

## GOVERNANCE AND ADAPTATION TO CLIMATE CHANGE

AN INVESTIGATION IN SARDINIA

**A. DE MONTIS<sup>a</sup>, A. LEDDA<sup>a</sup>, E.A. DI CESARE<sup>a</sup>  
D. TROGU<sup>a</sup>, M. CAMPAGNA<sup>b</sup>  
G. COCCO<sup>c</sup>, G. SATTA<sup>c</sup>**

<sup>a</sup> Department of Agricultural Science,  
University of Sassari  
e-mail: andreadm@uniss.it

<sup>b</sup> Department of Civil and Environmental  
Engineering and Architecture,  
University of Cagliari

<sup>c</sup> General Directorate of Environment,  
Autonomous Region of Sardinia

*How to cite item in APA format:*

De Montis, A. Ledda, A., Di Cesare, E.A. ...& Satta, G. (2018). Governance and adaptation to climate change. An investigation in Sardinia. In A. Leone & C. Gargiulo (Eds.), *Environmental and territorial modelling for planning and design*. (pp.207-214). Naples: FedOAPress. ISBN: 978-88-6887-048-5, doi: 10.6093/978-88-6887-048-5

### ABSTRACT

*Climate change implies increase of temperature, rising of sea level, and more frequent and intense floods and droughts than in the past. All landscapes are impacted by such deleterious events. Effective measures able to prevent or minimize the negative effects of climate change consist of adaptation actions. In 2013, the European Commission adopted the EU Adaptation Strategy that aims at making the European context more climate-resilient. Scientific literature stresses that adaptation to climate change is affected by both hard (legal, economic and technological) and soft (social) factors, which should be all considered by governance approaches to adaptation. This implies coordination and cooperation among the different domains, actors and responsibilities, to avoid or solve conflicts and facilitate choral implementation of adaptation measures.*

*In this study, we aim at investigating multi-sectoral governance processes involved in the Regional Strategy for Adaptation to Climate Change, which is being designed by the regional administration of Sardinia (Italy). We are interested in proposing major governance models starting from the scrutiny of the main actors currently involved in setting climate change adaptation strategies. In this preliminary phase we report on the mapping of the competences of the regional departments, starting from the results of a questionnaire-based survey, an organizational chart, and an analysis of regional plans.*

### KEYWORDS

*Climate Change adaptation Strategies and Measures; Governance; Regional Plans; Organizational Chart; On-line Questionnaire*

## 1 INTRODUCTION

According to reliable climate data, the Earth's surface has become increasingly warmer in the last three decades "than any preceding decade since measurements began over 150 years ago" (Bush, 2018). Climate change is considered one of the most important issues of the last years and includes effects, such as increasing of temperature, rising of sea level, and frequent and intense floods and droughts (Field et al., 2014). Over time, adaptation measures have been proposed to prevent or minimize the negative effects of climate change and take advantage, when possible. According to Salzmänn et al. (2016), "climate change adaptation refers to the adjustment of natural or human systems as a response to actual or expected climatic stimuli or their effects, which moderates harms or exploits beneficial opportunities" and adaptation can be planned, anticipatory, or autonomous. Adaptation measures include crop diversification, early warning systems, and seasonal climate forecasting (Ochieng et al., 2016). Keskitalo (2010) argues that "[c]limate change is a problem that poses high requirements for governance by requiring the coordination of demands and needs across international, national, regional and local scales, as well as coordination between sectors [...]". Governance for climate change adaptation means that "policies and action programmes exist on different levels" and "these [are] coordinated across levels and sectors" (Keskitalo, 2010).

In 2015, the Italian Ministry of the Environment and Protection of Land and Sea approved the National Climate Change Adaptation Strategy (SNACC) (MEPLS, 2015). Such a strategy points out the main impacts of climate change for socio-economic and natural sectors, and proposes adaptation measures. A national adaptation plan is currently being developed (MEPLS, 2017). At the same time, the Autonomous Region of Sardinia (Italy) is developing the Regional Strategy for the Adaptation to Climate Change (SRACC).

In these early stages of our research, we focus on multi-sector governance of climate adaptation in Sardinia, a region where adaptation strategies and measures have been scarcely discussed so far. We aim at identifying the main actors - and the synergies between them - which are explicitly or implicitly involved in setting climate change adaptation strategies or measures. Furthermore, we scrutinize regional plans to figure out to what extent adaptations strategies or measures have been taken into account by the regional administration. The paper unfolds as follows. In the next section, we report on scientific literature concerning governance of climate change adaptation. In the third section, we describe the methodology proposed and applied in this research. In the fourth section, the results are shown and discussed. Finally, section five focuses on the concluding remarks.

## 2 GOVERNANCE OF CLIMATE CHANGE ADAPTATION

The importance of climate change adaptation measures has grown over time. Indeed, even if the greenhouse gases emissions ceased today, the climate change in progress would continue in the future (Baffo et al., 2009). In 2013, the European Commission adopted a strategy on adaptation to climate change (EU Adaptation Strategy) that aims to make the European context more climate-resilient. The EU Adaptation Strategy focuses on promoting (i) action by Member States, (ii) better-informed decision-making, and (iii) adaptation in key vulnerable sectors (European Commission, 2013). Adaptation to climate change is affected by a series of elements including economic resources and social factors (values, interests, traditions and so on). Scientific literature stresses that hard factors (legal, economic and technological) as well as soft factors (social) should be considered by governance approaches to adaptation, and social factors can be an important barrier that needs to be overcome in implementing adaptation strategies (Grothmann, 2011).

