategies developed under a shared funding framework and tailored to local contexts. The study considers the commodification of natural elements, their use in city branding, and their potential to redefine the relationship between people and the environment. Moreover, it explores the process through which global climate agendas are adapted to local contexts in order to facilitate the conservation, regeneration, and functional integration of nature in urban planning. The study is divided into three sections. The first section introduces the Climate Transition Strategies that have been promoted by Fondazione Cariplo. The second part of the study explores a selection of Climate Transition Strategies experiences enabled by this initiative, highlighting their visions and nature-oriented interventions. The third section of this study examines how these strategies have influenced urban planning instruments.

Climate transition strategies

The '*F2C - Fondazione Cariplo per il Clima*' project was initiated in 2019. The initiative has been promoted by Fondazione Cariplo (FC) and is in alignment with the European and national climate policies that gave rise to the European Green Deal (EC, 2019), the Next Generation EU and the National Recovery and Resilience Plan (PCM, 2021). The objective of the project is to implement CC mitigation and adaptation interventions within the Lombardy Region. Furthermore, the objective is to enhance the level of institutional and public understanding of CC. One of the F2C call is the call for ideas *Strategia Clima* [Climate Strategy]. The objective of this initiative is the realisation of Climate Transition Strategies (CTS), with the identification of a partnership necessarily composed of a lead municipal administration (with limits for the number of residents), an organisation managing a naturalistic area of high importance for the protection of biodiversity and a private non-profit organisation with experience in involving citizenship in environmental sustainability. In the context of this second project, Fondazione Cariplo is committed to providing technical assistance during the implementation phase of the CTS, as well as financing a share (up to 60%) of the expenditure related to each intervention.

The competitive call for ideas proposed by Fondazione Cariplo for the Climate Strategy Call for Ideas is composed of three phases (F2C, 2020): (i) Call for ideas: collection of project ideas related to the Climate Transition Strategy. In this phase, a high degree of detail is not required with regard to the proposals for action, but the application must mandatorily contain a number of well-defined areas (e.g. support to the revision of urban planning instruments of public bodies, adaptation and mitigation to CC). However, the necessity to influence public administration decision-making mechanisms from a policy and resource allocation perspective is emphasised. (ii) Provision of technical assistance for co-design: this is only available for ideas that have been selected during the initial phase. This phase is characterised by the elaboration of project ideas. The Fondazione Cariplo may provide direct support for the implementation of specific actions, prioritising those that have demonstrated effectiveness and can be implemented promptly (Quick win/No regret actions) and in social contexts where the consequences of CC are most pronounced. At the conclusion of the second phase, financial contributions are also determined. (iii) Effective implementation of interventions by the partnership. The terms of these agreements are to be defined in writing between the partners and Fondazione Cariplo.

The CTSs developed in this process must have two main objectives: (i) mitigation and adaptation to CC of vast

territorial areas, intervening on climate-altering emissions, impacts of extreme weather phenomena and increase in natural capital; (ii) intervention to improve public knowledge and awareness of CC, both by supporting scientific research and by promoting cultural and dissemination activities.

The territories and actions

The 2020 edition of the Climate Strategy encompasses four projects, each pertaining to a distinct Lombard territory. Of these four projects, three are the focus of this analysis: (i) 'Cli.C. Bergamo!', spearheaded by the Municipality of Bergamo in collaboration with the Parco Regionale dei Colli di Bergamo, Legambiente Lombardia, and ERSAF. The involvement of the Regional Park is instrumental in facilitating the project's extensive area of action. Within the designated area, encompassing a total of nine municipalities, the park's plan supersedes the urban planning instruments of the local authorities. This indirect influence enables the Cli.C. Bergamo! project to extend its intervention to areas beyond the municipal boundaries of Bergamo (Comune di Bergamo et al., 2020). (ii) 'Un Filo-Naturale', led by the Municipality of Brescia in partnership with Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), AmbienteParco, Parco delle Colline di Brescia (Comune di Brescia et al., 2020); (iii) ACE3T - CLIMA, spearheaded by the Municipality of Mantua in collaboration with multiple municipalities, namely Curtatone, Marmirolo, Porto Mantovano, San Giorgio Bigarello, Parco del Mincio, Unione Colli Mantovani, and Alkémica Cooperativa Sociale (Comune di Mantova et al., 2020). The territorial extension of the intervention possibilities is variable for the three cases. Starting from the most limited, the Un Filo-Naturale project envisages interventions only within the municipality of Brescia. Conversely, the Cli.C. Bergamo! initiative delineates interventions within the lead municipality and, in a secondary manner, in the territory of nine other municipalities within the Regional Park. The final case, designated ACE3T - CLIMA, involves a total of six municipalities in addition to the primary municipality, thereby enabling direct intervention in the designated territory.

