



Climate change adaptation in Europe and the United States: A comparative approach to urban green spaces in Bilbao and New York City



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ABSTRACT

Climate change adaptation policies in the United States and Europe have common aims but a different initial focus. While in the United States the principal factor when establishing adaptation plans and programs is based on risk control, the criterion in most European countries is directly linked to strategies of urban regeneration and sustainability. In both cases, cities are taking up the initiative to define adaptation strategies without waiting for state legislative acts. This article focuses on analysis of the ability of Urban Green Spaces to promote adaptation to climate change for both risk control and as an urban regeneration resource. With the analysis of two urban regeneration cases studied in zones affected by climate change, Red Hook in New York and Zorrotzaurre in Bilbao, the adaptation policies in the United States and Europe are studied. These cases allow a focus on how cities' capacities to establish initiatives for specific adaptation measures include Urban Green Spaces. Final conclusions reveal that, according to the extreme events expected, location and composition of Urban Green Spaces is key in the adaptive strategy of cities facing climate change.

1. Introduction

The scientific evidence about global warming has prompted cities, in Europe and the United States (USA), to establish measures to control greenhouse gases (GHG) (Krause, 2011; Reckien et al., 2014). Urban sustainability strategies and measures for mitigation have together started to form part of the development of proposals for urban rehabilitation. However, the variability of events directly associated with climate change implies the development of a more complex view. The perturbations of climate due to the increase in global average temperatures will generate risks that up to now have not been common in urban zones (Pelling, 2011; Revi et al., 2014). Therefore, along with urban rehabilitation proposals based on sustainability criteria and strategies for reduction of GHGs, cities must incorporate long-term measures in order to adapt to climate change. Non-intervention in the face of the variability of future climate events will increase the costs of repair to levels that could affect local or national economies (Stern, 2007; Wang et al., 2015). It seems reasonable, therefore, to consider the necessity of incorporating flexible adaptation legislation from an initial approximation of the risks (Fankhauser and Soare, 2013; Solecki and Rosenzweig, 2014), in which urban planning appears to be the most suitable tool to manage this phenomenon.

Urban Green Spaces (UGS) are open spaces with surfaces that are at least 50% permeable and include public parks, gardens, or open spaces exclusively used by pedestrians (Gobierno de España, 2012). Local authorities have usually managed them from an integrated viewpoint, incorporating socioeconomic and environmental aspects (Fryd et al., 2011; Pauleit et al., 2011). The planning of green spaces in urban areas faces a new as yet unexplored aspect, namely, incorporating the effects that may be produced due to climate change, in which the urban adaptation strategies become inherent means of planning itself (Matthews et al., 2015). In addition to the difficulties in monitoring and maintaining our urban parks and green open spaces, there is a complexity in the process of integrating adaptation measures to face the effects of climate change (Foster et al., 2011; Demuzere et al., 2014; Jones and Somper, 2014). The strategies for usage of UGS in the context of climate change have had two basic aims: on the one hand, strategies seek to improve the urban environment in order to increase the degree of urban adaptation to expected climatic variability (Carter et al., 2015); on the other hand, UGS strategies also attempt to reduce the losses in value of properties and city infrastructures as UGS have lower costs of repair compared with other infrastructures and assets (Foster et al., 2011). The objective of this article is to analyze, from an urban planning approach, the value of urban green spaces in climate change adaptation strategies.

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2. Risk control vs. sustainability: two different approaches to the same question

In Europe, with the approval of the *European Strategy on Adaptation* (ESA), urban policies include green spaces as an essential resource in urban planning against climate change impacts (European Commission, 2013). The ESA attempts to harmonize urban policies for adaptation to climate change in the member states, although many cities had already established initiatives to carry out adaptation actions prior to ESA (EEA, 2016, p. 37). The incorporation of adaptation in European city planning is nowadays complex. The legislation on urban planning is based on traditional strategies in which the term climate change adaptation does not even exist. This concept appears on the Environmental Impact Assessment (EU, 2014), where UGS is a main topic related to climate change but not yet in an urban planning context.

At national scale, in the United States, climate policy has not yet addressed urban environments with specific adaptation actions. From the *President's Climate Action* (EOP, 2013) to the *U.S. Climate Action Report* (U.S. Department of State, 2014), all documents focus on risk management (Hughes, 2015), although different urban sustainability criteria are partially introduced. Some of them refer to the importance of changes that may take place in land use and to the management of urban planning, which is decisive in the application of good adaptive practices, for example, the management of vegetation to reduce heat in cities.

