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Inner Peripheries spread over rural Europe: from territorial needs to the European Policy debate

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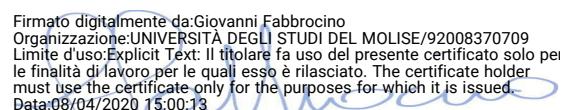
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Usually, I choose one sentence for a thesis's preface. Today, I chose two sentences that I feel mine. The first one, for my Ph.D experience; the second one, for my endless vibrant interest towards the European disadvantaged territories.

"Failed experiments and wrong or risky hypotheses are the driving forces of scientific discovery, and scientists must embrace failure if they are to eventually succeed."

Topalidou, I. (2018)

"Teach undergraduates that doing a PhD will require them to embrace failure"
Nature Career Column, doi: 10.1038/d41586-018-06905-0

"The places that don't matter are becoming tired of being told that they don't matter and are exercising a subtle revenge. They are voting down or threatening to vote down a system they perceive has quelled their potential and driven them down a road in which the future offers no opportunities, no jobs and no hope. It is as if the declining agricultural areas and rustbelts the world over have had enough of being patronised and have said, rightly or wrongly, that enough is enough: If we are being told that we no longer matter and that we are going down, the whole ship will sink with us"

Rodriguez-Pose A (2018)

"The revenge of the places that don't matter (and what to do about it)"
Cambridge Journal of Regions, Economy and Society, Issue 11 pp.189-209

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Preface

This work arises from a personal experience in disadvantaged territories, which has motivated a strong will to provide instruments to change how things currently work in these areas. During my PhD course, I have not only scientifically analysed these territories but I have also been lucky enough to work with their administrations. I supported the local stakeholders to sustainably develop their territories, but it was an arduous work. On this occasion, I felt the populations' scepticism towards the National and European governments, and the feeling that nothing could change because they have been left behind. Indeed, so far, the political and financial efforts have been mainly allocated to urban areas, while the development of disadvantaged territories plods along.

On the strength of this awareness, the PhD work is aimed to analyse and disentangle the new and sometimes misinterpreted concept of Inner Peripheries already explored in several projects, which properly identifies the disadvantaged territories' main characteristics and processes in Europe. The Inner Peripheries potentialities and criticalities are highlighted, relating them to key EU policies pathways, providing instruments and composite policy framework to sustainably develop Inner Peripheries.

Moreover, the final remarks are synthetized in an opinion paper aimed to underline the relevance of Inner Peripheries in the current European context, which is hurt by a widespread populism arisen from these forgotten territories.

Abstract

English version

The Inner Peripheries' concept is a quite new and sometime misinterpreted theme in science and policy arenas. The Inner Peripheries have been recently explored in several European projects which highlighted complex territorial characteristics and unbalanced territorial processes all around Europe. Indeed, Inner Peripheries are mainly characterised by peripherality and marginality conditions, low economic potential, poor access to Services of General Interest (SGIs) and lack of relational proximity. These features lead to reduced quality of life, demographic decline and population ageing. According to the ESPON project PROFECY's main findings, the Inner Peripheries spread over the 45% of the European territory, partially overlapping territories which may access to territorial support schemes, such as Lagging Regions and Less Favoured Areas. Theoretically, this imply that Inner Peripheries may obtain funds from the Cohesion and Rural Development Policy, respectively. The Italian National Strategy for Inner Areas is one of the first attempt in Europe to deal with Inner Peripheries issues, mainly focusing on the critical role of SGIs and the implementation of Cohesion Policy funds. According to the above mentioned issues, this research aims to *i*) disentangle the Inner Peripheries concept and related European Policies linkages through a structured review; *ii*) create an indicators' set linked with Rural Development Priorities (as the completion of the Cohesion Policy) and based on socio-economic and environmental characteristics of Inner Peripheries in Italy to test the progresses of these areas towards rural development; *iii*) analyse the main territorial characteristics of a Spanish case study, suggesting sustainable development strategy pathways following the "Rural Cohesion Policy" framework; *iv*) provide critical insights into potential regional development actions and policy to assess and monitor Inner Peripheries' characteristics and to address specificities of land use, implementing integrated policy schemes.

In the first place, the main findings shown the complexity of framing Inner Peripheries within the research and policy debates, highlighting poor linkages between Inner

Peripheries and Cohesion and Rural Development Policies in the Academia debate. On this basis, the effort to explore Inner Peripheries rural needs, building an indicators' set, meets the poor research attempts dealt so far to analyse rural development in the Inner Peripheries context. The indicators' set robustly described the current territorial potentialities and limitations of the Inner Peripheries to cope with rural development (e.g. lack of farms' competitiveness and connectivity), and could be useful to support future planning and policy interventions. Moreover, future sustainable development strategies in Inner Peripheries have to foster the territorial cohesion, avoiding urban-rural inequalities and the depopulation issue, as well as use the territorial resources (e.g. agricultural and forest lands), and simultaneously improving and promoting the environment and landscape. Finally, this research points out that Inner Peripheries should become a European Priority, addressing fine scaled related issues as relevant spaces to establish more efficient territorial strategies based on land use specificities and using the European Integrated Territorial Investments tools, following the Rural Cohesion Policy framework.

Abstract

Versione italiana

Il concetto di Inner Peripheries è un tema recente e talvolta mal interpretato in ambito scientifico e politico. Le Inner Peripheries sono state recentemente studiate da numerosi Progetti Europei che hanno messo in evidenza caratteristiche territoriali complesse e squilibri nei processi territoriali in tutta Europa. Le Inner Peripheries sono principalmente caratterizzate da condizioni di perifericità e marginalità, da un basso potenziale economico, da uno scarso accesso ai Servizi di Interesse Generale e dalla mancanza di prossimità relazionale. Queste caratteristiche riducono la qualità della vita e incentivano lo spopolamento. Secondo i risultati del progetto ESPON PROFECY, le Inner Peripheries coprono circa il 45% del territorio Europeo, sovrapponendosi parzialmente a territori che possono accedere a schemi europei di supporto territoriale, come le Regioni in ritardo di sviluppo e le aree svantaggiate. Teoricamente, ciò implica che le Inner Peripheries possano ottenere fondi dalla Politica di Coesione e di Sviluppo Rurale. La Strategia Nazionale per le Aree Interne è uno dei primi esempi in Europa che affronta i problemi delle Inner Peripheries, concentrandosi principalmente sul ruolo critico dei servizi di interesse generale e sulla Politica di Coesione. In base alle questioni sopra menzionate, la ricerca mira a *i*) chiarire il concetto di Inner Peripheries e i relativi collegamenti delle Politiche Europee attraverso una revisione strutturata; *ii*) creare un set di indicatori collegato alle Priorità di Sviluppo Rurale (a completamento quindi della Politica di Coesione), basato sulle caratteristiche socioeconomiche e ambientali delle Inner Peripheries in Italia, al fine di testare i progressi di queste aree verso lo Sviluppo Rurale; *iii*) analizzare le principali caratteristiche di un caso studio spagnolo e suggerire strategie di sviluppo sostenibile, seguendo il principio della "Politica di Coesione Rurale"; *iv*) ipotizzare azioni e politiche di sviluppo regionale per valutare e monitorare le caratteristiche delle Inner Peripheries sulla base delle specificità dell'uso del suolo, oltre ad attuare schemi politici integrati che promuovano uno sviluppo equilibrato.

I risultati principali hanno evidenziato la complessità nell'inquadrare le Inner Peripheries nei dibattiti scientifico-politici, evidenziando scarsi collegamenti tra queste e le Politiche di Coesione e Sviluppo Rurale. Lo sforzo quindi di esplorare le esigenze rurali delle Inner Peripheries costruendo un insieme di indicatori, soddisfa gli attuali e limitati tentativi della ricerca. Il set di indicatori creato, descrive in modo robusto le attuali potenzialità e i limiti delle Inner Peripheries (ad es. mancanza di competitività e connettività delle aziende agricole) e potrebbe essere utile per futuri interventi politico-pianificatori. Inoltre, le future strategie di sviluppo sostenibile devono favorire la coesione territoriale, evitare le disuguaglianze urbano-rurali e lo spopolamento, nonché utilizzare le risorse territoriali (ad es. terreni agricoli e forestali) promuovendo le risorse ambientali e paesistiche. Infine, la presente ricerca sottolinea che le Inner Peripheries dovrebbero diventare una Priorità Europea, in quanto spazi pertinenti per stabilire strategie territoriali più efficienti, basate sulle specificità dell'uso del suolo, utilizzando gli strumenti europei per gli investimenti territoriali integrati e seguendo il quadro della Politica di Coesione Rurale.

CHAPTER 1.

The Inner Peripheries in Europe: an introduction on their main element

The Inner Peripheries' concept and related planning issues are quite new themes in science and policy arenas, and posed critical questions to the European regional development policy and practice. The Inner Peripheries recently arise from two ESPON Projects (Perez-Soba et al., 2013; Noguera et al., 2017) which highlighted complex territorial characteristics and unbalanced territorial processes all around Europe, such as low economic potential, poor access to Services of General Interest and lack of relational proximity (Copus, Mantino, & Noguera, 2017). Since Inner Peripheries cover around the 45% of the European territory, it is important to deeper analyse their main characteristics and discuss the related "new" challenges. The "new" word is quoted, considering that Inner Peripheries may overlap, even if they are not the same, other territorial categories, such as mountains, islands, sparsely populated areas (Gløersen et al. 2012), thus sharing some potentialities and challenges. Moreover, Inner Peripheries partially overlap territories which may access to support schemes, namely Lagging Regions (for the 37% on average) and Less Favoured Areas (for the 41% on average) (Noguera et al., 2017). Theoretically, this imply that Inner Peripheries may obtain funds from the Cohesion Policy, which usually support Lagging Regions, and from the Rural Development Policy, directly related to the Less Favoured Areas development.

However, we are still far from systematically adopt integrated political schemes (e.g. Rural Cohesion Policy, Dax & Copus, 2018). For example, the Italian Inner Areas are identified by the poor accessibility to SGIs only (Barca, Casavola & Lucatelli 2014), and can be viewed as a type of Inner Peripheries (Noguera & Copus 2016). Consequently, the related Italian National Strategy for Inner Areas, is currently financing the Inner Peripheries criticalities mainly on the basis of Cohesion Policy and National Funds' use. Indeed, Barca (2012) indicates the Inner Peripheries as strategic territories to effectively orient and use the EU Cohesion Policy funds. To date, the potentiality of Inner Peripheries to boost local economic

development through Rural Development Policy funds use is rather unexpressed (Cesaro & Marongiu, 2017).

However, at European level, Inner Peripheries are covered by forest and agricultural lands for the most part (Matthews 2016), as well as in the Italian case. In detail, Inner Peripheries spread over the 60% of the Italian National territory (Lucatelli, Carlucci & Guerrizio 2013), and host the 75% of the entire Italian forest lands and the 63% of the total Italian agricultural areas (De Toni, Sallustio, Di Martino, Lasserre & Marchetti, 2017). Moreover, Inner Peripheries include the 75% of the Italian Protected Areas surface (Marchetti, De Toni, Sallustio & Tognetti 2017, see Annex 1 for the full article), thus showing high values of habitat quality (a proxy of the biodiversity conservation status). Indeed, it has been recently demonstrated that the habitat quality is higher within the Protected Areas and where human population is less dense and the agricultural areas are extensively used (Sallustio et al., 2017, see Annex 2 for the full article).

Thus, these territories are extremely important for the provision of goods and services, and it is needed to contextualize both Cohesion and Rural Development Policies by analysing and considering territorial resources. According to the above-mentioned issues, the research aims to:

- disentangle the Inner Peripheries concept and related European Policies linkages through a structured review, suggesting a comprehensive policy approach to consider for reduce the marginality condition taking advantage of peripherality characteristics;
- create an indicators' set linked with Rural Development Priorities and based on socio-economic and environmental characteristics of Inner Peripheries in Italy to test the progresses of these areas towards rural development and

identifying the aspects which are needed to be strengthened (e.g. competitiveness, environmental sustainability);

- analyse the main territorial characteristics of a Spanish case study (i.e. depopulation trend, lack of accessibility to Services of General Interest, land use – land cover and Natura 2000 network coverage), suggesting sustainable development strategy pathways on these bases, following the recent comprehensive policy approach named “Rural Cohesion Policy”;
- summarize the major criticalities of Inner Peripheries concept highlighted in this research and provide critical insights into potential regional development actions and key policy developments to assess and monitor Inner Peripheries' characteristics.

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CHAPTER 2.

Disentangling a new concept and
related planning and policies issues

One of the first aims is to explore the Inner Peripheries concept and related issues through a scientific literature review, since the theme of Inner Peripheries is a quite new and misinterpreted concept. Thus, in the following Review article we provide critical insights into the Academia debate on Inner Peripheries concept and the related funding possibilities, i.e. Rural Development Policy and Cohesion Policy.

Inner Peripheries: dealing with peripherality and marginality issues within the European Policy framework

Review article, submitted to Italian Journal of Planning Practice (10/10/2019)

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Abstract

Inner Peripheries is a complex and often misinterpreted concept, as demonstrated by current scientific evidence. Such complexity derives from the intrinsic peripherality and marginality characteristics of the Inner Peripheries. Despite Inner Peripheries suffer from geographical and socio-economic disparities, their environmental, social and economic potentialities are not fully expressed, and thus can be further strengthened by both the EU Cohesion and Rural Development Policies. However, there is currently a lack of knowledge about the conceptualization of the Inner Peripheries, which limits the effectiveness of planning strategies in these territories. Therefore, through a structured review, we

explore the linkages between Inner Peripheries and peripherality and marginality concepts and related criticalities and opportunities. Moreover, we consider the relationships between Inner Peripheries and Cohesion Policy Thematic Objectives and Rural Development Policy Priorities. The main findings show that the Inner Peripheries concept needs to be further explored, especially concerning the environmental aspects. Accordingly, we suggest that great challenges and opportunities currently exist in these territories, and combined policies efforts need to be oriented to strengthen the future sustainable development in the Inner Peripheries.

Keywords

review; inner peripheries; peripherality; marginality; rural development policy; cohesion policy.

1. Introduction: Inner Peripheries as a recent concept

The Inner Peripheries concept has been recently interpreted as coupling peripherality and marginality concepts (Copus, Mantino, & Noguera, 2017). The debate around such terms focuses on the polarization of space, as argued by several authors (e.g. Máliková & Klobučník 2017; Kebza 2018). Theoretically, there are centres (namely, core areas), that have a high degree of autonomy and potential for creating innovation and growth, and peripheries, that are dependent on centres (Friedmann, 1966). The terms peripherality and marginality are consistent with this theory, and still debated in literature, as well as their respective processes (Kühn, 2015; Pezzi & Urso, 2017). In particular, primarily the peripheralization and secondarily the marginalization processes generate the stigmatization process (ESPON, 2017), and subsequently, poverty and outmigration. Such dynamics ultimately generate both peripherality and marginality that are common

conditions of the Inner Peripheries. In fact, “the peripherality of an area is connected with spatial (situational) characteristics such as distance and transport accessibility. Marginality, on the other hand, is shaped by a “multi-dimensional” spectrum of problems, from economic and cultural to social, political and historical” (Pileček & Jančák 2011, p.45). More specifically, the peripherality is characterized by a lack of innovation and powerlessness (exclusion from network and lack of agency), in addition to the distance from core areas (Kühn, 2015) and poor accessibility. The marginality is described by different approaches that explain multifaceted problems, such as (Pileček & Jančák, 2011): (i) the geometric approach, underlining the remoteness of an area; (ii) the ecological approach, representing the environmental conditions (e.g. an area as biodiversity hotspot); (iii) the social approach, referring to a weak integration of social groups because of ethnicity, gender, religion, etc. (including cultural marginality); (iv) the economic approach, focusing on the regional economic disparities (economic activities, Gross Domestic Product, etc.); and (v) the political approach, considering the distance from the centres of power. According to these characteristics, the marginality and peripherality concepts are strictly interconnected (Nagy, Timár, Nagy, & Velkey, 2015).

In EU, the Inner Peripheries concept is a quite new theme, originally coined by ESPON (2013), and referred to territories suffering from: (i) demographic decline (migration and low birth rates), population ageing, lack of Services of General Interest (SGIs) such as hospitals and schools, lack of accessibility (time), lack of economic diversity, loss of local identity; (ii) restricted development areas/zoning, closing down of main economic activities and of SGIs; and (iii) closeness (proximity) to natural barriers. Then, there was a first policy attempt, namely the Italian National Strategy for Inner Areas, aimed to define, map and develop territories (i.e. Inner Areas) far from the main SGIs, such as hospitals, train

stations and schools (Barca, Casavola & Lucatelli 2014). Finally, the Inner Peripheries' broad definition was further explored and improved by ESPON (2017). Indeed, according to the latter definition, Inner Peripheries are characterized by poor accessibility to core areas and to SGIs, as well as the exclusion from networks, which in turn lead to negative demographic trends, social exclusion and economic decline (Copus et al., 2017). Such different definitions of Inner Peripheries and Inner Areas have increasingly led to a terminological confusion, at least in the scientific community.

However, the will to provide an unambiguous definition of the Inner Peripheries most probably derives from a widespread condition of unbalanced territorial development as perceived all around Europe. Indeed, the Inner Peripheries cover 45% of total area in EU (ESPON 2017), and 32% of the Italian territory (i.e. Peripheral and Ultra-Peripheral areas; Lucatelli, Carlucci, & Guerrizio 2013). It is therefore important to assess the main characteristics and issues of the Inner Peripheries to tackle challenges such as e.g. outmigration and economic decline. More than one third of the Inner Peripheries overlaps the Lagging Regions (ESPON, 2017) and about 80% of rural areas in EU (ESPON, 2018). This in turn means that the Cohesion Policy, directly related to Lagging Regions, and the Rural Development Policy, mainly sustaining the agricultural areas, are by-nature in support of the Inner Peripheries. Beyond all the disadvantages previously listed, the Inner Peripheries have resources that may be sustainably used through the EU funds. For example, in Italy these territories are mainly covered by forest lands, agricultural areas and Protected Areas (Marchetti, De Toni, Sallustio, & Tognetti, 2017), and are characterized by the presence of the primary sector, and by a predisposition towards social innovation (Carrosio, 2016). These characteristics and the related development potential, are consistent with the 11 Thematic Objectives (Cohesion Policy) or 6 Priorities (Rural Development Policy) scopes and

targeted investments. Furthermore, the Italian National Strategy for Inner Areas currently deals with Inner Peripheries characteristics and related financial supporting tools (such as those from the EU Policies, Mantino & De Fano 2015; Pagano & Losco 2016). Barca (2012) indicates the Inner Peripheries as strategic territories to effectively orient and use the EU Cohesion Policy funds. Nevertheless, to date the potentiality of Inner Peripheries to boost local economic development (through Rural Development Policy funds) is rather unexpressed (Cesaro & Marongiu, 2017).

According to the above-mentioned issues, the present work mainly aims to understand the Inner Peripheries status quo, in terms of the main issues and challenges linked to peripherality and marginality characteristics, including their linkage with Cohesion and Rural Development policies, through an extensive review of currently available scientific literature. We deeply focus on how peripherality and marginality concepts are addressed in the context of the Inner Peripheries in EU, and to what extent the Thematic Objectives of the Cohesion Policy as well as the Priorities of the Rural Development Policy are connected to the Inner Peripheries in EU.

2. Review exercise

In a preliminary step, similar terms and synonyms of the Inner Peripheries concept have been identified, according to the currently available terminologies (see Appendix 1 for more details). Considering that a unique definition of the Inner Peripheries does not still exist (Copus et al., 2017), we use as reference concept the latest definition of Inner Peripheries provided by ESPON (2017) (see the Introduction section for further details), because we consider it as: (i) comprehensive (incorporating both peripherality and marginality concepts and Inner Areas as an Inner Peripheries typology); (ii) most up-to-date; and (iii)

inclusive (based on territorial evidences all around Europe supporting policy-making; Böhme 2016).

The identification of similar terms and synonyms of Inner Peripheries was needful to set the keywords that have been then used in the review exercise, and try to be as comprehensive and inclusive as possible. The similar terms are strictly connected with the Inner Peripheries because of their main characteristics, such as accessibility (i.e. Remote Rural Regions, Brezzi, Dijkstra, & Ruiz 2011) and/or disparities in welfare state (i.e. Fragile Rural Areas; Osti 2016). The synonyms are different translations of the Inner Peripheries concept, such as for instance Inner Areas adopted in Italy (Noguera & Copus, 2016), or even others such as Internal Areas and Inland Areas (Saccomani, 2014; Scrofani & Novembre, 2015).

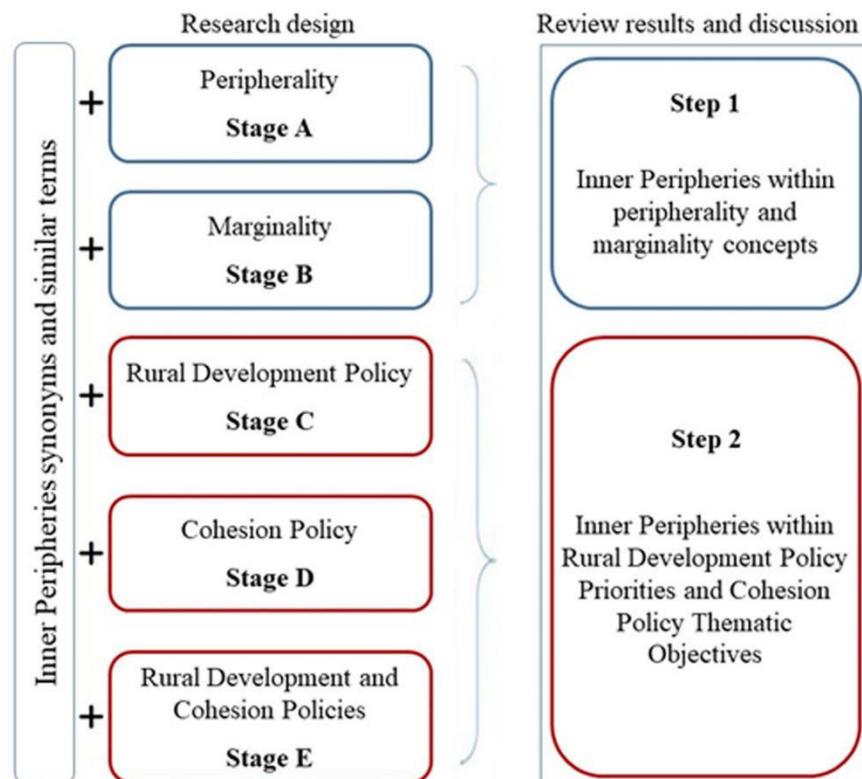
The review exercise followed two steps (1, 2) and five stages (A-E) (see Table 1), and was carried out through using search strings created from a combination of the keywords listed in Appendix 1 plus additional keywords by using SCOPUS (www.scopus.com) as search tool. The review considered title, abstract and keywords as search fields for each publication without a reference time-threshold, taking into account that the Inner Peripheries concept is relatively recent. For the purpose of the present work, and considering the characteristics of SCOPUS as search engine, we considered only the indexed and peer-reviewed publications written in English.

Table 1. The combination of keywords, rationale behind, and expected results. (1) the explanation of similar terms and synonyms of the Inner Peripheries concept is reported in Appendix 1.

Review step	Review stage	Rationale	Research database	Keywords combination (1) (search strings)	Expected Results
1	A	Inner Peripheries and peripherality	Scopus	"inner peripher*" OR "remote rural region*" OR "peripheral area*" OR "marginal area*" OR "internal peripher*" OR "inner area*" OR "internal area*" OR "inland area*" OR "fragile rural area*" AND "peripherality"	No. of publications per year
	B	Inner Peripheries and marginality	Scopus	"inner peripher*" OR "remote rural region*" OR "peripheral area*" OR "marginal area*" OR "internal peripher*" OR "inner area*" OR "internal area*" OR "inland area*" OR "fragile rural area*" AND "marginality"	No. of publications per year
2	C	Inner Peripheries and Rural Development Policy	Scopus	"inner peripher*" OR "remote rural region*" OR "peripheral area*" OR "marginal area*" OR "internal peripher*" OR "inner area*" OR "internal area*" OR "inland area*" OR "fragile rural area*" AND "rural development policy"	No. of publications per year
	D	Inner Peripheries and Cohesion Policy	Scopus	"inner peripher*" OR "remote rural region*" OR "peripheral area*" OR "marginal area*" OR "internal peripher*" OR "inner area*" OR "internal area*" OR "inland area*" OR "fragile rural area*" AND "cohesion policy"	No. of publications per year
	E	Inner Peripheries and Rural Development Policy and Cohesion Policy	Scopus	"inner peripher*" OR "remote rural region*" OR "peripheral area*" OR "marginal area*" OR "internal peripher*" OR "inner area*" OR "internal area*" OR "inland area*" OR "fragile rural area*" AND "rural development policy" AND "cohesion policy"	No. of publications per year

The step 1 of the review exercise refers to the consistency between Inner Peripheries concept and peripherality and marginality ones. The step 2 of the review exercise refers to the connection between Inner Peripheries concept and EU Rural Development and Cohesion Policies pathways. Each review step was then divided into review stages according to the main topic to be analysed. Figure 1 provides an overview of the entire review exercise.

Figure 1. Flowchart of the review exercise. From left to right, once similar terms and synonyms are identified, the review is divided into review stages (“Research design” column; stages A-E) which follow two different steps (blue and red boxes; “Research design” column) to structure the next analysis of results and related discussion (steps 1 and 2, blue and red boxes; “Review results and discussion” column).



In review step 1, the following key elements for the peripherality and marginality concepts were considered: i) the relevance of peripherality for the Inner Peripheries concept - publications were classified according to their linkages with peripherality, in terms of geographical location and accessibility, lack of innovation

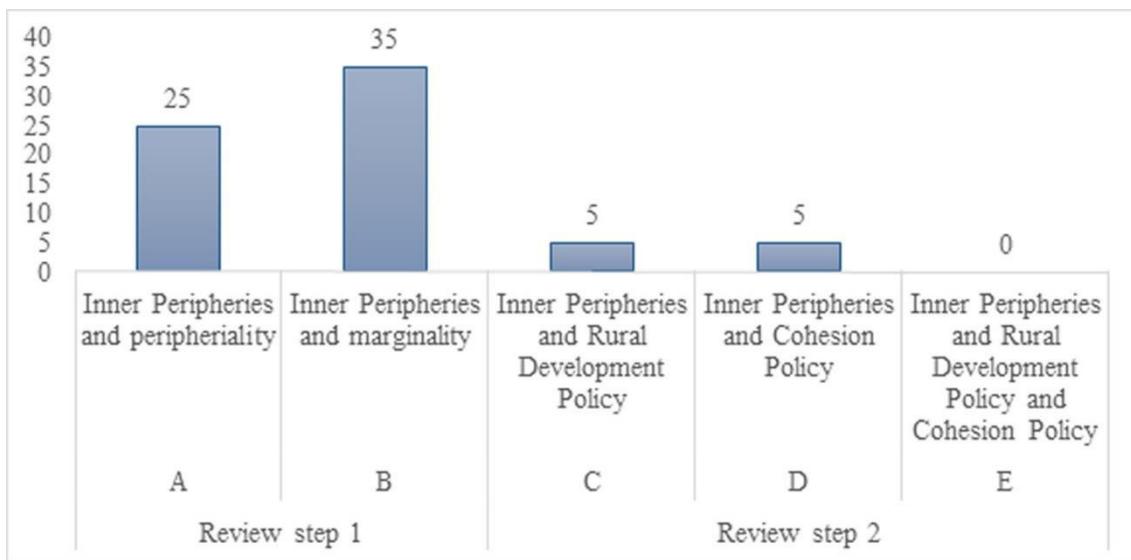
and powerlessness (Kühn, 2015); and ii) the relevance of marginality for the Inner Peripheries concept - publications were classified according to their linkages with marginality, in terms of geometric, ecological, social, economic and political marginality (Pileček & Jančák, 2011).

In review step 2, each publication was then categorized, according to i) the connection of the publication's contents with the Rural Development Policy, and particularly with one or more of its six Priorities ; ii) the connection of the publication's contents with the Cohesion Policy, and particularly with one or more of its eleven Thematic Objectives ; and iii) the connection of the publication's content and both EU Policies. In some cases, more than one specific Priority or Thematic Objective was assigned to a given publication.

3. Results

We found a total of 70 publications to date, for both review steps 1 and 2. These results are additive, i.e. a certain publication having relevance for more than one topic, is counted twice or more. Figure 2 summarizes the publications according to the rationale (see Table 1 for further details). Inner Peripheries and marginality issue is the most debated topic (Review stage A, 35 articles), followed by Inner Peripheries and peripherality issue discussion (Review stage A, 25 articles). No publication was found concerning both Rural Development and Cohesion Policy in the same search string (review stage E).

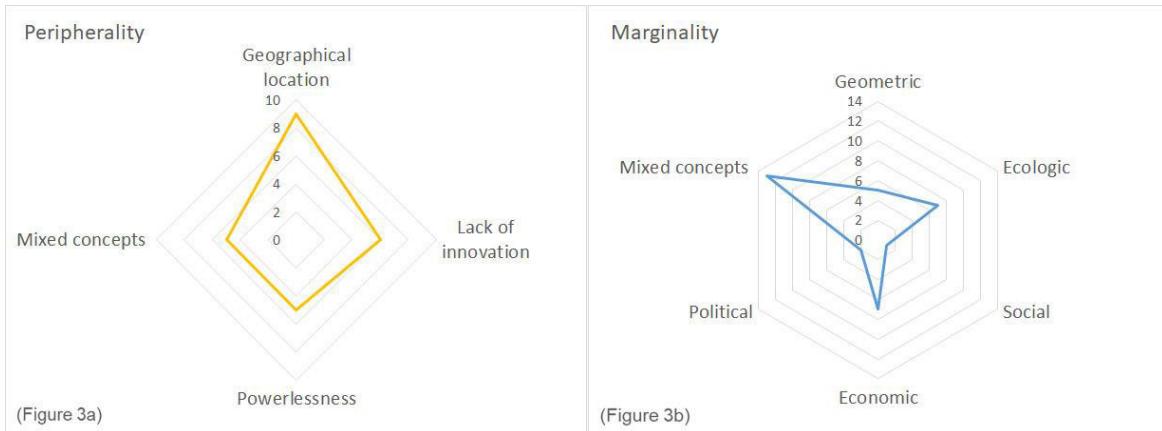
Figure 2. Number of publications by review step (1 and 2) and stage (A to E).



The results concerning the peripherality concept (review step 1, review stage A) show that the geographical location and accessibility (9 publications) and the lack of innovation (6 publications) are the most debated topics (see Figure 3a). According to the results related to the marginality concept (review step 1, review stage B), the mixed concepts of marginality is the most debated issue (13 publications), followed by the economic and ecologic marginality category (7 publications per each). On the other hand, the geometric (5 publications), social and

political marginalities (1 publication and 2 publications, respectively) are not very much debated (see Figure 3b).

Figure 3 (a, b). Spider charts reporting the number of cases for which a correlation between publication's contents and peripherality and marginality characteristics (a and b, respectively) is found.

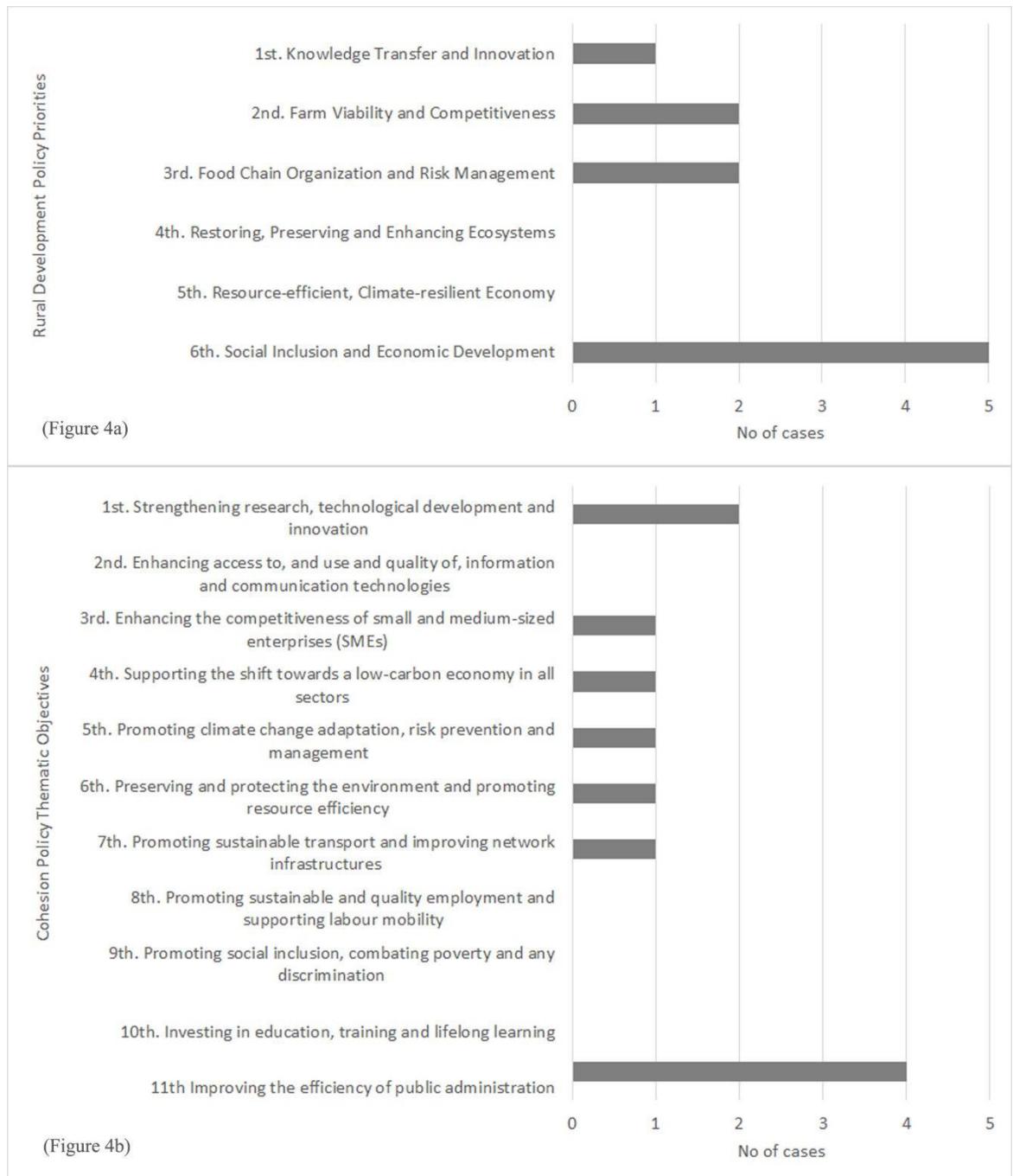


The results concerning the Rural Development Policy (review step 2, review stage C) show that the 6th Policy Priority (i.e. "Social Inclusion and Economic Development") is treated in all the publications found (see Figure 4a). The 1st, 2nd and 3rd Priorities (i.e. "Knowledge Transfer and Innovation", "Farm Viability and Competitiveness" and "Food Chain Organization and Risk Management") are less debated. No publication treating the 4th and 5th Priorities (i.e., "Restoring, Preserving and Enhancing Ecosystems" and "Resource-efficient, Climate-resilient Economy").

The results concerning the Cohesion Policy (review step 2, review stage D) show that the 11th Thematic Objective named "Improving the efficiency of public administration" is the most treated, followed by the 1st Objective, i.e., "Strengthening research, technological development and innovation" (see Figure 4b). Additional four Objectives are treated with the same frequency, as follows: the 3rd Objective ("Enhancing the competitiveness of small and medium-sized enterprises (SMEs)'), the 4th Objective (i.e., "Supporting the shift towards a low-

carbon economy in all sectors”), the 5th Objective (i.e., “Promoting climate change adaptation, risk prevention and management”), the 6th Objective (“Preserving and protecting the environment and promoting resource efficiency”), and the 7th Objective (i.e., “Promoting sustainable transport and improving network infrastructures”). No publication was found as specifically regarding the 2nd Objective (“Enhancing access to, and use and quality of, information and communication technologies”), the 8th Objective (“Promoting sustainable and quality employment and supporting labour mobility”), the 9th Objective (“Promoting social inclusion, combating poverty and any discrimination”), and the 10th Objective (“Investing in education, training and lifelong learning”).

Figure 4 (a, b). Bar chart reporting the number of cases for which a correlation between publications' contents and Rural Development Policy Priorities (a), and Cohesion Policy Thematic Objectives (b) is found (review step 2, review stage C and D).



