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Daniele La Rosa
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Innovation in Urban and Regional Planning

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Editors
Daniele La Rosa
Department of Civil Engineering
and Architecture
University of Catania
Catania, Italy

Riccardo Privitera
Department of Civil Engineering
and Architecture
University of Catania
Catania, Italy

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Preface

The 11th Edition of the International Conference focuses on how to integrate nature-based solutions in urban and regional planning processes and science. Previously planned for September 2020, due to the COVID-19 pandemic the INPUT 2020 Conference will be hosted in 8–10 September 2021 by the University of Catania (Italy).

The overarching theme of INPUT 2021 edition is "Integrating Nature-Based Solutions in Planning Science and Practice". There is growing evidence that nature-based solutions (NBS) are strategic instruments to restore or improve the functionality of urban ecosystems towards more livable, healthier and resilient cities. Despite their many advantages, NBS are not widely implemented because the evidence of their effectiveness is not yet sufficiently diffused among policy-makers, city-planners and residents and because NBS are often overlooked due to the complexity of their design and lack of normative instruments supporting planning choices. In order to permanently incorporate NBS into planning instruments, more research and international discussion are required to consolidate the fragmented evidence that NBS can significantly improve the overall degree of environmental sustainability of contemporary cities.

INPUT 2020 gathers international scholars in the fields of planning, civil engineering and architecture, ecology and social science, to build and consolidate the knowledge and evidence on NBS and to help an efficient implementation and replication of solutions.

The INPUT 2020 Conference hosts 14 thematic sessions, namely:

- Enhancing the use of nature-based solutions in urban planning
- Modelling to innovate planning solutions for socio-ecological systems
- Input visions: new technologies, data and hybrid models for spatial planning
- Urban metabolism and simulation for decision-making in spatial planning
- Performance-based planning
- Computational planning
- Geodesign for informed collaborative spatial decision-making

- Planning and design of ecosystems services: assessment frameworks, models, mapping and implications
- Green infrastructure for planning healthy urban environments
- The mitigation of peripheralization risk in urban and regional planning
- Strategies and actions for climate change adaptation and mitigation in mediterranean regions
- Analysis and planning of rural landscapes
- Accessibility in urban planning: moving towards innovative approaches
- Maintenance, upgrading and innovation in cultural heritage

This book presents the first collection of 69 contributions submitted to the INPUT 2020 Conference, following the first call for paper launched in Winter 2020. The accepted articles, after a blind-review process, are here organized in 5 topical parts, which group together the 14 thematic sessions of the conference:

- Nature and Ecosystems for Urban Systems
- Models and Technologies for Spatial Planning
- Climate Change and Spatial Planning
- Peripheries, Rural and Cultural Landscapes
- Accessibility in Urban Planning

INPUT 2020 proceedings explores empirical as well as theoretical frameworks for NBS, their attitude to provide ecosystem services, to deal with climate change effects and to support mitigation and adaptation planning strategies. Integration of NBS in planning science and practice is investigated across different contexts and scales, from urban cores to peripheries as well as from rural to cultural landscapes. Above all, this collection presents the state of the art of modelling approaches and innovations employed in urban and spatial planning, with a trans-disciplinary, boundary-less character to face the complexity of contemporary socio-ecological systems and following a practice-oriented approach aimed to problem solving.

INPUT is a group of Italian academic researchers and academics working in different fields related to the exploitation of innovation for urban and regional planning, with particular reference to geo-informatics and socio-ecological aspects of spatial planning. INPUT Conference is held every two years in Italy, with last editions been hosted in Viterbo (2018), Torino (2016), Cagliari (2014) and Potenza (2012).

INPUT 2020 Conference is organized by LAPTA, a research laboratory of Department of Civil Engineering and Architecture of the University of Catania (Italy), working on sustainable urban and landscape planning.

