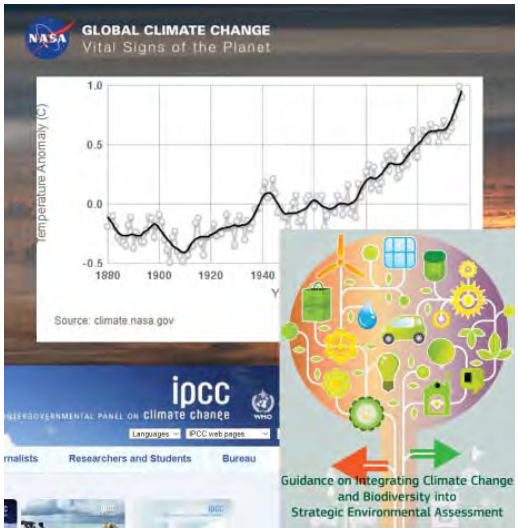

INTEGRATING CLIMATE CHANGE ADAPTATION INTO SEA

AN ASSESSMENT FOR SARDINIA, ITALY

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ABSTRACT

Climate Change (CC) is recognized as an urgent concern, which implies negative effects on the environment, such as sea level rise, coastal erosion, flooding, droughts, and desertification. It involves not only the environmental, but also the economic, and social sphere. The impacts of CC are addressed through two complementary strategies: mitigation and adaptation. The first one operates on the reasons of CC aiming at preventing or reducing greenhouse gases emissions, while the second one focuses on the damage they can cause, aiming at minimizing it or to take advantage of opportunities that may occur.

Strategic Environmental Assessment (SEA) represents a systematic and participatory decision-making support process, aiming at integrating environmental considerations in the elaboration of plans and programs. While SEA regards explicitly mitigation strategies, so far it still refers marginally to CC adaptation measures to be carried on when implementing spatial planning tools at the regional and local scale. The integration of SEA processes with concepts inspired to adaptation to CCs represents a powerful tool for mainstreaming the corresponding policies and strategies. In this study, we scrutinize SEA and spatial planning tools issued in Sardinia (Italy), with reference to their attitude to incorporate possible climate adaptation concerns. We are interested in proposing and applying a framework based on internationally acknowledged criteria that need to be met to properly implement climate change adaptation measures and actions in current spatial planning and SEA practices.

KEYWORDS

Climate Change; Strategic Environmental Assessment; SEA Report

1 INTRODUCTION

According to the Italian National Strategy for Adaptation to Climate Change (SNACC), over the next decades, the impacts resulting from climate change in the European Mediterranean region will be particularly negative. These impacts, in combination with the effects of human pressure on natural resources, make this area one of the most vulnerable in Europe. Therefore, it is necessary, in addition to defining climate change mitigation policies and strategies, to introduce adaptation measures, aimed at countering the effects of climate change in the best possible way, in spatial planning policies both at the local and the global scale. Strategic Environmental Assessment (SEA) aims at assessing the effects of certain plans and programs on the environment and could be "vehicle for the implementation of climate protection within spatial planning ([Blanco et al., 2009]), [...]" (Wende et al., 2012). Then, in this paper we aim at: i) assessing if and to what extent SEA reports address climate change adaptation issues, and ii) highlighting critical factors that need to be dealt with in the Regional Strategy for Adaptation to Climate Change (SRACC).

The paper is organized as follows. The second section gives a brief description of the SEA and climate change adaptation issues based on literature review, while the third section illustrates the study methodology, which investigates the state of the art of climate change adaptation integration in Sardinian SEAs. Then, the fourth section highlights the results of this preliminary analysis, while the last section illustrates the concluding remarks and some elements for future research.

