ECOLOGICALLY-COMPATIBLE URBAN PLANNING

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Designing a Healthier Environment

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INVESTOR IN PEOPLE

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ABOUT THE AUTHOR: A NOTE FROM STEFANO SALATA

Born in Grado (Italy) in 1983, I was awarded a PhD in Territorial Government and Urban Design in March 2014 (XXVI Cycle) at the Department of Architecture and Urban Studies (DAStU), Politecnico di Milano. I have a bachelor's degree in Urban and Territorial Planning (2006) from the Urban Planning Faculty (IUAV – Venice) and a master's degree in Urban Planning and Territorial Policies (2008) from the School of Architecture, Politecnico di Milano. I am a Research Technologist in the Interuniversity Department of Regional and Urban Studies and Planning, Politecnico di Torino, and I have participated in the European project *LIFE+Soil Administration Models for Community Profit (SAM4CP)* with the same department.

Since 2009, my research activity as a member of the National Research Centre on Land Take – Italy (CRCS) has focused on land use change analysis and its environmental effects. In 2014, I joined the Ecosystem Service Partnership (ESP), and I have been selected to co-host thematic sessions at the European and World ESP conferences. I am co-editor of many Italian national reports on land take (2010, 2012, 2014, 2016, 2017 and 2018) of CRCS and co-author of the chapter *Policy and good practices* in the book *Urban Expansion,*

Land Cover and Soil Ecosystem Services edited by Ciro Gardi (Routledge), as well as many international publications on ecosystem services mapping and their utilisation for urban planning and territorial policies.

During my bachelor degree, I learnt the fundamental theories of the urban planning discipline: the economic, environmental and societal challenges of newly emerging territorial issues were explored and analysed within a multi-disciplinary approach. My interest was mostly focused on analysing environmental issues, among others, as the most challenging for territorial policies. Subsequently, in Milan, I put into practice the previously acquired theoretical background, and during my master's degree I was able to gain some academic experience participating in a range of collaborative research projects related to Urban and Territorial Design Plans. On graduating, the Politecnico di Milano offered me a period of research training on land use planning activities, and I also continued to participate in many academic collaborations. At the same time, I started a professional career as an urban and territorial analyst.

Since 2009, my research activity has been focused on land take assessment through land use change analysis in post-metropolitan urban regions at different levels (using European, national, regional and local datasets, applying both the statistical differences approach or cross tabulation analysis). From 2011 to 2014, I completed my education with a PhD in Territorial Government and Urban Design. The PhD thesis pointed out the topics that were to characterise my research activity:

- The growth of urban areas is not only happening to the compact city, and thus land use change analysis should be expanded to large-scale datasets.

- Urban forms are multiple and of different characteristics, thus data are not always reliable for some kinds of urban dynamics such as the sprinkling morphology.
- The effects of land use change are not only related to the phenomenon of 'urbanisation', therefore it is necessary to identify all possible land use changes and their effects rather than just those referred to as 'expansion' in agricultural or natural zones.
- The environmental impact of land use change needs to be assessed with composite indicators that apply the ecosystem services (ES) approach as a proxy for the Natural Capital state and its pressures under different land use scenarios.

During my PhD, I discovered the debate (theoretical and practical) around ES. As a planner by training, I was fascinated by ES modelling as a powerful tool to understand the spatial distribution of environmental values. Nonetheless, soon the problem of the spatial interpretation of statistical data (biophysical values) became relevant to my research. With the help of my PhD thesis supervisor (Prof. Ciro Gardi), I tried to find practical solutions to using ES for planning purposes. At the core of the ES approach, there is the awareness of preserving Natural Capital value as one of the fundamentals for social health and well-being, which nowadays is a key issue of spatial design for green infrastructures (GIs). As a senior Post-doctorate Researcher at the LIFE+ SAM4CP research project (Politecnico di Torino), I had the opportunity to work on ES mapping for land use regulation purposes at the local level, discovering new techniques and tools for ES assessment. Their values (biophysics and economics) are fundamental for stakeholder participation and citizen involvement with environmental processes.

As a planner with a broad background in various disciplines, I am curious to find practical solutions for applying ES

quantification and assessment to territorial policies rather than land use plans and projects. Such an approach requires significant improvements to the traditional way territorial government and land use planning are structured. From this point of view, I am aware that the ES approach is one that considers in a more holistic way the concept of sustainability because it accounts for the different kinds of services that Natural Capital provides. Planning for an increase in Natural Capital needs a significant renewal of the methodological approach that adequately supports the evaluation of land use scenarios. In this book, I will explore how one of the most promising elements in planning for urban resilience in order to foster the adaptive capacity of a socio-ecological system is, for example, the development of GIs.

From this perspective, the assessment of ES trade-off under different land use configurations is crucial to the design of GIs. For example, an improved incorporation of ES in the scenario planning process will increase the possibility of suite mapping models for different kinds of ES (supporting, regulating, provisioning and cultural). Mapping ES is crucial for planning purposes. Nonetheless, mapping has several limitations in that it does not account for (1) the scale of assessment, (2) stakeholder interests and (3) the mismatch between supply and demand of ES. However, these issues are the most stimulating for my interest in these research topics.

I have found that ES analysis and related mapping tools and techniques can be used to define sustainable land use strategies aimed at achieving resilience of socio-economic systems. In my experience, it was evident that the analysis of ES improves the ability of politicians, administrators, planners, and stakeholders to define strategies of urban regeneration, ecological adaptation and energy efficiency.