4. Discussion and conclusions

The main findings highlight that more attention is given to the concept of marginality and peripherality (a total of 60 publications) than to the connection

between Inner Peripheries and EU policies (a total of 10 publications). The results also highlight that there is no publication discussing both Policies in relation to the Inner Peripheries concept.

We hereinafter provide an overview of the major peripherality and marginality criticalities of the Inner Peripheries. Moreover, based on the main findings from the review exercise, we propose some territorial strategies and interventions that can be implemented in Inner Peripheries in order to address their major challenges through an integrated policy approach.

Current criticalities for Inner Peripheries related to peripherality and marginality

The review exercise aims to provide an overview of how Inner Peripheries are currently permeated by the marginality and peripherality issues, without focusing on the historical processes that generated peripherality and marginality conditions. In this respect, we found few publications discussing the Inner Peripheries combined with marginality or peripherality concepts (60 publications from 1966, see Figure 2). Concerning the peripherality concept, in most cases (9 publications) the Inner Peripheries are mainly identified by considering their geographical location, i.e. the remoteness and lack of accessibility to centres and SGIs. Instead, the marginality concept, as more complex, is debated in the largest part of publications by mixing geometric, socio-economic and political aspects. In general, the peripherality and marginality conditions are two different concepts in literature, as well as two intrinsically linked features in the reality, especially considering that “in most of Inner Peripheries the primary processes of peripheralization are associated with a range of secondary marginalisation processes” (ESPON, 2017). Thus, hereinafter we highlight how the peripherality conditions (e.g. remoteness) may lead to marginality features (e.g. low economic potential), based the literature results.

In detail, the Inner Peripheries are mainly characterized by peripheral location, outmigration (Andželković-Stoilković, Devedžić, & Vojković, 2018; Vaishar & Pavlu, 2018), low accessibility and underdeveloped infrastructures (Lapka, Cudlínová, Rikoon, & Boháč, 2001), which in turn create low economic potential (Koloszko-Chomentowska & Sieczko, 2018) and socio-economic marginality. On the one hand, the distance from markets and limited accessibility to urban centres influence the related high costs for transportation (Mackenzie & McEldowney, 1990), which in turn trigger problems for self-sustaining enterprises due to a lack of suppliers of materials and components in these remote areas (Gripaios, Bishop, Gripaios & Herbert, 1989). On the other hand, the Inner Peripheries suffer from a lack of innovation compared to large core areas (Fitjar & Rodríguez-Pose, 2011). This may be due not only to the remoteness, but also to the absence of widespread broadband infrastructures. Indeed, the rural-urban digital divide phenomenon currently represents one of the most important constraints for the economic development in Inner Peripheries (Rosina & Hurbánek, 2013), because of their peripheral location. The geographical location is also correlated with environmental constraints, such as high altitude, steep conditions, short growing seasons and low soil fertility, which cause a lower economic productivity, especially for the agricultural sector (Bertaglia, Joost, & Roosen, 2007). However, remote and economically marginal areas host vast networks of protected areas, especially in Southern Europe (i.e. ecologic marginality) (Cortes-Vazquez, 2017). At local scale, this may create an imbalance between economic exploitation and effective protection of natural resources.

The remoteness of these territories and the lack of SGIs influence the effectiveness of rural policies and public actions in general (i.e. political marginality): “communities with a good level of public services have a high level of awareness of the role of collective action and of the significance of public services

as public goods" (Cecchi & Basile 2006, p. 145). Thus, the lack (and in certain cases, poor effectiveness) of networks is perceived as a problem within the social and economic systems. The majority of the issues described so far have led to the land abandonment in Inner Peripheries, at least in Italy (Forleo, Giaccio, Giannelli, Mastronardi, & Palmieri, 2017).

Correlation between Inner Peripheries and Cohesion and Rural Development Policies

Based on the review's outcomes, we found a relatively weak connection between Inner Peripheries concept and the Cohesion and Rural Development Policies. Indeed, there is still limited literature treating the Inner Peripheries in relation to the Cohesion and Rural Development Policies, separately (a total of 10 publications; Figure 2), and no publication focusing on Inner Peripheries with regards to both Policies.

The results highlight that the Rural Development Priorities are mainly correlated to the enhancement of the economic and social sectors. On the contrary, the Priorities specifically concerning the environmental issues are neglected (see Figure 4a). Even concerning the Cohesion Thematic Objectives, the environmental issues are discussed only in one publication (see Figure 4b). These results were partly expected, especially taking into account that the two main sources of information about Inner Peripheries (i.e. ESPON 2017 and Italian National Strategy for Inner Areas) do not consider the environmental characteristics of these territories (e.g. presence of biodiversity hotspots, areas covered by agricultural and forestry land, hydrological risk issue). In detail, the 4th and 5th Priorities of the Rural Development Policy and the 6th Thematic Objective of the Cohesion Policy generally focus on the enhancement of biodiversity, the soil erosion prevention and water management improvement especially in agriculture, and the renewable

sources of energy use. Since Inner Peripheries cover 80% of rural areas in Europe (ESPON, 2018) and their productive capacity is mainly based on agriculture and forestry sectors (Matthews, 2016), the exploration of the environmental aspects is currently lacking.

On the contrary, the 6th Rural Development Policy Priority, i.e. “Social Inclusion and Economic Development”, is treated in all publications related to Inner Peripheries and Rural Development Policy. Even in this case, the result was rather expected, since the major criticalities in the Inner Peripheries as described in literature, i.e. depopulation trend, population ageing and young outmigration, lack of SGIs and low economic potential, may be reduced by using the 6th Priority funds. Moreover, we did not find literature resources specifically addressing the linkages between the two main EU Policies, in particular with regards to the 6th Rural Development Priority “Social Inclusion and Economic Development” and the potentially related Thematic Objectives of the Cohesion Policy. In detail, the efforts to foster the rural development in Inner Peripheries may be supported by different Thematic Objectives such as “enhance access to, and use and quality of, ICT” (2nd Thematic Objective), “promote sustainable and quality employment and supporting labour mobility” (8th Thematic Objective), “promote social inclusion, combating poverty and any discrimination” (9th Thematic Objective) and “invest in education, training and vocational training for skills and lifelong learning by developing education and training infrastructure” (10th Thematic Objective).

Instead, the 11th Thematic Objective “improve the efficiency of public administration” is treated in many publications, mainly referring to the participation in decision-making processes, as well as to the Italian National Strategy for Inner Areas (Francini, Palermo & Viapiana, 2017; Las Casas, Murgante & Scorza, 2016). This could be linked to the sensitive topic of the “place-based

approach" (Barca 2009), on which the Italian National Strategy for Inner Areas is based.

Reducing Inner Peripheries criticalities

It may be possible to reduce the Inner Peripheries' criticalities through focusing on the potentialities of a peripheral location while inverting the marginalisation processes through the efficient use of the Rural Development and Cohesion Policies funds. Indeed, there is the need to implement an integrated policy approach, such as the "Rural Cohesion Policy" framework (Dax & Copus, 2018), to concurrently foster the rural development and the territorial cohesion dimensions in Inner Peripheries.

In detail, the opportunities to sustainably develop the Inner Peripheries should be mainly correlated with valuing both natural and human capital, while paying closer attention to the combination of the economic and social aspects. The environmental relevance of the Inner Peripheries should be valorised through re-establishing traditional uses (Burton & Riley 2018), enhancing the ecosystem services originated by natural capital (e.g. Marino & Pellegrino 2018), or even promoting the natural and cultural heritages in such contexts.

In addition, the tourism sector is one of the most feasible options to develop and regenerate these territories (Těšitel, Kušová, & Bartoš, 1999), through e.g. the stewardship of rural heritage and environmental conservation (or care) (Boniface, 2000). Tourism can be combined with the re-emergence and development of traditional vocations and enterprises, thus encouraging the endogenous growth (Garrod & Wilson, 2004) and fostering the community-based tourism (Salvatore, Chiodo, & Fantini, 2018).

Moreover, it is essential to prioritize the access to the broadband connection, in order to stimulate innovation in the local economy and improve social wellbeing

in these remote areas. Indeed, nowadays the information and communication technology is essential to improve the smallholders' competitiveness (Townsend, Wallace, & Fairhurst, 2015), and services such as the telemedicine (Whitacre, Wheeler, & Landgraf, 2017), and finally guarantee a prompt and continuous health care interventions (Balestrieri et al., 2019; Kvernflaten, 2019).

Moreover, to further encourage the sustainable socio-economic development in Inner Peripheries, feasible pathways may consider for example, the implementation of concepts such as multifunctional agriculture and forestry (Sutherland & Huttunen, 2018), circular and bio-based economies (Marchetti et al. 2014), and the promotion of climate change adaptation and mitigation strategies. These interventions may be coupled with innovative productions and markets (e.g. Sallustio et al. 2018), as well as with landscape labelling approaches (Mann & Plieninger, 2017). Such interventions can promote local goods (e.g., local foods) and rural landscape amenities, and create jobs. This is for example the case of fostering the small and medium size enterprises and agricultural holdings (Che, 2007) which could guarantee sustainable employment in these areas, and discourage younger generations to move. Moreover, the landscape amenities and the environmental aspects are the key factors to reactivate the social framework (i.e. the environment as driving force for the re-emergence of local identity) via the lens of the so-called "relational values" (Chan et al., 2016), and strengthen the sustainable economic development in these territories (i.e. active natural resources management).

Thus, it is important to stimulate the most representative economic sectors (i.e. agriculture and forestry) and community-based solutions, and simultaneously foster the social cohesion and inclusion. The establishment and maintenance of effective enterprises' networks, cooperatives, and groups of smallholders may increase the economic revenues from less productive areas and diversify the production chain (Tregear & Cooper, 2016). In this perspective, it is extremely

important to combine the development of new products with the establishment of stronger connections between centres and Inner Peripheries (Pezzi & Urso, 2017) through e.g., the rail and train network development.

More comprehensively, policies and community-based solutions are expected to enhance latent resources and encourage innovation processes. The Inner Peripheries suffer from the “underestimation of local capital by stakeholders and lack of wider strategic thinking” (Hall, Birtwistle, & Gladstone, 2011), and the scarce representation of social and institutional actors. It is thus extremely important to foster the development of the local capital by considering the local needs (Dax & Fischer, 2018). A possible strategy would be strengthening the communication between different administration levels and local communities (De Filippi et al., 2016; Wójcik, Dmochowska-Dudek, Jeziorska-Biel, & Tobiasz-Lis, 2018), and enhancing the involvement of inhabitants and stakeholders in decision-making processes (Salvatore, Chiodo, & Fantini, 2018).

A further improvement of the research activities in deeper understanding the consistency between the Inner Peripheries, and the Cohesion and Rural Development Policies would provide more robust and accurate evidences to support local planning and policy-making processes. In this way, the promotion in EU of the Integrated Territorial Investments (ITI) tool (European Commission, 2015) would enable a more comprehensive approach in the use of EU funds and more coordinated investments in the Inner Peripheries’ territories.

Moreover, the implementation of the EU Cohesion and Rural Development Policies should be made more effective through commonly defining the main characteristics of Inner Peripheries, harmonizing currently available information systems, and implementing robust scientific multi-disciplinary methods and approaches based for example, on comprehensive indicators framework based on land use-land cover characteristics (e.g. LUISA Territorial Modelling Platform;

Jacobs-Crisioni et al., 2016; Lotze-Campen et al., 2018). The EU policies should convey to a common target, and put the concept of “territory” at the basis of EU regions-oriented policies, in order to limit the overlaps among funding sources and emphasize the possible synergies. Some authors tried to ex-post assess the economic and social impacts of projects supported by EU funds (2007-2013 programming period) at the municipal and national scales (Kouřilová & Pělucha, 2017). However, a contextualized ex-ante analysis incorporating specific territorial needs and priorities would be promising and useful (Las Casas et al., 2016), particularly to consider specific regional diversities (Copus et al., 2013) with a place-based approach (Barca, 2009; Copus et al., 2017).

Final remarks

The present work is a first attempt to convey the currently available scientific knowledge on the Inner Peripheries. Through the review exercise, we described the main issues and challenges for Inner Peripheries as expressed in the scientific debate. We also explored the theoretical connections between Inner Peripheries and Cohesion and Rural Development Policies, as discussed in the research and science domains. Nevertheless, despite the robustness and replicability of our approach, we excluded additional information sources from social and economic contexts, which could be potentially relevant to complement the current knowledge on Inner Peripheries. Moreover, the review exercise focused on a broader scale than the national one. As a consequence, it is difficult to disclose any possible translation of the broad conceptualization of the Inner Peripheries into individual national contexts. Despite these limitations, the present work offers a comprehensive starting point for potential discussion on external social and economic forces acting at national and regional scale to effectively orient funding opportunities towards the sustainable development of these territories.

Based on main findings, the Inner Peripheries need to improve their competitiveness through fostering productive capacity, establishing a sustainable use of local resources, and making more efforts to bridge the innovation and technology gaps than centres. This can be achieved through e.g. adopting labelling and marketing tools for the supply and trade of local products, incentivizing the establishing of cooperatives or small-scale farming groups, and investing in sustainable agriculture and forestry use (shortened source-product chain). Also, it is necessary to strengthen the inclusive participation of the local communities in decision-making processes, and maintain places and traditions, by including the improvement of the related productive and cultural attractiveness. Of course, it is difficult to achieve all these interventions simultaneously, due to the implications of balancing immediate local needs, policy and planning rules, and funding opportunities. Based on our results, we can argue that priority should be given to further explore the possibility to combine rural development and territorial cohesion, through for example, incentivizing land management activities (agro-forestry sector) in abandoned areas, and thus re-coupling the human and natural systems. Focusing policies efforts on these aspects may be the chance for the renaissance of the Inner Peripheries.

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Disclaimer

The views expressed are purely those of the writers and may not in any circumstances be regarded as stating an official position of the European Commission or any other Government Agency.

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CHAPTER 3.

Inner Peripheries between EU Cohesion
and Rural Development Policies:
from the lack of services to the rural
development issues

In the Review article we highlighted the need to overcome the Inner Peripheries criticalities through the efficient use of different EU Policies. Moreover, we mentioned the Italian National Strategy for Inner Areas, which indicates Inner Peripheries as strategic territories to orient the EU Cohesion Policy funds. At the best of our knowledge, this National Strategy is the first and unique effort in Europe to deal with Inner Peripheries criticalities in a structured way. However, the National Strategy identifies as Inner Peripheries only those areas which suffer from lack of accessibility to centers and distance from Services of General Interest, such as schools, train stops and hospitals (Barca, Casavola & Lucatelli 2014). This imply that the other main characteristics of Inner Peripheries (e.g. low economic potential, lack of relational proximity and power) are not considered, as well as are not highlighted the main land use land cover characteristics (i.e. main agricultural and forest lands coverage), potentialities and criticalities. These lacks lead to a not comprehensively orientation of the EU policies' funds use, mainly considering the Cohesion Policy and National funds as key financial resources. Indeed, the Italian National Strategy for Inner Areas strives for reduce the territorial criticalities creating and implementing territorial strategies based on stakeholder needs in selected Inner Peripheries in Italy. The majority of these strategies aim to provide services for Inner Peripheries' inhabitants, promoting e.g. community nursing or flexible transports.

We took part in a strategy definition of an Inner Periphery in Italy (i.e. Matese area) within the National Strategy framework, and we summarized the related strategy design experience in a scientific article. We emphasized the reason why the local development, and particularly the enhancement of environmental resources, could strengthen the Matese area development (De Toni, Sallustio & Marchetti 2017, see Annex 3 for the full article).

The Matese area is an Italian Inner Periphery located within the Molise Region, composed by 14 Municipalities and covers about 400 km². This area suffers from demographic decline (about 3.1% of demographic decrease occurred during the last ten years, i.e. 2001-2011) and the population density is about 49 inhabitants per km² (against a national average of 74 inhabitants per km²). About 50% of the Matese territory is covered by forest lands in addition to having a high natural degree (the Natura 2000 Network spread over 40% of the entire Matese territory). Thus, following the Italian National Strategy main mandate and according to the stakeholder needs, during the Matese strategy definition, on the one hand we focus our efforts on the improvement of basic services in order to avoid further depopulation processes. On the other hand, we considered the sustainable development of Matese's agro-forestry sector as crucial to foster the local development, in addition to the conservation and enhancement of valuable environmental resources. Thus, we suggest to support the agricultural and forestry sectors by focusing on the creation and strengthening of agro-forestry small-medium enterprises. Moreover, we propose to identify the abandoned agricultural lands in order to entrust their management to young farmers triggering innovation processes and inverting the demographic decline. Concerning the forest lands, we recommend to sensitize the local population regarding the potential use of forestry resources (e.g. wood supply chain, bioenergy) and concerning the relevance of a shared and supra-municipal forest management, defining forward-thinking strategies and common objectives. Furthermore, we suggest to include the Matese forest resources in the voluntary carbon credit market, as a tangible economic possibility for small-medium enterprises.

According to this strategy design experience and considering the Review article main results, we recognize a poor focus on Inner Peripheries' rural development issues, particularly in Italy. Thus, in the following research article we

analyse some Inner Peripheries cases study in Italy, highlighting the need to implement the Rural Development Policy Priorities through a new (ex-ante) approach, as a completion of the territorial cohesion achievement.

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Aligning Inner Peripheries with Rural Development in Italy: territorial evidences to support policy contextualization

Original full-length research paper, submitted to Land Use Policy (24/07/2019)

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Abstract

Inner peripheries are fragile territories spreading over rural Europe, which suffer from depopulation, low economic potential, and weak territorial cohesion. However, these territories are extremely important for the provision of goods and services, and the stewardship of natural and semi-natural environments. Such dichotomous condition poses several challenges for planning in the EU context, particularly regarding the implementation of the Rural Development Policy. Therefore, current planning needs to contextualize the policy implementation by considering local needs and territorial resources in the Inner Peripheries. With a focus on the Italian case, the main aim of the present work is to explore to what extent Inner Peripheries cope with Rural Development targets, in the light of improving the effectiveness of planning interventions. We create and implement a set of context indicators to describe the Inner Peripheries' territorial contexts, and test their alignment with the Rural Development Policy through ANOVA and PCA. The results show that the indicators' set is significant and robust in depicting the current territorial potentialities and limitations of the Inner Peripheries towards strengthening rural development. Furthermore, we demonstrate that the Inner

Peripheries exhibit alignments and misalignments with rural development targets, depending on localities, and exogenous and endogenous characteristics. We find that the Inner Peripheries in Italy need to develop holistic strategies incorporating different Rural Development Priorities, such as increased competitiveness in agriculture and forestry sectors, sustainable use of resources and climate adaptation. We argue that strategies with less consideration of environmental and social aspects may be counterproductive for the local development in Inner Peripheries. Performing an ex-ante assessment of the main characteristics of the Inner Peripheries through e.g. the use of the indicators' framework as proposed, may support the decision-making processes in selecting planning priorities. Considering the large replicability and comparability of the indicators' set, the findings of the present study are useful to further understand how rural development is considered in territorial strategies for Inner Peripheries in similar contexts in Europe.

Keywords

Inner Peripheries; Inner Areas; context indicators; Rural Development Policy; ex-ante assessment; integrated planning.

Highlights

- Inner Peripheries potentialities towards Rural Development Policy are assessed;
- Indicators' set aligned with Rural Development Policy targets is created and tested;
- Different rural development progresses are based on local barriers and drivers;
- Ex-ante assessment supports planning for rural development from local to EU scale.

1. Introduction

Rural areas host almost one third of the EU population (¹), and provide essential benefits to people living in urban environments, such as for example, food and fibres, water, biodiversity, and natural and cultural heritages (Balzan et al., 2018). However, depending on localities and environmental contexts, rural areas increasingly face challenges related to growth, job, sustainability, and accessibility (Matthews, 2007; Dax and Fischer, 2018).

Spreading over the Europe, the Inner Peripheries overlap the 45% of the whole territory² (Noguera et al., 2017) and are mainly covered by agricultural and forest areas (Matthews et al., 2016). These territories are characterized by remoteness, poor accessibility to Services of General Interest (SGIs), and are in turn associated with some peculiar social-economic dynamics, such as negative demographic trends and population ageing, social exclusion and economic decline (Copus et al., 2017). The Inner Peripheries mainly cover 80% of rural areas in Europe, show low economic potential and lack of accessibility (ESPON, 2018), which in turn affect local social-economic conditions. To overcome these criticalities, it is not only necessary to maximize economic incomes in agricultural and forestry sectors, but also to valorise social inclusiveness, territorial cohesion, cross-sectorial opportunities, and natural capital's potentialities (e.g. Dax and Fischer, 2018).

Over the last decade, the Inner Peripheries have entered the policy and scientific debates in Europe (Gløersen et al., 2016; Matthews et al., 2016; Haarich et

¹ https://ec.europa.eu/eurostat/statistics-explained/index.php/Statistics_on_rural_areas_in_the_EU#Source_data_for_figures_and_maps_28MS_Excel.29

² Precisely, Inner Peripheries cover the 45% of the ESPON PROFECY territory. The PROFECY (Processes, Features and Cycles of Inner Peripheries in Europe) project area covers EU countries, Iceland, Norway, Switzerland and Turkey, see PROFECY Appendix 2 'Datasets and Database' for more details.

al., 2017). Despite the Inner Peripheries are by nature more associated with the territorial cohesion, they are also rural by economic performance, and therefore linked to rural development (Copus et al., 2017). Indeed, on the one hand, the Cohesion Policy aims to stimulate the accessibility and delivering of SGIs, the creation of jobs and the increase of employment and territories' endowments and cooperation (Doucet et al., 2014). On the other hand, the Rural Development Policy aims to enhance the viability and competitiveness of agricultural and forestry sectors, promote food chain organization, and restore, preserve and enhance ecosystems and resources' use efficiency, as well as strengthen social inclusion and economic development (Sousa Uva, 2013). With regard to the Inner Peripheries' development, the Rural Development Policy may be considered as the completion of the Cohesion Policy (Mantino and De Fano, 2016). Furthermore, the enhancement of rural development and sustainable use of natural capital mainly depends on the asset of natural resources and landscape within Inner Peripheries (Marchetti et al., 2017). Therefore, the sustainable development of agricultural and forestry sectors should be one of the key priorities for each Inner Periphery (Matthews et al., 2016; Pettenella and Romano, 2016; Cesaro and Marongiu, 2017).

Among the EU countries, Italy has been at the forefront in fostering the competitiveness and sustainable development of the Inner Peripheries. Indeed, the Italian concept of Inner Areas is extremely close to the Inner Peripheries one (Noguera and Copus, 2016). Inner Areas are a specific type of Inner Peripheries, because they are characterized by low accessibility to SGIs (for further information see Noguera et al., 2017), such as education, health and mobility services (Barca et al., 2014). In Italy, this type of Inner Peripheries covers more than 60% of the national territory (more than 18 million hectares), hosts 23% of the total population (Lucatelli et al., 2013), and mostly includes forest and agricultural lands. Italy started developing a National Strategy for Inner Areas (NSIA) in 2012, by adopting

the place-based approach, with the main purpose to improve the accessibility to SGIs, quality of life and economic well-being through reducing territorial depopulation and thus recalibrating local welfare systems (Carrosio, 2016). NSIA is built on context-specific territorial strategies based on stakeholder needs. Such strategies are composed by different interventions targeting four key objectives: health, mobility, education and local development (i.e. agro-forestry sector and tourism) (Lucatelli, 2016). Some key priorities for rural development in Inner Peripheries in Italy are included into an effective implementation of a multi-level governance, and encompass the sustainable use of natural capital and fruition of the historical heritage, the reduction of outmigration, the improvement of local social-economic competitiveness, and the establishment of a stronger legacy with local traditions and identities (e.g. Copus et al., 2017).

Currently available studies propose the use of indicators to evaluate the state of the art and progresses of rural development processes through e.g., evaluating the capacity of rural territories to attract and use the EU Rural Development Policy funds (Bonfiglio et al., 2017). Concerning the EU agricultural and rural development instruments, the European Commission developed the Common Monitoring and Evaluation Framework (CMEF) in order to “check to what extent policies and initiatives achieve the set objectives and to develop recommendations on what can be improved in the future” (European Commission, 2017a, p.9). Several studies have mainly focused so far on the effectiveness of the CMEF’s indicators to assess the main driving-forces influencing the distribution of the expenditures of the Rural Development Policy (Camaioni et al., 2016; Uthes et al., 2017) or participation (Piorr and Viaggi, 2015), or appraisal of the different aspects of social capital in LEADER (Pisani and Christoforou, 2017). Nevertheless, there is still the need to establish a robust set of instruments (e.g. proxy indicators; European Commission, 2016a) to deeper understand how rural development

territorial strategies can be robustly contextualized, through considering peculiar conditions, i.e. main territorial characteristics and stakeholders' needs (e.g. Zasada et al., 2017), as well as downscaling current and near-future Policy Priorities (e.g. European Commission, 2018a). Indeed, at the best of our knowledge, there is no indicators' framework that directly addresses Rural Development Policy Priorities or targets (i.e. Focus Areas), in order to support the promotion and implementation of effective territorial strategies with scientific and technical evidences. Indeed, a deeper understanding of the potentialities and limitations of the Inner Peripheries towards the promotion of rural development is crucial to invert the current abandonment trend (Carrosio, 2016). Such approach may also prevent negative implications from land abandonment, such as landscape simplification (Uchida and Ushimaru, 2015), biodiversity loss (Uchida and Ushimaru, 2014), soil erosion (Foucher et al., 2019), loss of valuable cultural landscapes and aesthetic values (Plieninger et al., 2015).

Considering the above-mentioned challenges, we propose a comprehensive approach to evaluate the major limitations and opportunities of Inner Peripheries in Italy to align with the Rural Development Priorities. For such purpose, at first we build and implement an indicators' framework, with established linkages with Rural Development Priorities. Then, we test the progresses of Inner Peripheries towards Rural Development. Finally, we suggest which Inner Peripheries' aspects (e.g. competitiveness, environmental sustainability) need to be strengthened in the next future to improve sustainable rural development in these fragile territories.

2. Material and methods

2.1 Workflow and preliminary phase

The main steps of the present work are hereinafter described and depicted in Figure 1.

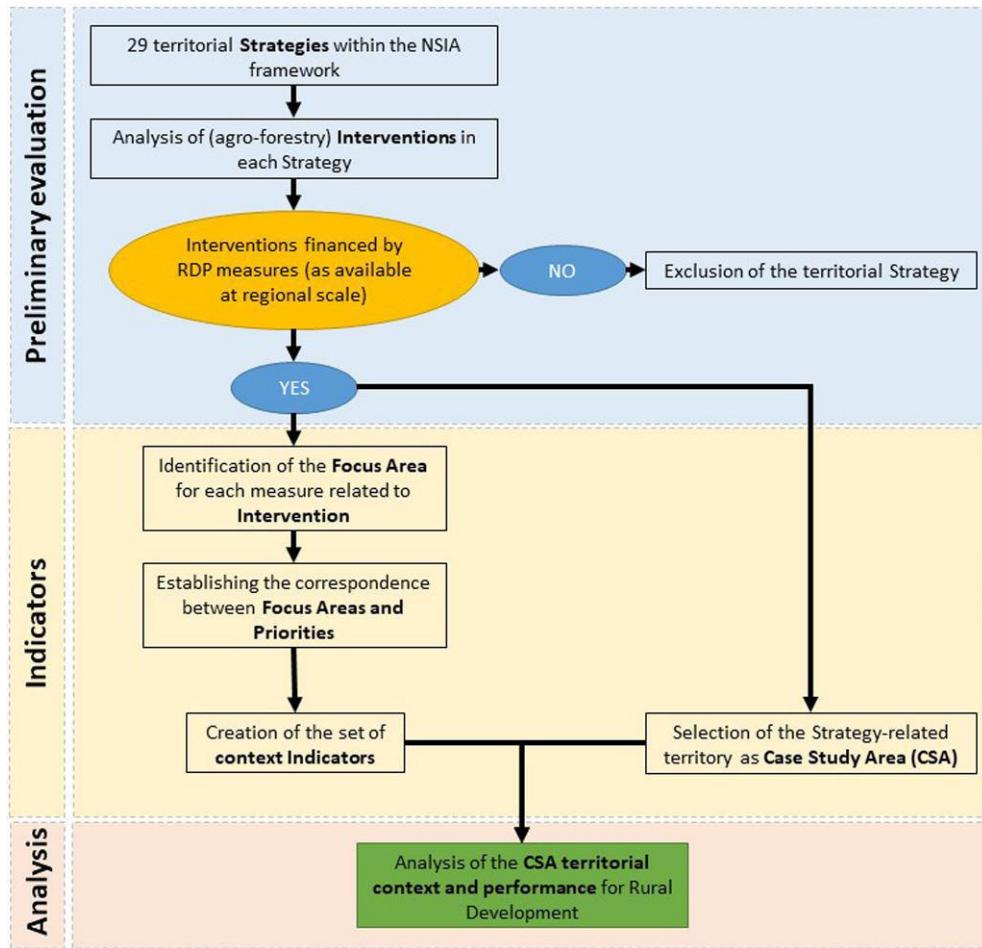
At first, the Inner Periphery-related Strategies within the NSIA framework were evaluated in terms of their relevance for rural development. In detail, on the basis of the whole territorial strategies approved by the National Government³ (29 strategies updated to November 2018), we selected only those reporting agroforestry interventions with a corresponding allocation of Rural Development Policy Funds, for a total number of 18 Strategies nationwide. For each territorial strategy, we established the correspondences between the identified territorial strategies' interventions and their respective funds' allocation as provided by measures in the regional Rural Development Programme. It was indeed relatively easy to establish a correlation between interventions, measures and overarching Focus Areas (FAs) and Priorities as in the Rural Development Policy⁴ (see Appendix A for examples of correspondences). Finally, we grouped interventions according to their common aims and linkages with primary related FAs and Rural Development Policy Priorities⁵, in order to highlight coherent rural development targets and pathways in Inner Peripheries in Italy.

³ http://old2018.agenziacoesione.gov.it/it/arint/Strategie_di_area/Strategie_di_area.html

⁴ Summary on Focus Areas: https://enrd.ec.europa.eu/policy-in-action/rural-development-policy-figures/priority-focus-area-summaries_en. Legislation: REGULATION (EU) No 1305/2013: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:347:0487:0548:en:PDF>

⁵ The first Rural Development Priority is excluded from the analyses – Knowledge Transfer and Innovation – because is a cross-priority: “is considered to be a support for the other five priorities and almost all measures of intervention” (Vagozzzi, 2015).

Figure 1. Workflow and its main phases (from top to bottom), such as preliminary evaluation, including the selection of case study areas (light blue box), the building of the indicators' set (light orange box), and main analyses (light red box).

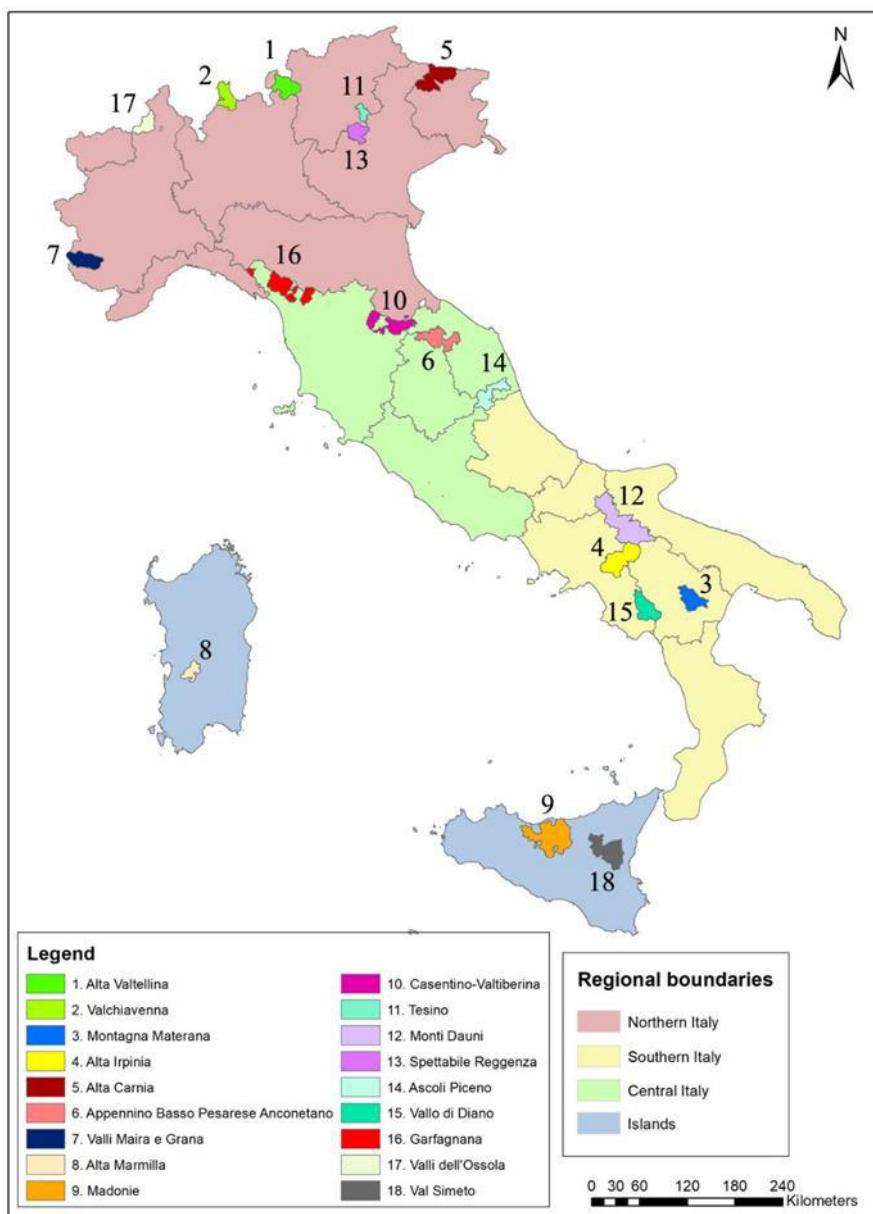


2.2 Case Study Areas

The whole investigated territory covers 1,510,433 ha and comprises 256 municipalities, grouped into 18 Case Study Areas (CSAs) along the Italian peninsula (see Figure 2). The number of municipalities per group ranges from 3 (Tesino, the Autonomous Province of Trentino-Alto Adige) to 29 (Monti Dauni, Apulia Region), with an average area of about 84 ha each. The CSAs are mainly characterized by agricultural and forest lands mostly located in mountain environments (average elevation: 152-2356 m a.s.l., ranging from 0 to 4542 m a.s.l.), and by a low population density (42 people km⁻², averagely). CSAs are

representative of the entire Italian territory (in terms of overlapping with less developed, transition or more developed regions), since they are equally distributed in terms of relative area coverage across the sub-national contexts (i.e. regional boundaries) (see Figure 2): 7 CSAs in the Northern Italy (27%); 4 CSAs in the Central Italy (23%); 4 CSAs in the Southern Italy (29%), 3 CSAs in the Islands (21%) (see Appendix B for the full list of CSA, including their main characteristics).

Figure 2. Italy and the distribution of Inner Peripheries (i.e. case study areas; CSAs).



2.3 Indicators' set

For each correlation between interventions, RDP measures, and Rural Development Policy's FAs, we created an indicator suitable to identify strengths and weaknesses of each CSA to combine relevant territorial characteristics with rural development targets. Indirectly, each indicator provides information concerning the potential use of Rural Development Policy funds at the local scale. The indicators' set is composed by 14 proxy and state indicators, newly established (10 out of 14 indicators) or retrieved from the CMEF context indicators (European Commission, 2017a) (4 out of 14 indicators). Table 1 provides the list of indicators, a brief explanation of the use of each indicator, and the related calculations. To maintain internal consistency and large-scale replicability, the input information for each indicator are collected from data sources as available at EU (e.g. European Environmental Agency, EEA) and national scale (e.g. Istituto Nazionale di Statistica, ISTAT), while fulfilling the alignment with the European Statistical System (ESS⁶). Further details are provided in Appendix C.

⁶ <https://ec.europa.eu/eurostat/web/european-statistical-system/overview?locale=fr>

Table 1. Summary list of indicators by identifier (ID), name and acronym. For each indicator, a brief explanation and type of indicator (proxy or state) is provided. For each indicator, the equation used for its calculation is reported. The correlation between indicators and identified Focus Areas and Rural Development Policy Priorities are also reported, in addition to the eventually correspondences with already existing CMEF indicators.

