Peri-Urban Ecosystem Services in Europe

The phenomenon of urbanization affecting our era has seen the shift of the city from compact and well-defined structures to agglomerations with a seamless expansion. This has led to several environmental consequences that have affected the urbanized areas and the surroundings. The peri-urban areas may be the main urban design and planning challenge of the 21st century. These hybrid landscapes, characterized by high fragmentation, can be turned into opportunities to improve the sustainability and quality of urban areas, generating multiple economic, social and environmental benefits. Areas beyond the immediate urban core can be considered a zone of influence, which represent a critical resource in terms of provisioning, regulating, supporting services and cultural ecosystem services.

1. Introduction

Cities are increasingly in a process of transformation from well-defined agglomerations towards disordered and shapeless structures [1]. This urbanization process leads to environmental consequences in the cities and in their surroundings. In our research, we focused on the peri-urban landscape, the space around urban areas which merges into the rural landscape. Since they have high potential, these areas may be considered as one of the planning challenges of the 21st century.

Traditionally, peri-urban space has been seen as a separation between urbanized areas and indefinite places, between city and countryside. Several studies have attempted to overcome these interpretations, capturing their potential to implement processes which contribute to urban sustainability transitions, offering an opportunity to invest in environmental safety, the improvement of ecological performance and the urban environment, also in terms of the quality of public space and in the economic dimension. Urban sustainable transition researchers have raised the issue on how to deal with the ecosystem services in consolidated city and in its suburbs, "where the city is no longer a city and the countryside is not yet countryside" [2].

Peri-urban landscapes can be seen as a spatial and figurative broken network, characterised by fragmentation, lack of urban and ecologic continuity, hybrid (not-rural, not-urban) environments, thus lacking identity.

Urban hybridization involves the contamination of territories (urban–rural) with their own identity [3]. It implies the coexistence and intermingling functions in a specific area. According to Ellin [4] and Zanni [5], the development of these areas is an integral part of contemporary societal growth and is linked to the rapid transformation of patterns in the urban fabric.

Hybrid spaces are critical resources for the economy of a city, as they constitute the drivers of spatial, social and public changes [6].

Jencks [7] argues that the postmodernist science of complexity has influenced the development of multifunctional, hybrid urban spaces. Zanni [5] highlights that urban hybridization is determined by the multi-layered and multi-scaled urban fabric.

However, areas beyond the immediate urban core can be considered as zones of influence which represent critical resources both in terms of provisioning, regulating and supporting services and habitat ecosystem services. Peri-urban landscapes include different types of ecosystems that are able to deliver a diverse set of services. They provide to the urban core water and climate-related regulating services, such as air filtration, cooling and ventilation [8][9], which are necessary elements to mitigate the effects of climate change. These areas beyond urban areas are part of larger ecological networks for biodiversity and green infrastructure [10][11][12]. The provision of food represents the major ecosystem service [13], as agriculture represents the prevalent land use. From a cultural viewpoint, these landscapes are

seen as important areas for citizens' outdoor recreation [14][15]. These areas, mainly woodlands, fringe forests, country and agricultural parks and green open spaces that offer the user multifunctional recreation possibilities and different kind of nature [16].

The ecosystem services definition has been developed in Millennium Ecosystem Assessment [17], but there are still uncertainties related to this concept, as well as conceptual fuzziness and social controversies [18][19][20]. Therefore, it has been identified as a "boundary object" [21][22]: strong enough to link different points of view and values within a scientific community while remaining a nuanced concept capable of maintaining participants' identities.

Research on urban ecosystem services has been proliferating and new developments in this field of research are evident, but little attention has been devoted to the peri-urban space. Internationally debated, the concept of Landscape Urbanism [23] is gaining ground with the idea of interpreting the city as a "living organism", applying the same principles of the biological world towards an ideal model a of "metropolis landscape". It is based on the widely recognised principles of sustainability, sharing and resilience. At present, the condition of our cities is characterized by a high demand for resources (energy, water, raw materials, food, soils), which are the main inputs deriving from the territories and by the urban outputs that are poured into them (waste, emissions, consumption, various externalities). It is critical to balance this exchange of inputs and outputs between territories in urban fringe and cities to produce goods and services (input) and to absorb anthropogenic actions (output) with a focus on sustainable development.