According to the SNACC (MEPLS, 2015), the adaptation measures can be clustered in three macro-groups: gray, green, and soft measures. Gray measures include technological and engineering solutions, green ones consist of ecosystem-based approaches, while the soft ones include management, legal and political approaches (including governance system). Governance is a key factor “in shaping the process of adaptation” (Wolf, 2011) and “effective adaptation to climate change requires new governance approaches that are able to bridge or even transcend governmental levels and societal domains” (Bauer & Steurer, 2014). Climate change influences several sectors and actors, and scientific literature points out the necessity for coordinated and cooperative adaptation governance to solve or avoid conflicts and implement adaptation measures (Grothmann, 2011; Juhola & Westerhoff, 2011). Runhaar et al. (2017) state that “[m]ainstreaming climate adaptation objectives into existing policies [...] is widely advocated for public action”. Thus, adaptation to climate change and governance have been addressed in scientific literature in both European and non-European contexts. As an example, Bauer and Steurer (2014) studied the effects of regional adaptation partnerships in facilitating adaptation to climate change in a multi-level governance context in Canada and England. The authors scrutinized documents such as reports and websites, and performed semi-structured interviews with responsible, managers and key partners involved in the partnerships. In this study, we focus on governance in the climate change adaptation context, aiming at scrutinizing the main actors and factors currently explicitly or implicitly involved in setting climate change adaptation strategies in Sardinia.

### 3 METHOD

We focus on regional governance of climate adaptation in Sardinia (Fig. 1). In detail, we: (i) use data provided by the Autonomous Region of Sardinia to figure out the level of regional officers' acquaintance concerning adaptation to climate change; (ii) perform an analysis of the official regional website to define the regional organization chart and identify the assignments per Regional Departments (RDs) and Services (RSs); (iii) analyze regional plans to assess if adaptation measures have been included in such documents (Tab. 1).

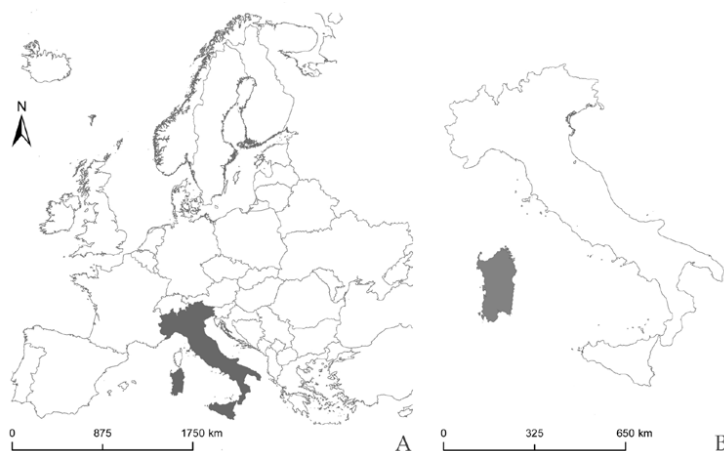


Fig. 1 Geographical context. A: in gray, Italy; B: in gray, Sardinia

TOPIC	TOOLS	DESCRIPTION
GOVERNANCE AND ADAPTATION TO CLIMATE CHANGE	On-line questionnaire	We use data provided by the Autonomous Region of Sardinia, which were recorded through an on-line questionnaire developed in the context of the Life project 'Master Adapt'. Such data help us to figure out the level of regional officers' acquaintance concerning adaptation to climate change.
	Analysis of official regional website and documents	We draft the organisation chart of the Regional Departments, to identify responsibilities for adaptation measures at the regional level.
	Analysis of regional plans	We scrutinize plans to assess to what extent the adaptation to climate change has been considered in such documents.

Tab. 1 Methods and tools adopted for investigating the current regional governance of climate change adaptation

We scrutinize the plans against four criteria rooted in scientific literature and/or in international/national guidance documents or strategies (Tab. 2).

CRITERIA	DESCRIPTION	REFERENCES
ADAPTATION STRATEGIES REFERENCE	Do the documents refer to national or international climate change adaptation strategies?	European Commission ,2013; MEPLS, 2015
ADAPTATION MEASURES	Do the plans define climate change adaptation measures?	European Commission, 2013; MEPLS, 2015
IMPLICIT OR EXPLICIT MEASURES	Are the adaptation measures implicit or explicit?	Donner et al., 2016
RESPONSIBLE FOR THE IDENTIFIED ADAPTATION MEASURES	Do the plans define responsibilities for adaptation measures?	Mees & Driessen, 2018; MEPLS, 2015

Tab. 2 Criteria selected for analyzing the plans

We aim at checking if the plans refer to national or international climate change adaptation strategies (i.e. EU Strategy and/or SNACC), which define a framework for defining climate change adaptation actions, and if adaptation measures are defined by the plans. We report on implicit or explicit adaptation measures, where implicit measures stand for "activities which can reduce societal vulnerability to external stresses like climate events (e.g., capacity building), but may not be explicitly designed to adapt to a particular range of projected climate outcomes" (Donner et al., 2016). Finally, according to Mees and Driessen (2018), clear responsibilities are key for adaptation governance and, then, we check if responsibilities for adaptation have been assigned.

