

**The relationship between
people and nature in
traditional rural landscapes:
*a case study from Southern
Transylvania***



Doctoral thesis by Andra Ioana Horcea-Milcu

2015

**The relationship between people
and nature in traditional rural
landscapes:**
a case study from Southern Transylvania

Doctoral dissertation

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In memory of my grandparents:

In memoria bunicilor mei:

Tătăicu, Ticu, Dada, și Banu

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*“C'est le temps que tu as perdu pour ta rose qui fait ta rose si importante.”
Antoine de Saint-Exupéry, The Little Prince*

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I dedicate this thesis to the magical and candid memory of my kind and good grandfathers, Dumitru Pătătu and Vasile Milcu, born in rural Romania ninety years ago.

Preface

This dissertation is presented as a series of manuscripts. Main chapters are designed to be stand-alone articles intended for scientific journal publication, completed before beginning the next chapter. Stylistic differences (e.g. U.K. or American spelling, hyphenation) and some repetition are possible among articles. Chapters II and III, and Appendices I, II, and III have been published. Chapters IV and V have been submitted to international scientific journals. Appendix IV is a manuscript in preparation. A reference to the journal each manuscript is published in or submitted to and the contributing co-authors are presented on the title page of each chapter or appendix. The content of each chapter or appendix is the same as the published journal article, with figure and table legends adapted to the presentation of this dissertation. The style used for citing literature in the text and for the references sections at the end of each chapter and appendix, respects the formatting requirements of the journal where the respective manuscript was published in or submitted to. Chapter I uses the reference formatting style of the journal *Land Use Policy*.

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Declaration

I hereby certify that the submitted dissertation entitled “The relationship between people and nature in traditional rural landscapes: a case study from Southern Transylvania” has been written by me without using unauthorized aids. I did not use any aids and writings other than those indicated. All passages taken from other writings either verbatim or in substance have been marked by me accordingly.

I hereby confirm that in carrying out my dissertation project I have not employed the services of a professional broker of dissertation projects, nor will I do so in the future.

This dissertation, in its present or any other version, has not yet been submitted to any other university for review. I have not taken or registered to take another doctoral examination.

Lüneburg, 24.03.2015

Andra Ioana Horcea-Milcu

Abstract

The importance of a social perspective on the relationships between humans and nature has long been acknowledged. The field of social-ecological systems research in particular is striving to achieve a holistic understanding of human-nature relationships by balancing social and ecological perspectives. Here I sought to develop a social understanding of the Saxon area in Central Romania, by exploring aspects of human-nature relationships as seen from the perspective of local people. To this end, I employed the concepts of social-ecological systems (SES), ecosystem services (ES) and cultural landscapes to assess perceptions of locals through empirical case studies.

I first conducted a literature review to acquire an overview of a particular type of human-nature relationship mediated by non-consumptive use and non-use values (“cultural ecosystem services”). Second, to isolate and address the interaction from the social system to the ecological system, I investigated the different ways locals perceived the role of landscapes in Southern Transylvania. I conceptually mapped these landscape preferences by revealing their potential land use and management implications. Third, to approach the human-nature relationship from the ecological system to the social system, I studied the flow of ES to disaggregated human beneficiaries. Specifically, I studied which factors, beyond ecosystem processes and functions, influenced nature derived human well-being from the perspective of potential beneficiaries. I conceptualised the mediating role of a range of contextual factors underpinning the current distribution of ES, with regard to the relation between ES and human well-being. Fourth, in order to explore an example of bidirectional human-nature relationship, I studied the particular case of human-carnivore coexistence and the suite of mechanisms shaping it.

Despite building throughout this thesis a more complex and in-depth understanding of the human dimensions of the studied system, I chose four main cross-cutting themes to explain the human-nature connection in Southern Transylvania. These four themes may serve as pillars of a socially minded understanding, as well as potential research and policy foci. First, the *values* held by locals are key for understanding the endemic human-nature relationships and should not be overlooked in future social-ecological assessments or policy interventions. Second, the cultural landscape of Southern Transylvania is both *a physical and virtual space* of social-ecological interaction fostering human-nature experiences and social-ecological knowledge integration. Third, the identified *diversity of the social system* in terms of landscape aspirations and ES beneficiaries is expanding the range of human-nature connections, but at the same time, may in future be a source of conflict or disconnection if not managed appropriately. Finally, *small-scale farmers*, through their interactions with the land and resultant belief system, play a major role in maintaining the human-nature relationships, but their values and lifestyle are threatened.

Chapter I

The relationship between people and nature in Southern Transylvania: a synthesis



*There is a pleasure in the pathless woods,
There is a rapture on the lonely shore,
There is society, where none intrudes,
By the deep sea, and music in its roar:
I love not man the less, but Nature more,*

*From these our interviews, in which I steal
From all I may be, or have been before,
To mingle with the Universe, and feel
What I can ne'er express, yet cannot all
conceal.*

G.G. Byron

1. INTRODUCTION

The aim of this introductory chapter is to lay out the background of this dissertation, summarize the included papers and draw out the general conclusions of this doctoral research. I first emphasize the need to understand and research the social dimensions of human-nature relationships, especially in the context of social-ecological systems. Second, I provide a short summary of three main concepts that supplied a useful theoretical “lens” for this thesis: the concepts of social-ecological systems, ecosystem services, and cultural landscapes. Third, I briefly explain the overall methods of data collection and data analysis. Fourth, a summary of the included papers aims to highlight the links between these, and to outline the studied aspects, methods and key findings that helped me build a social understanding of the study area. Finally, I derive four main cross-cutting themes that synthesize the developed understanding, and I discuss their implications for research and policy.

1.1 The challenge of a social understanding of human-nature relationships

The importance of the social sciences in understanding the relationships between nature and people has long been acknowledged. Research in natural resource management was among the first to draw attention on this potential caveat (Abel and Stepp, 2003; Glaser, 2006; Scoones, 1999). While being traditionally informed by insights from the natural sciences, aspects related to people and their interactions with nature have received less emphasis in the literature on natural resource management. More recently however, in the context of social-ecological systems thinking, acquiring a social perspective on the relationship between nature and people has become a fundamental concern. A social-ecological system (SES) is thought of as a tightly coupled system where (what is by agreement and artificially bounded as) the social (sub)system influences the correspondingly delineated ecological (sub)system and vice versa (Folke, 2006). This relatively recent approach encouraged an interdisciplinary perspective and opened the path for applying a social lens to these complex systems (e.g. Duraiappah and Rogers, 2011). The concept of ecosystem services (ES) was brought forward as a powerful but also contested framing of the human-nature connection (Flint et al., 2013; MA, 2005; Schröter et al., 2014). Research on ES, in particular on cultural ES (Chan et al., 2012a; Daniel et al., 2012; Milcu et al., 2013; Russell et al., 2013), called for collaborations between natural and social scientists (Burkhard et al., 2010; Ostrom, 2009; Steffen, 2009), and for fostering a cross-fertilization of the ecological sciences with the social sciences (Carpenter et al., 2009; Duraiappah and Rogers, 2011; Fischer et al., 2007; Fish, 2011). For example, a social perspective on human-nature relationships was found useful to learn about the importance and value people ascribe to ES (Daily et al., 2009; Spangenberg et al., 2014).

This has led to progress towards interdisciplinarity and the emergence of bridging disciplines between natural and social sciences (Pretty, 2011) that address the challenges of global change (Daily and Ehrlich, 1999), vulnerable SES (Folke et al., 2005), and biodiversity conservation (Campbell, 2005; Mascia et al., 2003; Sandbrook et al., 2013). Advancements have been made in understanding the social dimension of ecosystem management (Liu et al., 2007), including institutional flexibility (Anderies et al., 2004) and social capital (Adger, 2003). The idea of integrating social and ecological knowledge when researching human-nature connections and pursuing their sustainability, has likewise advanced on the political agenda of several global initiatives (IPBES – The Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services, see Díaz et al., 2015; Larigauderie and Mooney, 2010; TEEB – The Economics of Ecosystems and Biodiversity, 2010; UNEP – United Nations Environment Programme, 2012).

1.2 Motivation and aim

Despite the progress in bringing together the social and ecological sciences (Liu et al., 2007), the challenge has persisted until today to integrate social approaches when exploring the human-nature connection in SES (Carpenter et al., 2006; Cote and Nightingale, 2012; Folke, 2006). So far, social-ecological research on human-nature relationships has been framed around the concept of ES and conducted from a natural resource management perspective with a strong focus on ES generation and the ecological system. Only recently, researchers have begun to engage with the linkage between ES and the social system asking questions such as: how people perceive human-nature relationships or systems generating ES, which ES people value, who benefits from these services, and how issues of power and equity affect nature derived well-being. This gap is particularly evident when striving to link social knowledge to ecosystem change (Liu et al., 2007), as nicely put by Berkes et al. (2003: XIX), “ecological theory ignores the richness of people’s needs and inventiveness” in response to uncertainty and change. Despite the general recognition of the human role in shaping and changing SES, the vast majority of research focuses on the ecological rather than the human dimensions of these systems, thus hindering the understanding of human-nature relationships and limiting potential paths for their sustainable management (Kittinger et al., 2012). Similarly, research on ES tends to focus on proximate drivers of change (e.g. intensification, abandonment, invasive alien species), rather than ultimate factors (usually socio-political, economic or cultural factors such as markets, governance, consumption choices) (Carpenter et al., 2006; Norton et al., 2013). Research needs encompass clarifying the linkages between social and ecological systems, including a critical appraisal of the roles of these linkages in situations of change and under different socio-economic circumstances.

This thesis was developed within a larger interdisciplinary research effort: “Sustainable landscapes in Central Romania”¹. This umbrella project was part of the aforementioned initiatives to combine social and ecological knowledge (Berkes et al., 2003) in order to address complex problems at the interface of environment and society. The overarching goal of the project was to develop a holistic, social-ecological understanding of the Saxon area in Central Romania, broadly overlapping with the region of Southern Transylvania, and to identify pathways for its sustainable development. My thesis, in particular, provided insights into the social subsystem by applying social methods of investigation and analysis, complementary to the ecological ones targeting biodiversity assessments, and translated these insights into practical considerations for the sustainable future of the region. Hence, the central focus of this thesis was the social subsystem (defined as in Berkes et al., 2003: 41; Gunderson and Holling, 2002: 107) within the SES of Southern Transylvania, specifically its linkages to the ecological subsystem, as seen from locals’ perspective, and studied through the lens of ES. Moreover, this thesis aimed to clarify the theoretical and policy implications my findings on the relationships between people and nature in Southern Transylvania may yield with regard to identifying sustainable pathways for the future development of the region. In this scientific endeavor, I was motivated by the desire to explore and comprehend a wide spectrum of human-nature relationships in Southern Transylvania, while interacting and engaging with local communities.

The aim of this doctoral research was to develop a social understanding of the Saxon area in Central Romania, by exploring the human-nature relationships in these rural landscapes, based on the perspective of local people, through the lenses of ES and SES.

To this end, I investigated four research objectives:

- 1) to explore and review the current state of research on the non-material benefits people obtain from ecosystems, typically conceptualized as cultural ES. This overview resulted in a broad theoretical familiarity with a range of non-use values people associate with nature (Chapter II, Review paper);
- 2) to explore and understand the perceptions of local people regarding their relationships with nature by eliciting their landscape preferences (Chapter III, Empirical paper);
- 3) to explore and understand the perceptions of local people regarding their relationships with nature by examining which factors influence the distribution of nature-derived well-being among potential beneficiaries (Chapter IV, Empirical and conceptual paper);

¹ <https://peisajesustenable.wordpress.com>

4) to explore and understand a particular example of a reciprocal human-nature relationship in the rural landscapes of Southern Transylvania, by assessing perceptions of human-carnivore coexistence (Chapter V, Empirical and conceptual paper).

The remainder of this introductory chapter is organized as follows: First, I introduce the conceptual terms that underpin this doctoral work. I then provide an overview of the methods employed and a background of the study area. Next, I present the results of the individual chapters (II-IV) and appendices (I-IV). Finally, I discuss four cross-cutting themes and their implications. Notably, the Discussion section represents my reflections on the developed understanding of the human-nature relationships in the study system.

2. CONCEPTUAL AND THEORETICAL BASIS

Three concepts were particularly salient in this research: SES, ES and the notion of a “cultural landscape”. These concepts were also pertinent to the characteristics of the chosen study area, as I develop further in the Methods section, and underlie each of the thesis’ chapters, as I show in the Results section.

2.1 Human-nature relationships in a changing social-ecological system

First, I drew on the SES framework proposed by Berkes et al. 2003, and subsequently modified by others, including Folke (2006). This choice of theoretical framing was justified and guided by several arguments. Social-ecological approaches recognize intrinsic, tight links between humans and nature, as they “emphasize the integrated concept of humans in nature” (Berkes et al., 2003:3; Forbes et al., 2009; Gunderson and Holling, 2002:122). Synonymous “coupled human-environment systems” (Turner et al., 2003), “coupled human and natural systems” (Liu et al., 2007), or “human-environment systems” (Vihervaara et al., 2010) consider humans as an integrative part of nature. Within a SES, the delineation between the social and the natural system is artificial and arbitrary (Berkes et al., 2003; Gunderson and Holling, 2002), allowing the analysis of complex and numerous interactions between components. These interactions become even more important in situations of change when human actors in SES need to navigate uncertainties. Understanding social-ecological systems in the case study area was also influenced by a particular type of systems thinking, namely resilience thinking, a body of concepts and tools that deal with the structure and management of SES in the face of change (Folke, 2006; Holling, 2001; Walker and Salt, 2006; Walker et al., 2009). Resilience theory continues to develop, by building bridges between academic disciplines (Cote and Nightingale, 2012; Fischer et al., 2009), and towards policy makers (Lebel et al., 2006). Sometimes criticized for its vagueness (Strunz, 2012), some authors offer a more situated perspective of resilience in relation to the human dimensions of SES: “Resilience is the capacity of a SES to sustain a certain set of ES, in

face of uncertainty and change, for a certain set of humans” (Ernstson, 2008:36). Very recently, some authors have pursued to broaden it with insights from political ecology, thus striving for a more complete knowledge integration of human and ecological dynamics (Fabinyi, 2008; Peterson, 2000; Turner, 2014).

2.2 Human-nature relationships conceptualized via the concept of ecosystem services

Second, my research philosophy was grounded in the concept of ES, as a reference framing of the relationships between nature and people (Flint et al., 2013). Here, I often limited these relationships to the major linkages existing among broad categories of ES and components of human well-being, as identified by the United Nation’s Millennium Ecosystem Assessment framework (MA, 2005: VI). Initially termed as nature’s services (Daily, 1997), and subsequently defined as the “benefits people obtain from ecosystems” (MA, 2005: V), ES have become a heuristic tool for revealing the multiple ways in which ecosystems support human well-being, as well as an operational tool for making decisions (Daily et al., 2009) by using compelling language for policy makers (Foley et al., 2005). At the same time, the concept has generated a lot of criticism because of its hypertrophied focus on utilitarianism and potential commodification of nature (Schröter et al., 2014). For example, within a SES, ES are typically represented in the form of linkages that go from ecosystems to human systems, providing individuals, groups or communities with benefits. Specifically, some authors have viewed ES as a one sided simplistic metaphor (Norgaard, 2010), preventing or crowding out (Corbera et al., 2007a) other arguments in relation to different types of human-environment relationships (Raymond et al., 2013), and blind towards different, often non-material, values that beneficiaries may assign to ecosystems.

2.3 Human-nature relationships in a cultural landscape

The third concept I emphasized is the notion of “cultural landscape”, roughly a synonym for human-shaped environments (Bieling and Plieninger, 2013), where culture and nature are bound together (Pretty et al., 2009). Cultural landscapes are differentiated from other types of SES, through their spatial scale and the human-nature historical bond. Over long periods of time cultural groups transformed, and were in turn transformed by the natural landscape which they inhabited (see e.g. Berkes et al. 2003, Folke et al. 2005). Thus, cultural landscapes arise from a co-evolutionary process and are characterised by repetitive patterns of their often diverse elements (e.g. local communities or ecosystems) and the presence of unifying social or natural features (e.g. a similar governance history or topography).

This dissertation is in line with recent steps to integrate landscapes into the ES framework (Plieninger et al., 2014). Here, the relationships between people and nature have often been analyzed in light of ES available in the cultural landscape. This adds to efforts directed at bridging the interdisciplinary gap between research on ES and research on cultural landscapes,

an academic opportunity and challenge presently being tackled by several researchers (e.g. Huntsinger and Oviedo, 2014; Plieninger et al., 2014). Research on cultural landscapes complements knowledge on human-nature interactions and “deepens the understanding of their role in landscapes and ecosystems” (Schaich et al., 2010:274). In addition, in cultural landscapes, the relationship between human communities and ecosystems is evident, thanks to outputs such as historical human imprints on land uses, or cultural bonds (Plieninger and Bieling, 2013; Plieninger et al., 2006). Cultural landscape approaches also answer to preservation calls of supranational institutions such as UNESCO (World Heritage Convention, 1972) and the Council of Europe (European Landscape Convention, Council of Europe, 2000).

3 METHODS

The review part of the thesis (Chapter II) relied on desk research. For the empirical component of the dissertation (Chapters III, IV and V), I used a mix of quantitative and qualitative methods for data collection and analysis, with emphasis on the latter (Fig. 1). I directly collected or contributed to data collection through approximately 200 semi-structured interviews, 40 group interviews or workshops, and questionnaires in all of the empirical papers presented in this dissertation. With regard to data analysis, I conducted thematic analysis and used a grounded theory approach operationalised through coding, as qualitative methods. Quantitative data analysis methods included descriptive statistics, as well as multivariate methods (e.g. hierarchical cluster analysis, reversed factor analysis within the Q-methodology, principal component analysis). These techniques were generally applied in an exploratory manner to support inductive analysis (Fig. 1).

3.1 A thesis based on assessing perceptions

The underlying assumption of this dissertation is that locals are stake- and knowledge holders. They are considered both agents and recipients of changes occurring in the ecological and social subsystems. Hence, their perceptions provide rich and valuable information to understand and study the human dimensions of a given SES. In fact, a central piece of the newly emerging disciplines that seek solutions for managing SES in the face of change is engaging with “the knowledges of people within their contexts” (Pretty, 2011). Hence, in my empirical field-studies, I iteratively generated knowledge by consulting locals as experts, which produced insights complementary to scientific manifestations of knowledge (Tengö et al., 2014). In line with interdisciplinary frameworks for the analysis of nature’s benefit to humans, locals were treated as social actors (Biggs et al., 2012; Díaz et al., 2011) with different perceptions, needs, means

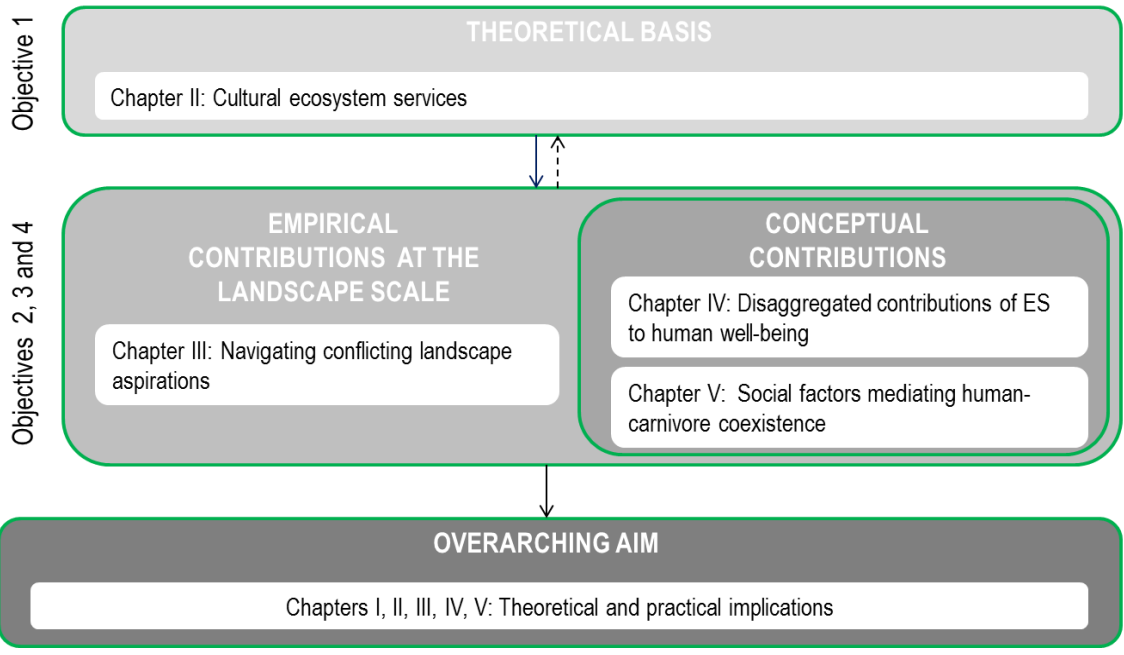


Fig. 1. Type of methodological contributions (review, empirical, conceptual) of included papers, direct (full arrows) and indirect (dotted arrow) relations among papers and relations with research objectives. All chapters include suggestions regarding the practical and theoretical implications of the attained deep social understanding of the study system, consistent to the overarching aim of this thesis.

and assets, in relation to ES (Chapter III) and land-use decisions agency (Chapter II). My research was focused on patterns and meanings of local attitudes, visions, interests, and values associated with living in this particular landscape of Romania (see also Bodorkós and Pataki, 2009). Within the umbrella project, my responsibility was to empower these local social actors to express and articulate their reality (Chambers, 1995), trying to grasp and explain what matters to them, within their knowledge system (Tengö et al., 2014). Limitations of this approach include the risk of overreliance on using people as providers of knowledge, and a trade-off for range in favor of representativeness.

3.2 Empirical case study at the landscape scale

Most of the empirical data of this dissertation was generated at a landscape scale through the study of the cultural landscape of Southern Transylvania, central Romania (Fig. 2). A landscape scale study emphasizes the human experience of nature and land (Wu, 2013), and makes a socio-cultural assessment of human-nature relationships relevant and challenging at the same time (Plieninger et al., 2014). Moreover, human-nature interactions are deemed to be the underlying forces of a given landscape (Palang et al., 2006). By applying a place based research approach (Fischer et al., 2014), I obtained firmly grounded findings which improve the specific understanding of social aspects relevant to ES and human well-being, and at the same time provide a nuanced, contextually situated understanding of human-nature interactions within human dominated rural landscapes (Kittinger et al., 2012; Reyers et al., 2013).

3.3 The case study of Southern Transylvania

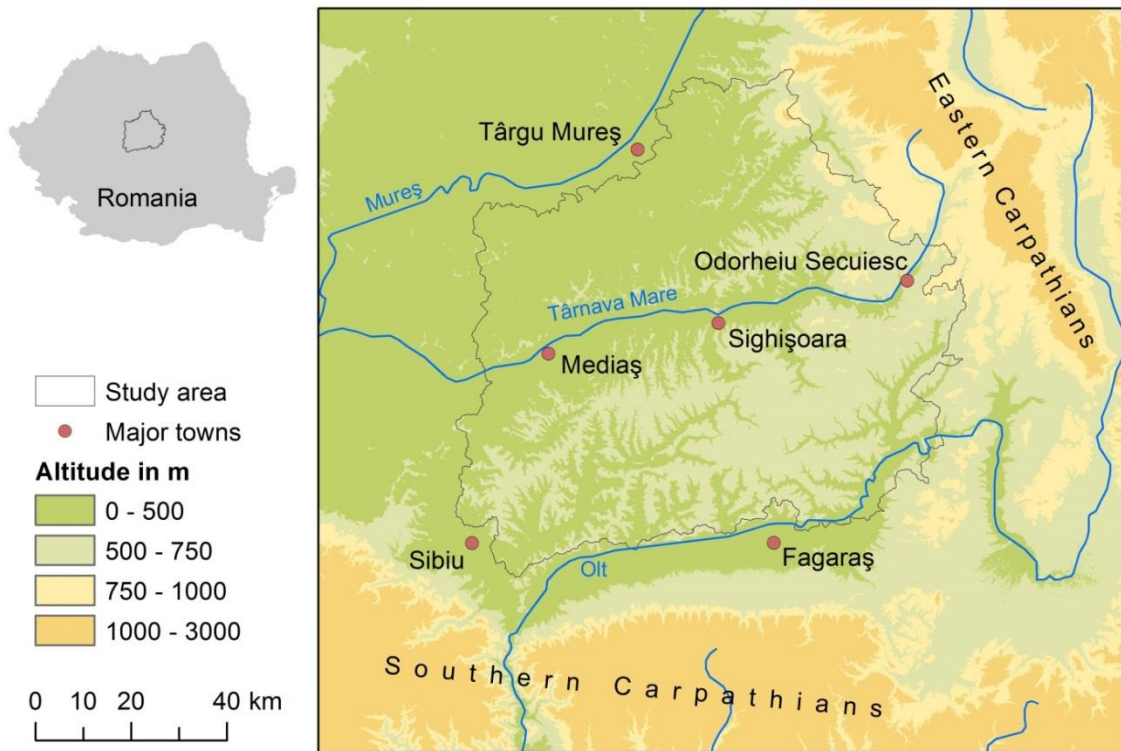


Fig. 2. Topographic map of the study area.

The case of Transylvania is valuable for various reasons. First, it is characterised by rather direct linkages between resource users and ecological dynamics (*sensu* Berkes et al., 2003; Folke et al., 2005). One such linkage is the persistent reliance of inhabitants on local ES (Plieninger et al., 2014), or the historical impact human activities have had on ecosystem processes (Palang et al., 2006). Sometimes referred to as a traditional rural landscape (Dorresteijn et al., 2013), a cultural-historic landscape (Loos et al., 2014a), a (low-intensity) agricultural landscape (Loos et al., 2015, 2014a), a traditional rural landscape (Hartel et al., 2010), a historic landscape (Akeroyd and Page, 2006), an acknowledged cultural landscape (Akeroyd and Page, 2006; Barthel et al., 2013), a traditional farming landscape (Fischer et al., 2012b), or an extensively managed rural landscapes (Öllerer, 2013), Southern Transylvania offers a fertile ground for applying a “human in the environment” perspective (Folke, 2006), as the concept of SES implies. This type of SES configuration stemming from a historical co-evolution of social-ecological factors is typically found valuable for its biodiversity, cultural and social characteristics (Fischer et al., 2012b; Plieninger et al., 2006).

Second, Southern Transylvania (Fig. 2) harbors some of Europe’s greatest natural (Loos et al., 2014a) and cultural diversity, being considered one of Europe’s last biocultural refugia (Barthel et al., 2013). The persisting small-scale farming (Kuemmerle et al., 2009) supports a

heterogeneous landscape mosaic and high levels of biodiversity (Akeroyd and Page, 2006; Cremene et al., 2005), that have been lost in other parts of Europe (Loos et al., 2015; Stoate et al., 2001). Due to its valuable species and habitats, large parts of the case study area are protected within the European Union (EU) Natura 2000 network as Sites of Community Importance (SCI, under the Habitats Directive EC, 1992) (e.g. Sighișoara-Târnava Mare), Special Protected Areas (SPA under the Birds Directive, EC, 2009) (e.g. Podișul Hârtibaciului), or even an overlap of the two types. The Sighișoara-Târnava Mare SCI covers 85 374 ha, making it one of the largest lowland areas of High Nature Value farmland in the EU². In addition to the diversity of the landscape, the region's history has shaped a rich cultural and ethnic diversity, even at the community level (INS, 2011). Historical periods, which can be roughly summarized as the Saxon period, communism, post-communism and EU membership, all have left prominent cultural and identity legacies, and have shaped the social and the ecological subsystems (Fig. 3).

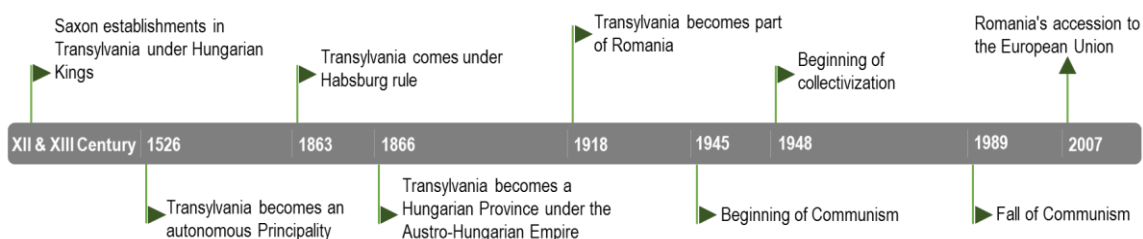


Fig. 3. Timeline depicting main historical events impacting Southern Transylvania.

Third, Southern Transylvania is changing under human influence and also as a consequence of recent historical events. The 2007 Eastern enlargement of the EU has caused tensions between people's aspirations for economic prosperity and the conservation of cultural and natural heritage (Young et al., 2007). Consequently, rural landscapes have faced the dangers of biodiversity loss, but also the threats of a challenged social subsystem and social capital (Bădescu and Sum, 2011; Newton, 2011). The shift towards a market-based economy and the progressive modernization of agriculture have made traditional agricultural practices no longer profitable for rural livelihoods, and have encouraged a strong rural-urban migration, especially of young people. Commonly and traditionally grazed areas are endangered by privatization (Hartel et al., 2010; Sutcliffe et al., 2013), and less visibly by the dissolution of the community itself, following a loss of community spirit and an increase of mistrust and individualism during and after communism respectively (Bădescu and Sum, 2011; Sztompka, 1993). The return to land ownership enabled by post-communism restitution laws (Kuemmerle et al., 2009; Mikulcak

²http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3798

et al., 2013) was quickly followed by market liberalization and competition, encouraging large-scale, intensive, profit-based agriculture. Very soon afterwards, in relation to EU integration, rural development measures (e.g. post-2007 economic incentives) were enforced seemingly without taking the reality on the ground into account and being often perceived as development barriers (Knight, 2010; Mikulcak et al., 2013). Notably, all these social, economic and cultural pressures are likely to affect locals' relationships to nature.

In light of the above, Southern Transylvania is a suitable case study system for exploring human-nature relationships in a changing rural landscape, based on the perspective of local people, through the lenses of SES and ES. The concepts and methods utilized in this thesis thus built an empirically grounded, landscape based understanding of the selected SES, by exploring and describing local perceptions on the human-nature relationships.

4. RESULTS

4.1 Structure of the dissertation

This cumulative dissertation comprises the following papers (Chapters II-V):

- II. Milcu, A. I., Hanspach, J., Abson, D., Fischer, J., 2013. Cultural ecosystem services: a literature review and prospects for future research. *Ecology and Society* 18(3), 44³.
- III. Milcu, A. I., Sherren, K., Hanspach, J., Abson, D., Fischer, J., 2014. Navigating conflicting landscape aspirations: Application of a photo-based Q-method in Transylvania (Central Romania). *Land Use Policy* 41, 408-422⁴.
- IV. Milcu, A. I., Leventon, J., Hanspach, J., and Fischer, J., 2015. Disaggregated contributions of ES to human well-being in low intensity farmland. Submitted to *PNAS Social Sciences*.
- V. Dorresteijn, I., Milcu, A. I., Leventon, J., Hanspach, J., Fischer, J., 2015. Social factors mediating human-carnivore coexistence: understanding coexistence pathways in Central Romania. Submitted to *AMBIO*.