ID	Name (and acronym used in Tables and Figures)	Brief explanation	Indicator type	Calculation	Targeted Focus Area(s) and Rural Development Policy Priority(-ies)	Corresponding indicator(s) in the CMEF, 2017.
1	Road Density (in agricultural and forest lands) (RoD)	<i>RoD</i> indicator assesses the state of accessibility to agricultural and forest lands for productive purposes, which in turn affects the competitiveness in the agricultural and forestry sectors (Ota, 2011).	Proxy for the accessibility to more productive agricultural and forest lands	$RoD = RoL/(Ag + Fo) [m \text{ ha}^{-1}]$ Where: <i>RoD</i> ranging from 0° to 30° slope; <i>RoL</i> is the total length of roads (m) for agricultural and forestry uses; <i>Ag</i> is the total area of agricultural land (ha); <i>Fo</i> is the total area of forest land (ha).	Focus Area 2A, Rural Development Policy Priority 2	-
2	Labour Intensity (in agriculture) (LIA)	<i>LIA</i> indicator focuses on the current state of labour force of farms in a specific territory; hence it estimates the farms' propensity to modernization and innovation (Bojneč et al., 2014).	State	$LIA = AWU/UAA [no.\text{ha}^{-1}]$ Where: <i>AWU</i> is the annual working unit, corresponding to the work performed by one person who is occupied on an agricultural holding on a full-time basis ⁷ (i.e. 225 working days of eight hours each); <i>UAA</i> is the utilised agricultural area (ha), corresponding to the total area taken up by arable land, permanent grassland, permanent crops and kitchen gardens used by the holding, regardless of the type of tenure or of whether it is used as a part of common land ⁸ .	Focus Area 2A, Rural Development Policy Priority 2	-
3	Multifunctionality (of agriculture, i.e. presence of agritourisms) (MuA)	<i>MuA</i> indicator describes the diversification of farms' activities and goods and services delivered to people, thus the potentiality to increase their incomes (Brelík, 2013).	Proxy for the multifunctional agriculture	$MuA = FARMSAT/FARMS [\%]$ Where: <i>FARMSAT</i> is the total number of agritourisms; <i>FARMS</i> is the total number of farms.	Focus Area 2A, Rural Development Policy Priority 2	-

⁷ https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Annual_work_unit_%28AWU%29

⁸ [https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Utilised_agricultural_area_\(UAA\)](https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Utilised_agricultural_area_(UAA))

4	Young Farmers (YoF)	<i>YoF</i> indicator shows the age structure of farmers in a specific territory and the relevance of the younger farmers, considering that they are found to improve the farms' performance (Sandu, 2014).	State	$YoF = YFar/Far [\%]$ Where: <i>YFar</i> is the number of farmers under 35 years; <i>Far</i> is the total number of farmers.	Focus Area 2B, Rural Development Policy Priority 2	CAP Context Indicator 2014-2020, C.23
5	Farm Size (FaS)	<i>FaS</i> indicator averagely describes the potential of farms and their products to be integrated into the agricultural-food chain in a specific territory. The FaS indicator describes the accessibility of farmers to the local market, depending on the size of their farms (the farm size for direct selling is small) and thus indirectly provides an estimate of the competitiveness of the agricultural sector (Aguglia et al., 2009).	Proxy for the development of short food supply chain	$FaS = UAA/FARMS [ha]$ Where: <i>UAA</i> is the utilized agricultural area (ha), corresponding to the total area taken up by arable land, permanent grassland, permanent crops and kitchen gardens used by the holding, regardless of the type of tenure or of whether it is used as a part of common land ⁹ ; <i>FARMS</i> is the total number of farms.	Focus Area 3A, Rural Development Policy Priority 3	CAP Context Indicator 2014-2020, C.17
6	Quality Product (in agriculture) (QuA)	<i>QuA</i> indicator describes the share of farms adhering to the European quality product schemes; hence it estimates the agricultural sector's competitiveness (e.g. improving the communication of high quality food products to consumers) (Vladu et al., 2016)	State	$QuA = FARMS_{(PDO+PGI)}/FARMS [\%]$ Where: <i>FARMS_(PDO+PGI)</i> is the number of farms adhering to the PDO scheme or to the PGI scheme or to both; <i>FARMS</i> is the total number of farms.	Focus area 3A, Rural Development Policy Priority 3	-
7	Nature Conservation (habitat and species) (CoN)	<i>CoN</i> indicator refers to the extent of Natura 2000 network sites. It is essential conceived to understand how the objectives of biodiversity conservation as in the Habitat Directive, and other local development aims as in the Rural Development Policy are currently integrated and implemented at landscape scale in Europe (Agnelli, 2014).	Proxy for the implementation of management plans	$CoN = N2K [ha]$ Where: <i>N2K</i> is the areas covered by Natura 2000 Network sites.	Focus Area 4A, Rural Development Policy Priority 4	CAP Context Indicator 2014-2020, C.34
8	Forests (For)	<i>For</i> indicator assesses the total forest area in a specific territory, and indirectly how forest managers and owners (sustainably) manage their forests through periodically updating or creating plans (Cullotta and Maetzke, 2011).	Proxy for the implementation of management plans	$For = Fo [ha]$ Where: <i>For</i> is the area covered by forests.	Focus Area 4A, Rural Development Policy Priority 4	CAP Context Indicator 2014-2020, C.29.

⁹ [https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Utilised_agricultural_area_\(UAA\)](https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Utilised_agricultural_area_(UAA))

9	Hydrological Risk (HyR)	<p><i>HyR</i> indicator refers to the portion of a territory under high and very high probability of exposure to hydrological risk, implying its reduction through the protection and management of forests and rural lands (Cislaghi et al., 2019; Galve et al., 2015).</p>	Proxy for adaptation forests disturbances	<p style="text-align: center;">$HyR = AUHYR [ha]$</p> <p>Where: $AUHYR$ is the area (ha) under high and very high hydrological risk, as retrieved by Trigila et al., 2015.</p>	Focus Area 4C, Rural Development Policy Priority 4	-
10	Water Efficiency (in agriculture) (WEA)	<p><i>WEA</i> indicator assesses the water efficiency use in agriculture (usually low, Wu et al., 2015), which can be improved managing the water consumption and improving its distribution system (Nam et al., 2016).</p>	State	$WEA = \frac{1}{n} \sum_{i=1}^n \frac{WUI_i}{WaN_i} [\%]$ <p>Where: n is the total number of crops (e.g. rice, maize) as cultivated in each municipality; WUI_i is the Water Used for the Irrigation ($m^3 \text{ ha}^{-1} \text{ year}^{-1}$) per crop i; WaN_i is the Water Need ($m^3 \text{ ha}^{-1} \text{ year}^{-1}$) per crop i.</p>	Focus Area 5A, Rural Development Policy Priority 5	-
11	Energy Crops (extent of) (EEC)	<p><i>EEC</i> indicator expresses the potentiality of agricultural areas to host bioenergy crops and, indirectly, refers to the capacity of renewable sources (i.e. biomass) in the agriculture and forestry sectors to contribute to GHG emissions reduction through energy substitution (European Commission, 2018b).</p>	Proxy for the mitigation to climate change	$EEC = UAA \cdot SHARE [ha]$ <p>Where: UAA is the utilized agricultural area (ha), corresponding to the total area taken up by arable land, permanent grassland, permanent crops and kitchen gardens used by the holding, regardless of the type of tenure or of whether it is used as a part of common land¹⁰; $SHARE$ is the share of cropland devoted to energy and biomass crops, corresponding to 0.4% of the total UAA (European Commission DG AGRI, 2013).</p>	Focus Area 5C, Rural Development Policy Priority 5	-
12	Tourist Function (ToF)	<p><i>ToF</i> indicator assesses the potential of a territory to attract tourists, i.e. its capacity to support the development of the tourist-related infrastructures, as well as indirectly the improvement of the quality of life of the city's residents (e.g. Przybyla and Kulczyk-Dynowska, 2018).</p>	Proxy for the territorial attractiveness	$ToF = BED/I [\%]$ <p>Where: BED is the total number of beds for tourism accommodation, as offered; I is the total number of inhabitants.</p>	Focus Area 6A, Rural Development Policy Priority 6	-

¹⁰ [https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Utilised_agricultural_area_\(UAA\)](https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Utilised_agricultural_area_(UAA))

13	Unemployment Rate (UnR)	<p><i>UnR</i> indicator assesses the rate of unemployed people over the total population in a specific territory within the framework of the Local Action Groups. It indirectly refers to the potential of rural communities to revert the depopulation trend, and foster local entrepreneurship and investments in jobs' creation within LEADER Programme (e.g. Müller and Korsgaard, 2018).</p>	Proxy for the local employment rate	<p>$UnR = UnLAGS/WfLAGS [\%]$</p> <p>Where: <i>UnLAGS</i> is the total number of unemployed people covered by LAGs; <i>WfLAGS</i> is the total workforce covered by LAGs.</p>	Focus Area 6B, Rural Development Policy Priority 6	-
14	Broadband (pervasiveness) (BbP)	<p><i>BbP</i> indicator assess the progresses in broadband pervasiveness; hence it provides an estimation of the degree of access to high-speed internet by local communities, and in turn the potential for economic growth in rural area (Younjun and Orazem, 2012).</p>	Proxy for the accessibility to information and communication technologies	<p>$BbP = RER/REI [\%]$</p> <p>Where: <i>RER</i> is the total number of real estates reached; <i>REI</i> is the total number of real estates originally involved in the "Italia Digitale 2020" project.</p>	Focus Area 6C, Rural Development Policy Priority 6	-

2.4 Statistical analyses

2.4.1 ANOVA

Since the 14 indicators strongly differ in their unit of measurement, they were scaled to unit variance as to make their values comparable. Subsequently, we tested for statistical differences in the mean values of each indicator among the 18 CSAs. For this purpose, we used permutational analysis of variance (ANOVA) considering each indicator in turn as response variable and CSAs as grouping variable. We also applied Tukey HSD post-hoc tests and calculated the effect size of each ANOVA model through eta-squared metric (η^2 ; Cohen, 1988). These analyses were performed by using the "ImPerm" R package (Wheeler and Torchiano, 2016).

2.4.2 Principal Component Analysis (PCA)

To describe the multivariate difference of indicators' values among the 18 CSAs, we calculated a between-group Principal Component Analysis (bgPCA; Krzanowski, 1979), again including CSAs as grouping variable. Subsequently, we calculated the Pearson's correlation coefficient between the eigenvector of each indicator and the multivariate centroid of each group (CSA) in the PCA space. We performed this calculation in order to quantify the magnitude and the sign of the multivariate association between each CSA and the values of the 14 indicators in it, therefore assessing if a given CSA lie toward high/low indicators' values. Finally, we grouped CSAs and indicators according to the abovementioned Pearson's correlation coefficients, e.g. we clustered CSAs showing a high correlation with a given set of indicators, etc. To find clusters with the highest possible degree of similarity, we applied a hierarchical clustering approach based on the complete linkage method (Legendre and Legendre, 1998). Starting from the hierarchical clustering results, we empirically individuated three groups of indicators and four

groups of CSAs. These analyses were performed through the “Morpho” (Schlager, 2017) and “pheatmap” (Kolde, 2019) R packages.

3. Results

3.1 ANOVA: characteristics of the indicators' set

The characteristics of the indicators' set are summarized in Table 2. According to the ANOVA's results, all the 14 indicators showed statistically significant differences among the CSAs (p value < 0.001). Road Density, Young Farmers, Unemployment Rate, Water Efficiency show lower variability than Labour Intensity, Multifunctionality, Farm Size, Quality Product, Nature Conservation, Forests, Hydrological Risk, Energy Crops, Tourist Function and Broadband indicators. Among such differences, Broadband, Road Density, Water Efficiency, and Unemployment Rate indicators show a “medium to large” effect size *sensu* Cohen (1988), ranging from 0.505 to 0.692. Similarly, Young Farmers, Labour Intensity, Tourist Function, Nature Conservation, Multifunctionality, Farm Size, Energy Crops, Hydrological Risk, Forests and Quality Product indicators show a “small to medium” effect size, ranging from 0.216 to 0.412.

Table 2. Main characteristics of the indicators' set calculated for the whole CSAs. The mean, standard deviation (sd), p-values and effect size values are reported.

Indicator name and acronym	mean	sd	p-value	effect size
Road Density (RoD)	10.747	7.182	< 0.001	0.572
Labour Intensity (LIA)	0.225	0.299	< 0.001	0.272
Multifunctionality (MuA)	0.0241	0.0479	< 0.001	0.285
Young Farmers (YoF)	0.0677	0.0614	< 0.001	0.216
Farm Size (FaS)	19.905	34.827	< 0.001	0.310
Quality Product (QuA)	0.0623	0.0974	< 0.001	0.412
Nature Conservation (CoN)	1837.588	2707.114	< 0.001	0.281
Forests (For)	2049.749	2274.512	< 0.001	0.384
Hydrological Risk (HyR)	667.052	1062.588	< 0.001	0.343
Water Efficiency (WEA)	0.699	0.582	< 0.001	0.637
Energy Crops (EEC)	9.104	11.751	< 0.001	0.333
Tourist Function (ToF)	0.232	0.483	< 0.001	0.278
Unemployment Rate (UnR)	0.117	0.0694	< 0.001	0.692
Broadband (BbP)	0.350	0.429	< 0.001	0.505

The results from ANOVA show a different indicators' behaviour depending on location (i.e. CSA) and geographical boundary (see Figure 3 for Road Density, Farm Size, Nature Conservation, Forests, Hydrological Risk, Water Efficiency, Unemployment Rate, and Broadband indicators; see Appendix D for all indicators). In detail, Road Density indicator shows higher values in e.g. CSA 8 Alta Marmilla (about 24 m ha⁻¹), CSA 11 Tesino (about 23 m ha⁻¹) and lower values in e.g. CSAs 15 Vallo di Diano (about 4 m ha⁻¹), and CSA 12 Monti Dauni (about 7 m ha⁻¹), taking into account that the optimal road density for agricultural and forestry activities is demonstrated to be around 25-30 m ha⁻¹ (Hippoliti, 1976; Cielo et al., 2003). Considering the regional boundaries, Road Density indicator generally shows higher values in Northern than in the Southern Italy.

The Farm Size indicator shows low discrepancies among values. CSA 17 Valli dell'Ossola (84 ha on average) CSA 11 Tesino (80 ha on average) and CSA 7 Valli Maira e Grana (57 ha on average) present quite different values.

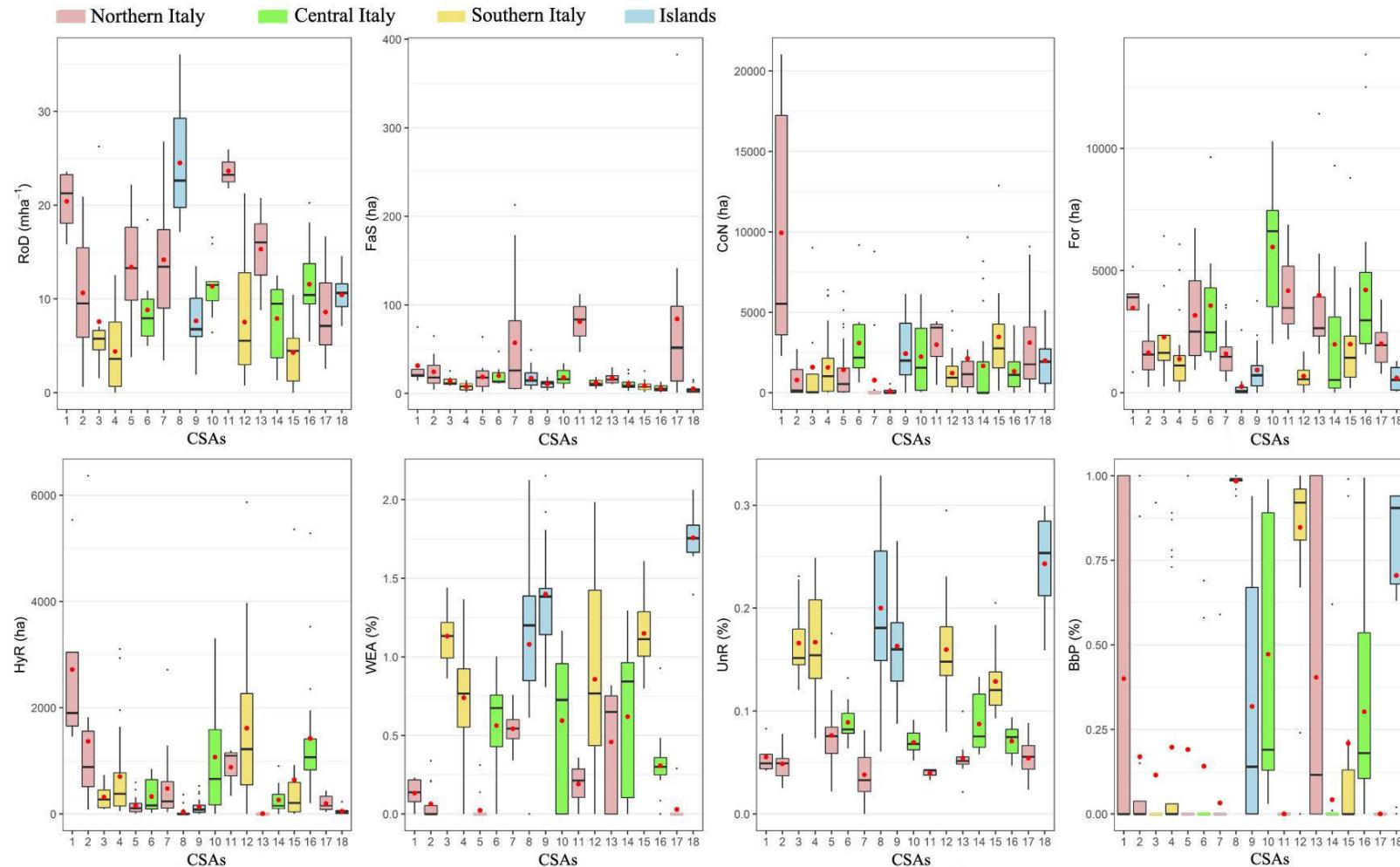
The Nature Conservation, Forests and Hydrological Risk indicators show the similar trends among them in the whole Country, with some differences. For example, the CSA 18 Val Simeto (located in Southern Italy) has low extent of forest lands (27%), Natura 2000 network sites (18%), and a certain exposure to hydrological risk (0.5%) compared to the total area surface. Also, the CSA 11 Tesino (located in Northern Italy) presents high percentage of forest lands (92%), Natura 2000 (42%) and areas exposed to hydrological risk (12%) compared to the total area surface.

The Water Efficiency indicator highlights important differences between the Northern and Central Italy, such as e.g. 0.54 in CSA 7 Valli Maira e Grana, and the Southern Italy and Islands, such as e.g. 1.4 in CSA 9 Madonie.

The Unemployment Rate indicator highlights differences between Northern and Central Italy, and Southern Italy and Island, since it well differentiates for example, CSAs 10 Casentino-Valtiberina (7%) from CSAs 3 Montagna Materana (17%).

The Broadband indicator shows lower values in CSAs in Northern Italy (e.g. CSA 7 Valli Maira e Grana, about 3% of progresses in broadband pervasiveness) than in the South and Islands (CSA 12 Monti Dauni, about 85% or CSA 8 Alta Marmilla, about 98% of broadband coverage).

Figure 3. Box plots resulted from ANOVA regarding the RoD, FaS, CoN, For (top row, from left to right), HyR, WEA, UnR and BbP indicators (bottom row, from left to right). See Table 1 for the full-length names of indicators. Boxes are coloured by identifying the regional boundaries for CSAs (light pink for Northern Italy; green for Central Italy; yellow for Southern Italy, and blue for Islands). Red dots identify the mean values for each indicator.



3.2 PCA: characteristics of the indicator-CSA groups

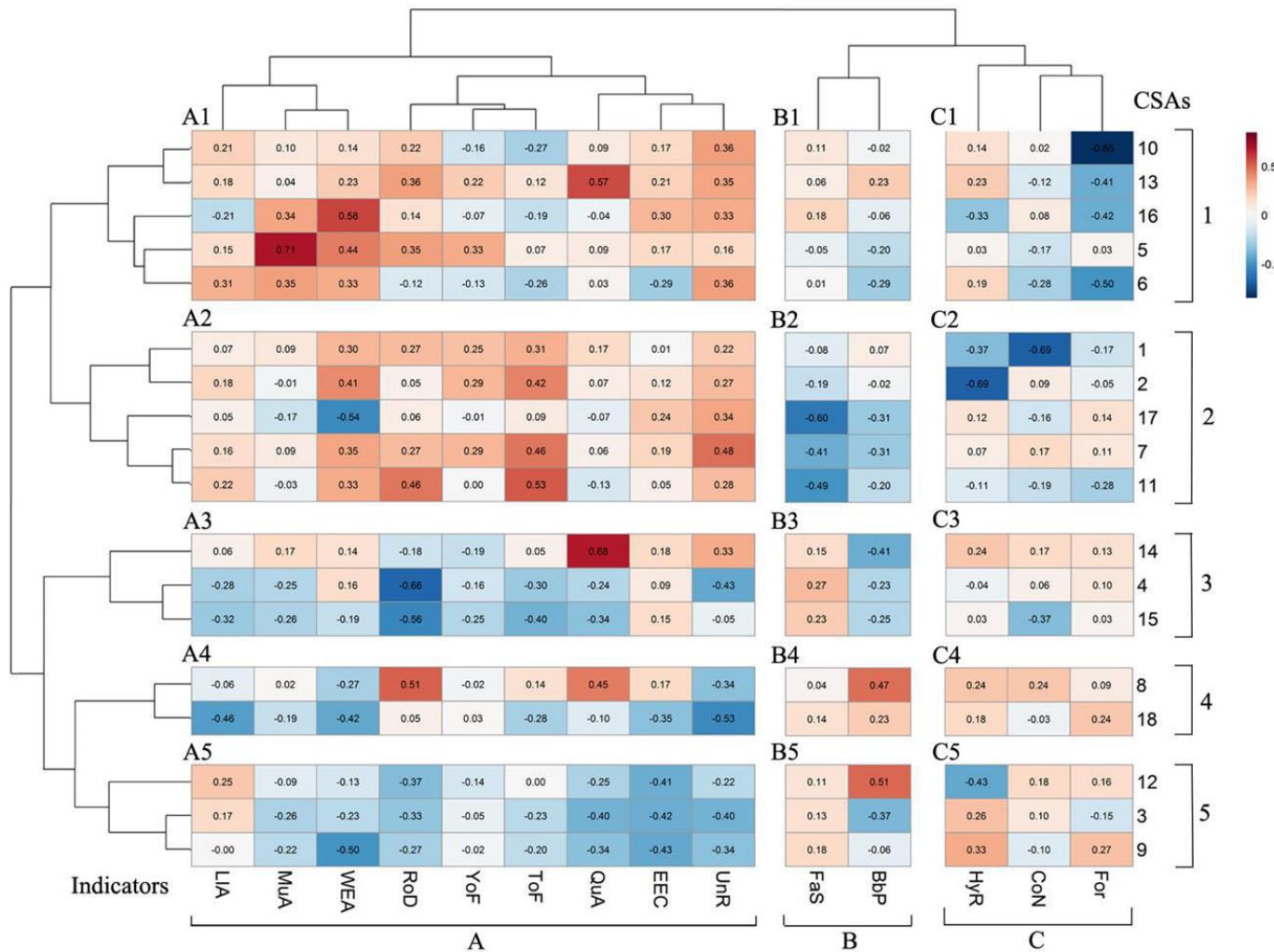
The results of the PCA show the relationships between indicators (x axis) and CSAs (y axis), through groups of coupled CSA-indicator (hereinafter, clusters) (see Figure 4).

The cluster A groups the Labour Intensity, Multifunctionality, Water Efficiency, Road Density, Young Farmers, Tourist Function, Quality Product, Energy Crops, and Unemployment Rate indicators; the cluster B groups the Farm Size and Broadband indicators; the cluster C groups the Hydrological Risk, Nature Conservation and Forests indicators. Moreover, the CSAs show a division related to the geographical boundaries (see y axis in Figure 4). The clusters A1, B1 and C1 are composed by areas located in Central and Northern Italy (10, 16, 6 and 13, 5, respectively); the A2, B2, C2 clusters are composed by areas only located in the Northern Italy (1, 2, 17, 7, 11); the A3, B3, C3 clusters are composed by areas which belong to the Southern (4, 15) and Central (14) Italy; the A4, B4, C4 clusters gathers of CSAs located only in Italian Islands (8, 18); the areas within the A5, B5, C5 clusters belong to the Southern Italy (12, 3) and Islands (9).

Clusters A1, A2, B4, B5, C3, C4, C5 show quite homogenous high values (98 positive values and 25 negative values; see red cells in Figure 4); on the contrary, clusters A3, A4, A5, B2, C1, C2 show quite homogenous low values (33 positive values and 77 negative values; see blue cells in Figure 4). In detail, the Water Efficiency indicator well differentiates CSAs in Northern and Central Italy (A1 and A2 clusters, 9 positive values and 1 negative value) from those in Southern Italy and Islands (A4 and A5 clusters, 0 positive values and 5 negative values). The Road Density indicator shows higher values for CSAs located in Northern and Central Italy (A1 and A2 clusters, 9 positive values and 1 negative value) than in Southern Italy (A3 and A5 clusters, 0 positive values and 1 negative value). The Unemployment Rate indicator well differentiates CSAs between Northern and

Central Italy (A1 and A2 clusters, 10 positive values and 0 negative values), and between Southern Italy and Islands (A3, A4 and A5 clusters, 1 positive value and 7 negative values). The Farm Size and Broadband indicators are characterized by high values in B4 and B5 clusters (8 positive values and 2 negative values) which gather CSAs in Southern Italy and Islands. The B2 cluster, almost grouping CSAs in Northern Italy, shows homogenous negative values. Generally, the Farm Size indicator present quite homogenous values (except for CSAs 17 and 11) than the Broadband indicator. The Hydrological Risk, Nature Conservation and Forests indicators present generally quite homogenous values (except for CSAs 10, 1 and 2). Nevertheless, these three indicators present almost high values in Southern Italy and Islands (C3, C4 and C5 clusters, 18 positive values and 6 negative values) and negative values in Northern and Central Italy (C1 and C2 clusters, 13 positive values and 17 negative values).

Figure 4. PCA results. The x axis reports the indicators' set, the y axis the CSAs. The PCA provides 15 different clusters, divided into 3 clusters for indicators (A, B, C) and 5 clusters for CSAs (1, 2, 3, 4, 5). The blue and red colours show the degree of CSAs' deviation from or proximity to the direction of the indicators, i.e. darker is the red colour, higher is value of the indicator in a given CSA among all CSAs.



4. Discussion

4.1 Indicators' behaviour among the Inner Peripheries' contexts

The ANOVA's results (see Figure 3 and section 3.1) allow us to distinguish two subgroups of indicators according to their effect sizes. According to Cohen's interpretation, the medium-to-high effect sizes describe relatively diversified contexts, which are "large enough to be visible to the naked eye" (Cohen, 1988; p. 26), whereas small-to-medium effect sizes denote lesser diversified contexts. We hereinafter demonstrate that these effect sizes are to some extent explanatory of the endogenous and exogenous characteristics of the CSAs.

The indicators showing small-to-medium effect sizes (see Table 2) are directly correlated with endogenous processes, which in turn reflect characteristics that are common to almost all CSAs (low discrepancies among values; see Figure 3). Such characteristics are related to peripheral and marginal conditions (i.e. as for the Inner Peripheries' concept; Copus et al., 2017) and locations (i.e. boundaries set by the Italian National Strategy for Inner Areas; Lucatelli et al., 2013).

In detail, the Labour Intensity, Farm Size, Young Farmers and Energy Crops indicators properly reflect the widespread conditions due to extensive agricultural activities across the Inner Peripheries (De Vincenti, 2018), which are less mechanized than the intensive ones (Graf et al., 2019), usually apply to small-medium patches of crop lands (Marongiu and Cesaro, 2016), and are generally conducted by old farmers underlining a likely land abandonment process (Coppola, 2014). Moreover, these agricultural lands are not currently managed to prioritize bioenergy production, especially because of the difficulty to satisfy the low energy consumption in the Inner Peripheries (Menconi et al., 2016). The Quality Product, Multifunctionality and Tourist Function indicators directly explain the capacity of CSAs to support the so-called rural tourism, strengthen the high quality agricultural products (wine and food), and provide diversified agricultural activities, including cultural ones, despite

the negative demographic trend and the low population density may affect the competitiveness of these territories (e.g. Chiodo et al., 2019). In addition, we found that the Nature Conservation, Hydrological Risk and Forests indicators describe the common biophysical conditions of the CSAs' and indirectly of the Inner Peripheries, which host more than 70% of the Forests lands and of the national Protected Land Areas, and slightly more than 80% of mountain patterns (linked to the hydrological risk) of the whole Country (Marchetti, 2016). Also in this case, the small-to-medium effect sizes of these indicators (see Table 2) may explain that the relationship between the presence of forests, protected areas, and territories vulnerable to natural disasters, and local management for resilience and adaptation may be interpreted as an endogenous driver for rural development (e.g. the case of wood-pastures of Europe; Plieninger et al., 2015).

Adversely, the indicators showing medium-to-high effect sizes (Broadband, Road Density, Water Efficiency and Unemployment Rate) are correlated with drivers or processes – exogenous to the CSAs' definition and delimitation – which may have been incorporated in different ways in the CSAs (see Figure 3). In detail, the Broadband indicator explains the variation in the progresses towards digitization of the Inner Peripheries, which largely depends on the national investments for reducing the digital divide of these territories (Camera dei Deputati, 2019). Climate (temperature and precipitation), soil conditions, cultivars' selection and water infrastructures in agriculture are some of the exogenous drivers which differentiate the CSAs characteristics in terms of the water use efficiency (cf. Wriedt et al., 2009). Similarly, specific local environmental and social-economic conditions may influence the extent of roads (Demir, 2007) and the unemployment rates (Aria et al., 2019), and thus create large discrepancies among the CSAs' contexts.

4.2 Inner Peripheries' behaviour among indicators' clusters

We interpreted the results of PCA (see Figure 4 and section 3.2) as directly referring to the performance of the CSAs towards rural development pathways, as detected by specific indicators. In Figure 4, red values for a certain indicator reveal that the respective CSAs are already progressed towards rural development. Adversely, blue values for a certain indicator delineate that the respective CSAs actually need to improve their capacity towards meeting rural development objectives. Moreover, the results highlight regional assemblages of areas (i.e. Northern-Central Italy and Southern-Islands) with similar performances with regards to rural development progresses. As long as each indicator describes the linkages between peculiar territorial context and specific Rural Development Priorities, we can assign the following labels to the clusters resulted from the PCA (see section 3.2): sustainable economic growth (cluster A, referring to indicators such as Labour Intensity, Multifunctionality, Water Efficiency, Road Density, Young Farmers, Tourist Function, Quality Product, Energy Crops, Unemployment Rate); widespread broadband connection (cluster B, referring to indicators such as Farm Size and Broadband); and environmental management and protection (cluster C, referring to indicators such as Hydrological Risk, Nature Conservation, Forests).

The cluster A is directly linked to the competitiveness and economic growth in agriculture and forestry sectors in the CSAs, with implications on environmental features and social aspects. The sustainable economic growth cluster gathers indicators which imply four Rural Development Priorities targets (i.e. Priority 2 “Farm Viability and Competitiveness”; Priority 3 “Food Chain Organisation and Risk Management”; Priority 5 “Resource-efficient, Climate-resilient Economy”; Priority 6 “Fostering local development in rural areas”; see Table 1).

About the economic sphere, the modernization of techniques and technological processes (Labour Intensity indicator) (Rumanovská, 2013), the young farmers

employed (Young Farmers indicator) (Giannakis and Bruggeman, 2015), the diversification of farms' activities and services (Multifunctionality indicator) (Brelík, 2013) and the quality in agriculture (Quality Product indicator) (Vladu et al., 2016) foster the agro-forestry sector and farms' competitiveness (e.g. CSA 13). In addition, the Road Density indicator is explanatory of the efficiency of agricultural and forest activities (Ota, 2011). Indeed, Road Density indicator highlights large discrepancies among Northern and Southern Italian CSAs, which most probably derive from the combined effects of biophysical conditions and social-economic legacies. For example, Niedertscheider and Erb (2014) found that the biomass harvest was sensibly lower in the Southern than in the Northern Italy since the beginning of the last century, mostly because of the different land and agricultural systems (extensive vs. intensive), and the amount of investments made in the agricultural sector. The Unemployment Rate indicator presents the same discrepancies, which are mostly explained by the differences among more developed Italian regions (Northern and Central) and less developed and transition regions (Southern and Islands) (European Commission, 2017b). Indeed, in Southern Italy, the unemployment is one of the main drivers for a reduced well-being (Novak and Pahor, 2017), low territorial competitiveness (Aria et al., 2019), and the subsequent difficulty to attract external investments (Mussida and Pastore, 2012). This has of course implications not only on territorial competitiveness but also on the potential welfare. The Tourist Function indicator has the same ambivalence. On the one hand, the potential of a territory to attract tourists fosters the development of small enterprises (Pomeanu and Teodosiu, 2012). On the other hand, a proper support to the tourist function facilitates the development of infrastructures, and improves the well-being of local inhabitants (Przybyła and Kulczyk-Dynowska, 2018). The Water Efficiency indicator highlights important differences between the Northern and Central Italy, and the Southern Italy and Islands. This is rather obvious, considering that the water resources are abundant in the Northern Italy (i.e. Po valley)

and scarce in the Southern Italy (Berbel et al., 2007). Moreover, the high amount of precipitations in the Northern areas is found to heavily influence the crop productivity (Todorovic et al., 2007), and therefore the farms' competitiveness. The Water Efficiency in agriculture and the establishment of bioenergy crops (Energy Crops indicator) affect the environmental sphere, through preserving the water resource and providing an economically competitive and climate-neutral renewable energy source.

The cluster B is related to the potentiality for rural development offered by the broadband coverage, mainly referred to the short food supply chain (widespread broadband connection cluster). The indicators' cluster implies the Rural Development Priorities "Food Chain Organization and Risk Management" (Priority 3), and "Fostering local development in rural areas" (Priority 6). In detail, the Farm Size and the Broadband indicators are inherently connected, and *de facto* present similar trends. On the one hand, Broadband indicator has low values in CSAs located in Northern Italy, where Farm Size indicator presents some high values (large farm sizes). On the other hand, Broadband indicator has higher values in CSAs located in Southern Italy and Islands, where smaller farms are present (lower values of Farm Size indicator: a trend confirmed in the Sixth Italian General Census of Agriculture; Istat, 2013). In detail, the Broadband indicator trend may be associated with the fact that the government investments in the digitization of rural areas (*Italia Digitale 2020*, on the basis of the objectives set by the European Digital Agenda by 2020, European Commission, 2010) were prioritized in Southern Italy and Islands (Camera dei Deputati, 2019). The small farms served by large broadband network are in favour of integrating products from the primary sector into short agriculture-food chains. Indeed, the e-business and its marketplace – which are both strengthened by a fast broadband connection – can bridge the gap between suppliers and end-consumers (Sundmaeker, 2016). This is not only valuable for promoting and selling products

through a short food supply chain, but also for improving the management and quality of the agricultural products obtained by the implementation of new technologies (e.g. Internet of Things; Sundmaeker et al., 2016).

The cluster C strictly refers to the environmental management and protection. The Nature Conservation, Forests and Hydrological Risk indicators describe contexts able to “Restoring, preserving and enhancing biodiversity” (Rural Development Priority 4). According to the rationale behind the indicators’ definition (see Table 1 or Appendix C for a complete explanation), the positive correlation between CSAs and the indicators in cluster C is likely due to the specific environmental contexts. For instance, private land owners are less interested in implementing integrated management plans in contexts where there is a low extent of forest lands and Natura 2000 network sites and in general a low exposure to hydrological risk (cf. Joshi et al., 2015), e.g. as in CSAs located in Southern Italy and Islands. On the contrary, the negative correlation between CSAs and the indicators in cluster C indicates the need for implementing or updating management and adaptation plans in territories covered by Natura 2000 sites (Sallustio et al., 2017) and vast forest lands, as well as highly exposed to hydrological risk (i.e. erosion and landslide prevention) (Schirpke et al., 2014), e.g. CSAs in the Northern and Central Italy.

4.3 Alignment of Inner Peripheries with Rural Development Policy

Beyond the relationships between CSAs and indicators, in which way the Inner Peripheries are currently progressed towards the Rural Development Priorities, on the basis of their territorial contexts and planning strategies, remains an open question.

According to the main outcomes, some CSAs need to improve their efforts in further developing a comprehensive and integrated territorial strategy, simultaneously reflecting economic, connectivity and environmental conditions (e.g.