## 4 RESULTS AND DISCUSSION

In the context of the Life project MASTER Adapt (MAInSTreaming Experiences at Regional and local level for adaptation to climate change), the Autonomous Region of Sardinia investigated on methodology to activate a mainstreaming action to adaptation to climate change so that regions, metropolitan cities and local authorities can incorporate climate change adaptation (CCA) actions into their plans and programs (MASTER ADAPT, 2018). The results of the project, which will be promoted between the Italian and European regions,

will be at the basis of the strategic framework of the plan of the regional adaptation to climate changes (PRACC). The method implies, *inter alia*, the opportunity of working -since the early stages of the PRACC drafting- on three issues: i) involvement of regional structures (departments, agencies and agencies), in a collaborative process aiming at the identification of the objectives and adaptation options to be adopted in the corresponding sector plans and programs; ii) identification of territorial partnerships for adaptation to CC at the intermunicipal (see the Interregional Board for the adaptation of the Environment and Energy Commission of the State-Regions Conference) and regional level (see the inter-departmental coordination board for the adaptation established in 2015); iii) elaboration of strategic projects for adaptation, on a supra-municipal scale, as test case studies in the perspective to define minimum climate unit suitable for the implementation of strategies and adaptation actions identified in the PRACC. The first investigation involves regional officers and aims at ascertaining the level of familiarity with the issues connected to adaptation to climate change. On a sample of 21 answers, part of the respondents claims to know climate change issues well or very well. Four respondents claim to deal with climate change as a relevant part of their tasks. Finally, little attention has been posed on both national strategy and plan for adaptation to climate change (i.e. few respondents specify to have read such documents). As a second step, we recreate the network of regional assignments per RD - which usually consist of RSs - for identifying responsibilities for adaptation measures at the regional level. The Decrees concerning the RSs institution and their respective statutory core tasks have been retrieved on-line. We assessed if such decrees included tasks consistent with the adaptation measures suggested by the SNACC, with focus on governance issues. Such an analysis is still ongoing, but preliminary results show that some adaptation tasks belong (explicitly or implicitly) to the Environment and Agriculture RDs. To perform the third step, we gave priority to the analysis of plans and programs concerning the landscape, water, and agriculture sectors, for they have been identified as priority sectors for the SRACC. We retrieved on-line and scrutinized four regional plans to figure out if such documents included adaptation measures.

Thus, the plans have been analyzed against four basic criteria: (i) presence of explicit reference to national or international adaptation strategies, (ii) presence of implicit and explicit adaptation measures, (iii) specification of the presence of implicit or explicit adaptation measures, and (iv) identification of the responsible authorities for the identified adaptation measures. Tab. 3 reports on the results of such review. The Landscape Plan and the Hydrogeological System Plan described measures that could be considered adaptation measures such as: processes of de-pollution and environmental regeneration, vegetable recolonization in industrial areas, functionality preservation of watercourses, drainage structures, which mainly consist of gray and green adaptation measures.

Overall, two out of four plans explicitly report on adaptation measures. The River Basin District Management Plan explicitly identifies adaptation measures such as: updating and integration of weather-climate data acquisition systems, updating and development of the drought monitoring system, drafting and dissemination of guidelines aimed at saving water in agriculture.

The Flood Risk Management Plan provides prevention and protection measures in synergy with the SNACC, as, where possible, the measures are oriented towards favoring the resilience of the involved systems, in order to support climate change adaptation. The Plan includes both gray and soft adaptation measures. The gray measures include the realization of protective works (e.g. slopes stabilization, relocation of elements due to a given risk), while the soft measures include study and monitoring actions, active territorial maintenance (e.g. improvement of the knowledge of critical hydraulic situations).

REGIONAL PLAN OR PROGRAM	YEAR	ADAPTATION STRATEGIES REFERENCE	ADAPTATION MEASURES	IMPLICIT OR EXPLICIT MEASURES	RESPONSIBLE FOR THE IDENTIFIED ADAPTATION MEASURES
Regional Landscape Plan [Piano Paesaggistico regionale]	2006	No	Yes	Implicit	Yes
Hydrogeological System Plan [Piano stralcio per l'assetto idrogeologico]	2004	No	Yes	Implicit	Yes
River Basin District Management Plan [Riesame e aggiornamento del piano di gestione del distretto idrografico della Sardegna]	2016	No	Yes	Explicit	Yes
Flood Risk Management Plan [Piano di Gestione Rischio Alluvioni]	2016 (update 2017)	EU strategy on adaptation to climate change  Italian Strategy for Climate Change Adaptation	Yes	Explicit	Yes

Tab. 3 Analysis of regional plans: findings

## 5 CONCLUSIONS

In this study, we focus on the governance of adaptation to climate change in Sardinia, a region where the interest in adaptation is still in its infancy. We analyze the current adaptation regional scenario, identifying responsibilities for adaptation measures at the regional level and assessing to what extent the adaptation to climate change has been considered in regional plans and programs.

This study can be considered as an early base for more systematic analyses. Preliminary results show that, in general, despite some RSs are (explicitly or implicitly) responsible for adaptation tasks, regional officers do not always have complete awareness about their competence in such a domain. Finally, although implicitly, the regional plans analyzed so far contain adaptation measures.

## ACKNOWLEDGEMENT

This study has been developed and funded in the framework of the technical and scientific agreement, between the Autonomous Region of Sardinia and the University of Sassari, concerning the drafting of the Regional Strategy for the Adaptation to Climate Change (SRACC).

## REFERENCES

- Baffo, F., Gaudioso, D., & Giordano, F. (2009). *L'adattamento ai cambiamenti climatici: strategie e piani in Europa. Rapporti 94/2009*. Rome, IT: ISPRA.
- Bauer, A., & Steurer, R. (2014). Multi-level governance of climate change adaptation through regional partnerships in Canada and England. *Geoforum*, 51, 121-129. doi:<https://doi.org/10.1016/j.geoforum.2013.10.006>

Bush, M. J. (2018). *Climate Change Adaptation in Small Island Developing States*. (1st ed.). Hoboken, USA: John Wiley & Sons.

Donner, S. D., Kandlikar, M., & Webber, S. (2016). Measuring and tracking the flow of climate change adaptation aid to the developing world. *Environmental Research Letters*, 11(5), 054006. doi: <https://doi.org/10.1088/1748-9326/11/5/054006>

Field, C. B., Barros, V. R., Dokken D. J., Mach, K. J., Mastrandrea, M. D., ... & White, L. L. (Eds.). (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, USA: Cambridge University Press.

