

# TeMA

Journal of  
Land Use, Mobility and Environment

This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

Tema is the Journal of Land use, Mobility and Environment and offers papers with a unified approach to planning and mobility. TeMA Journal has also received the Sparc Europe Seal of Open Access Journals released by Scholarly Publishing and Academic Resources Coalition (SPARC Europe) and the Directory of Open Access Journals (DOAJ).

# INPUT 2014

papers selected

## Smart City

planning for energy, transportation  
and sustainability of the urban system

## SMART CITY

## PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

Special Issue, June 2014

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**Editorial correspondence**

Laboratory of Land Use Mobility and Environment  
DICEA - Department of Civil, Architectural and Environmental Engineering  
University of Naples "Federico II"  
Piazzale Tecchio, 80  
80125 Naples  
web: [www.tema.unina.it](http://www.tema.unina.it)  
e-mail: [redazione.tema@unina.it](mailto:redazione.tema@unina.it)

# TeMA

Journal of  
Land Use, Mobility and  
Environment

TeMA. Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science, and complex systems.

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Journal of  
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This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



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## EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

### SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website [www.input2014.it](http://www.input2014.it) . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website ([www.tema.unina.it](http://www.tema.unina.it)). The codex is not present on the pdf version of the papers.

## SMART CITY PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM Special Issue, June 2014

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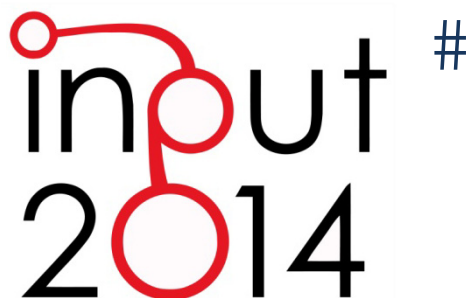
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## SPECIAL ISSUE

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of the Urban System

*Naples, 4-6 June 2014*

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## RESILIENCE THROUGH ECOLOGICAL NETWORKS

GRAZIA BRUNETTA<sup>a</sup>, ANGIOLETTA VOGHERA<sup>b</sup>

in collaboration with <sup>c</sup> DAFNE REGIS

<sup>c</sup> [dafne.regis@polito.it](mailto:dafne.regis@polito.it)

<sup>a b c</sup> DIST (Interuniversity Department of Regional and Urban Studies and  
planning), CED PPN (European Documentation  
Centre on Nature Park Planning) Politecnico di  
Torino, Viale Mattioli, 39 - 10125 Turin - Italy,

e-mail: <sup>a</sup> [grazia.brunetta@polito.it](mailto:grazia.brunetta@polito.it)

<sup>b</sup> [angioletta.voghera@polito.it](mailto:angioletta.voghera@polito.it)

### ABSTRACT

The paper explores the strategic role that urban biodiversity and ecosystem services management, natural infrastructure and adaptive governance approaches can play in making our economies and societies more resilient and in linking human societies and the natural environment. Resilience – a concept that entered the debate on urban governance – means the ability of urban systems, considered as linear-systems, to react to external disturbances by returning to some socio-ecological equilibrium steady-state by overcoming a crisis period (Gunderson & al. 2010, Newman & al. 2009). In this view, green infrastructures can assume a strategic role in restoring and enhancing the ecological and environmental livability in urban areas. Starting from the International and European context, the paper discusses innovative programs and interdisciplinary projects and practices (some cases in Turin Metropolitan Area) to demonstrate how green infrastructures can increase the adaptive capacity of urban systems in term of resilience. They can contribute to increase the ability of European cities to adapt to climate change and to reduce their ecological footprints, to enhance security and life quality.

### KEYWORDS

Green infrastructures, Landscape and ecological services, Agro-ecosystems, Resilience

## 1 THE RESILIENCE PERSPECTIVE

The world is increasingly urban and by 2050, almost three billion more people will live in cities. In Europe around 75% of the population lives in urban areas and in some countries this figure is estimated to grow to 80% by 2020 (UN 2012). Urbanization interacts with global environmental change in important ways: although urban areas account for only 2% of Earth's land surface, they produce 78% of greenhouse gases, thus contributing to global climate change; cities also play a central role in alteration of global biogeochemical cycles, changes in biodiversity due to habitat fragmentation and exotic species, and changes in land use and cover far beyond the city's boundaries (i.e., within the urban "footprint").

In this context the importance of urban biodiversity and ecosystem services management, natural infrastructure and adaptive governance approaches can play a strategic role in making our economies and societies more resilient and in linking human societies and the natural environment.