Catania, Italy
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Daniele La Rosa
Riccardo Privitera

Contents

Investigating the (Un)Integration Between Sectoral Policies with the Habitat Degradation Model

Francesco Scorza, Angela Pilogallo, Lucia Saganeiti, and Beniamino Murgante

Abstract Even if the Natura 2000 Network was established in order to preserve the biological diversity among the European States, a relevant percentage of Natura 2000 sites are expected to be lost by the end of this century and an issue linked to the effectiveness of conservation policies emerges. This paper deals with the (un) integration between sectoral policies and different competences that leads to a lacking monitoring system of territorial management performances in terms of achieving the conservation objectives of the Natura 2000 site and the management of the remediation of a polluted area. The case study includes indeed a Site of National Interest (SNI), for which several reclamation projects are still in the submission/approval phase, and a partially overlapping Natura 2000 Network Site. The tool used as a proxy for monitoring the biodiversity spatial distribution over the study area is the degradation map computed by the 'Habitat quality and degradation' InVEST tool. After defining a baseline representative of the current conditions, two medium and long-term scenarios respectively were compared in order to assess the effects procedure of partial and total remediation of the SNI on the habitat quality and degradation. This methodology is aimed to offer a valuable support to the decision-makers and the competent authorities in biodiversity conservation policy design by allowing to overcome the limits related to the actual normative framework concerning the land management system.

Keywords Habitat degradation · Ecosystem services · N2K network · Site of national interest (SNI)

F. Scorza · A. Pilogallo (✉) · L. Saganeiti · B. Murgante
Laboratory of Urban and Regional Systems Engineering (LISUT), University of Basilicata, Potenzo, Italy
e-mail: angela.pilogallo@unibas.it

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1 Introduction

Over the last twenty years, considerable progress has been made in understanding of how impoverishment of biodiversity affects ecosystem services (ES) and their relevant performance (European Commission 2015), and consequently the quality (Cardinale et al. 2012) of human life. Despite this, the composition of species communities is rapidly decreasing with potentially significant consequences for ecosystem resilience (Oliver et al. 2015). Nowadays, about 25% of animal and plant species are threatened and about 1 million species are expected to become extinct within a few decades (IPBES 2019).

If the current challenges included in the Sustainable Development Goals (SDGs) point towards balancing the often conflicting objectives of human development and biodiversity conservation (see SDGs 1, 2 and 8) (Waldron et al. 2017), the aims of biological diversity preservation and protection of vulnerable habitats and species have already been addressed by the European Union (EU) through the Birds and Habitats Directives and the subsequent establishment of the Natura 2000 (N2K) Network. Although the N2K Network's potential for the achievement of the conservation objectives is widely recognized (Donald et al. 2007), the results to date are not considered to be fully satisfactory (European Environment Agency 2010) and a number of studies have been carried out in order to identify the main weaknesses (Pellegrino et al. 2017).

As far as territorial governance is concerned, the effectiveness of site designation and management depends on the decision-making and policy-design process (Beunen and de Vries 2011), the support of local stakeholders in the approval and participation processes being relevant (Achim Steiner 2009). Another point considered very critical is the overlapping of policies and responsibilities at different government levels, which is often reflected in political contradictions on several scales, conflicts related to other sectoral policies and a top-down governance gap. The European Commission (EC) (Simeonova et al. 2017), in declaring the gap between spatial planning and its instruments for the implementation of the N2K network as one of the most significant causes for the lack of conservation objectives, points to territorial planning as the most appropriate framework for the creation of an improved synergy between different sectoral and environmental policies and ensuring that developments comply with the EU sectoral and environmental legislation.

The aim of this work is to describe and explain the conflict between a Site of Community Interest (SCI)/Special Protection Area (SPA) and a Site of National Interest (SNI) in the case study of the Basilicata region.

By assessing Habitat Quality as a proxy for the biodiversity of the area, an estimation of positive effects that remediation produce on environmental components in medium and long-term scenarios will be produced.

In this work, we refer to Habitat Quality and Degradation as a measure (or even as a proxy) for biodiversity in general. The closest reference to the meaning by which we have dealt with habitat quality is the class "Maintaining nursery

populations and habitats (Including gene pool protection)" (code 2.2.2.3—CICES v.5 (Haines-Young and Potschin 2018)) representing the provision of suitable habitats for wild plants and animals and the maintenance of appropriate ecological conditions necessary for sustaining these populations.

The results obtained in the study area highlight the potential of the proposed methodology to support the decision-making process, orienting reclamation procedures and improving management actions for both SCI/SPA and SNI sites within an integrated approach.