Grothmann, T. (2011). Governance Recommendations for Adaptation in European Urban Regions: Results from Five Case Studies and a European Expert Survey. In K. Otto-Zimmermann (Ed.), *Resilient Cities. Cities and Adaptation to Climate Change Proceedings of the Global Forum 2010* (pp. 167-175). Dordrecht, NL: Springer Science+Business Media B.V. doi: <https://doi.org/10.1007/978-94-007-0785-6>

Juhola, S., & Westerhoff, L. (2011). Challenges of adaptation to climate change across multiple scales: A case study of network governance in two European countries. *Environmental Science and Policy*, 14(3), 239-247. doi: <https://doi.org/10.1016/j.envsci.2010.12.006>

Keskitalo, E. C. H. (2010). Introduction – Adaptation to Climate Change in Europe: Theoretical Framework and Study Design. In E. C. H. Keskitalo (Ed.), *Developing Adaptation Policy and Practice in Europe: Multi-level Governance of Climate Change* (pp. 1-38). Dordrecht, NL: Springer Science+Business Media B.V. doi: <https://doi.org/10.1007/978-90-481-9325-7>

Mees, H., & Driessen, P. (2018). A framework for assessing the accountability of local governance arrangements for adaptation to climate change. *Journal of Environmental Planning and Management*, 1-21. doi: <https://doi.org/10.1080/09640568.2018.1428184>

Ochieng, J., Kirimi, L., & Mathenge, M. (2016). Effects of climate variability and change on agricultural production: The case of small scale farmers in Kenya. *NJAS - Wageningen Journal of Life Sciences*, 77, 71-78. doi: <https://doi.org/10.1016/j.njas.2016.03.005>

Runhaar, H., Wilk, B., Persson, Å., Uittenbroek, C., & Wamsler, C. (2018). Mainstreaming climate adaptation: taking stock about “what works” from empirical research worldwide. *Regional Environmental Change*, 18(4), 1201-1210. doi: <https://doi.org/10.1007/s10113-017-1259-5>

Salzmann, N., Huggel, C., Nussbaumer, S. U., & Ziervogel, G. (2016). Setting the Scene: Adapting to Climate Change – A Large-Scale Challenge with Local- Scale Impacts. In N. Salzmann, C. Huggel, S. U. Nussbaumer, G. Ziervogel (Eds.), *Climate Change Adaptation Strategies – An Upstream-downstream Perspective* (pp. 3-15). Basel, CH: Springer International Publishing AG. doi: <https://doi.org/10.1007/978-3-319-40773-9>

Wolf, J. (2011). Climate Change Adaptation as a Social Process. In J. D. Ford, L. Berrang-Ford (Eds.), *Climate Change Adaptation in Developed Nations - From Theory to Practice* (pp. 21-32). Dordrecht, NL: Springer Science+Business Media B.V. doi: <https://doi.org/10.1007/978-94-007-0567-8>

## WEB SITES

European Commission (2013). *EU Adaptation Strategy*. Retrieved from <http://climate-adapt.eea.europa.eu/eu-adaptation-policy/strategy>

Master Adapt (2018). *MAInSTreaming Experiences at Regional and local level for adaptation to climate change*. Retrieved from <https://masteradapt.eu>

MEPLS (2015). *Strategia Nazionale di Adattamento ai Cambiamenti Climatici (SNACC), approvata con il decreto direttoriale n. 86 del 16 giugno 2015*. Retrieved from [http://www.pdc.minambiente.it/sites/default/files/allegati/Strategia\\_nazionale\\_adattamento\\_cambiamenti\\_climatici.pdf](http://www.pdc.minambiente.it/sites/default/files/allegati/Strategia_nazionale_adattamento_cambiamenti_climatici.pdf)

MEPLS (2017). *Plano Nazionale di Adattamento ai Cambiamenti Climatici. Bozza 2017 sottoposta a consultazione*. Retrieved from [http://www.minambiente.it/sites/default/files/archivio\\_immagini/adattamenti\\_climatici/documento\\_pnacc\\_luglio\\_2017.pdf](http://www.minambiente.it/sites/default/files/archivio_immagini/adattamenti_climatici/documento_pnacc_luglio_2017.pdf)

## AUTHOR'S PROFILE

Andrea De Montis is a civil engineer, Ph.D. in Urban planning Sapienza, University of Rome and Master of Science in Economic and Planning, Northeastern University, Boston USA, he is associate professor in rural development at the Department of Agriculture, University of Sassari. His research interests concern regional and landscape analysis and planning, strategic environmental assessment, and, recently, the strategy for the adaptation to climate changes.

Antonio Ledda, master's degree *cum laude* in Planning and Management of Environment and Rural Land, PhD in Civil Engineering and Architecture - Doctor Europeus, is research assistant at Department of Agricultural Science, University of Sassari. His research interest focuses on rural buildings, historic rural buildings, rural areas and landscapes, strategic environmental assessment in urban, regional, and landscape planning, landscape fragmentation and defragmentation measures, and governance processes in climate adaptation strategies.

Elisabetta Anna Di Cesare, master's degree in Construction and Architecture Engineering (Università di Cagliari), post-graduate master's degree in Design and environmental assessment techniques (Politecnico di Torino), PhD in Civil Engineering and Architecture (Università di Cagliari), is research assistant at Department of Agricultural Science (University of Sassari), where she works on governance processes in climate change adaptation. She is also professional consultant in urban planning and Strategic Environmental Assessment.