Further information on authors' contributions, publication status and conference contributions are available in a separate Appendix of this thesis.

In addition, this cumulative dissertation comprises the following appendices (I-IV):

- A I. Mikulcak, F., Newig, J., Milcu, A. I., Hartel, T., Fischer, J., 2013. Integrating rural development and biodiversity conservation in Central Romania. *Environmental Conservation* 40(2), 129-137.

³ <http://dx.doi.org/10.5751/ES-05790-180344>

⁴ <http://www.sciencedirect.com/science/article/pii/S0264837714001392>

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- A II. Hartel, T., Fischer, J., Câmpeanu, C., Milcu, A.I., Hanspach, J., Fazey, I., 2014. The importance of ecosystem services for rural inhabitants in a changing cultural landscape in Romania. *Ecology and Society* 19(2), 42.
- A III. Hanspach, J., Hartel, T., Milcu, A. I., Mikulcak, F., Dorresteijn, I., Loos, J., von Wehrden, H., Kuemmerle, T., Abson, D., Kovács-Hostyánszki, A., Báldi, A., Fischer, J., 2014. A holistic approach to studying social-ecological systems and its application to southern Transylvania. *Ecology and Society* 19(4), 32.
- A IV. Mikulcak, F., Milcu, A. I., Bouriaud, L., Fischer, J., 2015. Who benefits? Power struggles around forest resources in post-socialist Romania. Manuscript in preparation.

Appendices I-IV are papers I co-authored during the PhD and which were conducted in the same study area. They bring additional insights that serve the overarching aim of the dissertation without being fundamental to understanding human-nature relationships in the Saxon area of Transylvania.

In the following, for each of the chapters, I briefly synthesize underpinning concepts, contributions to the research objectives, and key findings, while highlighting the main relationships to the other included research papers (see also Fig. 1). This summary is intended to avoid undue repetition and direct reader's attention to the latter part of this chapter, which proposes an emergent perspective on the overall contribution of this thesis.

4.2 Overview of included papers

Chapter II "Cultural ecosystem services: a literature review and prospects for future research" pursues Objective 1: to explore and review the current state of the research on the non-material benefits people obtain from ecosystems, typically conceptualized as cultural ES. It draws strongly on the concepts of "ES" and "cultural landscape". For this chapter, I performed a bibliographic, semi-quantitative review of 104 mainly peer-reviewed publications on cultural ES (CES) (de Groot et al., 2005; MA, 2005). Despite some publications referring to CES only superficially, I identified five clusters of publications: (1) conceptual papers; (2) descriptive reviews; (3) papers on localized outcomes; (4) social and participatory papers and; (5) economic assessments. One of the distinctive contributions of this paper was to link the strengths of the identified literature clusters to the following proposed opportunities for future CES research: a) acting as a theoretical bridge between different disciplines and research communities; b) serving as a tool for engagement; c) and fostering conceptual links between social and ecological issues. During the course of this review, it also became apparent that there are many parallels in this field of research to other bodies of work, especially to cultural landscape research. The elicitation of non-material landscape values (e.g. Bieling et al., 2014) may prove valuable for future CES assessments. This stage of my doctoral work expanded my theoretical knowledge

and helped me calibrate and refine the perspectives I was to apply to the case study system in subsequent papers. It also equipped me with a broad socially orientated understanding of ES, and familiarity with a wide range of cultural and non-use (e.g. existence) values (Chan et al., 2012b; MA, 2005: VI).

Chapter III “Navigating conflicting landscape aspirations: Application of a photo-based Q-method in Transylvania (Central Romania)”, aimed to understand human-nature relationships in the Saxon area by assessing locals’ appreciation and aspiration of landscapes, therefore contributing to Objective 2 with a typology of landscape preferences. By using the Q-methodology that combines quantitative and qualitative research techniques, within 129 sorting interviews with local people, I identified five “preference narratives”: (1) landscapes for prosperity and economic growth; (2) landscapes for traditions and balanced lifestyles; (3) landscapes for human benefit; (4) landscapes for farming; and (5) landscapes for nature. The focus of these preference narratives or viewpoints (factors) may be positioned on a continuum from modern to traditional aspirations regarding the landscape.

This chapter indirectly links to the previous one, through the bulk of qualitative data I gathered and interpreted. The cultural services provided by the landscape were present in each of the five elicited preference narratives (or viewpoints) to a greater or lesser extent. For example, locals sharing the first viewpoint were willing to accept the trade-off between prosperity versus cultural and natural heritage that might come with development. The importance of non-material benefits for this group was low and they appreciated cultural values largely to the extent they could provide some sort of entertainment. In contrast to the first factor, during interviews with locals grouped under the second factor, I identified a large and diverse range of CES that they appreciated and valued such as: sense of place, cultural heritage, spiritual values, cultural diversity. The third preference narrative inclined towards traditional rural landscapes but without its discourse clearly identifying elements of cultural identity or heritage. According to post-sorting interviews, within this narrative, the landscape was seen as a space for celebration and community. The fourth narrative coincides with a utilitarian view of nature. Locals sharing it were least impressed by the beauty of nature and felt little connection to recreation activities in nature. However, they expressed appreciation for open settings, and had an aesthetic preference for well-maintained landscapes that mirror stewardship qualities. People sharing the “recreation consumer” viewpoint (fifth factor), typically appreciated a natural landscape for its visual and aesthetic qualities.

Chapter III was highly influenced by the consideration of Southern Transylvania as a diverse cultural landscape, delivering tangible and intangible values (e.g. cultural) (Chan et al., 2012b), that is shifting away from one single, well-defined management goal to multiple, often

conflicting goals corresponding to existing viewpoints within communities. In accordance to the integrated concept of SES where humans are agents of ecosystem change, the way humans look at their landscape influences their behavior and practices which in turn shape the landscape and perpetuate the connection to it (see also Swanwick, 2009). With this in mind, I envisioned how the systematized aspirations and expectations people projected onto the landscape could be reflected into land-use decisions and management practices that would affect the landscape and its land-use. This enabled me to explore the relation from the social subsystem to the ecological subsystem ($S \rightarrow E$).

Chapter IV “Disaggregated contributions of ecosystem services to human well-being in low-intensity farmland” contributes to Objective 3: to explore and understand locals’ perception of their relationships to nature. It explores the distribution of nine provisioning ES among potential beneficiary groups in Southern Transylvania and the contextual factors that explain this distribution. Data collection was based on group interviews. For analyzing the data I used an informed grounded theory approach operationalized in two iterative cycles of coding. This chapter responds to calls for context-sensitive empirical research on human-nature relationships, that may uncover broader aspects than the initial operationalization of the ES concept allowed for, but at the same time develop stronger concrete evidence for relating ecosystems and human well-being, as proposed by the MA (Flint et al., 2013; Kittinger et al., 2012; Reyers et al., 2013). Here, I revealed six mediating factors that better situate the relations between human well-being and nature’s benefits: (1) condition of the supplying ecosystem; (2) policies and institutions; (3) social and power relations; (4) household decisions and individual contexts; (5) perceptions of equity; and (6) individually held values. Depending on where the system boundaries are drawn and defined (Kittinger et al., 2012) and on the level of resolution of the analysis (Díaz et al., 2015), these factors may be exogenous or endogenous to the SES. The way ES contribute to human well-being depends not only on the condition of the supplying ecosystem (1st factor), but also policies and the institutional environment (2nd factor) influence how ES are accessed and how well-being is influenced by them. The 3rd factor emphasizes the network of social and power relations among beneficiary groups. In accordance to human agency and human action as a central part in understanding the capacity of ecosystems to generate ES (Díaz et al., 2011; Reyers et al., 2013; Spangenberg et al., 2014), I also pointed to the importance of individual strategies for well-being, that is, the livelihood choices, capacities and interests of different individuals (4th factor). Finally, the study brought to light perceptions about equity (5th factor), and internal norms and values (6th factor).

Chapter IV showed how a multi-dimensional context creates winners and losers among potential ES beneficiaries in Southern Transylvania. The original contribution of this paper is its conceptualization of the contextual space between ES and human beneficiaries, beyond the

simple notion of ES benefits. This conceptualization may serve as a continuation of the Haines-Young and Potschin (2010: 25) “cascade model” that goes from biophysical structures or processes to functions, services and finally to benefits, without disaggregating among beneficiaries. This chapter challenges the dominant and fixed conceptualization of the relations between ES provision and aggregated contribution of ES to human well-being, by replacing it with a more nuanced, explicit and contextualised perspective on disaggregated contributions of ES to human well-being. Hence, this chapter allowed me to focus on the relation from the ecological subsystem to the social subsystem ($S \leftarrow E$) by looking at the local, constructed realities around nature’s contributions to well-being.

Chapter V “Social factors mediating human-carnivore coexistence: understanding coexistence pathways in Central Romania” allowed me to focus on the reciprocal social-ecological interactions within the Transylvanian linked SES through the example of human-carnivore coexistence. Here, co-existence is presented as an outcome of internal co-evolutionary processes that enabled locals to meaningfully experience nature through time (in both utilitarian and non-utilitarian ways), with cultural experiences playing an important part. Through 252 questionnaires and 70 semi-structured interviews, this study revealed three so-called pathways via which interaction mechanisms shape locals’ attitudes and perceptions of bear (*Ursus arctos*) proximity: the landscape-bear coexistence pathway, the landscape-human coexistence pathway and the management coexistence pathway. The landscape-bear coexistence pathway describes that direct human-bear interactions or experiences within the landscape were major factors shaping people’s perceptions and beliefs about bears. The landscape-human coexistence pathway showed that genuine human-environment connections stemming from people appreciating their natural surroundings had a positive influence on people’s attitudes towards bears and on their attributing non-use values to bears. The management coexistence pathway revealed that distrust towards management bodies and the disempowerment perceived by locals may erode the rural population’s tolerance for bears. This chapter advances the notion of co-existence pathway with a two-fold intention. First, it explains mechanisms through which ongoing interactions between components of the social subsystem and components of ecological subsystem emerge in, and at the same time influence human-carnivore co-existence. Second, it further develops the understanding of the human-nature relationship using locals’ subjectivity as a reference, and lays the ground for future analysis of the social learning process in response to the ecological subsystem. Within this chapter, I took the opportunity to consider coexistence as a case study to investigate the bidirectional relationship between the social subsystem and the ecological subsystem ($S \leftrightarrow E$).

Appendix I “Integrating rural development and biodiversity conservation in Central Romania” sought to understand the role of Transylvania’s local governance in integrating biodiversity

conservation and rural development. It does so by analyzing the implementation of EU rural development policy within Romania at the local level, highlighting the perceptions and expectations of local actors (here town hall representatives from 30 villages) in relation to it. As highlighted by Diaz et al. (2011), elements of a simplified wider context of a local SES, such as legislation and government interventions directed at compliance to supranational regulations, may modify the social component of the local SES, consisting of local actors. Such large-scale processes may also influence human-nature relationships within local SES (Liu et al., 2007). Appendix I therefore touched on the impact of these higher level exogenous drivers (i.e. the EU rural development policy) on the local and regional social subsystems that may have indirect repercussions in their linkages to the ecological subsystems. For example, our findings indicated that several town hall representatives considered the Natura 2000 status a barrier to rural development, highlighting “problems of fit” (Forbes et al., 2009) of the institutions pertaining to the social subsystem and expected to perform within a multi-level governance system. This paper was the first within the umbrella project to depict the major social and economic problems affecting the region that would later be confirmed by many of the studies directed at the level of local communities: lack of non-farming job opportunities, emigration of rural youth, low community cohesion, and poor infrastructure.

Appendix II “The importance of ES for rural inhabitants in a changing cultural landscape in Romania” was a pilot social study. It addressed the linkages between the natural and human components by applying various conventional survey-based techniques focusing on getting a first measure of locals’ perception of the importance of ES. A simple scoring exercise revealed provisioning services were the most valued by rural communities, while semi-qualitative interviews confirmed many of the social and economic themes elicited in Appendix I. Appendix II orientated my methodological choice for ways to elicit what locals prefer to see in their landscape (Chapter III) and set the scene for exploring how they experience the well-being contributions that derive from top-scored ES, in terms of distributional issues, power and fairness (Chapter IV).

Appendix III “A holistic approach to studying SES and its application to Southern Transylvania” provides a spatially explicit understanding, complementary to the social one, of the SES in Southern Transylvania, particularly of its future. Stakeholders were involved in a participatory process of scenario elaboration via the organization of multiple workshops to identify regional dynamics and future trends, and included the mapping of social-ecological conditions in the study area. As main results, the study presents four different future scenarios for the region, as well as spatial maps of possible trends of key variables in the future. The three implications of this spatial understanding broadly coincide with conclusions I reached by following a dominantly qualitative approach (especially in Chapter IV). First, historical legacies

and contingencies shaping the dynamics of the Transylvanian SES, were also shown to mediate nature's contribution to human well-being in Chapter IV. Second, the influence of external drivers that steer regional development pathways was again evident in Chapter IV where similar exogenous contextual factors (such as national and supranational policies) were found to influence locals' access to ES. Depending on the level of resolution, national and supranational institutions and policies are commonly associated with indirect drivers of change influencing the regional or local SES (Díaz et al., 2015). For example, within the study area, the EU (through the Common Agricultural Policy – CAP and the Natura 2000 network) acts as an external large-scale indirect driver of change influencing not only rural development (Appendix I, III) but also the ES flowing from the ecological to the social subsystem (Chapter IV). Third, local system properties that can enhance or counteract the effects of external drivers were also supported by Chapter IV which points out that ES inequities created by the identified mediating context may not be fatal or unavoidable.

Appendix IV “Who benefits? Power struggles around forest resources in post-socialist Romania” was a local level stakeholder analysis of the forest sector in Southern Transylvania. Forests were regarded here as components of the ecological subsystem, with their management and governance being a result of processes within the social subsystem. We aimed to understand the web of actors, stakes and powers in relation to the forest. To this end, we used the same notions of structural and relational access mechanisms as in Chapter IV, according to the theory of access proposed by Ribot and Peluso (2003). We found that institutions pertaining to the national central administration are perceived as having high power and high stake in forest governance. We explained four mechanisms through which such stakeholders exercise their powers and retain access to forest resources.

4.3 Elucidating the internal coherence of the cumulative dissertation

A significant aim of this summary chapter is to specifically lay out the internal coherence between the sub-parts of this cumulative dissertation⁵. In addition to the relations between papers signaled in the previous subsection, I will try to attain this goal by referring to Fig. 4, inspired by a number of scholars engaging with understanding and managing SES: Berkes et al. (2003: 22), Ernstson (2008: 36), Fischer et al. (2012a: 5), Folke (2006: 9), and The Resilience Alliance⁶. Contrasting with original versions of the social-ecological framework, centered around ecological knowledge and understanding (see e.g. Berkes et al., 2003: 22; Folke, 2006: 9), Chapter II laid the foundation for a social understanding and served as an initial basis to the

⁵ According to the “Doctoral Regulations of the Faculty of Sustainability of Leuphana University of Lüneburg” 2011, and to the “Guideline for cumulative dissertations” enacted 2012.

⁶ <http://www.resilience.org/>

more contextualized and localized contributions of the following chapters. In accordance to all those cited above (see also Gonzalez et al., 2009; Kittinger et al., 2012; Raymond et al., 2013: 538), the relationship between people (social subsystem) and nature (ecological subsystem) is intrinsically bidirectional. While being fully aware of the reciprocity and complexity of relationships between societies and ecosystems, macro social-ecological relationships have two main components: human actions affecting the ecological subsystem, and ecosystem goods and services provided to the social subsystem (Fig. 4 A) (see also Binder et al., 2013). In Fig. 4, the interaction between the social and the ecological subsystem is decomposed according to the above components: from the social subsystem to the ecological subsystem ($S \rightarrow E$), and from the ecological subsystem to the social subsystem ($S \leftarrow E$). In its entirety, Fig. 4 also illustrates the reciprocal nature of social-ecological relationships $S \leftrightarrow E$. Chapters III and IV may be associated to the two unidirectional components of the human-nature relationship while keeping with the social perspective of the dissertation. Chapter III details the perspectives of locals on their relations *to* nature, through landscape aspirations. Chapter IV deals with the constructed reality of locals around services and benefits *from* nature. Chapter V is a particularization of the bidirectional relationship restrained to bears (as components of the ecological subsystem), and locals (as components of the social subsystem). Appendices I and III are an attempt to populate the framework with insights into how the SES relates to exogenous drivers of change (such as the national and supranational institutional pressure) and into how to navigate its ensuing dynamic through management practices, informal institutions, bridging organizations, pertaining rather to the local social subsystem. Appendix II informs the framework with perceptions of locals on the importance of ecosystem services they derive from nature. Appendix IV focuses on the regional institutions and governance involved in natural resource management, using the case study of forest resources. Fig. 4B) is complemented by the efforts of my project colleagues, who mainly worked within the limits of the ecological subsystem or assessed the influence of direct drivers of change (e.g. land-use change, MA, 2005: 64). Finally, I caution here that this conventional representation of the two subsystems as separate (Fig. 4) is a false dichotomy and intended for ease of communication, abstraction and visualization.

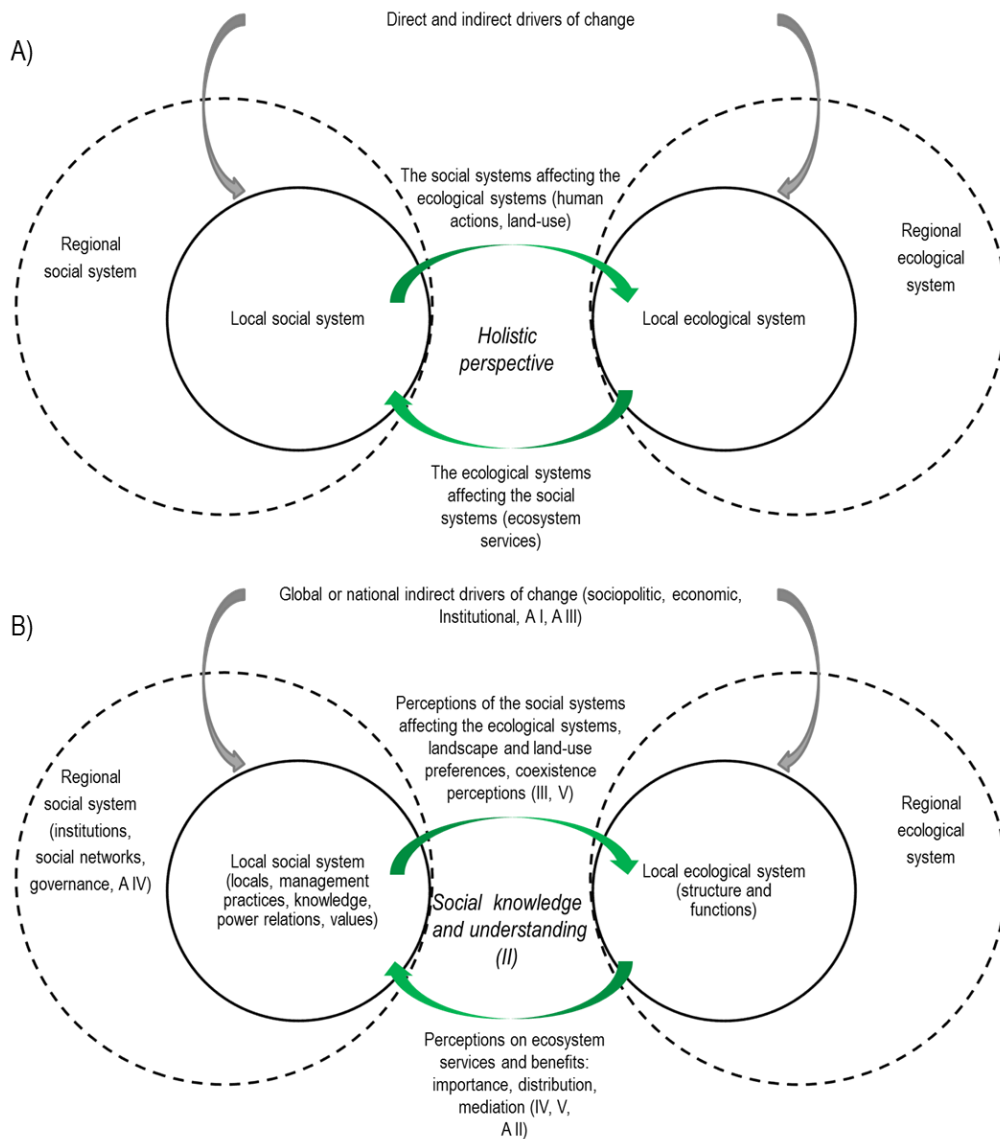


Fig. 4. The underlying logic behind the thesis' chapters is embedded in the conceptual framework for the analysis of interlinked SES (e.g. Berkes et al., 2003). Fig. 4A) is closer to existing versions (see e.g. Berkes et al., 2003: 22; Folke, 2006: 9), recognizing the reciprocity between subsystems without describing or specifying them. Fig. 4B) is a more informed version of Fig. 4A), particularized according to the chapters' empirical and conceptual contributions. Roman numbers (II-V) show a possible positioning of chapters' contributions within the framework. The positioning of appendices' contributions is indicated with A (I-IV).

5. DISCUSSION

In the following, I identify four themes that span the different summarized studies. These four cross-cutting themes relate to the human dimensions of the studied system thought to foster and support human-nature relationships in Southern Transylvania. Below I use the four themes to structure the empirically acquired understanding of the studied SES and of the relationships between people and nature. At the end of the section, I briefly discuss their implications.

5.1 The importance of held values for human-nature relationships

As expected for a dissertation based on researching subjectivity, the essential role of values cannot be overemphasized. In Chapter II, I underline how the most intangible among MA categories of ES, the cultural ones, fail to encompass the variety of non-use values (including intrinsic, see Raymond et al., 2009), as well as other socio-cultural dimensions of ES, which are particularly relevant for cultural landscapes (e.g. López-Santiago et al., 2014). Other scholars correspondingly criticized the concept of ES for not being sufficiently inclusive of human-based values as stand-alone or part of linkages between nature and humans (Bieling et al., 2014; Ernstson, 2013; Raymond et al., 2013). Although last within the cognitive hierarchy after attitudes and basic beliefs (Ives and Kendal, 2014), and particularly difficult to elicit, personal and community held values often underpinned or influenced the qualitative results I obtained. For example, the normative value of not abandoning agricultural land (Chapter IV), and the values attributed to a maintained landscape (Chapter III), stem from the experiences of local people gathered in the long course of engaging with the landscape. At the same time, these values presently maintain the human-nature relationships. Chapin (2006) confirmed that cultural ties to the land are a type of slow social variable shaping how the social subsystem interacts with the ecological one. I hypothesize the elicited intrinsic values play a fundamental and stabilizing role in the cultural landscapes, while keeping the system resilient, all the more because they are slower to change and relatively stable (Ives and Kendal, 2014). Yet, such values face the risk of being eroded (Chapin et al., 2006) or in more economic terms, “crowded out” (Clements et al., 2010; Corbera et al., 2007; Kosoy and Corbera, 2010; Muradian et al., 2010) by exogenous factors – from large-scale institutional arrangements (e.g. monetary incentives), to values extrinsic to the landscape that created and nurtured them. The importance of values and perceptions is increasingly being recognized and integrated within frameworks and worldwide initiatives (Díaz et al., 2015; Fisher et al., 2014; Kittinger et al., 2012; Ringold et al., 2013). In the case of Southern Transylvania, I envision a looming tipping point when the landscape-born value system will shift under a combination of exogenous and endogenous pressures, entailing a whole system perturbation. SES are vulnerable not only to ecological changes, but also to social ones (Forbes et al., 2009), and these may well be the most profound ones (Fischer et al., 2012a; Ives and Kendal, 2014).

5.2 The cultural landscape as a favorable space for human-nature relationships

This dissertation emphasized the role of the cultural landscape for the human-nature relationships in Southern Transylvania. Especially Chapters III and V strengthened the idea of the Transylvanian landscape functioning as an interface, a provider of physical and virtual space for experiencing components (carnivores, in Chapter V) and functions (ES in Chapter IV) of the ecological subsystem, but also landscape aspirations (Chapter III). The cultural landscape of

Southern Transylvania is not only the scene for the historical co-evolution that allowed locals to meaningfully relate to nature in both utilitarian and non-utilitarian ways, but also the current daily arena for interaction, connection and proximity between elements of the social and ecological subsystem, such as farmers engaging with the land, or shepherds considering bears as “neighbours”. I posit that this landscape interface has similar characteristics to those of a socio-cultural institution (see Pretty et al., 2009), and thereby contributes to maintaining the human-nature relationship. Inversely, disconnection from the landscape was shown to erode the human-nature connection of cultures that have been closely tied to their environments to the point of creating psychological, physical and financial dependency on the state (Pretty, 2011), as also demonstrated in Chapter IV. However, the proximity of nature could, to a certain extent, reverse or counterbalance the action of disconnecting factors, such as institutional ones, as revealed in Chapter V. Finally, the salience of the theme “well-maintained landscapes“ within conducted interviews emphasizes the functional quality of the landscape, being defined, maintained and kept alive by the amount and types of bidirectional relationships established at its interface between the social and the ecological subsystem. These interactions foster ecological knowledge, value creation processes (Ernstson, 2008), and co-production of ES from human agency and ecosystem functions (Selman and Knight, 2006). Moreover, their abundance is associated with a higher degree of social-ecological resilience (Biggs et al., 2012; Folke et al., 2005). Initiatives to rebuild the people-nature connection at the spatial and functional level of a landscape are increasing in importance worldwide (Plieninger et al., 2006; Takeuchi, 2010).

5.3. Diversity within the social subsystem

This thesis revealed a diversity of human-nature relationships in Southern Transylvania. It also highlighted the diversity of several elements pertaining to the social subsystem. Different formal and informal institutions, land-use preferences, management approaches, various values, perspectives and interests were found and explored within the studied communities. Specifically, Chapter III describes the diversity of landscape preferences and aspirations, and the multiple values and roles local people assigned to their landscape. Chapter IV points to the diversity of experiencing nature derived well-being by considering, *inter alia*, the micro scale of interactions within the social subsystem (Binder et al., 2013) through social networks and relations. Simultaneously to the social diversity, the diversity of elements within the ecological subsystem strongly emerged from my colleagues work on multiple species and land-covers in the study area (Dorresteyn et al., 2013; Loos et al., 2015, 2014a). Interestingly, the heterogeneity and multifunctionality of the landscape was an important finding of both social (Chapter III) and ecological studies (Loos et al., 2014b). In fact, literature emphasizes linkages between landscape heterogeneity and the diversity of opinions, as well as the heterogeneity of locals’ livelihoods, especially regarding their somewhat potential co-decline. Authors caution that “monocultures of

land, people and mind” may take over (Pretty, 2011; Pretty et al., 2009), following changes in lifestyles, land use practices, migration patterns and globalization. Although other more conceptual studies already acknowledged the internal diversity of both ecological and social subsystems as essential (Díaz et al., 2011), my scholarly engagement with the study area also suggests an instrumental role for economic and income diversity (Scoones, 2009; Solymosi, 2011), diversity of opinions and interests, and perceptual diversity. This doctoral work adds to voices advocating against the progressive homogenization of rural spaces, including of rural landscapes communities (Pretty, 2011; Selman and Knight, 2006), moreover in view of the established positive correlation between diversity and resilience (Biggs et al., 2012). Such diversity is all the more important for sustainability in an era of changing environments, and “one size fits all” policy goals.

In addition to being a strength for the region, the diversity within the social subsystem may be regarded as a source of vulnerability. My findings indicate that this diversity of human-nature relationships (Chapter III) and ES related livelihoods (Chapter IV) may lower community spirit, if not managed carefully. Based on Chapter III, I anticipate conflicts between those wishing to maintain the traditional and cultural landscape, and those sharing a more utilitarian perspective regarding the role of the landscape. For example, it has been suggested that major disputes may arise from the initially latent tensions between nongovernmental organisations and residents sharing an informed interest in cultural and natural heritage preservation and privileging the “landscapes for traditions and balance”, and other residents who try to imprint their own identities and values on the landscape (Chapter III) (Hughes, 2008; Young et al., 2007). To inform community interventions, research may pursue a critical appraisal of the identified viewpoints such as questioning the legitimacy and feasibility of the more idealistic viewpoints (Corsale and Iorio, 2014), and the sustainability of the more growth-orientated views (see also Appendix III).

5.4. The small-scale farmer and human-nature relationships

Finally, during this doctoral research small-scale farmers emerged as a key component of the social subsystem, maintaining typical ecosystems and sustaining a certain value system within the cultural landscape of Southern Transylvania. Through chapters III and IV, I achieved a good understanding of small-scale farmers, including how they relate to their environment, their interests and values, and the way they experience nature-derived well-being. Ecological studies typically underline the conservation benefits of low-intensity small-scale farming, while the maintenance of high nature value (HNV) farmland is a policy priority for the EU (Sutcliffe et al., 2014). In Transylvania, this richness and diversity of nature is supported by the small-scale mosaic of cultivated land, and the diversity of the land-uses (Babai and Molnár, 2014; Loos et al., 2014b). The creators of this balanced mosaic are the small-scale farmers, characterized by a

high degree of interaction at least with the biophysical landscape (Bieling et al., 2014). Some studies also demonstrated the cultural side of their relationship to nature (e.g. Burton, 2004). Indeed, results in Chapter IV confirmed that small-scale farmers are functionally connected to the landscape. At the same time it showed how a set of mediating and contextual factors may seriously challenge this group and its ability to benefit from nature, to the point of increasing its vulnerability to changes in ecosystems. Chapter IV also pointed out that small farmers talked about the normativity of cultivating the land, hence interacting with it, as something that is linked to their identity and way of life. Taken together, my interviews with small-scale farmers depicted them as the ones closing the loop between ecosystems and people (see also Raymond et al., 2013). Small-scale farmers are the ones maintaining a balanced cycle of (labor and resource) investments in and returns from nature (in their words: “spinning around the stock [land]”). They appear as stewards of the landscape that provides them with life-support functions and economic opportunities (see also Selman and Knight, 2006). These findings may point to small-scale farmers not only as investors of human agency in order to mobilize and appropriate ES, but as the actual agents of the human-nature relationship in Southern Transylvania, endowed with the human capacity to preserve them.

5.5 Implications

Here I reflect on the wider policy and research implications of the four cross-cutting themes arising from this thesis. These are meant to be non-exhaustive propositions.

Understanding held values and eliciting perceptions. Drawing upon social sciences helped to produce a socially biased, but arguably insightful, and deeper understanding of the relationships between the natural and the social subsystems. Increasingly, scholars have begun to acknowledge that there is a social side to the production of ES (e.g. Ernstson, 2013). Essential social inputs such as anthropogenic activities or value articulation processes contribute to their creation (Reyers et al., 2013; Spangenberg et al., 2014), while various social factors mediate the relations between human well-being and ES (Chapter IV). Relations and dynamics among components of the social subsystem, such as power networks, are also deemed important (Chapter IV, see also Binder et al., 2013). However, within the multitude of traits (Kittinger et al., 2012) and processes within the social subsystem, the results of this research stress the importance of investigating the held values (Ives and Kendal, 2014) with regard to the different aspects of the human-nature connection. Locals’ held values were found to furnish a great explanatory power (see also Evans and Cole, 2014), especially as ultimate driving forces (Norton et al., 2013). In addition, within a complex SES, intrinsic values may arguably represent an intervention point with greater potential for changing the system (Meadows, 2008). Nevertheless, a sole social perspective does not suffice and sustainably tackling a SES through

action or analysis demands scientists and policy makers to integrate interdisciplinary knowledge and approaches (Clark et al., 2003).