2 Study Area

The study area, located in the Basilicata region (Southern Italy) extends for about 742.5 Km^2 and is located along the middle valley of the Basento river. The interest in this study area is based on the simultaneous presence of a large industrial area, a SNI and areas of acknowledged naturalistic-environmental value SCI/SPA.

This area is part of the Val Basento industrial agglomeration, founded between the 50s and 60s subsequent to the discovery of a large methane deposit. After the starting phase of the construction works of the gas pipeline in 1961, many other industrial activities were established, such as a petrochemical plant. The international crisis started in 1973 led to the shutdown of several establishments. A Program Agreement signed in 1987 gave the National Hydrocarbons Agency (Eni) full powers to relaunch the Val Basento industrial area, and the Matera Industrial Consortium was given the task of creating a Technology Park. In 1990 the so-called Tecnoparco Valbasento Spa was founded, which currently hosts production activities and companies involved in the environmental and energy sectors, providing services and infrastructures such as: analysis laboratories; production and distribution of electricity, nitrogen and demineralized water production plants; collection, treatment and disposal of liquid waste.

Public driven industrial policies stopped during the 80s and the area underwent a period of abandonment and decline with consequent environmental issues deriving from extensive pollution in abandoned industrial parcels. At the end of the 90s a part of the area was proposed as a SCI/SPA site thanks to the variety of species and biodiversity richness present there. The procedure for the recognition of sites as nodes of the N2K of the Basilicata Region was completed in 2003, but it was only in 2017, following the drafting and approval of their Management Plans, that sites were designated as Special Areas of Conservation (SACs).

At the same time, due to the high levels of pollution and related effects on health, environment and the local economy, Law 179/2002 established the "Val Basento" as a SNI and assigned its remediation responsibility to the Ministry of the Environment, Land and Sea (MATTM).

The fragmentation of competences in territorial governance led to a lack of integration between those acts promoted by the different responsible authorities (Basilicata Region for N2K sites and MATTM for SNI) who operated without any coordination.

3 Methodology

The analytical tool used is InVEST Habitat Quality and Degradation, that proved to be effective for the assessment of how different change scenarios in land cover or, as in our case study, habitat threats might affect habitat quality, and consequently biodiversity (Arcidiacono et al. 2015). This model draws up two maps: habitat quality (Q_{xj}) and degradation (D_{xj}). Habitat degradation was used to model the cumulative impact of the threats affecting the study area. D_{xj} is the function of the sensitivity of each LULC class to each threat (S_{jr}), of the relative weight of each threat (w_r), and of the impact i_{rxy} of the threat r in cell x originating in y and distant d_{xy}:

$$D_{xj} = \sum_r \sum_y \left(\frac{w_r}{\sum_r w_r} \right) r_y i_{rxy} \beta_x S_{jr}$$

where β_x represents the level of accessibility in grid cell x.

The highest sensitivity values were assigned to woodlands, freshwaters, agricultural lands and grasslands falling within the SCI/SPA area because they were considered to be of higher value and more vulnerable to the threats taken into consideration. In line with habitat suitability, zero sensitivity values have been assigned to land use classes with a strong anthropogenic component.

For each threat, users have to assign the maximum influence distance $(d_{r_{\max}})$ and the distance-decay function (linear or exponential).

Since this work aims at comparing the positive effects of remediation actions, three scenarios were formulated, based on the current trend, medium and long-term reclamation programs. According to MATTM, the polygons bounded and classified as sources of pollution included by the SNI perimeter, and corresponding to abandoned or still active industrial and production sites, are divided on the basis of the environmental remediation program progress. For some sites (polygons) the reclamation plan has already been approved, while for others it is still not approved, so it is fair to assume that the reclamation times will be longer. For this reason, the mid-term scenario represents the approved remediation plans while the long-term scenario analyses the effects of the completely reclaimed site. The weights range between 0 (less important) and 1 (very important). The highest value was attributed to the industrial areas included within the perimeter of the SNI considering the hypothesis that the remediation process cannot recover a full degree of naturalness but has to render the environmental conditions of the sites comparable with other

industrial ones. The values assigned to sensitivity variables, threats and decay distances are the result of an evaluation by a team of experts involved in previous work. All detailed values used for threat definitions and sensitivity table are summarized in Scorza et al. (2020). In the context of this work it was considered useful to modify the values of the parameter "habitat suitability" by including among the criteria for the assignment of the value, also the belonging to the SCI/SPA site. For the same class of land use, therefore, the areas within the N2K site were privileged because they were considered more sensitive than the presence of the industrial site.