The three territories under consideration present different characteristics. The geographical area of Cli.C. Bergamo and Un Filo-Naturale are distinguished by their similarity in terms of urbanisation levels and topographical characteristics, specifically the presence of foothill zones. Conversely, the area of ACE3T - CLIMA pertains to a heavily irrigated and agricultural lowland context. The repercussions of CC accentuate phenomena deemed pivotal by the three projects: the hydraulic and flooding risk, and the escalation in temperature, in conjunction with the urban heat island phenomenon. However, the distinct local characteristics translate into further specific territorial criticalities. The first two territories highlight problems related to hydrogeological instability while the final territory is distinguished by diminished soil quality and reduced water availability.

The vision of each strategy is defined based on the territorial cognitive framework and the criticalities identified. The Cli.C. Bergamo! programme identifies five objectives: preventive adaptation and reactive adaptation to climate change; containment of the expansion of urbanised areas, including processes of depopulation and renaturalisation; strengthening of social cohesion for a new urban welfare; attribution of a relevant role to green areas and vegetation, including the creation of a green belt; and safeguard and enhancement of agricultural areas. Un Filo-Naturale, commencing from specific objectives, summarises them with three key words: oasis city (creating shade and coolness for human wellbeing, improving the urban microclimate and increasing urban biodiversity), sponge city (restoring space, time and quality to water) and city for people (with beautiful and liveable spaces guaranteeing rights such as health, slow mobility, meeting and inclusion). The vision of ACE3T-CLIMA is predicated on three fundamental pillars: firstly, blue permeability (the transformation of hydraulic risk into a resource, with concomitant improvements in safety, environmental quality and the adaptability of the territory to the effects of CC); secondly, green inclusion (the overcoming of the separation between natural and anthropic systems, with a view to favouring biodiversity, human wellbeing and the sustainability of productive and agricultural systems); and thirdly, resilience and decarbonisation of territorial systems (the energy efficiency which improves the quality of life and the sustainable management of resources from a fossil-free perspective)., The semantic structure of the strategies' objectives is different. Un Filo-Naturale employs a vision narrative, synthesising the advantages associated with the term 'city' and emphasising the robust 'urban' character of the strategy. ACE3T-CLIMA articulates the objectives by integrating them with the strategies of eco-climatic planning of the territory, thereby establishing a nexus between rural and urban contexts. It appears that Cli.C. Bergamo! employs a more technical approach, with a focus on the performance of the actions. The objectives of the vision are then translated into specific actions aimed at resolving the critical issues identified. All the actions, as explicitly requested by the call, fall into one of the following categories: governance actions/application for funding; support for the revision of urban planning tools; CC adaptation; CC mitigation; monitoring systems and

networks; capacity building and training of municipal technicians; territorial animation and communication.

The number of planned actions ranges from 20 in ACE3T - CLIMA to 30 in Un Filo-Naturale. Highlighting only the direct actions, that involve physical modification of the territory, Cli.C. Bergamo initiative entails 11 direct actions, constituting a proportion of the total 23 planned initiatives. All 11 of these direct actions pertain to mitigation or adaptation strategies. Un Filo-Naturale present only 11 direct actions, all in the adaptation category. In this STC, mitigation is achieved through actions that do not involve land modifications but are based on citizen participation and involvement. ACE3T - CLIMA incorporates a total of nine direct actions, exclusively those pertaining to CC adaptation. Despite the heterogeneity of strategies and the partiality of territorial criticalities, all direct actions can be ascribed to five families: (re)naturalisation, (re)forestation, depaving, maintenance and extension. Each action falls within a specific typology of space: wetlands, urban or suburban forests, green and blue infrastructure, urban parks, parking areas and draining plazas, water network, roof gardens, rain gardens, slow mobility paths.

The Influence of CSTs on Planning Instruments
The call expressly requires CTS to directly influence the planning instruments of the territories.