The purpose of this article is to provide an overview of peri-urban ecosystem services in European countries, in order to contribute to the debate on how to promote resilience and sustainability as their main assets. We first discuss the peri-urban landscape that hosts a mixture of ecosystem functions and supports new urban configurations. Our research considers the peri-urban landscape as a privileged key to interpreting hybrid spaces, still poorly understood by the planning culture, in which regeneration drives the enhancement of rural areas.

To synthesize the latest advances in the research, a systematic review of recent literature on peri-urban ecosystem services was conducted to identify current research trends. A semi-automated content analysis using a text-mining tool called Leximancer has been adopted on studies published in Scopus-indexed journals. While text analysis is not a new field in the academic community, automated content analysis is gaining ground because of its advantages in information processing for literature synthesis purposes. It provides instrumental assistance to analyse a large amount of textual data in the context of increasingly digitized information, providing a framework to critically investigate the existing literature or highlight issues that are relevant in a field of study.

2. Urban Growth and the Implications on Peri-Urban Landscapes

Continued and rapid urbanization influences people's quality of life since it limits the availability of green space and vegetation. The more that cities expand and become more dense, the more that ecosystem services provided by open public spaces are important for local residents in terms of public health, well-being, provisioning services and resilience [24][25]. This expanded model has been defined by the international literature as sprawl in Italy, a "widespread city" [26], a form of "frayed urbanism" [21] and a dispersed territory that produces a rarefied metropolis in dissolution. Sprawl, which manifests itself in peripheral areas in the form of urban dispersion resulting from the rapid and disordered growth of cities, has also made the definition of periphery complex. The growth of the urban system has led to a peri-urban landscape characterised by patches of buildings with small tracts of natural or semi-natural habitat (e.g., forest patches, parks). Peri-urban zones grow outwards into the rural hinterlands and become increasingly multifunctional, changing the way in which land is used and consumed [27][28]. Peri-urban landscape reading shows a high presence of areas characterised by fragmentation, lack of urban and ecologic continuity and dispersion of a sense of place [29]. The boundaries that delimit the compact neighbourhoods are generally very poorly defined and usually coincide with the morphological characteristics of a territory [30]. In other cases, the borders coincide with infrastructure such as railways, highways, artificial dams and other boundaries. Finally, internal boundaries are often determined by social characteristics of historical or contemporary settlements. Peri-urban areas will, over time, become embedded in cities and therefore their landscapes should be seen as a functional extension of the city rather than peripheral, spatially fringe land. Such zones are often defined as residual or marginal areas and—not being seen as integral parts of our cities—their social, cultural and ecological potential is undervalued [31]. In ecological terms, such spaces need to be seen as networks and green corridors, the outcome of organising the remaining free areas. [32]. As such, they constitute a significant reserve for biodiversity. Today, peri-urban areas consist of a frayed and unstable settlements, with patches of marginal green parcels bordered by infrastructure and constructions that are completely external to rural activities, with a significant environmental impact [33]. Urban growth in Europe, especially in the south and in most Mediterranean areas, as in Italy, is characterized by "horizontal expansion", which has led to a reduction of available land. According to the most recent data [34], the sealed soil increases by 57

million square meters per year, i.e., two square meters per second. This phenomenon has created unprecedented growth of new hybrid landscapes [3], characterised by the persistence of vast agricultural and natural areas within the metropolitan perimeters. A discontinuous, anonymous and endless city [35] continues to sprawl far beyond the boundaries of the large suburbs built since the second half of the twentieth century. Peri-urban areas can be seen as a patchwork of landscapes, encompassing not only the areas surrounding the city, but also the historic centre, the consolidated districts of the public city, the large infrastructure, agricultural areas and fringe greenhouses. This phenomenon has been generated by the dynamics of divestment, abandonment, reuse and contamination, constantly mixing materials, relationships and different social actors in chaotic directions [36]. The "horizontal city" [27] and the urban dispersion that it generates, in particular in the South of Europe, represents an emergency which can only be addressed by experimenting with innovative, interpretative and operational approaches. Most buildings, infrastructures and "recyclable" open spaces are concentrated within the "horizontal" urban settlements of recent construction.