Capitalizing on integration within the landscape interface. According to the emerging understanding acquired through this doctoral work, the landscape appeared as a favorable space for facilitating and reinforcing human-nature relationships. In addition, considering the landscape as an interface between the social and the ecological subsystem has potential research implications. For example, studies at landscape scale may create premises for the integration of social and ecological academic disciplines, but also of local knowledge. Literature also notes ways in which the landscape may represent an integrative framework for research and policy (Selman and Knight, 2006), but also “the most operational scale for understanding and shaping the relationship between society and the environment” (Wu, 2013:1019). Conservation strategies considering the composition and configuration of the landscape as a whole may ensure a more effective management for sustainability. Most importantly, when answering to external shocks and increasing pressures, capitalizing on the capacity of the landscape to nurture human-nature connections and fight disconnection may create better premises for the SES to reorganize in ways that allow it to continue to function (social-ecological resilience cf. Folke, 2006).

Managing for diversity while building social capital. The identified diversity of the social subsystem in terms of landscape aspirations and experiencing ES benefits is expanding the range of human-nature connections, but at the same time may in future be a source of conflict or disconnection if not managed accordingly. Recent changes in technology and farming are likely to continue to increase the heterogeneity of aspirations and individual contexts. In the face of diverging landscape preferences and well-being strategies involving a greater or lesser reliance on ES, it will become increasingly important to manage the ecological subsystem for diversity, while taking into account the diversity of the social subsystem. The maintaining and harnessing of the diversity of the SES, encompassing spatial heterogeneity, but also diverse institutions, livelihood strategies and governance structures, was shown to enhance the resilience of ES provision, by creating redundancy and supporting a diversity of responses (Biggs et al., 2012; Díaz et al., 2011). For example, in the social subsystem, the diversity of values and perspectives can protect against behaviors threatening the ecological subsystem (Biggs et al., 2012), such as the diversity of perceptions about carnivore coexistence may guard against drastic measures and keep the general level of carnivore acceptance relatively high. However, a diverse social subsystem must not run the risk of there being low social capital. Strong communities are needed to reduce the threat of potential conflicts arising among its members and to negotiate diverging land-uses (for example), while social capital is recognized to play an enabling role in rural settings (Mikulcak et al., 2015). Finding the right balance between community spirit and individual empowerment may prove essential to sustainable rural development.

Acknowledging the small-scale farmer. In this thesis, I argued for the importance of the small-scale farmer as a component of the social subsystem, retaining knowledge, taking land management decisions, maintaining the return of benefits from the landscape, and holding important values. I propose that small-scale farmers are not simply land managers, but key custodians of a “stabilizing” value system that has helped to create and maintain endemic human-nature relationships within the studied cultural landscape. Future research that deals with assessing the contribution of their value system in maintaining the social-ecological resilience of the system may prove particularly worthwhile, as will be interventions that support and empower small-scale farmers regardless of their productivity or motivation. A closer look at the small-scale farmer(s) in addition to small-scale farming may be the missing link in understanding and managing many traditional farming SES that are prone to change. Greater focus should be placed on understanding the values held by small-scale farmers and on how external policies influence these values.

6. CONCLUSION

This thesis is part of larger efforts to integrate social and ecological perspectives within systems thinking. By using the conceptual lenses of social-ecological systems, ecosystem services and cultural landscapes and by conducting empirical landscape scale studies, while considering locals as knowledge, stake and agency holders, I iteratively built up a grounded understanding of human-nature relationships in Southern Transylvania. While being fully aware of reciprocity in relationships between societies and ecosystems, human-nature relationships can be primarily decomposed in two directions: from the social subsystem to the ecological subsystem, and from the ecological subsystem to the social subsystem. I empirically explored the relation social subsystem \rightarrow ecological subsystem by describing the different aspirations locals have for their landscapes. I addressed the relation social subsystem \rightarrow ecological subsystem by describing the distribution of ES benefits among groups of beneficiaries. I provided insights into the specific factors responsible of the uncovered distribution and into the general factors explaining the current flow of provisioning ES in Southern Transylvania. Finally, I addressed the reciprocity of the human \leftrightarrow nature relationship by looking at human-carnivore co-existence. Four cross-cutting themes contributed knowledge to the “ecology of social systems“ (cf. Gunderson and Holling, 2002: 103) and to achieving a social understanding of human-nature relationships within this particular SES. Although acknowledged, the exact effect and nature of their role in enhancing the social-ecological resilience of the system yet remains to be investigated by future research. The *landscape interface*, the *diversity of the social subsystem*, *deeply held values*, and *small-scale farmers* are thought to strengthen or at least favor the sustainability of the human-nature relationships in Southern Transylvania, and hence may represent strategic points of intervention for achieving a sustainable future.

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Chapter II

Cultural ecosystem services: a literature review and prospects for future research

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*“A rock pile ceases to be a rock pile the moment a single man contemplates it,
bearing within him the image of a cathedral.”*

Antoine de Saint-Exupéry, The Little Prince

ABSTRACT

Cultural ecosystem services constitute a growing field of research that is characterized by an increasing number of publications from various academic disciplines. We conducted a semiquantitative review of publications explicitly dealing with cultural ecosystem services. Our aims were: (1) to provide an overview of the current state of research, (2) to classify the diversity of research approaches by identifying clusters of publications that address cultural ecosystem services in similar ways, and (3) to highlight some important challenges for the future of cultural ecosystem services research. We reviewed 107 publications and extracted 20 attributes describing their type and content, including methods, scales, drivers of change, and trade-offs between services. Using a cluster analysis on a subset of attributes we identified five groups of publications: Group 1, conceptual focus, deals with theoretical issues; Group 2, descriptive reviews, consists mostly of desktop studies; Group 3, localized outcomes, deals with case studies coming from different disciplines; Group 4, social and participatory, deals mainly with assessing preferences and perceptions; and Group 5, economic assessments, provides economic valuations. Emerging themes in cultural ecosystem services research relate to improving methods for cultural ecosystem services valuation, studying cultural ecosystem services in the context of ecosystem service bundles, and more clearly articulating policy implications. Based on our findings, we conclude that: (1) cultural ecosystem services are well placed as a tool to bridge gaps between different academic disciplines and research communities, (2) capitalizing on the societal relevance of cultural ecosystem services could help address real-world problems, and (3) cultural ecosystem services have the potential to foster new conceptual links between alternative logics relating to a variety of social and ecological issues.

Key Words: aesthetic values; bundling; CES valuation; cluster analysis; cultural heritage; cultural landscapes; drivers of change; intangible benefits; landscape values; nonuse values; policy implications; recreation and ecotourism

INTRODUCTION

The Millennium Ecosystem Assessment (Sarukhán and Whyte 2005) defined cultural ecosystem services as “the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences”. Cultural ecosystem services have been included in many other typologies of ecosystem services and referred to variously as cultural services (Constanza 1997), life-fulfilling functions (Daily 1999), information functions (de Groot et al. 2002), amenities and fulfillment (Boyd and Banzhaf 2007), cultural and amenity services (de Groot et al. 2010, Kumar 2010), or socio-cultural fulfillment (Wallace 2007).

One broadly agreed upon characteristic of cultural ecosystem services is their intangibility. Intangibility has been advanced both as an explanation for their poor appraisal (Sarukhán and Whyte 2005, Adekola and Mitchell 2011, Daw et al. 2011), but also as an impetus for better consideration of them in the future (Chiesura and de Groot 2003, Chan et al. 2011, Smith et al. 2011). The physical, emotional, and mental benefits produced by cultural ecosystem services are often subtle and intuitive in nature (Kenter et al. 2011) and implicitly expressed through indirect manifestations (Anthony et al. 2009). The value assigned to cultural ecosystem services depends therefore on individual and cultural assessments of their contribution to well-being (Charles and Dukes 2007, Eicken et al. 2009, Scullion et al. 2011). The Millennium Ecosystem Assessment definition of cultural ecosystem services has been criticized because it does not clearly separate, based on their connectedness to the welfare of human beneficiaries, between the above notions of services, benefits, and values (see Boyd and Banzhaf 2007, Wallace 2007, Chan et al. 2012). Cultural ecosystem services are frequently dependent on intermediate ecosystem services (Fisher et al. 2009, Johnston and Russell 2011), and cultural benefits derive from final cultural ecosystem services combined with other forms of capital (Chan et al. 2011, Constanza et al. 2011).

Cultural ecosystem services are usually included under non consumptive direct use values (Sarukhán and Whyte 2003) and suffer from poor quantification and integration in management plans (de Groot et al. 2005). With the exception of recreational and aesthetic values (Chan and Ruckelshaus 2010) and cultural heritage and educational values (Kumar 2010), cultural ecosystem services are seldom reflected by economic indicators (e.g. real estate prices) and are rarely marketable (e.g. Carpenter et al. 2009, Martín-López et al. 2009).

Cultural ecosystem services are important in a wide range of settings. Industrialized societies often value cultural ecosystem services ahead of other services (Quétier et al. 2010, Tielbörger et al. 2010, Palomo and Montes 2011). Demand for cultural ecosystem services is expected to further grow in industrialized societies (Carpenter et al. 2009, Guo et al. 2010, Ingold and Zimmermann 2011) owing to increasing budget shares for recreation (Vandewalle et al. 2008). By contrast, in traditional communities, cultural ecosystem services are essential for cultural identity and even survival (e.g., Le Maitre et al. 2007, Voora and Barg 2008, Brown and Neil 2011). Although cultural ecosystem services are greatly valued by diverse stakeholders and score highly in assessments of public perceptions, they are sometimes sacrificed by decision makers for economic and ecological reasons (de Groot et al. 2005, Chan et al. 2011, Hende 2011).

Cultural ecosystem services research engages disciplines including ecology, economics, and the social sciences, and uses a wide range of research approaches. Despite input from multiple disciplinary, methodological, and theoretical perspectives, there is broad agreement that a

satisfactory level of understanding of many important facets of cultural ecosystem services has not yet been attained (de Groot et al. 2005, Beaumont et al. 2008, Gasparatos et al. 2011). Moreover, many authors are increasingly sending signals that cultural ecosystem services deserve attention beyond the label of a Millennium Ecosystem Assessment category, but nevertheless fail to address this problem convincingly. We provide a semi quantitative literature review of publications explicitly dealing with cultural ecosystem services. First, we provide an overview of the current state of literature by discussing the temporal trends, the geographical distribution of case studies, the methods, and the background disciplines of cultural ecosystem services research. Second, within the diversity of research perspectives on cultural ecosystem services, we identify clusters of publications that address cultural ecosystem services in similar ways. Third, based on our findings, we highlight some important challenges for the future of cultural ecosystem services research.

METHODS

We conducted a comprehensive search of ISI Web of Knowledge and of Scopus, using the search terms (1) "cultural ecosystem service*", (2) "cultural services", and (3) "cultural service*" AND "ecosystem service*" in order to identify existing literature dealing specifically with cultural ecosystem services. Moreover, a full-text search for the term "cultural ecosystem service*" was performed in Science Direct. Because a significant proportion of cultural ecosystem services research is not published in peer-reviewed journals, we supplemented the peer-reviewed literature survey by a more subjective search of the 100 most-cited publications in Google Scholar. By reviewing both peer-reviewed and other highly-cited sources, we hoped to provide a more comprehensive review of the current state of cultural ecosystem services research.

Following the searches, we limited the literature set to items published between 2005 (coinciding with the publication of the Millennium Ecosystem Assessment synthesis reports) and January 2012. We excluded articles that mentioned cultural ecosystem services only in the context of listing other ecosystem services categories, articles in languages other than English, publications that could not be located, and conference abstracts. Some articles appeared in several academic databases. We retained 104 publications for in-depth analysis, to which we added three additional relevant publications (Elmqvist et al. 2010, Vandewalle et al. 2008, Vejre et al. 2010) that were cited in key papers. For full transparency, a list of all publications is provided in Table A1.1 (Appendix 1). We acknowledge that these publications do not comprise every single paper that mentioned cultural ecosystem services, but they do allow us to gain a broad overview on the most significant literature and to draw reliable conclusions on recent approaches to cultural ecosystem services research.

For each publication we answered twenty questions that were formulated in association with our research objectives and were built upon preliminary literature reviews and expert judgment (Table A2.1, Appendix 2). Questions sought to gather basic information about the reviewed literature including when, where, by whom, how, and why the research took place. Other questions targeted critiques of the categorization of cultural ecosystem services, namely the inclusion of ecotourism as a cultural ecosystem service (Kumar 2010) and the limited consideration of cultural ecosystem services subcategories (Vihervaara et al. 2010b). To gain a deeper understanding of the research field, we asked to what extent recent themes such as economic versus noneconomic valuation, ecosystem services bundling, mapping, and multidisciplinary were addressed.

All questions were initially tested and modified on a subset of publications. Response categories were based on the Millennium Ecosystem Assessment and other works (Table A2.1, Appendix 2). For example, because some authors consider both use and nonuse values of cultural ecosystem services – including existence, bequest, and option values (e. g., Gee and Burkhard 2010, Finnoff et al. 2012) and the intrinsic value of ecosystems (e.g., Raymond et al. 2009, Burkhard et al. 2012) – we considered these as a subcategory of cultural ecosystem services. Publications could fall in multiple categories in the case of seven questions (Table A2.1, Appendix 2; for example, Maass et al. (2005) gathered information at all four spatial scales considered). When information relating to some of the questions was not provided or did not apply to the text of the publication, the response was classified as Not Applicable (Table A2.1, Appendix 2).

We used descriptive statistics to identify how many publications fell into which categories of the 20 extracted attributes. We conducted a cluster analysis on 9 of the 20 questions that best addressed our objective of identifying groups of publications that approach cultural ecosystem services in similar ways (Table A2.1, Appendix 2). Specifically, we ran an agglomerative hierarchical cluster analysis using Euclidian distances and Ward's method. Taking into account all variables, this method starts by clustering single elements (i.e., papers) into aggregates of two elements. Next, it clusters the previous aggregates and does so, following a bottom-up logic, until one cluster remains (Everitt et al. 2001). The premise is to minimize within-group variance and maximize dissimilarities between groups. We chose Ward's clustering because it is widely used and understood, and readily interpretable. The quantitative assessment and its interpretation were complemented by a qualitative reading of the literature.

RESULTS

Overview and general patterns

The publications included 84 peer-reviewed articles, two Millennium Ecosystem Assessment chapters, four full papers presented at conferences, three book chapters, five PhD and Master theses, three working publications and six reports (Table A1.1, Appendix 1). Cultural ecosystem services is a growing research field with an increasing number of publications (Fig. 1). Thirty-nine publications acknowledged the existence of cultural ecosystem services in less than 5% of the text, and 42 publications discussed cultural ecosystem services alongside other Millennium Ecosystem Assessment categories in 5 to 25% of the text. These 81 papers generally mentioned cultural ecosystem services within an enumeration of the types of ecosystem services and provided little new insight specifically on cultural ecosystem services. Eleven publications devoted between a quarter and a half of the text to cultural ecosystem services, and ten publications focused on cultural ecosystem services in more than 50% and up to 75% of the text. Only five publications were entirely dedicated to cultural ecosystem services (de Groot et al. 2005, Gee and Burkhard 2010, Chan et al. 2011, Chan et al. 2012, Norton et al. 2012). Publications dedicating more than half of their content to cultural ecosystem services were typically published after 2009. The publications came from eight academic disciplines (Table 1); 72 publications contained case studies, 32 included strong conceptual elements (e.g., Burkhard et al. 2012), and 21 were reviews.

Table 1. Number of publications according to the discipline of the first author. (For three of the authors, information regarding their disciplines was not available.)

Discipline	Publications (no.)
Biodiversity conservation and ecology	45
Environmental management and policy making	33
Others (geography, social sciences, engineering, chemistry)	10
Agriculture and forestry	9
Economics	7

We examined service providers, geographical distribution, cultural ecosystem services subcategories, methods, and drivers of change. Most publications named, as suppliers of cultural ecosystem services, specific types of ecosystems (n=54) such as coastal ecosystems or urban green areas, or specific geographical areas (n=25). Fewer publications focused on specific species (n=8) or specific stocks of natural capital and associated human activities (n=8). The majority of the case studies were in the USA (n=12); the others were in the UK (n=10), Germany

(n=8), Spain (n=8), Australia (n=4), and Finland (n=4) (Fig. 2). Sixteen case studies were at the landscape scale (1000 to 9999 km²) while local (0 to 999 km²), regional (10,000 to 99,999 km²), and national or global scales were represented each by approximately 20% of case studies. The first three cultural ecosystem services subcategories were investigated more often than all the other eight subcategories put together (Fig. 3). Qualitative, quantitative, and mixed methodologies were used across all scales and regardless of disciplines, with a general preference for mixed (n=42) and qualitative methods (n=38) rather than quantitative ones (n=17). Sixty-four publications discussed one or more specific drivers promoting change of cultural ecosystem services, either directly (e.g., decision making, management), or indirectly (land use, resource depletion) (Fig. 4).

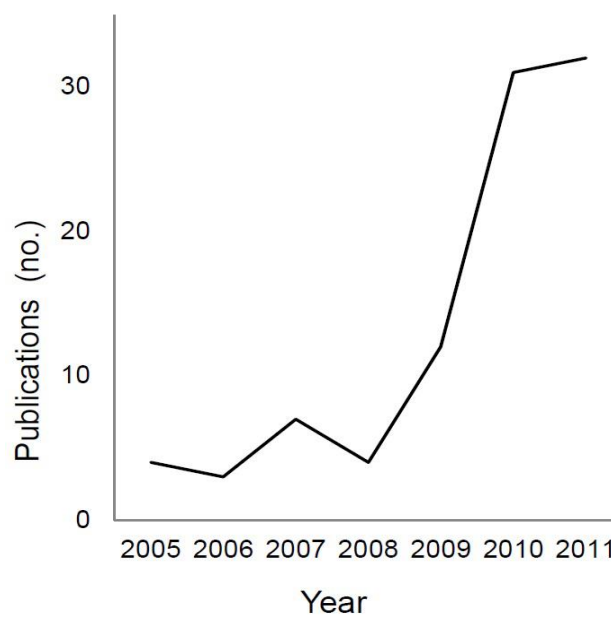


Fig. 1. Number of publications per year.

Elicitation and valuation

Thirty-five publications undertook or conceptualized economic valuation of cultural ecosystem services, often in relation to recreation and ecotourism. By contrast, twentyseven specifically argued against monetary valuation of cultural ecosystem services. Where economic valuation was undertaken, stated preference, revealed preference, and market price methods were by far the most employed (Fig. 5).

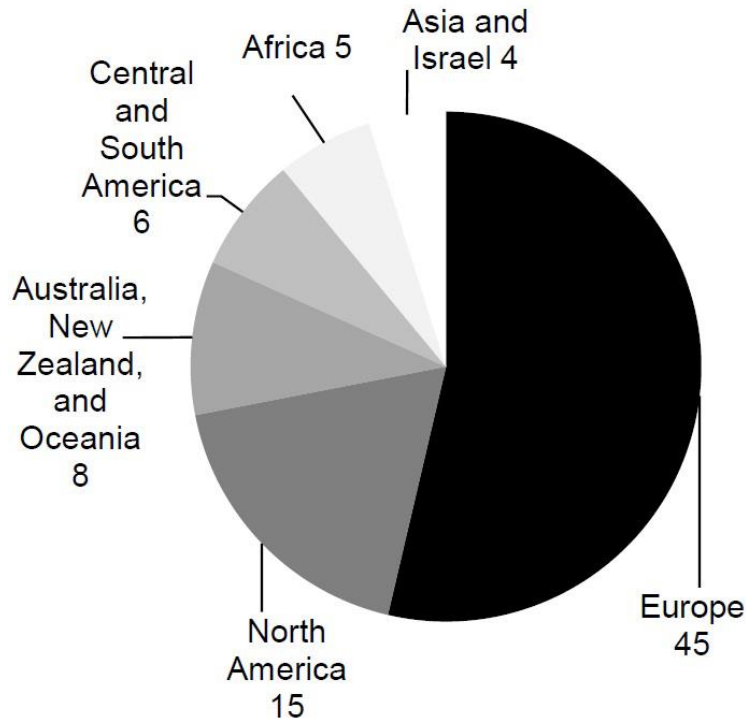


Fig. 2. Regional distribution of case studies in the review. Publications could have no entries or multiple entries if, respectively, they contained no or multiple case studies. Case studies located in Europe included three pan-European studies (Ding 2009, Harrison et al. 2010, Vilà et al. 2010).

Forty-seven publications involved or envisaged involving stakeholders to identify, assess, or otherwise value cultural ecosystem services. More than half the reviewed items ($n=55$) acknowledged the contribution of cultural ecosystem services to well-being or health, particularly through mental benefits (e.g., Niemelä et al. 2010, Tzoulas and James 2010) but these were rarely quantified. Twenty publications presented maps or ways to map cultural ecosystem services (e.g., González et al. 2010). Forty-two publications discussed trade-offs between cultural ecosystem services and other services (e.g., Rodríguez et al. 2006), but only thirteen publications explicitly considered ecosystem services bundles (e.g., Raudsepp-Hearne et al. 2010a).

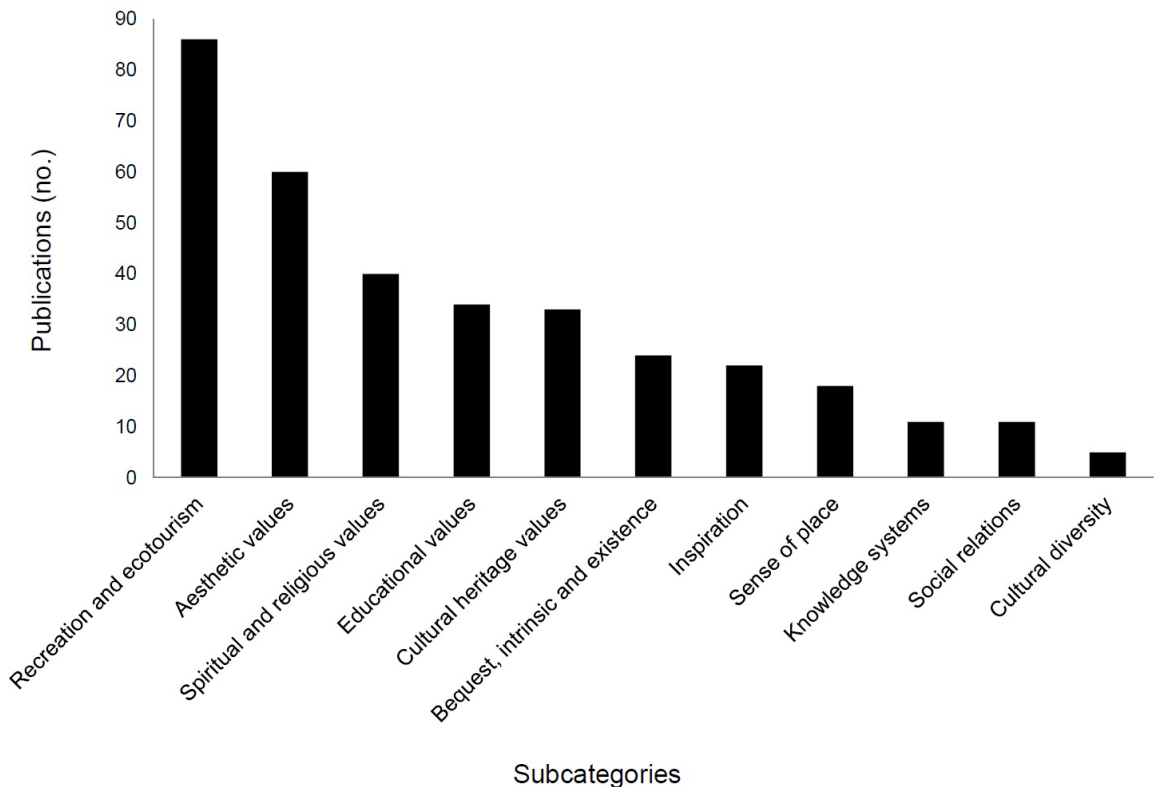


Fig. 3. Number of publications investigating different subcategories of cultural ecosystem services. Publications could have no entries or multiple entries if, respectively, no or multiple subcategories were addressed.

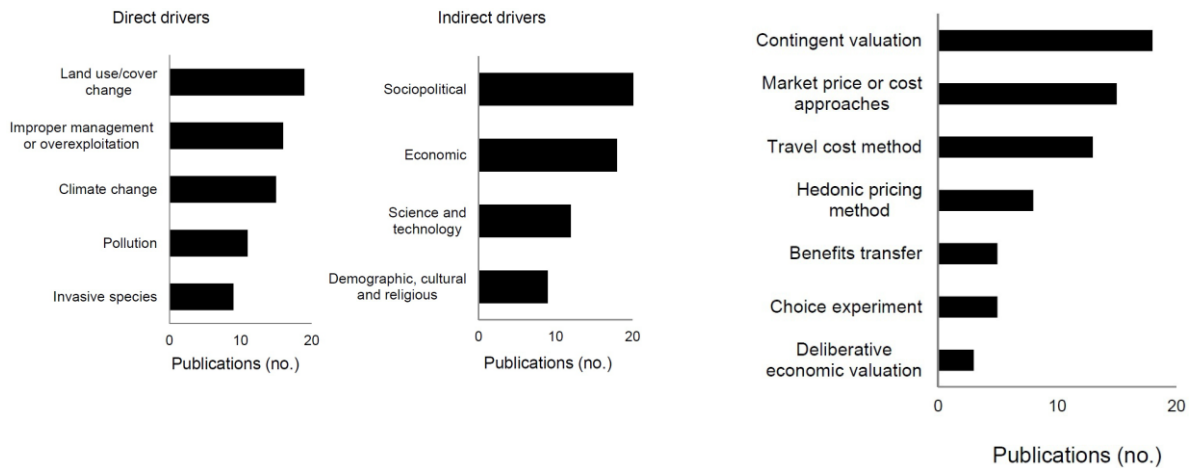


Fig. 4. Number of publications dealing with different drivers of cultural ecosystem service change: (a) direct drivers, and (b) indirect drivers. Some publications discussed no drivers or multiple drivers.

Fig. 5. Number of publications applying or discussing different economic techniques used to value cultural ecosystem services. Some publications approached none or multiple of these techniques.

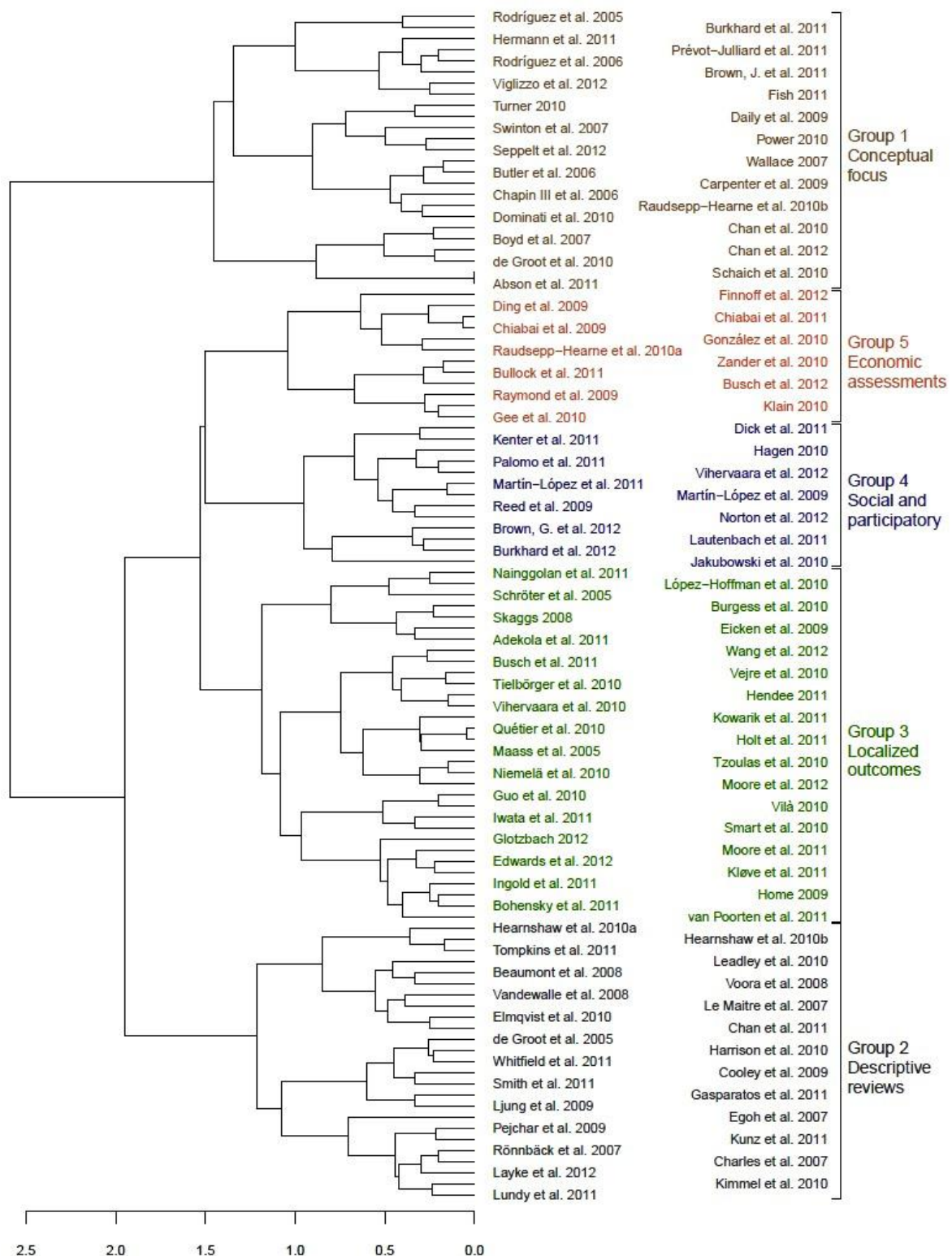


Fig. 6. Dendrogram showing the five groups of publications identified by the cluster analysis.

Cluster analysis

Five clusters were chosen as a meaningful compromise between generality and specificity of results (Fig. 6). The strength of the resulting clustering had an agglomerative coefficient of 0.9 (1 being the maximum). We applied a topdown logic when interpreting the cluster analysis. The top node of the dendrogram (Fig. 6) generated two broad categories based predominantly on the presence or absence of a specified scale. The first group, called conceptual focus, contained predominantly theoretical publications (n=25). Such publications specified recommendations or advanced theoretical frameworks for conceptualizing and evaluating ecosystem services (e.g., Butler and Oluoch-Kosura 2006, Carpenter et al. 2009, Daily et al. 2009, Seppelt et al. 2012). These publications typically addressed challenging concepts such as the questions of bundling in ecosystem services or the suitability of noneconomic valuation techniques (e.g., Rodríguez et al. 2006, Viglizzo et al. 2012). This group tended to pioneer new research directions, such as agricultural production as a source of cultural and utilitarian cobenefits (Swinton et al. 2007, Power 2010).