The CTS Cli.C. Bergamo! provides for four actions to 'review of urban planning instruments'. These four actions aim to address four CC mitigation objectives, two CC adaptation objectives, four governance objectives for the implementation of the CTS, and three objectives for participatory processes and co-design.

Action 1, 'mapping the climate risk index', has the following objectives: capacity building for public entities involved in the management, implementation and monitoring of the CTS; raising awareness of the impacts of CC among stakeholders and citizens. It involves correlating CC manifestations with the morphological and socio-economic characteristics of the territory in order to assess exposure and vulnerability. The mapping is carried out in stages: characterisation of the local climate through analysis of historical data series; investigation to characterise future climate scenarios; in-depth analysis of environmental, demographic and socio-economic matrices and the relationships between them to investigate the vulnerability and resilience of the territory; risk assessment consists of relating the potential direct and indirect impacts to the characteristics of the territory. The expected results include the creation of a Climate Risk Map to guide climate change adaptation and mitigation policies, the identification and study of the main climate-related threats and issues, and an analysis of the degree of exposure, vulnerability and adaptability of the territory.

Action 2, 'River contract for the Morla and its tributaries - how it flows between the hills and the city of Bergamo', will be described in detail below.

Action 3, 'Increasing resilience through planning choices in the new *Piano di Governo del Territorio*[1] (PGT)', has several objectives: disseminating CC mitigation policies in territorial governance choices; integrating CC adaptation and mitigation policies into urban choices and transformations; capacity building for public entities involved in the management, implementation and monitoring of the CTS. The Municipality of Bergamo is revising its PGT to respond to socio-economic and regulatory changes, with the aim of promoting sustainable and regenerative urban development. The new PGT pays particular attention to environmental and climate protection, integrating actions for climate change mitigation and adaptation, such as the enhancement of urban green spaces, sustainable water management and the limitation of land consumption. In this context, the CTS is a tool for guiding urban policies towards resilience, contributing to the definition of structural and non-structural interventions capable of reducing the city's environmental vulnerabilities. The CTS also supports the creation of new ecosystem services, urban forestry and renaturalisation, strengthening the integration between planning and sustainability. The expected results include the construction of a resilient city capable of coping with climate change and environmental risks in the long term. The development of organisational and management strategies geared towards prevention is envisaged, through both preventive adaptation tools – to reduce hazards and

1 The Piano di Governo del Territorio (PGT) is the overarching urban planning instrument to which all Lombardy municipalities are obliged to adhere in order to regulate land use, urban and territorial development, and environmental and landscape protection. The plan is composed of three primary documents: the Documento di Piano, which outlines the development strategies and general objectives; the Piano dei Servizi, which identifies the necessary equipment and public infrastructures; and the Piano delle Regole, which regulates the admissible uses and transformations of the territory.

vulnerabilities – and reactive tools to respond effectively to extreme events such as heat waves, droughts and floods.

Action 4 'from PAES to PAESC' involves the transition from the *Piano d'Azione per l'Energia Sostenibile*[2] (PAES) to the *Piano d'Azione per l'Energia Sostenibile e il Clima*[3] (PAESC). The objectives are manifold: dissemination of CC mitigation policies in land management decisions; reduction of climate-changing gas emissions through energy efficiency; integration of CC adaptation and mitigation policies into urban planning and transformation; capacity building for public entities involved in the management, implementation and monitoring of the CTS. The Municipality of Bergamo has begun developing its new PAESC. This process is part of the commitments made under the Covenant of Mayors, which Bergamo joined in 2009. After two monitoring cycles of the previous PAES, the municipality now intends to align itself with the new European targets: -55% CO$_2$ by 2030 and climate neutrality by 2050. The new SEAP will include mitigation actions to reduce emissions and adaptation actions to strengthen the city's resilience to climate change. The plan will be divided into three main parts: emissions inventory and risk analysis, decarbonisation plan and adaptation plan. The process will involve public participation, biennial monitoring and the sharing of good practices with other European cities through a network.

The CTS Un Filo-Naturale for the Brescia area provides for two actions to 'revise urban planning instruments', which aim to respond to one CC mitigation objective, one CC adaptation objective, two governance objectives for the implementation of the CTS, and one objective for participatory processes and co-design.

Action 1.1 of the CTS Un Filo-Naturale 'support for the revision of urban planning instruments' will be described in detail below.