4 Results and Discussions

The first result is the degradation map referred to the actual situation (Fig. 1). The most degraded areas are located near larger industrial areas, close to the N2K site and in the most southern part of SNI area. Out of a total of 21 polygons (i.e. industrial areas) recognized as a source of impact according to the MATTM, the medium-term scenario shows the remediation effects of only one of these industrial areas accounting for 3.71 ha. The degradation decrease is therefore rather localized and is not extended to the entire study area. In order to assess the variations following the implementation of a remediation program, the percentage changes were calculated using map algebra operations.

The maximum reduction in the degradation level (therefore corresponding to the long-term scenario) within the study area is 6%, whereas in the medium term, a decrease of less than 1% can be expected.

Within the SCI/SPA site, the partial reclamation (mid-term scenario) has no effect on changes in habitat degradation or quality. Differently, in the southern part of the area, the degradation reduction reaches 3% as its maximum value (Fig. 2).

The effects of a complete remediation, which involves a total of three industrial areas, are more significant. One area is located in the northern part of the SNI, two

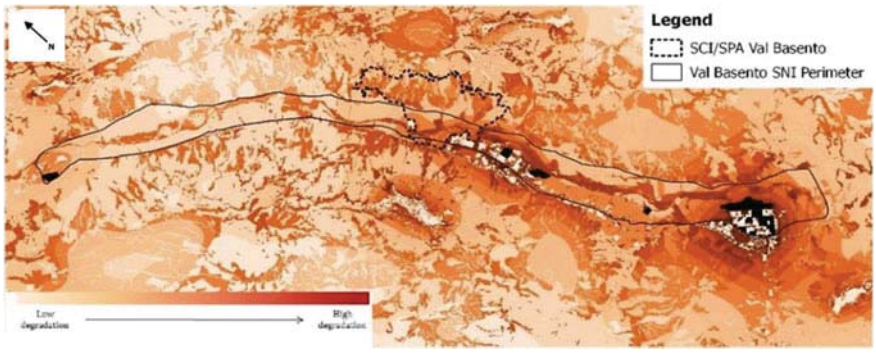

Fig. 1 Degradation map of current trend

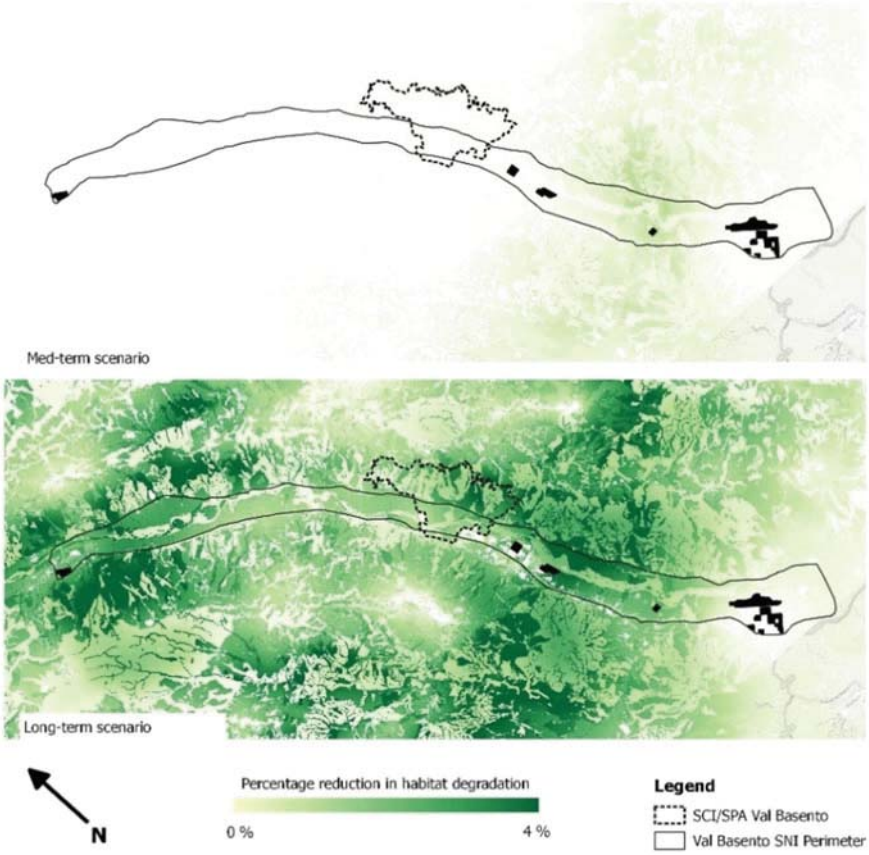

Fig. 2 Percentage reduction in habitat degradation in medium and long-term scenarios

are in the immediate downstream area with respect to the SCI/SPA perimeter. The surface area involved in this case is 30.06 ha, equal to 0.04% of the entire study area. An interpretation of the results must take into account that the model neglects the morphology of the territory, and therefore the privileged directions of pollutant diffusion. The results are linked to land use class in terms of habitat suitability and vulnerability to different threats. Since it is, in actual fact, a valley river bed with two converging sides, the expected spatial distribution of reclamation effects—all other variables being equal—is not isotropic as, however, appears from the image. In the western part of the study area there is a sector along the slope where a relevant degradation reduction is recorded, especially with respect to meadows, grazing grounds and agricultural crops. Moreover, no improvement in the wooded areas has been achieved, especially where they are surrounded by cultivated areas. This happens because agriculture is itself a source of threat and the relevant reclamation effects are clearly marginal.

The results show that habitat degradation in the study area is certainly due to the cumulative impact of multiple threats arising partially from the industrial area located along one of the main regional road infrastructures, and partially from the road and rail network that from the river valley branches off along the slopes, also bordering or crossing areas of high naturalness.