The cluster of descriptive reviews (n=25) contained mostly papers that did not use quantitative methods and which allocated up to one quarter of text length to cultural ecosystem services. These publications rarely discussed trade-offs and focused mostly on direct drivers of change. They typically aimed to document, backed mostly by references, the range and relative importance of ecosystem services delivered in changing conditions by suppliers, and typically argued that cultural ecosystem services needed more attention, thus appealing for more research (e.g., Ljung et al. 2009, Kunz et al. 2011, Lundy and Wade 2011).

The largest cluster of publications, localized outcomes (n=32), dealt with case studies typically seeking to advance qualitative arguments for the conservation of a particular ecosystem or area (e.g., Kovarik et al. 2011). They ranged from publications reporting the values and benefits associated with particular locations (e.g., open spaces) (Wang et al. 2012) or ecosystems (e.g., wetlands) (Moore and Hunt 2012) to those dealing with the effects of specific threats (e.g., Schröter 2005, Burgess et al. 2010, Kløve et al. 2011) or policies and management approaches on place-based cultural ecosystem services (e.g., Nainggolan et al. 2011). Many of these publications discussed conflicting situations (e.g., Vihervaara et al. 2010a) and trade-offs between alternative development strategies (e.g., López- Hoffman et al. 2010). They mostly used information from other research communities (*sensu* Q20, Table A2.1) (e.g., Norton et al. 2012).

Publications that placed people first, by quantifying preferences and perceptions, were aggregated in the fourth cluster, termed social and participatory (n=13). While the previous clusters were mainly concerned with conservation and development objectives, publications in this group emphasized the social aspects of case studies (e.g., Kenter et al. 2011, Palomo and Montes 2011), or considered the

contribution of stakeholders to knowledge, emphasizing participatory techniques (e.g., Brown et al. 2012).

The fifth cluster, economic assessments (n=12), was centered around the present (e.g., Chiabai et al. 2011) or future (e.g., Ding et al. 2009) economic value of ecosystem services. Using quantitative methods (econometric models, spatial valuation), these case studies aimed to communicate factual, often monetary, accounts of cultural ecosystem services to be incorporated by policy makers (e.g., Zander et al. 2010, González et al. 2010).

DISCUSSION

Heterogeneous perspectives of cultural ecosystem services research

Cultural ecosystem services have attracted attention in a wide variety of publications, originating from multiple academic disciplines, and employing heterogeneous approaches. The heterogeneity in approaches to cultural ecosystem services research may result from three interacting circumstances. First, a diversity of approaches and apparent lack of cohesiveness rightfully corresponds to the eclectic nature of cultural ecosystem services (as described in the introduction).

Second, within all clusters, cultural ecosystem services tended not to be the priority focus of research projects; rather, cultural ecosystem services were considered as part of a broader analysis. Therefore, cultural ecosystem services are often assessed using methods initially designed to address broader research questions, with the concept of cultural ecosystem services loosely related to the actual research outputs. Cultural ecosystem services being somewhat peripheral in most papers is also indicated by the typically low proportion of text dedicated to cultural ecosystem services (Q2).

Third, the multitude of perspectives on cultural ecosystem services reflects the development of a relatively new field of research that lacks a well-established, reproducible research framework. Improved definitions and more widely acknowledged methodologies and research agendas are required. Cultural ecosystem services is a vibrant research arena where incipient directions are starting to crystallize and move away from the initial labels of a “generic” (Vihervaara 2010b) or even “residual” ecosystem services category – encompassing everything that does not fit in the more utilitarian classes of ecosystem services (Chan et al. 2012, Daniel et al. 2012).

Drivers of change for cultural ecosystem services

Regarding the drivers of change in cultural ecosystem services, published accounts are again diverse. We found that the socioeconomic drivers impacting on cultural ecosystem services provision (Q11) differ across countries (Q6), with issues such as poverty and corruption (López-Hoffman et al. 2010,

Glotzbach 2012) being predominant in relatively poor countries, whereas cultural ecosystem services in industrialized societies are more commonly affected by drivers of change related to science or technology (e.g. through the development of renewable energies, agricultural intensification, dam building) (Bullock and Collier 2011, Busch et al. 2011, Tompkins et al. 2011). In a context where more than half of all publications come from Europe and North America (Fig. 2), such divergent trends between developing and developed countries must not be forgotten, especially given the tendency of Western cultures to underestimate the importance of cultural ecosystem services for rural livelihoods and identities (Bohensky et al. 2004).

Valuing cultural ecosystem services

The majority of cultural ecosystem services are placed outside the methods of neoclassical economics (e.g., Chan et al. 2012) but some researchers consider their value measurable since they are expressed in human action (e.g., Boyd and Banzhaf 2007, Zhang et al. 2010). The Economics of Ecosystems and Biodiversity initiative (2010a), for example, clearly delineated a subset of cultural ecosystem services amenable to traditional valuation: recreation, ecotourism, cultural heritage, and educational values. Unsurprisingly, the most frequently studied cultural ecosystem services (Fig. 3) are the most easily quantifiable (e.g., Chan and Ruckelshaus 2010), further deepening the gap between counting that which matters to people and that which is easy to measure. Although recreation and ecotourism are routinely considered as cultural ecosystem services (e.g., de Groot et al. 2010), some authors have argued that they should instead be classified as provisioning services (Abson and Termansen 2011), especially for communities strictly dependent on these services (Rounsevell et al. 2010, Daw et al. 2011). An overemphasis on recreation and ecotourism, although pointing to a general helplessness towards measuring other cultural ecosystem services, may lead researchers and policymakers to assume that these represent cultural ecosystem services as a whole, thereby contributing to an unconscious marginalization of other important cultural ecosystem services (Fig. 3, see also Liu et al. 2010, Seppelt et al. 2011). For example, our review shows that cultural ecosystem services often produce spiritual benefits, but these are not quantified.

Alternatives for valuing cultural ecosystem services

The adequacy of established economic techniques (Fig. 5) to capture cultural norms and express plurality of values (Sukhdev et al. 2010) remains contested (e.g., Kumar and Kumar 2008, Klain 2010, Tielbörger et al. 2010). Revealed preference based monetary valuation is dependent on consumers' sovereignty and not on ecological conditions. For example, the ease of accessibility is a crucial factor typically included in the monetization of recreational services (de Groot et al. 2010, Lautenbach et al. 2011). Moreover, cultural ecosystem services cannot be split into discrete units for marginal valuation (Abson and Termansen 2011) or into spatial units of actual cultural ecosystem services "consumption"

(Burkhard et al. 2012). To overcome these problems, some authors recommend describing cultural ecosystem services via ordinal classes (Seppelt et al. 2012), or descriptors, such as "charismatic landscape" or "appropriate diversity" (Norton et al. 2012). Proxies such as percentage of land under protected status, donations to conservation agencies (Rössler 2006, Raudsepp-Hearne et al. 2010b), the presence of labeled products (Kumar 2010), tracing visible manifestations of cultural ecosystem services on the physical landscape (Bieling et al. 2012), or the number of studies about an ecosystem (e.g., Tompkins et al. 2011) provide useful alternatives for revealing the values ascribed to cultural ecosystem services.

Given inherent problems with monetary valuation, many authors increasingly focus on noneconomic deliberative techniques (e.g., Daily et al. 2009, Turner 2010, Abson and Termansen 2011) such as Delphi surveys (Edwards et al. 2012) or the Q method (Kerr and Swaffield 2007). Some authors specifically argue for using methods that reflect the relationship between a specific cultural service and its user, including personal experience, imagination, expectation, and preference (e.g., Martín-López et al. 2009, Gee and Burkhard 2010), thereby achieving an explicit psycho-cultural perspective (Kumar and Kumar 2008). An increasingly popular alternative to valuation is the spatial representation of ecosystem services (Kumar 2010), which is frequently associated with participatory mapping (Raymond et al. 2009, Sherrouse et al. 2011, Plieninger et al. 2013) or photo-based methods (Williams and Cary 2001, Sherren et al. 2010).

Bundling cultural ecosystem services

Bundling of ecosystem services (Q19) and its implications for navigating trade-offs and synergies between services constitutes another major challenge for the valuation of ecosystem services (Bennett et al. 2009). However, our review has shown that the concept of bundling has been embraced by few cultural ecosystem services researchers. Many authors still think primarily in a hierarchy of trade-offs between different kinds of services (e.g., cultural versus provisioning), rather than recognizing their potentially interlinked nature. Authors who do consider bundles typically recognize the existence of combinations of ecosystem services that flow from particular landscapes (Carpenter et al. 2009) or ecosystems (Dick et al. 2011, Whitfield et al. 2011), interdependencies between different types of ecosystem services (Hermann et al. 2011), and joint production of services (Busch et al. 2011, Finnoff et al. 2012). Particularly in the context of agro-ecosystems, the discussion of cultural ecosystem services often is centered on their multifunctionality and on studying several ecosystem services in parallel (Swinton et al. 2007, Gordon et al. 2010, Lautenbach et al. 2011).

Inclusion of cultural ecosystem services in decision making

There is a debate about whether cultural ecosystem services are properly considered in real decision contexts (e.g., Gee and Burkhard 2010, Schaich et al. 2010). While many authors consider cultural ecosystem services as under-studied and under-regarded, some argue that literature on economic valuation and planning recognizes cultural ecosystem services more strongly than regulating and supporting services (Egoh et al. 2007, Bennett et al. 2009, Wittmer et al. 2010). We believe that these two positions may co-exist, in part due to the tendency of cultural ecosystem services research to focus on specific subcategories of cultural ecosystem services (Fig. 3) and not on the whole range of cultural ecosystem services. As with the secondary focus on cultural ecosystem services in terms of research agendas, cultural ecosystem services usually serve as a complementary – rather than a leading – incentive for orientating decisions. Nearly all studies recommended, to some extent, the integration of ecosystem services in management plans (Dominati et al. 2010, Kimmel and Mander 2010). However, few papers explicitly tackled the challenge of accounting for socio-cultural values in ecosystem services assessments (Raudsepp-Hearne et al. 2010b, Tzoulas and James 2010) or as stimuli for the conservation of biodiversity (e.g., Khan et al. 2008, Haslett et al. 2010, Everard and Kataria 2011). Even fewer acknowledged the need to adapt institutional arrangements to a nonutilitarian perspective (e. g., Daily et al. 2009, Holt et al. 2011).

Cultural ecosystem services, multidisciplinary, and other schools of thought

Our results underlined that to gain a holistic understanding of ecosystem services, economics, other social sciences, and the humanities, are just as important as ecology (Table 1). Being related to human perceptions, attitudes and beliefs, cultural ecosystem services highlight powerful linkages with the social sciences (e.g., Wallace 2007, Daily et al. 2009, Chan et al. 2012). Insights from psychology, anthropology and behavioral studies, similar to those obtained by the social and participatory cluster, move the focus from individual needs to those fulfilled at a collective level (e.g., Chiesura and de Groot 2003, Turner 2010, Daniel et al. 2012). They highlight the concrete contribution of cultural ecosystem services to human well-being, public health (e.g., Dallimer et al. 2012) and psychological experiences (Vejre et al. 2010). Despite this, our review shows a low level of involvement of social scientists in cultural ecosystem services research. As Fish (2011) argued, cultural scholars may be more inclined to find the concept of cultural ecosystem services in conflict with the nonutilitarian and nonlinear meaning of “culture” from the social literature and therefore may be reticent to adopting an ecosystem services framework.

Collaboration and exchange with closely related fields of research will be equally necessary. In our research, we uncovered a range of publications that partially overlapped with the concept of cultural ecosystem services. However, many of these studies were not identified in our literature search because

they did not use the terminology associated with ecosystem services. Examples include studies on people's sense of place (e.g., Soini et al. 2012), work on landscape preferences (e.g., Conrad et al. 2011), place attachment (e.g., Brown and Raymond 2007), cultural heritage (Tolentino 2007), and traditional knowledge (Yeo-Chang 2009). Our review thus reflects only a subset of literature about nature's intangible benefits to people, because parallel work is taking place in other research communities that do not use the term ecosystem services. Deeper engagement with scientists working with alternative phrases such as landscape values (e.g., Brown 2005, Haaland et al. 2011), community values (Raymond et al. 2009), social values (Fagerholm and Käyhkö 2009), landscape services (Enengel et al. 2009, Termorshuizen and Opdam 2009), visual qualities (Arriaza et al. 2004), experiential values (Barthel et al. 2005), and amenity values (Kerr and Swaffield 2007) could further strengthen the methodological and philosophical foundations of cultural ecosystem services research.

Literature on the relationships of people with cultural landscapes appears particularly important (Giannecchini et al. 2007) as the awareness of services provided by a certain region or land-use is increasing (Lamarque et al. 2011). Cultural landscapes are a good point of departure (Vejre et al. 2010) for cultural ecosystem services research not least because they incorporate many of the concepts that fall outside the Millennium Ecosystem Assessment framework. In our sample, 41 out of 107 publications cited at least one reference from typical "landscape journals", such as *Landscape and Urban Planning*, *Landscape Ecology*, or *Landscape Research*. The mutual recognition between the ecosystem services approach and (cultural) landscape research has been acknowledged for some time (de Groot et al. 2005), and recent work noted a similarity of scopes and potential for cross fertilization (Schaich et al. 2010, Hermann et al. 2011, Gee and Burkhard 2010).

FUTURE CHALLENGES AND CONCLUSION

Our review showed that there are various valid points of departure within the cultural ecosystem services research field. The emergence of five discrete research clusters reveals plausible alternatives, i.e., distinct ways to conceptualize and measure cultural ecosystem services that carry their own achievements and flaws and provide researchers with rich opportunities to learn and to adapt. A particular challenge is to develop coherent approaches to cultural ecosystem services research while remaining connected to the wider ecosystem services research community. With a view to advancing cooperation on cultural ecosystem services within the scientific community and with practitioners, we propose the following: (1) greater synthesis of the existing approaches to cultural ecosystem services found in different research communities, (2) capitalizing on the societal relevance of cultural ecosystem services to address real-world problems, and (3) mobilizing cultural ecosystem services as a conceptual bridging element between various social and ecological constructs. Although universal, each of these challenges tends to be better met by one of the five clusters.

First, cultural ecosystem services are well placed to bridge gaps between different disciplines, research communities, and intellectual heritages. Cultural ecosystem services is a relatively young research field that does not wear the burden of entrenched academic traditions or paradigms. The diversity of research on cultural ecosystem services indicates scientific dynamism but at the same time, the lack of a solid common terminology and understanding. The five clusters carry the danger of drifting into very specialized and potentially sealed-off ways of thinking. Greater synthesis of these different research approaches may help reduce the production of disconnected understandings of cultural ecosystem services. The divergent perspectives illustrated by the five clusters (or by parallel research communities for that matter) should not be in competition but, rather, should be complementary. For example, cultural landscape research shares many objectives with research on cultural ecosystem services which sometimes uses similar elicitation methods as traditional social sciences. Interdisciplinary case studies that have cultural ecosystem services as a secondary concern (localized outcomes) are benefiting from comprehensive studies that appeal for research (descriptive reviews) or theoretical progress (conceptual focus). Similarly, cultural ecosystem services are caught in between the economic focus of economic assessments and the socio-psychological perspective of being social and participatory, while, in order to have a holistic understanding of human–environment relationships, both perspectives are needed. We stress that cultural ecosystem services call for diverse elicitation and valuation methods across multiple scales and types of societies, which is an approach that offers opportunities for exchange and innovation.

Second, capitalizing on the societal relevance of cultural ecosystem services could help address real-world problems. Practitioners and scientists alike recognize at least some cultural ecosystem services as contributors to human wellbeing, but also envisage integrating them in conservation plans. Thanks to their interdependence with other ecosystem services (Kumar 2010) and their intimately rooted familiarity to the stakeholders of a given ecosystem, the “tacit” values of cultural ecosystem services (Anthony et al. 2009) are an accessible and effective vehicle for the multistakeholder, holistic management of ecosystems. Authors have suggested that including immaterial benefits in the management of natural resources can improve the social acceptance and legitimacy of management decisions (e.g., Leadley et al. 2010). For example, the social and participatory research cluster seems especially well positioned to use its secondary focus on cultural ecosystem services to illustrate that the aesthetic value of a landscape is indispensable in the eyes of the broader public (Tielbörger et al. 2010). On the contrary, the factual accounts provided by the economic assessments cluster and the localized outcomes cluster are less successful in making cultural values key to environmental awareness, collective action, and ecosystem stewardship (Hendee 2011, Chan et al. 2012). Our research suggests that cultural ecosystem services can be used as an effective foot in the door for engaging actors who have different values and goals.

Third, cultural ecosystem services have the potential to foster new conceptual links between logics relating to a variety of social and ecological issues. The conceptual focus cluster is best placed to have a positive effect on the development of cultural ecosystem services research at a theoretical level. The conceptual openness shared by these papers may reveal new paths to reconnect humanity and nature in the twenty-first century (Fischer et al. 2012). We believe that cultural ecosystem services can serve as stepping stones in today's sea of ideas by, for example, creating congruencies between social-ecological systems theory and the ecosystem services framework. Cultural ecosystem services have the potential to trigger the evolution of the ecosystem services framework in a direction that more deeply engages people and accounts for social values (Kumar and Kumar 2008). Thoroughly accounting for cultural ecosystem services would help to balance primarily economic considerations (Hearnshaw and Cullen 2010) and facilitate a more inclusive social-ecological approach by exploring the interactions between social and ecological processes. In our view, mobilizing cultural ecosystem services as binding elements between social and ecological conceptual constructs meets the core idea of the sustainability ideal.

Our review illustrates that literature on cultural ecosystem services, while making conceptual advances, deals with many topics and addresses cultural ecosystem services in a diversity of ways. Within this diversity of concepts, measurements, and valuations, five relatively distinctive foci of cultural ecosystem services literature were found. The notion of cultural ecosystem services has generated a myriad of ideas, and, most likely, we will witness in the coming years the rapid evolution of this research field. Based on our findings we anticipate a future increase in papers that are social and participatory or have conceptual focus. Embracing different cultural ecosystem services research approaches, including their vagueness and intangibility, may contribute to the resolution of real-world problems in the management of human–nature interactions.

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SUPPLEMENTARY MATERIAL FOR CHAPTER II

Table A1.1. List of the 107 papers considered in this review.

	Paper	Type of paper
1.	Abson, D. J., and M. Termansen. 2011. Valuing ecosystem services in terms of ecological risks and returns. <i>Conservation Biology</i> 25 :250-258.	Journal article
2.	Adekola, O., and G. Mitchell. 2011. The Niger Delta wetlands: threats to ecosystem services, their importance to dependent communities and possible management measures. <i>International Journal of Biodiversity Science, Ecosystem Services & Management</i> 7 :50-68.	Journal article
3.	Beaumont, N. J., M. C. Austen, S. C. Mangi, and M. Townsend. 2008. Economic valuation for the conservation of marine biodiversity. <i>Marine Pollution Bulletin</i> 56 :386-396.	Journal article
4.	Bohensky, E., J. R. A. Butler, R. Costanza, I. Bohnet, A. Delisle, K. Fabricius, M. Gooch, I. Kubiszewski, G. Lukacs, P. Pert, and E. Wolanski. 2011. Future makers or future takers? A scenario analysis of climate change and the Great Barrier Reef. <i>Global Environmental Change</i> 21 :876-893.	Journal article
5.	Boyd, J., and S. Banzhaf. 2007. What are ecosystem services? The need for standardized environmental accounting units. <i>Ecological Economics</i> 63 :616-626.	Journal article
6.	Brown, G., J. M. Montag, and K. Lyon. 2012. Public participation GIS: A method for identifying ecosystem services. <i>Society & Natural Resources</i> 25 :633-651.	Journal article
7.	Brown, J., and M. Neil. 2011. A site-based approach to delivering rangeland ecosystem services. <i>The Rangeland Journal</i> 33 :99-108.	Journal article
8.	Bullock, C. H., and M. Collier. 2011. When the public good conflicts with an apparent preference for unsustainable behaviour. <i>Ecological Economics</i> 70 :971-977.	Journal article
9.	Burgess, P. J., A. J. Moffat, and R. B. Matthews. 2010. Assessing climate change causes, risks and opportunities in forestry. <i>Outlook on Agriculture</i> 39 :263-268.	Journal article
10.	Burkhard, B., B. D. Fath, and F. Müller. 2011. Adapting the adaptive cycle: Hypotheses on the development of ecosystem properties and services. <i>Ecological Modelling</i> 222 :2878-2890.	Journal article
11.	Burkhard, B., F. Kroll, S. Nedkov, and F. Müller. 2012. Mapping ecosystem service supply, demand and budgets. <i>Ecological Indicators</i> 21 :17-29.	Journal article
12.	Busch, M., K. Gee, B. Burkhard, M. Lange, and N. Stelljes. 2011. Conceptualizing the link between marine ecosystem services and human wellbeing: the case of offshore wind farming. <i>International Journal of Biodiversity Science, Ecosystem Services & Management</i> 7 :190-203.	Journal article
13.	Busch, M., A. La Notte, V. Laporte, and M. Erhard. 2012. Potentials of quantitative and qualitative approaches to assessing ecosystem services. <i>Ecological Indicators</i> 21 :89-103	Journal article
14.	Butler, C. D., and W. Oluoch-Kosura. 2006. Linking future ecosystem services and future human well-being. <i>Ecology and Society</i> 11 :30.	Journal article
15.	Carpenter, S. R., H. A. Mooney, J. Agard, D. Capistrano, R. S. DeFries, S.	Journal article

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- Díaz, T. Dietz, A. K. Duraiappah, A. Oteng-Yeboah, H. Miguel, C. Perrings, R. J. Scholes, A. Whyte, and W. V. Reid. 2009. Science for managing ecosystem services: Beyond the Millennium Ecosystem Assessment. *Proceedings of the National Academy of Sciences of the United States of America* **106**:1305-1312.
16. Chan, K. M. A., and M. Ruckelshaus. 2010. Characterizing changes in marine ecosystem services. *F1000 Biology Reports* **2**:54. Journal article
17. Chan, K. M. A., J. Goldstein, T. Satterfield, N. Hannahs, K. Kikiloi, R. Naidoo, N. Vadeboncoeur and U. Woodside. 2011. Cultural services and non-use values. Pages 206-228 in P. Kareiva, H. Tallis, T. H. Ricketts, G. C. Daily and S. Polasky, editors. *Natural Capital: Theory & Practice of Mapping Ecosystem Services*. Oxford University Press, Oxford, UK. Book chapter
18. Chan, K. M. A., T. Satterfield, and J. Goldstein. 2012. Rethinking ecosystem services to better address and navigate cultural values. *Ecological Economics* **74**:8-18. Journal article
19. Chapin, F. S., III, A. L. Lovcraft, E. S. Zavaleta, J. Nelson, M. D. Robards, G. P. Kofinas, S. F. Trainor, G. D. Peterson, H. P. Huntington, and R. L. Naylor. 2006. Policy strategies to address sustainability of Alaskan boreal forests in response to a directionally changing climate. *Proceedings of the National Academy of Sciences of the United States of America* **103**:16637-16643. Journal article
20. Charles, H. and J. S. Dukes. 2007. Impacts of Invasive Species on Ecosystem Services. Pages 217-237 in W. Nentwig, editor. *Biological Invasions* Springer, Berlin, Germany. Journal article
21. Chiabai, A., C. M. Travisi, H. Ding, A. Markandya, and P. A. L. D. Nunes. 2009. Economic valuation of forest ecosystem services: Methodology and monetary estimates. Fondazione Eni Enrico Mattei. EU funded project COPI "Cost of Policy Inaction". Report
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23. Cooley, S. 2009. Ocean acidification's potential to alter global marine ecosystem services. *Oceanography* **22**:172-181. Journal article
24. Daily, G. C., S. Polasky, J. Goldstein, P. M. Kareiva, H. A. Mooney, L. Pejchar, T. H. Ricketts, J. Salzman, and R. Shallenberger. 2009. Ecosystem services in decision making: time to deliver. *Frontiers in Ecology and the Environment* **7**:21-28. Journal article
25. Dick, J., C. Andrews, D. A. Beaumont, S. Benham, D. R. Brooks, S. Corbett, D. Lloyd, S. McMillan, D. T. Monteith, E. S. Pilgrim, R. Rose, A. Scott, T. Scott, R. I. Smith, C. Taylor, M. Taylor, A. Turner, and H. Watson. 2011. A comparison of ecosystem services delivered by 11 long-term monitoring sites in the UK environmental change network. *Environmetrics* **22**:639-648. Journal article
26. Ding, H. 2009. A hybrid approach to the valuation of climate change effects on ecosystem services: evidence from European forests. 11th Annual BIOECON Conference on Economic Instruments to Enhance the Conservation and Full paper presented at conferences Sustainable Use of Biodiversity", Venice, Italy. Full paper presented at conferences
27. Dominati, E., M. Patterson, and A. Mackay. 2010. A framework for classifying and quantifying the natural capital and ecosystem services of soils. *Ecological Economics* **69**:1858-1868. Journal article
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28. Edwards, D., M. Jay, F. S. Jensen, B. Lucas, M. Marzano, C. Montagné, A. Peace, and G. Weiss. 2012. Public preferences across Europe for different forest stand types as sites for recreation. *Ecology and Society* **17**:27. Journal article
29. Egoh, B., M. Rouget, B. Reyers, A. Knight, R. Cowling, A. van Jaarsveld, and A. Welz. 2007. Integrating ecosystem services into conservation assessments: A review. *Ecological Economics* **63**:714-721. Journal article
30. Eicken, H., A. L. Lovecraft, and M. L. Druckenmiller. 2009. Sea-ice system services: A framework to help identify and meet information needs relevant for Arctic observing networks. *Arctic* **62**:119-136. Journal article
31. Elmqvist, T., E. Matby, T. Barker, M. Mortimer, C. Perrings, J. Aronson, et al. 2010. Biodiversity, ecosystems and ecosystem services. Pages 1-96 in P. Kumar et al., editors. *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*. Earthscan, London, UK. Book chapter
32. Finnoff, D., M. Gong, and J. Tschirhart. 2012. Perspectives on ecosystem based management of eighteen-species subject to multi-species harvesting. *International Review of Environmental and Resource Economics* **6**:79-118. Journal article
33. Fish, D. R. 2011. Environmental decision making and an ecosystems approach: Some challenges from the perspective of social science. *Progress in Physical Geography* **35**:671-680. Journal article
34. Gasparatos, A., P. Stromberg, and K. Takeuchi. 2011. Biofuels, ecosystem services and human well-being: Putting biofuels in the ecosystem services narrative. *Agriculture, Ecosystems & Environment* **142**:111-128. Journal article
35. Gee, K., and B. Burkhard. 2010. Cultural ecosystem services in the context of offshore wind farming: A case study from the west coast of Schleswig-Holstein. *Ecological Complexity* **7**:349-358. Journal article
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Table A2.1. Set of questions asked for every paper reviewed. The column “Cluster analysis” indicates whether the question was used to inform the cluster analysis. When information relating to some of the questions was not provided or did not apply to the text of the publication, the response was classified as “not applicable” with the exception of: Q1, Q2, Q3, Q16, Q17, Q19, Q20.

Question	Response categories	Based on	Cluster analysis
1. Year of publication		Schaich et al. 2010	No
2. Percentage of the text length of the paper dedicated to CES without bibliography pages	<5% 5-25% 25-50% 50-75% >75%		No
3. Type of paper *	Case-study Conceptual Review	Schaich et al. 2010	Yes
4. Discipline of first author	Biodiversity conservation and ecology Environmental management and policy making Others (Geography, Social sciences, Engineering, Chemistry) Agriculture and forestry Economics	Vejre et al. 2010	Yes
5. Supplier of CES*	Specific geographical area Specific type of ecosystem(s) Stocks of natural assets One or multiple species	Constanza et al. 2011 Vihervaara 2010b	Yes
6. Country of the case study*		Seppelt et al. 2011 Vihervaara 2010b	No
7. Scale of the case study*	Local 0-999 km ² Landscape 1000-9999 km ² Regional 10000-99999 km ² National or global >100000 km ²	Constanza et al. 2011	Yes
8. Category of CES addressed by the publications *	Recreation and ecotourism Aesthetic values Spiritual and religious values Educational values	MA 2005 Burkhard et al. 2012 Raymond et al. 2009	Yes

	Cultural heritage values	Gee and	
	Bequest intrinsic and existence	Burkhard 2010	
	Inspiration		
	Sense of place		
	Knowledge systems		
	Social relations		
	Cultural diversity		
9. Is ecotourism considered/debated within the CES category?	Yes	TEEB 2010a	No
	No		
10. Methodology for CES identification/elicitation ^{**}	Quantitative	Schaich et al.	Yes
	Qualitative	2010	
	Mixed		
11. Driver of CES change publications are dealing with [*]	Indirect drivers of change:	MA 2005, p.	No
	Socio-political	64-67	
	Economic		
	Science and technology		
	Demographic and culture and religion		
	Direct drivers of change:	MA 2005, p. 67-68	
	Improper management and overexploitation of		
	Resources		
	Land use/cover change		
	Climate change		
	Pollution		
	Invasive species		
12. Does the paper undertake/ conceptualize/mention the economic valuation of CES?	Yes/No	de Groot et al. 2010	Yes
13 Method for economic valuation applied or discussed in relation to CES [*]	Contingent valuation	de Groot et al. 2010	No
	Market price and cost approaches		
	Travel cost method		
	Hedonic pricing		
	Benefits transfer		
	Choice experiment		
	Deliberative valuation		
14. Does the paper argue for a non-economic valuation of CES?	Yes/No	Kumar and Kumar 2008	No
		Sherrouse et al. 2011	

15. Does the paper involve/conceptualize involving stakeholders for assessing CES as in participation?	Yes/No	Seppelt et al. 2011	Yes
16. Does it link CES to wellbeing or human health?	Yes/No	MA 2003 MA 2005	Yes
17. Does the paper undertake or conceptualize mapping of CES?	Yes/No	Constanza et al. 2011	No
18. Does it mention/discuss trade-offs between CES and other ES?	Yes/No	Constanza et al. 2011 Seppelt et al.2011	No
19. Does it integrate CES in bundles of ES, does it discuss/mention bundles?	Yes/No	Raudsepp- Hearne et al. 2010a Constanza et al. 2011	No
20. Does the article use at least one reference from landscape ecology literature (in relation to ES)?	Yes/No	Schaich et al. 2010	No

* - Response categories to these questions are not mutually exclusive

** - Response categories to this question are mutually exclusive with the exception of Busch et al. 2012

Chapter III

Navigating conflicting landscape aspirations: application of a photo-based Q-method in Transylvania (Central Romania)

Andra Ioana Milcu, Kate Sherren, Jan Hanspach, David Abson, and Joern Fischer

Land Use Policy (2104), 41: 408-422



"People have forgotten this truth," the fox said. "But you mustn't forget it. You become responsible forever for what you've tamed. You're responsible for your rose."