Action 1.2 'analysis of local climate variability' has as its main objectives improving awareness of CC and capacity building for public bodies, citizens and stakeholders. The Municipality of Brescia wants to integrate the analysis of local climate variability into the process of revising urban planning tools. The aim is to identify the main past and future climate challenges to plan targeted adaptation measures. The analysis is based on internationally recognised climate indicators, calculated both from historical data (last 30 years) and future projections based on climate scenarios. This analysis makes it possible to define the current state of the climate and the potential risks arising from future changes, providing a scientific basis for planning local adaptation strategies and assessing climate risk. The expected result is the development and study of local climate variability.

ACE3T - CLIMA for the Mantua area provides for a single action of 'mainstreaming and revision of urban planning tools': action 2 'revision of urban planning instruments'. The objective of the action is to reorient the actions of municipalities in local and supralocal government decisions to include adaptation and mitigation to CC in urban planning instruments and processes. Some of these instruments are mandatory, others optional. The action plans to integrate the following tools with specific guidelines:

- *Piano Triennale delle Opere Pubbliche*[4]: definition of public intervention standards to contribute to resilience.
- *Regolamento del Verde Pubblico e Privato*[5]: identifying native plant species with high environmental

2 Piano d'Azione per l'Energia Sostenibile (PAES) is a strategic instrument developed by municipalities under the Covenant of Mayors, a European initiative focused on climate and energy. The SEAP delineates objectives and specific actions aimed at mitigating greenhouse gas emissions, encompassing initiatives pertaining to energy efficiency, renewable energy, and sustainable mobility.

3 Piano d'Azione per l'Energia Sostenibile e il Clima (PAESC), represents the evolution of the PAES and signifies the strategic instrument through which municipalities adhering to the new Covenant of Mayors commit themselves not only to reducing CO2 emissions, but also to addressing the impacts of climate change through adaptation measures. The strategy delineates an integrated approach to achieving European decarbonisation targets, promoting energy efficiency, the utilisation of renewable sources, and fortifying territorial resilience.

4 The Piano Triennale delle Opere Pubbliche is a planning document that every Italian municipality is required to draw up in order to plan, over a three-year time horizon, the implementation, maintenance and adaptation of public works of economic importance. It includes, for example, schools, roads, public buildings, sports facilities, road and environmental infrastructure.

5 The Regolamento del Verde Pubblico e Privato is a regulatory instrument adopted by municipalities for the purpose of protecting, managing and enhancing the public and private urban plant heritage. The document establishes criteria and procedures for the design, maintenance, felling and replacement of plants, with the overarching objectives of promoting biodiversity and

effectiveness; redeveloping public green spaces in relation to heat islands; considering CC in the design criteria for urban green spaces; promoting the adoption of municipal or inter-municipal green space plans.

- *Regolamento Edilizio*[6]: defining specific rules to increase adaptation and mitigation capacity in new construction and renovation projects and defining an index to increase the response to heat waves and urban flooding.
- *Documento di Piano*[7]: consider scenarios and critical issues arising from CC; integrate objectives and strategies with adaptation and mitigation elements and promote agriculture and rural land management, considering ecological networks, the promotion of biodiversity and the contribution of ecosystem services.
- *Piano delle Regole*[8]: promote urban regeneration by encouraging adaptation to CC; encourage environmental sustainability and urban resilience with new standards and criteria to minimise carbon emissions, improve drainage and the urban microclimate, create green infrastructure, mitigate heat islands; reduce hydraulic risk and de-impermeabilisation;

Action 2 of the CTS Cli.C. Bergamo! involves signing a River Contract (RC) for the Morla river basin, a 14 km watercourse considered to be Bergamo's river. From the start of its course within the city, the Morla is heavily artificialised. The RC is a voluntary planning instrument negotiated between several municipalities, which aims to protect water resources, improve their management and contribute to safeguarding against hydraulic risk. The RC can also help to integrate and guide local planning, while improving subordinate planning. The RC '*Il Morla e i suoi affluenti*' (The Morla and its tributaries) has the specific objective of restoring the watercourse and the surrounding area, both in terms of its naturalness and its historical and identity value. The stages indicated by the CTS for the implementation of the RC, which were then actually implemented, included: the drafting of a document of intent containing the reasons for the creation of the RC, its objectives and methodology; a fact-finding analysis of environmental, social and economic aspects; the mapping of potentially interested public and private entities and stakeholder; the implementation of participatory processes to share intentions among the entities and stakeholder; the development of a shared medium- to long-term strategic scenario; the definition of a three-year Action Programme, indicating objectives, actors (with obligations and commitments), timelines, implementation methods, and the necessary human and economic resources; the signing of the River Contract. Specifically, the Memorandum of Understanding was signed on 2 December 2022, while the actual River Contract was signed on 8 February 2024.