2 STRATEGIC ENVIRONMENTAL ASSESSMENT AND CLIMATE CHANGE

The Directive 2001/42/EC (SEA Directive) has officially introduced the SEA within the European Union as a mandatory procedure for plans and programs, which goes with the decision-making process since the early stages of elaboration with the aim to govern territorial development according to sustainable principles. The SEA aims at assessing the effects of certain plans and programs on the environment, integrating environmental considerations into the design of planning and programming tools (European Parliament and Council, 2011). SEA promotes a significant methodological innovation in the plan-making process, aiming at enriching it with environmental considerations and public participation. During the process, the SEA Report shall be produced, in order to document the results of the analyses carried out, including the description of significant expected effects on the environment (including those ones linked to biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors), and encouraging public participation and transparency. The Intergovernmental Panel on Climate Change (IPCC) states that "human influence on the climate system is clear and growing, with impacts observed across all continents and oceans" (Pachauri & Meyer, 2014). Climate change has been acknowledged "as one of the major environmental challenges of the global society" (Larsen et al., 2012) and includes effects such as increase of temperature, rising of sea level, and more frequent and intense floods and droughts than in the past (Pachauri & Meyer, 2014). Over time, adaptation measures have been proposed to prevent or minimize the negative effects of climate change and take advantage when it is possible. According to Salzmann 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". Adaptation measures include crop diversification, early warning systems, and seasonal climate forecasting (Ochieng et al., 2016).

In 2013, the European Commission adopted an EU strategy on adaptation to climate change (EU Strategy), which focuses on the promotion of three main targets: (i) action by Member States, (ii) climate-proofing action

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at EU level, (iii) better informed decision-making (European Commission, 2013a). The EU Strategy consists of several documents, including the one 'Principles and recommendations for integrating climate change adaptation considerations under the 2014-2020 rural development programmes'. According to such a document, "[so] far, SEA has been designed to assess impacts on the environment, rather than viceversa – e.g. to assess impacts of a changing climate on a programme. However, climate change impacts are closely related to the environment and, typically, biodiversity and ecosystems" (European Commission, 2013a). The European Commission remarks the need for considering climate change impacts in implementing: (i) European Directives on environmental assessments (i.e. Environmental Impact Assessment and SEA), and (ii) spatial planning policies (Commission of the European Communities, 2009). Since the purpose of SEA is to encourage transparent and environmental informed decision-making processes (Fundingsland Tetlow & Hanusch, 2012), SEA is acknowledged as "the vehicle for the implementation of climate protection within spatial planning ([Blanco et al., 2009]), [...]" (Wende et al., 2012). Furthermore, in 2013 the European Commission released the 'Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment' (European Commission, 2013b).

In this study, we aim at investigating whether in Sardinia the SEA Reports of regional plans and programs deal with climate change adaptation issues. Moreover, we want to verify whether adaptation-driven SEA processes lead to drafting plans and programs focusing on climate change adaptation issues.

3 METHOD

In this study, we scrutinize SEA Reports of regional plans and programs in Sardinia (Fig. 1), Italy, for assessing to what extent climate change adaptation has been taken into account during the plan elaboration process, in order to integrate the plan main objectives. Three SEA Reports were selected, among the most recent adopted plans, and checked to verify if adaptation strategies and measures are considered.

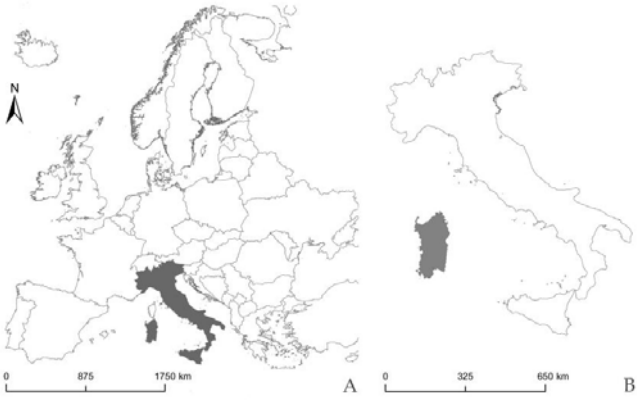

Fig. 1 Geographical context. A: in gray, Italy; B: in gray, Sardinia

The SEA Reports have been analyzed against four basic criteria (Tab. 1): (i) outline of (and relation with) the main objectives of national or international climate change adaptation strategies, (ii) presence of a climate analysis at the regional level, (iii) identification of adaptation objectives to be included in the plan, and (iv) description of implicit or explicit adaptation objectives.