In this view, the paper will define: a) resilience; b) describe the key role of resilience in urban socio-ecological environment; c) describe the ecological infrastructure for developing resilience in cities; d) describe a study case in Italian metropolitan areas related to the agro-ecosystem enhancement for river resilient management.

### 1.1 THE RESILIENCE AND ECOSYSTEM SERVICES

The concept of resilience bringing into play the sustainability of the territory (Kates et al., 2001) as an innovation of social-ecological systems (Gallopín *et al.* 1989; Berkes and Folke 1998), based on the reciprocal interaction and adaptation between man and the environment / coupled human–environment systems (Turner *et al.* 2003). Adaptability refers to the capacity to adapt to future changes in the environment of the system concerned, taking on a multitude of meanings, which permeate anthropology, human geography, social science (Folke 2006), risk management (Kasperson *et al.* 1995), the fight against climate change and the planning of the territory (Davoudi 2012). In the cultural debate there emerges a utopic vision that imagines a future for the city, the territory and the landscape which, in its natural and anthropic characteristics, launches a non-linear transformation process which invests the quality of the performance of the environmental and territorial system. This perspective gives a central role to the ecosystem services for adaptive management of the environmental resources. The adaptive management affects the urban and regional planning contribution for resilient development of a socio-ecological system; in the urban system there is continuous interrelation among ecological functionality and human creative use and transformations. As Porter and Davoudi (2012) the resilience looks at city as a linear system, the theory of complexity demonstrates that cities are non-linear systems. They are open adaptive complex systems that are based on their capacity to adapt to the continuous changes linking the natural and cultural system (the community and institutional capacity and creativity) in order to react and develop its system (Portugali 2000; Brunetta and Moroni 2012).

Many cities are developing a new perspective development in relation to adaptation plans for resilience (such as Ancona, Barcellona, Copenhagen, etc.). The adaptation plans assume a system perspective for urban development, based on integration of environmental functionality and socio-economic organization, development of management tools, and actions for developing local reactivity based on institutional capacity and on the urban planning and regulation flexibility (such as the local initiatives ICLEI; the networking and exchange perspectives in Global Forum on Urban Resilience and Adaptation, Bonn, May 2012). This perspective can be analyzed using the Panarchy Model that is not a deterministic cycle and that define the 'evolutionary' approach of resilience (Davoudi 2012; Brunetta and Baglione 2013). Firstly, cities are open



because they exchange matter, energy, informations and people with their environments. Being open implies that the system continuously reacts to external changes, in an adaptive manner. Secondly, cities are complex because 'their parts are so numerous, and changing, that there is no way to describe them in terms of cause an effect (as did the urbanists of the 1950s and 1960s), nor in terms of probabilities (as did the urbanists since the end 1960s and the regional scientists of the 1970s and 1980s)' (Portugali 2000, 46).

This perspectives implies a continuous need to consider the interaction among the following key factors:

- a community based approach for planning and risk assessments based on a wide local collaboration for adaptation between stakeholders, within communities, forming partnerships with business (only 11% of cities worldwide; Global Forum 2012). It will also involve local government units at international level to effectively steer cities along a resilient path (Joann, Nadkarni and Rhie 2012).
- a systems perspective integrating solutions into all aspects of city management (logistic, urban agriculture, green infrastructure, renewable energies, social and political aspects, private involvement, land-use plans and building regulations, etc.)
- a strategic perspectives in spatial planning, for developing adaptive capacity: a long term plan to mitigate risks and to evolve living conditions in urban systems (such as Copenhagen Climate Change Plan -2011- that reads adaptability as 'a competitive advantage - cities capable of protecting business and citizens from climate related threats' creating conditions for more attractive places where to live, work, and invest).

We assume that resilience is the ability of urban systems, to react to external disturbances by reaching a socio-ecological equilibrium steady-state (Gunderson *et al.* 2010, Newman *et al.* 2009), but also transforming and evolving the previous urban conditions.

In this view green infrastructure can assume a strategic role in integrating actions to restore and enhance the ecological and environmental livability in urban areas, increasing the adaptive capacity of urban systems in term of resilience, climate change adaptation and reduction of their ecological footprints, enhancing security and life quality.

## 1.2 GREEN INFRASTRUCTURE AS ECOSYSTEM SERVICES

The ecosystem services (ES) gathered a wide range of environmental and cultural aspect linking biodiversity, ecology, economics and human wellbeing (Gómez-Baggethun *et al.* 2010). In the late 1990s the ES concept began to receive ample attention in literature (Baskin 1997; Costanza *et al.* 1997; Daily 1997).