Therefore, contemporary metropolitan reality has been defined in several ways: "megistopolis" (Gottmann), "in (d)efinite city" (Krstic), "soft city" (Raban), "global city" (Sassen) and "exopolis" (Sorking) [37][38][39][40][41]. In an attempt to synthesize the characteristics of some metropolises or of sprawl, "no town" and "slurb" have been used to refer to the physical diffusion process, and "patchwork" (Neutelings), "urban island" (Ungers) and "hyperville" (Corboz) [42][43][44] have been used to replace terms such as suburb or banlieu.

Urban voids and abandoned spaces can be transformed into opportunities through their reuse, thereby improving urban quality with multiple economic, environmental and social advantages. Emerging opportunities for urban resilience planning and design can be achieved through the reduction of risks linked to climate change and floods, the improvement of water quality and other ecological and ecosystem benefits, together with the advantages deriving from urban agriculture, such as production and access to food. Improving the future quality of life in cities is strictly linked to rethinking peri-urban areas in urban planning.

In these belt contexts of European cities, attention is focused on land stocks [45], which can be understood as those residual areas or those voids capable of constituting a "deposit" of territory or a "reserve", in the sense that Clément attributes to them, that is, unexploited places that constitute a refuge for diversity [46], or as waste landscapes, theorized by Berger, in the sense of spaces left behind by development, left without destination, residues of a rapid process of urban transformation [47]. From a theoretical point of view, various contributions such as the *Manifesto of the Third Landscape* [48] affirms the biological potential of these urban spaces that are not built and abandoned or left uncultivated. The storage of these areas has enormous potential in providing ecosystem services of immediate availability, dictated by their proximity to cities. They play an important role in the metabolic logic by providing material and immaterial resources, capacity to absorb and contain urban externalities and limits to further urban expansions and resources to face climate changes challenges. These areas, if appropriately reconnected within integrated visions and strategies, are ideal for the urban transition towards greater criteria of sustainability and resilience. Gilles Clément [48], in his essay, refers to the ecological potential expressed by *friches*, residual and uncultivated territories (*délaissé*) abandoned by human activities or never exploited but which are fundamental for the conservation of biological diversity. This perspective goes beyond the contents of the European Landscape Convention, a highly innovative document when compared to the landscape and environmental policies of recent decades. It focuses on residual open spaces devoid of identity and does not limit itself to dignifying to those "ordinary" landscapes or conceiving such safeguarding policies as conservation and maintenance of the significant or characteristic aspects of a landscape.

"Starting from what remains" [22] is the basis on which to build a project idea of the landscape and the periphery in order to use its existing resources with a single strategy and vision, taking into account climate change, environmental and social emergencies and placing the active involvement of local communities and citizens at the centre of urban regeneration projects.

Landscape is the emergent theme and the predominant strategy to face the environmental and social emergencies of our cities. New challenges have emerged for the protection and safeguarding of such an important element as the landscape in terms of the heritage that interacts with community and individual life, climate change, the depletion of natural resources and the conflict between globalization and local development. It often surpasses national boundaries and creates the need for global response in the EU's urban strategy. It can be interpreted as a result of the general process of urban reorganization, that underlines the limits of a dualistic approach to territorial "metropolization", de-coupling form from functions. Some cities in Europe have developed urban transformation strategies that place the landscape as the fulcrum of vital processes of urban transformation to generate a new quality of life for the inhabitants. This role has been recognized by the European Landscape Convention [49], according to which landscape is an essential component in cultural, ecological, environmental and social fields as well as for individual and social well-being and quality of life.

Similarly, the Convention recognises that landscape is an indispensable asset, favourable to economic activities and economic growth.

Fragmented open spaces are therefore places to experiment with participatory practices, with the active involvement of the communities of inhabitants in the process of re-appropriation of the space. Valorising the peri-urban landscape is a resource for society and an economic opportunity. The residuals within the urban and peri-urban spaces can play a fundamental role to improve the quality of the city life. Promoting new functions and public services in these areas, protecting the remaining signs of the cultural and natural heritage, "rediscovering" these places and taking them out of the margins.

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