CSAs 6 or 15 in Figure 4). For instance, the results demonstrate that despite the CSA 1 (Alta Valtellina in Northern Italy) seems to be highly progressed in developing a general sustainable growth (sustainable economic growth cluster) compared with other contexts (e.g. CSA 18), there may be the need to further valorise the combination between short food supply chain and broadband connectivity (widespread broadband connection cluster), and environmental potentialities (environmental management and protection cluster). In this specific case, the Rural Development Policy funds could have been oriented to strengthen some territorial potentialities (cf. mainly the economic growth cluster) than others (cf. the environmental management and protection cluster) (see Figure 4). In general, results demonstrate that areas with low population density, abundant protected areas and more ecologically valuable farms, have a reduced propensity to invest in natural capital (cf. Zasada et al., 2018). In some cases, (e.g. CSA 9, Madonie in Sicily), we noted that enhancing a sectoral opportunity (short food supply chain) does not necessarily contribute to the overall economic performance of the territory (mostly negative correlation with the indicator in the sustainable economic growth cluster). Such behaviour partially reflects the misbalance between the current environmental conditions (farm yield) and economic performance (global competitiveness) affecting the crop production, e.g. as in the case of old wheat cultivars (Recchia et al., 2019) and the ongoing development of tourist paths revitalizing local heritages and traditions in Sicily (e.g. *Via dei Borghi* project in Sicilian Region, Samuels, 2017; ESA, 2011). On the other hand, for CSA 3 (Montagna Materana in Southern Italy), the results show that some potentialities such as agricultural land accessibility, short food supply chain, multifunctionality and water efficiency in agriculture, the enhancement of the tourist services (i.e. accommodation), and the encouragement of the generational change in the agricultural sector are well enhanced.

In general, the main findings demonstrate that in order to cope with rural development targets, the Inner Peripheries need to develop holistic strategies incorporating farms' competitiveness and connectivity, efficient use of resources, and local development through the creation of job and tourism opportunities which may improve the quality of life of the city's residents (e.g. CSA 15 sustainable economic growth cluster A, see Figure 4) and likely invert the land abandonment trend. Such objectives can be met through improving social inclusion (Bock et al., 2014) and fostering public participation in planning processes at a very local scale (Tobias et al., 2019). Strategies targeting performance and competitiveness with less consideration of environmental and social aspects may be counterproductive for enhancing local development, especially in marginal and disadvantaged areas (Knickel et al., 2018). Indeed, we demonstrate that an increased water efficiency in agriculture (non-efficient water use), and the establishment of bioenergy crops are positively correlated with the farms' performance and the environmental conservation (CSA 14 in Figure 4).

It is important to note that possible alignments or misalignments of the Inner Peripheries with the rural development priorities are to some extent uncertain. Such uncertainty is difficult to evaluate because it depends on both the territorial capacities reflecting social, economic and environmental characteristics (as highlighted by the context indicators in the present study), and the decisions taken during the participatory processes for developing each Inner Periphery's strategy. Therefore, the selection of indicators could have not been exhaustive in describing all territorial characteristics and capacities at local scale (cf. Bertolini and Pagliacci, 2017). Our selection of the relevant indicators and their linkages with rural development priorities should implicitly reflect the correspondences between specific funded interventions and rural development priorities, as identified by stakeholders and designers at local scale. However, we noticed some mismatches depending on the

different approaches adopted (expert-based vs. participatory-based) as well as the related uncertainty, which may have led to divergent consideration of rural development issues (cf. Bijlsma et al., 2011). This may be explained by the fact that at least conceptually, priorities and targets in the Inner Peripheries almost refer to improving and guaranteeing services of general interest, and thus to further strengthening territorial cohesion, with a less prominent role of valorising rural development.

5. Conclusions

In the present work, we created and implemented a set of context indicators to evaluate the alignment of the Inner Peripheries with rural development priorities at national scale in Italy. The main findings demonstrate that the indicators robustly described the current territorial potentialities and limitations of the Inner Peripheries to cope with rural development. In this way, we argue that an ex-ante comprehensive assessment of the social, economic and environmental characteristics of the Inner Peripheries is helpful to prioritize specific planning actions towards the simultaneous improvement of competitiveness in agriculture and forestry sectors, sustainable use of resources, climate adaptation, technological innovation and local connectivity. Moreover, the indicators set addresses the achievement of Rural Development targets, and could be useful to support the effective implementation of the future intervention at sub-regional scale. Considering that the indicators' set was based on the Inner Peripheries' strategies, we implicitly reflected the bottom-up approach as adopted by local stakeholders and other relevant actors (administrators, strategy designers, experts, etc.) through public consultation and participatory planning (context-specific). We also demonstrated the large replicability and comparability of the indicators, since they are standardized at national scale among different territorial

contexts and the same test we performed can be easily replicated in other Inner Peripheries in Europe.

According to the outcomes of the present study, we may delineate the following pathways to further improve rural development in Inner Peripheries:

- i. The added value of the Inner Peripheries should be valorised, through the following actions: promoting resilience of farms and forest enterprises to the increased competitiveness in national to global markets and social-economic transformations through for example, enabling differentiation of agricultural products in balance with farmers' capacities and strengths, valorising opportunities for networking and cooperation in local food-product's chains, implementing strategies adapted to local barriers and limitations (multi-objective agriculture), and balancing the farms' performance and the environmental conservation.
- ii. The connectivity within and among Inner Peripheries should be further enhanced, especially through improving investments in connectivity and digitalization of productive sectors and local communities' framework, in order to broadly increase competitiveness and welfare.
- iii. The place-based planning approaches should be implemented, mainly through fostering participatory planning and public consultation in decision-making processes, along with improving communication strategies and effective marketing exercises, with the primary purpose to enforce the collaborative partnership at local scale and reflect opinions and perceptions of local communities into adopted strategies and activities.

In conclusion, despite such suggested options are already in the policy agenda at EU scale (European Commission, 2016b, 2018a), further efforts are required to reconcile local needs, equity and identity, with high-level policy strategies in a more comprehensive and integrated way, with the primary purpose to pro-actively transform the Inner Peripheries from depopulated and marginalized areas to areas where sustainable development of social-economic and natural heritages is elicited.

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Appendices

Appendix A

Examples of identified correspondences among strategies' interventions, Rural Development Programme measures, Focus Areas and Rural Development Policy Priorities

Table A1. Identified correspondences among strategy interventions and common aims, Rural Development Programme Measures, Rural Development Policy Focus Areas and Priorities. For each Focus Area there may be more groups of related interventions (i.e. Focus Areas 2a, 3a and 4a).

Examples of intervention in the Strategies	Strategies-related common aim(s)	Rural Development Programme Measures (M)	Rural Development Policy Focus Areas (FA)	Rural Development Policy Priorities
Public investments in rural infrastructures to support agro-forestry sector	Improve the accessibility to agricultural and forest lands in order to increase the economic development	M 4.3.01 Infrastructures for agro-forest development (Lombardy RDP)		
Development of agricultural business activities	Increase the farm profitability through the technological progress (modernization)	M 4.1.01 Investments to improve farm performance and sustainability (Piedmont RDP)	FA 2a. Improving the economic performance of all farms and facilitating farm restructuring and modernisation	Priority 2. Farm Viability and Competitiveness
Agro-forestry-pastoral system development for the recovery of traditional agricultural activities and improved land management	Supplement the farm income activities through the agricultural diversification (multifunctional agriculture)	M 6.4.01 Support for the development of agritourism activities (Lombardy RDP)		
Production system investment renovation	Promote generational change in agricultural and forest sector	M 6.1.01 Start-up aid for young farmers (Sardinia RDP)	FA 2b. Facilitating the entry of adequately skilled farmers into the agricultural sector and generational renewal	
Local productions development	Incentivize the short food supply chains development	M 16.4 Supply chain cooperation for the creation and development of short supply chains, local markets and promotional activities (Tuscany RDP)	FA 3a. Improving competitiveness of primary producers by better integrating them into the agri-food chain	Priority 3. Food Chain Organization and Risk Management
Territorial sustainable development and management's support	Encourage the subscription to European quality products schemes	M 3.1.01 Support the farmers participating in quality schemes for the first time (Lombardy RDP)		

Landscape protection, land access and grazing land recovery	Management and enhancement of environmental resources	M 4.4.01 Conservation and restoration of the characteristic elements of the landscape, preservation and enhancement of biodiversity (Tuscany RDP)	FA 4a. Restoring, preserving and enhancing biodiversity	Priority 4. Restoring, Preserving and Enhancing Ecosystems
Associated forest planning predisposition	Management and enhancement of forest resources	M 16.8 Support for the drafting of forest management plans or equivalent instruments (Tuscany RDP)		
Agro-forestry-pastoral system development for the recovery of traditional agricultural activities and improved land management	Forests prevention and restoration	M 8.3.01 Prevention of forests damage (Lombardy RDP)	FA 4c. Preventing soil erosion and improving soil management	
Support for agricultural investments to improve water resource management	Improve water resource management	M 4.3.02 Support for agricultural investments in infrastructure to improve water resource management (Basilicata RDP)	FA 5a. Increasing efficiency in water use by agriculture	Priority 5. Resource-efficient, Climate-resilient Economy
Agro-forestry-pastoral system development for the recovery of traditional agricultural activities and improved land management	Support the energy production activities	M 6.4.02 Support the creation and development of energy production activities (Lombardy RDP)	FA 5c. Facilitating the supply and use of renewable sources of energy	
Creation of strategic places, services and products of the "Asili d'Appennino" network	Increasing the territory attractiveness through inter-sectorial actions	M 7.4 Investments in the creation, improvement or expansion of basic local services and infrastructure (Marche RDP)	FA 6a. Facilitating diversification, creation and development of small enterprises, as well as job creation	Priority 6. Social Inclusion and Economic Development
Support the local supply chains forest-wood, agri-food and tourism through the LEADER approach	Support the local territorial development (under LAGs)	M 19 Support the local LEADER development (Friuli-Venezia Giulia RDP)	FA 6b. Fostering local development in rural areas	
Agro-forestry-pastoral system development for the recovery of traditional agricultural activities and better land management	Promotion of support services (broadband) for local populations and business development	M 7.3.01 Support for the installation, improvement and expansion of broadband infrastructure (Trento RDP)	FA 6c. Enhancing the accessibility, use and quality of information and communication technologies (ICT) in rural areas	

Appendix B

Description of Case Study Areas (CSAs)

Table B1. List of Case Study Areas (CSA) and associated municipalities (source: Open Aree Interne, <http://www.agenziacoesione.gov.it/it/arint/OpenAreeInterne/>). Additional characteristics about population, elevation range, and land cover are also reported.

CSA ID	CSA Name	No. Municipalities	Total area (ha)	Population density (people/km ²)	Land cover (CLC 2012 – I level)
1	Alta Valtellina	5	66816,83	27,77	Artificial surfaces 1,03% Agricultural areas 5,00% Forest and semi natural areas 93,26% Wetlands 0% Water bodies 0,71%
2	Valchiavenna	12	56087,44	43,80	Artificial surfaces 1,56% Agricultural areas 5,19% Forest and semi natural areas 91,17% Wetlands 0% Water bodies 2,08%
3	Montagna Materana	8	64503,16	18,80	Artificial surfaces 0,33% Agricultural areas 59,78% Forest and semi natural areas 39,85% Wetlands 0% Water bodies 0,04%
4	Alta Irpinia	25	111802,58	57,59	Artificial surfaces 2,36% Agricultural areas 8,69% Forest and semi natural areas 38,49% Wetlands 0,03% Water bodies 0,43%
5	Alta Carnia	21	99899,19	21,10	Artificial surfaces 0,72% Agricultural areas 6,35% Forest and semi natural areas 92,79% Wetlands 0% Water bodies 0,14%
6	Appennino Basso Pesarese Anconetano	9	84612,63	41,22	Artificial surfaces 1,83% Agricultural areas 45,16% Forest and semi natural areas 52,94% Wetlands 0% Water bodies 0,07%
7	Valli Maira e Grana	18	71202,28	19,22	Artificial surfaces 0,58% Agricultural areas 8,13% Forest and semi natural areas 1,29% Wetlands 0% Water bodies 0%
8	Alta Marmilla	19	33456,77	30,47	Artificial surfaces 1,65% Agricultural areas 62,15% Forest and semi natural areas 36,20% Wetlands 0% Water bodies 0%
9	Madonie	21	172813,88	38,42	Artificial surfaces 0,89% Agricultural areas 59,86% Forest and semi natural areas 38,86% Wetlands 0% Water bodies 0,39%
10	Casentino- Valtiberina	9	82795,28	26,38	Artificial surfaces 1,15% Agricultural areas 25,93%

					Forest and semi natural areas 72,39% Wetlands 0% Water bodies 0,53%
11	Tesino	3	21236,45	11,15	Artificial surfaces 0,66% Agricultural areas 7,62% Forest and semi natural areas 91,72% Wetlands 0% Water bodies 0%
12	Monti Dauni	29	194665,34	31,18	Artificial surfaces 0,64% Agricultural areas 84,96% Forest and semi natural areas 14,10% Wetlands 0% Water bodies 0,30%
13	Spettabile Reggenza	8	46617,93	45,58	Artificial surfaces 2,52% Agricultural areas 16,17% Forest and semi natural areas 81,31% Wetlands 0% Water bodies 0%
14	Ascoli Piceno	15	70775,92	37,36	Artificial surfaces 1,08% Agricultural areas 38,94% Forest and semi natural areas 59,90% Wetlands 0% Water bodies 0,08%
15	Vallo di Diano	15	72531,05	82,91	Artificial surfaces 2,19% Agricultural areas 35,47% Forest and semi natural areas 61,96% Wetlands 0% Water bodies 0,38%
16	Garfagnana	19	106228,08	38,65	Artificial surfaces 1,56% Agricultural areas 12,52% Forest and semi natural areas 5,74% Wetlands 0% Water bodies 0,18%
17	Valli dell'Ossola	10	46510,85	9,61	Artificial surfaces 0,06% Agricultural areas 1,99% Forest and semi natural areas 97,65% Wetlands 0% Water bodies 0,30%
18	Val Simeto	10	107877,19	165,48	Artificial surfaces 4,03% Agricultural areas 67,87% Forest and semi natural areas 27,48% Wetlands 0% Water bodies 0,62%

Appendix C

Indicators: explanation, data sources and elaboration

Indicator 1 (RoD) – Road Density (in agricultural and forest lands)

Explanation. The Road Density (RoD) indicator is conceived to assess the state of accessibility to agricultural and forest lands for productive purposes (e.g. land management and transportation) in a specific territory. Indeed, the improvement of accessibility to agricultural and forest lands, and the further development of the road infrastructure network, foster the competitiveness of the agriculture and forestry sectors, and enhance the overall efficiency (cost-benefit ratio) of the related productive activities (e.g. energy savings, improved work conditions), especially in disadvantaged territories (Ota, 2011). For example, Demir (2007) defined the road density as the ratio between the length of existing roads in forests (and agricultural areas, in the present study) and the unit area.

Data sources. *Ag + Fo:* CORINE Land Cover (CLC) 2012 (COPERNICUS¹¹); Digital Elevation Model (DEM), 75m resolution (ISPRA¹²); *RoL:* OpenStreetMap (© OpenStreetMap contributors¹³).

Data elaboration. Data were elaborated in GIS environment (ESRI® ArcMap™ 10.0¹⁴). At first, the total area of agricultural and forest lands (referred to classes 2 and 3.1 in CLC2012) was calculated for each municipality. On the basis of the previously obtained total area, a DEM mask was created to differentiate agricultural and forest areas on the basis of the elevation range (degree) for each municipality. According to Nagendra et al. (2003) and Piegai and Hippoliti (2015), only those agricultural and forest lands located at an elevation between 0° and 30° were selected, and the associated areas calculated (i.e. *Ag + Fo*). Then, the length of “track” roads as defined in OpenStreetMap (i.e. “this tag represents roads for mostly agricultural use, forest tracks etc.; usually unpaved – unsealed – but may apply to paved

¹¹ <https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012>

¹² <http://www.sinanet.isprambiente.it/it/sia-ispra/download-mais/dem75/view>

¹³ <https://www.openstreetmap.org/copyright/en>

¹⁴ <http://desktop.arcgis.com/en/arcmap/>

tracks as well, that are suitable for two-track vehicles, such as tractors or jeeps”¹⁵) included in the agricultural and forest lands (within the 0°-30° slope range) were calculated for each municipality (i.e. *RoL*).

Indicator 2 (LIA) – Labour Intensity (in agriculture)

Explanation. The Labour Intensity (LIA) indicator is mainly conceived to assess the current status of labour force of farms in a specific territory, and indirectly, to provide for an estimate of the farms’ propensity to modernization and innovation. For example, Bojnec, Fertő, Jambor, & Tóth (2014) found that the “agricultural natural factor endowment” (calculated as the ratio between annual working units and utilized agricultural area) is inversely correlated with the technical efficiency of farms. Similarly, Diederens, Meijl, & Wolters (2003) demonstrated that bigger farms (with more labour resources) are oriented to implement an innovation early.

Data sources. AWU and UAA: Italian National Institute of Statistics (ISTAT), 2010 Agricultural Census¹⁶.

Data elaboration. Not performed.

Indicator 3 (MuA) – Multifunctionality (of agriculture, i.e. presence of agritourisms)

Explanation. The Multifunctionality (MuA) indicator is conceived to assess the diversification of farms’ activities (e.g. agritourism, livestock, and grazing), and goods and services delivered to people (e.g. biodiversity conservation, tourism and recreation, maintenance of landscape aesthetics). Indirectly, MuA refers to the current potentialities by farmers to increase their incomes, and thus improve their competitiveness (Bumbalova, 2010; Brelik, 2013). In the present work, the presence of agritourisms is selected as a proxy to describe the multifunctional farming (Dorocki, Rachwał, Szymańska, & Zdon-Korzeniowska, 2013).

¹⁵ <https://wiki.openstreetmap.org/wiki/Tag:highway=track?useLang=nl>

¹⁶ <http://dati-censimentoagricoltura.istat.it/Index.aspx>

Data sources. AT and FARMS: Italian National Institute of Statistics (ISTAT), 2010 Agricultural Census¹⁷.

Data elaboration. Not performed.

Indicator 4 (YoF) – Young Farmers

Explanation. The Young Farmers (YoF) indicator is conceived to assess the age structure of farmers in a specific territory, and in particular the relevance of young farmers. Indirectly, the YoF indicator offers an overview of the economic potential of the agricultural sector, by following a restructuring of the age of farmers, from older to younger. Indeed, young farmers are demonstrated to improve the farms' performance, in terms of economic potential, farm size and labour productivity than older farmers (Sandu, 2014; Giannakis & Bruggeman, 2015; Tudor & Alexandri, 2015). The European Council of Young Farmers considers "young" those farmers under an age of 35 (Urdiales et al., 2016).

Data sources. YFar and Far: Italian National Institute of Statistics (ISTAT), 2010 Agricultural Census¹⁸.

Data elaboration. Not performed.

Indicator 5 (FaS) – Farm Size

Explanation. The Farm Size (FaS) indicator is conceived to averagely describe the potential of farms and products to be integrated into the agricultural-food chain in a specific territory. Indirectly, the FaS indicator describes the accessibility of farmers to the local market, depending on the size of their farms, and thus provides for an estimate of the competitiveness of the agricultural sector. Indeed, Aguglia, De Santis, & Salvioni (2009) argued that the farm size for direct selling is small, according to the basic principles of the shortness of the supply chains in agriculture.

¹⁷ <http://dati-censimentoagricoltura.istat.it/Index.aspx>

¹⁸ <http://dati-censimentoagricoltura.istat.it/Index.aspx>

Data sources. *UAA* and *FARMS*: Italian National Institute of Statistics (ISTAT), 2010 Agricultural Census¹⁹.

Data elaboration. Not performed.

Indicator 6 (QuA) – Quality Product (in agriculture)

Explanation. The Quality Product in agriculture (QuA) indicator is intended to describe the share of farms adhering to the European quality product schemes, such as the Protected Designation of Origin (PDO) and the Protected Geographical Indication (PGI)²⁰. Indirectly, the QuA indicator provides for an estimate of an improved competitiveness of the agricultural sector (Vladu, Sperdea, & M. Vladu, 2016). Indeed, food standards and quality product schemes have been introduced to both improve the communication of high quality food products to consumers by too small firms, and assist farmers to achieve a critical mass required for brand name and trademark development (Moschini et al., 2008).

Data sources. *FARMS_{PDO}*, *FARMS_{PGI}*, and *FARMS*: Italian National Institute of Statistics (ISTAT), 2010 Agricultural Census²¹.

Data elaboration. Not performed.

Indicator 7 (CoN) – Nature Conservation (habitat and species)

Explanation. The Nature Conservation (CoN) indicator refers to the extent of Natura 2000 network sites in a specific territory. Indirectly, the CoN indicator provides for an estimate of the current mixture between areas primarily devoted to the conservation of species and habitats, and those oriented to e.g. agriculture and forestry. Indeed, it is extremely important to understand how the objectives of biodiversity conservation as in the Habitat Directive, and other local development aims as in the Rural Development Policy are currently integrated

¹⁹ <http://dati-censimentoagricoltura.istat.it/Index.aspx>

²⁰ https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/quality-schemes-explained_en

²¹ <http://dati-censimentoagricoltura.istat.it/Index.aspx>

and implemented at landscape scale in Europe (Agnoletti, 2014; Hodge et al., 2015; Kati et al., 2015).

Data sources. European Environment Agency (EEA)²².

Data elaboration. Data were elaborated in GIS environment (ESRI® ArcMap™ 10.0²³) to obtain the total area of Natura 2000 Network sites in each municipality.

Indicator 8 (For) – Forests

Explanation. The Forests (For) indicator is conceived to directly assess the total forest area in a specific territory, and indirectly to provide for an estimate of the potential implementation of forest management plans in rural environments. The latter derives from the assumption that forest managers and owners need to (sustainably) manage their forests through periodically updating or creating plans (Rametsteiner and Schmithüsen, 2009; Cullotta and Maetzke, 2011) benefitting of the currently available funding mechanisms. The importance of forest management plans for both the EU Biodiversity Strategy and the EU Rural Development funding is highlighted in the EU Forest Strategy²⁴.

Data sources. Class 3.1, CORINE Land Cover (CLC) 2012 (COPERNICUS)²⁵.

Data elaboration. Data were elaborated in GIS environment (ESRI® ArcMap™ 10.0²⁶) to obtain the total forest area in each municipality.

Indicator 9 (HyR) – Hydrological Risk

Explanation. The Hydrological Risk (HyR) indicator refers to the portion of a territory under high and very high probability of exposure to hydrological risks (Trigila et al., 2015). This indicator implies that it is possible to reduce the probability of exposure to such risks through protecting and managing forest (Cislaghi et al., 2019) and rural lands (Galve et al., 2015).

²² <https://www.eea.europa.eu/data-and-maps/data/natura-9>

²³ <http://desktop.arcgis.com/en/arcmap/>

²⁴ https://ec.europa.eu/agriculture/forest/strategy_en

²⁵ <https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012>

²⁶ <http://desktop.arcgis.com/en/arcmap/>

Data sources. AUHYR: ISTAT risk map²⁷, source Trigila et al., 2015.

Data elaboration. Not performed.

Indicator 10 (WEA) – Water Efficiency (in agriculture)

Explanation. The Water Efficiency (WEA) indicator assesses the water efficiency use in agriculture. The water efficiency in agriculture is usually low on the basis of e.g. the poor hydrological system and land properties (Wu et al., 2015). These criticalities can be overcome through a constant source of water supply (creating e.g. reservoir), managing the water consumption and improving the water distribution system (Nam et al., 2016) benefitting from EU funds.

Data sources. WUI_i : Italian National Institute of Statistics (ISTAT), 2010 Agricultural Census²⁸; WaN_i : Gasparri, 2004, p.27.

Data elaboration. In the case of WUI_i , the volume of water (m^3) used for irrigation was divided by the related crop (i) surface (ha). In the case of WaN_i , we converted the water need of each crop i as reported in Gasparri (2004) into $m^3 \text{ ha}^{-1}$ ($1 \text{ mm year}^{-1} = 10 \text{ mm}^3 \text{ ha}^{-1} \text{ year}^{-1}$ ²⁹).

Indicator 11 (EEC) – Energy Crops (extent of)

Explanation. The Energy Crops (EEC) indicator expresses the potential by agricultural areas to host bioenergy crops. Indirectly, this indicator refers to the capacity of renewable sources (i.e. biomass) in the agriculture and forestry sectors to contribute to GHG emissions reduction through energy substitution European Commission, 2018). However, trade-offs derived by the competing use of land (e.g. energy vs. food) have to be considered when implementing sustainable agricultural policies (Smith et al., 2010).

²⁷ <http://www4.istat.it/it/mappa-rischi/indicatori>

²⁸ <http://dati-censimentoagricoltura.istat.it/Index.aspx>

²⁹ https://www.arpae.it/dettaglio_notizia.asp?id=2909&idlivello=32

Data sources. UAA: Italian National Institute of Statistics (ISTAT), 2010 Agricultural Census³⁰; SHARE: European Union DG AGRI, 2011.

Data elaboration. Not performed.

Indicator 12 (ToF) – Tourist Function

Explanation. The Tourist Function (ToF) indicator is conceived to assess the potential of a territory to attract tourists. Indirectly, the ToF indicator provides for an estimate of the current state of the tourism infrastructure, as well as of the possibility of a specific territory to increase diversification and further economic development of small enterprises (e.g. Pomeanu and Teodosiu, 2012). In general, the competitiveness of a tourist destination depends on several aspects, such as e.g. core resources and attractions (García Paramio et al., 2018), supporting factors and resources (Rodríguez et al., 2018), management (Haraldsson and ólafsdóttir, 2018), promotion and qualifying determinants (Chang, 2014). Indeed, properly supporting the tourist function facilitates the development infrastructures, and improves the quality of life of the city's residents (e.g. Przybyła and Kulczyk-Dynowska, 2018). For example, to assess the relative importance of tourism in a specific area, several authors adopted the Defert's tourist function rate (DTFR; Defert, 1967), which is based on the currently available accommodation offers (e.g. Borzyszkowski et al., 2016).

Data sources. BED: Italian National Institute of Statistics (ISTAT)³¹; I: Italian National Institute of Statistics (ISTAT), 2011 Population and Housing Census³².

Data elaboration. Not performed.

Indicator 13 (UnR) – Unemployment Rate

Explanation. The Unemployment Rate (UnR) indicator is conceived to assess the rate of unemployed people over the total population in a specific territory within the framework of the Local Action Groups. Indirectly, the UnR indicator provides for an estimate of the

³⁰ <http://dati-censimentoagricoltura.istat.it/Index.aspx>

³¹ <https://www.istat.it/it/archivio/124086>

³² <http://dati-censimentopopolazione.istat.it/Index.aspx>

potential by rural communities to revert the depopulation trend, and foster local entrepreneurship and investments in jobs' creation and reduce rural poverty. Indeed, the Local Action Groups (LAGs) within the LEADER programme as initiative, seem to be effective in job creation in rural areas (e.g. Powell et al., 2017; Müller and Korsgaard, 2018).

Data sources. *Un* and *Wf*: Italian National Institute of Statistics (ISTAT), 2011 Population and Housing Census³³; *LAGS*: EU LAGs database for Italy³⁴.

Data elaboration. Not performed.

Indicator 14 (BbP) – Broadband (pervasiveness)

Explanation. The Broadband (BbP) indicator is conceived to assess the progresses in broadband pervasiveness within a specific territory. Indirectly, the BbP indicator provides for an estimate of the degree of access to high-speed internet by local communities, and in turn the potential for economic growth in rural areas. For example, Younjun and Orazem (2012) argued that broadband positively affects productivity of local industries. In addition, Dower (2013) demonstrated that the widespread access to broadband networks is one of the key drivers for rural development.

Data sources. *RER* and *REI*: Data on Ultra-broadband network up to 2018 (Ministero dello Sviluppo Economico)³⁵.

Data elaboration. Not performed.

³³ <http://dati-censimentopopolazione.istat.it/Index.aspx>

³⁴ https://enrd.ec.europa.eu/leader-clld/lag-database/Italy_en

³⁵ <https://bandaultralarga.italia.it/>

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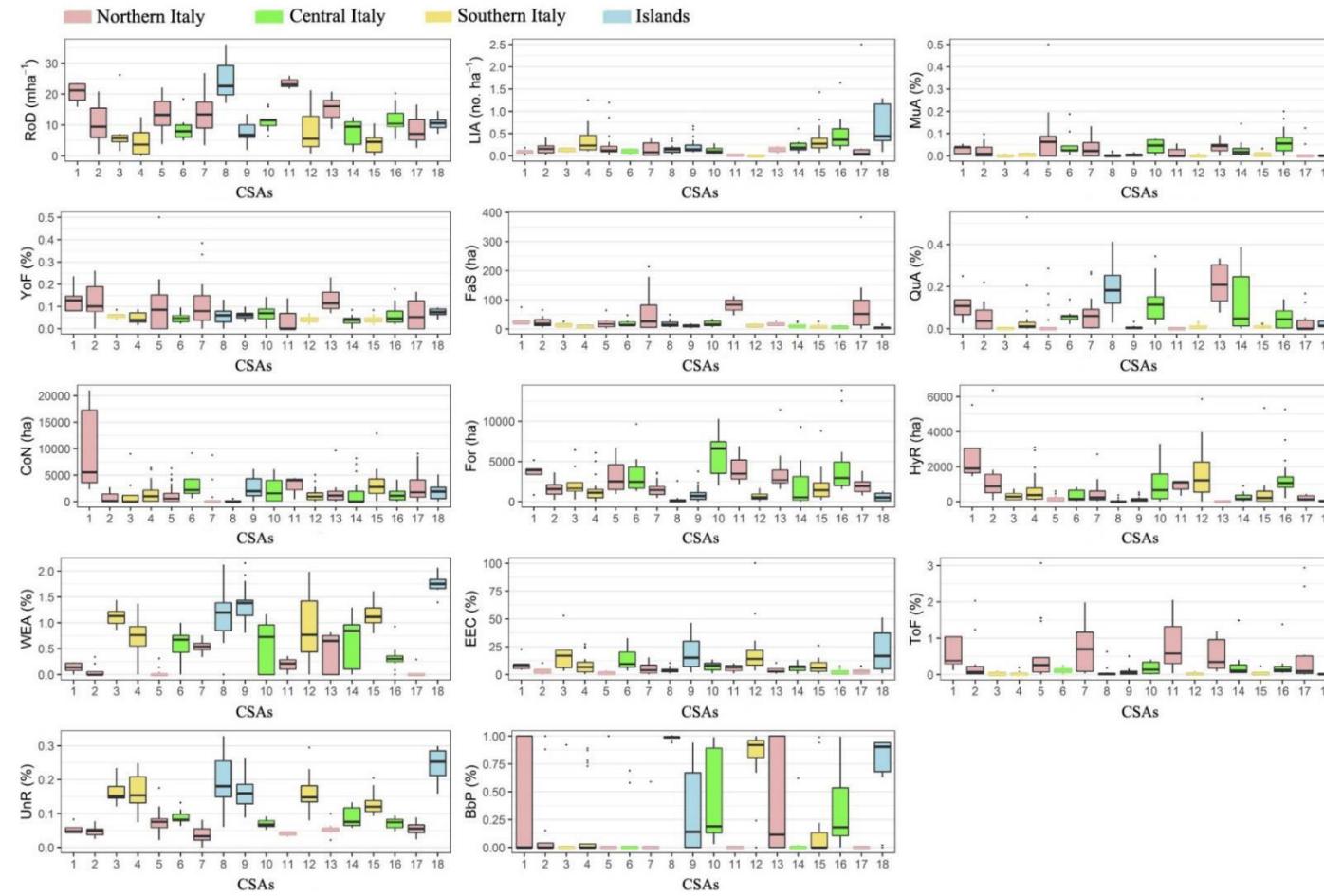
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Appendix D

Statistical analysis: ANOVA's results

Figure D1. ANOVA's results for the complete indicators' set. The CSAs are identified within the related regional boundaries (see different colours in the legend). Within each indicator, the thicker black lines identify the median values.



CHAPTER 4.

How can we deal with Inner Peripheries criticalities through an integrated policy approach? A lesson learning and the new “Rural Cohesion Policy” framework

So far, our efforts focused on fostering the rural development in Inner Peripheries, since the Italian National Strategy for Inner Areas already addresses the achievement of territorial cohesion. What is missing now, is to introduce a comprehensive territorial strategy which has to address both the rural development and the territorial cohesion objectives at the same time. In the following research article, we examine a Spanish case study finding evidences of demographic decline and poor accessibility to Services of General Interest and analysing its main land use land cover characteristics, identifying an Inner Periphery area. Thus, we suggest policy and planning strategies and interventions aimed to improve the sustainable territorial development of such Inner Periphery, implementing a comprehensive policy framework approach based on both Cohesion and Rural Development Policies funds use (i.e. Rural Cohesion Policy framework).

Facing Inner Peripheries' main criticalities through the "Rural Cohesion Policy" implementation.

Original full-length research paper, in preparation, to be submitted to Ager journal

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Abstract

The recent concept of Inner Peripheries defines areas which suffer from demographic decline and remoteness, among others. On the one hand, the depopulation challenge is already heeded around Europe, particularly referring to Spanish Government. On the other hand, even if it appears only as lack of services and demographic problems, the Inner Peripheries criticalities need to be overcome thanks to a sustainable territorial strategy development, on the basis of the comprehensive “Rural Cohesion Policy” framework. This contribution aims to i) identify the depopulation trend in Marina Alta, a Spanish case study; ii) evaluate the accessibility to the main low and middle centrality services in the Marina Alta through a spatially-explicit network analysis; iii) analyse the territorial characteristics suggesting sustainable development strategy pathways. The results show robust correlations between the population growth and the accessibility to basic services, i.e. hospitals, primary and secondary schools and train stations, revealing a depopulation trend and a lack of accessibility to services in the Marina Alta’s internal municipalities. Therefore, we define the largest part of the Marina Alta’s territory as an Inner Peripheries area. According to the territorial characteristics, we finally propose possible recommendations to reverse the depopulation trend in the Inner Peripheries area.

Keywords

Rural Cohesion Policy, Inner Peripheries, sustainable territorial strategy, demographic trend, accessibility.

1. Introduction

Inner Peripheries is a recent concept arisen from different territorial projects (ESPON, 2013, 2017b), which have shown worrisome territorial evidences mainly spread over the rural areas within the European Countries. Inner Peripheries are mainly characterized by demographic decline, population ageing, lack of Services of General Interest (SGIs), remoteness and lack of accessibility, lack of economic diversity, and social exclusion (Copus, Mantino, & Noguera, 2017). The peripheralization process, which is peculiar in these areas, is actualized in the exclusion from network, in addition to the distance from core areas (Kuhn, 2015) and poor accessibility. These territorial criticalities usually turn into the marginalization of these areas and subsequently, poverty and outmigration (ESPON, 2017b). Hence, the first clear process that occurs in Inner Peripheries is the demographic decline coupled with the lack of SGIs. Indeed, the outmigration of the young people, the austerity policies, and the concentration of basic services in urban areas have negatively affect many of rural areas, especially in Spain (Camarero & Oliva, 2019). Nowadays, the depopulation challenge is included in some European Governments' agenda (Montalvo, Ruiz-Labrador, Montoya-Bernabéu, & Acosta-Gallo, 2019). In particular, the Spanish Government has recently approved the National Strategy on the Demographic Challenge to ensure a greater balance between the rural and urban areas since about the 80% of Spanish municipalities are losing people. Following Oswalt & Rieniets (2006), the population losses are significant «if they amount to a total of at least 10% or more than 1% annually». Instead, the accessibility to services issue may be calculated on the basis of the distance from SGIs via travel time by car (Caubel, 2006), which usually have to be not higher than 10-15 minutes (the time changes on the basis of the type of service analysed). Moreover, according to Milbert, Breuer, Rosik, Stepniak, & Velasco (2013), the rural population have to benefit from the low

centrality level services (e.g. primary and secondary schools); the middle centrality level services (e.g. hospitals, railways) have to be some extent accessible and the high centrality level services (e.g. universities, airports) may be not accessible in rural areas. Hence, the services define the quality of citizenship, which has to be provided also in rural areas (Barca, Casavola, & Lucatelli, 2014). Therefore, the depopulation tendencies and the accessibility are two related indicators (Šťastná & Vaishar, 2017) to be monitored in order to avoid future territorial unbalances such as demographic concentration in cities and coast areas and consequent loss of rural activities (i.e. environmental and territorial protection, food supply chain, forest management). Indeed, the territorial accessibility is strictly connected to the economic growth and development potential (Pieraar, 2019), and the rural activities are in turn connected to the main territorial resources (i.e. land use-land cover).