The green urban infrastructures are an important element of the concept of ecosystem services (The Millennium Ecosystem Assessment - MA, 2005; and The Economic of Ecosystem and Biodiversity report - TEEB 2010). Studying cities as ecosystems within the new paradigms of ecosystem science (Pickett *et al.* 1992, Flores *et al.* 1997), we need to consider both raise the ecologic functionality concept and the human actions that influences on ecosystems; the study should use approaches developed in the social, behavioral, and economic sciences. In fact human perception, choices, and actions are often the phenomena that drive political, economic, or cultural decisions that lead to or respond to change in ecological systems. Ecosystems supplied to humankind benefits from a multitude of resources and processes, known as ecosystem services. They include many products and processes impacting on our global footprint that can be grouped into the following categories: provisioning, such as the production of food and water (including agro-ecosystem); regulating, such as the control of climate and disease; supporting, such as nutrient cycles and crop pollination; and cultural, such as spiritual and recreational benefits (Millennium Ecosystem Assessment 2005). In this view the UNEP in COP 10 Decision X/2 promotes the Strategic Plan for Biodiversity

2011-2020 to develop the landscape ecosystem and their contribution for quality of urban areas and the EU define an integrated view in Resolution on Our Life Insurance, Our Natural Capital: an EU Biodiversity Strategy to 2020 (2011/2307(INI)). Urban ecosystems, such as urban 'green and blue spaces' may have a crucial role in building the necessary capacity to cope with environmental changes. In many cities in the world – New York, New Orleans, Singapore, Cape Town, and in Europe Copenhagen, Amsterdam, Barcelona, Berlin, Rotterdam, Salzburg, Stockholm, Turin, etc. – investments are made in tree planting, 'green roofs', urban agriculture and ecological restoration projects. Those actions are now growing rapidly as part of a low-carbon strategy to increase the capacity to adapt to climate change (i.e. URBES European network, Urban Biodiversity and Ecosystem Services: focused on quantifying and valuing urban ecosystem services incorporated into urban planning and policy). The role of the city's green infrastructure for the enhancement of local ecosystems (parks, gardens, woodlands and wetlands, social hortus) (Barthel, Parker and Ernstson 2013) developing resilient communities in the construction of ecosystems and landscapes has been already explored at Resilient Cities 2012.

In this view we will present a case study for developing the agro-ecosystems for river management in the urban environment of Turin.

## 2 CASE STUDIES

We will discuss the contribution of the green infrastructures for enhancing the ecological services in the management strategies of Turin metropolitan area aimed at resilient and sustainable development. The City of Turin decided to develop two interlinked programs aimed at a cross scale creative and conservative enhancement of the socio-ecological system:

- a) River Contract of Stura, a river system strategic action aimed at evolving the environmental quality and security of the river basin. It can be defined as a 'green and blu contribution' for resilience in the North part of the Turin City, integrated in the Green Hearth (Corona Verde);
- b) a new projects Turin City to be cultivated (TOCC -Torino Città da coltivare) aimed at enhancing agro-ecosystems, involving the North Part of Turin Metropolitan area (from Stura River to the urban fringes).

The Stura River Contract is an innovative method of territorial governance, useful in identifying shared strategies, actions and rules for the environmental, landscape and socio-economic enhancement of a river basin. The River Stura Basin in the Turin Metropolitan Area is a complex territory affected by different territorial practices: private, public and illegal cultivations, nomad settlements, abandoned and underused public spaces and parks, productive activities and peripheral urban areas, characterized by a mixture of density of these different urban space and uses.

The Stura River Contract promotes the sustainable innovation of territorial practices, starting from the participation of the institutional and social stakeholders in the river basin management. It contributes to rebuild knowledge and the self-defining skills associated with hydrogeological safeguard, the ecological development of the river and its landscape (creation of the ecological network), and the development of multifunctional agricultural practices; this is achieved by reactivating multi-level management of basin communities and enabling people to recover rivers; furthermore, it will help to generate new urban and rural territoriality, set up a network of local initiatives, and create integrated territorial enhancement policies. It is a creative tool for local ecological and community development, enforcing the institution capacity building to preserve the green urban areas. Besides it contribute to the realization of green ecological networks (river reforestation, biological agriculture), creating a great permeable defense from floodings.

In the same areas, affecting many part of the basin territory and the urban high density borders and fringes within natural riverscape, the City develops the Turin City to be Cultivated project (TOCC, proposed by the City Council in 2012). TOCC proposes a new relationship between agriculture and the city. The project aims to promote the development of agriculture in the urban environment: sustainable farming, addressing the concept of "short-chain" and social agriculture, promoting individual or collective horticulture and farms, and urban reforestation. TOCC responds to the evolution of the actual social-economic crisis, helping people to sustain families in alimentary supplies and local institutions to manage the green and rural urban areas.