With regard to 2024, the first year of the RC, various interventions were carried out within the river basin: unsealing of a section of the stream; restoration of a drainage ditch; cleaning and redevelopment of the banks; conservation of tree vegetation; training meetings for technicians and professionals; development of a GIS database; updating of the areas of environmental enhancement within the PGT of the municipality of Bergamo. The year 2025 will be characterised by five themes: green space regulations, environmental compensation for investments and infrastructure, river routes, environmental education, and communication.

Action 1.1 of the CTS Un Filo-Naturale 'support for the revision of urban planning instruments' aims to update and integrate land management tools with objectives and actions strategically geared towards climate transition. The action therefore consists of updates and additions to reports, regulations, project guidelines, maps, procedures and regulations for planning tools that are currently in force or being implemented. The activities follow two coordinated lines: the first involves the introduction of new support tools to guide and prescribe interventions in the territory, improving resilience to climate change; the second line involves direct or indirect interventions

defining the responsibilities of citizens and entities in the care of green areas.

6 The Regolamento Edilizio constitutes a municipal regulatory instrument, the function of which is to govern the processes of construction, renovation and maintenance of buildings within the municipal territory. The overarching objective of the plan is to establish a set of rules that, if adhered to, will ensure safety, urban quality, environmental sustainability and respect for the local context. It is integrated with the PGT.

7 The Documento di Piano constitutes the strategic element of the PGT. It delineates the objectives of urban and territorial development for a medium-long term time span. It identifies the needs of the territory, guidelines for urban transformation, environmental, social and economic policies, and demographic and settlement forecasts.

8 The Piano delle Regole constitutes one of the three constituent components of the PGT. It is the regulatory component, the function of which is to regulate land use and the transformation of the existing territory. The document under consideration comprises the regulations that govern the construction and town planning interventions permitted within the various areas of the municipal territory. It identifies the agricultural areas, the landscape, historical or environmental assets to be protected, and the parts of the urban fabric where restructuring, replacement or building conservation is permitted.

on areas and buildings aimed at urban regeneration and the creation of interconnected green infrastructure. In detail, the CTS provides for interventions on specific urban planning instruments. Within the PGT, the main municipal-level tool is expected to:

- Introduce new annexes: climate variability analysis and municipal study for flood risk management.
- Updating documents and maps: urban redevelopment areas with direct and indirect interventions; areas for hanging gardens and green roofs; areas for tree planting and permeability; pilot interventions for water retention basins; areas for new woods and habitats in urban areas; retrofitting areas.
- Introducing a procedure for participatory processes in urban transformation interventions.

In addition to the PGT, the CTS also intends to intervene on other instruments such as the *Regolamento Edilizio*, the *Piano Urbano della Mobilità Sostenibile*[9] (PUMS), the PAESC, the *Piano Comunale del Verde*, and the Multi-Year Plan for the PLIS of the municipality of Brescia. New planning instruments are also planned: the de-paving implementation plan, the strategy for the spread of green roofs, the forestry action plan, and guidelines for the extension of the district cooling pilot project.

Worthy of note is the new municipal green plan, called the 'Green and Biodiversity Plan of the Municipality of Brescia'. The introduction presents the CTS and analyses of climate change scenarios. It highlights air pollution, heat islands and hydrogeological risk as specific vulnerabilities of the Brescia area. It then explores the benefits of ecosystem services such as carbon sequestration and the removal of air pollutants, temperature regulation, protection from hydrogeological risk, etc. Just as the CTS summarises the objectives in three visions for the city, this tool also has the same structure: the healthy city (inspired by the One Health principle), the spring city (to restore the central role of water), and the city for people (with public space and community at its heart). Finally, the plan's implementation tools include the NbS abacus, organised into three sections: the first section introduces the functions and benefits of NbS; the second relates NbS to the project areas of the city of Brescia, listing the appropriate NbS for each area; the last section brings together the NbS fact sheets, outlining guiding principles and ecosystem services.