Usually, the accessibility to services analyses in rural areas aim to provide guidelines on location strategies for facility planning (Özer, 2017), to evaluate and develop road accessibility (Wolny, Ogryzek, & Źróbek, 2019) or to underline some disparities in urban and rural areas accessibility to services (Reshadat, Zangeneh, Saeidi, Teimouri, & Yigitcanlar, 2019). Instead, one of the main aims of this paper is to provide some feasible solutions to face the lack of services issue, also revitalizing local economies through the use of territorial resources within a holistic and sustainable strategy development. Indeed, has been demonstrated that single territorial interventions without a strategic vision is clearly not efficient in the long run (ESPON, 2017a). A hypothetical win-win strategy for the rural areas in Europe may be the new «Rural Cohesion Policy» framework implementation. This new Policy «includes an emphasis upon inclusive growth and social justice, exploiting the increasing potential from rural-urban and rural-global interaction, making greater use of «soft» intervention tools» (Dax & Copus, 2018). These useful tools

may be the Integrated Territorial Investment (ITI) and the CLLD-LEADER approach (OECD, 2016). Hence, the Inner Peripheries need to be supported by the Cohesion Policy and Rural Development Policy Funds, thus related National and Regional Programmes, since their territorial issues affected both territorial cohesion and rural sphere. Practically, this may mean analysing the major territorial criticalities and potentialities in order to understand suitable territorial planning interventions to be implemented in order to foster the main territorial resources in a sustainable way, inverting the depopulation trend and provide basic services.

According to the above-mentioned issues, this work aims to analyse the Marina Alta case study (Spain), which is characterized by Internal, Intermediate and Coast areas (municipalities), in order to find out evidences on the hypothesized depopulation process analysing the demographic trend within 1960-2018 range (the 1960-2011 DG REGIO project dataset was updated using the Instituto Nacional de Estadística - INE – 2018 demographics' data) and the lack of accessibility to the main low and middle centrality SGIs (i.e. primary and secondary schools, hospitals, railways stations), performing network analyses using the ArcGIS® Network Analyst extension. Furthermore, the present contribution intends identify in broad terms the case study land use – land cover characteristics, analysing the CORINE Land Cover 2018 and Natura 2000 Network, and suggest sustainable development strategy pathways on these bases, following the «Rural Cohesion Policy» orientations.

2. Materials and methods

2.1. *Marina Alta case study description*

The Marina Alta territory covers about 76.042 ha and comprises 33 municipalities divided in 3 areas. According to the Marina Alta Observatory , the

Coast area gathers 8 municipalities (El Verger, Benissa, Calp, Teulada, Poble Nou de Benitatxell, Xàbia, Dénia, Els Poblets); the Intermediate area grouped 7 municipalities (Pego, Ondara, Pedreguer, Gata de Gorgos, Senija, Llíber, Xaló); the Internal area is composed by 18 municipalities (Atzúbia, la Vall de Gallinera, la Vall d'Alcalà, la Vall d'Ebo, Castell de Castells, la Vall de Laguar, Benigembla, Murla, Parcent, Alcalalí, Orba, Benidoleig, Beniarbeig, Sanet y Negreals, Benimeli, el Ràfol d'Almúnia, Sagra, Tormos) (see Fig. 1). The road network and railway line mainly cover the Coast municipalities (see Fig. 2). The railway line has three stops in Calp, Benissa, Teulada, Gata, La Xara, Hospital Dénia, Ferrandet, Denia, Alqueries.

Figure 1. Marina Alta's geographical framework. According to the Marina Alta Observatory, the municipalities be part of Coast, Intermediate or Internal areas. Source: authors' data elaboration.

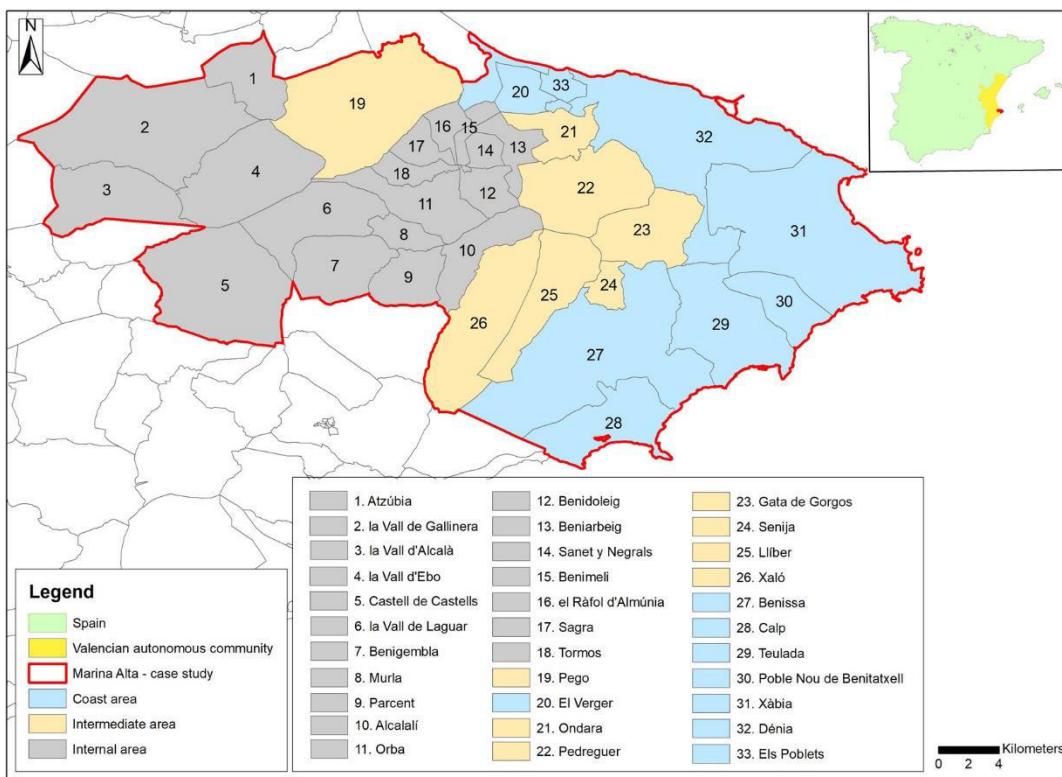
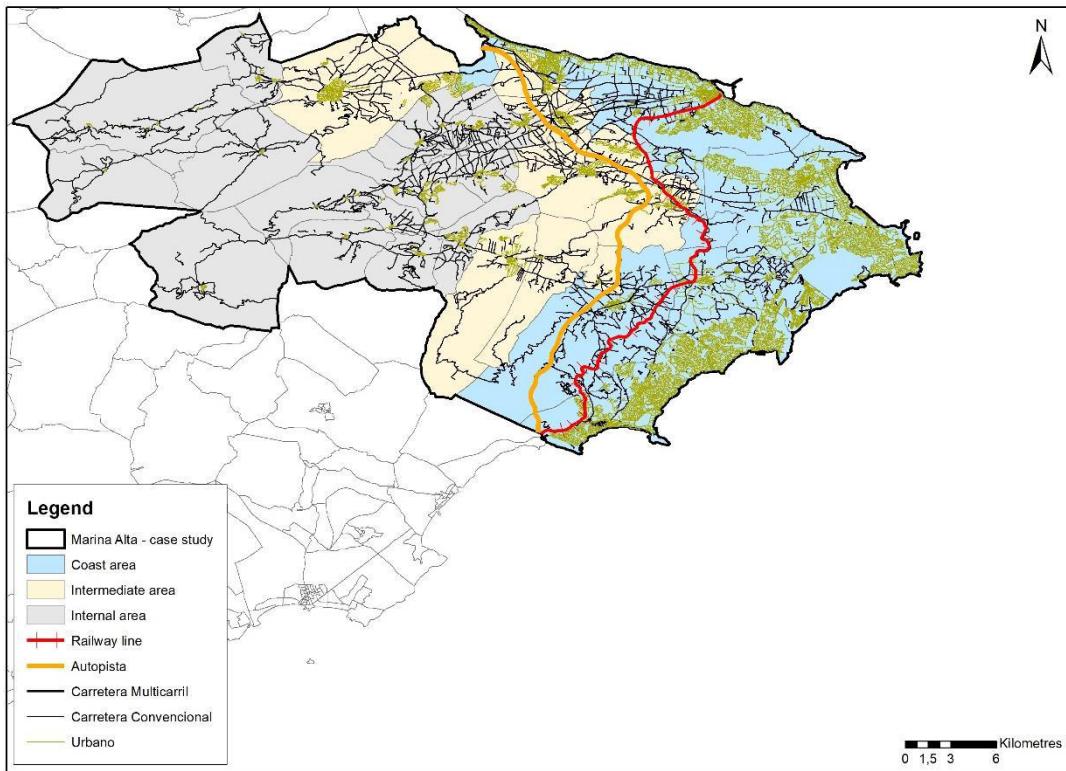


Figure 2. Road network and railway line in Marina Alta. Source: authors' data elaboration.



2.2. Demographic trend analysis

For the demographic trend analyses, we use the DG REGIO "Population Data Collection for European Local Administrative Units from 1960" dataset at LAU level (data range 1960-2011, e.g. Walser & Anderlik, 2004), which was updated through the 2018 INE demographic dataset use. For each municipality, we calculated the demographic change (absolute and relative change) in order to highlight a population loss or growth trends.

(1) Absolute demographic change

$$VAR_{demo}(t1960:t2018)_i = [P_i(t2018) - P_i(t1960)] \quad i = 1 \dots 33 \quad (1)$$

(2) Relative demographic change

$$\%VAR_{demo}(t1960:t2018)_i = 100 \times [P_i(t2018) - P_i(t1960)/P_i(t1960)] \quad i = 1 \dots 33 \quad (2)$$

where i is the municipality, t is the census year considered and P is total population.

The population losses occur when the amount is higher than 10% (Oswalt & Rieniets, 2006).

2.3. Accessibility analyses – Services of General Interest

The present work aims to evaluate the accessibility to the main low and middle centrality SGIs in the Marina Alta case study. To achieve this goal, we perform different spatial analyses using the Network Analyst tool of ArcGIS® software, which creates service areas (i.e. isochrone maps) based on the road network (e.g. Tome, Santos, and Carvalheira 2019).

In detail, firstly, we selected primary and secondary schools, hospitals and railway stations services which belong to the education, health and mobility sectors respectively. Within the Network Analyst model these services are identified as points. Then, we identify different types of roads, online available, within the Marina Alta territory. These roads have different average speeds. In particular, we extracted four types of road (polyline) to create the road network, as follow: “Urbano”, “Carretera convencional”, “Carretera Multicarril” and “Autopista”. The related average speeds are: «40 km/h», «70 km/h», «90 km/h» and «120 km/h» respectively, since the distance is calculated on travel time by car.

For each point (service) the Network Analyst tool creates an isochronous map on the basis of a distance criterion. According to Milbert et al., 2013, each service type is related to a different distance (travel time by car) criterion in order to be accessible: the primary (and secondary) schools have to be distant no more than 8 minutes; the railway stations no more than 15 minutes; the hospitals within a range of 10-30 minutes.

2.4. Correlations between population trend and services' accessibility

The correlations are based on the demographic trend absolute values calculated per each municipality and the areas (calculated in hectares) on which

the SGIs may be accessible. We calculate the service area (as *polygons*) per each service identified, primary and secondary schools, hospitals and train stations respectively. Concerning the hospitals service, we grouped the three service areas ranged 0-10, 11-20 and 21-30 minutes driving in one polygon identified on 0-30 minutes, in order to simplify the analysis.

2.5. Land Use – Land Cover analysis and Natura 2000 Network

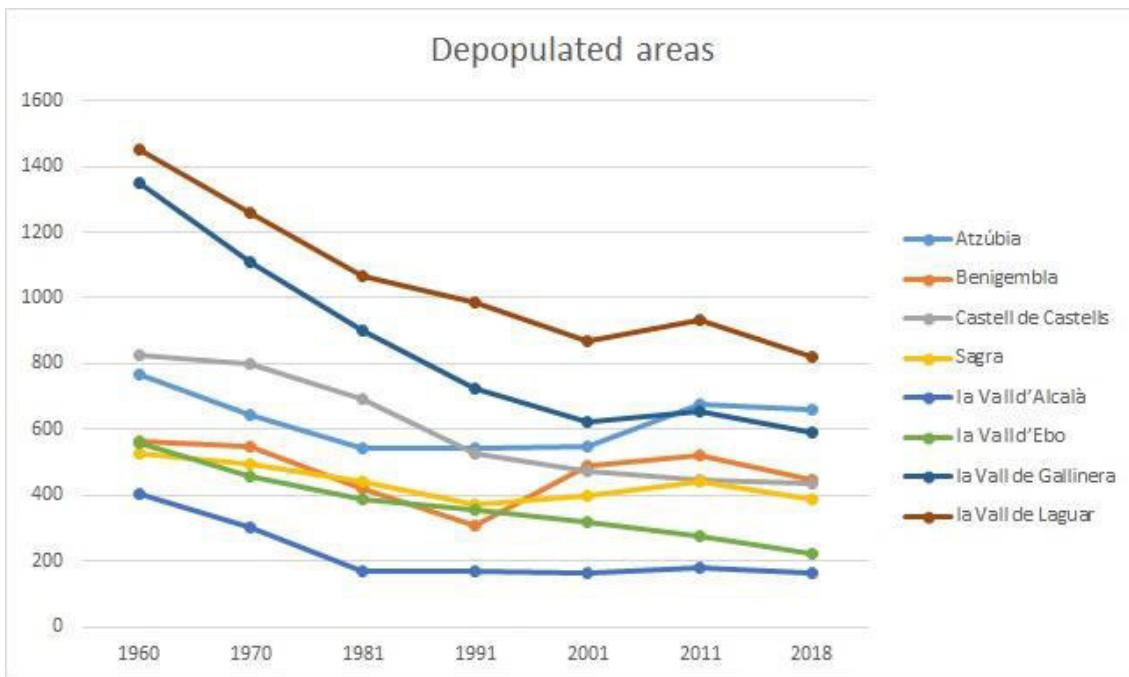
The Land Use – Land Cover (LULC) analysis is based on the CORINE Land Cover 2018 (European Environment Agency data source). We calculate the hectares' coverage for each LULC category, i.e. Urban Areas, Arable lands, Forest lands, Wetlands, Water bodies. The same analysis was performed on the Natura 2000 Network data.

3. Results

3.1. Demographic trends (1960-2018)

results reported in absolute and relative changes, highlight the demographic growth occurred from the 1960 to the 2018 in the Coast (+350% on average) and Intermediate areas (+58% on average) of the Marina Alta. Instead, the Internal area, with a positive average of 8%, presents 8 out of 18 municipalities which shown a depopulation trend (see Fig. 3). In detail, the municipalities which are characterized by population losses values (range 1960-2018) are: Atzúbia (-13,7%), Benigembla (-21,3), Castell de Castells (-47,5%), Sagra (-26,5%), la Vall d'Alcalà (-59,2%), la Vall d'Ebo (-60%), la Vall de Gallinera (-56,4%) and la Vall de Laguar (-43,5%). This group of municipalities identifies the depopulated area in Marina Alta.

Figure 3. Internal municipalities which shown a depopulation trend (absolute change). Source: authors' data elaboration.

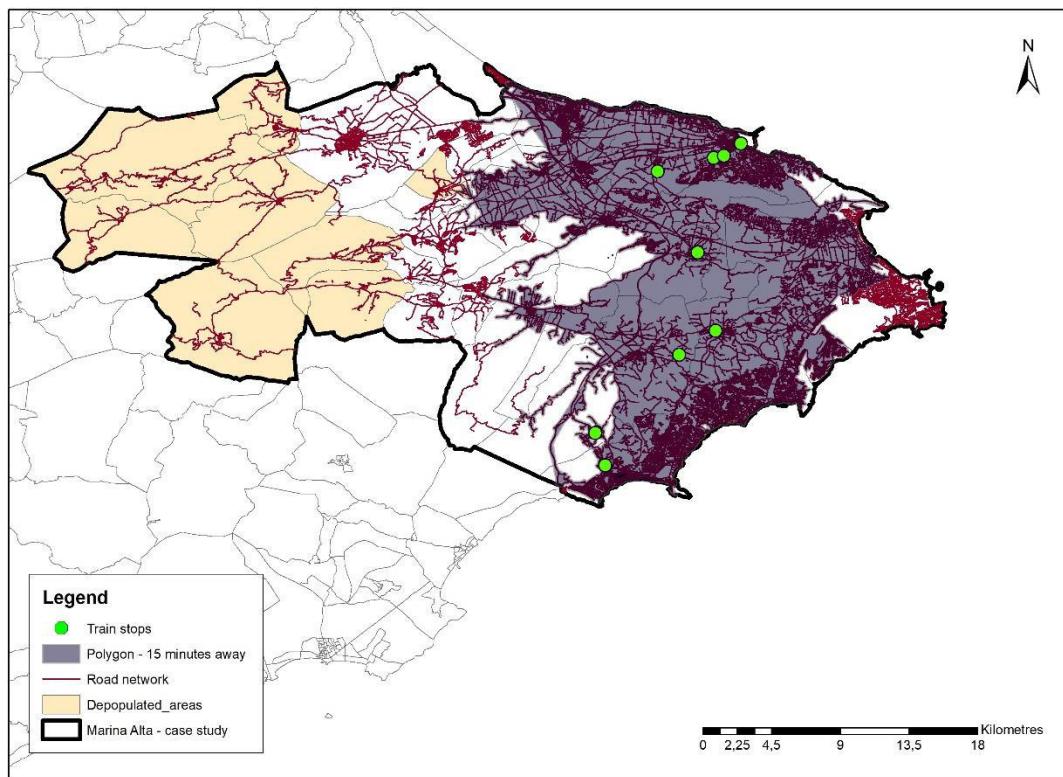


3.2 Accessibility analyses – Services of General Interest

3.2.1. Network analysis of train stations

The trains stations are mainly located in the Coast municipalities of the Marina Alta. The service area (identified as a *polygon*, see Fig. 4) is calculated on maximum 15 minutes of driving time, and includes the 78% of the Coast area and the majority of the Intermediate area (39%). The depopulated area's inhabitants cannot access to the train stations within 15 minutes driving.

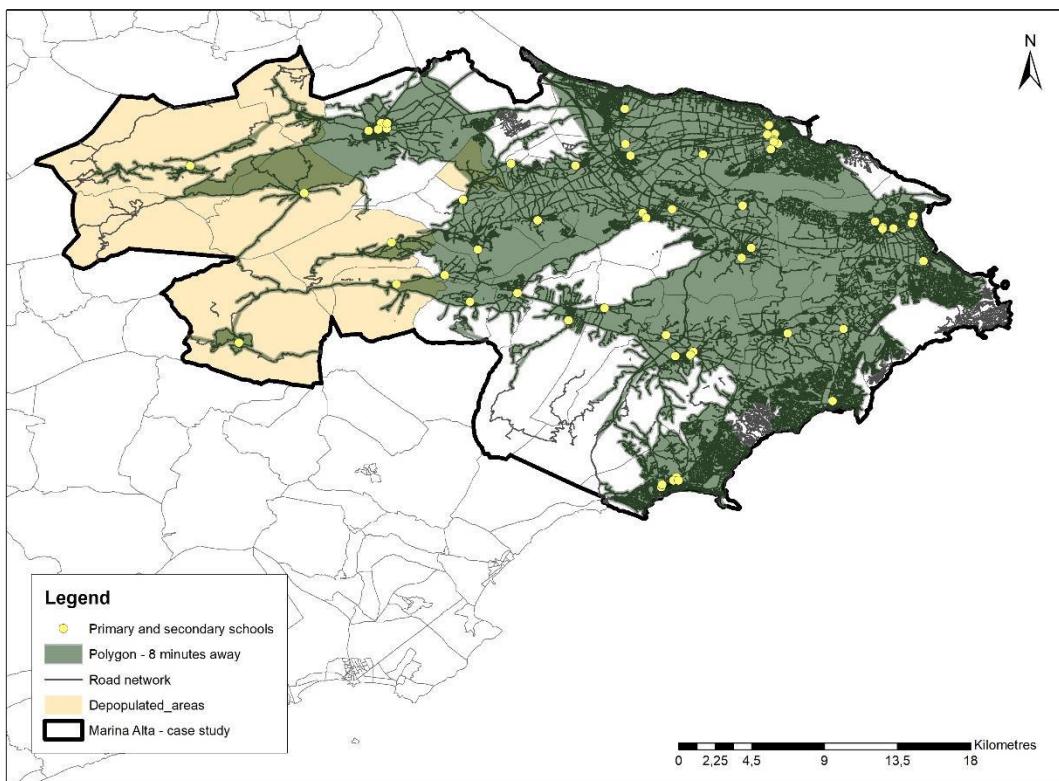
Figure 4. Train stations – isochrones maps. Source: authors' data elaboration.



3.2.2. Network analysis of primary and secondary schools

The majority of the primary and secondary schools (28 out of 56) are located in the Coast area; the Intermediate area hosts 15 schools and the Internal area 13 schools. The service area is calculated on maximum 8 minutes driving and covers 16% of the total depopulated area.

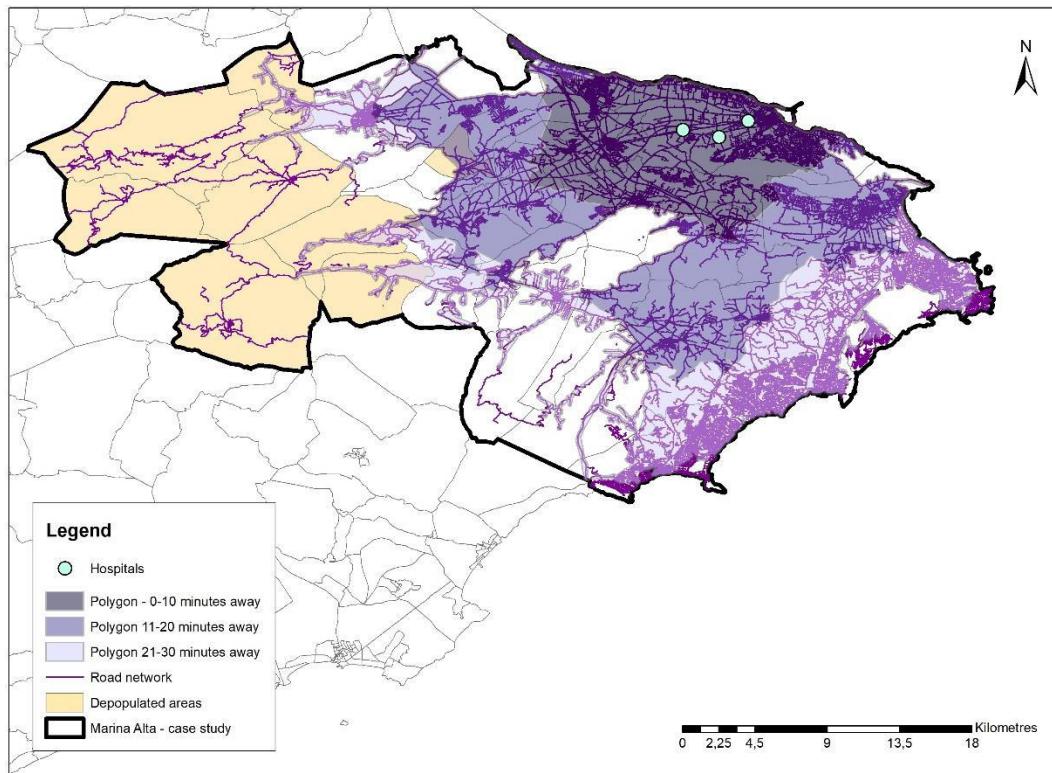
Figure 5. Primary and secondary schools – isochrones maps. Source: authors' data elaboration.



3.2.3. Network analysis of hospitals

The three hospitals are located in Dénia municipality in the Coast area. The Coast and Intermediate municipalities are for the most part covered by the service area (0-30 minutes) for the 79% and 58% of the total territories respectively (see Fig. 6). Instead, the 7% of the depopulated area is covered by the hospitals' service area.

Figure 6. Hospitals – isochrones maps. Source: authors' data elaboration.



3.2.4. Correlations between the demographic trends and the accessibility to services

The results of the three correlations performed are highly significant. The demographic trend calculated in absolute values per each municipality is correlated to the primary and secondary schools ($R^2=0.70$), the train stops ($R^2=0.73$) and the hospitals ($R^2=0.71$) service areas (ha) respectively.

3.3. Land Use – Land Cover and Natura 2000 Network

The Marina Alta's territory is mainly characterized by forest lands (40.584 ha), arable lands (24.790 ha) and urban areas (10.478 ha). Particularly, more than the half of the whole case study is covered by forests, and one third by arable lands. Instead, the depopulated area is covered by the 82,8% of forest lands, 16,8% of arable land and only the 0,4% are urban areas (see Fig. 7). The Natura 2000 Network

covers the 29% of the total Marina Alta territory (21.808 ha) and the 62% (12.480 ha) of the depopulated area (see Fig. 8).

Figure 7. Land Use Land Cover analysis based on CORINE Land Cover 2018 data. Source: authors' data elaboration.

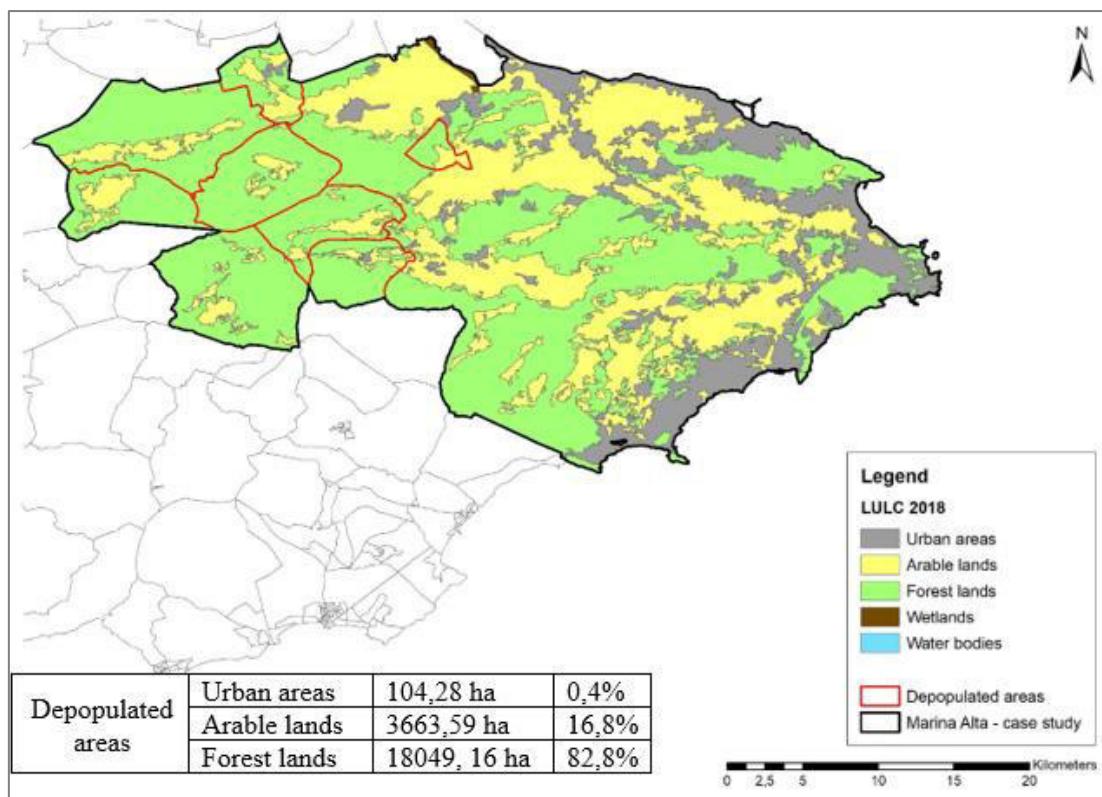
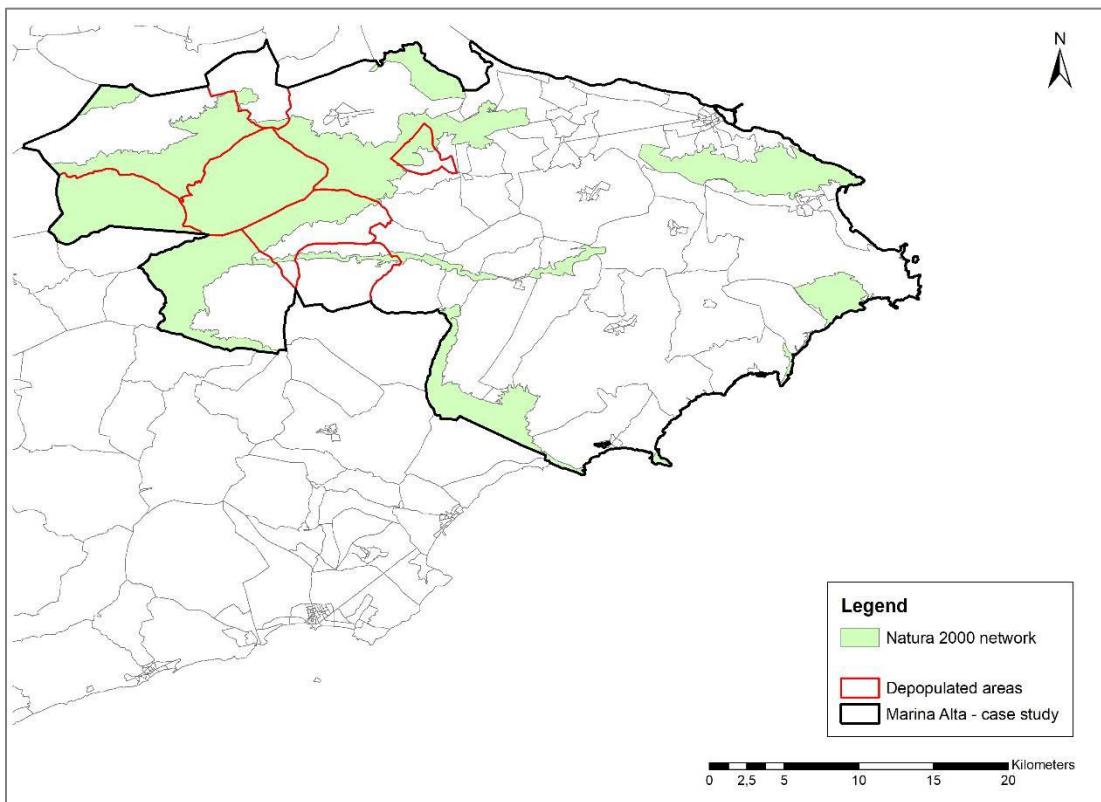


Figure 8. Natura 2000 network analysis based on EEA data. Source: authors' data elaboration.



4. Discussion and conclusions

The demographic analysis results show a clear division between municipalities with a demographic growth trend (Intermediate and Coast municipalities) and areas characterized by demographic decline, entirely located in the Internal area of Marina Alta. In detail, the depopulated area is composed by Atzúbia, Benigembla, Castell de Castells, Sagra, la Vall d'Alcalà, la Vall d'Ebo, la Vall de Gallinera and la Vall de Laguar (see Fig.5), and is mainly covered by forest lands and Natura 2000 network (see Fig. 7 and 8). According to the network analyses results the train stops and hospitals service, which are located in Coast municipalities, not serve the depopulated area's municipalities. Indeed, the depopulated area is more distant than the established thresholds, which are 15 and 30 minutes from respectively services. Moreover, despite the primary and secondary schools are scattered located, the depopulated area is not adequately

covered neither by school service. Thus, we argue that the depopulation trend may be influenced by the distance from SGIs on the basis of three high correlations found between the demographic trend (in absolute values) and hospitals, primary and secondary schools, and train stops service areas respectively.

The main findings highlight important urban-rural inequalities, particularly affecting the equity and accessibility to urgent healthcare services (Khairat et al., 2019). Indeed, if the distance from train stops and schools may appear as a mere inconvenience that may be solved, the distance from hospitals can be lethal. According to recent medical research findings on the effects of ambulance transport time on mortality, “an increased driving distance is associated with a modest increase in mortality”, estimating “a 0.51 percentage point increase in mortality per 5-minute increase in transport time” (Karrison et al., 2018). The healthcare service provision is a well-treated topic in literature (Best and Myers, 2019; Zobair, Sanzogni, and Sandhu, 2019) and some authors suggest to consider a better management of pre-hospital emergency center and transport system (Moradi, Ansari, Ansari, and Yarahmadi, 2018), or to place hospitals in a better location (Hilmola & Henttu, 2016) in order to ameliorate the service. Instead, we suggest some possible innovative solutions which involve different specialist spheres such as medicine, computer sciences, and planning and development. Indeed, since the «rural areas generally have lower and more dispersed demands» (Mounce, Wright, Emele, Zeng, & Nelson, 2018, p. 175) we argue that the good health facilities in territories with poor connections may be guarantee through e.g. community nursing (Barrett, Terry, Lê, & Hoang, 2016). Indeed, the community and family nursing may provide primary health care services in rural areas within commune health centers (Huy et al., 2018), also promoting infant care practices through home visits (Kawafha, 2016). The telemedicine may guarantee the healthcare service in rural areas as well (Khairat et al., 2019), applying the Internet of Things to the

medical science to monitor the elderly people. On the one hand, the solutions provided may stimulate new families with children to move to rural areas, on the other hand they may ensure the quality of life to people with poor motor skills.

Concerning the primary and secondary schools and train stops' lack in rural areas, the distance from these basic services is usually related to compelled car ownership (Zhao et al., 2019). The car is perceived as a more positive, faster and more comfortable alternative to public transport (Gebauer, Fingerhut, Lahner, & Schläuter, 2019), which is normally characterized by longer waiting times, thus encouraging the car's unsustainable transport mobility. In this case, we recommend different solutions to access to services in a sustainable way. Firstly, the transition to new hybrid car models may be incentivized (Camarero and Oliva, 2019). Secondly, the standard public transport may be replaced with flexible mobility solutions (Mounce et al., 2018). Indeed, this type of transport may be an adequate solution not only for low demand areas but also for vulnerable people such as elderly or disabled inhabitants (Tsoukanelis, Genitsaris, Nalmpantis, & Naniopoulos, 2019), in the light of a sustainable mobility implementation, satisfying the school and train stop lack of services in the depopulated area.

The provision of services coupled with the depopulation issue in rural areas has recently become a sensitive topic not only within the Governments agenda (i.e. Spanish National Strategy on the Demographic Challenge) but also inside the Academia debate (e.g. Camarero and Oliva, 2019; Wang, Zhang, Yang, Yang and Hong, 2019; Meerstra-de Haan, Meier, Bulder and Haartsen, 2019). One of the innovations of this work is to propose an interventions' package to revitalize the area, understanding the complexity of the case study criticalities and possibilities, avoiding sectorial solutions. Indeed, a comprehensive approach implies developing this territory as a whole, in order to invert the depopulation process, thus focusing on poor connection issue, meanwhile sustainable exploit the

territorial resources (e.g. agricultural and forest lands) and simultaneously improving and promoting the environment and landscape. This may lead to create jobs and ameliorate the inhabitants' quality of life. We calculated that the depopulated area is mainly covered by forest lands and Natura 2000 Network (see Fig. 7 and Fig. 8). These territorial characteristics let us to introduce some suitable strategies and interventions to sustainably develop the depopulated area of the Marina Alta, even considering measures provided by the Rural Development Programme of the Valencia Autonomous Regions³⁶. In particular, the measure 8 promote the sustainable development of forest lands and improvement of their viability, i.e. through the «sustainable forest management for environmental and landscape improvement and promotion of forest ecosystems» (measure 8.5.2) or «the conservation and development of the Natura 2000 Network, aid for investments to increase the adaptive capacity and the environmental value of forest ecosystems» (measure 8.5.3). According to the identified measures, it may be possible to draft or improve forest management plans focusing e.g. on the wood supply chain, ameliorate the natural paths network (trails) in the forest environment or restore the dry-stone heritage, thus increasing the potential attractiveness of the territory. Moreover, the presence of highly relevant natural habitats, ecological networks, natural and semi-natural resources (forests) should be valorised through re-establishing traditional and adaptive uses (management practices) (e.g. Traditional Ecological Knowledge for meadows management; Burton & Riley, 2018).

Therefore, in order to implement a holistic strategy, it is needed more than an EU fund use, integrating all the measures identified through the Integrated Territorial Investments tool.

³⁶ https://enrd.ec.europa.eu/country/spain_en

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CHAPTER 5.