Daniele Trogu is a Ph.D. in Land Engineering. His research interests are about advanced spatial analysis and spatial modeling by mean spatial statistics and composite indicators. Currently He works as research fellow at University of Sassari and as GIS consultant for public and private companies.

Michele Campagna is Associate Professor of Spatial Planning at the University of Cagliari (Italy). His research interests concern Spatial Planning and Geodesign, Metaplaning, Strategic Environmental Assessment, Planning Support Systems (PSS), Spatial Data Infrastructure and Volunteered and Social Media Geographic Information.

Gianluca Cocco, public Manager, currently Director of the Environmental Sustainability and Information Systems Department at the Directorate General for Environmental Protection of the Autonomous Region of Sardinia. From 2011 to 2015 he was also Director of the Environmental Assessment Department (EIA and SEA). He has been working since many years on environmental issues (climate change, sustainability, GPP), energy (efficiency, public lighting and mobility) and new technologies (information systems and monitoring networks). He has been official of the Sardinian forest service for over 12 years, dealing with forest fires and telecommunications. He is vice president of the Board of Professional Engineers of the Province of Cagliari.

Giovanni Satta, degree in territorial planning, since 2002 deals with environmental and social sustainability issues related to climate change. After some experiences in the field of architectural and urban planning, he worked for the ESIF Environmental Authority of the Italian Ministry of the Environment and Protection of the Territory and of the Sea and of the Autonomous Region of Sardinia, mainly on energy efficiency programs and light pollution. Currently coordinates the Climate Change sector of the DG Environment of the Autonomous Region of Sardinia.



Antonio Leone Carmela Gargiulo  
*Editors*

# Environmental and territorial modelling for planning and design



**INPUT** TeMA Lab Dicesa UniNA

Federico II Open Access University Press







Università degli Studi di Napoli Federico II  
*Scuola Politecnica e delle Scienze di Base*

Smart City, Urban Planning for a Sustainable Future

**4**



# **Environmental and territorial modelling for planning and design**

Antonio Leone Carmela Gargiulo

Federico II Open Access University Press



*Environmental and territorial modelling for planning and design* editors  
Antonio Leone, Carmela Gargiulo - Napoli: FedOAPress. 2018. - (Smart  
City, Urban Planning for a Sustainable Future. 4).

Web link:

<http://www.fedoabooks.unina.it>

ISBN: 978-88-6887-048-5

DOI: 10.6093/978-88-6887-048-5

#### *Editor*

Rocco Papa, University of Naples Federico II, Italy

#### *Editorial Advisory Board*

Mir Ali, University of Illinois, USA - Luca Bertolini, Universiteit van Amsterdam, Paesi Bassi - Luuk Boelens, Ghent University, Belgium - Dino Borri, Politecnico di Bari, Italia - Enrique Calderon, Universidad Politécnica de Madrid, Spagna - Roberto Camagni, Politecnico di Milano, Italia - Derrick De Kerckhove, University of Toronto, Canada - Mark Deakin, Edinburgh Napier University, Scotland - Aharon Kellerman, University of Haifa, Israel - Nicos Komninos, Aristotle University of Thessaloniki, Grecia - David Matthew Levinson, University of Sydney, Australia - Paolo Malanima, Magna Graecia University of Catanzaro, Italy - Agostino Nuzzolo, Università degli Studi di Roma Tor Vergata, Italia - Rocco Papa, Università degli Studi di Napoli Federico II, Italia - Serge Salat, Urban Morphology and Complex Systems Institute, France - Mattheos Santamouris, National Kapodistrian University of Athens, Greece - Ali Soltani, Shiraz University, Iran

#### **Selection and double blind review under responsibility of Conference Committee**

© 2018 FedOAPress - Federico II Open Access University Press

Università degli Studi di Napoli Federico II

Centro di Ateneo per le Biblioteche "Roberto Pettorino"

Piazza Bellini 59-60 - 80138 Napoli, Italy

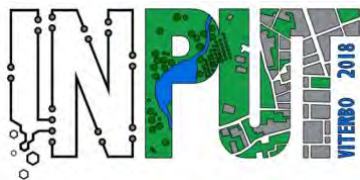
<http://www.fedoapress.unina.it>

Published in Italy

Gli E-Book di FedOAPress sono pubblicati con licenza

Creative Commons Attribution 4.0 International

Cover and graphic project: TeMALAB



This book collects the papers presented at the 10th International Conference INPUT 2018 which will take place in Viterbo from 5th to 8th September. The Conference pursues multiple objectives with a holistic, boundary-less character to face the complexity of today socio-ecological systems following a systemic approach aimed to problem solving. In particular, the Conference aims to present the state of art of modelling approaches employed in urban and territorial planning in national and international contexts.

### SCIENTIFIC COMMITTEE

Ivan Blečić - Università di Cagliari  
 Dino Borri - Politecnico di Bari  
 Marta Bottero - Politecnico di Torino  
 Domenico Camarda - Politecnico di Bari  
 Michele Campagna - Università di Cagliari  
 Arnaldo Cecchini - Università degli Studi di Sassari  
 Donatella Cialdea - Università del Molise  
 Giovanni Colombo - ISMB Istituto Superiore Mario Boella  
 Valerio Cutini - Università di Pisa  
 Andrea De Montis - Università degli Studi di Sassari  
 Giovanna Fancello - Dauphine University (Paris)  
 Romano Fistola - Università degli Studi del Sannio  
 Carmela Gargiulo - Università di Napoli "Federico II"  
 Davide Geneletti - University of Trento  
 Roberto Gerundo - Università degli Studi di Salerno  
 Federica Gobattoni - Tuscia University  
 Paolo La Greca - University of Catania  
 Daniele La Rosa - University of Catania  
 Giuseppe Las Casas - University of Basilicata  
 Antonio Leone - Tuscia University  
 Sara Levi Sacerdotti - SITI Istituto Superiore sui Sistemi Territoriali per l'Innovazione  
 Giampiero Lombardini - Università degli Studi di Genova  
 Stefania Mauro - SITI Istituto Superiore sui Sistemi Territoriali per l'Innovazione  
 Giulio Mondini - Politecnico di Torino  
 Beniamino Murgante - University of Basilicata  
 Silvie Occelli - IRES Piemonte  
 Rocco Papa - Università di Napoli "Federico II"  
 Raffaele Pelorosso - Tuscia University  
 Alessandro Plaisant - Università degli Studi di Sassari  
 Bernardino Romano - Università degli Studi dell'Aquila  
 Francesco Scorza - University of Basilicata  
 Maurizio Tira - University of Brescia  
 Angioletta Voghera - Politecnico di Torino  
 Corrado Zoppi - Università di Cagliari

