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Counteracting Urban Heat Island Effects in a Global Climate Change Scenario



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Planning and Climate Change: Concepts, Approaches, Design

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Abstract Reflect on the present, on the dynamics and the conditions that built it, and look forward at the same time, in search of a prospect to improve the future. Since Howard (1850–1928) and Geddes (1854–1932), this has been the dominant logic supporting the work of all those (architects, urban planners, planners, landscape architects, etc.) who grappled with city and territorial management and planning. However, from the 1970s, territorial planning has been confronted with new concepts – such as sustainable development, environmental sustainability and social equity – and more recently, new challenges – such as the ones linked to climate change, which led to the need to redefine territorial planning in disciplinary and operational terms. For some years now, the planner’s new role is under discussion, especially in relation to the challenges posed by climate change. Sustainability, mitigation, adaptation, renewable energy, low-carbon transition, ecosystem approach and post-disaster planning are just some of the new keywords surrounding the discussion on territorial management and planning. This chapter aims to present rationally, what it means to re-organize and re-think the city, in a long-term perspective. It wants to show how it is possible, and above all is a duty to integrate the new concepts mentioned above in urban planning, to deal with the effects of climate change. The Urban Heat Islands contrast enters fully into the feasible experimentation with appropriate innovations in territorial planning. The paper draws attention to the Italian situation, in the light of the European reference framework.

Keywords Climate change • Adaptation • Policy • Urban heat islands • Urban planning & design

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Introduction

Climate change has undoubtedly emerged as a crucial issue since the beginning of the twenty-first century. According to IPCC predictions, the phenomena associated with climate variability will intensify in the coming decades (2007), and climate-related extreme events will constitute an increasing risk on a social and ecological level (2012). Over the past 20 years, the need to address the dynamics of climate change on an urban scale has been recognized at the institutional, academic and operational levels.

In this context, the challenges posed by the changing climate scenario require a redefinition of the urban and territorial planner's role, as well as revising the planner's skills and planning tools. In fact traditionally, planning has been based on the assumption that human activities are planned and implemented in an "unchanging" context, characterized by stable regional and environmental conditions. The compressed environmental dynamics set in motion by environmental change and – more generally – the social, economic and environmental impacts related to climatic phenomena that occur in urban settings, even under emergency conditions, require the adoption of a new perspective and new tools, able to increase the adaptive capacity of cities compared to changes to the city, which are partially generated by the cities themselves.

The relationship between climate change and cities is rather complex and some of the challenges that planners will have to face, especially in terms of mitigation and adaptation, can be identified with the effects of climate change. The contrast with the Urban Heat Islands (UHI) is one of the most obvious, intensified by global warming, which in the coming years will also have to be addressed structurally by urban and territorial planning.

Climate Change and the City: A Complex Relationship

From Sustainability to Climate Change: Towards a New Approach

With respect to when cities and territories were built, conditions are changing radically. Urban planning, as a discipline, was developed in the late nineteenth and early twentieth century, mainly as a response to the crisis of the times, related to hygienic needs, clean water, decent housing, open spaces, efficient transport systems and social welfare. During the twentieth century however, urban planning expanded to meet the emerging challenges of environmental protection, sustainable urban development and international cooperation (Wheeler 2010).

To speak today of sustainability, in planning or in relation to territorial dynamics, is not easy and requires attention. A first element to consider is the lack of consensus that exists with respect to the concept of "sustainable city". A second

consideration is related to the perception of sustainability, often viewed as an “abstract” goal, whose implementation is beset with difficulties. In addition, the perception of the city’s decline has encouraged the integration of urban planning, economy and ecology moving more and more towards an understanding of social, political and environmental sustainability disciplines (Musco 2008).

If with the signing of the New Aalborg Charter in 2004, European local governments made specific commitments ranging from urban planning to new ways of life, from the economy to urban upgrading, it is with the Leipzig Charter on Sustainable Cities and the EU’s Territorial Agenda (2007) that the strategies and principles for sustainable urban development policies in Europe were defined.

Nowadays, cities are facing a new crisis, which therefore requires a new perception of all the principles related to sustainability. Climate change goes beyond any previous human challenge, as it requires an integrated and dynamic approach.