Discussion

The present study investigates the role of urban nature within Climate Transition Strategies, which is funded by Fondazione Cariplo, in medium-sized Italian cities. The analytical framework utilised in this study focuses on the Climate Transition Strategies that have been developed by the municipalities of Bergamo, Brescia and Mantua. The primary objectives are twofold: firstly, to comprehend the manner in which diverse ideologies, imaginaries and objectives influence the conceptualisation and integration of nature within urban contexts; and secondly, to critically evaluate the impact of these strategies on urban planning instruments.

The semantic structures employed in the objectives of each strategy reveal distinct approaches to framing urban 'natures'. The 'Un Filo Naturale' project is an ambitious undertaking that aims to create an 'oasis city,' a 'sponge city,' and a 'city for people.' This vision, in which human society is placed at the centre, synthesises the benefits of urban nature with broader concepts of human well-being and liveability, positioning nature as an intrinsic component of an ideal urban environment. The 'ACE3T-CLIMA' initiative articulates its objectives through the integration of established ecoclimatic planning strategies for the territory, thereby establishing a nexus between rural and urban contexts through concepts such as 'blue permeability' and 'green inclusion'. The 'Cli.C. Bergamo!' project adopts a more technical approach, with a focus on the measurable performance of actions related to preventive and reactive adaptation or containment of urban sprawl. The manifestation of these disparate conceptualisations as discrete 'socionatures' (Swyngedouw, 1996) in action illuminates the multifaceted manner in which social and ecological processes are hybridised and negotiated within these climate strategies. The conceptualisation of nature, whether as a functional apparatus, a provider of ecosystem services or a source of human well-being, exerts a direct influence on the cultural approach to urban nature and the language employed to communicate its value.
Despite these divergences in vision, there is convergence regarding the direct actions proposed in the three CTS.

9 The Piano Urbano della Mobilità Sostenibile (PUMS) is a strategic planning instrument adopted by municipalities to design efficient, safe and environmentally friendly mobility systems. The objective of the initiative is to enhance the quality of life in urban areas by reducing pollution, traffic congestion and greenhouse gas emissions. It delineates integrated interventions to promote sustainable transport modes, including public transport, cycling and walking, shared mobility, and the utilisation of environmentally friendly vehicles.

These actions, which are designed to induce physical changes to the urban territory, can be categorised into five distinct families: (re)naturalisation, (re)forestation, depaving, maintenance and extension. These interventions target a variety of urban spaces, ranging from wetlands and urban forests to green and blue infrastructure and urban parks. The 'Cli.C. Bergamo!' initiative integrates climate mitigation and adaptation into direct actions, whilst 'Un Filo-Naturale' and 'ACE3T – CLIMA' focus their direct interventions on adaptation strategies. The mitigation objectives in 'Un Filo-Naturale' are chiefly pursued through initiatives centred on citizen participation and involvement. One of the key findings of this study is the influence of CTS on existing and developing urban planning instruments, demonstrating a systemic change in urban governance frameworks. In accordance with the stipulations of the call, all three projects under consideration have been designed to incorporate their respective climate objectives into the existing urban planning instruments.

The 'Cli.C. Bergamo!' project is an initiative that proposes a series of actions with the objective of revising urban planning tools. These include the creation of a detailed Climate Risk Map, the integration of climate policies into the TMP, and the adoption of a PAESC. The River Contract for the Morla basin in Bergamo serves as a case study in multi-municipal strategies for ecological restoration of natural watercourses, illustrating a direct and quantifiable impact on land management practices and environmental enhancement within the broader TMP framework. The contract under discussion is indicative of a shift towards collaborative governance models that transcend administrative boundaries, a key element for effective action against climate change. In a similar manner, the Brescia 'Un Filo-Naturale' project endeavours to modernise and amalgamate prevailing urban planning instruments. The development of a new 'Green and Biodiversity Plan', based on the visions of a 'healthy city', a 'spring city' and a 'city for people', together with the creation of an NbS abacus, represents an approach to integrating climate resilience directly within urban planning. This process underscores a transition from ad hoc projects to systematic policy integration.