### CONFERENCE COMMITTEE

Ivan Blečić - Università di Cagliari  
 Marta Bottero - Politecnico di Torino  
 Domenico Camarda - Politecnico di Bari  
 Michele Campagna - Università di Cagliari  
 Arnaldo Cecchini - Università degli Studi di Sassari  
 Donatella Cialdea - Università del Molise  
 Valerio Cutini - Università di Pisa  
 Andrea De Montis - Università degli Studi di Sassari  
 Romano Fistola - Università degli Studi del Sannio  
 Paolo La Greca - University of Catania  
 Daniele La Rosa - University of Catania  
 Antonio Leone - Tuscia University  
 Sara Levi Sacerdotti - SITI Istituto Superiore sui Sistemi Territoriali per l'Innovazione  
 Stefania Mauro - SITI Istituto Superiore sui Sistemi Territoriali per l'Innovazione  
 Beniamino Murgante - University of Basilicata  
 Raffaele Pelorosso - Tuscia University  
 Alessandro Plaisant - Università degli Studi di Sassari  
 Corrado Zoppi - Università di Cagliari

### ORGANIZING COMMITTEE

Antonio Leone - Tuscia University  
 Raffaele Pelorosso - Tuscia University  
 Federica Gobattoni - Tuscia University  
 Maria Nicolina Ripa - Tuscia University  
 Fabio Recanatesi - Tuscia University  
 Beniamino Murgante - University of Basilicata  
 Romano Fistola - Università degli Studi del Sannio  
 Andrea De Montis - Università degli Studi di Sassari  
 Mauro Patano - Politecnico di Bari

This book is the latest scientific contribution of the "Smart City, Urban Planning for a Sustainable Future" Book Series, dedicated to the collection of research e-books, published by FedOAPress - Federico II Open Access University Press. The volume contains the scientific contributions presented at the INPUT 2018 Conference and evaluated with a double peer review process by the Scientific Committee of the Conference. In detail, this publication, including 63 papers grouped in 11 sessions, for a total of 704 pages, has been edited by some members of the Editorial Staff of "TeMA Journal", here listed in alphabetical order:

- Rosaria Battarra;
- Gerardo Carpentieri;
- Federica Gaglione;
- Rosa Anna La Rocca;
- Rosa Morosini;
- Maria Rosa Tremiterra.

The most heartfelt thanks go to these young and more experienced colleagues for the hard work done in these months. A final word of thanks goes to Professor Roberto Delle Donne, Director of the CAB - Center for Libraries "Roberto Pettorino" of the University of Naples Federico II, for his active availability and the constant support also shown in this last publication.

*Rocco Papa*

Editor of the Smart City, Urban Planning for a Sustainable Future" Book Series  
Published by FedOAPress - Federico II Open Access University Press



**Table of contents**

*Introduction* **13**

**Session 1 - Territorial modelling: state-of-art and future development**

An integrated evaluation model for shaping future resilient scenarios in multi-pole territorial systems **17**

*Vanessa Assumma, Marta Bottero, Roberto Monaco, Ana Jacinta Soares*

Features of agents' spatial knowledge in planning open spaces. A pilot study **25**

*Domenico Camarda, Giulia Mastrodonato*

Agent-based modelling and geographic information system for evaluation of eco-district's scenarios **35**

*Caterina Caprioli, Marta Bottero*

Land development support in marginal areas. An opportunity of environmental quality implementation **47**

*Elena Cervelli, Stefania Pindozi, Donatella Cialdea*

Landscape urbanism's interpretative models. A new vision for the Tiber river **57**

*Donatella Cialdea, Chiara Pompei*

The land of the border **69**

*Silvia Dalzero*

The territorial frames. A new integration model for local development **79**

*Donato Di Ludovico, Federico d'Ascanio*

Supporting retail planning with territorial models. Approaches, innovations and opportunities **87**

*Giorgio Limonta, Mario Paris*

Geosimulation methods for settlement morphologies analysis and territorial development cycles **105**

*Giampiero Lombardini*

**Session: 2 - Environment, planning and design: the role of modelling**

Climate change and coastal cities. A methodology for facing coastal flooding **115**

*Carmela Gargiulo, Rosaria Battarra, Maria Rosa Tremiterra*

Ecosystem Services for spatial planning. A remote-sensing-based mapping approach **127**

*Davide Longato, Denis Maragno, Francesco Musco, Elena Gissi*

Integrating participatory modelling in risk management **139**

*Giulia Motta Zanin, Stefania Santoro*

Surface temperature variation and urban heat island intensity in Antofagasta, Chile **147**

*Massimo Palme, Francisco Flores, Leonardo Romero*

The places and times in risk management. The case of the school system **159**

*Francesca Pirlone, Ilenia Spadaro*

---

Distributed delay models. A proposal of application in urban context to forecast pest insects' life cycle <i>Luca Rossini, Maurizio Severini, Mario Contarini, Stefano Speranza</i>	<b>169</b>
--	------------