Currently, the international scientific community recognizes climate change as a major challenge for the development and sustainability of the twenty-first century (UNDP 2005, 2010; OECD 2009; World Bank 2012; UN-Habitat 2011a, b), for the revitalization of urban areas, and it recognizes two main aspects: (i) the difficulty of reaching a shared consensus for the reduction of greenhouse gas emissions (GHG) in international negotiations and (ii) the growing international consensus on the urgent need to build strategies to adapt to climate change on a national, regional and local level (Musco and Magni 2014).

For this reason, during the last decade, urban areas have become central to the international debate on climate issues. The new geography of contemporary urbanization in fact identifies urban areas as a key element in the processes of globalization and transition to new land occupation models worldwide (Seto et al. 2010). Therefore, today as in the past, if the task of planning is to reduce the risks and negative externalities and help provide answers to the concerns and aspirations that people express with respect to their living environment, it is necessary to step back and critically reflect on the concepts that underlie the planning and reformulate them in the light of new urban scenarios.

Mitigation and Adaptation in the European Agenda

The debate on climate change, supported by empirical evidence brought by the Stern Review (Carraro 2009), followed by regular reports from the IPCC (2007, 2013), the EU report on temperature increases and the EEA’s (2012) report on “Urban adaptation to climate change” in Europe, has become increasingly important within the urban issues. Climate protection can be generally defined as a set of indirect policies for adaptation and mitigation aimed at reducing the impact of climate change on natural and anthropized systems to the reduction of environmental externalities that may favour the climate changes in the medium and long term (Musco 2009). This combined approach of policies to mitigate and adapt acquires a strategic value, since it allows different management levels, multiple policy areas

and a number of actors to be held together, both in terms of top-down and bottom-up.

State of the art “climate protection planning” in Europe is far from consistent. Each country is characterized by a national indication (national mitigation and/or adaptation plans and strategies), and the presence of local initiatives in terms of climate plans and local authority tools or networks. The latter’s status varies widely from case to case and only a few local authorities have introduced adaptation, mitigation and energy efficiency strategies in the existing territorial planning systems.

Although a growing part of the scientific community (Betsill and Bulkeley 2006; Biesbroek et al. 2009; Musco 2010), together with international institutions’ research and policies (IPCC; EEA; EU White Paper, EC), recognizes the role that territorial planning can play in addressing both the causes and consequences of climate change, the explicit translation of CC-problems into territorial policy measures and actual management is far from being reached.

In 2006 the publication of the Green Paper on Energy, “An European Strategy for Sustainable, Competitive and Secure Energy” raised the issue of energy efficiency and exploitation of renewable energy sources. This tool was followed in 2007 by the proposal of an action plan for energy efficiency (2007–2012) and a SET Plan (Strategic Energy Technology Plan). With the so-called Climate and Energy package, the EU has finally set a solid and binding goal for the member countries: 20 % reduction in their greenhouse gas emissions (measured in CO₂ equivalent) by 2020 compared to 1990 levels, reduction in energy consumption by 20 % compared to a “business as usual” scenario and production of energy from renewable sources accounting for 20 % of final energy consumption. 2020 is not however a suitable timeframe for the resolution of problems related to the impacts of climate change. For this reason, the European Commission has already begun to explore the different scenarios ahead for post-2020. With the communication of 8th March 2011 (“A Roadmap for moving to a competitive low carbon economy in 2050”), the Commission states that this transition goes through stages involving a reduction of greenhouse gas emissions by 25 % by 2020, 40 % by 2030, 60 % by 2040 and 80 % by 2050 compared with 1990, thus surpassing the target set by the same package.

Although the implementation of policies and action plans is highly dependent on the national context and the various modes of urban governance, there are an increasing amount of experiences, programmes and projects that connect directly the local level, for the European Community, to the creation of new networks (Covenant of Mayors, GRaBS) or are based on already existing relations (Agenda 21, ICLEI, C40).

On this basis, local, regional and sometimes national authorities have begun to define, in many cases on an experimental basis, a series of plans aimed at protecting the areas from the effects of climate change.