Antoine de Saint-Exupéry, The Little Prince

ABSTRACT

In combination, the economic realities brought about by globalization, and the sustainability goals set by the European Union, translate into contradictory challenges for European cultural landscapes. With its high natural and cultural diversity, Transylvania (Central Romania) is facing the choice between development based on a “production for profit” logic, with the risks of a liberalized land market, versus a largely untested development pathway based on sustainability, landscape multifunctionality and conservation. In the context of these largely externally imposed and contradictory development pathways, clarifying the viewpoints and preferences of local people is important, and may help explain the outcomes of past policies, as well as inform future interventions. We undertook a photograph-based Q methodology study—interviewing 129 residents from 30 villages – to understand and explore the diverse range of landscape preferences held by locals in Southern Transylvania. We clarified these preferences by identifying groups of participants who shared similar viewpoints regarding local landscapes and their changing purpose. Our findings revealed five different “preference narratives” about Transylvanian landscapes, namely (1) landscapes for prosperity and economic growth; (2) landscapes for traditions and balanced lifestyles; (3) landscapes for human benefit; (4) landscapes for farming; and (5) landscapes for nature. Our systematic assessment of narratives showed areas of consensus and disagreement among participants. We relate the five preference narratives to current management approaches targeting rural landscapes. We conclude by suggesting policy approaches to tackle the diversity of opinions and interests found in this culturally and ecologically diverse landscape. Important policy priorities include fostering economic diversification and improving social capital.

INTRODUCTION

Cultural landscapes are geographic areas where humans and the environment have interacted through a variety of land-uses over long periods of time (Plieninger et al., 2006; Vos and Meekes, 1999), creating distinct ecological, socioeconomic and cultural patterns (Farina, 2000). Their worldwide importance has been recognized under the auspices of UNESCO through the World Heritage Convention (1972; Chief, 2006). Cultural landscapes are particularly relevant to Europe’s countryside (Plieninger et al., 2006; Solymosi, 2011a; Vos and Meekes, 1999), and their conservation, esthetic and cultural values have been widely acknowledged (Palomo and Montes, 2011; Solymosi, 2011a). However, many valued elements of Europe’s cultural landscapes have come under threat. The sustainable management of cultural landscapes poses complex problems (Vos and Meekes, 1999), because it depends on specific types of human interventions, including extensive agricultural land-uses (Babai and Molnár, 2014), which are

economically and culturally vulnerable in a rapidly changing, increasingly globalized world (Plieninger et al., 2006).

Southern Transylvania in Central Romania is one of Europe's most notable examples of a cultural landscape (Akeroyd and Page, 2006). Historically, the region was shaped in terms of land-use and culture by Transylvanian Saxons, colonists from Western Europe who settled in Transylvania approximately 800 years ago (Akeroyd and Page, 2006). Aspects of everyday life, including social disputes within the "conservative but well-ordered" (Akeroyd and Page, 2006) Saxon settlements, were organized by powerful Saxon institutions such as "neighborhoods", and relied on rigorous community rules and collective action (Dinu, 2012). Individually owned arable fields and communal forests and pastures were managed through traditional practices (Dorner, 1910; Sutcliffe et al., 2013), with individuals benefiting from participation in the commons (Akeroyd and Page, 2006; Dorner, 1910). A tight co-evolution between rural communities and local ecosystems resulted in a coupled social-ecological system (Babai and Molnár, 2014; Fischer et al., 2012) and a cultural identity embedded in the landscape (Hughes, 2008).

The natural and built Saxon heritage is still visible today (Akeroyd and Page, 2006; Dinu, 2012, pp. 44; Hughes, 2008, pp. 311), despite the various consequences of abrupt economic, political and social changes that took place in the region in the last century (Fischer et al., 2012). The number of Transylvanian Saxons declined progressively after World War II, following deportations to the Soviet Union, and controlled emigration to Germany (Dinu, 2012; Gündisch, 1998). Saxon depopulation left more room for the other ethnic groups already living in the region (i.e. Romanians, Hungarians, Roma), with additional immigrants arriving from other regions, and contributed to rapid growth of the Roma population (Dinu, 2012; Hughes, 2008). The new settlers' connection to the region's landscape was diluted by their own cultural identities and values (Hughes, 2008).

The last 70 years has seen rapid social, cultural and economic changes in Southern Transylvania. Starting with the agrarian reform (1945) and following land collectivization (1949–1962) imposed by Romania's centrally planned economy, the individual and communal properties of many farmers in Romania (including Saxons), were absorbed into state or collective farms (Gündisch, 1998). Following the collapse of communism in 1989, the post-communism and transition periods were marked by social, institutional and political instability (Fraser and Stringer, 2009), and the opening of borders caused a final wave of Saxon emigration (Gündisch, 1998). Low levels of trust, and widespread corruption, have eroded social capital (Mikulcak et al., 2013; Newton, 2011; Slangen, 2004). Much of the population became unemployed as a result

of the closure of state farms and factories. Tenure changes were brought about by widespread privatization (early 1990s) and restitution laws (of 1991, 2000, and 2005) (Kuemmerle et al., 2009; Nichiforel and Schanz, 2009). Initially envisioned as a “return to a just order”, the process of land restitution to pre-communist owners was intensely politicized (Verdery, 2003) and influenced by territorial administrative units (Verdery, 2002). This led to increasing domination of land holdings by a minority of individuals (Kuemmerle et al., 2009; Sutcliffe et al., 2013) and 2–3 ha holdings scattered in small parcels (Mikulcak et al., 2013; Verdery, 2003, pp. 133). Low profitability of subsistence farming, tenure insecurity, together with increased competition and land speculation, favored land abandonment and declining livestock numbers (Beaufoy et al., 2008; Huband, 2007; Kuemmerle et al., 2009). Finally, Romania’s accession to the European Union (EU) in 2007 led to further land-use and tenure changes, such as overgrazing by sheep (Akeroydand Bădărău, 2012), encroachment on the commons (Sutcliffe et al., 2013), and changing migration patterns.

The novel institutional and legal changes introduced inherently with EU membership, have had positive and negative consequences for Transylvania. For example, Southern Transylvania now contains one of the largest sets of continental Natura 2000 sites in Europe, including both a Site of Community Importance – SCI (EC, 1992), and Special Protection Areas – SPA (EC, 2009).

Yet, while Natura 2000 designation provides financial and other resources for land management, the extent of such sites in Southern Transylvania has been regarded by regional officials as a barrier to economic development (Mikulcak et al., 2013). Similarly, the Common Agricultural Policy (CAP), most notably Pillar II, in theory grants the region access to financial support for agriculture. However, the cumbersome nature of funding applications has meant limited efficacy in attaining European rural development objectives (EC, 2005) in the region (Mikulcak et al., 2013).

Today, the economic realities brought about by globalization and the sustainability goals set by the European Union (European Commission, 2010) create demanding and often contradictory challenges for the management of cultural landscapes. The international race for competitiveness and efficiency, and increasing connections to global agricultural markets have favored agricultural modernization and intensification, and made traditional subsistence agriculture increasingly unviable (Mikulcak et al., 2013; Öllerer, 2013). As of 2014, Romania liberalized its land sales, allowing greater foreign ownership, thereby risking “land grabbing” by foreign investors motivated by the region’s untapped potential for profitable intensification (Bouniol, 2013).

Despite a trend toward agricultural intensification there are indications of a shift (van der Ploeg et al., 2000) or at least a transition phase (Jongeneel et al., 2008) in agricultural policies, practices and paradigms. For example, environmental sustainability and societal relevance are enshrined as core objectives in Pillar II of the CAP (EC, 2005). During the 1990s, the historical, multifunctional nature of agriculture in Europe became increasingly recognized (e.g. the European Model of Agriculture, European Commission, 1998), and management objectives shifted back toward the provision of diversified rural goods and services (Haaland et al., 2011; Huband, 2007; Quétier et al., 2009; Wästfelt et al., 2012). Within academia, multifunctionality has been further revived as a means of operationalizing sustainable development (Helming et al., 2011). Empirical studies have reported the diverse expectations that people have of rural land-use, including food production and income, but also water regulation (Nainggolan et al., 2013) or outdoor recreation (Rogge et al., 2007). Similarly, growing awareness of the threats to cultural landscapes has driven policy makers to elaborate conservation policies which seek to preserve valuable social–ecological systems and their built and natural artifacts. International instruments (UNESCO World Heritage Convention) and European agreements (e.g. The European Landscape Convention, agrienvironmental payments) now aim to include cultural heritage protection into the working ethics of land owners and farmers (de Groot et al., 2005; Rogge et al., 2007). At the same time, the Natura 2000 network requires farmers to protect ecologically valuable sites within farmland. These nascent approaches to managing agricultural landscapes challenge the “production for profit” logic to which newer member states such as Romania are only beginning to adapt. In addition, some critics argue that sustainability-oriented landscape initiatives largely serve the Western need to preserve cultural and natural heritage, but fail to maintain viable farming enterprises in the new (Eastern European) member states (Dahlström et al., 2013; Wästfelt et al., 2012).

Having experienced historical turbulence and facing contrasting development pathways, Southern Transylvania is under pressure to become simultaneously economically viable, ecologically multifunctional and socially sustainable. These multiple, potentially incommensurable, goals force Southern Transylvania’s inhabitants to reconsider how they perceive their landscapes. As a response, societal demands, preferences and expectations regarding local landscapes are expected to diverge. Various studies show how contested viewpoints can emerge about the purposes of landscapes, depending on personal motivations, needs and aspirations (Amblard and Colin, 2009; Greiner and Gregg, 2011; Solymosi, 2011a, 2011b).

Clarifying such contested viewpoints can make a difference in the current context of alternative, potentially contradictory development pathways. Despite progress in the study of Central and Eastern European cultural landscapes (Öllerer, 2013; Urbanc et al., 2004; Young et al., 2007),

there is an urgent need for specific research on Southern Transylvania, where the overwhelming majority of the population directly interacts with, or is dependent on, the landscape (Mikulcak et al., 2013; Palanget al., 2006; Stringer et al., 2009). Knowledge of which functions locals favor in their changing landscapes may help mediate conflicting landscape management options. Local commitment is critical for the preservation of the multifunctional character of the Southern Transylvanian landscape in accordance with the emphasis on sustainability and multifunctionality in the new CAP 2014–2020 (European Commission, 2013; Rutz et al., 2013). Similarly, outcomes of policies targeting biodiversity conservation will largely depend on the attitudes of locals interacting with the land. Finally, careful understanding of diverse local perspectives can inform future policies, thus improving their social legitimacy and facilitating efficient implementation (Rogge et al., 2011, 2007).

Here, we sought to understand and explore the diversity of landscape preferences held by locals in Southern Transylvania, and to clarify these preferences by identifying groups of people who share similar viewpoints regarding local landscapes. By using the Q methodology (Brown, 1993, 1980) with photographs, which combines quantitative (reverse factor analysis) and qualitative methods (semi-structured interviews that were analyzed for themes), we revealed five different ways in which locals perceive and value their landscape. We characterized these viewpoints by reporting the elements of the Transylvanian landscape to which locals attached importance and how they prioritized different landscape functions. This systematic assessment of landscape narratives outlines areas of consensus and disagreement, and points to how different landscape preferences relate to current management approaches targeting rural landscapes, such as multi functionality or biodiversity conservation. Based on the demographic information provided by interviewees, we assess which viewpoints, and associated groups of locals, are likely to be important drivers of future changes in Southern Transylvania. We conclude by suggesting ways for policies to tackle the existing diversity of perceptions and values when considering landscape management and development options.

MATERIALS AND METHODS

Study area

We focused on a 7.440 km² area, within a 50 km radius around the town of Sighisoara, in Southern Transylvania (Central Romania), comprising more than 400 villages. The dominant land covers – based on Corine landcover classes (EEA, 2006) – are arable land, including permanent crops (37%), forest (28%) and pasture land (24%). Altitudes range from 230 to 1100 m above sea level. Small-scale farms persist in the valleys (Huband, 2007; Mikulcak et al., 2013; Öllerer, 2013), with low-intensity farming supporting high levels of biodiversity (Akeroyd and

Page, 2006; Beaufoy et al., 2008; Dorresteijn et al., 2013), and providing diverse ecosystem services (Plieninger et al., 2006; Sólyom et al., 2011). Owing to its unique ethnic composition (Akeroyd and Page, 2006; INS, 2011), the region also has notable cultural diversity. At present, the region is mostly populated by ethnic Romanians, Hungarians and Roma, along with a very small number of Transylvanian Saxons (Dinu, 2012, pp. 105). Within the study area, we randomly selected 30 villages (Fig. 1, see also Dorresteijn et al., 2014), ensuring they covered the full available range of biophysical and social conditions (Mikulcak et al., 2013). The average number of inhabitants per village was 584 (min–max cc. 30–1900) (INS, 2011).

The Q methodology

To determine what locals value in the landscape, we employed Q methodology as a means to empirically explore the “subjective realities” of participants (McKeon and Thomas, 1988, pp. 7). It is not common for this technique to confirm or inform hypotheses (e.g. Watts and Stenner, 2005, pp. 75; Robbins and Krueger, 2000). Instead, it identifies clusters in the way people think about a topic by how they sort a set of prompts related to it. Data collection involved the process of sorting such a set “along a continuum defined by a condition of instruction” (McKeon and Thomas, 1988). The results of this process – the Q sorts – were subsequently statistically analyzed. We chose this method owing to its non-normative, internal focus (McKeon and Thomas, 1988; McKeown, 1990); subjects were free to decide what was meaningful in the landscape from their perspective alone (Watts and Stenner, 2005), and this self-referenced viewpoint was likewise conserved during the statistical analysis (Robbins and Krueger, 2000).

Q methodology is frequently performed with verbal statements (e.g. Neff, 2011), but we used photographs as stimuli because we judged these more suitable to local people. Photo-elicitation has proven its utility for participatory landscape research; including the capacity to reveal underlying attitudes, produce rich data, “speak” to different categories of people and bridge the researcher-interviewee gap created by more traditional methods (Sherren et al., 2010; Van Auken et al., 2010). Photograph-based Q methodology is acknowledged as a reliable, valid, and useful photo-elicitation method (Fairweather and Swaffield, 2001; Pitt and Sube, 1979; Swaffield and Fairweather, 1996) that can encompass a wide variety of landscape settings (Fairweather and Swaffield, 2001). In contrast to other more prominent photo-based approaches assessing landscape preferences (e.g. externally driven photo-elicitation, photo-voice, photo novella), Q methodology employs quantitative methods to understand qualitative judgments (Kerrand Swaffield, 2007), and thus facilitates a solid systematization of preferences (Mazur and Asah, 2013). This systematization of preferences is a manageable entry point into the complexity of human subjectivity (Cross, 2005; Robbins and Krueger, 2000) and remains operational throughout advanced levels of statistical analysis (Pitt and Sube, 1979). While other

photoelicitation methods can be used to identify attachments to specific features in the landscape (Sherren and Verstraten, 2012), in Q methodology, the photos cannot be subdivided. A photo illustrating an entire landscape setting may be ranked differently (or the same) by individuals who are looking at different features in the photo.

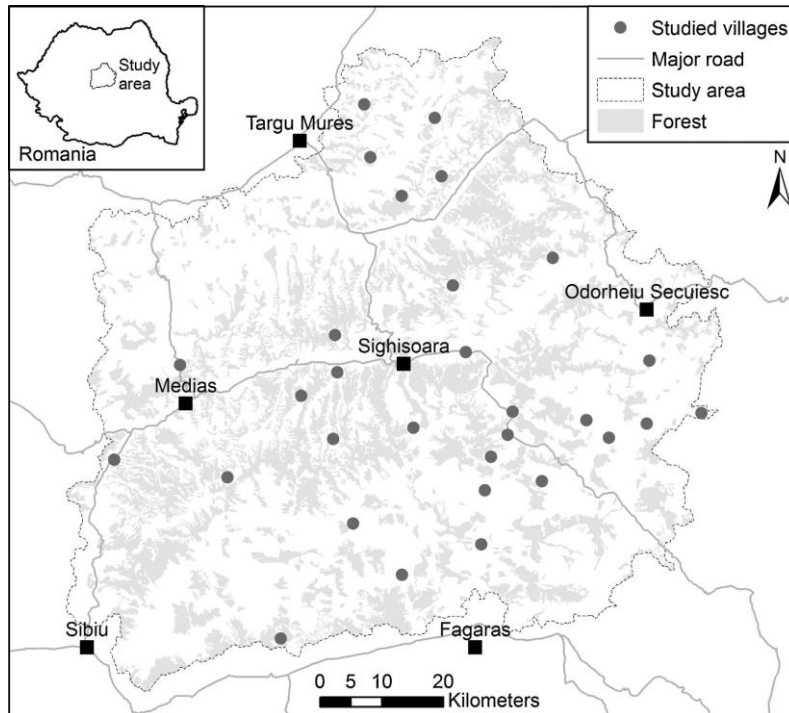


Fig. 1. Map of the study area showing the 30 villages where interviews took place, the major roads and towns.

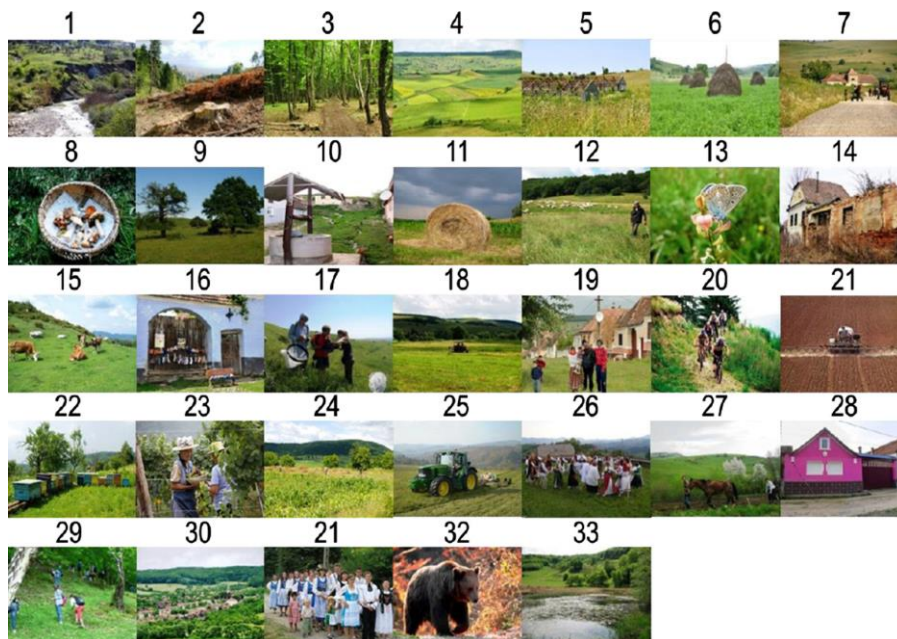


Fig. 2. List of the photographs used during the Q-sorting. See acknowledgements section for photo credits.

The Q set

Thirty-three photographs were selected from a large and diverse set taken by colleagues during field studies in Southern Transylvania in 2011, supplemented with photographs from other sources and contacts, which capture various elements of modernization (Fig. 2). For in depth knowledge of the landscape, during the photograph selection process, we consulted with a local scientist specialized in biodiversity conservation. We also relied on the expertise of our research team which previously completed substantial other field-work in the study area. According to Q methodology, the sample of stimuli (the Q set) needs to be diverse, rather than random or representative (Kerr and Swaffield, 2007; Neff, 2011). The photographs were chosen in away that ensured a diverse and plausible range of landscape settings showing one or more of the following: (1) the main land cover types: arable land, pasture, wood pasture and forest; (2) some characteristic provisioning, cultural, regulating and supporting ecosystem services (e.g. hay, folklore, fresh water, pollinators); (3) signs of recent socio-economic changes affecting the area, such as gradients of agricultural intensification or uncontrolled modernization of heritage buildings. The photographs also reflected typical human occupations (e.g. scything). In choosing the final set we also consulted a local researcher and previous international studies employing the Q methodology with photographs (Fairweather and Swaffield, 2002, 2001). A preliminary sample of photographs was tested during a pilot study in March 2012, and the final selection of 33 photographs was adjusted accordingly. Some photographs were cropped or minimally altered to enable a clear focus on particular landscape elements. All photographs were printed in 13 cm × 9 cm, numbered and laminated.

Characteristics of participants

Our study had 129 participants, with approximately equal numbers of individuals from the randomly chosen set of 30 villages. This high number of participants (unusual for Q methodology) was justified by the regional scale of the study. Our sampling strategy targeted different local ethnicities (e.g. Romanians, Hungarians, Roma, Saxons), diverse stakeholder groups such as farmers, subsistence farmers, town hall officials, local activists, people engaged in tourism, and other important rural occupations (e.g. priest, doctor, teacher, policeman, forester). As is customary for Q methodology, mere availability was one strategy for approaching participants (McKeon and Thomas, 1988, pp. 37), together with the snowball sampling method, i.e. requesting respondents to recommend additional participants (Biernacki and Waldorf, 1981). The method was positively received; 68% of approached locals agreed to participate. The 129-person sample comprised 83 males and 46 females with a median age of 45 (interquartile range 35–55) (Fig. 3).

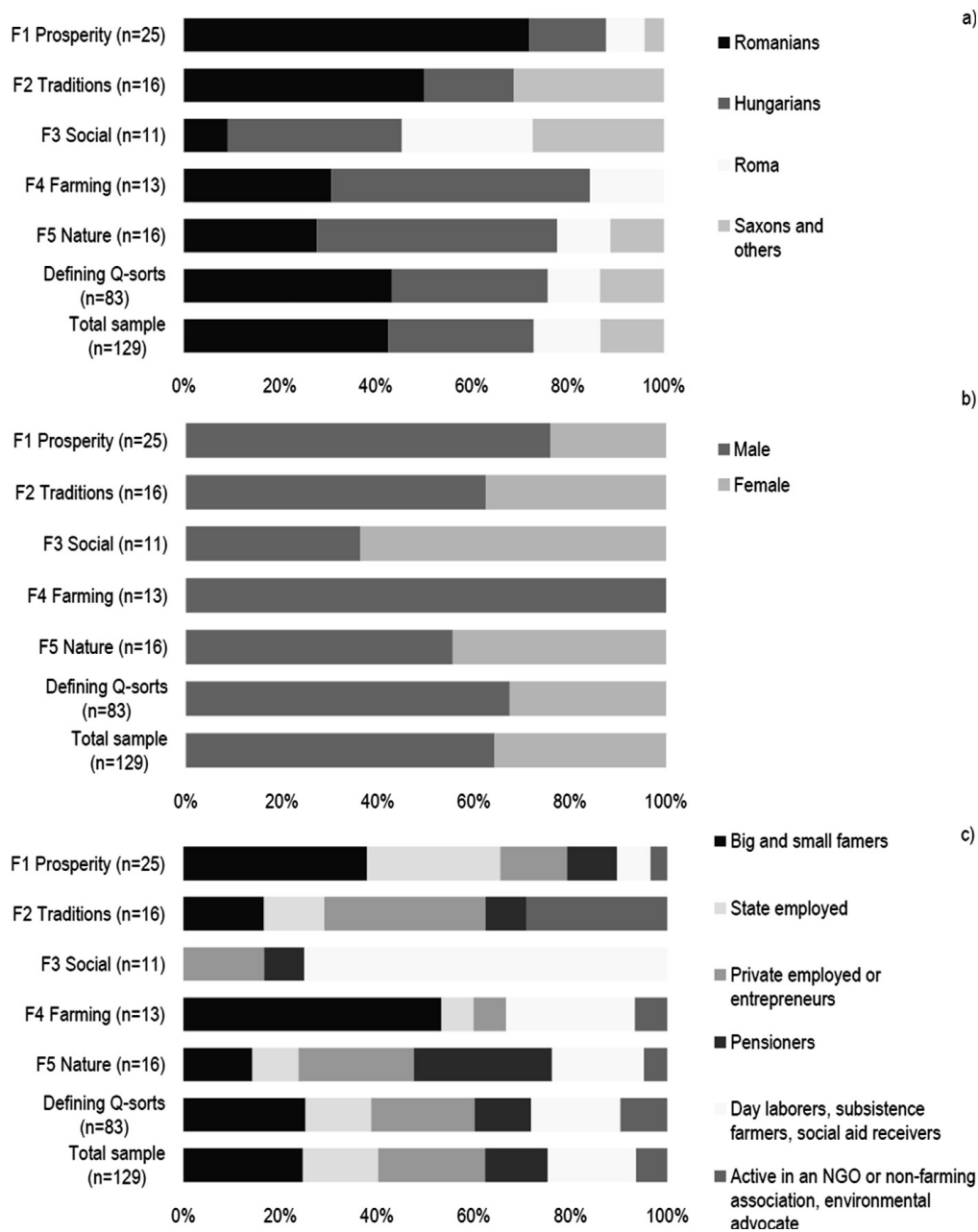


Fig. 3. Demographic summaries of the five factors based on factor-defining Q sorts. Summaries by: (a) ethnicity; (b) gender; and (c) occupation. Notably, occupational categories are dynamic and unstable because many individuals have more than one source of income and are often engaged in short-term employment.

Administration of the Q sorts and post-sorting interviews

Before beginning the interview, the researcher introduced the study, gave information about the interview procedure (privacy and confidentiality), obtained permission for recording and tried to put the interviewee at ease. The 129 participants were asked to sort all 33 photographs in a forced normal distribution according to what they would most like to see in their village or village surroundings, and what they would least like to see. For each interview, photographs were randomly spread out, and participants were advised to initially sort them into three

categories: things they would most like to see, things they would least like to see, and things toward which they were relatively indifferent. Each person was then provided with a template of a normal distribution that was drawn on a wooden board in a diamond shape (Fig. 4) and was instructed to place the photographs working from the top and bottom ends to the center. The novel diamond shape was introduced after the pilot study because it made intuitive sense to locals to place their most preferred pictures at the top. The number of photographs to be placed at each ranking value (shown in parentheses) was predefined: 1 (+4), 2 (+3), 4 (+2), 6 (+1), 7 (0), 6 (-1), 4 (-2), 2(-3), and 1 (-4). For intuitive clarity, one smiley face and one sad face were drawn next to the highest and lowest rankings, respectively (Fig. 4).

Following the sorting, participants were asked to explain their choices, especially with respect to the top seven (+2 to +4) and bottom seven (-2 to -4) photographs. Moreover, they were asked to provide basic demographic information (age, occupation, personal history). All interviews were conducted in May–July 2012, by the first author in Romanian (with the exception of two interviews conducted in Hungarian using a local translator). The interviews had an average length of 45 min, and were held in places familiar to the respondents such as their household, local shop or along the street. Interviews were recorded and the Q sorts were photographed. Recordings were transcribed directly in English, and coded (Gibbs, 2002) using NVivo software for qualitative data analysis (Fig. 5). Coding was used to categorize the rich qualitative information and assess how themes arising from the interviews related to the quantitative results (Fig. 5). Qualitative analysis played a key role, because unlike in the case of statements, a photograph can easily hold several meanings to different individuals (Robbins and Krueger, 2000).

Statistical analysis and interpretation

We applied factor analysis using the PQMethod Version 2.33 software to investigate patterns in the Q sorts (Schmolck, 2012). Five factors were extracted using Principal Component Analysis and then rotated via the Varimax orthogonal method (Brown, 1993). The extraction of five factors was based on screening for eigenvalues greater than one, on the Scree test plot, and on our personal judgment of interpretability (four and six factor solutions were considered but dismissed). The five factors grouped together people who sorted photographs in similar ways – hence, it could be inferred that they shared common views on the landscape (Watts and Stenner, 2005). To assess the extent of association of each interviewee with each of the five factors, we calculated the factor loading for each individual Q sort. Based on statistical significance and their degree of communality (the proportion of a sort's common variance, i.e. variance that has been accounted for by the study factors, should be significantly tied to a single factor) (Schmolck, 2012; Watts and Stenner, 2012), 83 out of the 129 Q sorts were considered factor-

defining Q sorts for at least one of the five extracted factors. By employing weighted averaging on these defining Q sorts, a single archetypical Q sort for each factor was obtained, called a factor array. Factor arrays illustrate the particular arrangement of photo graphs (Fig. 4) characteristic of each of the factors. Demographic (Fig. 3) and qualitative (Table 1) summaries for the five factors were calculated using the 83 factor-defining Q sorts. Their factor loadings were statistically significant at $P < 0.01$, with the exception of three, which were significant at $P < 0.05$, but displayed a strong association to only one of the factors. We used this solution (based on 83 defining Q sorts) because it provided the lowest levels of correlations between factors, the highest interpretability, and was based on the highest number of participants.

To interpret the factors, we first examined the factor arrays of photographs (Appendix A) and the ranks assigned to photographs for a given factor (Table 2). Second, we used results of the coding of the post-sorting interviews (Table 1). Third, we complemented our interpretation of the underlying ways people think and feel about their landscape with demographic information (Fig. 3) and the “deep interaction” (sensu McKeown, 1990) we had with locals. For each factor we identified relevant quotes by the top loading participants.

RESULTS

Interpretation of the factors

The factors are interpreted in narrative form below. Following rotation, the five factors collectively explained 58% (16%, 11%, 9%, 10% and 12%, respectively) of variance, indicating that some of the opinions expressed by participants through sorting the photos were not encompassed by the factors. We caution that each participant verbalized to some extent opinions specific to multiple factors. Interpretations of the five factors are merely archetypes of the existing perspectives.

Factor 1 (F1) landscapes for prosperity and economic development

Individuals loading onto this factor would like to see signs of wealth and economic growth in the landscape, and disliked elements suggesting underdevelopment and poverty. Pictures covering the top ranks (Fig. 4) showed modern tractors (#25, #21), beehives (#22), a renovated house (#28), locals celebrating (#31, #26) and women gathering grapes (#23). F1 ranked photograph #21, showing spraying and intensification (Table 2), more highly than any of the other study factors: “The weeds are resistant, we can only eliminate them with herbicides. Otherwise we won’t have the work force to get rid of them” (Participant 66, hereafter P66).

Table 1. Number of participants per factor mentioning certain themes in the post-sorting interviews. The table shows the 16 most frequently coded themes. Themes are presented in the order of frequency according to defining Q sorts (n = 83). For each theme, the highest percentage across factors is marked in bold. Please note that by considering for each factor, only the values marked in bold, every factor had three themes percentage-wise most coded at, with the exception of Factor 1 that had four themes.