The findings indicate that competitive funding programmes, such as those administered by Fondazione Cariplo, function as catalysts for medium-sized cities to adopt experimental approaches and integrate climate strategies into their spatial planning. This is of particular significance when considering the financial and human resource limitations experienced by these cities. This research study lends further credence to the integration of 'natural systems' in urban areas, a concept that has gained significant traction in contemporary planning discourse. However, this raises questions regarding the long-term sustainability and scalability of these experimental approaches, underlining the need to evaluate their socio-ecological effectiveness and their influence on urban governance (CIT). The potential for the commodification of natural elements in urban branding further underscores the necessity for a more profound and critical examination of how these emerging strategies are reshaping the relationship between urban populations and their environment. In addition, an evaluation of the potential equity concerns is necessary, as well as an assessment of whether the advantages derived from these 'greening' initiatives are distributed uniformly across all demographic groups within the urban population.

Conclusion

This study provided a comprehensive analysis of climate transition strategies in medium-sized Italian cities, revealing both promising progress and critical areas for improvement in local climate action. The results of the study indicate a paradigm shift in the way urban nature is conceptualised and integrated into planning. The cases of Bergamo, Brescia and Mantua exemplify different and functional approaches to exploiting NbS for climate change adaptation and mitigation, reflecting different narratives adapted to local specificities. Despite the integration of urban nature being substantial within planning instruments, the analysis also highlights certain challenges. A fundamental concern pertains to the absence of a systemic and strategic approach to climate action. The individual direct actions promoted by CTSs appear to be fragmented and independent, with no internal coordination or external alignment with other ongoing projects. This underscores the necessity for a systemic approach that acknowledges the variability of climate change effects, transitioning from isolated interventions to coordinated strategies.

A further distinction is to be drawn between the ways in which 'old' and 'new' nature are addressed. The concept of 'old nature' frequently serves as the focal point for conservation, control, exploitation, or removal interventions, largely attributable to the perceived risks associated with it. Conversely, the concept of 'new nature' (Tononi, 2025) is predominantly evaluated based on its immediate benefits for human well-being and the natural system. The incorporation of socio-nature mapping, encompassing elements such as wasteland, forgotten spaces,

and groundwater, could facilitate the development and implementation of more effective climate strategies. The strategy for planning tools demonstrates a commitment to institutionalising climate resilience, ensuring that these efforts become lasting urban development rather than 'experimental' phases (Broto and Bulkeley, 2013; Caprotti and Cowley, 2017). However, further investigation is required into the long-term socio-ecological effectiveness of these changes, in order to assess the impact on biodiversity, ecosystem service provision and the general well-being of urban populations. It is also necessary to investigate how these strategies can redefine the relationship between urban populations and their environment, fostering a sense of connectedness and responsibility. It is therefore essential to explore the distribution of environmental benefits across different socioeconomic groups and the potential of these initiatives to address existing urban inequalities.

Addressing these implications and conducting further comparative studies on different funding mechanisms and governance structures will facilitate the identification of best practices and improve the transferability of successful models. This, in turn, will promote a climate-resilient, nature-positive and socially just urban future.

References

Benevolo, L. (1971). The origins of modern town planning, 1. paperback ed. ed, MIT Urban studies. M.I.T. Press, Cambridge, Mass.

Bockarjova, M., Botzen, W.J.W., Bulkeley, H.A., Toxopeus, H. (2022). Estimating the social value of nature-based solutions in European cities. Sci Rep 12, 19833. https://doi.org/10.1038/s41598-022-23983-3

Broto, V.C., Bulkeley, H. (2013). Maintaining Climate Change Experiments: Urban Political Ecology and the Everyday Reconfiguration of Urban Infrastructure. Int J Urban Regional Res 37, 1934–1948. https://doi.org/10.1111/1468-2427.12050

Caprotti, F., Cowley, R. (2017). Interrogating urban experiments. Urban Geography 38, 1441–1450. https://doi.org/10.1080/02723638.2016.1265870

Castree, N., & Braun, B. (2001). Social nature: theory, practice, and politics. Blackwell Publishers

Comune di Bergamo, Parco del Colli di Bergamo, ERSAF Lombardia, Legambiente Lombardia (2020). "Cli.C CLImate. Change Bergamo!". https://www.fondazionecariplo.it/static/upload/stc/stc-bergamo.pdf