Discussion and conclusions

According to the main findings of the previous works (i.e. review and research articles), on the one hand, we propose an opinion paper summarizing the major challenges of Inner Peripheries, particularly those related to regional development policy and practice. We provide methods to assess and monitor specific issues of Inner Peripheries, setting academic and policy priorities to reduce spatial inequalities in these territories. On the other hand, we resume the main research outcomes and further efforts needed within research and policy sectors in the next subparagraph. We also highlight the key role of scientific dissemination on Inner Peripheries topic within science and policy arenas, inasmuch it holds actual and sensitive issues for local and regional stakeholders and policy decision makers.

Location matters. Are science and policy arenas facing the Inner Peripheries challenges in EU?

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Abstract

The challenges to achieve balanced territorial development are often related to the predominance of spatial concentration processes, lack of awareness of local potential and critical mass in remote regions. Despite this large-scale picture, increasingly development problems are observed also in more “centrally-located” regions of Europe necessitating a much finer grained level of spatial analysis. The resulting perception of Inner Peripheries in recent years pose several critical

questions for the evaluation and planning of the European regional development policy and practice. This is particularly due to their nature, i.e. peripherality and marginality, which might instigate local population feelings of being treated ‘unfair’, and at the same time, to the relatively poor attention given by EU policy and scientific frameworks to these remote territories. Recent studies have highlighted the need for reflecting local distinctive challenges and pathways in different types of rural regions. Through adopting an interdisciplinary approach with robust and finer level analyses and multi-stakeholder processes, the Academic studies and policy strategies should pool their strengths towards understanding and devising actions for mitigation of the underlying problems, making use of European and National Funds also for affected Inner Peripheries.

Keywords

Inner Peripheries; spatial inequalities; interdisciplinary approach; integrated policy schemes.

Highlights

- The key role of Inner Peripheries in academic and policy contexts is illustrated;
- Methods to assess and monitor local issues of Inner Peripheries are proposed;
- The main opportunities to foster the Inner Peripheries are suggested;
- A new integrated policy scheme to tackle local problems is introduced;
- Academic and policy priorities to reduce spatial inequalities are set.

1. Introduction

The Inner Peripheries is a quite new concept that emerges from the observation of fine geographical differences and unfavourable spatial development in small-scaled areas across many European regions. Inner Peripheries have been recently explored in several projects (Pérez Soba et al., 2013; Noguera et al., 2017) and discussed by many authors (Noguera & Copus 2016; Carrosio 2016; Humer 2018). According to the ESPON project PROFECY, Inner Peripheries spread across over 45% of the total European territory, implying poor accessibility to Services of General Interests (remoteness), low economic potential and lack of relational proximity and power, leading to reduced quality of life, demographic decline and population ageing. These negative trends contributed to high unemployment, social exclusion, loss of local identity and consequently land abandonment (Copus, Mantino, & Noguera 2017). Moreover, in recent years, the accentuated territorial inequalities have not just intensified structural regional problems, but also triggered political populism in disadvantaged territories throughout Europe (Dijkstra, Poelman, & Rodríguez-Pose, 2019). The European scepticism is related to an unfairness felt (Rodrik 2017), and actually, living within the Inner Peripheries' context observing territorial inequality with regard to surrounding spaces, is experienced by many locals as "unjust". These feelings are augmented by the impression of an enhanced focus on urban areas in scholarly discourse and policy objectives for regional development, which are by the way "failing (to) reduce internal regional disparities in the long term" (Benedek, Varvari, & Litan 2019).

Despite "old" territorial support schemes, like the Less Favoured Areas support of the Common Agricultural Policy (Dax 2014) or support for "Lagging Regions" (Farole, Goga, & Ionescu-Herouiu 2018), Inner Peripheries largely have been left out and only now are starting to be recognized as a composite

interdisciplinary problem type that embraces socio-economic and environmental specificities. Working with Inner Peripheries territories means effectively allocating European and National Funds within a complete package of criticalities and potentialities. Partly this overlaps with spatial terms that were labelled as “marginal lands” (Acuña, Rubilar, Cancino, Albaugh, & Maier 2018), territories characterized by “low competitiveness” (García-Cortijo, Castillo-Valero, & Carrasco 2019) or “socio-economic inequalities” (Huggins, Waite, & Munday 2018) which nowadays hardly serve anymore as inspiring background to use different EU Funds, from Rural Development Programs to Cohesion Funds, as adopting a holist approach seems inevitable.

However, the difficulties in identifying and defining Inner Peripheries is a substantial obstacle in conceiving effective strategies for these areas. Indeed, Inner Peripheries are characterized by peripherality and marginality features (Copus et al., 2017), “the peripherality of an area is connected with spatial (situational) characteristics such as distance and transport accessibility. Marginality, on the other hand, is shaped by a ‘multi-dimensional’ spectrum of problems, from economic and cultural to social, political and historical” (Pileček, & Jančák 2011, p.45). It is not easy to quantify these dynamic and complex processes (e.g. marginalisation and depopulation) and identify indicators and thresholds, in addition to the “socio-economically defined border that changes over time” (Pérez Soba et al. 2013). To address these methodological challenges and the need for adapted strategies the following regional development approach is suggested.

2. Assess and monitor Inner Peripheries' characteristics

As a first step, it is suggested to identify a reference time frame for the description of the Inner Peripheries' characteristics and boundaries, hence define them in spatially-explicit terms with comparable criteria. Such analysis should be

repeated by updating the dataset (e.g. every 10 years). The LAU (Local Administrative Units) level is assumed to provide in general an appropriate scale of analysis, indicating the challenge to overcome missing data at that level (mostly only available for NUTS3 and larger scales). Furthermore, such fine-scaled spatial analysis is required for a place-based approach (Barca 2009) aimed at delineating a clear and dedicated plan to overcome these areas' criticalities, combining the experts' skills with the experiential knowledge. It is hence necessary to boost the data collection at a finer scale (Fastelli, Rovai, & Andreoli 2018), as shown by recent ex-ante impact evaluation studies of EU policies (Jacobs-Crisioni et al., 2017) and projects commissioned by the DG Regio (e.g. Gløersen & Lüer 2013). We need more detailed data to assess the impact of policies as well as to perform a preliminary context evaluation (Fedeli & Balducci 2019), in order to better orient the EU and National funds to the needs of the actual territorial characteristics of Inner Peripheries.

3. Address specificities of land use and implement integrated policy schemes

Inner Peripheries are mainly rural areas and traditionally their productive capacity is largely based on agriculture and forestry (Dax & Copus, 2018). Therefore, the challenges of Inner Peripheries are not only linked to peripherality and marginality conditions, but also to the under-valorisation of their large potentialities. The opportunities to foster the Inner Peripheries' economies are mainly correlated with valuing both human and natural capital. For example, the tourism sector is one of the most promising options to develop and regenerate these territories through e.g. the preservation of cultural heritage and environmental conservation (Saviano, Di Nauta, Montella, & Sciarelli 2018). Another useful approach might be seen in smart specialization strategies (Di Bella, Petino, & Scrofani 2019; Fentie & Beyene). Lack of critical mass and the rural-urban digital

divide still represent important constraints for economic and services development in Inner Peripheries (Rosina & Hurbánek 2013). The Italian National Strategy for Inner Areas is one of the prime examples in Europe to deal with Inner Peripheries contexts (Barca, Casavola, & Lucatelli 2014), mainly focusing on the critical role of SGIs and the implementation of Cohesion Policy funds. As a completion, the environmental relevance of the Inner Peripheries, e.g. regarding the presence of natural and semi-natural resources, should be valorised taking advantage of the context-specific land use systems to creating jobs through e.g. the LEADER programme which often comprises still an untapped opportunity.

Moreover, it seems crucial to implement policies and community-based solutions in these areas, fostering the development of the place-specific capital by considering local needs (Zasada et al., 2017; Dax & Fischer 2018). Strengthening the communication between different administration levels and local communities might be seen as inevitable, but necessitates the deliberate involvement of inhabitants and stakeholders in decision-making processes to become effective in the long run.

Concluding from economic and institutional weaknesses of Inner Peripheries, it seems therefore decisive to enhance local processes through a dedicated extended framework of “Rural Cohesion Policy” which aims at nurturing “inclusive growth, territorial cohesion and social justice” (Dax & Copus 2018, p. 206) by applying all relevant policies, in particular the Rural Development and Cohesion Policies Funds.

4. Policy efforts and future priorities

In recent years, spatial inequalities and limited consideration of local needs have aggravated economic and political instability in the EU. The European Parliament has recently approved the “Smart Villages Pact” highlighting the need

to foster balanced territorial development in rural, mountainous and remote areas, through an integrated approach to European policies (European Parliament, 2018). Moreover, the Cohesion Policy post 2020 forecasts a 5% reserve of the European Regional Development Fund resources to be allocated in the “non-urban areas with natural, geographic or demographic handicaps or disadvantages or which have difficulty accessing basic services” (European Parliament, 2019, amendment 110). Even if such resolutions address the problems of Inner Peripheries, it seems just a first positive effort. The current reform debate in no way suggests that in the next period the complex situation of local challenges of Inner Peripheries will be considered comprehensively. Relevant steps forward would be to focus on research to identify the complexity of territorial dynamics leading to challenges of Inner Peripheries, by analysing the whole socio-economic and environmental criticalities and raising awareness for opportunities. In this way it might turn out as a European priority to address fine scaled problems of Inner Peripheries as relevant spaces to establish more efficient territorial strategies based on land use specificities, using the European Integrated Territorial Investments tool. Focusing on scientific and policies efforts on these newly emerging pathways might foster the renaissance of rural areas and Inner Peripheries, signifying a first step to turn around the widespread populism trend in Europe.

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The opinion paper highlights the current main issues concerning Inner Peripheries definition, mapping and challenges, particularly regarding the policy and practice spheres.

So far, the research works have shown the complexity of framing Inner Peripheries within the research and policy debates (Chapter 2). It is needed to scientifically justify a unique definition of these disadvantaged territories, identifying a set of suitable indicators to map their main characteristics and geographical borders all around Europe. Even if the lack of Services of General Interest and the distance from centres may be a good proxy for Inner Peripheries identification, further efforts are needed to properly map these areas. Moreover, the current lack of a comprehensive approach even in the recent Italian National Strategy for Inner Areas policy initiative, has allowed for further consideration particularly regarding the rural development progresses (aligned with Rural Development Policy Priorities) and the implementation of a holistic Rural Cohesion Policy approach (Chapter 3 and Chapter 4).

Furthermore, it is needed to sensitize the research and policy sectors disseminating the evidences, limitations and future challenges of Inner Peripheries, through organizing scientific Special Sessions at International Conferences. However, involve the scientific and policy arenas in Inner Peripheries issues debate is not enough. We have to engage the population who leave in disadvantaged areas, illustrating the research progresses on their territories and assisting them in planning and development. We have just done all of the suggested items, but much efforts are expected. We cannot leave the disadvantaged territories behind once again, they sent to us a clear message causing a political instability in Europe. It's time to listen to them and actively work for their renaissance.

Annex 1. Marchetti M., De Toni A., Sallustio L., Tognetti T. 2017. *Criticità e opportunità di sviluppo per le aree interne. Una lettura dei processi territoriali recenti*. In Aree Interne. Per una rinascita dei territori rurali e montani. Ed. Rubbettino, 27-37.

Criticità e opportunità di sviluppo per le aree interne Una lettura dei processi territoriali recenti

MARCO MARCHETTI, ANDREA DE TONI, LORENZO SALLUSTIO, ROBERTO TOGNETTI

1. Il contesto nazionale e internazionale

Negli ultimi anni sia l'ambito politico-sociale che quello accademico hanno mostrato interesse per il tema della montagna ad ogni scala di analisi, recuperando pian piano la consapevolezza degli ambiti montani non più come un problema bensì una risorsa. Questo ha portato la montagna in genere, ma soprattutto le aree interne, a divenire protagonisti di un nuovo modello di sviluppo.

A livello globale, principalmente grazie ai contributi della FAO (*Food and Agriculture Organization*, 2015), si sottolinea l'importanza di tre sfide a lungo termine – *Hunger, Climate and Water Challenges* – alle quali la montagna deve far fronte e i cui esiti, pur avendo origine al suo interno, influenzano in maniera diretta e non i territori a valle. Questi concetti sono stati poi ripresi nella definizione dei *Sustainable Development Goals* promossi dalle Nazioni Unite (SDGs)¹, nei quali si esplicita la necessità di tutelare e ripristinare gli ecosistemi montani (con particolare attenzione al tema “Acqua”, in relazione alle scarsità idriche sopravvenienti a livello globale) e la loro capacità di assicurare benefici alle popolazioni locali (SDGs 6.6 e 15.4).

In Italia, le politiche per la montagna hanno preso corpo agli inizi del Novecento (1923) essenzialmente come politiche forestali², seguendo un approccio settoriale che non teneva conto, ad esempio, del settore agricolo a quel tempo dominante. Si è resa quindi necessaria l'implementazione di un approccio non solo funzionale (si deve a queste iniziali politiche l'introduzione della tutela idrologico-forestale) ma olistico, di cui si trovano riferimenti già nell'art. 44 della Costituzione (1947)³; “stabilire equi rapporti sociali” con le zone montane. Questo concetto è stato ripreso in seguito anche a livello internazionale con vari accordi e trattati come ad esempio il Trattato di Lisbona (UE, 2007)⁴, in cui le aree montane vengono individuate come zone ad handicap strutturale permanente. Partendo proprio dalle macro tematiche e dalle grandi sfide identificate nei contesti sovranaziali, è stata con lungimiranza da poco avviata in Italia la Strategia Nazionale per le Aree Interne (SNAI)⁵ che allarga la marginalità delle zone montane (così come pensata ad esempio nella L1102/71 sulle Comunità Montane) inglobando il concetto di perifericità geografica e sociale, e si pone *in primis* l'obiettivo di combattere lo spopolamento di queste aree innanzitutto migliorando o fornendo, ove necessario, i servizi essenziali per la popolazione. Contestualmente, la SNAI mira a rendere le aree interne maggiormente attrattive, fruibili e competitive implementando uno sviluppo sostenibile del territorio e valorizzando beni e servizi ambientali ivi presenti. Le aree interne sono state definite per la prima volta dal Dipartimento per lo Sviluppo e la Coesione Economica (DPS, 2013)⁶, oggi Agenzia per la Coesione Territoriale, come aree marginali e svantaggiate lontane da servizi principali quali sanità, istruzione e mobilità (Lucatelli, 2016).

¹ <https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals>

² <http://www.minambiente.it/normative/rd-30-dicembre-1923-n-3267-riordinamento-e-riforma-della-legislazione-materia-di-boschi>

³ https://www.senato.it/1025?sezione=122&articolo_numero_articolo=44

⁴ <http://eur-lex.europa.eu/legal-content/IT/TXT/?uri=URISERV%3Aai0033>

⁵ http://www.innovatoripa.it/sites/default/files/relazione_al_cipe_.pdf

⁶ <http://www.agenziacoesione.gov.it/it/arint/>

In altre parole, per una base comune del diritto di cittadinanza *conditio sine qua non* sono la facilità di accesso ad almeno un ospedale⁷, a scuole di istruzione media e superiore e ad una stazione ferroviaria⁸, in un lasso di tempo inferiore a 20 minuti dal più vicino centro di offerta di tali servizi. Secondo i dati riportati dallo stesso DPS, più del 60% del territorio nazionale (18.4 milioni di ettari circa) è classificabile come area interna e in esse risiede circa un quarto della popolazione nazionale. Come vedremo più avanti, si tratta di territori a forte connotazione naturale e forestale e, proprio in virtù di questo, essi possono essere intesi quali luoghi funzionali alla compensazione di “disastri sociali ed ecologici prodotti altrove”. Questo però non significa che le aree interne siano idealizzabili o assimilabili al *locus amoenus*. Si tratta infatti di territori spesso a forte handicap strutturale, che negli ultimi decenni hanno subito in maniera massiccia i fenomeni di abbandono delle terre e delle piccole aziende tradizionali, in virtù delle cospicue migrazioni delle popolazioni locali verso i poli urbani ed industriali (Agnoletti, 2014; Bevilacqua, 2012), con conseguente ricolonizzazione da parte del bosco (Gusmeroli e Marchetti, 1994; Boden et al., 2010). Oltre all’impatto antropico, sia per alcuni usi intensivi del territorio che come effetto del progressivo abbandono, tra i cambiamenti globali non sono trascurabili in queste aree, i cambiamenti climatici. Le aree interne, e più specificatamente i territori montani, possono essere infatti intese quali sentinelle del *climate change*, essendo estremamente sensibili all’aumento delle temperature causa dello scioglimento dei ghiacciai e della destabilizzazione del permafrost, e della ricorrenza e gravità di eventi atmosferici estremi. Ciò è supportato con evidenza negli ultimi scenari di cambiamento climatico tracciati dall’IPCC (*Intergovernmental Panel on Climate Change*) per la COP21 (Conferenza di Parigi sui cambiamenti climatici, 21^a sessione annuale della conferenza delle parti della Convenzione quadro delle Nazioni Unite sui cambiamenti climatici) e dal CMCC (Centro Euromediterraneo per i Cambiamenti Climatici) per l’Italia. Proprio il CMCC, parlando specificatamente del contesto italiano, indica possibili scenari di aumento della temperatura media di 3,2 gradi centigradi per secolo (viene in questo caso considerata la differenza tra le temperature medie dei trentenni 1971-2000 e 2071-2100), un aumento delle precipitazioni nelle stagioni fredde e una contestuale diminuzione in quelle calde⁹. Tutto questo è unito a un conseguente allungamento dei periodi aridi, che nel corso dei prossimi 60-70 anni potrebbero aumentare fino all’80% in alcune Regioni, soprattutto al Nord. Questi cambiamenti incidono fortemente sugli ecosistemi d’alta quota, nei quali alcuni degli effetti maggiormente riscontrabili sono ad esempio legati alla modifica della fenologia, distribuzione e fisiologia delle piante, oggetto di studi di monitoraggio a lungo termine, come ad esempio quelli condotti dalla rete LTER con il progetto GLORIA¹⁰ su aree sperimentali permanenti nelle montagne del nostro paese.

2. I cambiamenti d’uso del suolo e gli impatti sugli ecosistemi delle aree interne

L’impatto antropico e i processi territoriali influenzano non solo le dinamiche a livello socio-economico (spopolamento, invecchiamento della popolazione e abbandono delle terre) ma, anche e soprattutto, modificano il paesaggio e gli ecosistemi stessi delle aree interne. Grazie alle analisi di dettaglio condotte

⁷ Ospedale sede di DEA di I livello, rappresenta un’aggregazione funzionale di unità operative che garantisce le funzioni di osservazione, breve degenza e rianimazione, oltre che Pronto Soccorso, e realizza interventi diagnostico-terapeutici e assicura le prestazioni di laboratorio di analisi

⁸ Stazione ferroviaria di categoria SILVER, impianti medio piccoli con una frequenza media

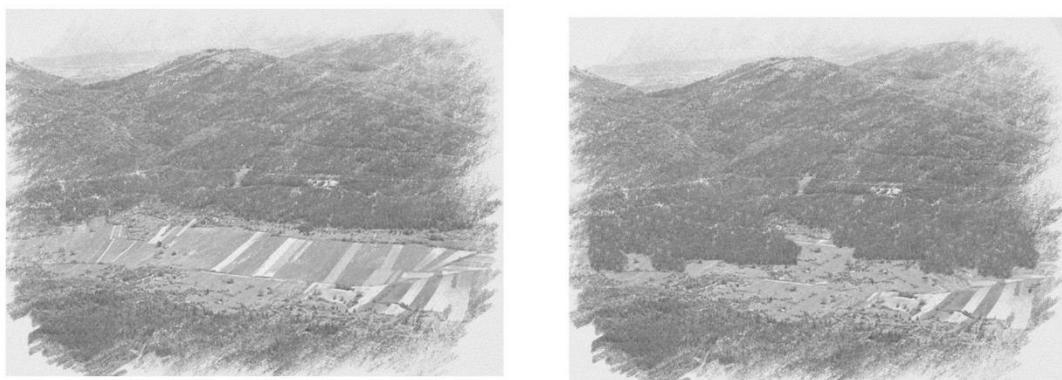
⁹ <http://www.cmcc.it/it/modelli-e-scenari/come-cambierà-il-clima-in-italia-2>

¹⁰ <http://www.lteritalia.it/>

tramite l'utilizzo dell'Inventario dell'Uso delle Terre d'Italia - IUTI (Marchetti et al., 2012), è possibile caratterizzare le dinamiche territoriali avvenute nelle ultime tre decadi.

Nelle aree interne del nostro paese sono stati persi circa 630 mila ettari di "Seminativi" cui si sommano circa 300 mila ettari di "Praterie e pascoli". Tali processi di abbandono hanno innescato a loro volta processi di successione ecologica secondaria, che dopo una fase inculta, portano dapprima all'invasione da parte di arbusti e poi lasciano spazio alla colonizzazione da parte degli alberi che hanno così incrementato le superfici boscate di circa 470 mila ettari (figura 1). Si tratta di superfici importanti, che danno contezza della magnitudine dei fenomeni in questione: basti pensare che le aree agricole perse nelle aree interne corrispondono alla metà del totale perso a livello nazionale e l'aumento delle superfici boscate corrisponde a più del 70% dell'incremento totale del bosco in Italia. Il processo di ricolonizzazione da parte del bosco è un elemento assolutamente rilevante di cui bisogna tener conto in termini sia ecologico funzionali e paesaggistici che economici e produttivi.

Figura 1. Altopiano di Navelli (L'Aquila). Simulazione del processo di abbandono delle terre coltivate e l'espansione naturale del bosco



Abbandono dell'agricoltura e della zootecnia ed espansione naturale del bosco, a sua volta soggetto per lo più ad abbandono culturale e sempre più spesso allo stesso oblio del possesso e della proprietà, per quanto da una parte comportino effetti positivi quali la fissazione di carbonio, la protezione del suolo o la maggiore disponibilità di habitat naturali per la fauna selvatica, dall'altra possono avere effetti negativi. Questi processi, identificati a livello europeo col termine di *rewilding*, (ma ancora solo fasi di "inselvatichimento" di coperture del suolo consolidate da secoli, nel nostro paese) scaturiscono dunque dalla mancanza di coltivazione, cura e gestione del territorio e comporteranno la crescita di nuove foreste a scapito di terreni agricoli, prati e pascoli. Il *rewilding*, dunque, è processo complesso che non significa semplicemente abbandono e non è detto che sia sempre inquadrabile come un processo auspicato o da combattere a priori. Esso, infatti, può rappresentare un'importante opzione da considerare in questa fase di transizione, con importanti benefici per la biodiversità e per i servizi ecosistemici. Dal punto di vista della conservazione della biodiversità, per esempio, la scelta tra *rewilding* e gestione attiva dipenderà dagli obiettivi e dal contesto locale. La gestione attiva è preferibile quando esistono obiettivi specifici, quali quello di ripristinare determinate specie o conservare gli habitat associati alle attività umane (agroecosistemi e paesaggi culturali). D'altra parte, assecondare la dinamica dei processi ecologici può essere sostenibile a lungo termine o su larga scala. La scelta dipende dalla sostenibilità dell'opzione gestionale e dai conseguenti obiettivi fissati a livello politico e di

pianificazione, laddove esistano decisori consapevoli (Sallustio et al., 2015a). Però, proprio la consapevolezza e la capacità e volontà di fare delle scelte di cura sembrano essere da tempo il vero problema della pianificazione nel nostro paese. Bisogna, inoltre, ricordare che le aree interne sono un importante momento territoriale di complementarietà tra il capitale umano (e culturale) e il capitale naturale. Questi, con i loro rapporti mutualistici e di influenza reciproca, hanno modellato il paesaggio e le funzioni ecologiche degli ecosistemi presenti in modo lento e impercettibile nel corso dei secoli originando i paesaggi del Bel Paese, e dunque la conservazione di tale rapporto sarebbe una necessità di non poco conto. A tal proposito, va segnalato anche come alla cessazione delle attività agricole nelle aree interne sia seguita la riduzione dell'attività di presidio e salvaguardia del territorio. È stato dimostrato come i cambiamenti di uso e copertura del suolo possano comportare una generale riduzione dei livelli di biodiversità legati alla riduzione di habitat peculiari (ad esempio le fasce ecotonali, Sitzia et al., 2010), dei saperi locali (a quali spesso ci si riferisce come capitale culturale) e in generale del mantenimento della vitalità delle aree rurali (Marino et al., 2010). È stata la tutela attiva del territorio che ha preservato nel corso del tempo queste aree, prettamente montane e rurali, da fenomeni di dissesto idrogeologico, erosione e da un generale degrado dei suoli. Problematiche che adesso, per contro e non a caso, caratterizzano non solo le aree interne italiane ma in maniera generale le aree montane di tutta Europa. Le analoghe criticità di questi due ambiti – la montagna e le aree interne - portano a pensare che ci si stia riferendo allo stesso territorio. In realtà, comprendere differenze e similitudini che le contraddistinguono, è essenziale per un'analisi consapevole del territorio e delle sue dinamiche e per rispondere alle diverse esigenze e proporre soluzioni ad hoc. Se da una parte è significativo il fatto che metà del territorio delle aree interne, applicando il criterio altitudinale, sia classificabile come montano¹¹ e che più di 4/5 del territorio nazionale montano ricada nelle aree interne, dall'altra esiste una differenziazione concettuale, e non solo semantica, fra aree interne e montagna. Il concetto di "montagna", definito dall'UNEP (*United Nation Environment Programme – World Conservation Monitoring Centre*) essenzialmente in base a criteri di elevazione e pendenza¹², ha subito numerose modifiche nel corso del tempo e può essere ricondotto, a seconda delle finalità ed utilizzi, a diversi tipi di classificazione facenti riferimento ad aspetti di tipo prevalentemente socio-economico (si veda ad esempio, seppur in fase di modifica e revisione normativa, la definizione di Comunità Montane¹³) o morfologico (si veda a tal proposito la definizione data da ISTAT¹⁴). Le aree interne sono invece identificate da un criterio ancor diverso, quello dell'accessibilità rispetto ai servizi primari che le pongono in una posizione di svantaggio rispetto ai grandi centri urbani (Dematteis, 2013). Se da un punto di vista geografico stiamo quindi parlando di territori in parte sovrappponibili, tenendo in considerazione le differenze concettuali e di confini territoriali tra le aree interne e la montagna si è in grado di meglio definire le dinamiche territoriali in atto, dalle quali ripartire per la proposizione di modelli di sviluppo innovativi e funzionali alle peculiarità territoriali. A differenza di quanto avvenuto in passato, quando idee e concetti legati alla gestione territoriale sono stati permutati su ampia scala in contesti anche molto diversi tra di loro, tale approccio basato su un'attenta lettura del territorio permetterebbe di orientare meglio le future politiche e i relativi sistemi di gestione, prendendo in considerazione tutte le alternative possibili e, di volta in volta, selezionando quelle più aderenti

¹¹ Analisi effettuata mediante l'utilizzo dell'Inventario dell'Uso delle Terre in Italia (IUTI)

¹² "Defined by elevation above sea level (minimum between 300 and 1000 meters, depending on latitude), steepness of slope (at least 2° over 25 kilometers, on the 30 arc-second grid)" Millennium Ecosystem Assessment, 2005, Chapter 24, Mountain Systems.

¹³ <http://documenti.camera.it/Leg17/Dossier/Pdf/ID0019.Pdf>

¹⁴ <http://www3.istat.it/servizi/studenti/binariodie/CORSOExcel/Glossario.htm>

possibile alle specificità del territorio in esame (Sallustio et al., 2015b). Ne consegue che la sfida, ma anche la grande opportunità, sia, in effetti, quella di sviluppare politiche e strategie che tengano ben presente la duplice/triplice veste e caratterizzazione delle aree in questione.

3. Il capitale naturale: un patrimonio da gestire e valorizzare

Le politiche di sviluppo delle aree interne, devono quindi tenere in forte considerazione tutto ciò che le caratterizza sia da un punto di vista del capitale naturale, in particolare la significativa presenza di ecosistemi naturali e i relativi servizi ambientali che essi erogano, che del capitale umano. È di fondamentale importanza tutelare questi servizi dei quali beneficia, più o meno consapevolmente, l'intera popolazione nazionale (Barca, 2013), anche quella residente nei poli non periferici. Un esempio calzante in tal senso è quello dell'approvvigionamento idrico. Oltre al chiaro valore intrinseco di boschi e bacini imbriferi presenti nelle zone montane, i fiumi che si originano in questi territori servono a fini idropotabili, agricoli e industriali le popolazioni di pianura. Le aree interne non contribuiscono solo alla funzione di approvvigionamento e di purificazione delle acque, ma anche a quella di regimazione e di regolazione dei deflussi idrici i cui effetti negativi, dovuti anche all'abbandono precedentemente descritto e a un'inefficiente pianificazione e gestione territoriale, si riversano a valle recando danno ad abitanti e produzioni. Inoltre, grazie alla vasta estensione delle superfici forestali e pre-forestali secondo le attuali dinamiche attuali (stimabili in quasi 12 milioni di ettari ad oggi)¹⁵ le aree interne contribuiscono in maniera massiccia alla fissazione di anidride carbonica, coprendo gran parte del *budget* che a livello nazionale annualmente si contabilizza per il rispetto degli impegni assunti nel Protocollo di Kyoto (Marchetti, 2016).

Nonostante tali servizi abbiano un ruolo fondamentale nel supportare e migliorare la vita dell'uomo, in realtà essi sono al momento sottovalutati o completamente ignorati dalla pubblica opinione e dagli stessi *stakeholder* all'interno dei processi decisionali (Geneletti, 2011). Ciò è dovuto in larga parte alla loro caratteristica di essere "beni senza prezzo" ovvero non monetizzati (e difficilmente monetizzabili), per cui ritenuti non al pari dei beni di consumo prodotti nei centri o nei poli meno periferici. La loro analisi e contabilizzazione nelle politiche territoriali, per contro, potrebbe aprire importanti dibattiti sull'efficienza, ad esempio, delle aree protette – ampiamente presenti nelle aree interne – o alla nuova designazione di *hotspot* di biodiversità o aree di particolare pregio naturalistico. Il neoistituito Comitato per il Capitale Naturale, ai sensi del Collegato Ambientale del 18 aprile 2016 si pone fra gli obiettivi principali proprio la rendicontazione annuale sullo stato del capitale del paese e la messa a punto e regolamentazione dei Pagamenti per i Servizi Ecosistemici. Inoltre è di buon auspicio l'attenzione suscitata da diversi progetti europei fra i quali LIFE SAM4CP (*Soil Administration Model for Community Profit*)¹⁶ e LIFE+ MGN (*Making Good Natura*)¹⁷, che consentirebbero di gettare le basi per una pianificazione territoriale da attuare in chiave ecosistemica, che tenga quindi conto del valore di tali beni e servizi.

Oltre ai servizi ecosistemici, nel rilancio delle aree interne riveste un ruolo centrale la capacità di queste di fornire energie rinnovabili, come quelle eolica, idroelettrica e da biomasse, che rendono questi ambiti idonei all'istituzione di "*Oil free zones*", aree territoriali nelle quali si prevede la progressiva sostituzione del petrolio con energie provenienti da fonti rinnovabili (Art. 71 del Collegato Ambientale 2016).

¹⁵ Sono state considerate per questo calcolo le categorie "Bosco" e "Altre terre boscate" del sistema di classificazione IUTI, 2008.

¹⁶ <http://www.sam4cp.eu/>

¹⁷ <http://www.lifemgn-serviziecosistemici.eu/IT/home/Pages/default.aspx>

Proprio l'utilizzo e la valorizzazione delle risorse *in loco*, come la produzione di energia rinnovabile a cui invece si contrappongono le esigenze di conservazione e tutela di territori fragili e ricchi di biodiversità, sono alla base del controverso dualismo tra l'uso delle risorse e la loro conservazione, riferibili ai concetti di *land sharing* e *land sparing*. In questo contesto è decisivo sottolineare che proprio nelle aree interne, potenzialmente oggetto di sviluppo, ricadono il 75% (4.9 milioni di ettari) delle aree protette (parchi e riserve di varia natura e rete Natura 2000), identificando chiaramente questi ambiti come gli *hotspot* di biodiversità su cui si basa l'omonima Strategia Nazionale (Capotorti et al., 2012). Dunque, si devono conciliare due esigenze diverse ma intimamente connesse tra di loro. Da una parte è necessario far fronte ai bisogni della popolazione, cercando di soddisfare il crescente fabbisogno alimentare, incentivare la produzione di energia pulita o semplicemente creare occasioni di reddito e sussistenza per le popolazioni locali; dall'altra è essenziale proteggere la biodiversità e in generale gli ecosistemi da potenziali minacce quali la frammentazione di habitat (sparizione di prati e aree aperte) o il depauperamento delle risorse naturali a causa del loro sovrautilizzo (Phalan et al., 2011). Nella pratica, proprio con riferimento alle problematiche inerenti la produzione di energia pulita, i pannelli fotovoltaici a terra, ad esempio, vanno considerati superfici impermeabilizzate alla stregua dell'edificazione urbana e industriale o delle infrastrutture viarie¹⁸, mentre le turbine degli impianti eolici possono minacciare alcuni habitat interrompendo i collegamenti ecologici¹⁹. Un altro esempio concreto del dualismo uso-conservazione è rappresentato dal fatto che, per quanto il paesaggio forestale sia il risultato di secoli di utilizzo cospicuo (per alcuni momenti storici si può parlare di sovra-sfruttamento) attualmente l'81% circa della superficie forestale nazionale risulta disponibile al prelievo legnoso²⁰. Nonostante l'eccessivo utilizzo in passato, ad esempio nella prima parte del XX secolo, attualmente l'utilizzo annuale della risorsa forestale si attesta intorno solo al 30% della sua crescita annuale, molto al di sotto perfino della media europea (60%)²¹. Va inoltre evidenziato che, oltre ad offrire margini significativi per lo sviluppo di filiere locali, le utilizzazioni forestali in un'ottica di gestione sostenibile del bosco, consentono al tempo stesso di preservare, ed in alcuni casi anche migliorare, tutta la serie di servizi e beni ad essi connessi. La gestione forestale sostenibile richiede solide basi scientifiche e strumenti pianificatori utili a incorporare i risultati della ricerca in procedure di *governance*. In tal senso, il contributo della comunità scientifica è essenziale per monitorare gli ecosistemi, per identificare strumenti e criteri di previsione degli effetti dei cambiamenti climatici, e per valutare gli impatti dei cambiamenti d'uso del suolo sui servizi ecosistemici.

In medio stat virtus, la soluzione auspicabile a questo controverso rapporto è quella di bilanciare l'utilizzo e la conservazione delle risorse nelle aree interne seguendo i principi dello sviluppo sostenibile, così come definito dalla Commissione mondiale sull'ambiente e lo sviluppo (WCED) nel Rapporto Brundtland fin dal 1987. La sostenibilità ambientale si integra con quella economica e sociale, con l'obiettivo di valorizzare l'ambiente e le risorse naturali e territoriali, garantendo condizioni di benessere umano (sicurezza, salute, istruzione), ma preservandone l'integrità e funzionalità per le generazioni future (Malone et al., 2014). Le aree interne sono dunque un laboratorio ideale per concretizzare questo concetto, fissando livelli sostenibili di utilizzo delle risorse e sperimentandovi al

¹⁸ ISPRA, CORINE Land Cover, Categoria Superfici artificiali, 1.2.1.1 Impianti fotovoltaici

¹⁹ http://ec.europa.eu/environment/nature/info/pubs/docs/nat2000news/nat22_it.pdf

²⁰ Dati INFC (Inventario Nazionale delle Foreste e dei serbatoi forestali di Carbonio), 2005.

http://www.sian.it/inventarioforestale/jsp/06tabelle_prelievo.jsp

²¹ Annuario dell'Agricoltura Italiana 2014, Foreste e filiere dei prodotti forestali legnosi, CREA.
<http://www.crea.gov.it/wp-content/uploads/2016/02/REPORT-FORESTE.pdf>

contempo nuove economie riconducibili ai concetti di “*Green, bio and circular Economy*”²². In quest’ottica, considerate le diverse problematiche delle aree interne e la cospicua presenza di superfici agricole (5.1 milioni di ettari), si rendono opportune indicazioni per il ri-orientamento dei modelli economici. La promozione di agricoltura, alpicoltura, selvicoltura *climate-smart* e dei loro prodotti tipici associata ad un’efficiente gestione delle risorse idriche come volano di intervento per la manutenzione e la valorizzazione del territorio e del paesaggio – in generale si parla di politiche per la manutenzione del capitale naturale, al fine di contrastare l’instabilità del territorio (dissesti ed erosione). Tali obiettivi, ad esempio, sono perseguiti promuovendo tecniche agronomiche che permettano l’aumento della produttività, ma al tempo stesso di ridurre le emissioni di gas clima-alteranti anche grazie all’aumento dei serbatoi di carbonio. A livello di strategia, quindi, l’obiettivo è quello di incentivare il ritorno degli imprenditori agricoli nelle aree interne, andando a intervenire in tal modo anche sull’attuale trend negativo sia in termini di redditività netta della terra che del lavoro delle aziende del settore primario²³. La promozione di filiere agro-alimentari corte e il contestuale associazionismo in cooperative e consorzi, potrebbe fornire il giusto slancio all’economia di questi luoghi. La strategia produttiva della filiera corta si avvale di un’area di approvvigionamento locale di circa 70-100 chilometri – distanza massima fra produttore e consumatore – che presenta non solo il vantaggio della prossimità geografica, con minori costi e minor impatto ambientale, ma incorpora anche la condivisione di saperi e valori (“prossimità sociale”) e la circolazione del bene all’interno di una comunità o territorio (“prossimità economica”). Il concetto di filiera può essere altresì applicato sia al comparto agro-zootecnico che a quello agro-energetico. Con il primo è possibile garantire il mantenimento della biodiversità e la manutenzione del paesaggio grazie al mantenimento di prati e pascoli, arrivando poi, in un secondo momento, alla valorizzazione e commercializzazione dei prodotti locali, grazie anche alla creazione di sinergie fra le stesse aziende produttrici²⁴. Grazie allo sviluppo del comparto agro-energetico, invece, è possibile produrre biomassa da materiali legnosi e da residui agricoli (paglia e potature), valorizzando in questo modo non solo i classici prodotti ma anche, e soprattutto, i sottoprodotti agricoli, agro-zootecnici e agroindustriali. Per loro natura, le aree interne sono ambiente ideale per rispondere a questioni sociali ed ecologiche associate ai cambiamenti globali. In ogni caso, la mitigazione dei cambiamenti climatici non può essere il solo obiettivo della gestione agrosilvopastorale nelle aree interne. L’applicazione dell’approccio *climate-smart* al settore forestale, per esempio, richiede la sperimentazione di nuove soluzioni di carattere produttivo per sviluppare una bioeconomia ad alto valore aggiunto, mantenendo gli altri pilastri *climate-smart*, adattamento e benessere.