### **Session 3 - Rural landscapes and well-being: towards a policy-making perspective**

Spatial relations in the benefits from ecosystem services. The case study of Bratsigovo municipality <i>Angel Petrov Burov</i>	<b>179</b>
Historical land use change and landscape pattern evolution study <i>Elena Cervelli, Ester Scotto di Perta, Annalisa di Martino, Salvatore Faugno, Stefania Pindozi</i>	<b>189</b>
Landscape defragmentation policy and planning. An assessment of strengths and weaknesses <i>Andrea De Montis, Antonio Ledda, Vittorio Serra</i>	<b>199</b>
Governance and adaptation to climate change. An investigation in Sardinia <i>Andrea De Montis, Antonio Ledda, Elisabetta Anna Di Cesare, Daniele Trogu, Michele Campagna, Gianluca Cocco, Giovanni Satta</i>	<b>207</b>
Integrating climate change adaptation into SEA. An assessment for Sardinia, Italy <i>Andrea De Montis, Elisabetta Anna Di Cesare, Antonio Ledda, Daniele Trogu, Michele Campagna, Gianluca Cocco, Giovanni Satta, Agnese Marcus</i>	<b>215</b>
Modis data for detection of landscape changes by oil palm plantations in Borneo <i>Samuele De Petris, Piero Boccardo, Barbara Drusi, Enrico Borgogno Mondino</i>	<b>223</b>
Water technologies and rural landscapes in the Apulia region. Multi-sectoral and multi-functional approaches to analysis and planning <i>Laura Grassini</i>	<b>231</b>
Natural rural landscape perception and restorativeness <i>Giulio Senes, Luca Pernechele, Rita Berto, Natalia Fumagalli, Giuseppe Barbiero</i>	<b>243</b>
Evaluating ecological connectivity in cultivated and urbanized areas at landscape scale. A case study in the North-East plain area of Italy <i>Maurizia Sigura, Marco Vizzari, Francesco Boscutti</i>	<b>257</b>

### **Session 4 - Smart planning**

Analysis of zoning plan changes in an urban regeneration area <i>Burcu Aslan, Cankut Dağdal Ince</i>	<b>269</b>
Italian metropolitan cities. A quantitative analysis aimed at the implementation of governance and innovation policies <i>Giuseppe Mazzeo</i>	<b>281</b>
Classifying railway station catchment areas. An application of node-place model to the Campania region <i>Rocco Papa, Gerardo Carpentieri</i>	<b>299</b>

---

**Session 5 - Maintenance, upgrading and innovation in cultural heritage**

Social construction of space in heritage conservation. Geo-mining Park in Sardinia <i>Nada Beretić, Arnaldo Cecchini, Zoran Đukanović</i>	<b>323</b>
Enhance the historical city with new technologies <i>Francesco Botticini, Michele Pezzagno, Michela Tiboni</i>	<b>331</b>
The chartreuse in Calci. Application of a multi criteria decision making method (MCDM) to its functional recovery <i>Ewa Karwacka, Luisa Santini, Denise Italia</i>	<b>341</b>
Spatial data infrastructure in historical contexts. The case study of Matera <i>Piergiuseppe Pontrandolfi, Antonello Azzato</i>	<b>357</b>
On restoring and reviving lost religious buildings. Multi criteria analysis techniques to address an increasingly underused patrimony <i>Elisabetta Pozzobon, Luisa Santini, Alessandro Santucci</i>	<b>369</b>

**Session 6 - Urban and environmental planners: who is the client? The planners jobs in a new millennium**

Gap Reduce. A research & development project aiming at developing a tool for promoting quality of urban life of people with autism spectrum disorder <i>Tanja Congiu, Francesco Lubrano, Luca Pilosu, Pietro Ruiu, Valentina Talu, Giulia Tola, Giuseppe Andrea Trunfio</i>	<b>383</b>
Biourbanism. The role of environmental systems in urban regeneration processes <i>Mauro Francini, Lucia Chieffallo, Annunziata Palermo, Maria Francesca Viapiana</i>	<b>393</b>
Environmental criteria. Consistency between the Minimum Environmental Criteria and the Itaca Protocol criteria concerning the quality of the intervention site <i>Mauro Francini, Giusi Mercurio, Annunziata Palermo, Maria Francesca Viapiana</i>	<b>401</b>
G3w-suite, publishing and managing cartographic Qgis projects on the web. The use in "Foreste Casentinesi, Monte Falterona e Campigna" National Park <i>Walter Lorenzetti, Francesco Boccacci, Leonardo Lami, Davide Alberti, Matteo Ruocco</i>	<b>409</b>

**Session 7 - Big data and data mining**

Tangible and intangible aspects in the promotion and fruition of the UNESCO sites. A case of sustainable innovation <i>Marichela Sepe</i>	<b>417</b>
--	------------

**Session 8 - ICT & models: planning for communities**

Toward clarification of meanings via ontological analysis method in environmental planning processes and actions <i>Domenico Camarda, Maria Rosaria Stifano Melone, Stefano Borgo, Dino Borri</i>	<b>427</b>
--	------------

---

Implementing GIS technology. A spatial decision support system tool to study the impacts of land uses <i>Tullia Valeria Di Giacomo</i>	<b>437</b>
Augmenting the Smart City. A "new view" for the urban planning <i>Romano Fistola, Rosa Anna La Rocca</i>	<b>449</b>
Regenerate, retrain, reuse. A GIS based on spatial multi criteria analysis for the redevelopment of abandoned military areas in Pisa <i>Anna Maria Miracco, Luisa Santini, Alessandro Santucci</i>	<b>461</b>
Opportunities for the use of collaborative 3D mapping in post-disaster situations <i>Camilla Pezzica, Valerio Cutini, Clarice Bleil de Souza</i>	<b>475</b>