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CRITERIA	REFERENCES	KEY POINTS
REFERENCE TO ADAPTATION STRATEGIES	European Commission, 2013; MEPLS, 2015	National or international climate change adaptation strategies
CLIMATE ANALYSIS	(Prutsch et al., 2010)	Climate analysis, regional level
ADAPTATION OBJECTIVES	(Prutsch et al., 2010)	Adaptation objectives
IMPLICIT OR EXPLICIT MEASURES	(Donner et al., 2016)	Implicit or explicit adaptation measures

Tab. 1 Analysis of ERs: method

We aim at checking if the SEA reports 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. Prutsch et al. (2010) argue that the potential effects of climate change need to be assessed and a series of factors have to be considered, including "[a]nalyse the impacts of past weather events and recent climate trends on key systems" (Prutsch et al., 2010), thus we check if the ERs include a climate analysis. According to Prutsch et al. (2010) "adaptation options should be characterized in as much detail as feasible including information about objectives, direct and indirect effects with emphasis on potential benefits [and so on]". Then, we check if adaptation objectives are defined. Finally, 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).

4 RESULTS AND DISCUSSION

We find out that the SEA Report of the Flood Risk Management Plan refers explicitly to the SNACC while outlining the contents and the main objectives of the other relevant plans and programmes, as required by Annex I to the SEA Directive. It clarifies how the Plan transposes the principles brought by the SNACC, through the implementation of a set of structural and non-structural measures. It also reports on a general climate analysis at the regional level without reference to past and current climate trends. The SEA Report of the Regional Energetic and Environmental Plan describes the impacts of climate change on the energy sector, such as extreme weather events, heat waves and projections on annual rainfall changes. Moreover, it outlines the relevant SNACC information to be integrated in the Plan objectives. The SEA Report of the Rural Development Programme refers to both SNACC and national climate change adaptation plan (which has not been approved yet), and includes a climate analysis at the regional level. It also shows a set of explicit climate change adaptation measures, including recover of production potential damaged by natural disasters and catastrophic events and definition of appropriate prevention measures, investments for development of forest areas and improvement of forest revenue-generating, agri-climate-environmental payments, and so on. Tab. 2 summarizes the results of the scrutiny. As for the clarification of the causal relation between adaptation-driven SEA processes and focus of planning and programming tools on adaptation measures, we scrutinized how far the same plans and programs consider issues related to adaptation to climate change (De Montis et al., 2018). The aim of this comparison is to understand if the presence of implicit or explicit adaptation measures in each plan/program, is related to the SEA. The results of the comparison are synthetized in Tab. 3. All plans and programs but the first one explicitly refer to climate change adaptation measures and so do the related SEA Reports. The SEA of the Hydrogeological System Plan has not been carried out yet. The ERs report on climate change adaptation objectives, according to European and national guidance. Thus, as far as

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the analysis of the tools considered suggests, there is a correspondence between adaptation-driven SEA processes and planning tools focus for adaptation measures.

Plans evaluated	YEAR	ADAPTATION STRATEGIES REFERENCE	CLIMATE ANALYSIS	ADAPTATION OBJECTIVES	IMPLICIT OR EXPLICIT MEASURES
Flood Risk Management Plan (PGRA)	2016	EU strategy on adaptation to climate change Italian national strategy on adaptation to climate change	Yes	Yes	Explicit
Regional Energetic and Environmental Plan (PAES 2015-2030)	2015	Italian national strategy on adaptation to climate change	Yes	Yes	Explicit
Rural Development Programme 2014-2020 (PSR)	2015	EU strategy on adaptation to climate change Italian national strategy on adaptation to climate change	Yes	Yes	Explicit