Le dimensioni, quindi, che vanno ad interagire e integrarsi grazie all’implementazione di questa tipologia di filiera sono sostanzialmente quattro: il benessere degli agricoltori, lo sviluppo locale, il benessere della comunità e la protezione ambientale. L’obiettivo principale è rivitalizzare il settore primario, di cruciale importanza per mantenere il legame tra agricoltori e paesaggio locale, evitando la scissione fra produzioni agroforestali e aree rurali puntando, ad esempio, sul valore aggiunto realizzabile grazie all’accoppiamento di funzioni turistico-ricreative. Il programma di recupero e conservazione del paesaggio storico rurale all’interno Parco Nazionale delle Cinque Terre, in Liguria, è stato l’esempio della validità del trinomio agricoltura-aree rurali-turismo sostenibile, essendo funzionale anche a porre un freno al problema dell’abbandono delle terre. Il programma di Punta Mesco, nello specifico, ha previsto la simultanea opera di manutenzione e sistemazione dei terreni

²² Commissione Europea, Com. 363 del 20 giugno 2011

²³ Nell’ordine si riscontra una differenza di -25% (Reddito Netto/Superficie Agricola Utilizzata) e -9% (Reddito Netto/Unità Lavorativa) rispetto ai Centri

²⁴ http://www.sozooalp.it/fileadmin/superuser/quaderni/quaderno_1/17_Progetto_Malghe_SZA1.pdf

attraverso il recupero di manufatti quali i terrazzamenti e gli insediamenti rurali, nonché grazie alla ripresa di tecniche culturali tradizionali (vigneti, oliveti, orti e frutteti).

4. L'approccio interdisciplinare per lo studio delle aree interne

Questo contributo ha cercato di mettere in luce da una parte le forti ed evidenti criticità delle aree interne e dall'altra la grande rosa di opportunità che le vede protagoniste. Considerata la natura dei processi territoriali descritti e le tante implicazioni e interconnessioni con le diverse sfere in gioco (ecologica, economica, sociale), lo studio delle aree interne e le proposte di sviluppo devono necessariamente avvalersi di un approccio multi e interdisciplinare per questioni complesse e transdisciplinari. Le problematiche, grazie ad analisi specifiche e all'utilizzo dei tanti saperi locali, sono chiare; ciò di cui invece spesso si avverte la mancanza è la consapevolezza delle potenzialità di una loro conversione in possibilità reali di mantenimento e ripristino del benessere sociale, economico e ambientale.

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Annex 2. Sallustio L., De Toni A., Strollo A., Di Febbrario M., Gissi E., Casella L., Geneletti D., Munafò M., Vizzarri M., Marchetti M. (2017). Assessing habitat quality in relation to the spatial distribution of protected areas in Italy. *Journal of Environmental Management*, 201, 129-137.

Assessing habitat quality in relation to the spatial distribution of protected areas in Italy

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Abstract

The conservation of species and habitats is increasingly threatened by anthropogenic impacts, particularly land use change, from local to global scales. Although many efforts have been carried out so far to halt or at least reduce the biodiversity loss (e.g., the establishment of protected areas' networks), there are still both knowledge and policy gaps slowing the conservation of species and habitats in complex environments, such as the Mediterranean region. In particular, the human-driven impacts and threats on biodiversity need more careful analysis. Accordingly, this paper aims to assess the habitat quality and degradation in Italy in relation with the spatial pattern of the current protected areas' network, mainly to identify priority areas of intervention, thus supporting large-scale conservation strategies.

A survey of experts was conducted to identify the main threats for biodiversity from different land uses at the national scale. The InVEST software was then applied to assess and map habitat quality and degradation with a high spatial resolution (20m). The relationship between habitat quality and degradation as well as their hotspots, and alternative PA categories were also explored. Results indicate that: (i) habitat quality and degradation depend on the location and intensity of the anthropogenic impacts and are sensitive to different protection levels; (ii) the combination of the survey of experts and the spatially-explicit assessment of habitat quality and degradation is useful to highlight variations of the current conditions of biodiversity and habitats; and (iii) the identification of hotspots allows one to identify priority areas for conservation. Accordingly, the proposed approach may be used to strengthen the conservation efforts in similar contexts, and thus support the implementation of the biodiversity-related policies over the long term.

1 Introduction

Biodiversity, including habitat diversity, contributes to human wellbeing by ensuring ecosystem functionality and resilience (Oliver et al., 2015). During the last decades, human activities induced a widespread loss of species, habitat fragmentation, and invasion of alien species, negatively affecting local communities' wellbeing (e.g., Haddad et al. 2015). In particular, land use change strongly affects terrestrial biodiversity (Newbold et al. 2015), and climate change has negative impacts on species' life cycles and distribution (Bellard et al., 2012). This trend is particularly amplified in the Mediterranean region, where biodiversity is expected to be increasingly threatened in the future (e.g., Sala et al. 2000). In fact, more than 10% of "Natura 2000" protected areas (PAs) (i.e. areas protected under the EU Council Directive 92/43/EEC) in the Mediterranean ecosystem are projected to be lost by the end of the century, especially in Southern Italy and Sicily (Barredo et al., 2016).

Many attempts have been carried out so far to halt the biodiversity loss and habitat fragmentation, both from the management and policy side. The effectiveness of biodiversity conservation within the PA network was found to be higher than outside (e.g., Gray et al. 2016) and needs to be further improved (e.g., Andam et al. 2008). Moreover, there are still knowledge and policy gaps to strengthen biodiversity conservation in complex human and natural systems (Gissi et al., 2015). On the policy side, a recent interim review about the implementation of the EU Biodiversity Strategy to 2020 highlighted that progress toward maintaining and enhancing

biodiversity at an EU scale through agriculture and forestry is still insufficient (European
1 Commission 2015). Although several studies highlight the conservation effectiveness of different
2 PA categories, at both global (Watson et al., 2014) and European (Leverington et al., 2010) scales,
3 others reported that the existing PA network is not sufficient to maintain the current biodiversity
4 status (i.e. conditions of living organisms and habitats), as for example in Italy (Maiorano et al.,
5 2007). Moreover, the effectiveness of the PA categories to reduce and mitigate anthropogenic
6 disturbances, such as human-driven land use and climate changes, seems to be poorly analyzed
7 (Nagendra, 2008).

Predicting the relationships between anthropogenic impacts and extant biodiversity by adopting
15 proxy environmental indicators is extremely useful for conservation planning (for a critical
16 appraisal, see Stephens et al. 2015). In this respect, habitat quality may be used as a proxy to
17 assess the effectiveness of the biodiversity conservation status, and becomes extremely important
18 to orient management strategies towards improving the preservation of certain species and
19 habitats. Recently, biodiversity conservation status was assessed through spatially-explicit
20 indicators at the European scale (e.g., Maes et al., 2012), or alternative models (and proxies) to
21 forecast future biodiversity through GLOBIO (Alkemade et al., 2013), and the habitat quality at the
22 watershed scale evaluated through InVEST model (Terrado et al., 2016). Moreover, advanced
23 remote-sensing techniques are demonstrated to support the monitoring of biodiversity (e.g.,
24 Nagendra et al. 2013). To rapidly highlight areas with peculiar positive or negative characteristics,
25 the use of the “hotspot” approach is particularly helpful. In fact, the term hotspot has been
26 proposed by Myers (1988) to identify areas that provide high species richness, endemism, and/or
27 threat, in order to assign different priorities for biodiversity conservation or highlight areas with
28 critical management importance.

Although several policies and regulations have been implemented in Italy to strengthen the
45 protection of species and habitats, such as the establishment of National and Regional Parks and
46 Natura 2000 network sites, their success at enhancing biodiversity conservation has been poorly
47 assessed (e.g., D’Amen et al., 2013 for saproxylic beetles; and Marino et al., 2014 for management
48 costs). Similarly, the strengths and weaknesses of the different PA categories in the context of the
49 biodiversity conservation are not yet fully analyzed (Marino et al., 2015). Moreover, despite the
50 recent availability of supporting tools for conservation at the national scale, such as the
51 Ecoregions’ map of Italy (Blasi et al., 2014), there is still no satisfactory approach to link species
52 and habitat heterogeneity, and related threats (climate and land use change) to regional and local
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1 management strategies. In this respect, the hotspot approach has already been demonstrated to
2 be effective toward improving spatially-explicit conservation planning and management (for an
3 exhaustive review, see Schröter and Remme, 2016).

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5 This paper aims to: (i) assess habitat quality (HQ) and degradation (HD) in Italy, in relation to
6 spatial patterns of PAs; (ii) propose a framework for identifying and mapping hotspots/coldspots
7 of HQ and HD for biodiversity conservation at national scale; and (iii) discuss whether the use of
8 HQ is a suitable option to support decision makers in identifying priority areas for biodiversity
9 conservation and suggest feasible approaches for their management (e.g. mitigation strategies).

10 First, the habitat suitability and the threats to biodiversity were identified for different land uses at
11 the national scale, through an expert based approach. Then, the InVEST model was applied to
12 assess and map the quality and degradation of habitats nationwide. Last, the relationship between
13 HQ and HD as well as their hotspots and coldspots, and alternative PA categories were explored as
14 a key approach to support large-scale conservation in Italy.

2 Materials and Methods

2.1 Study area

35 Italy covers about 300,000 km², mainly dominated by croplands (33.4% of the national territory)
36 and forests (32%) (Pagliarella et al., 2016). Urban area covers about 7.1% of the national territory,
37 one of the highest percent coverage within the EU, and increased in recent decades despite the
38 general negative national demographic trend (ISPRA, 2016). A large part of its territory is
39 recognized as a biodiversity hotspot, due to the high climatic, orographic, geological, and
40 ecological variability (Falcucci et al., 2007).

41 In Italy, PAs are intended as an effective tool for biodiversity conservation (i.e. Italian National
42 Biodiversity Strategy), and for providing important goods and services to local communities
43 (Vizzarri et al. 2015). The official list of PAs (*Elenco Ufficiale delle Aree Naturali Protette*, EUAP),
44 regulated by the national Framework Law on PAs (Law no. 394/91), counts 871 sites, of which
45 more than 96% are classified as terrestrial (Italian Ministry for the Environment Land and Sea,
46 2017). All PAs are differentiated by their aims, regulations, protection levels, etc. Moreover, 2,314
47 Natura 2000 network sites are designed at national level under the “Habitats” and “Birds”
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European Directives (Council Directive 92/43/EEC; and Directive 2009/147/EC, respectively). The
1 terrestrial sites within the Natura 2000 network cover about 58,200 km² (19% of the national
2 territory). In addition to EUAP and Natura 2000 sites, specific portions of the Italian territory are
3 protected by the so-called “Galasso Law” (GL; DL 431/85), which was introduced to preserve them
4 from human alterations, especially urbanization. Consequently, even if they are not formally
5 considered as PAs, we decided to include them into the national PA network because of their
6 active role contributing to the National Biodiversity Strategy. The GL is applied to vulnerable
7 territories such as *i*) coastline (300m from the sea), *ii*) water bodies (150m from the water body),
8 and *iii*) mountain areas (above 1600 and 1200 m a.s.l., for Northern and Southern Italy,
9 respectively). Altogether, GL covers about 39,800 km² (13% of the national territory). Taking into
10 account the existing overlap among the different sites and PA categories (e.g. a Natura 2000 site
11 can be included in a national park or in areas protected by the GL), the overall Italian PA network
12 covers about 86,000 km² (28% of the national territory).

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26 In this study, we assigned a priority scale to the 3 PA categories (EUAP, Natura 2000, and GL
27 areas), according to a decreasing level of protection and restrictions to human activities. In fact,
28 such restriction levels are usually considered to decrease when passing from EUAP (1st priority
29 level) to Natura 2000 (2nd priority level), and finally GL areas (3rd priority level), which have the
30 lowest authority within the national nature conservation framework.

31 2.2 The Habitat Quality Model and its parameterization

32 We used the InVEST Habitat Quality (HQ) model to map and assess the habitat quality in the study
33 area. It is a spatially-explicit model that uses HQ as a proxy for biodiversity associated with
34 different land use and land cover (LULC) classes (Sharp et al., 2016). This approach is particularly
35 useful for making an initial assessment of conservation needs (Terrado et al., 2016). As reported
36 by Terrado et al. (2016; p. 64), “The model is based on the hypothesis that areas with higher
37 habitat quality support higher richness of native species, and that decreases in habitat extent and
38 quality lead to a decline in species persistence”. HQ is directly related to the suitability of each
39 LULC class to provide habitat for biodiversity (H_j). The H_j ranges between 0 and 1, where 1
40 indicates LULC classes with the highest suitability for species (Leh et al., 2013). In our case, this
41 initial value of suitability is affected by three main factors (also referred to as threats), such as a)
42 the relative sensitivity of each LULC class to each threat (mainly human-induced) (S_{jr}), b) the
43 relative impact of each threat (W_r), and c) the distance between habitats and sources of threats,

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1 where a maximum influence distance is given to each threat indicating the thresholds over which
2 there are no impacts by the threat at all (*Max.D*). The impact of each threat on LULC class
3 increases as its distance from degradation sources decreases, following a distance-decay function
4 (for further details on the InVEST Habitat Quality model, please see Sharp et al., 2016).
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7 While HQ depends on habitat characteristics and the presence and magnitude of threats, HD is
8 particularly suitable to highlight parts of a territory where, due to the cumulative effect of
9 different threats, HQ is undermined. It is worth noting that very similar HQ values can be found in
10 pixels belonging to different LULC classes, thus potentially having quite different H_j and threats'
11 impacts. For example, 2 pixels may have the same final HQ value: the first belonging to a LULC
12 classes with intermediate H_j (e.g., extensive agriculture) and no threats' impacts, while the second
13 belonging to a LULC class with high H_j (e.g., forest) but considerably lowered by the high impact of
14 neighboured treats. In this case, using only HQ instead both HQ and HD, would result in an
15 incomplete description of the status due to the underestimation, or incomplete consideration, of
16 threats' effects.
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19 An input LULC map of Italy was obtained from the National High-Resolution Land Cover map for
20 2012 with a spatial resolution of 20m (Congedo et al., 2016). In order to better describe the
21 habitat variability, an integration with the CORINE Land Cover map (CLC) was performed,
22 increasing from 8 to 12 the number of the LULC classes, also referred to as habitat types (see Fig.
23 A.1 in the Supplementary Material for the LULC map). Three of these LULC classes were also
24 considered as sources of degradation (i.e. Intensive agricultural lands, extensive agricultural lands
25 and buildings, and other developed areas or imperviousness soils). Five additional threats from the
26 road network were added from the Open Street Map catalogue (Open Street Map, 2016), leading
27 to a total number of 8 threats (see Table C.2 in the Supplementary Material). The inclusion of the
28 road network and its categorization according to their characteristics is crucial to better
29 understand its effects on HQ and biodiversity in general (e.g., Von Der Lippe and Kowarik, 2008).
30 For this reason, we decided to use VGI data in order to include helpful information otherwise
31 ignored when only using the LULC map, which, for example, does not distinguish roads from
32 buildings.
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35 The H_j and the threat parameters were determined through an expert survey (Kuhnert et al.,
36 2010). Values were initially compiled by questioning experts from the field of biodiversity
37 conservation and management (see the Supplementary Material file for further details). To assess
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the outputs' uncertainty, we performed a sensitivity analysis by running the HQ model five times
1 using different input values randomly generated within a range defined by the standard deviation
2 of the mean scores ($\mu \pm \text{STD}$) of the expert survey.
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5 2.3 The hotspots and coldspots analysis 6

7 The hotspot is intended as an area characterized by high density clusters of a specific indicator (HQ
8 or HD, in our case), and surrounded by low density clusters of the same indicator, referable as a
9 coldspot (Hartigan, 1975). More specifically, we applied a methodology based on the combination
10 of spatial analyses and statistical procedures using the Local Indicators of Spatial Association (Anselin
11 1995). This approach allowed us to spatially identify statistically significant hotspots,
12 coldspots, and spatial outliers using the Anselin Local Moran's I statistic implemented in the
13 "Cluster and Outlier Analysis" tool in the ESRI ArcGIS® software package. This tool indicates spatial
14 similarity (spatial clustering) or dissimilarity (spatial outlier) through classifying each pixel based on
15 its cluster/outlier type (COType). As a final result, the clustering algorithm classifies the analyzed
16 landscape into *i*) statistically significant (0.05 level) clusters of high values (hotspot), *ii*) statistically
17 significant (0.05 level) clusters of low values (coldspot), *iii*) outliers in which a high value is
18 surrounded primarily by low values, and *iv*) outliers in which a low value is surrounded primarily by
19 high values (see ESRI 2014 for more details). To calculate the spatial association among different
20 grid cells, the analysis was based on a threshold distance of 1.3 km, representing the radius of an
21 area of 500ha (i.e. the average extent of PAs in Italy).
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24 Starting from the identified hotspot and coldspot, we additionally calculated 3 indices, such as the
25 Marginal Hotspot Index, the Marginal Coldspot Index, and the HQ-HD Hotspot ratio. The Marginal
26 Hotspot Index and the Marginal Coldspot Index were calculated for both HQ and HD to measure
27 their changes when passing from a reference PA category to others. We considered the National
28 Parks (NPs) as the reference PA system because it represents the highest level of nature
29 conservation in Italy (i.e. the "best case"). Marginal Hotspot and Coldspot index values of 1 mean
30 that adding one surface unit of a PAs category to the existing NPs causes a relative increase of one
31 surface unit of hotspot and coldspot. Accordingly, values lower than 1 represent a relative
32 decrease of the hotspot or coldspot by adding more protected surfaces of a given PA category
33 (direct proportionality), while values higher than 1 represent a relative increase of the hotspot or
34 coldspot by adding them (inverse proportionality). The lower these values are the higher the
35 correspondent marginal gain of hotspots or coldspots of HQ and HD, and conversely higher values
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1 correspond to marginal losses. These indices were calculated only for those areas belonging to the
2 PA category with the higher conservation priority thus avoiding redundancies among them in the
3 existing overlapping zones (e.g. areas falling in both Natura 2000 and GL were considered just
4 once in the hierarchical higher PA category, the Natura 2000 in this specific case).
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7 The HQ-HD hotspots ratio for a given PA category or administrative level j is calculated as follow:
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$$10 \quad 11 \quad 12 \quad 13 \quad 14 \quad 15 \quad 16 \quad 17 \quad 18 \quad 19 \quad 20 \quad 21 \quad 22 \quad 23 \quad 24 \quad 25 \quad 26 \quad 27 \quad 28 \quad 29 \quad 30 \quad 31 \quad 32 \quad 33 \quad 34 \quad 35 \quad 36 \quad 37 \quad 38 \quad 39 \quad 40 \quad 41 \quad 42 \quad 43 \quad 44 \quad 45 \quad 46 \quad 47 \quad 48 \quad 49 \quad 50 \quad 51 \quad 52 \quad 53 \quad 54 \quad 55 \quad 56 \quad 57 \quad 58 \quad 59 \quad 60 \quad 61 \quad 62 \quad 63 \quad 64 \quad 65$$
$$HQ - HD \text{ hotspots ratio}_j = \frac{HQ \text{ hotspot}_j}{HD \text{ hotspot}_j}$$

where $HQ \text{ hotspot}_j$ and $HD \text{ hotspot}_j$ are the surfaces of the HQ and HD hotspots in the PA category
 j .

The HQ-HD hotspot ratio is 1 when HQ and HD hotspots have the same extent in the observed
territory, thus referring to their perfect balance. Values higher than 1 mean that the surface of the
HQ hotspots is greater than the surface of the HD hotspots, and vice versa.

2.4 Interpretation of the model outputs through fitting with vertebrate β -diversity

To assess the reliability of the model, we compared the predicted values of HQ with existing values
of biodiversity for terrestrial vertebrates calculated from occurrence records at the national scale.
Specifically, values of β – diversity were calculated from occurrence records of vertebrate species
derived by the “Checklist of Italian Fauna” database (Italian Ministry for the Environment Land and
Sea, 2003). We used this database as it represents the only available source of vertebrate
occurrence data for Italy. Subsequently, we tested the statistical relationship between HQ and β –
diversity (adding both linear and quadratic terms) using a generalized linear mixed model (GLMM;
McCullagh and Nelder 1989) with a beta distribution of errors and a logit link function. We
included the LULC type as random effect, allowing the model to vary its intercept and slope
according to this parameter.

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3 **3 Results**
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11 **3.1 Habitat quality and degradation in Italy**
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Upon completion of the survey, 41 experts answered the questionnaire (see Table B.1 in the Supplementary Material) and the results are reported in the Supplementary Material file (Tables C.1 and C.2 in the Supplementary Material). HQ and HD maps have different spatial patterns across Italy (Fig. 1). HQ values are generally higher along the two major mountain chains of the country, the Alps and the Apennines, with two clearly noticeable isolated areas with high values corresponding to the Venetian Lagoon and the Gargano Massif. Low HQ values occur in the Po Valley (Northern Italy), and then decrease to the south along the Adriatic Coast to the Gargano and Salento sub-regions (in the Apulia Region), and in Sicily. Furthermore, the lowest HQ values are concentrated around the major urban areas of Milan, Florence, Rome, and Naples. These areas are historically mainly devoted to the agricultural and industrial production and have the highest population densities. In fact, these values are due to the high presence of LULC classes with low HQ values, such as commercial and residential areas or impervious soils (with a mean HQ value of 0.10), open urban areas (0.26), and intensive agricultural lands (0.30). The HQ coefficients of variation (CV) are 0%, 2%, and 5% for buildings and other artificial areas or imperviousness soils, intensive agricultural lands, and conifer forests, respectively; while 27%, 24%, and 19% for waterbodies, wetlands and beaches, dunes and sands, respectively.

HD values range between 0, where there is minimal human disturbance impacting HQ, and 0.12 with the maximum concentration of threats and maximum relative cumulative effect in reducing HQ values are found. High HD values usually have a narrower spatial distribution with respect to the HQ ones (Fig. 1).

The average uncertainty of the HQ is 34%, based on the standard deviation of the mean scores from the expert survey nationwide. Grasslands, shrublands, and forests are the habitats with the lower uncertainty values (8.4%, 9.2% and 11.2%, respectively). Otherwise, the highest level of uncertainty refers to urban areas (133.3%). More generally, the uncertainty is higher for the anthropic habitats (55%) and lower for the natural ones (19%).

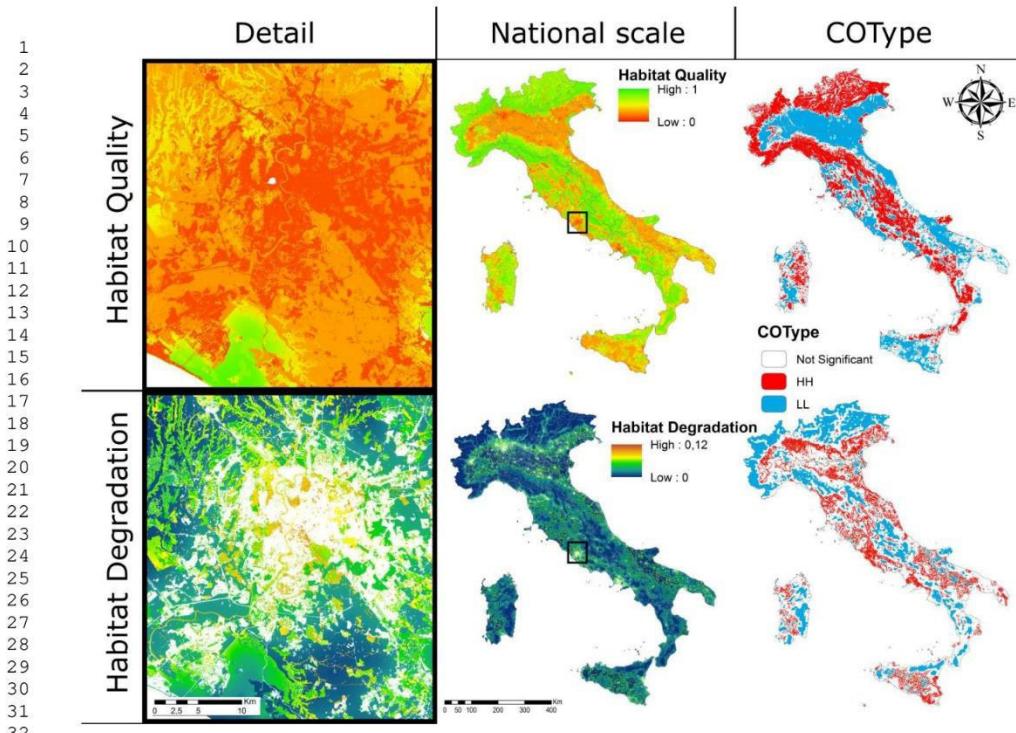


Figure 1- High resolution map of the HQ (top half) and HD (bottom half) at national scale (right side), with an inset map of Rome (left side), and the distribution of the relative COTypes at national scale (hotspot, HH, and coldspot, LL; far right).

3.2 Habitat quality and degradation in relation to different PA categories

Results show that the mean HQ is higher within the PA network (0.68 with a CV of 33%) when compared to the rest of the national territory (0.50 with a CV of 49%). In particular, the results show that among the different PA categories, NPs are those with the highest HQ with a mean HQ of 0.75, followed by Other EUAP (all the EUAP sites excluding NPs) (0.72), Natura 2000 sites (0.68) and GL (0.66). The opposite relationship was found for their CV of: 24%, 28%, 29%, and 34% for NPs, Other EUAP, Natura 2000 and GL, respectively.

The results of the Cluster and Outlier Analysis (Fig. 1) show that the patches of HD hotspots are rather smaller in size than those of HQ hotspots. HQ hotspots cover almost 32% of the Italian territory, ranging from 24% of the non-PAs to 51% of the protected ones (Fig. 2A). The number of HQ hotspots considerably increases when passing from non-protected to protected areas, as well

as increasing the protection level from GL to NPs (which have the highest relative hotspots coverage). In fact, almost 66% of the NPs area is currently considerable as a HQ hotspot, decreasing to 38% for GL. The opposite trends were found for the HQ coldspots.

Conversely, the number of HD hotspots is higher in non-protected areas (21% of their territory) than in protected ones (14%), with a national average of 19% (Fig. 2B). Although the number of HD hotspots is low in NPs (4%), other PA categories have a similar trend in HQ hotspots.

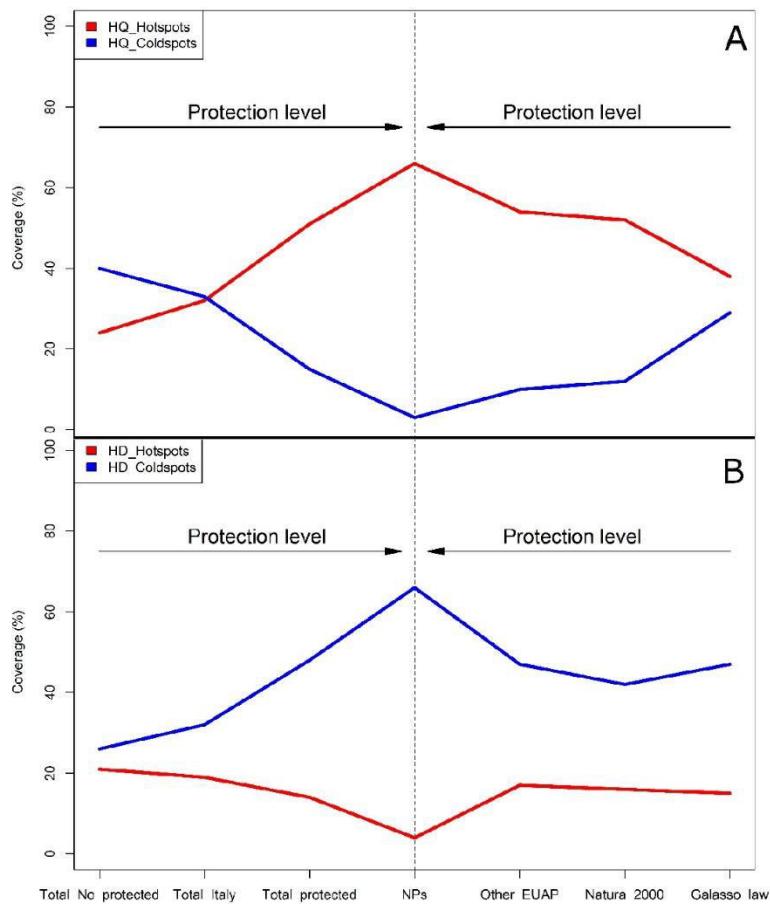


Figure 2- Relative coverage (in %) of HQ (A) and HD (B) hotspots and coldspots for different administrative levels and PAs categories.

These trends are evident and described by the Marginal Hotspot Index and HQ Marginal Coldspot Index for both HQ and HD (Fig. 3 A and B, respectively), which were calculated for the Other EUAP, Natura 2000 and GL areas with respect to the NPs, representing our reference level in terms of relative coverage with the highest HQ values (in terms of both mean HQ value and relative coverage of HQ hotspots). As expected, for all 3 PA categories HQ Marginal Hotspot Index and HQ Marginal Coldspot Index are respectively lower and higher than 1; whereas, HD Marginal Hotspot Index and HD Marginal Coldspot Index are higher and lower than 1, respectively. HD Marginal Hotspot Index ranges from 3.39 for GL to 3.91 for the Other EUAP. The lowest value of HD Marginal Coldspot Index was found in Natura 2000 (0.65), but is relatively similar to those in the other 2 PA categories (0.71).

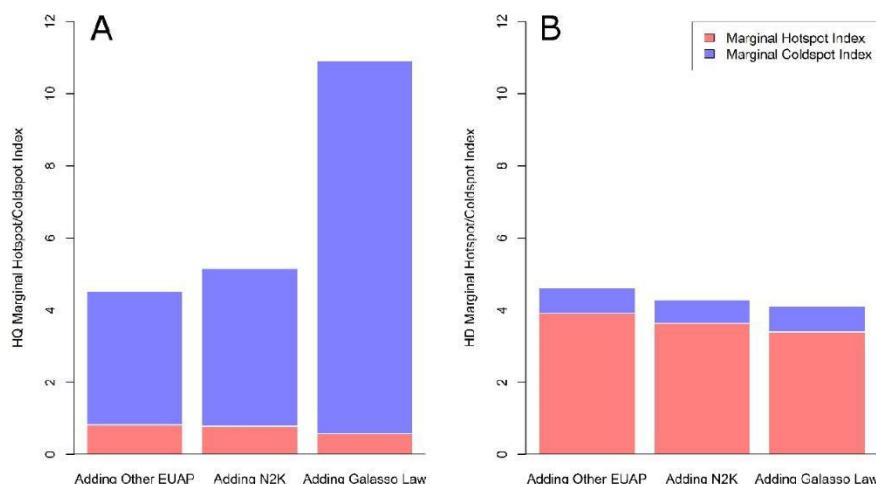


Figure 3- HQ (A) and HD (B) Marginal Hotspot Index (red bar) and Marginal Coldspot Index (blue bar) for the three protection levels.

The HQ-HD hotspots ratio is always greater than 1, ranging from 1.17 in the non-PAs to 3.66 in the protected ones (Fig. 4). The latter is influenced by the high value found in NPs (15.16) and relatively lower values of the other PA categories. Among the others 3 PA categories the highest value is in Natura 2000 (3.26), followed by Other EUAP (3.17), and GL (2.60).

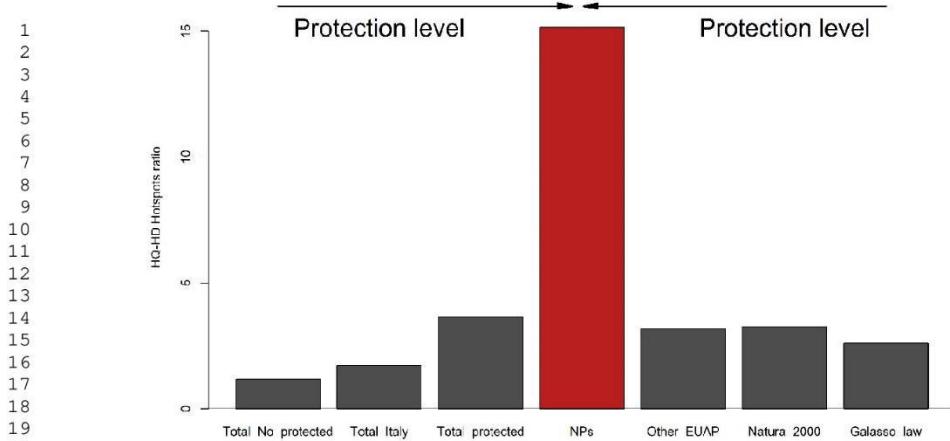


Figure 4- HQ-HD hotspots ratio for different administrative levels and PA categories.

Finally, there was a significant quadratic relationship between vertebrate species β -diversity and HQ values nationwide ($p < 0.01$). This relationship predicted β -diversity to reach its maximum toward HQ values of approximately 0.65 (Fig. 5).

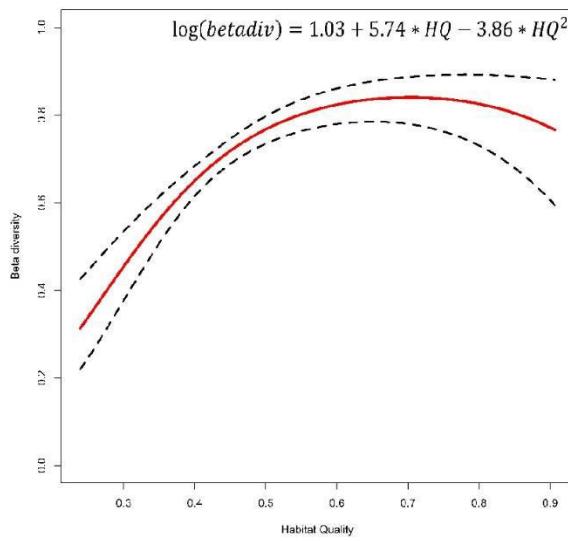


Figure 5- Relationship between modeled HQ and vertebrate β -diversity. Dashed lines represent the 95th % C.I. of the estimates.