5 Conclusions

This work analyses a case study where a strong contradiction in the management of the territory emerges. On the one hand, the presence of industrial areas with high pollution potential has led to the identification of a SNI whose remediation procedure is direct responsibility of MATTM. On the other hand, the recognition of the naturalistic and biodiversity conservation values has led to the identification of a N2K site whose management plan, approved in 2015, completely neglects the presence of SNI.

The aim of this work is to provide and test a methodology able to measure the effects of two overlapping and conflicting policy frameworks: the first is oriented towards naturalness preservation (N2K) and the second aims at solving environmental contamination issues (SNI). Both policies substantially ignore each other and demonstrate a fragmentation in the territorial governance system where different authorities are responsible of specific fields of intervention.

The developed application concerns the overlapping of sectoral policies, one for the management of the N2K site and the other for the reclamation of the industrial area included in the Val Basento Site of National Interest. The novelty of the proposed work lies in suggesting a methodology that declines the concept of performance in terms of complementarity between the two management plans thus offering support to the decision-making process in terms of prioritization of interventions and monitoring of expected effects. As already pointed out by the authors in previous works (Scorza et al. 2019; Mazzariello et al. 2018; Pilogallo et al. 2018, 2019; Scorza 2013), the ES framework allows to integrate and simultaneously consider multiple scales, multiple habitats and multi-level environmental policies, thus offering the advantage of a more holistic environmental management (Maltby et al. 2018).

Therefore, use of the InVEST Habitat Quality model allowed us to contribute to the general process for the provision of an effective territorial monitoring system, suitable to assess the effects of ongoing threats and environmental management actions on habitat quality. Although the model simplifies the complex reality linked to the phenomenon of pollutant diffusion, temporal and spatial variability, boundary conditions and more generally the complex dynamics with which threats act to the detriment of habitat quality (Tallis et al. 2012), it is useful to perform a scenario analysis in order to identify threats and habitats with respect to land use especially in those area in which information on species abundance and composition, endemism and functional significance are poor (Terrado et al. 2016).

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