The project TOCC initiates an analysis of the existing green areas used for agriculture , with a census of existing buildings, existing land concessions, as well as land owned by the city (two million square meters ) and the other owned – by private property. The local administration also identifies the most suitable areas for the promotion of forms of multifunctional agriculture and urban forestry. TOCC encourages the practices that recognize the food values, but also the social, environmental and soil conservation values related to farming (addressing Common Agricultural Policy and International URBES policies on urban ecosystem services).

The aim of TOCC is the creation of a new resilient model of urban living that is more linked to the earth and nature, directly involving communities in management (social hortus). It has positive economic consequences for those who live in the city and it is also a solution to the poverty problems for weak social actors. It contributes to ecological production of food and it can reduce the cost of managing the assets of urban green spaces. The challenge of the two innovative strategies is to design a city with natural smarter and resilient spaces that takes into account the various aspects of urban living such as local landscape, the social community development, and environmental management, helping to promote quality of the river fringes in an intense urban area, based on green and agricultural infrastructures.

### 3 CONCLUSIONS. RESILIENT RIVER MANAGEMENT AND AGRO-ECOSYSTEM DEVELOPMENT

The Stura River Contract Strategy and the correlated TOCC Project will contribute to resilience starting from green and agricultural infrastructure valorization. In fact the two planning strategies develop agro-ecosystem in the urban environments that can be defined as "(natural) ecosystems that have been deliberately simplified by people for purpose of the production of specific goods of value to humans" (Swift et al., 2004: 121). We should consider that those green and agro-ecosystems are both consumers and providers of different ecosystem services with many differences depending on the management system adopted:

- the main natural ecosystems (green infrastructures) provided ecosystem services to agriculture that include pest control, pollination, regulation of water quantity and quality, and soil fertility (Power 2010; Swift *et al.* 2004; Zhang *et al.* 2007);
- Agriculture provides also carbon sequestration, genetic diversity, soil retention, regulation of soil fertility, nutrient cycling and water (Power 2010; Ribauda *et al.* 2010);
- Agriculture contributes also to cultural services, such as aesthetic values, recreation and ecotourism (MA 2005);
- Agriculture in urban areas contributes to sustainable economic development of farmers and also of hortus communities, resolving the green management and the food needs (especially for poors).

Green and agro-ecosystems can also be managed to support biodiversity in order to produce an amount of economic compensations (Ruto and Garrod 2009) of human activities, especially in urban metropolitan

areas, constructing an adaptive socio-ecological development that affects climate change, reduction of urbane ecological footprints, enhancement of security and life quality.

The study cases show local actions for solving ecological, social, and economic problems, developing strategies to anticipate changes. The riverscape enhancement and the agriculture development are the answers to the current needs for quality living and security. They are also an innovation of the urban system and of its trajectories. They will contribute to resilience absorbing and contrasting ecological and socio-economic crisis, developing the cultural system and its organization capacity, and extending the capacity of the system to learn and adapt to external disturbances and processes.