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4 **4 Discussion**
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11 **4.1 Patterns and trends of HQ and their contribution to biodiversity conservation**
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30 The results confirm that HQ slightly decreases where human population becomes denser (i.e.
31 urban areas), as well as closer to more accessible areas (Newbold et al., 2015). In addition, the
32 results show that HQ decreases when (*i*) moving from the mountain chains to lowlands and coastal
33 areas (e.g., from Alps and Apennines to the Po Valley), (*ii*) passing from less to more intensively-
34 used areas for agricultural purposes, and (*iii*) shifting from more to less restrictive PA categories
35 (i.e., from NPs to GL areas). Most probably, this trend is explained by the large presence of PAs
36 (especially NPs) across the Italian mountain ranges (i.e. 24% of the Italian mountain area is
37 covered by the EUAP sites and 93% of the NPs are sited in highlands; Sallustio et al., 2015),
38 implying that high levels of biodiversity conservation are ensured in areas having the highest level
39 of protection (at least expected or pursued). Indeed, the key role of the NP network for improving
40 the biodiversity conservation status is widely recognized both at national (Blasi et al., 2007;
41 Capotorti et al., 2012) and global scales (Geldmann et al., 2013), as also emphasized by the results
42 concerning the HQ and HD hotspots. This aspect is in line with the strict relationships existing
43 between high degradation values and high anthropogenic pressure in high fertile soils and more
44 accessible and profitable areas (lowlands, coasts, etc.) (Rivieccio et al., 2017). Moreover, the HD
45 values generally exhibit a narrower distribution at the national scale, in comparison with the HQ.
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47 In fact, the highest values of HD are clustered in more fragmented natural and semi-natural areas
48 (e.g. small patches of forests) highly and diffusely permeated by threats (e.g. high density road
49 network and fragmentation of urban areas; e.g. Romano and Zullo, 2014; Von Der Lippe and
50 Kowarik, 2008). The different spatial distribution and characteristics of HQ and HD, as well as of
51 their hotspots, highlight that in spite of their intuitive correlation examining both HQ and HD
52 offers a valuable and more comprehensive understanding of both current habitat conservation
53 and negative impacts due to the cumulative effect of anthropogenic threats.

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55 The HQ values (as found in the Other EUAP, Natura 2000, and GL areas) suggest that the current
56 level of biodiversity in Italy is weaker than within NPs. Conversely, higher HD values in Other EUAP,
57 Natura 2000, and GL show that they are more prone and vulnerable to human activities than NPs,
58 which are generally sited in more natural areas and less influenced by anthropogenic threats (as
59 demonstrated, for example, by the presence of old-growth forests; Chiavetta et al., 2012). This
60 trend probably depends on how the current land uses (e.g., agriculture, forestry, and urban), and
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1 alternative management approaches (e.g., intensive, close-to-nature, ecosystem-based), interact,
2 and are implemented in and outside NPs, as well as in which way they relate to biodiversity
3 conservation purposes (e.g., habitat or species-targeted). Accordingly, for example, Maiorano et
4 al. (2007) suggested integrating the management and conservation of Natura 2000 network sites
5 with the neighboring areas, especially because they are located in highly diversified and used
6 landscapes, and often extremely permeable to threats.
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9 Consequently, much more effort is needed to improve biodiversity conservation and habitat
10 protection at regional and local scales in Italy. Generally, the conservation effectiveness of
11 alternative PA categories may be improved through: (i) developing a sustainable allocation of land
12 uses inside and outside the PA boundaries, as well as among different PA categories (cf. Cumming,
13 2015); and (ii) preparing and implementing appropriate management plans where still absent.
14 Harmonizing the current regulations for biodiversity conservation available at sub-regional scale
15 with the main strategies as suggested at national and EU scale, may be a good solution in that
16 sense. The multi-scale assessment and mapping of HQ can be used to provide a supporting tool for
17 decision makers, in order to reduce the mismatches between the management and planning, and
18 the information side (e.g., Essential Biodiversity Variables; Proen  a et al., 2016). Moreover, if
19 integrated with the assessment of additional ES (provisioning, regulation, and cultural), the HQ
20 model represents a powerful tool for further understanding the complexity between human
21 impacts and the ecosystem functionality, thus facilitating the future-oriented policies and
22 management strategies towards better biodiversity conservation and habitat protection (e.g.,
23 Maes et al., 2012). Furthermore, outside PAs, the adoption of conservation strategies and the
24 continuous monitoring of biodiversity and ES can be facilitated through the implementation of
25 Payments for Environmental Services (PES) schemes, offset mechanisms, and public/private
26 investments to compensate the unavoidable loss of biodiversity or further habitat degradation.
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51 **4.2 Model functioning, interpretation and limitations**

52 The combination of expert survey and spatially-explicit HQ model has proven to be effective in
53 characterizing the differences and peculiarities of biodiversity and habitat status at the national
54 scale in Italy, and for different LULC classes. Regarding the expert-based approach, the uncertainty
55 of the model outputs turns out to be strictly dependent on the subjectivity and variability in the
56 experts' judgements. In particular, this is due to the discrepancies between the experts'
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evaluations concerning the human-modified areas, in comparison with semi-natural lands (i.e. grasslands). In the case of the urban areas, the disagreement among the interviewees may depend on different levels of awareness or knowledge about suitability/quality of the investigated habitats. In fact, in contrast with the widely-accepted role of forest ecosystems to preserve habitats and species, the significance of the biodiversity value of urban forests needs to be further explored and communicated (Carrus et al., 2015; Gunnarsson et al., 2017). This aspect is exacerbated by the fact that most of respondents belongs to the “environmental planning” field, which is indeed based on an operative perspective of the actions to be undertaken to preserve integrity and health of different habitat types.

The adopted LULC classification system perhaps introduced uncertainty linked to how respondents interpreted quality and threats for “open urban areas”, as they might include urban forests and other habitat types. This is partly in contrast with current literature, which instead demonstrates high biodiversity levels in urban areas (e.g., Kowarik, 2011; Pesola et al., 2017; Sitzia et al., 2016).

Although such discrepancies in experts' evaluations introduce a moderate level of uncertainty in model predictions, HQ values appeared coherent with the chosen biodiversity indicator, i.e. vertebrate β -diversity. Specifically, vertebrate β -diversity tends to increase as HQ increases, also reaching an asymptote approximately to a HQ value of 0.65. This pattern may be explained by considering the so-called “intermediate-disturbance hypothesis”, for which “the highest diversity is maintained at intermediate scales of disturbance” (p. 1303: Connell, 1978).

Although the application of the InVEST HQ model was proven to be effective for underpinning biodiversity conservation at the national scale, it is important to note that a large scale wall-to-wall HQ-HD mapping has limitations related to the low thematic resolution (i.e., limited number of LULC classes). Such limitations mainly depend on the scale of the study (i.e., national) and on the resolution of the input data, which already include some constraints and are not very sensitive to variability of habitat types at a lower scale (e.g., urban areas). This in turn could tend to oversimplify and smooth the habitat complexity over the landscape, especially in heterogeneous contexts such as the Mediterranean one. In fact, the quality of large scale ES maps is often questioned due to the related high uncertainty, and poor validation (e.g., Schulp et al., 2014), generally linked to the lack of field-observed data. Similarly, although the hotspot approach has potential in simplifying the understanding of often complex processes, it needs to be used in a more comprehensive way, toward a broader vision of biodiversity conservation (e.g., Marchese

1 2015). With this in mind, it is worth noting that our results concerning the gradient of HQ along
2 different PAs are consistent with those obtained by Maiorano et al. (2007) through a GAP analysis,
3 but, from a methodological point of view the present methodology is significant as *i*) it is not
4 species-related, which implies that conservation is not only focused on target species or group of
5 them; *ii*) it requires a limited amount of input data, such as presence/absence and abundance,
6 which are often major constraints for large-scale analysis; *iii*) it not only gives insights on positive
7 values (e.g. habitat quality, suitability, species richness, biodiversity) but even on sources of
8 degradation, which have their own no less important place in a planning framework.
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5 Conclusions

19 This work provides a spatially-explicit assessment of the HQ and HD, which were used as a proxy of
20 biodiversity conservation status across Italy, and shows their spatial relationships with PAs. The
21 expert-based and the spatially-explicit approach were combined for assessing the habitat status at
22 a national scale with a high spatial resolution, thus providing a reliable information to best orient
23 the implementation of policy and management strategies towards maximizing the future
24 biodiversity conservation efforts. In particular, the identification of hotspots may be important to
25 identify priority areas for conservation, as well as to better orient management activities and
26 budget allocation, both inside and outside the current PAs. This approach may be replicated in
27 other similar contexts across the globe, especially where the lack of data strongly limits the use of
28 more complex ecological models (e.g. stochastic models, species distribution models, etc.). If
29 combined with other assessment tools (e.g., ecosystem models) or regulation instruments (e.g.,
30 UNESCO Man and Biosphere Reserves), the adopted approach would balance sustainable
31 management with conservation efforts, and simultaneously facilitate the understanding of
32 patterns in the human impacts on biodiversity and ecosystem services provision at various scales
33 (from national to sub-regional). The insights from this study mainly suggest that *(i)* the
34 identification of biodiversity hotspots and coldspots should be used to best orient conservation
35 efforts towards the most vulnerable sites to anthropogenic pressures and additional threats on
36 global and local scales, thus improving conservation efforts and related economic investments; *(ii)*
37 the biodiversity conservation policies have to be implemented at a larger scale, by including the
38 differences among the management approaches both in- and out-side the PA boundaries, even
39 considering the often undermined buffer zones around them (e.g., Allan et al., 2017); and *(iii)* the
40 research on biodiversity and ecosystem services should be considered and implemented within
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1 landscape management and planning contexts. These insights are critical for conserving the
2 natural heritage that maintains the intimate relationship between ecosystems and human
3 wellbeing.
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**Sviluppo locale e valorizzazione del patrimonio ambientale
in aree marginali. Antinomia o possibilità?
L'esperienza del Matese nella Strategia nazionale per le aree interne**

di Andrea De Toni, Lorenzo Sallustio e Marco Marchetti

1. Introduzione

Il processo di definizione e avvio della pianificazione strategica delle aree interne italiane trae ispirazione da indirizzi, politiche e strategie internazionali e comunitarie che negli ultimi anni stanno vedendo le aree marginali, montane e rurali in genere, quali ambiti da tutelare e valorizzare in chiave di sviluppo sostenibile. A livello internazionale, l'attenzione si focalizza sulla conservazione e ripristino del capitale naturale e contestuale promozione dell'uso sostenibile delle risorse¹, in aggiunta, sulla riduzione delle disuguaglianze, la promozione di politiche per il rilancio dei territori (dall'imprenditorialità, piccole medie imprese nello specifico, al tema del turismo sostenibile)², per arrivare, in ambito nazionale, alla tutela e salvaguardia del patrimonio storico, artistico, e ambientale (articolo 9 della Costituzione). In questo contesto nasce la Strategia nazionale per le aree interne (SNAI).

Per aree interne, secondo il Dipartimento per lo Sviluppo e la Coesione Economica, si intendono tutti quei territori con problemi di accessibilità, che distano almeno 20 minuti da un ospedale³, da scuole di istruzione media e superiore e da una stazione ferroviaria⁴. Per darne contezza, si tratta del 60% del territorio italiano che ospita circa un quarto della popolazione nazionale (18.4

¹ Rosalaura Romeo, Alessia Vita, Riccardo Testolin, Thomas Hofer, *Mapping the vulnerability of mountain peoples to food insecurity*, FAO, Roma 2015 (<http://www.fao.org/3/a-i5175e.pdf>).

² United Nations, *Transforming our world: the 2030 Agenda for Sustainable Development*, 2015 (<https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>).

³ Ospedale sede di DEA di I livello, rappresenta un'aggregazione funzionale di unità operative che garantisce le funzioni di osservazione, breve degenza e rianimazione, oltre che Pronto Soccorso, e realizza interventi diagnostico-terapeutici e assicura le prestazioni di laboratorio di analisi.

⁴ Stazione ferroviaria di categoria SILVER, impianti medio piccoli con una frequenza media.

milioni di ettari per 13.5 milioni di abitanti)⁵. Il Comitato tecnico aree interne (CTAI) ha definito 71 Aree progetto in tutta Italia, in accordo con le Regioni, adottando un metodo di diagnosi aperta condotta su un set di 133 indicatori (*database Open Aree Interne*, <http://www.agenziacoesione.gov.it/it/arint/OpenAreeInterne/>) che descrivono le principali caratteristiche di un sistema complesso qual è, di per sé, il territorio: Demografia, Agricoltura e specializzazione settoriale, *Digital Divide*, Patrimonio culturale e turismo, Salute, Accessibilità, Scuola, Associazionismo fra comuni. Ripercorrendo brevemente l'*iter* della programmazione negoziata che si fonda su un approccio *place-based*⁶, pilastro della SNAI, all'analisi di contesto di ogni singola area interna fa seguito la stesura, da parte dei territori interessati, di una Bozza di idee che dà spazio alle comunità locali di rappresentarsi e autodefinirsi, individuando elementi distintivi del territorio, vocazioni, attrattività da potenziare. Una volta approvate le linee guida contenute nella Bozza, si arrivano a definire (prima nel Preliminare, poi nella Strategia d'Area) scelte volte a innescare processi di cambiamento dello *status quo*, mediante attività di co-progettazione tra territorio e istituzioni. Si dà infine avvio, con la firma dell'Accordo di Programma Quadro, allo stanziamento dei finanziamenti previsti per la realizzazione degli interventi, necessariamente accompagnati da attività di animazione territoriale e monitoraggio sulla base di indici e indicatori individuati⁷.

L'obiettivo della SNAI è quello di far sì che le comunità locali prendano coscienza del territorio in cui vivono trasformando in valore aggiunto le peculiarità, creando una *governance* territoriale unitaria partendo dall'associazione di servizi e/o funzioni e arrivando ad alimentare e provocare un'inversione di tendenza rispetto all'evoluzione alla quale hanno assistito nel tempo: si tratta dunque di ripensare e valorizzare il Capitale Naturale, Umano e Costruito presente nel loro territorio. Per fare questo è necessario riconoscere e comprendere le risorse territoriali a disposizione, siano esse materiali o immateriali.

Complessivamente, le aree interne sono distribuite perlopiù in zone montane (per l'82%) e soffrono di gravi problematiche quali il dissesto idrogeologico, l'erosione e degrado del suolo, fenomeni negli anni aggravati dallo spopolamento che ha comportato una riduzione della millenaria opera di presidio territoriale

⁵ Sabrina Lucatelli, *La Strategia nazionale, il riconoscimento delle aree interne*, «TERRITORIO», 2015, 74, pp. 80-86.

⁶ Fabrizio Barca, *Towards a territorial social agenda for the European Union*, Report working paper, 2009. Fabrizio Barca, Paola Casavola, Sabrina Lucatelli, *Strategia nazionale per le aree interne: definizioni, strumenti e governance*, Materiali UVAL, n. 31.

⁷ Claudio De Vincenti, *Relazione annuale sulla Strategia nazionale per le aree interne*, Presentata al CIPE dal Ministro per la Coesione Territoriale e il Mezzogiorno, 2016. (http://www.agenziacoesione.gov.it/opencms/export/sites/dps/it/documentazione/Aree_interne/Presentazione/Relazione_al_CIPE_24_01_2017_def.pdf).

portata avanti dalle popolazioni locali soprattutto grazie all'agricoltura, pastorizia e selvicoltura. Queste aree godono di una grande disponibilità di risorse naturali⁸, vantano la presenza di 3/4 sia di aree protette che di superficie forestale nazionale⁹, sono ricche di servizi ecosistemici, definiti come «i benefici multipli forniti dagli ecosistemi al genere umano»¹⁰. Si tratta di beni e servizi di cui tutti noi godiamo quotidianamente e che, fra gli ecosistemi terrestri, sono offerti per gran parte dalle foreste. Il bosco infatti ospita specie animali e vegetali aiutando a mantenere in tal modo la diversità biologica, provvede al sequestro e alla fissazione del carbonio mitigando così i cambiamenti climatici, genera prodotti legnosi e non – disponibilità di legname da opera, legna da ardere, prodotti del sottobosco quali funghi e tartufi –, assicura l'approvvigionamento idrico garantendo la qualità dell'acqua ed è custode di valori culturali e tradizionali della popolazione¹¹. Tutti i beni e servizi appena descritti vengono erogati maggiormente in ambiti montani e aree interne¹², in virtù proprio dell'ingente copertura forestale che li caratterizza. Una volta appurata la presenza è necessario non solo comprendere e far comprendere appieno le opportunità offerte dal bosco, ma soprattutto gestire, seguendo un disegno strategico, queste risorse.

Attraverso la narrazione dell'esperienza progettuale dell'area interna del Matese, area pilota della Regione Molise, si intende mettere in luce come le risorse agro-forestali possano divenire volano per lo sviluppo e l'innovazione se opportunamente valorizzate in accordo con gli indirizzi forniti dalla SNAI. Le proposte progettuali e i relativi interventi hanno infatti un obiettivo comune, primario e fondante: ri-radicare le persone ai luoghi, quei luoghi da cui «se ne sono andati tutti, specialmente chi è rimasto»¹³. Riscoprire le vocazioni agro-silvo-pastorali dell'area è di fondamentale importanza per far

⁸ Mary Kuckelshaus, Emily McKenzie, Heather Tallis, Anne Guerry, Gretchen Daily, Peter Kareiva, Stephen Polasky, Taylor Ricketts, Nirmal Bhagabati, Spencer A. Wood, Joanna Bernhardti, *Notes from the field: Lessons learned from using ecosystem service approaches to inform real-world decisions*, «Ecological Economics», 2015, 115, pp. 11-21.

⁹ Marco Marchetti, Andrea De Toni, Lorenzo Sallustio, Roberto Tognetti, *Criticità e opportunità di sviluppo per le aree interne. Una lettura dei processi territoriali recenti*, in Marco Marchetti, Stefano Panunzi, Rossano Pazzagli (a cura di), *Aree interne. Per una rinascita dei territori rurali e montani*, Rubbettino, Soveria Mannelli 2017, pp. 27-37.

¹⁰ Millennium Ecosystem Assessment, *Ecosystems and human well-being: synthesis*, World Resources Institute, Washington, D.C. (USA) 2005 (<https://www.millenniumassessment.org/documents/document.356.aspx.pdf>).

¹¹ Matteo Vizzarri, Fabio Lombardi, Lorenzo Sallustio, Gherardo Chirici, Marco Marchetti, *I servizi degli ecosistemi forestali ed il benessere dell'uomo: quali benefici alla ricerca?* «Gazzetta Ambiente, Rivista sull'ambiente e il territorio», 2013, Anno XIX n. 6/2013, pp. 9-18.

¹² Claudia Drexler, Valerie Braun, Derek Christie, Bernat Claramunt, Thomas Dax, Igor Jelen, Robert Kanka, Nikolas Katsoulakos, Gaël Le Roux, Martin Price, Thomas Scheurer & Rolf Weingartner, *Moutains for Europe's Future - A strategic research agenda*, 2016, (http://www.chat-mountainalliance.eu/images/Mountains_for_Europe's_Future_04_16_d.pdf).

¹³ Franco Arminio, *Cedi la strada agli alberi. Poesie d'amore e di terra*, Editore Chiarelettere, Milano 2017.

si che gli abitanti prendano coscienza delle risorse naturali a disposizione, delle loro potenzialità, un primo passo verso il ritorno alla cura e presidio del territorio in un'ottica di sostenibilità non solo ambientale, ma anche economica e sociale¹⁴. Tutti questi aspetti devono obbligatoriamente essere messi in sinergia: ripensare il territorio non significa strutturare e attuare singoli progetti e azioni a se stanti, bensì muoversi nella direzione di una scelta strategica, condivisa e permanente, con l'obiettivo ultimo di provocare vere e proprie inversioni di tendenza rispetto alla condizione attuale.

2. L'area del Matese

L'area del Matese, localizzata a Sud della Regione Molise, è costituita da 14 Comuni¹⁵, si estende su circa 400 Km², una popolazione complessiva di 20.500 unità e una densità abitativa di 49 abitanti per km² (contro una media nazionale di 74 ab/km²), con la popolazione residente, secondo i dati ISTAT, in diminuzione di 3,1% negli ultimi dieci anni (2001-2011). L'area progetto è in generale carente rispetto alla dotazione di servizi per residenti e turisti (mobilità, istruzione, sanità), condizione per la quale è stata annoverata nella categoria "area interna". Il territorio matesino presenta un forte grado di naturalità, con il 40% di territorio oggetto di misure di conservazione (2 aree naturali protette e 5 Siti di Interesse Comunitario). A riprova della chiara connotazione naturale dell'area, è in approvazione da parte della Camera l'istituzione del Parco Nazionale del Matese. Il 50% circa del territorio è coperto da superficie forestale con buona fertilità e produttività dei popolamenti, ma relativamente poco utilizzata a fini produttivi e con una pianificazione non omogenea. Infatti, pur essendo indubbia la presenza e la centralità della risorsa forestale, il suo potenziale non si traduce in effettiva valorizzazione della filiera bosco-legna-energia. Indice della scarsità di investimenti nella risorsa forestale è il numero esiguo di imprese boschive e di imprese di prima trasformazione del legno (2 segherie in totale) che oltretutto, rispettivamente, operano e si approvvigionano al di fuori dell'area del Matese, quindi non riuscendo, di fatto, a chiudere un ciclo di filiera locale.

Il comparto agricolo non vanta miglior condizione o stato di prosperità. Il territorio matesino è prevalentemente montuoso, con terreni inculti e un'estrema polverizzazione della proprietà agricola, in aggiunta le caratteristiche cli-

¹⁴ Giovanni Carrosio, *Economia civile e gestione delle risorse ambientali nelle aree interne*, «TERRITORIO», 2015, pp. 115-121.

¹⁵ Castelpetroso, San Massimo, Santa Maria del Molise, Cantalupo, Roccamandolfi, Bojano, Colle d'Anchise, Spinete, San Polo Matese, Campochiaro, Guardiaregia, Sepino, San Giuliano del Sannio, Cercepiccola.

matiche non sono sempre idonee alla coltivazione intensiva. Dalle analisi effettuate mediante l'utilizzo dell'Inventario dell'Uso delle Terre d'Italia (IUTI), dal 1990 al 2008 si è assistito a una perdita relativa del 7% di seminativi (1.150 ettari) e del 22% di prati e pascoli (1.200 ettari), in linea quindi con quanto osservato a livello nazionale ed in altri ambiti territoriali¹⁶. Di pari passo, secondo i dati ISTAT, le aziende agricole hanno subito un forte decremento pari al 35% (-637 aziende nel periodo 2000-2010) con una bassissima percentuale di giovani conduttori (solo il 15% del totale dei conduttori agricoli dell'area ha meno di 39 anni). All'insieme delle condizioni che influenzano negativamente in prevalenza il settore agricolo, si aggiunga la mancanza di associazionismo fra le aziende, di reti di imprese o filiere produttive che, come noto, risulterebbero estremamente funzionali in ottica di sviluppo.

3. Sviluppo locale e valorizzazione del patrimonio ambientale: una possibilità concreta

Dalla descrizione dell'area studio emerge che alle due principali risorse dell'area, riferibili al comparto agricolo e forestale, attualmente si conferisce uno scarso valore concreto in termini di opportunità di crescita per il territorio. Al fine di innescare una netta inversione di tendenza nell'area matesina, si intende in primo luogo sostenere e incentivare lo sviluppo locale, concentrando sforzi e investimenti nei due compatti principali – interventi relativi al comparto agricolo e a quello forestale in senso stretto –. Questo getta le basi non solo per l'incremento della produzione di beni e servizi, attraverso la commistione di saperi esperti e saperi e volontà locali, ma è anche e soprattutto il primo passo per fornire opportunità concrete di supporto a questi settori puntando, ad esempio, sulla creazione e potenziamento delle imprese locali. La tutela del patrimonio ambientale e dei servizi ecosistemici a esso connessi, attraverso la gestione territoriale e una *governance* unitaria, deve necessariamente permeare tutti gli interventi descritti.

L'agricoltura

La presenza di terreni seminativi e pascoli abbandonati, la frammentazione fondiaria e le problematiche relative all'accesso alla terra, hanno portato a riflettere sull'importanza di stimolare nuovi paradigmi produttivi, per dare nuova vita e vigore a un settore strategico non solo per le aree interne ma per

¹⁶ Marco Marchetti, Marco Ottaviano, Rossano Pazzagli, Lorenzo Sallustio, *Consumo di suolo e analisi dei cambiamenti del paesaggio nei Parchi Nazionali d'Italia*, «TERRITORIO», 2013, pp. 121-131.

l'interesse nazionale. Ripartire dalla campagna significa innanzitutto creare le condizioni necessarie affinché i giovani neo-agricoltori possano disporre di terreni sui quali scommettere e investire risorse ed energie. Il primissimo intervento previsto nell'area matesina verde proprio sulla possibilità di realizzare in via sperimentale un censimento dei terreni agricoli in stato di abbandono con la finalità di affidarli a giovani disposti a riscoprire il mondo rurale, co-niugando passato e presente, tradizione e innovazione. L'iniziativa della "Banca della Terra del Matese" – sulla scia della *best practice* toscana della Lega Coop Agroalimentare (<http://www.legacoopagroalimentare.coop/pt1582/Banca-della-terra-.html>) tutt'ora promossa in tutto il territorio nazionale – offre quest'opportunità, censendo e affidando in gestione a chi ne faccia richiesta, tramite affitto o concessione, appezzamenti agricoli. Non solo, la frammentazione fonciaria è una problematica che affligge anche coloro che allevatori e agricoltori lo sono da tempo, che hanno visto negli anni gravemente minata l'efficienza produttiva. La Banca della Terra, attraverso il censimento dei terreni non più utilizzati e la loro messa a disposizione a scopi agricoli, aiuterà anche coloro che da tempo ormai erano sfiduciati rispetto a un cambiamento. A tutto ciò si aggiunga poi l'innovazione: si intende conciliare la produzione agricola con la riscoperta di antiche tradizioni, attraverso il recupero di alcune *cultivar* antiche e autoctone dell'area del Matese, con il supporto tecnico-scientifico della Banca del Germoplasma dell'Università degli Studi del Molise e dell'ARSRP regionale. Le azioni e gli interventi tangibili devono però, contestualmente, essere affiancati e completati da una particolare e sistematica attenzione alla sfera relazionale e socio-economica, affinché la strategia produca gli effetti desiderati. Gli interventi di accompagnamento alla costituzione della Banca della Terra del Matese, e in generale alla volontà di avviare imprese nel territorio, sono semplici ma efficaci: creare occasioni di confronto, momenti di formazione e accompagnamento – c.d. educazione non formale – che possano aiutare a tradurre l'idea di futuri giovani imprenditori in un sistema complesso di scelte. Non si tratta in questo caso di prediligere solo le tradizionali imprese agricole, ma anche e soprattutto di innescare processi di innovazione sociale quale, ad esempio, la costituzione di cooperative di comunità. Vista la scarsa propensione all'imprenditorialità consapevole e la quasi totale assenza di una cultura alla progettualità, la volontà è quella di stimolare l'interesse della popolazione, offrendogli sia un supporto teorico che uno tangibile con servizi reali. Nel complesso si vuol partire dalla descrizione delle potenzialità del percorso imprenditoriale in sé e della rigenerazione di un territorio svuotato di attività e soprattutto di relazioni¹⁷, fino ad arrivare all'assistenza tecnico-gestionale in relazione all'attività in oggetto.

¹⁷ Federica Bandini, Renato Medei, Claudio Travaglini, *Territorio e persone come risorse: le cooperative di comunità*, «Impresa sociale», 2015, 5 (<http://www.rivistaimpresasociale.it/rivista/item/117-cooperative-comunita.html>).

Gli effetti che l'auspicata ripresa dell'attività agricola avrà sul territorio matesino saranno molteplici e significativi. L'alimentare forme di neoruralità implica il ritorno all'uso e alla cura del territorio, sulla base di una forte conoscenza e coscienza territoriale. Questo permetterà di ristabilire il presidio, di mantenere l'integrità del paesaggio e le funzioni a esso connesse come ad esempio la regimazione del deflusso idrico, la biodiversità, o meglio l'agrobiodiversità: la varietà di specie – animali, piante e microrganismi – e di ecosistema, necessaria a sostenere le funzioni, la struttura e i processi degli agroecosistemi.

La risorsa forestale

Nonostante buona parte della superficie forestale matesina sia attualmente pianificata grazie alla presenza dei Piani Forestali Aziendali (PFA), uno strumento particolareggiato di pianificazione degli interventi selvicolturali a valenza comunale, a ciò non corrisponde necessariamente l'utilizzo e la gestione attiva di tale risorsa. Infatti, per quanto questo tipo di pianificazione disciplini e indirizzi le utilizzazioni boschive e l'uso dei pascoli, non è assolutamente detto che esista una corrispondenza reale fra questo e l'utilizzo della risorsa forestale stessa. A questo si aggiunga la mancanza di conoscenza da parte della comunità locale delle potenzialità delle risorse ambientali di cui dispongono: secondo un'indagine condotta fra il 2009 e il 2011 dal CRA¹⁸ nella Comunità Montana Matese¹⁹, gli intervistati del luogo considerano la produzione di legname da opera una funzione assolutamente trascurabile, e, più in generale, si rileva una scarsa percezione da parte della popolazione di quelle che sono le potenzialità (economiche e non) legate ad una risorsa naturale così diffusa sul territorio.

La situazione delineata ci restituisce una chiara linea da seguire: la mera pianificazione della superficie forestale a scala comunale non risulta sufficiente alla sua valorizzazione in termini economici. Si evidenzia altresì la necessità di una *governance* territoriale unitaria che permetta di definire strategie e obiettivi da seguire nel lungo periodo, necessariamente basati su un approccio di tipo sistematico, olistico ed ecosistemico affinché le risorse siano utilizzate nel rispetto dei principi della sostenibilità, ma allo stesso tempo cercando di massimizzare la loro capacità di fornire beni e servizi soprattutto per la comunità locale.

La comunità locale, seppur con una parziale diffidenza iniziale rispetto allo strumento noto e in uso (il PFA), ha totalmente compreso le caratteristiche prin-

¹⁸ CRA-SFA Unità di ricerca per la Gestione dei Sistemi Forestali dell'Appennino, Progetto di ricerca Pianificazione Forestale Territoriale - Relazione conclusiva, 2012.

¹⁹ Indagine condotta su un campione di 39 indagati fra attori istituzionali e attori attivi nel settore forestale e affini.

cipali e soprattutto visto le grandi potenzialità di un nuovo livello di pianificazione da sperimentare in quest'area, il Piano Forestale di Indirizzo Territoriale (PFIT). Questo si configura come uno strumento adatto a dare contezza delle risorse territoriali a scala comprensoriale sovra comunale (al di là del regime patrimoniale), determinando le destinazioni d'uso, le forme di governo e trattamento, nonché le modalità e priorità di intervento delle superfici boscate e pascolive, favorendo l'insediamento di popolamenti ad alto valore ecologico e produttivo²⁰. Si pensi ai boschi di neoformazione e alle loro potenzialità per l'economia locale: il prelievo legnoso, quale risultato della selezione di specie di pregio per facilitare l'insediamento di boschi secondari stabili, resilienti e con un maggiore valore produttivo, avrebbe in prospettiva dunque un notevole valore aggiunto sia in termini ambientali che economici. Proprio grazie al PFIT è possibile considerare in modo integrato necessità e criticità del settore forestale nonché valorizzare la multifunzionalità del bosco attraverso una gestione sostenibile. Ciò significa mettere a sistema funzioni quali la biodiversità, la produzione di legname e contestualmente garantire il servizio di mitigazione dei cambiamenti climatici (sequestro di carbonio), la raccolta di prodotti del sottobosco e la fruizione turistica del territorio, affinché si crei un bilanciamento²¹ nei rapporti e nell'utilizzo delle risorse ambientali. Nell'area del Matese, si tratta di tutelare il grande patrimonio ambientale presente, essendo stata l'area designata Parco Nazionale – processo *in itinere* –, e allo stesso tempo predisporre delle linee-guida a supporto della valorizzazione del legname da opera e da ardere. Il tutto deve essere pensato e progettato in ottica di filiera bosco-legna-energia, implementando schemi di certificazione (“legna del Matese”) atti a garantire la tracciabilità del prodotto e del processo. A questo si aggiunga un aspetto fondamentale: ancora una volta, la dimensione dell'innovazione. La predisposizione del PFIT, e quindi di misure di gestione forestale, risulta propedeutica al futuro inserimento della risorsa bosco del Matese nel mercato volontario dei crediti di carbonio. Come noto ormai da tempo, questo tipo di mercato rappresenta un'importante e reale possibilità economica non solo per le aziende operanti nel settore agro-forestale ma anche per le istituzioni e le comunità locali. Il meccanismo dei crediti di carbonio, inoltre, si pone in sinergia con gli schemi di pagamento per i servizi ecosistemici (*Payments for Environmental Services* - PES), più inclusivi rispetto ai primi. In relazione, ad esempio, a siti e habitat di particolare interesse naturalistico (rete Natura 2000), si prevedono interventi atti

²⁰ Strategia d'Area approvata, Area pilota Matese (http://www.agenziacoesione.gov.it/opencms/export/sites/dps/it/documentazione/Aree_interne/STRATEGIE_DL_AREA/Strategie_di_area/Molise/Strategia_di_Area.pdf).

²¹ Jon Paul Rodriguez, Jr. T. Douglas Beard, Elena M. Bennett, Graeme S. Cumming, Steven J. Cork, John Agard, Andrew P. Dobson, & Garry D. Peterson, *Trade-offs across space, time, and ecosystem services*, «Ecology and Society», 2006, vol. 11 issue 1, p. 28.

ad aumentare la stabilità ecologica degli ecosistemi e di valorizzazione turistico e storico-culturale legata alla loro fruizione. Infine, affinché si possa creare la condizione indispensabile per il raggiungimento degli obiettivi, per la loro riuscita e implementazione, il PFIT è il primo passo verso la costituzione del Contratto di Foresta, un vero e proprio modello di *governance* unitaria. Questo strumento di gestione partecipativa si fonda sulla concertazione fra amministrazione regionale e soggetti pubblici e privati locali²² che mira, attraverso scelte condivise, alla valorizzazione della filiera bosco-legno-energia.

Stabilire una *governance* unitaria significa allo stesso tempo mettere in sintonia gli interventi previsti sia nel settore agricolo che in quello forestale, affinché gli uni siano funzionali agli altri. Con tale logica, gli studi preliminari per la stesura del PFIT, ad esempio, non riguarderanno solo le aree boschate ma anche quelle pascolive, con particolare attenzione ai pascoli di altitudine, essendo spesso stati i primi a soffrire di fenomeni di abbandono. Tutto ciò va a sposarsi perfettamente con le azioni già previste dalla Banca della Terra. Il PFIT, infatti, rappresenterà uno strumento indispensabile di coordinamento e armonizzazione efficiente non solo delle attività forestali, ma anche di quelle del comparto agro-pastorale.

Per quanto sia difficile comparare differenti aree interne, relative realtà socio-economiche e condizioni iniziali di co-progettazione, un'azione simile è stata prevista nella Strategia d'Area dell'Alta Carnia nel 2016, area interna della Regione Friuli-Venezia Giulia. In quest'ultimo caso, l'intervento mira a sostenere iniziative orientate alla costituzione di un "condominio forestale" per far fronte al problema della frammentazione fondiaria (proprietà boschiva privata), cercando di stimolare, come prima conseguenza, lo sviluppo della filiera bosco-legno-energia. Ciò suggerisce che le aree interne possano condividere simili problematiche, si rende dunque necessario mettere in comune esperienze e interventi posti in essere nei diversi territori. Questo è il concetto alla base della Federazione delle aree interne, un lungimirante processo in atto che faciliterà il raggiungimento degli obiettivi della SNAI e dei territori.

4. Conclusioni

L'esodo rurale dell'età contemporanea ha provocato nell'area del Matese, così come nelle altre aree interne del nostro Paese, profondi cambiamenti.

Proprio la parola "cambiamento" racchiude la vera natura della SNAI, una variabile che dipende dal contesto.

²² Imprese boschive, segherie, piccole aziende artigianali, proprietari forestali (pubblici e privati), rivenditori, istituzioni tecnico-scientifiche (Università, CREA) e l'ARSARP.

Cambiare non ha necessariamente un'accezione positiva, viene declinata rispetto al contesto territoriale, a seconda della fiducia o sfiducia della popolazione in ciò che questo processo potrebbe generare. Pianificare un territorio secondo un approccio *bottom-up* significa vincere lo scetticismo della popolazione, svegliando le coscenze e conoscenze territoriali che in essa albergano da sempre. La commistione di sapere locale e sapere esperto ha permesso di ripartire dal Capitale Naturale per definire interventi e azioni fra loro sinergiche e funzionali allo sviluppo locale del territorio. Dallo stato di fatto, la grande presenza di boschi e terreni agricoli, sviscerando problematiche e potenzialità non espresse, si è arrivati a includere ricerca e innovazione in azioni e interventi: dalle cooperative di comunità alla vendita dei crediti di carbonio sui mercati dedicati.

Lo sviluppo territoriale in accordo alla valorizzazione del patrimonio ambientale nelle aree interne, non è poi così utopico e aleatorio, è invece una possibilità concreta, una strada da percorrere.

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