Comune di Brescia, AmbienteParco, Parco delle Colline, Fondazione CMCC (2020). Un Filo-Naturale. Una comunità che partecipa per trasformare la sfida del cambiamento climatico in opportunità. https://www.fondazionecariplo.it/static/upload/rel/relazione_stc_brescia.pdf

Comune di Mantova, Comune di Curtatone, Comune di Marmirolo, Comune di Porto Mantovano, Comune di San Giorgio Bigarello, Unione Colli Mantovani. Parco Regionale del Mincio, Alkémica (2020). ACE3T - CLIMA - Acqua, Calore ed Energia: 3 pilastri per la Transizione CLImatica del Mantovano. https://www.fondazionecariplo.it/static/upload/stc/stc-mantova.pdf

EC (European Commission) (2019). The European Green Deal. https://op.europa.eu/en/publication-detail/-/publication/762414e8-ee81-11eb-a71c-01aa75ed71a1/language-en

F2C - Fondazione Cariplo per il Clima (2020). Call for Ideas "Strategia Clima". https://www.fondazionecariplo.it/static/upload/cal/call-for-ideas-f2c-strategia-clima-.pdf

Gandy, M. (2022). Natura Urbana: ecological constellations in urban space. The MIT Press.

Howard, E. (1902). Garden cities of tomorrow. London: Faber and Faber.

IPCC (2023). Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland. Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/

AR6-9789291691647

Lynas, M., Houlton, B. Z., & Perry, S. (2021). Greater than 99% consensus on human caused climate change in the peer-reviewed scientific literature. Environmental Research Letters, 16(11), 114005. https://doi.org/10.1088/1748-9326/ac2966

Neidig, J., Anguelovski, I., Lliso, B., & Pascual, U. (2023). Pluralizing environmental values for urban planning: How to uncover the diversity of imaginaries about socio-natures from Vitoria-Gasteiz (Basque Country, Spain). People and Nature, 5, 1262–1283. https://doi.org/10.1002/pan3.10506

NextGenerationEU: for a stronger, more resilient Europe. NextGenerationEU. https://next-generation-eu.europa.eu/index_en

Osaka, S., Bellamy, R., Castree, N. (2021). Framing "nature-based" solutions to climate change. WIREs Climate Change 12, e729. https://doi.org/10.1002/wcc.729

PCM (Presidenza del Consiglio dei Ministri) (2021). Piano Nazionale di Ripresa e Resilienza (PNRR). https://www.italiadomani.gov.it/content/sogei-ng/it/it/home.html

Selada, C., Tomaz, E., & Cunha, I. (2011). Creative-based Strategies in Small and Medium-sized Cities: Guidelines for Local Authorities. Technical Action Plan develop by INTELI -Inteligência em Inovação, Centro de Inovação. 10.13140/RG.2.2.33945.63841.

SNPA (2024). Il clima in Italia nel 2023: Delibera del Consiglio SNPA n.250/24 del 02.07.2024, 2024. SNPA, S.l. OECD, European Commission (Eds.), 2020. Cities in the World: A New Perspective on Urbanisation, OECD Urban Studies. OECD Publishing, Paris. https://doi.org/10.1787/d0efcbda-en

Sowińska-Świerkosz, B., García, J. (2022). What are Nature-based solutions (NBS)? Setting core ideas for concept clarification. Nature-Based Solutions 2, 100009. https://doi.org/10.1016/j.nbsj.2022.100009

Swyngedouw, E. (1996). The city as a hybrid: On nature, society and cyborg urbanization. Capitalism Nature Socialism, 7(2): 65–80.

Tang, K.H.D. (2024). Urban Solutions to Climate Change: An Overview of Latest Progress. Academia Environmental Sciences and Sustainability 1. https://doi.org/10.20935/AcadEnvSci7342

Tononi M. (2025). Urban socionatures and climate strategies: the cases of three medium-sized cities in Northern Italy, in Bonati S., Cisani M., Tononi m:, Zanolin G., Critical Perspectives on Social Constructions of Nature Italy and the Bel Paese, Routledge London.

Urbano, J. (2016). The Cerdà Plan for the Expansion of Barcelona: A Model for Modern City Planning. Focus 12. https://doi.org/10.15368/focus.2016v12n1.2

WEF (World Economic Forum) (2025). Nature Positive: Financing the Transition in Cities, insight report, January 2025. https://reports.weforum.org/docs/WEF_Nature_Positive_Financing_the_Tranisition_in_Cities.pdf