Themes mentioned by “x” participants out of “n” participants	Defining Q sorts (n = 83) x	Total sample (n = 129) x	Factor 1 (n = 25) x (%)	Factor 2 (n = 16) x (%)	Factor 3 (n = 11) x (%)	Factor 4 (n = 13) x (%)	Factor 5 (n = 18) x (%)
1. Traditional values endangered	37	56	9 (36)	9 (56)	6 (55)	5 (38)	8 (44)
2. Modernization of agriculture	37	54	18 (72)	6 (38)	1 (9)	6 (46)	6 (33)
3. Farming as the social norm	34	56	10 (40)	6 (38)	5 (45)	7 (54)	6 (33)
4. Historical changes and nostalgia for the past	31	47	12 (48)	5 (31)	3 (27)	4 (31)	7 (39)
5. Attitude toward nature	30	48	8 (32)	5 (31)	3 (27)	3 (23)	11 (61)
6. Local institutions and the mayor	30	44	14 (56)	6 (38)	3 (27)	4 (31)	3 (17)
7. Community spirit aspirations	27	41	9 (36)	3 (19)	5 (45)	5 (38)	5 (28)
8. Neglected appearance of the village	27	47	11 (44)	4 (25)	4 (36)	1 (8)	7 (39)
9. Appreciation for maintained landscapes	26	40	11 (44)	2 (13)	5 (45)	3 (23)	5 (28)
10. Local living conditions	26	31	8 (32)	2 (13)	6 (55)	5 (38)	5 (28)
11. Sense of place and local identity	25	43	6 (24)	8 (50)	2 (18)	3 (23)	6 (33)
12. Water related issues	24	38	7 (28)	3 (19)	3 (27)	2 (15)	9 (50)
13. Profitability of agriculture	23	36	11 (44)	3 (19)	0	7 (54)	2 (11)
14. Degradation of ecosystem services	22	33	4 (16)	3 (19)	3 (27)	3 (23)	9 (50)
15. Corruption and cheating	21	32	6 (24)	4 (25)	1 (9)	7 (54)	3 (17)
16. Traditional ecological knowledge	21	32	5 (20)	8 (50)	2 (18)	2 (15)	4 (22)



Fig. 4. The characteristic arrangement of photographs (in a typical Q sort) for the first factor. We used a diamond-like shape for the suggested distribution template because it made intuitive sense to locals to place their most preferred pictures at the top. Appendix A shows the characteristic arrangement for all factors.

Another distinguishing photograph was #28, which suggested the quest for prosperity might come at the expense of cultural heritage: “I like new, modern buildings” (P66). F1 individuals were fond of traditional celebrations due to their recreational nature rather than their cultural value. This group was less fond of raising sheep (#12 ranked 16th) which was regarded as outdated: “This one with the shepherd I don’t like it so much, it’s not modern anymore” (P80). Instead, photograph #22 (of beehives) was favored because of a perceived link to income generation through European projects supporting apiculture. Pictures suggesting wild, nature-dominated landscapes, decaying buildings, or traditional agricultural practices were rated poorly: “Animals are not treated nor fed as they are supposed to; very outdated and inefficient agriculture” (P85).

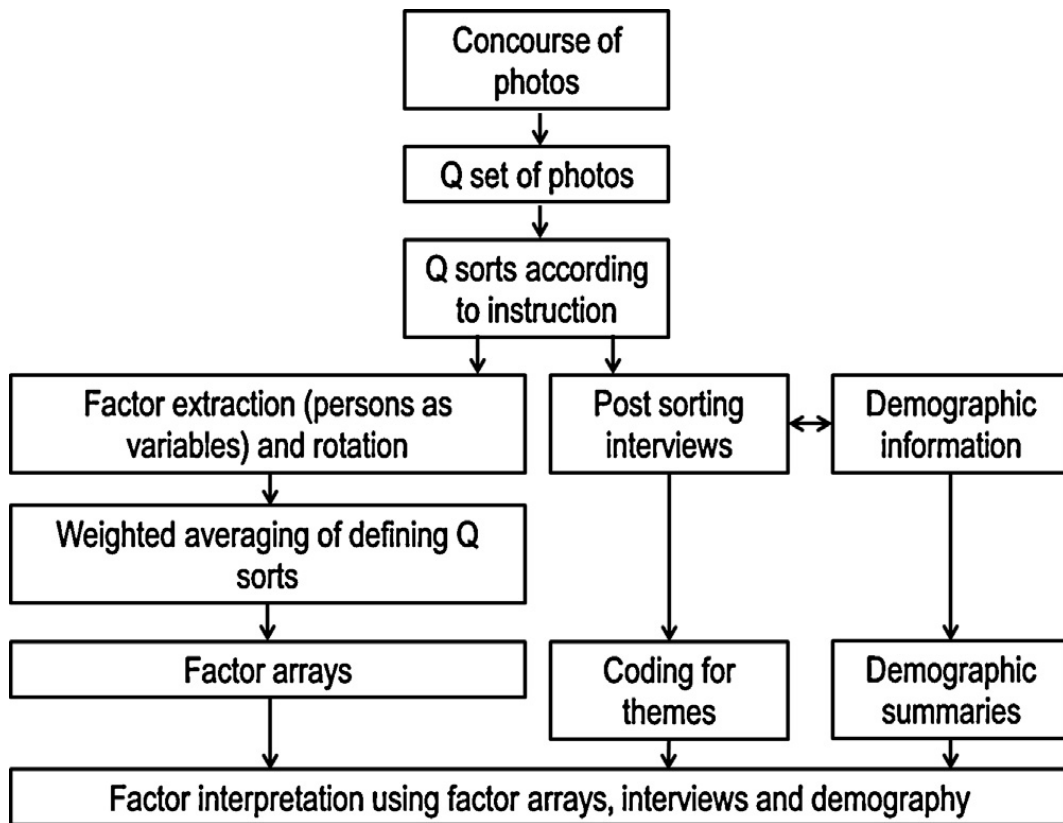


Fig. 5. Workflow depicting the stages of the study (after Neff, 2011).

Qualitative data further clarified the reasoning behind the most popular photographs: “Something that brings abundance, prosperity, virtue and joy should be placed at the top” (P3); “The first photographs show the modernization of the village, exploitation of the soil with modern machinery and tools and on large surfaces” (P88). Interviewees who loaded significantly onto F1 talked about the necessity to shift to modern agriculture to attain comfort and improve efficiency: “Let there be mechanization” (P3); “Modern agriculture, a way for the future development of the village” (P66). Participants associated with this factor were aware of local institutions and frequently mentioned the mayor (Table 1). They also talked about historical changes such as land-use changes and had vivid recollections about the past, especially communist times: “Before ‘89 they used to export wheat from here as from Southern Romania. There wasn’t the smallest piece of fallow land” (P36). F1 was sensitive about the external appearance of the village and disapproved of unkempt houses: “We don’t want to see houses that are knocked down or left behind” (P3). People under F1 were also concerned about the profitability of agriculture: “The capitalizing of dairy products is under what is an efficient and expected price” (P88). Compared to the other factors, were least worried about the withering away of traditional values. Demographically, the 25 participants grouped under F1 had the oldest age profile (median: 51; interquartile range: 35–59) (Fig. 3). F1 was male- and Romanian-dominant. It had the largest proportion of state employed participants (one vicemayor, one town

Table 2. Ranks assigned to photographs under each factor. Ranks were calculated on the basis of normalized weighted means of the rankings of each photo for that factor, and were used to interpret the factors. Highest rankings for each photo are marked in bold.

Photo number and short description	Factor 1 rank	Factor 2 rank	Factor 3 rank	Factor 4 rank	Factor 5 rank
1. River	25	24	27	24	9
2. Deforestation	32	32	32	28	27
3. Forest	19	23	26	6	3
4. Fields (crops)	9	18	25	10	13
5. Abandoned farm construction	29	30	31	22	30
6. Traditional bale of hay	22	16	19	8	19
7. Current means of work and transport	26	21	17	11	23
8. Forest products	24	13	23	29	21
9. Wooded pasture	15	22	24	15	5
10. Fountain	28	25	12	23	28
11. Modern bale of hay	10	28	29	12	25
12. Shepherd with livestock	16	1	22	3	18
13. Butterfly on a flower	14	5	15	25	4
14. Old house	33	31	30	31	33
15. Cattle	8	8	11	2	14
16. Display of traditional products	27	9	16	30	29
17. Butterfly catching	18	12	10	26	12
18. Tractor on field	11	20	18	5	20
19. Roma people	30	27	28	32	31
20. Bikers	17	17	6	27	11
21. Spraying	2	29	13	9	32
22. Beehives	3	15	7	14	16
23. Grape harvest	6	2	5	17	7
24. Manual mowing	23	7	21	7	17
25. New tractor	1	26	9	1	22
26. Traditional celebrations	7	4	2	18	6
27. Horse ploughing	31	6	8	4	24
28. Renovated house	5	33	3	16	26
29. Trips in nature	13	11	4	19	10
30. Village situated in a valley	12	14	14	13	2
31. Saxon people	4	3	1	21	8
32. Bear	20	10	33	33	15
33. Lake	21	19	20	20	1

hall secretary, two counselors, two policemen and one doctor). Many of the farmers that shared this viewpoint were also involved in farming associations with managing positions, or were village representatives or past candidates in the local council. Only one person active in a non-farming association loaded on this factor.

F2 landscapes for traditions and balance

F2 suggested pastoral, bucolic landscapes in which people are present but interact with the landscape in somewhat idyllic ways. The seven top-ranked photographs (Appendix A) featured typical rural occupations, cultural events, biodiversity and traditional agricultural practices. A defining photograph was the “shepherd” (#12) which was ranked more highly than in all other factors. Similarly, the position conferred to photograph #16 (display of traditional products) was also unusually high, partly because of potential tourism opportunities: “This is an attempt to value the craftsmanship of some women and attract tourists” (P34). F2 also believed in the compatibility of large carnivores and human settlements (#32 ranked 10th, Table 2): “This is something special, a place where there are so many bears. [...] Here nature and people are in a communion, they live together” (P50). F2 individuals were also fond of finding useful plants and mushrooms in nature (#8 ranked 13th). “Nature offers everything that is needed including the fruits of the forests” (P34). F2 responded to the picturesque nature of the landscape and expressed respect for traditional agriculture: “What is mown by hand has a better chance to set seed, and the pasture will have more flower species” (P51); “Horse ploughing is something that one can see rarely nowadays and I guess globally it is even rarer. Something that you don’t see often is precious and valuable” (P73). The bottom ranked photographs showed abandoned buildings, mechanized agriculture, and deforestation. F2 gave the lowest score to renovated houses that did not respect cultural heritage (#28 ranked 33rd).

Qualitative data (Table 1) indicated that F2 participants had a strong need for traditional values and sense of place (although two participants were born outside Romania) (Fig. 3): “This looks too western for these landscapes” (P73). People sharing this view point were seeking a balanced relationship between human intervention and nature while projecting on the landscape their own expectations: “Sheep offer a double benefit: to myself in the form of money and to the environment in the form of pastures being maintained” (P73). Although shepherding was not widespread among Transylvanian Saxons (Akeroyd and Bădărău, 2012; Dorner, 1910), F2 idealized sheep grazing as a traditional way of interacting with the landscape: “I wish I would see more shepherding and that it will not disappear. Without this Romania will no longer be Romania” (P51). F2 valued locals’ traditional ecological knowledge, while being driven by inner principles and intrinsic motivations: “This is where we should go back to and this is where it’s going anyway: [...] focusing on traditions, on our own work, and on what we produce” (P42). Six people out of sixteen, more than in any factor, spoke about “natural products and health” when discussing their sorting decisions.

Demographically (Fig. 3), F2 was the youngest factor with a median age of 35 (interquartile range: 35–47). Sixteen respondents loaded significantly onto this factor, including three

guesthouse owners, six environmental activists, a catholic priest, and a stud-farm owner; among which two persons were also aware of the Natura 2000 network. F2 included the largest proportion of Saxons and foreigners (German, Austrian), but no Roma significantly loaded onto this factor. Instead, it had the highest percentage of persons active in NGOs and of entrepreneurs involved with tourism (Fig. 3). Based on the photographs (Appendix A), qualitative (Table 1) and demographic information (Fig. 3), F2 individuals made a conscious choice to escape modernization and their income and lifestyle was at least partly dependent on the conservation of the landscapes.

F3 landscapes for people

The typical configuration of photographs for F3 (Appendix A) promoted rural landscapes dedicated to people and simple livelihoods including entertainment: “Besides elections and political campaigns there is nothing going on in the village (P62)”. Photographs that occupied the highest rankings presented people indifferent settings, mostly during leisure activities or cultural events. Distinguishing photographs were #31 (Saxon people) and #26 (traditional celebrations), ranked first and second. F3 also recognized dependence on the landscape for food and clean water (#10 ranked 12th, highest overall position, Table 2). Just like F1, F3 gave a very high ranking to #28, the modernized house. However, in this case the house was not seen as a sign of prosperity but as a necessity and aspiration: “It is important that people have money to build a nice house like that. But there are no jobs now” (P62). F3 did not agree with the presence of carnivores in the landscape which they regarded as a threat to human lives (#32 placed last).

Qualitative data (Table 1) indicated that, just like F2, F3 individuals also felt threatened by the loss of traditional values: “I would like for our traditions to come back to life” (P55); “We haven’t had celebrations for ten years” (P118). Interviewees also emphasized concerns about the local standard of living, including job opportunities, education, and transport infrastructure (Table 1). F3 individuals saw agriculture as a socially acceptable way to fulfill their needs, and consequently expressed appreciation and aspired for well-maintained landscapes (sensu Rogge et al., 2007): “This is a landscape from agriculture. It can be seen that there are some nicely worked crops” (P82). Very specific to this factor was the concern for community cohesion. According to post-sorting interviews, F3 saw landscapes as a space for celebration and community: “I like photographs where people come together and are happy (P118)”.

With 11 respondents significantly loading onto it, F3 had the lowest percentage of Romanians but the largest proportion of Roma (Fig. 3). More than half of the individuals within F3 were women. This factor was dominated by people with low and unstable incomes from subsistence

agriculture, social aid, or occasional jobs as day laborers. There were no farmers, nor state-employed persons, in F3.

F4 landscapes for farming

For F4 individuals, landscapes were spaces for agriculture and other practical uses of the environment (Appendix A). Discriminating photographs related to cattle (#15 ranked 2nd) and forest (#3 ranked 6th). F4 was the least impressed by the beauty of nature (#13 ranked 25th) and felt little connection to leisure or research activities in nature (#26 ranked lowest of all factors). “People who farm don’t have time for this. This is for the ones who live in flats, we can’t do this, we have a lot of work in the fields” (P107). Cultural manifestations also were of little importance to F4 individuals. Unlike F3 individuals, people loading onto F4 ranked the “Saxons” photo (#21) lower than any of the other factors. F4 also did not have any interest in activities that could be associated with tourism (#20 and #16) or the value of biodiversity. Just like F3, they disliked most the presence of large carnivores in the landscape which they blamed for damages to crops and livestock: “I don’t want to see this at all, I see it every evening. It takes the sheep and you can’t complain anywhere because no one listens to you” (P84); “It eats our lives [. . .]. It destroys everything we work for all year long” (P107). As in F1, the big new tractor (#25) occupied the top position because modernization of agriculture was seen as a way forward. However, F4 seemed to prefer a mix of new and old (#24 manual mowing, #27 horse ploughing) farming practices. While F1 individuals wanted to explore development opportunities offered by the landscape, F4 individuals generally viewed modern agriculture as their only option for achieving development and wellbeing. Their strong utilitarian viewpoint was also reflected by their attitude toward the forests (#3): “People need timber, but we also need forests. If you don’t have forests, it’s very hot, bad times come” (P107).

The overall narrative relating to F4 (Table 1) emphasized key issues affecting the social–ecological system, such as competitiveness, capitalization of agricultural markets, and corruption, especially with respect to subsidies. “We work all the time and we are not paid. How long does it take to produce a kilogram of milk, to raise a calf, while a liter of diesel fuel costs 6 lei [~EUR1.3]? Now try to do agriculture with that money when lamb, pork and veal are sold at dumping prices” (P84). “I don’t get profit from agriculture. If there were no subsidies it wouldn’t be worth it to work in agriculture. I get subsidies for the sheep and the pastures but we invest a lot of money in agriculture” (P129). F4 individuals conformed to the same socially validated livelihood strategy as F3: raising animals and managing the land. While F3 was dependent on “local living conditions” for continuing this pathway, F4 did not have the same expectations, but rather, was concerned about hindering factors such as corruption and poor social capital. “Nobody ever gave me anything. I handled it. If I didn’t have it, I made it” (P84). “The state

steals from our subsidies. We don't even know how much we should get. [. . .] They don't say anything, about the animals or about how land is being used. Everybody lies" (P107). The viewpoint associated with F4 was shared by multigenerational as well as first-generation farmers that seized the opportunities offered by the EU integration (e.g. subsidies): "It's not my real job, but this is what I did to survive. I'm a driver but I can't find a job. In these times everything costs a lot and this is what I need to do to make a living" (P84); "If I grow sheep I also have to like them and I have 30 sheep, but I think I will have more" (P120). F4 individuals were dependent on the landscape for financial gain, making their deep involvement with the landscape obvious: "I have 32 hectares of land, all of it hay meadows and pastures. I don't have arable at all" (P84); "I have 17 cows on the pastures. This is the most important job in the village" (P104).

Thirteen persons with a median age of 45 (interquartile range: 39–54) were grouped under F4 (Fig. 3). No women significantly loaded onto F4. It had the largest proportion of Hungarians and no Saxons. F4 included mainly farmers, mostly being described by themselves or other villagers as among the largest farmers in their village, but no pensioners (retired persons). More than a quarter of respondents significantly loading on F4 were day laborers or subsistence farmers.

F5 landscapes for nature

In this factor, the arrangement of photographs emphasized natural and semi-natural vegetation. It suggested high appreciation for woody vegetation and forest-dominated landscapes and their overall esthetics and naturalness, and denoted the least degree of involvement of people in the landscape. Photographs displaying a lake (#33), a village situated in a valley (#30), a forest (#3), a butterfly (#13) and a wood pasture (#9) ranked highest in F5. Such settings were described as "natural, "clean" and "alive", and the most highly ranked photographs (Appendix A) evoked "purity, silence and freedom" (P63). The least-liked photographs represented, among others, old rural constructions and mechanized agriculture: "Photo 21 doesn't say anything to me" (P124). According to correlations between factor scores (Table 3), F5 shared similarities with F2, but with a primary focus on nature conservation: "Herbicides are not my type, I'm a naturalist" (P17). Notably, F5 was not interested in the marketing of traditional products (#16 ranked 29th).

Qualitative data (Table 1) revealed that F5 individuals cared about nature and their relationship with it: "Water is the source of life and I feel connected to it" (P124). F5 indicated a general concern for the degradation of ecosystem services, for example, as caused by climate change, and a particular concern for water-related phenomena such as drought or the pollution of rivers: "We don't have rivers in the village, only a lot of garbage" (P63). F5 respondents were recreation consumers and landscape observers, and their interactions with the landscape were driven by a quest for tranquility: "Nature and silence, you can see it's a peaceful area" (P112).

F5 displayed the most diverse and balanced demographics (Fig. 3) with respect to source of income, and was most similar in composition to the overall sample of 129 respondents. This group of eighteen respondents included retired country-dwellers but also commuters and weekend inhabitants; as well as private employees and entrepreneurs. Among subsistence

Table 3. Correlations between factors and factor characteristics.

		Factor 1 Prosperity focus	Factor 2 Traditions focus	Factor 3 Social focus	Factor 4 Farming focus	Factor 5 Nature focus
Correlations between factor rankings	F1	1.00	0.33	0.52	0.52	0.47
	F2	0.33	1.00	0.42	0.22	0.59
	F3	0.52	0.42	1.00	0.31	0.32
	F4	0.52	0.22	0.31	1.00	0.24
	F5	0.47	0.59	0.32	0.24	1.00
No. of defining Q sorts		25	16	11	13	18
% of explained variance		16	11	9	10	12

farmers that significantly loaded on F5 there were persons that moved from the city to the countryside in search of lower living costs. Like F4, the fifth factor was ethnically dominated by Hungarians. Its age profile was comparably younger than for factors 1, 3 and 5 but was similar to F2 (median: 38, interquartile range: 28–63).

Consensus photographs and frequent themes

Despite relatively high correlations between factor scores (Table 3), there were no consensus photographs, that is, photo graphs that were given the same ranking by all factors. The highest levels of consensus were found for photographs #22 (beehives), #6 (traditional bale of hay), #17 (butterfly catching), #14 (old house), and #23 (grape harvest). The lowest consensus or highest disagreement revolved around photographs #28 (renovated house), #32 (bear), #21 (spraying), #27 (horse ploughing) and #25 (new tractor).

The most common themes arising from post-sorting interviews were the modernization of agriculture and the fading of traditional values (Table 1). Other themes that were mentioned by more than 30 participants out of the 83 were about “farming as the social norm” and “historical changes and nostalgia for the past” (Table 1). Interviewees noted that making a living as a farmer (having returns from working the land, raising livestock and managing a household – “gospodarie” –) is considered by the community to be normal, desirable, and socially valuable. The evident social value of this livelihood strategy thus clearly contains a normative dimension (Câmpeanu and Fazey, in press; Crane, 2010) where farming represents an ideal, and a source of social acceptance and validation: “It looks very nice, land that is worked. This is how our land should look like” (P80); “A cow should not be lacking in any Romanian’s household” (P43);

“We should go and work [as farmers]. It’s a lot of work but it’s good to go and carry on what our grandparents started” (P109); and, “For me this signified that these people give their best, they strive with rudimentary tools to achieve something, [...] and that’s important” (P48). People frequently spoke of the cultural Saxon legacy, the communist era, and the time immediately thereafter, suggesting it left a deep imprint in people’s minds: “Collective farms had been well done, and they didn’t do it better after that” (P85).

DISCUSSION

Our results showed that locals look at their landscape in multiple ways, appreciate different elements and uses of the landscape, and prioritize these differently. Such a diversity of perceptions and aspirations is somewhat expected for the chosen study area and corresponds to the heterogeneous and multifunctional nature of Transylvanian landscapes and to their ethnically and socially diversified population. Greater understanding of the diversity of viewpoints could help to facilitate the design of effective management strategies – whether these target economic competitiveness or the conservation of cultural landscapes. Navigating this space of contested priorities is all the more relevant in polarized Transylvania, where globalization is driving increasingly specialized, high productivity landscapes, while rural development measures (EC, 2005) incentivize more diverse and multifunctional landscapes.

Consensus and disagreement areas

The lowest consensus photographs outlined areas of considerable disagreement between preferences for traditions and multifunctionality and views on modernization and intensification. Interestingly this area of disagreement was confirmed by the central dichotomy found in the qualitative data, where the two most prominent themes in interviews were the modernization of agriculture and the fading of traditional values (Table 1). Despite these contested preferences and the lack of consensus photographs, there were also common opinions, as reflected by the relatively high correlations between factor scores (Table 3), and the qualitative analysis, which highlighted many themes that are common to all of the five factors (Table 1). A certain overlap between factors is natural, especially with large studies (Watts and Stenner, 2012).

Additionally, however, the contribution of Romania’s communist past and the recent and ongoing transition to capitalism in explaining the level of correlation is obvious, since the median age of the total sample is 45 years. Literature suggests that people’s viewpoints and perspectives are influenced by cultural, social and historical experiences (Robbins and Krueger, 2000; Rogge et al., 2007; Suckall et al., 2009). This is also confirmed by the frequency of the code “Historical changes and nostalgia for the past”. Participants referred many times to the various historical periods the region traversed (before World War II, communism, post-

communism), often regretting today's modern, individualized organization of society or the job market. This is strongly validated by many Eastern European studies revealing positive evaluations, by the public, of the communist period (Tileaga, 2012). Locals who currently live in Southern Transylvania, despite originating from a diversity of other Romanian regions, all bear to a greater or lesser extent, the imprint of Communist oppression (Badescu and Sum, 2011). They were forced to think and act as a mass of people, by a political regime that infringed on the liberty of expression and individuality (Tismaneanu, 2008). Because of the Communist time lag, followed by an accelerated transition period, the diversification of opinions regarding landscapes within the communities from Southern Transylvania may be in its early stages, while stronger, more distinctive, and less consensual, positions are yet to emerge. In addition, the first and second generation settlers, experiencing a weak connection to the region's cultural landscape, may be expected in the future to exert and mark more clearly their distinct identities and aspirations on the landscape.

The relationship between factors and current approaches for the research and management of rural landscapes

The narratives associated with this study's five factors share resemblances with contrasting policy discourses on rural landscape management as well as with alternative rhetoric in the scientific literature: the wild nature versus cultured nature debate (Hansen-Møller et al., 2005; Newton et al., 2002), the biodiversity conservation versus human development paradigm (Martín-López et al., 2011; Young et al., 2005), the focus on landscape functionality versus intrinsic values (Rogge et al., 2007), as well as the discourses around the social (Fagerholm and Käyhkö, 2009), cultural (Daugstad et al., 2006), agricultural, ecological, or esthetic values of rural landscapes (Hansen-Møller et al., 2005; Williams and Cary, 2001).

The five revealed viewpoints cannot be extrapolated to the whole population, nor used to make claims about the percentage of people sharing the views expressed, therefore caution is needed when discussing them (Kerr and Swaffield, 2007; Watts and Stenner, 2012). By revealing potential management implications of the five viewpoints, we do not seek to force generalizations to the entire population. Rather, we aim to "translate" what village residents said about landscapes in Southern Transylvania into a language that is familiar to a wide audience including a policy-focused readership.

The first factor ("Prosperity") seemed most determined to adopt any means or technologies in order to achieve modernization (van der Ploeg et al., 2000) and economic growth (sensu Kuznets, 1955). Importantly, many individuals grouped within F1 also possess the power and interest (Reed et al., 2009) to actively contribute toward such modernization. F1 included many

state officials and individuals in management positions who often administrate or control relatively large areas of land, typically without being directly affected by potentially negative consequences of their decisions (Verdery, 2003, 2002). Moreover, being part of the local institutional environment gives such individuals implicit access to information relating to decision-making processes (Mikulcak et al., 2013).

For F2 (“traditions”), “diversity in use” (de Groot et al., 2005) was particularly important in order to balance the provision of multiple services, including cultural benefits, with economic development. Many individuals in F2 appeared able to independently assess relevant information, with this factor being dominated by NGO and privately employed people, many of whom have relatively high levels of income and education. Being at least partly dependent on the landscape through income and lifestyle, F2 aligns closely with the objective of “sustainable cultural landscapes” (de Groot et al., 2005, pp. 461) and may be most committed to maintaining landscape identity.

For F3 (“Social”), the most obvious preference was the prominence of people in the landscape. Individuals within this factor were interested in seeing socio-economic improvements from rural development programs, that is, they would like to see improved livelihoods, higher incomes and higher employment levels for rural people (Scoones, 2009; van der Ploeg et al., 2000). But unlike for F1 individuals, their current impact on landscape management was far smaller due to the demography of individuals within this factor. They had the highest proportion of relatively poor subsistence farmers who control very small parcels of land that comprise their sole source of income, and day laborers who are dependent on the landscape for daily jobs.

F4 (“Farming”) was dominated by medium-large farmers and included beneficiaries of agricultural subsidies, thus directly shaping and being dependent on the landscape. F4 aspired to prosperity through farming, and envisioned modernization as one possible way to achieve it. Respondents grouped under F4 were concerned with getting tangible returns from farming and the viability of agriculture as a back-up livelihood strategy: “I don’t get profit from agriculture. The subsidies are not enough, but despite this, in case something happens, like we get sick or we can’t work [in the city], we have something to eat. [. . .] We don’t need internet, we need food” (P120). Such a strong pragmatic attitude is in line with an increasing body of literature (Burton et al., 2008; Greiner and Gregg, 2011) showing that farmers are not simply economically driven profit-maximizers, and exhibit considerable inertia when responding to financial incentives.

F5 (“Nature”) strongly embodied interests of nature conservation, but most of the individuals in this factor were consumers of recreation, in search of quietness. Thus, F5 displayed less active engagement in the landscape than F2, less dependence on the landscape than F3 and F4, and

considerably less power than F1. However, the degree to which recreation consumers are involved in the landscape and impact land-use may increase in the future. Considering their predominantly urban origins, such consumers may expect to have modern facilities in the villages, which would imply a need for infrastructure development, hence affecting land-use.

The relationship between the five factors' viewpoints and the management trends affecting the region can be graphically illustrated within a conceptual space diagram (Fig. 6) (Watts and Stenner, 2012). We positioned locals' viewpoints alongside two axes. The five factors and the qualitative data indicated areas of considerable disagreement between views inclined toward modernization and intensification, and views embracing traditions and maintaining the landscape. Hence, the horizontal axis refers to the modern versus traditional continuum. The second axis is based on factors' degree of involvement in the landscape which we conceptualized as the level of agency possessed by individuals associated with a given factor, defined as "the capacity of persons to transform existing states of affairs" (Newman and Dale, 2005). Factors with a high level of agency and with views prioritizing modernization were judged to share a high change agency toward modernization. This suggests that individuals holding F1 and F4 viewpoints are potential agents of landscape change, driving the trajectory toward modernization, while people grouped under F2 are likely to be the most resistant to change and see themselves as the drivers of sustainability and multifunctionality. We caution that clear indications regarding which locals will influence the landscape cannot be established based solely on the identification of viewpoints within the population of Southern Transylvania. However, our previous studies in the region (Hanspach et al., 2014; Hartel et al., 2014; Mikulcak et al., 2013) and ongoing interactions with the locals support the insights gained through this study. In the same vein, it has been suggested that major disputes may arise from the initially latent tensions between NGOs and residents sharing an interest in cultural and natural heritage preservation, and the other residents who try to imprint their own identities and values on the landscape (Corsale and Iorio, 2014; Hughes, 2008).

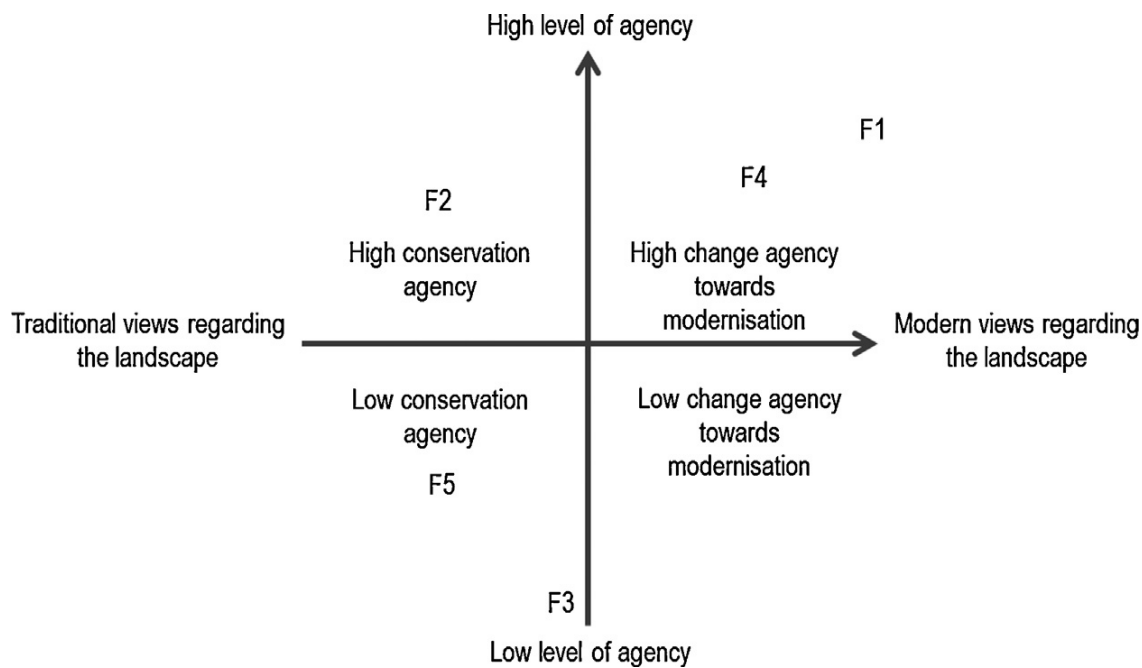


Fig. 6. Conceptual space diagram illustrating the positioning of factors and associated viewpoints (regarding the landscape) relative to the level of desired modernization and the change agency level of individuals within a given factor relative to the landscape.