From the analysis of their official strategies, it can be deduced that the ESA, in Europe, focuses more on policies of urban regeneration and sustainability while in the USA there is an emphasis on risk control (in fact, Hazard Mitigation Plans are mandatory for municipalities around the country). The lack of specification of the adaptation strategies at the urban level, and especially in relation to UGS, obliges the cities to take initiative in adaptation actions (Heidrich et al., 2016). However, the essential economic support from the state for these local actions requires an evaluation of their efficacy. In both cases, assessment is necessary through indicators verifying the effectiveness of their policies (European Commission, 2013; U.S. Department of State, 2014; Solecki et al., 2015; Kallalos et al., 2015). The follow-up of the impact becomes a priority rather than the evaluation of the efficacy of the urban adaptation measures (European Commission, 2013, p. 10). The European proposal is based on the long tradition of sustainability indicators while the USA policy proposes that the evaluation system focused on risks should reach multiple geographic levels of use (Janetos et al., 2012). The European and North American experience provide valuable knowledge about urban sustainability indicators and parameters, as well as control values for the emissions of GHGs. However, there is a lack of evidences related to the definition of guiding values about specific adaptation actions that enable their effectiveness assessment.

The level of interaction between regional policies and urban adaptation strategies varies notably at the regional scale. Among the climate change policies deriving from the EU Strategy of Adaptation, the Spanish case is of particular interest, as the regional administrations (*Autonomous Communities*) are responsible for legislation on urban and regional planning. Therefore, the cities must adjust their urban planning to the decisions established in the regional scale. Under the umbrella of the *National Climate Change Adaptation Plan* (PNACC) (Gobierno de España, 2006), the regional administrations have developed adaptation plans which rarely contemplate urban considerations (García, 2016).

The lack of response from the Spanish regional administrations does not impede the development of Local-level Adaptation Plans. These kinds of plans proposed since 2008 by the Spanish Network of Cities for Climate (RECC, 2008; FEMP, 2015), have not been incorporated by the municipal authorities either. The importance of the regions in adaptive management of the cities is relative, since the administrative framework within which they develop their strategies obliges an

understanding of each other. Therefore, adaptive management should be carried out at all levels of governance (Galarraga et al., 2009). The Spanish experience demonstrates that cities take advantage of the financial resources of the EU to carry out adaptive actions coordinated in urban sectors through development planning tools such as the “master plans” (incorporating UGS as an adaptive strategy).

In contrast to the Spanish case in which the regional administrations do not contemplate specific actions for cities, New York State's response is more integrating, although it does not differ greatly from the USA national strategy focused on risk control. The NY Energy Research and Development Authority (Rosenzweig et al., 2011) identified main risk factors and established a systematic evaluation of adaptation measures. At the same time, in the urban resilience context, the *Open Space Conservation Plan* (2009 and 2016) already contemplated urban heat islands and rising sea levels as risk factors, highlighting the importance of green areas in greater urban adaptation: “Increasing open space in urban areas lends itself to not only diversifying the landscape but has an element of addressing issues related to climate change” (NYS, 2016, p. 296).

In both cases, USA and Spain, the regional management is mainly focused on risk control and the definition of adaptive strategies and not on specific actions for cities. However, regional policies highlight the importance of green zones as an urban adaptation measure. Although in Spain the regional administrations have greater management capacity in terms of defining specific legislation that affects cities, the counties are very limited in this facet of urban intervention and are mainly focusing on the exclusive definition and localization of risks. In any case, the management of adaptive action in the urban context is dependent on the municipal coordination, where, as we will see, UGS acquire greater relevance as a resource in adaptive strategies.

3. A comparative analysis –methodology and objectives

To build a better understanding of the capacity of UGS as resources to counteract climate change risks, it is necessary to go down to the regional and urban scales. In these scales the paper contemplates two main objectives: to identify the level of interaction between regional and local policies and to check the capacity of adaptation of the urban green spaces.

First, in the aim of verifying the level of interaction between regional policies and the urban ones the research has focused on those regions where three principal climatic risks are anticipated: 1) flooding provoked by stormy climatic events; 2) flooding derived from the increase in sea level; 3) urban heat islands caused by extreme temperature rise. The case studies in Spain and New York selected for the present analysis allow for comparisons on these different factors on both sides of the Atlantic Ocean. A review of the plans for adaptation and risk assessment at regional and local levels examines the role of UGS in the planning policies in both cases.

Second aim of this paper focuses on the identification of the most significant adaptation strategies that use green spaces as elements for greater urban resilience. To do so, the study has identified the cases of Bilbao and New York, and specifically the neighborhoods of Zorrotzaurre and Red Hook as examples whose adaptation plans integrate strategies that incorporate open spaces. The similarity of the starting conditions of the cases, in terms of their exposure to climate change-related risks and urban characteristics, permits a comparative analysis and the extraction of specific variables related to their green spaces. Addressing the requirement to identify possible urban adaptation indicators, this work proposes the analysis of study areas that incorporate UGS in their adaptive planning and verification of the role UGS play in the increase of urban resilience in those areas. The spatial characteristics of the two neighborhoods have been analyzed by Geographical Information Systems (GIS). For the analysis of the Red Hook neighborhood, we have used metadata extracted from the ZOLA and OASIS applications provided by the City of New York. In the

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