Few planners are really aware of the effects of land use change to human health. I remember when, in 2014, I discovered

the problem of particulate matter (PM) re-suspension when I was involved in a study for the new Climate Adaptation Plan of the Lombardy Region (Italy). Professor Antonio Ballarin Denti first talked to me about this problem and its relationship with soil sealing. At that time, I was a young post-doctorate student with a fellowship at the Department of Urban Studies at Politecnico di Milano, where I was developing a GIS-based spatial analysis of land use changes in the Lombardy Region. I was collecting data on soil sealing rates and their environmental effects and wondered why my department had asked me to participate in the regional study for the Adaptation Plan. I remember very well what Professor Ballarin Denti told me: the more you seal urban areas, the more PM increases independently from direct emissions, because PM re-suspends when not captured by vegetation or by green areas. Therefore, if you know the sealing rate of urban areas, you are able to have an assessment of PM concentrations due to re-suspension.

In mid-2015, I was participating in the first Scientific Young Researcher national competition with a research proposal entitled *Deterioration of Ecosystem Services: Influence of Land Use Change on Particulate Matter Resuspension in the Metropolitan Area of Milan* (the acronym was DtEcS2014 and I now understand why I didn't pass). That research was the first tentative step towards designing an activity around the issue of health problems generated by land take and soil sealing.

Subsequently, I discovered that 'air filtering' and the contribution of green areas to capturing PM avoided re-suspension and consequently improved the relation between ES provision and the quality of life of citizens. The loss of soil functions and ES is one of the major environmental challenges Europe is facing. The European Commission has proposed, in the Environment Action Programme for 2020 (seventh EAP), having policies in place by 2020 to achieve 'no

net land take' by 2050; it has also clarified the contribution urban and rural land use planning can make to achieve the target to limit urbanisation and protect soil ES. Moreover, the *Guidelines on Best Practice to Limit, Mitigate or Compensate Soil Sealing* emphasises the fact that land use alteration generates huge impacts on human health; thus the effect of spatial planning is crucial to achieving environmental sustainability. This means all relevant public authorities (municipalities, regions and countries) are fully committed to considering ES alteration during decision-making processes for land use planning, changing the philosophy of how we use land: newer integrated approaches are needed. The concept of sustainability in urban planning has risen to the fore, and the techniques/methodologies of environmental assessment have become more sophisticated.

I believe that ES modelling aids land use planning processes, revealing new paths to define practically sustainable land use strategies, thereby introducing the concept of an 'ecosystemic approach'. My field of research (according to the Italian Minister of Education, University and Research) is 08/F1 urban and territorial planning; this book will therefore embrace a multidisciplinary approach to define some steps: modelling re-suspension in urban areas (an environmental engineer approach integrated with geomatics experience) whilst observing the outcomes that such knowledge will generate to my main research area (urban planning).

Finally, I wish to thank the Interuniversity Department of Regional and Urban Studies and Planning of Politecnico di Torino (DIST, Polito) and the Interdepartmental Responsible Risk Resilience Centre (R3C) where I work. Their goal is to increase knowledge of operative models to integrate environmental assessment into traditional planning discipline. The use of ES as a new paradigm of resilience is an asset in developing an international dimension to our research.

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This book is the result of an enjoyable and enthusiastic research activity that I developed interacting with many people. Since I believe that the quality of research depends on the quality of people, I would like to thank some of them: Andrea Arcidiacono, Silvia Ronchi, Laura Pogliani, Carlo Alberto Barbieri, Carolina Giaimo and Grazia Brunetta.

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GENERAL INTRODUCTION

This book is structured in three main parts. The first introduces the reader to the main challenges in urban planning by explaining how changing conditions require a new approach to spatial policies, a more ecological-oriented approach to the city design and new competencies. Chapters 1 and 2 present the discourse around the descriptive approach to cities, their expansion and how the process of urbanisation affects ecosystem service provision, while Chapter 3 introduces a new approach to urban analysis which has been entitled 'the ecosystemic planning reform' that forward 'an agenda for urban planning'.

Part two of this book is entitled 'Acquiring New Competences', and it demonstrates how the traditional approach to the ecological study of urban systems should be integrated with new competences and tools that aid the decision-making phase during urban planning. In particular, Part two is dedicated to 'mapping' ecosystem services as a crucial phase to reach a spatial knowledge of the distribution of biophysical and economic values of ecosystems in a defined environment. This part moves from the utilisation of mapping tools to the basic GIS operations that are crucial to designing multifunctional GIs. Chapter 4 aims at demonstrating how the quality of urban environments affects human health and connects the concept of ecosystem services to well-being and the health

of communities. This chapter links the discourse of ecosystems to their tangible effects to demonstrate the important responsibility of urban planners to acquire an adequate knowledge and competence to deal with these problems.

Part three of this book aims at bridging the gap between theory and practice by presenting case studies that demonstrate how urban areas are vulnerable to climate conditions and how changing scenarios affect quality of life.

The first case study regards the assessment of particulate matter distribution due by the land use configuration in the city of Milano and shows how urban green areas are fundamental to obtain a higher deposition of fine and coarse particulate matter and achieve a higher air quality. This case study serves to demonstrate the roles that urban planning should play to create better environmental conditions by implementing mitigation measures, compensation and multifunctional GIs that serve to regulate ecosystem functioning in anthropic systems.

Case study two shifts the problem to the measurement of water provisioning resilience in metropolitan areas. It is shown how the water yield ecosystem service in the metropolitan area of Turin reacts to climate change conditions, displaying that sustainable areas are not necessarily resilient to changing conditions. Therefore, adaptation planning requires in-depth instruments to assess the variability of the system in a co-evolutive perspective.

Finally, Chapter 7 is dedicated at concluding this book and putting forward some brief suggestions.