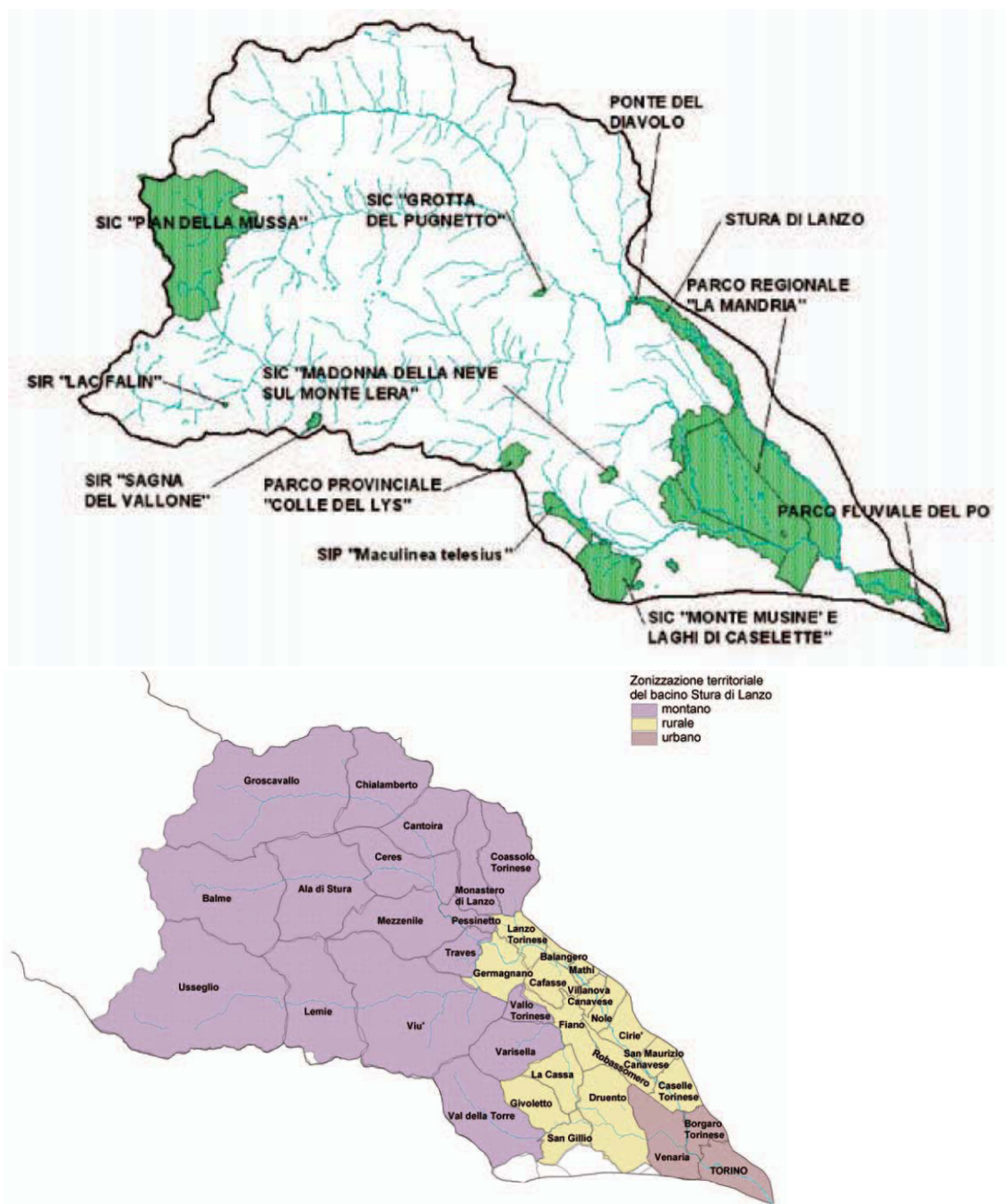


Fig. 1a / 1b The Stura River Contract in Turin Metropolitan Area: the fluvial areas, the natural parks, the institutional framework



Fig. 2 The latter an example of TOCC project related to urban hortus

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## **AUTHORS' PROFILE**

Grazia Brunetta

Architect, PhD in Spatial Planning, Associate Professor of Urban and Regional Planning at the Interuniversity Department of Urban and Regional Studies and Planning (DIST) of Turin Polytechnic where she teaches Urban Planning and Strategic Environmental Assessment. She has been member in Editorial Board of Italian Journal of Regional Science until 2010, and in the elected scientific board of Italian Section of the Regional Science Association. Her research activities is related to the following topics: institutional innovation in spatial planning, strategic evaluation in territorial planning, environmental and landscape planning. The results of her researches have been collected in numerous national and international publications.

Angioletta Voghera

Architect, PhD in Territorial Planning and Local Development, Assistant Professor in Urban and Regional Planning - Interuniversity Department of Urban and Regional Studies and Planning (DIST), Politecnico di Torino. Hers main research

field and teaching activities deals with Regional and Landscape Planning, and Urban Design with reference to the international and European context. Special attention is focused on sensible environments such as: natural and landscape protected areas, fluvial and rural areas. Author of numerous articles and researches findings in this fields have been published both nationally and internationally; particularly author of the monographs: *Culture europee di sostenibilità. Storie e innovazioni nella pianificazione* (Gangemi Editore, 2006); *After the European Landscape Convention. Policies, Plans and Evaluation*, (AlineaEditrice, 2010); with Ingaramo R., *Planning and Architecture. Searching for an Approach*, (Alinea International, 2012).

#### Dafne Regis

Architect, PHD student in Environment and Territory, Interuniversity Department of Urban and Regional Studies and Planning (DIST), Politecnico di Torino. Her main research fields are dealing with ecological network in local planning and methods for the management of complex territorial and landscape projects. She is involved in "Indicazioni per un progetto di sviluppo del territorio in Valle di Susa" SITI, DIST, Confindustria Piemonte.