Policy recommendations and conclusions

The current preferences and viewpoints of locals regarding Southern Transylvanian landscapes are diverse but include certain unifying themes. We clarified five local viewpoints and mapped these to policy and research agendas. The revealed diversity of opinions, analogous to the multifunctional and multicultural landscapes, suggests a way forward based on a diversity of management approaches, while the areas of agreement point toward an integrated development strategy. As policies should be based on local realities and actively involve locals, policy makers face the challenge of considering local viewpoints. We suggest a judicious and coordinated mix of policies that harness the identified diversity of development options, and policies that target their harmonization. We acknowledge that outcomes of these recommendations are subject to advanced policy evaluation and research. Yet, we communicated these policy suggestions through a dissemination campaign during a short field visit in Southern Transylvania, by distributing a diverse range of materials (flyers, booklets) to town halls and local NGOs, giving presentations in the villages and exhibiting posters summarizing the findings from this study and related research.

Specifically, our policy recommendations are twofold.

1. Analogous to its multipolar social and natural environment, Southern Transylvania should avoid development strategies that oversimplify its economic context or reduce opportunities for income generation activities. Economic diversity, in turn, will create space for the

inclusion of groups with different identities and aspirations, but will also increase societal resilience and adaptability to disturbances (Norris et al., 2008). Hence, a unilateral development vision for Southern Transylvania is inappropriate not only from the perspective of the local population, but also from an economic point of view. Policies should nurture diverse opportunities for development, by providing equal chances for economically viable farming, including operational markets for niche products stemming from traditional agriculture, as well as for non-agricultural livelihoods (Fraser and Stringer, 2009) such as culture-based tourism (Plieninger and Bieling, 2013). Given the potentially dominant agency of certain developmental viewpoints in the study area (Fig. 6), we suggest that the process of economic diversification would benefit from the participation of all community members. For this to be realized, top-down policies, regardless of their national or European origins, should aim at complementing rather than obstructing local bottom-up initiatives by giving due attention to all potential perspectives. Flexible policy settings should allow for a mix of measures tailored to the cultural identity of the area while also fostering diversity of opinions and offering opportunities for community involvement (Varughese and Ostrom, 2001). In a country where the freedom of expression was seriously curtailed until recently, policy programs should first tackle the incapacity and, to a certain extent, lingering fear to form, discuss and defend personal convictions. Policies embracing economic diversity should enable the emergence of committed leaders (*sensu* Goodman et al., 1998) for each archetypal viewpoint identified here. As stated in the Discussion (Section “Consensus and disagreement areas”) and implied by Fig. 6, multiple lenses can be used to drive landscape policies: economic, sustainability, or conservation. Considering groupings such as those derived in this study, with their diverse needs and interests, will foster potential for innovation while informed and motivated leaders can enhance collective action (Goodman et al., 1998) within value-based “guilds”. Creating opportunities for them to manifest therefore will be key.

2. Another set of policies should proactively support the articulation of different viewpoints on the role of landscape, through communication, education and empowerment. Not all viewpoints can always be addressed in policy outcomes, but on going communication during policy development (Mikulcak et al., 2013; Rogge et al., 2011) can reduce social malcontent and sensitize communities in anticipation of changing policy. The raising of awareness on the benefits of new viewpoints, for example regarding rising demand for traditional high-quality food (Plieninger and Bieling, 2013), can also contribute to local “self-esteem” (*pers. comm.* with a Transylvanian organic farmer), and avoid a dangerous confusion with a new imposed post-Communism homogenization of opinions. To facilitate discussions at a community level, policy programs need to urgently redress the current lack of social capital

(sensu Reimer et al., 2008; Adger, 2003) by fostering community collaboration and encouraging the development and articulation of shared viewpoints. Our findings offer an encouraging point of departure by identifying areas of potential consensus signaled by the results of the qualitative analysis (Table 1).

In practice, simultaneously responding to emerging economic, cultural, social and recreational landscape demands should be done slowly, paying due respect to traditions and nature (Table 1). Rural planning that accounts for multiple landscape values and serves pluralistic goals (Haaland et al., 2011; Lynam et al., 2007; Öllerer, 2013), be it biodiversity conservation, rural development, or agricultural production, should be regarded as an incremental process. As more players learn civic behavior (Islam and Morgan, 2012; Morgan, 2008) and feel encouraged to convey their personal opinions, they will contribute to its gradual evolution. To this end, we see the focus on financial incentives, considered a standard conservation approach in Europe (Plieninger and Bieling, 2013), to be just an intermediate stage within the multi-step process; financial incentives can only be effective in the short term, because (as demonstrated in this study) some viewpoints are not primarily driven by economic motivations. Several recent papers propose instead creating new “functional links between biodiversity, livelihoods, and culture” (Xu et al., 2009), more effective “virtuous circles” between natural, cultural, and economic assets (Plieninger and Bieling, 2013; Selman and Knight, 2006), or worthy couplings of the ecological subsystem with a transformed social subsystem (Fischer et al., 2012). Because complex but intrinsic linkages between culture and nature need to be able to anticipate and enable future contexts, the ability to innovate will be critically important (Dwyer et al., 2007). This, in turn, implies empowering communities to discover meaningful livelihoods, while avoiding real-world economic inadequacy or an unconstructive political enforcing.

Finally, the insights gained through this study could contribute to a conceptual framework for managing complex rural landscapes holding both cultural and ecological values, by reconfirming the theoretical and practical value of the populations’ viewpoints. This study proposes the use of Q methodology with photographs as a promising and empowering method for revealing landscape preferences: individuals assert deeply held values and concerns without being overlooked during the research process (Robbins and Krueger, 2000).

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SUPPLEMENTARY MATERIAL FOR CHAPTER III

The characteristic arrangement of photographs (in typical Q sorts) for the five factors based on the calculated factor arrays.



Fig. A.1. Factor 1 Landscapes for prosperity and economic development.



Fig. A.2 Factor 2 Landscapes for traditions and balance.



Fig. A.3. Factor 3 Landscapes for people.



Fig. A.4. Factor 4 Landscapes for farming.



Fig. A.5 Factor 5 Landscapes for nature.

Chapter IV

Disaggregated contributions of ecosystem services to human well-being in low-intensity farmland

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*Pământul nostru-i scump și sfânt,
Că el ni-e leagăn și mormânt;
Cu sânge cald l-am apărat,
Și câte ape l-au udat
Sunt numai lacrimi ce-am vărsat -
Noi vrem pământ!*

*Our land is holy, rich and brave,
It is our cradle and our grave;
We have defended it with sweat
And blood, and bitter tears have wet
Each palm of it - so, don't forget:
'Tis land we crave!*

Noi vrem Pământ! / We want land! George Coșbuc

ABSTRACT

Aggregated analyses of the benefits from ecosystem services (ES) neglect important differences among beneficiaries with respect to their well-being contexts, access mechanisms, and cash as an indirect ES benefit. Based on 25 group interviews, we explored these differences across five groups of potential beneficiaries from ES in a farming landscape in Southern Transylvania (Romania). Using a combination of deductive and inductive qualitative analysis, we identified six general contextual factors that mediate the ES benefits obtained by a given group: (1) condition of the supplying ecosystem; (2) policies, formal institutions and markets; (3) social and power relations, and informal institutions; (4) household decisions and individual contexts; (5) different perceptions and understandings of equity; and (6) individually held values. This empirically-derived framing of the six factors that mediate ES flows can be used to advance ES research in a wide range of settings. Specifically, it creates an explicit means of incorporating an equity perspective that is more refined than the dominant discourse on the relation between poverty and ES, which emphasizes that poor people are most dependent on ES. Moreover, recognizing multiple contextual factors that shape the contribution of ES to human well-being opens doors for harnessing new collaborations among currently disparate but pertinent bodies of work, and can help to inform more holistic policy interventions.

Keywords: equity, benefit distribution, justice, perception, poverty, value, Transylvania, Romania

SIGNIFICANCE STATEMENT

The way ecosystem services (ES) contribute to human well-being depends not only on their ecological availability but also on policies, institutional context, and power relations. Moreover, ES benefits are mediated by livelihood types, perceptions, attitudes, internal norms and values. This multi-dimensional context creates winners and losers among potential ES beneficiaries. To understand and manage the contribution of ES to human well-being, research needs to better address such contextual factors. Here, we derived a general heuristic framework of six mediating factors. For each of these factors, different bodies of literature offer new insights and potential collaboration pathways. In practice, accounting for these contextual factors will provide an improved basis to manage ES fairly and inclusively.

INTRODUCTION

Originally, the ecosystem services (ES) concept aimed to raise awareness about the links between nature and human well-being (1, 2). Research on ES evolved quickly from conceptualization, localized documentation and modeling of ecological dynamics, to policy and management applications, such as the creation of exchange markets and payments schemes for ES (3, 4). Despite ecologists, economists and policy makers now widely engaging with the “benefits people obtain from ecosystems” (5), research has sought more depth in understanding the relations between multiple components of human well-being and ES. New research agendas have emerged, including on the connection between ES and the well-being of human beneficiaries (6, 7), and on issues of equity and benefit distribution (8, 9). Various works have tried to extend existing frameworks by looking at ES from complementary perspectives such as environmental justice (10, 11), political ecology (12), social production (13), or the capabilities approach (14).

Recent research has emphasized the need to disaggregate beneficiaries in order to better understand how ES contribute to human well-being, particularly in relation to equity and poverty alleviation (15, 16). A conventional, aggregated analysis of “human well-being” lumps different potential beneficiaries (including vulnerable groups), and assumes fixed relations between the level of ES provision and its well-being contribution. By not disaggregating the beneficiaries of ES, research overlooks potentially important trade-offs between ES and beneficiaries (17, 18). Disaggregation is useful in asking who are the “winners” and “losers” of a certain change in ES provision, whose well-being is at stake, and at which scales. In their conceptual paper, Daw et al. (15) posited research on disaggregation would benefit from considering the following: (i) the ability of ES to provide cash or employment as indirect benefits; (ii) access mechanisms or “the ability to derive benefits from things” (19); (iii) the different well-being contexts of ES beneficiaries; and (iv) the well-being implications of ES trade-offs.

Despite disaggregation of beneficiaries being increasingly acknowledged as important for research (20, 21), policy (8), and valuation (16), there have been few empirical studies. To address this gap, we explored the distribution of benefits from nine ES (SI 1) among five groups of potential beneficiaries in Southern Transylvania (Romania), addressing the first three aspects suggested above (15). Drawing on 25 group interviews (GI), our objectives were: (i) to explore how direct and indirect ES benefits, access mechanisms, and well-being contexts unpack for locals; and (ii) to clarify the implications of this for the relation between ES and human well-being. Based on our findings, we developed a conceptual *model of mediating factors* (MMF), which describes how six general factors influence the contribution of ES to the well-being of beneficiaries. This model considers both formal structures causing inequality such as policies

and power relations, but also incorporates other dimensions of equity such as recognition of norms, values and perceptions (8). We argue that for each mediating factor, different, and sometimes largely under-recognized bodies of literature offer useful insights for new research on ES. In practice, better accounting for contextual factors should help to manage ES more fairly and inclusively.

Because benefits depend on the perspective of a given beneficiary (22), including wants, needs, and perceptions (23), we judged people self-reporting their benefits a suitable method for gaining a (bottom-up) grounded understanding of how “people obtain benefits from ecosystems”. By asking about subjective assessments of needs and benefits, we enabled participants to express their own, internal constructions of ecosystem-derived well-being, in contrast to much established literature, which externally assesses ES (24). Our choice of method thus served to acknowledge the subjectivity of well-being (25–27), the increasing importance of deliberative approaches (28), and requests for empirical data on how ES–human well-being linkages vary across socio-economic cases (29).

RESULTS

1. Unpacking benefits, access and well-being contexts

Depending on their ability to provide cash or employment (Fig. 1) as indirect benefits, and their propensity to generate competition among locals, ES were classified into three categories: farming, vital and no-stake ES. The remainder of our results is structured around these sets of ES.

Farming ES (hay meadows, pastures, arable land, sheep, cattle) were closely linked to the provision of indirect benefits from the land (Fig. 1). For example, obtaining agricultural subsidies under the Common Agricultural Policy was frequently mentioned as one of the indirect benefits of using a pasture [n=25 GIs]. Locals and farmers in particular perceived an intrinsic link between animals and fodder sources [14]. Pastures and hay meadows were regarded as subject to high access competition, sources of village conflicts [22], or factors underpinning [16] the possibility to increase well-being. “Participant 5 (P5): If he has a pasture, he has animals, because he needs the pasture for the animals...P3: Yes. P5: So, this is like a food chain” (GI 16).

Vital ES were important for all beneficiary groups [21] as a direct benefit. Wood (as heating fuel) and water (for domestic and farming use) were both critical for living in the area, with high needs (“P3: Wood is vital for us. [...] I could not live without wood, that's it. It's like drinking water” GI 19), but lower competition across groups.

In contrast, *no-stake ES* were characterized by low direct and indirect benefits and no competition, and included berries, agro-tourism, and apiculture products. These ES were not associated with major opportunities for cash or employment.

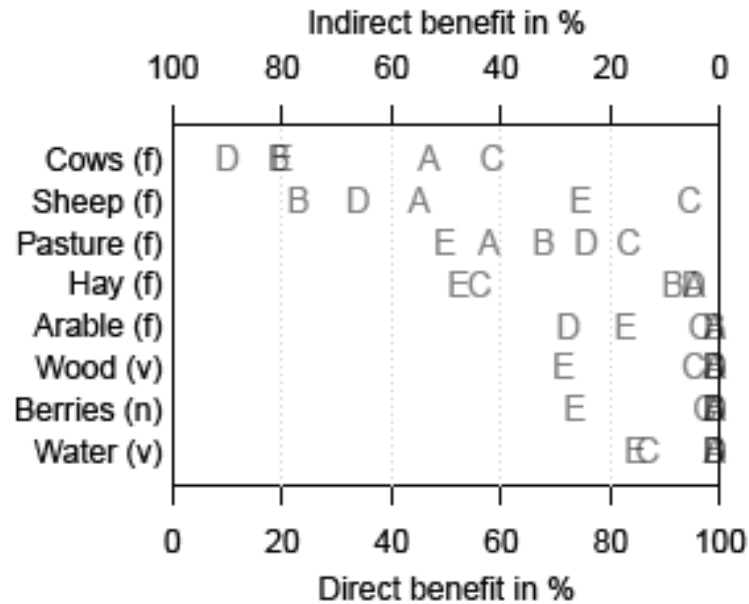


Fig. 1. Descending proportion of perceived indirect vs. direct benefit per ES ((f) = farming ES, (v) = vital ES, (n) = no-stake ES). The position of the letters indicates average values of scores assigned to beneficiary groups: A - small farmers; B - large farmers; C - non-farmers; D - officials; E - poor people; F - external supertenants. Groups were asked to decide which percentage (multiple of 10) of the total ES benefit arises from direct use (e.g. food, fodder) versus indirect use (e.g. cash through selling or subsidies, job opportunity).

Disaggregating beneficiaries showed that participants considered the nine ES benefits to be unevenly distributed among potential beneficiaries, who also had different perceived needs. Supertenants and large farmers benefited most from ES, while small and large farmers were considered the most needy groups (Fig. 2; SI 2). Among groups, officials appeared to have their needs met best (SI 2), and also had the best access to non-ES related components of human well-being (SI 3).

When explaining the distribution of farming related ES benefits among beneficiary groups, participants emphasized a large range of structural and relational mechanisms of access (19) (Table 1), to the detriment of rights-based mechanisms (e.g. illegal access, post-socialism property restitution laws).

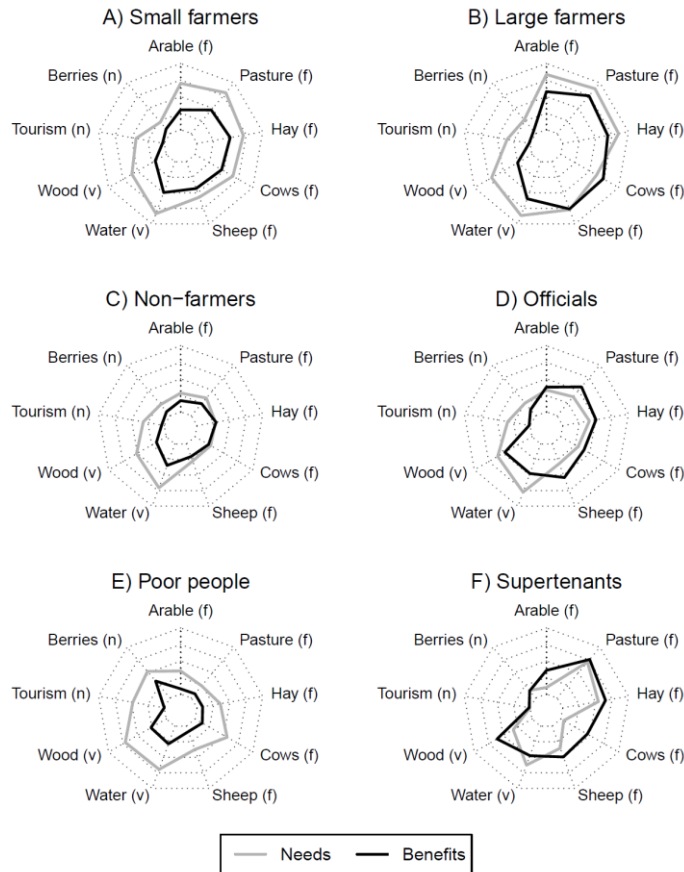


Fig. 2. Averages of matrix scores (SI 1) for the perceived benefits from and needs of ES ((f) = farming ES, (v) = vital ES, (n) = no-stake ES), per beneficiary group, on a scale from 1 (very low; inner circle) to 5 (very high; outer circle).

Table 1. Access mechanisms to the farming set of ES that participants perceived for each beneficiary group, ordered by the number of GIs mentioning each (number shown in each cell). Only the seven most widely quoted mechanisms (across all GIs) are listed here. Each mechanism can either enhance or hinder the access of a beneficiary group to the set of farming ES. Mechanisms are discussed in detail in the text.

A) Small farmers	B) Large farmers	C) Non-farmers	D) Officials	E) Poor locals	F) External supertenants
Economic profitability [20]	Land access [22]	Livelihood strategy and normativity [20]	Power and authority [18]	Labor access (cash income) [21]	Land access [19]
Land access [18]	Financial capital [20]	Limited time resources [7]	Livelihood strategy and normativity [9]	Social relations [17]	Business and management abilities [18]
Ecological availability and conditions [16]	Business and management abilities [20]	Agrarian identity and normativity [7]	Land access [9]	Policies and institutions [17]	Land business [12]

Policies and institutions [12]	Labor access (paid) [18]	Land access [6]	Social relations [8]	Knowledge [17]	Power [11]
Labor access (work investment) [12]	Personal history [16]	Financial capital [5]	Limited time resources [6]	Land access [14]	Market access [11]
Market access [12]	Economic profitability [16]	Market access [4]	Agrarian identity and normativity [5]	Technology [12]	Personal history [8]
Subsidies access [12]	Market access [15]	Policies and institutions [4]	Labor access [5]	Financial capital [5]	Subsidies access [6]

Three access mechanisms were considered particularly important across all beneficiary groups. First, *access to land* („P3: He can't get any benefit if he doesn't own land" GI 16), especially pasture, encapsulated a mix of the other access mechanisms, including right-based policies, power and social relations. Rights-based mechanisms (long-term lease, concession) were generally mentioned in relation to supertenants or large farmers, while small farmers typically depended on a temporary transfer of use rights through short-term leasing. Sometimes access to land was acquired through non-binding or oral contracts, with terms negotiated on faith and social relations. Second, *access to labor* was cited as important, with small farmers investing their own workforce, large farmers soliciting additional workforce, poor people day laboring for other groups in exchange for cash, and supertenants hiring farming labor (when not using accessed land for real estate operations). Third, *social relations* were perceived to strongly influence access and the realization of benefits. Their impact was experienced positively (e.g. for well-connected officials) as well as negatively (e.g. for poor people experiencing a lack of trust).

For small farmers, access mechanisms to farming related ES benefits revolved primarily around economic profitability: "It's not really worth it to keep sheep" (GI 20); "It is not profitable to go outside to take care of two cows" (GI 17). Small farmers were also considered the most vulnerable to ecological availability and conditions (e.g. drought, pasture capacity), whereas policies and the institutional environment were frequently reported as barriers to access. Membership in a farming association was perceived as one of few mechanisms acting in favor of small farmers: "If we didn't have the association, there wouldn't be anything" (GI 13). However participants talked about these associations as something outside their control: "If they rented out the land of the association [outside the community], we would be destroyed" (GI 17). The livelihood strategy of small farmers was motivated by a lack of rural prospects as well as by being the normative pathway of making a living of farming: "This is the source, there isn't another source" (GI 24).

Participants placed large farmers ahead of small farmers in terms of access to ES benefits: “They [large farmers] leased land and did it very well because [in this way] they got somewhere. But we didn't do anything, and remained like this” (GI 20). Large farmers capitalized on opportunities arising from political and institutional changes, and accumulated financial capital, knowledge. They could thus more easily derive ES benefits: “P2: Most of them used to work at the collective farm. P1: And they continued. They knew better how to do this, so they became what they are today. P2: He had money when the collective farm was dissolved, he bought 100 sheep or 10 cows, that's how he started” (GI 8).

The access mechanisms of non-farmers were perceived to be livelihood-related mechanisms, the affirmation of their rural identity and of the norm to continue farming practices: “P2: This is not an income source... P1: We are only working the land ... just so that we don't abandon it” (GI 4). These mechanisms could take various forms such as: practicing subsistence agriculture as a supplementary source of food for the family (“to have a lamb to eat for Easter” GI 13); being selectively involved in profitable activities without taking part in the whole production process (e.g. working for large farmers, renting land, selling hay); or applying a mixed income livelihood strategy at household level (spouse provides complementary income based on farming). Access mechanisms that were perceived as generally functional for small and large farmers (including rights-based and large-scale institutional arrangements) became overwhelming or impractical for non-farmers. According to their personal narratives, non-farmers often evolved from resigned farmers: “When they started to pass these laws [...] they destroyed us. [...] I sold all the cows and went to work for someone else” (GI 9).

For officials, key perceived access mechanisms were power and authority: “The higher the position, the more animals they have” (GI 21); “P2: Those who have functions earn more and have more animals. P1: They earn more. P3: Of course. P4: Yes.” (GI 17). Officials also had the highest perceived illegal access across groups, especially in relation to pastures (managed by the town hall) and related subsidies. Thanks to their functions, officials were believed to be more easily able to find poorer people to work for them.

Poor people were thought to benefit mostly indirectly from farming-related ES by day laboring for other groups. The second most widely referred to mechanism related to a perceived low labor investment by the poor which prevented them from obtaining more direct benefits (e.g. crops, animal products): “P3: They could make it [hay], because it remains un-mown, and in the winter they should sell it... and not to come and ask us for lard and bread, but they don't want to” (GI 1). Another important access mechanism for poor people related to the influence of social assistance policies that guarantee welfare payments to individuals below a certain income threshold, thereby acting as a monetary safety net. This financial aid was perceived to have

disconnected the poor from the ES in the area: “P1: They have no animals because these laws are contradictory. They would receive social assistance only if they wouldn’t own animals. It is a great encouragement! P2: They would sell the cow, or would give it to their mother and brother” (GI 8). Poor people were also reported to have sold their land (negative land access), either to qualify for welfare payments, or because they felt forced to by the changing profitability of Romanian agriculture. “P3: In agriculture [now], you have high costs for plowing, for digging, for sowing, and that’s the annual costs. P1: Yes, yes. P6: Yes. P2: And they preferred to give up everything and take the social assistance and they became day laborers and live better than us. P6: Yes, because we have to work. P4: Because they don’t care. P2: They don’t care, they don’t wake up at 5 o’clock” (GI 1).

External supertenants relied on strong management abilities and enhanced land access as mechanisms to access benefits from ES: “P1: He signed a lease for 49 years. And he will not terminate the lease, to give us the pasture back so we can have it for animals, he holds it with his teeth, he has power... P3: He holds it because he gets subsidies” (GI 7). Supertenants were perceived to be more capable businesswise than other groups: “They cultivate colza, they have contracts to export, they take most of it, they don’t bother with small things” (GI 20). Although supertenants may not be directly involved in farming, they derive indirect benefits from other groups who directly manage ES provided by the land (e.g. through sub-letting). The position of Romanian supertenants appears closely linked to past power structures: “P2: They knew what and where they should invest. [...] P1: They had some relations with people in various important positions who quickly told them: now you have to do this!” (GI 2).

In contrast to farming-related ES, access to vital ES was mainly mediated by ecological conditions and village infrastructure. However, social relations and financial payments also played important roles. For example, some large farmers used social relations with foresters to access wood; some officials had access granted through the institution they represent (e.g. priests); some poor people stole wood to sell it; and supertenants used their wealth and power to win auctions organized by the town hall. Water was available at village wells or personal wells, with competition for water apparently increasing in the pastures. Members of some beneficiary groups could afford a household hydro pump. Large farmers and supertenants were able to transport water to their sheepfolds, while small farmers depended on farming associations. During drought, officials and large farmers tended to control the availability of water at the village well: “P2: If you don’t have a benefit given by God... what else will you have, then? P3: They will kick us in the head for a cup of water. [...] I went there with two bottles and a bucket. And if he [a large farmer] gets insane, he starts screaming and then he goes up and turns the tap off” (GI 19).

Regarding the no-stake set of ES, berries were reported to be freely picked, mostly by poor people. Thus ecological conditions were the primary access mechanism. Most of the GIs [23] stated that tourism was still too insignificant to be discussed.

Table 2. Qualitative summaries of well-being contexts in relation to ES benefits that participants perceived for locals within the beneficiary groups of small farmers, large farmers, non-farmers, officials, and poor people. Discussions pertaining to well-being contexts were reduced during the first-cycle of coding (Fig. 4; SI 1) to perceptions of the level of wealth, needs for ES, vulnerability to changes in ES, and profit-driven aspirations. The content of the cells shows the dominant nature of the context for a given beneficiary group. For each cell, we provide characteristic quotes in SI 4.

Beneficiary group	Level of wealth	Level of needs	Level of vulnerability	Level of aspirations
A) Small farmers	Low	Moderate	High	High
B) Large farmers	High	High	High	High
C) Non-farmers	Moderate	Low	Low	Moderate
D) Officials	High	Moderate	Low	High
E) Poor people	Low	Low	Low	Low

There was an imperfect overlap between the qualitative assessment of well-being contexts (Table 2) and the aggregated scores on needs obtained during GIs (Fig. 2). Based on the qualitative data, small and large farmers were considered to be most vulnerable to ES changes. Discourses placed small farmers at a relatively similar level of wealth to that of poor people, in accordance to results of questionnaires on groups' access to non-ES well-being components (SI 3). The nature of profit-driven aspirations, especially regarding the extraction of well-being benefits from ecosystems, appeared higher for large farmers than for the other groups (Table 2, SI 4). Poor people were the only group with perceived low aspirations, which many GIs linked to the recent Romanian social policy: "P1: In those [socialist] times, they were forced to keep their head above, because they didn't receive any social assistance. [...] They changed in a bad way because they got the circumstances." (GI 3). Poor people were perceived to be in a poverty trap created and maintained by reinforcing well-being contexts and barriers preventing their access to farming-related ES; they did not have animals and so did not have access to land – and hence could not have animals. Surprisingly, although the basic nature of the needs of poor people was acknowledged, the well-being impact of ES changes was perceived to be low for poor people, especially regarding ES involving work investment and long-term returns.

2. Contextualized and disaggregated contributions of ES to human well-being

After grouping the data driven codes during the first cycle of coding (SI 1), we obtained twelve emergent themes: (i) Defeatist and fatalistic attitudes [25 GIs]; (ii) Degradation of ES [23]; (iii) Distorted perception of equity [22]; (iv) Transition to non-planned economy [21]; (v) Lack of trust and low community spirit [18]; (vi) Value of work [17]; (vii) Capitalism and globalization influence [15]; (viii) Unfairness of exogenous policies and institutions [12]; (ix) Historical political contingencies [11]; (x) Corruption of political leaders [10]; (xi) Humaneness towards the poor [10]; (xii) Lack of juridical and administrative knowledge and distorted sense of property. Characterizing quotes are provided in SI 5. Through further abstraction in the second cycle of coding (SI 1), and by “coding on” emergent as well as research driven themes (Fig. 4), we condensed the complexity of our findings and derived six factors (SI 5) perceived to mediate how ES contribute to the well-being of locals in Southern Transylvania: 1. Ecological availability and conditions; 2. Policies, formal institutions, and markets; 3. Social and power relations, and informal institutions; 4. Household decisions and individual contexts; 5. Perceptions of equity; 6. Individually held values. SI 5 presents how the refined research driven themes (Tables 1, 2) and emergent themes (i-xii) were reorganized to inform these six mediating factors. We then created a conceptual model based on the six mediating factors (model of mediating factors - MMF) (Fig. 3).

The MMF considers a range of contextual factors that move beyond the typical fixed relation between the level of ES provided by physical structures and process, and their aggregated contributions to human well-being. The model does not imply a strict hierarchy of factors where one is more important than the other. Rather, factors are expected to interact and, to different extents, are within or outside the control of potential beneficiaries, exogenous or endogenous to a given system. Characteristics of both ES beneficiaries and the ES themselves determine the manifestation of the different mediating factors. For example, vital ES (e.g. freshwater) are more prone to ecological limitations, while cash-providing ES are more likely to be mediated by policies and institutional arrangements (e.g. subsidy payments for pasture use), which in turn, play out differently for different beneficiary groups.