Towards Urban Adaptation

Adapting to CC can be considered a “new” theme on the planning stage. The need to address the CC from a point of view of adaptation and not just of mitigation represents a substantial leap in scale, from a global logic for mitigation, to an urban and strongly localized one for adaptation. Adaptation is an urban and local issue, since it is very specifically the cities and the people that must find their “way” to adapt to the effects of CC that impact them and there are no appropriate policies and adaptive measures that are suitable to be applied anytime and in all contexts. Adaptation is a complex mechanism that is based primarily on the geomorphologic specificities of the place and the local community that lives in it with its customs and traditions, but the economy, infrastructure and flows that characterize it must necessarily also be taken into account. Adaptation is therefore primarily a spatial, territorial concept, which cannot forcefully enter as a new standard in the elaboration of the theories and tools of the plan and the project of urban and territorial planning.

The need to face CC at an urban scale can be attributed to diverse considerations, that should be addressed in an integrative way. First, as partially highlighted in the previous section, CC became an issue in urban agendas in response to the necessity to face urban vulnerability, defined as “the degree to which people, places, institutions and sectors are susceptible to, and unable to cope with, climate change impacts and hazards” (UN-HABITAT 2014). The higher vulnerability of urban contexts can be attributed to a series of factors, such as “their heavy reliance on interconnected networked infrastructure, high population density, large numbers of poor and elderly people and major concentration of material and cultural assets” (Carter et al. 2015: 4, see also EEA 2010). With this respect, a further consideration concerns climate change and risk perception: also due to the factors mentioned above, the impacts of climate change are mainly experienced at a urban and local scale. Secondly, the emergence of urban CC issues is related to the need to limit the urban drivers that cause pollution. Currently, cities are the main producers of greenhouse gases, and this incidence will steadily increase with the growing urbanization trend (UN 2008).

At the conceptual level, adaptation would adopt an integrated theoretical framework capable of integrating Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) also considering their relevance for urban planning.

A New Role for Planning

The marginalization of territorial and urban planning in recent years has become an objective and consolidated fact. The reasons for this have been identified in the inability to understand how the city and the territory in general were changing (yesterday and today), in the progressive loss of a complex design idea in which space and society, physical and socio-economical dimensions, general concepts and specific action plans, interactions between scales and times interact constantly

(Gasparrini 2015; La Cecla 2015; Benevolo 2012). Considering the above, planning can and must (re-) play an important role by sharing the challenges established by CC, by ecological issues, the geo-strategic and environmental re-appropriation of our territories and our cities. The spread of environmental issues and CC can reshape planning discipline by focusing on water, soil, energy, waste, accessibility/mobility, but also on concepts such as blue and green infrastructures, recovery and regeneration of marginal areas (*vague terrains*), the densely populated and widespread city. In addition, the issues of recovery and regeneration through environmental and ecological networks are closely linked to security (ANCE/CRESME 2012), which opens a new and important line of research and design on “post-disaster planning”. The many risks, as well as their dynamic and cumulative interaction, require planning strategies guided by adaptive logic in order to rethink the space we live in structurally and not limit ourselves to making buildings “safe”.

What territorial and urban planning must do is be more attentive to the physical and social realities of the places, going further than just looking at the individual events and embracing the extreme complexity of each territory and city. Planning must be more attentive to the spatial project to recognize the peculiarities and opportunities and to ensure not only quality urban landscapes, but also externalities and interdependencies that only efficient and safe cities and territories can provide (Gasparrini 2015). The great environmental and spatial challenges posed by CC require visions and relations on a super-local and a place-specific scale at the same time: a continuous multi-scale attitude that links resilience and recovery tactics and strategies. It seems obvious that all these issues require a rethinking of the shape and use of the territory and the city through the integrated enhancement of environmental components, to counter the effects of the CC and at the same time to rethink the contemporary city by looking for a sustainable balance.

New Concepts

Adaptation to climate change, broadly defined by the IPCC in 2007, and subsequently analysed in its various meanings in a lot of literature can be divided into different types: (i) anticipatory, (ii) autonomous and (iii) planned. These three different aspects of the concept and adaptation strategies support a number of new slogans and tools that fill the discussion on territorial management and planning. If in recent decades, the concept of “sustainability” has become a key element of territorial urban development, and “adaptation” aims at laying the foundations for durability through specific strategies, measures and actions. Given the difficulty in predicting the change of climatic parameters on different scales and different natural and anthropic components, adaptation strategies must be regulated by seeking not just to ensure the system’s functionality but also to take advantage of opportunities that may arise from the change. For this reason, in recent years, headway is being made in the idea of using an “ecosystem approach” (Grumbine 1994; Christensen et al. 1996 Millennium Ecosystem Assessment, 2005) to mitigate and

adapt to climate change and its effects (Doswald and Osti 2011; Naumann et al. 2011).