Tab. 2 Analysis of SEA Reports by plans and programs: findings

REGIONAL PLAN OR PROGRAM	YEAR	IMPLICIT OR EXPLICIT ADAPTATION MEASURES	SEA	ADAPTATION QUOTED IN THE SEA REPORT
Hydrogeological System Plan [Piano stralcio per l'assetto idrogeologico]	2004	Implicit	No	No
Flood Risk Management Plan [Piano di Gestione Rischio Alluvioni]	2016 (update 2017)	Explicit	Yes	Yes
Regional Energetic and Environmental Plan [Piano energetico ed ambientale]	2015	Explicit	Yes	Yes
Rural Development Programme [Programma di Sviluppo Rurale]	2015	Explicit	Yes	Yes

Tab. 3 Final comparison

5 CONCLUSIONS

In this study, we investigate if and how far the issue of climate change adaptation is addressed in the most recent SEA of regional plans and programs in Sardinia, through the examination of their respective SEA Reports. The analysis highlights that climate change adaptation considerations are beginning to influence, implicitly or explicitly, planning practices also thanks to the availability of sectorial national and international strategies (i.e. EU Strategy and SNACC), underlining the importance of developing the Sardinian SRACC.

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Notwithstanding this is a preliminary study, we found out that SEA represents a useful instrument to integrate environmental considerations related to climate change adaptation into the objectives of plans and programs.

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REFERENCES

Blanco, H., Alberti, M., Forsyth, A., Krizek, K. J., Rodríguez, D. A., Talen, E., & Ellis, C. (2009). Hot, congested, crowded and diverse: Emerging research agendas in planning. *Progress in Planning*, *71*(4), 153-205. doi: https://doi.org/10.1016/j.progress.2009.03.001

Commission of the European Communities (2009). *White Paper. Adapting to climate change: Towards a European framework for action. {SEC(2009) 386} {SEC(2009) 387} {SEC(2009) 388} /* COM/2009/0147 final */*. Brussels, BE: Commission of the European Communities.

De Montis, A., Ledda, A., Di Cesare, E. A., Trogu, D., Campagna, M., … & Satta, G. (2018). Governance and adaptation to climate change: An investigation in Sardinia. In this book.

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

European Commission. (2013a). *The EU Strategy on adaptation to climate change*. Retrieved from https://ec.europa.eu/clima/policies/adaptation/what_en#tab-0-1

European Commission. (2013b). *Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment*. Retrieved from http://ec.europa.eu/environment/eia/pdf/SEA%20Guidance.pdf

Fundingsland Tetlow, M., Hanusch, M. (2012). Strategic environmental assessment: The state of the art. *Impact Assessment and Project Appraisal*, *30*(1), 15–24. doi: https://10.1080/14615517.2012.666400

Larsen, S. V., Kørnøv, L., & Wejs, A. (2012). Mind the gap in SEA: An institutional perspective on why assessment of synergies amongst climate change mitigation, adaptation and other policy areas are missing. *Environmental Impact Assessment Review*, *33*(1), 32-40. doi: https://doi.org/10.1016/j.eiar.2011.09.003

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

Pachauri, R. K., & L. A., Meyer (Eds.). (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, CH: IPCC.

Prutsch, A., Grothmann, T., Schauser, I., Otto, S., & McCallum, S. (2010). *Guiding principles for adaptation to climate change in Europe ETC/ACC* (Technical Paper 2010/6). Retrieved from http://acm.eionet.europa.eu/docs/ETCACC_TP_2010_6_guiding_principles_cc_adaptation.pdf

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 and G. Ziervogel (Eds.), *Climate Change Adaptation Strategies – An Upstream-downstream Perspective* (pp. 3-15). Basel, CH: Springer International Publishing AG.

Wende, W., Bond, A., Bobylev, N., & Stratmann, L. (2012). Climate change mitigation and adaptation in strategic environmental assessment. *Environmental Impact Assessment Review*, *32*(1), 88-93. doi: https://doi.org/10.1016/j.eiar.2011.04.003

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

WEB SITES

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

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Antonio Leone Carmela Gargiulo
Editors

Environmental and territorial modelling for planning and design

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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 Conferences 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.

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

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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 pursed 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.

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