**Special session 1: Did we learn lessons? Following the paths of Giovanni Rabino**

Models at the time of weak planning. Their role, if any <i>Valerio Cutini</i>	<b>483</b>
Informal settlements, complexity and urban models. Is there any order in autopoietic urban systems? <i>Valerio Cutini, Valerio Dipinto</i>	<b>491</b>
From the rules to the models and vice-versa for a new planning rationality <i>Giuseppe B. Las Casas, Beniamino Murgante, Francesco Scorza</i>	<b>499</b>
A meta-model of regional transportation planning: the case of Piedmont <i>Sylvie Occelli</i>	<b>509</b>

**Special session 2: Ecosystem-based and performance-based approaches for spatial planning**

Ecosystem services and ecological networks. A case study from Flanders <i>Ignazio Cannas, Daniela Ruggeri</i>	<b>531</b>
Resilient criteria for strategic road network <i>Mauro Francini, Sara Gaudio, Annunziata Palermo, Maria Francesca Viapiana</i>	<b>543</b>
Inclusion of ecosystem-based approaches in the regulations of marine protected areas. An experimental procedure developed in Sardinia. Part 1 <i>Federica Isola, Francesca Leccis</i>	<b>551</b>
Inclusion of ecosystem-based approaches in the regulations of marine protected areas. An experimental procedure developed in Sardinia. Part 2 <i>Maddalena Floris, Salvatore Pinna</i>	<b>561</b>
Spreading green infrastructure-related benefits a study concerning Sardinia, Italy <i>Sabrina Lai, Federica Leone, Corrado Zoppi</i>	<b>569</b>
What planning for facing global challenges? approaches, policies, strategies, tools, ongoing experiences in urban areas <i>Gabriella Pultrone</i>	<b>577</b>
Ecology-based planning. Italian and French experimentations <i>Angioletta Voghera, Benedetta Giudice</i>	<b>589</b>

---

**Special session 3: Geodesign**

The geological workshop of geodesign for landscape planning <i>Pedro Benedito Casagrande, Ana Clara Mourão Moura</i>	<b>595</b>
A hybrid decision-making process for wastescapes remediation. Geodesign, LCA, urban living lab interplay <i>Maria Cerreta, Pasquale Inglese, Chiara Mazzarella</i>	<b>603</b>
Towards a novel approach to geodesign analytics <i>Chiara Cocco, Michele Campagna</i>	<b>611</b>
Facing urban regeneration issues through geodesign approach. The case of Gravina in Puglia <i>Pietro Fiore, Angela Padula, Angela Pilogallo, Francesco Scorza</i>	<b>619</b>
A geodesign project on Post-Earthquake rehabilitation. Co-designing a strategy for Norcia <i>Francesco Fonzino, Emil Lanfranchi</i>	<b>633</b>
Complementary web-based geoinformation technology to geodesign practices. Strategic decision-making stages of co-creation in territorial planning <i>Ana Clara Mourão Moura, Simona Tondelli, Aurelio Muzzarelli</i>	<b>643</b>
Collaborative approach in strategic development planning for small municipalities. Applying geodesign methodology and tools for a new municipal strategy in Scanzano Jonico <i>Angela Padula, Pietro Fiore, Angela Pilogallo, Francesco Scorza</i>	<b>665</b>
The application of geodesign in a Brazilian illegal settlement. Participatory planning in Dandara occupation case study <i>Susanna Patata, Priscila Lisboa De Paula, Ana Clara Mourão Moura</i>	<b>673</b>
From the logic of desktop to web services applications in GIS. The construction of basic evaluation maps to support urban planning and co-design. <i>Nicole Andrade Rocha, Ana Clara Mourão Moura, Hrishikesh Ballal, Christian Rezende, Markus Neteler</i>	<b>687</b>

---



## INTRODUCTION

*Between 5th and 8th September 2018 the tenth edition of the INPUT conference took place in Viterbo, guests of the beautiful setting of the University of Tuscia and its DAFNE Department.*

*INPUT is managed by an informal group of Italian academic researchers working in many fields related to the exploitation of informatics in planning.*

*This Tenth Edition pursued multiple objectives with a holistic, boundary-less character, to face the complexity of today socio-ecological systems following a systemic approach aimed to problem solving. In particular, the Conference will aim to present the state of art of modeling approaches employed in urban and territorial planning in national and international contexts.*

*Moreover, the conference has hosted a Geodesign workshop, by Carl Steinitz (Harvard Graduate School of Design) and Hrishi Ballal (on skype), Tess Canfield, Michele Campagna.*

*Finally, on the last day of the conference, took place the QGIS hackfest, in which over 20 free software developers from all over Italy discussed the latest news and updates from the QGIS network.*

*The acronym INPUT was born as INformatics for Urban and Regional Planning. In the transition to graphics, unintentionally, the first term was transformed into "Innovation", with a fine example of serendipity, in which a small mistake turns into something new and intriguing. The opportunity is taken to propose to the organizers and the scientific committee of the next appointment to formalize this change of the acronym.*

*This 10th edition was focused on Environmental and Territorial Modeling for planning and design. It has been considered a fundamental theme, especially in relation to the issue of environmental sustainability, which requires a rigorous and in-depth analysis of processes, a theme which can be satisfied by the territorial information systems and, above all, by modeling simulation of processes.*

*In this topic, models are useful with the managerial approach, to highlight the many aspects of complex city and landscape systems. In consequence, their use must be deeply critical, not for rigid forecasts, but as an aid to the management decisions of complex systems.*