The ecosystem approach concept is a way of thinking and acting in a science-based, ecological way, integrating the biological, social and economic conditions to achieve a socially and scientifically acceptable balance between the priorities of nature conservation, the use of resources and the division of benefits (sustainability). This approach attempts to remove the barriers between human economy, social aspirations and the natural environment, placing humans within the ecosystem models and aspiring to maintain the ecosystem's natural structures and functions, taking into consideration the emerging properties from the interaction of these systems. Given the holistic view, which sees man as an integral part of the natural system, and the aspiration to integrate policies and measures that affect the system, the use of this approach is proving to be a promising strategy to increase resilience of the cities and territories in response to growing pressures. In this perspective, the use of renewable energy sources and low-carbon transition does not just take on a role in mitigative strategies for reducing CO₂ emissions, but become key tools in adaptation strategies that follow an ecosystem approach. The measures and actions that are being taken at a territorial level from an adaptive viewpoint following an ecosystem approach are manifold. Examples of these are the planning and use of blue and green infrastructures, river corridors, overflow basins for storage of rain and river water, containment tanks for the management of river floods, becoming more frequent due to the change in extreme rainfall patterns, living roofs and reconstruction of ecological corridors.

In this perspective, a reflection should be done about the importance of defining adaptation plans totally integrated with mitigation strategies, as well as about the urgent need to provide cities with management and planning strategies to be adopted after extreme climate events (such as draughts, floods and urban heat waves).

In fact if mitigations reduce the causes affecting climate, adaptation plans are aimed at reducing the future vulnerability on cities and built environment, thus at anticipating the adverse effects of climate change and at reducing potential damages deriving from it. At the same, if potential impacts are not more avoidable, *post-disaster planning* and management seek to define long-term recovery strategies, and ultimately to transform cities in more sustainable and resilient places, also through the direct involvement of local communities.

Re-shaping cities in ways that enable to enhance their adaptive capacity does not mean to bring them back to the way in which they were before the change and/or the disaster, nor to modify their deepest nature and *raison d'être*. Redefining urban patterns in this contexts means to take the opportunities that are hidden behind the change and use them to rethink a more secure, sustainable and resilient future. For the development and implementation of adaptation and mitigation including post-disaster recovery strategies, cities must be considered in their complexity, and all their dimensions (spatial, geographical, environmental, social, economic and cultural) must be addressed.

The adoption of measures and adaptation actions should not, however, be a short- and medium-term response to the negative effects of climate change, but become

part of a routine planning that recognizes in dynamic, changeable and resilient nature, a model to follow.

Controlling the effects of Urban Heat Islands is fully embedded in a new resilient planning aimed at reducing the impact of temperature change.

Conclusions: Building Urban Adaptation – The Main Role of Planners

The dynamics of climate change require a thorough review, not only of the approaches but also, at the same time, of the Territorial Governance tools. Operating within a Climate Proof scenario, territorial planning will have to be able to identify territorial vulnerabilities and implement effective measures designed around the territorial characteristics of the vulnerable area. The local effectiveness of the adaptation action identified is not just attributable to its design but also to the forms under which it is implemented.

Planning on all scales has so far only partially considered regulation of the relationship between climate, urban vulnerability and territorial planning, leaving room for activities and/or projects of a voluntary nature. The growing attention to these processes, however, has not yet led to suitable policy responses. It is more than ever evident that “climate protection” presents rather disjointed situations with cases in which adaptation plans and strategies have been introduced, and, on the other hand, realities where the risks and impacts are still undervalued despite the relevance of the phenomena in progress. In most Italian urban contexts, the impact of a changing climate is still just relegated to the civil protection. The main reasons can be traced to a shared lack of public awareness on climate variability and its territorial impact, to a slow response to extreme weather conditions due to lack of preparation and resources and a lack of public policies and regulations relating to urban and environmental planning designed to manage climate change.

It seems evident that adaptation, although by its nature being developed locally, needs to be supported by processes to integrate the different project and planning scales closely related to mitigation policies and efficiency of the urban scale.

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