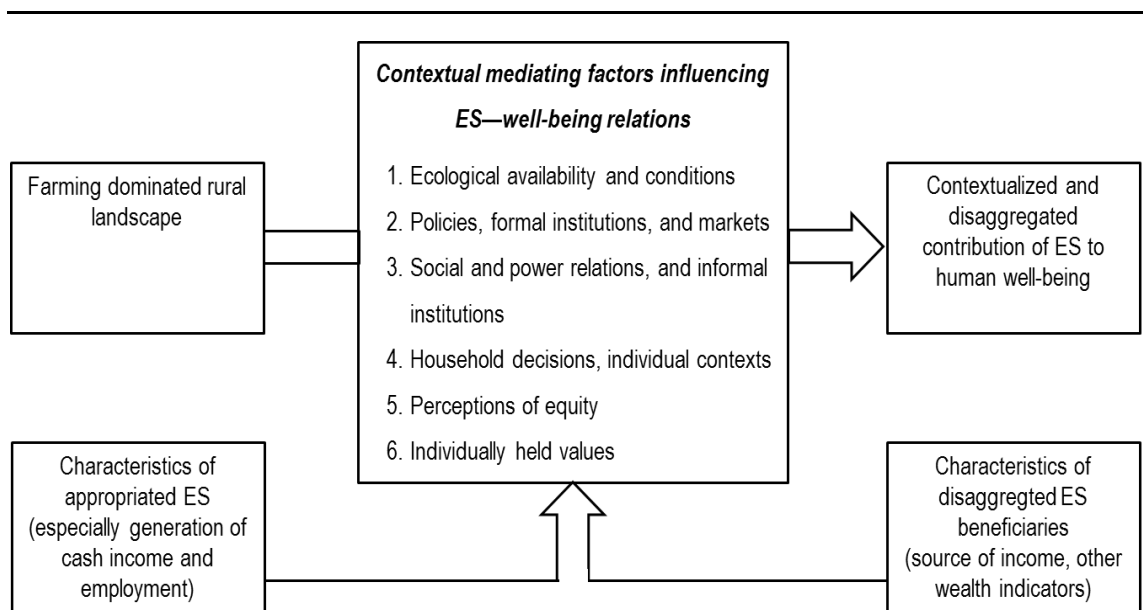


Fig. 3. A conceptual model of mediating factors (MMF) influencing the relation between ES and human well-being. Key contextual mediating factors, in combination with the characteristics of ES and the characteristics of potential beneficiaries, determine the contextualized and disaggregated contributions of rural ES to human well-being.

First, the ecological availability and conditions of supplying stocks of ES, mentioned as an access barrier for small farmers, represent the ultimate constraints or boundaries for benefiting from ES. This factor refers to natural barriers in accessing ES benefits, such as limited land surfaces, drought, dangerous wildlife, or soil fertility. When natural capital is abundant, this factor is only loosely limiting, as is the case in our study area – with the exception of pasture surface and to an extent, water availability.

Second, the influence of supranational and national policies, formal institutions and markets are powerful factors that mediate access and the contribution of ES to the well-being of potential beneficiaries (Table 1). Within this factor, the benefits stemming from ES become institutionalized, and accounted for (almost exclusively) in monetary terms. For example, historical contingencies, essentially in the form of Saxon ownership of land, and differentiated application of post-socialism restitution laws, have severely restricted land access in the past, but still have visible consequences today. Similarly, although many groups acknowledged a dependency on subsidies for improving the profitability of farming, subsidies also accentuated inequities in access (SI 5), and reinforced existing power structures (SI 6).

Third, beneficiaries are interconnected through social and power relations, and informal institutions, which can enhance or block access to ES benefits. Power was mentioned as an access mechanism (Table 1) for officials (formal authority), supertenants (political and economic influence), as well as for large farmers (economic influence, physical control over pastures). However, the web of power is further complicated by dominance, subordination and co-

dependencies among groups (SI 6). For example, in the case of land access, the bargaining power of large farmers, despite cultivating relations with officials, is lower than that of supertenants but higher than that of small farmers. Also very interesting is the case of poor people, which appear subordinate to all other groups, and are used as a cheap force of labor. Officials often invest in relations with this group, because they represent a numerous electorate. Low community spirit emerged as a self-standing theme during the analysis of transcripts (SI 5). Participants signaled an increase in individualism, most obvious in current working practices. Consequently, small farmers were reluctant to enter the informal institution of farming association, one of their main access mechanisms to farming-related ES.

Fourth, household decisions and individual contexts mediate the flow of well-being contributions and further explain the perceived differences among beneficiaries. Individual contexts are shaped by levels of wealth, needs and aspirations (Table 2, SI 4) but also personal abilities, assets and histories (SI 5). Household decisions were shown to rely on individual contexts and motivations, but also on acknowledging and preferring farming as a livelihood strategy. In turn, livelihood strategies as access mechanisms (Table 1) were often underpinned by the local social norm of making a living as a farmer, which was seen as the desired model to pursue and conform to in order to improve one's well-being and be successful according to the standards set by the community. "You can't live in the countryside if you don't own animals" (GI 14). This social norm has had an important influence on maintaining close ties between the well-being of local people and farming-related ES benefits.

Fifth, the way in which locals conceive and construct perceptions of equity fundamentally shapes the well-being contribution of ES benefits. A defeatist attitude was found to distort estimates of well-being contributions during all GIs. Many emerging themes (5.1.1 to 5.1.4 in SI 5) were grouped under this attitudinal factor, including disempowerment, favoritism of the rich, and conflation between wants and needs. Participants felt all beneficiary groups "tread the same roads" regarding benefits and needs from nature. There was little difference between scores self-assigned by GIs pertaining to one of the five beneficiary groups, compared to scores assigned by the other four beneficiary groups (SI 7). When recognized, inequities (especially in relation to officials and supertenants, SI 6) were regarded fatalistically, with certain groups thought to ordinarily obtain most of the benefits. Many villagers felt disempowered and were waiting for outside support from official institutions for accessing the flow of benefits. "P3: So here, despite the fact that this was a famous village, it has a beautiful landscape... P2: Yes. P3: We're very disfavored by law, by the town hall protection" (GI 19). Even if participants disliked the consequences, they rarely questioned the motivations of other groups. Discourses even validated the assumed high aspirations of some beneficiary groups ("It is in human nature to want more", GI 8) and often conflated wants and needs. Locals tended to regard the wants of the rich and

powerful as more important than the needs of the poor, thus giving the rich a distorted kind of legitimacy.

The perception of equity was further distorted in discourses where marginal utility played out counter-intuitively, following a logic by which those who have more also need more. “P2: They need it because they have it and they need it” (GI 11). This distorted perception was also shown by the Likert scores assigned by beneficiary groups (Fig. 2). Only rarely, one participant of a given GI raised the logic of decreasing marginal utility with the number of units. This topic generated most of the deliberations (see also SI 7). “P2: Nothing is enough for those, so... we end up in the place I was talking about. P4: Listen to me! Do you really think that the priest, that the mayor and other like them would need this?” (GI 11).

Sixth, values held by locals played a key role in unpacking the contribution of ES to well-being. People often explained both the current and an ideal distribution of ES as being proportional to work input (Table 1). “P4: You have to work... It has nothing to do with the situation, if you work, then you will have” (GI 13). This reasoning suggests underlying respect that locals ascribe to the value of work (emergent theme 6.1 in SI 5). “P2: He is fine, he works, he works the land, he deserves this. That’s good!” (GI 1). Similarly, participants were negative towards situations involving livelihood strategies deemed inferior to their own (e.g. social welfare payments, supertenants, or middlemen selling products). “P5: Any income is taxable, isn’t it? So, if you go and milk somewhere [and get paid for this], but also receive social welfare payments, how is this normal and equitable?” (GI 25). Although just vaguely elicited, the social norm and rule of maintaining cultivated land, as a manifestation of a deeply rooted agrarian identity, almost regardless of livelihood returns, explained some of the unconscious choices underpinning the current distribution of ES benefits. “Those who have less land, instead they would be forced to abandon it [...]. I am afraid of this!” (GI 1). “You would be able to work only 1 ha, and what will you do? Will you abandon it? A lot of weed would grow there because you don’t have any source of income to work the land” (GI 22). Finally, a spirit of compassion and altruism towards poor people (emergent theme) also mediated how nature’s well-being contributions reach beneficiaries: “You can live from animals, you can offer something to your children, to those who don’t need hay, you can give them a job, because there are no jobs here” (GI 23).

DISCUSSION

1. Context matters

Our study systematically unpacked the contribution of nine ES to the well-being of different groups of beneficiaries in a rural landscape. We described these groups based on their different balances of direct versus indirect benefits (Fig. 1), benefits versus needs (Fig. 2), but also access mechanisms (Table 1) and well-being contexts (Table 2). Our results confirmed that disaggregation is important to understand how ES relate to human well-being from an equity perspective, and revealed a range of under-recognized contextual issues. We have highlighted the role these contextual issues play in mediating access to ES benefits in a Model of Mediating Factors (MMF) (Fig. 3).

The MMF highlighted that future research needs to carefully address the context of people benefiting from nature (30). Focusing on contextual factors would help shift the ES discourse away from assessing isolated components of ecosystems, monetary valuations or the simple metaphor of nature as a supplying stock of service flows (31). Focusing on context revealed that elicited narratives were not about biophysical processes and functions but rather about final products and underlying values; despite nature setting the ultimate limits on ES availability, the flow of ES benefits is mediated by many other factors that are experienced differently by beneficiaries. Assessments based on social units of analysis may complement and add meaning to biophysically and spatially informed assessments. For example, our findings support the idea of socially defined ES bundles (32) in addition to spatially determined ones (33). The more we go down on the ES cascade represented by Haines-Young and Potschin (34), and leave the supply side behind, we head towards spheres of policy, human interrelations, cash livelihoods, perceptions, attitudes, and internal norms and values. The results of our research thus emphasize the importance of context for the global discourse on ES, poverty and equity, and show how well-being derived from nature is (strongly) mediated by almost man-made contextual spheres of influence (see e.g. 13, 35).

Perhaps one of the most surprising illustrations of the importance of context was that poor people were not perceived to be highly vulnerable to changes in ES (Table 2, SI 4), and to a certain extent this situation was self-acknowledged (SI 7). In this study, the argument of marginal utility followed a reverse logic where utility did not decrease with the increase of wealth; and ES were not regarded as a “safety net” (36). The explanation of this pattern resides in the influence of several mediating factors, namely social welfare policy (factor 2 in Fig. 3) in combination with low aspirations (factor 4) and specific values of poor people (factor 6). These findings suggest refinements are needed to the global discourse on ES and poverty alleviation

(e.g. 5: 61-63), which asserts that the poor are, relatively, the most dependent on natural resources, especially for social groups not directly using the land (e.g. welfare recipients or poor urban people). With some exceptions (37: 73), the current dominant poverty narrative may be too simple, grounded too much in cases of communities linked to their land and based on the study of developing countries (which typically have no government social safety net). Due to this emergent lack of fit, current research is failing to capture both the complex reality of developed societies that are increasingly disconnected from land and nature, and the diversity of mediating factors.

By eliciting subjective assessments of human well-being, our results demonstrate the need to incorporate subjective and objective knowledge in framings of vulnerability, aspirations and needs around ES. Listening to poor people yielded paradoxical patterns, because many are conditioned to go with existing power structures, justifying the aspirations of the more powerful groups such as large farmers, and constructing them into reality. The conflation of needs with wants and aspirations reveals one of the multiple dimensions of poverty (38) that is based on personal circumstances and hence more subjective. Future analysis of equity in relation to ES may obtain different outcomes depending on the extent to which nature contributes to human well-being by fulfilling objective versus subjective needs and demands (27, 39). Researchers' assessments of equity and poverty cannot be applied in an indiscriminating manner without exploring the cognitive dimensions of actors' behavior (40). The framing of poverty and vulnerability needs a contextual dimension that accommodates and sifts through objective knowledge. This may be especially necessary for the ES management of developed countries where following ecosystem disconnection, the conflation of needs and wants may be more prominent, and has implications related to human behavior and lifestyles (41).

2. Understanding and framing context

The MMF brings structure to the surrounding context and conditions that influence the ability of different stakeholders to obtain benefits from ES. Yet this structure is not intended to be rigid. Each mediating factor in the MMF may span multiple scales, including through time (e.g. historical political contingencies), as well as space (e.g. global (42), regional (43), and place-based constraints (13)). Notably, the mediating factors considered in the MMF are not inherently positive or negative. Accordingly, accounts of market access draw a positive influence for large farmers and a negative one for small farmers. In our example, factors such as national and supranational policies, social and power relations may be experienced positively or negatively, and may interact by working against, or by dampening or reinforcing trends set by the other factors. For poor people, the influence of policy circumstances through social welfare payments added to their cultural model and low aspirations, while historically they had traditional

occupations related to nature (e.g. wood crafters, bear trainers). The official separation drawn by social assistance between those who receive welfare payments and those who do not further accentuated the disempowerment of the poor and encouraged a way of life decoupled from nature.

Some factors are more directly within the control of beneficiaries than others, as a result of being more endogenous or exogenous to a given system (29, 44, 45). For example, considering the emergent code “disempowerment” (theme 5.1.2 in SI 5) under the factor of equity perceptions (factor 5 in Fig. 3), some inequities may be due to community’s incapacity to self-organize and the lack of agency of informal institutions (e.g. farming associations). The defeatist attitude of participants regarding the access to, and needs of ES benefits does not just reflect the political context and power relations, but also their own constructed perceptions of fairness.

Our model also helps to explain why the closer an ES came to directly enhancing well-being, the more it increased chances for conflicts and becoming a rival good with high use (see also 46). Within the studied community, competition for ES was fiercest around access to pastures, as a consequence of mediating factors at multiple levels. For example, at the level of formal institutions, the current pasture law (47), does not guarantee that anyone with animals can access the pasture. At the level of social relations and informal institutions, farmers need to be able to self-organize (e.g. in associations) to have a communal pasture. Where such self-organization fails, adverse trends set by institutional contexts may be reinforced by power relations, thus eroding community spirit (48) and contributing to disempowerment perceived by locals (SI 5), thereby fostering illegal encroachment on the pastures. Access to the benefits offered by ecosystems in communal regimes is frequently more important to the poor than to the rich (20). However, in our example, the way pastures were administered often indirectly contributed to reinforcing inequities, and to the progressive disappearance of the commons. Paraphrasing Verdery (49), the “vanishing commons” call for empowering community stewardship of ES and fostering social capital and collaboration (50).

3. Linking the ES discourse with other scholarly discourses

Many concepts discussed in this paper are not fundamentally new. Since the Millennium Ecosystem Assessment (MA) (5), scholars have recognized the importance of mechanisms that mediate and contextualize the ES–well-being relation (8, 10). To date, papers have considered the institutional context (31, 48, 51), social embeddedness (14, 29, 52–54) and value attribution (35) or articulation (13) around ES. However few papers have systematized dimensions of ES analysis from an equity perspective (10, 36, 55), and even fewer have offered a consistent and comprehensive overview drawing on empirical research (52). Based on our findings, context is

as much about political ecology and individual perceptions as it is about actual ecosystems. Moreover, our findings suggest that knowledge of specific contextual factors is needed as much as integrative knowledge across factors. Populating the MMF proposed here, via further empirical work in a range of different systems, provides a vast space to draw unexplored connections between different bodies of work. Our following overview of relevant work is not exhaustive, but is meant to serve as a starting point for future research.

With regards to the first factor of ecological supply and availability (Fig. 3), influential literature has recently highlighted connections between biophysical limits and equity implications. Ecological notions such as “natural limits” (31: 1126), and “safe and just operating spaces”, at both global (56) and regional (43) scales, may prove particularly useful in an equity context.

The second factor related to widely acknowledged institutional and policy contexts shaping the well-being contribution of nature’s services to humans (Fig. 3). This is unsurprising for many disciplines, such as political ecology (57) which holds as an ontological norm that economic and political factors influence the relationship between people and natural resources (36). The importance of such factors was confirmed empirically by our study, despite it not being inspired by political ecology literature. Recent work, particularly relevant to this level, further addresses the influence of markets (38, 58), globalization (59), and of commodification of ES. Moreover, policies and formal institutions are responsible for bundles of property rights (60), de jure endowments (61), macro-forces (62), and rights-based access (19). In our study, participants associated these with “institutionally grounded claims” (61: 241), which touched upon the perceived effect of specific policies such as the European Common Agriculture Policy and its agri-environmental payments (63).

The third factor related to social networks and power relations (Fig. 3). Access mechanisms resulting from negotiations of social relations (36, 52, 61) and the confrontation of bargaining powers of groups (8, 40), especially in a context of common pool resources (60), have been widely discussed. In order to tackle this factor in more depth, it appears useful to engage with Ribot and Peluso’s (19) structural and relational mechanisms of access. Mediating factors here operate in relation to effective entitlements (61), social capital and power constraints at the local scale (13). Regarding knowledge across scales, political ecology can also contribute here with an improved understanding of intracommunity dynamics (36, 37). This factor also takes us away from seeing groups in terms of (solidified) identities, towards seeing them as (flexible) strategic formations in relation to each other and their social environments, which allows more room for discoveries and eventually intervention.

The fourth factor dealt with well-being circumstances, abilities, preferences, livelihood decisions and strategies at individual or aggregated levels (Fig. 3). Linking an analysis of this factor to bodies of literature working with the notion of livelihood strategies from Scoone's framework may prove helpful (64). The types of capitals individuals could draw on strongly influenced their ability to access ES, and some strategies pertained directly to the ones mentioned by Scoones (e.g. income diversification, migration) in relation to rural development (65). Within their confined universe, the reality of local people revolved around applying survival strategies (49) and adapting to validated normative pathways as a source of social acceptance (66). Some patterns of decisions were shown to produce or contribute to social hierarchies and inequities (66). Moreover, the heterogeneity of livelihoods, and different opportunities to achieve desired livelihoods given personal circumstances, is also emphasized by the capability approach (36, 38, 67).

Equity perceptions (factor 5 in Fig. 3) played an essential explanatory role, and turned into a case of "Whose reality counts?" (24), and of needs being conflated with wants (68). As Pascual et al. (38) put it, whose fairness criteria prevail depends on power relations (69), but as demonstrated here, also on other social actors accepting (or not) the same dominant criteria (53). Subjective perceptions of fairness (70) and of who depends more on nature, and internally adjusted expectations thus become the socially constructed reality of those living within the system's borders (71). Our study illustrated that what is regarded legitimate is linked to social actors' judgments (8, 19) and mental models (40), placing fairness in the eye of the beholder (72). Furthermore, "within each culture and social group, the concept of fairness is dynamically constructed based on local meanings of what is fair, equitable or just" (38: 1239). Such social construction calls for new collaborations between behavioral literature, anthropology and ES research (73).

Finally, the sixth factor pertained to values, belief systems, and norms held by participants (Fig. 3). The importance of value systems is increasingly being recognized within frameworks (29, 74) that deal with aspects of the human-nature relation. We found that underlying values associated to agrarian identities and livelihoods have a high explanatory power when it comes to the distribution of ES in farmland (73). Participants posited that ES benefits should be distributed in accordance with beneficiaries' work contribution, associating the "losers" with those refusing to work, and the "winners" with those working hard. Their view was secondarily amended by their moral concern towards the poor (see the value of benevolence in 75). As such, they applied an accountability logic, in line with a philosophical discourse regarding economic fairness (38, 76). In fact, this factor may well draw its broad theoretical inputs from disciplines like philosophy, environmental psychology (77), anthropology, and ethnography. For example, land dispossession or disconnection were found to lead to psychological dependency on the state

(73). Although the norm of making the land worthwhile as the expression of a deep held rural identity may no longer be shared by all community members, we stress the crucial role of these “cultural ties to the land” (78: 16638) acting as slow variables in subjectively shaping the contribution of the farming ES to their well-being. We anticipate that with increased commodification of nature, these deeply held values will be increasingly “crowded out” (53, 59).

4. From context to policy

ES interventions should be informed by explicit consideration of the diversity amongst recipients of ES benefits and their realities. By focusing on biophysical units only, policies oversimplify when trying to increase human well-being through ES and do not address mediating factors that interact to modify outcomes (79). Each factor within the MMF signals opportunities for managing equity-enhancing factors and trade-offs. For example, the social norm of working the land represents one possible leverage point for programs aiming for sustainable rural landscapes in Transylvania, because there is high in-principle support by local people to maintain an agricultural lifestyle. The MMF also suggests an operational classification of “leverage points” (80: 145). Specifically, it highlights that policies could address any of the single factors that influences how benefits are accessed. Alternatively, more fundamental system changes could be realized by targeting the structure of the MMF, or interactions between multiple factors. Therefore, the MMF can also be used as an analytical tool for policy design.

By disaggregating ES benefits for diverse beneficiary groups, we highlighted that managing ecosystems only for economic or environmental outcomes, without an awareness of external context, could inadvertently create unwanted feedbacks that undermine initial policy aims (81) and create asymmetries in well-being outcomes. The policy relevance of the MMF is particularly apparent when focusing on groups for which most of the mediating factors have a negative influence. In the case of Transylvania, small farmers are considered stewards of the landscape (50) and key providers of ES (SI 6). The support of this group therefore appears key to aggregated human well-being. However, small farmers are particularly vulnerable to changes in ecological conditions (Table 1, 2), and many of their needs are not adequately covered by access to ES benefits (Fig. 2). Simultaneously, small farmers also experience policy barriers and pressures from the other groups (SI 6); that is, context is denying them the capacity to act (Table 1) (49: 261), and restricting their access to ES. Based on our analysis, we argue that negative (formal) institutional pressures acting on small farmers should be alleviated to improve human well-being in Transylvania more broadly. In contrast, at the moment narrowly designed subsidy schemes may compromise the identity defining social norm of cultivating and maintaining land, while subsidies may follow a similarly unbalanced distribution pattern to that of payments for ES (69, 79). The MMF can be used to identify and support the most contextually challenged

beneficiary group whose way of life and perceived well-being are tightly linked to ES, so that policies stand a better chance of tackling inequities in well-being contributions.

METHODS

Following five initial pilot group interviews (GIs) we disaggregated ES beneficiaries by their main income source into 5+1 beneficiary groups: (A) small farmers (82, 83), (B) large farmers, (C) non-farmers (non-farming, with/without additional farming income), (D) officials (state salary; e.g. mayor, policeman, priest), (E) poor people (generally recipients of state financial assistance), and (F) external supertenants (people living outside the community, Romanians or foreigners, but having economic connections to the village) (49: 312-313). Supertenants were not interviewed for practical reasons, but their situation was discussed with other groups if respondents felt sufficiently knowledgeable. In each village, we held a GI for each beneficiary group, inviting a range of representatives within that group. Therefore, 5 GIs were held in each village. Questions were asked around nine pre-selected ES benefits (as described in SI 1). Following an informed grounded theory approach, we used a combination of deductive and inductive qualitative analysis in two iterative cycles of coding (Fig. 4, SI 1).

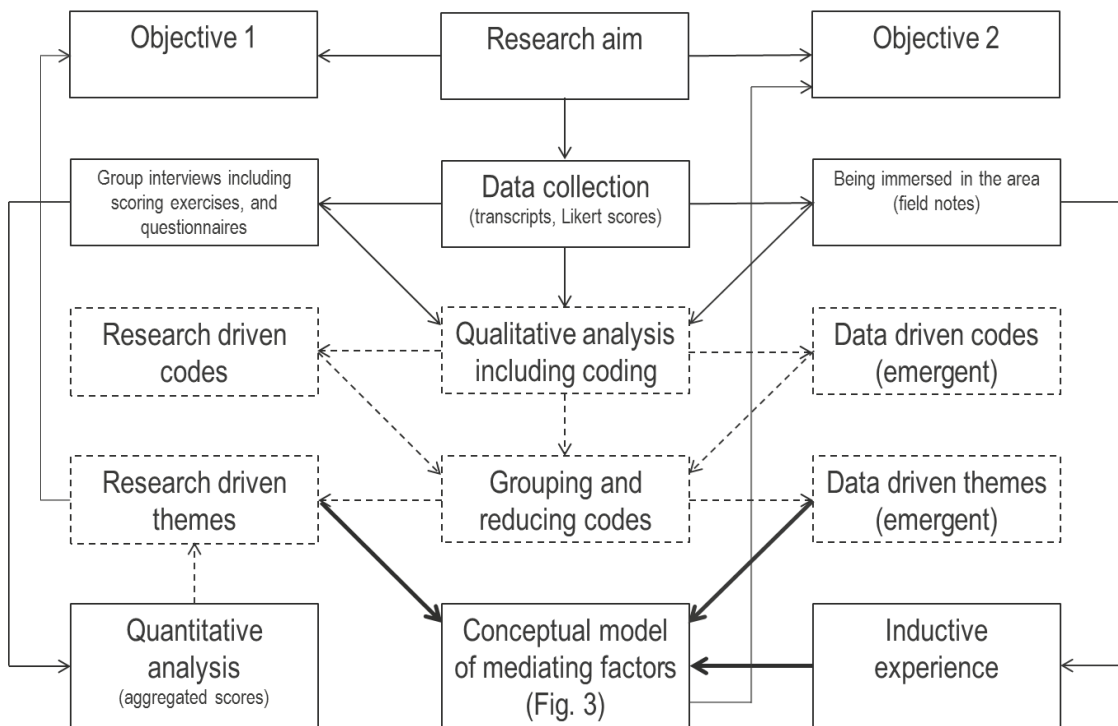


Fig. 4. Workflow depicting the collection and treatment of data. The first cycle of coding the data (dashed arrows) revealed themes pertaining to the investigated topics, as well as emergent themes. During iterative second-cycle coding (bold arrows), all themes were coded to a higher level of abstraction into general factors mediating the contribution of ES to human well-being. Factors were integrated within a conceptual model.

Further methodological information on study area, selection of ES benefits, data collection and analysis is presented in SI 1.

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SUPPLEMENTARY MATERIAL FOR CHAPTER IV

SI 1 METHODS

Study area

The study area covered 448 villages across 7440 km² in central Romania, at altitudes ranging between 230 and 1100 m above sea level. The dominant Corine Landcover classes (1) are arable land (37%), forest (28%) and pasture (24%). Farming usually takes place at the valley floors (2), with low-intensity farming providing diverse ecosystem services (ES) (3), and maintaining the landscape mosaic. For this study, we selected five villages, based on the success of previous social fieldwork. Being part of the same landscape ensured consistency of land use and thus physical context for ES provision within villages. The suite of relevant ES in these villages was similar to that previously identified across the study area as a whole (4), although average pasture cover in our selected villages was higher (43%) than the average for the study area. Data from all villages were aggregated to capture a diversity of responses because communities had comparable social structures.

The socio-political and economic background of the region provided a fertile ground for exploring aspects shaping the current distribution of ES and their contribution to well-being. Southern Transylvania is recognized as one of Europe's most prominent biocultural refugia (5), but the traditional relationships between people and nature are being altered (6), as the area experienced rapid institutional, cultural and socio-economic changes over the last decades (6). Following the collapse of socialism (1989), inequalities around land restitution (7, 8) fueled social and economic inequity and sometimes caused tensions among villagers (9). In 2007, Romania entered the European Union (EU). By EU standards, rural Transylvania still has high levels of poverty in terms of low cash income, and strongly relies on local ES (2, 10). The economic realities brought about by increasing connections to global agricultural markets, as well as novel institutional arrangements inherent to the EU membership, have posed multiple challenges (6). The transition to a more market-based economy has made traditional subsistence agriculture increasingly unviable (2). Additionally, the Common Agricultural Policy (CAP), most notably Pillar II, grants the region access to financial support for agriculture, conditioned by the compliance to certain environmental standards (11).

Ecosystem service benefits

We initially considered nine provisioning ES: (i) hay from hayfields; (ii) pasture (fodder and pasture management); (iii) sheep and related products; (iv) cows and related products; (v) arable and orchard crops; (vi) berries, mushrooms, medicinal plants and snails (referred to collectively

as “berries” in the paper); (vii) wood and timber; (viii) clean water; and (ix) agro-tourism. Participants were allowed to add an additional ES benefit to the given list. The nine benefits relate to those services deemed most important by locals in previous research (4), and are situated close to the point of explicit final services in the ES cascade (12).

Data collection

Beneficiary groups partially overlap with those presented by Verdery (9, p. 348). Ample field notes served to better situate the groups and their contexts and decide when data saturation (13) occurred. Group interviews (GIs) lasted on average 105 minutes and comprised four persons on average. In total, GIs included 109 persons, 66 males and 43 females, with a median age of 45 (interquartile range 35–55). The different beneficiary groups were interviewed separately. All interviews were conducted in Romanian, inside participants’ houses or working places. Although the interviewer played a central role, the method also generated lively discussions among participants. Group discussions provided insights into people’s different perspectives, but especially into shared understandings of a topic that would be difficult to obtain without the deliberation fostered by a group (14, p. 243). Weaknesses of this method include group pressure, as well as identifying and balancing individual views from the group.

Recruitment of participants was challenging despite the help of previous connections established in the village following former research in the area (2, 6, 15). Town halls, local stores, and priests were approached for relevant information on the socio-economic profile (e.g. number of animals) of potential participants. Those individuals ultimately selected were relevant to the research goal according to purposive sampling (16).

GIs were organized around three main topics of discussion, inspired by Daw et al. 2011 (17): (i) How does the interviewed beneficiary group benefit from each of the nine ES in terms of direct versus indirect benefits? (ii) How much each of the six beneficiary groups benefit from each of the nine ES and what may explain the resulting differences or similarities among groups? (iii) How much does each of the six beneficiary groups need a given ES and what may explain the resulting differences or similarities among groups? Generally participants within beneficiary groups felt able to assess the access and benefits of external supertenants to ES (topic 2 above), but only six GIs felt comfortable assessing the needs and well-being contexts of external supertenants (topic 3 above). Hence this beneficiary group is not included in the qualitative summaries of well-being contexts in relation to ES benefits (Table 2).

Following an explanation of the study and after obtaining voluntary consent with assurance for confidentiality and anonymity, participants were prompted to talk about their opinion on the above three topics. All three topics involved: (i) discussions and deliberation; and (ii) scoring

exercises as a way to summarize and validate information (using a 1 [very low] to 5 [very high] Likert scale). Consensus scores were recorded using a matrix of beneficiary groups (in the columns) by perceived benefits/needs of ES (in the rows), which was visible to everyone. Filling out the matrix was intended in part to facilitate discussions and give participants the opportunity to consolidate their thoughts and visualize their answers. Hence, this stage had a twofold role: process facilitation and outcome provision (quantitative data).

GIs were followed by numerous open-ended discussions with key informants. In addition, through 129 questionnaires in the five villages, we collected data on the access of the first five beneficiary groups to the following non-ES related components of human well-being: connectedness with outside the village (e.g. access to transport infrastructure), education, employment, healthcare, income and stability of income, social relations (18). The selection of well-being components was found to be relevant for this study, following previous social research in the area (19). By combining GIs and questionnaires we aimed to clarify the image of winner and loser groups revealed by access to ES benefits, in relation to their access to non-ES related well-being. Questionnaires (SI 3) were also used as a way to triangulate information on well-being contexts (Table 2, SI 4). All interviews and questionnaires were conducted by the first author, while being based in the field during May–July 2013 (Fig. 4).

Data analysis

GIs were recorded (after obtaining permission), translated and transcribed, resulting in approximately 2500 pages of transcripts. Data produced by a GI was treated as a whole without analyzing individual contributions (20). To avoid the dangers of data drowning or oversimplification, a combination of inductive and deductive analysis was used. Accordingly, computer assisted (21) first-cycle coding (22) of transcripts was twofold (Fig. 4). On the one hand, we revealed themes pertaining to the investigated research topics of (i) ES-based cash and employment, (ii) access mechanisms, and (iii) well-being contexts. On the other hand, we coded emergent themes. In keeping with an inductive logic, following an informed grounded theory approach (23), we allowed themes which were likely to explain the overall distribution and disaggregated contributions of ES to beneficiary groups to emerge from the data. Both data and research driven themes (24) went through several iterative stages of reducing, grouping, and aggregating.

Section 1 of the results corresponds to the three topics of research guided by Daw et al. and presents the refined research driven themes in a narrative descriptive form, primarily used to answer Objective 1. A list of refined data driven (emergent) themes is presented at the beginning of section 2 of the results. During the second-cycle coding (bold arrows in Fig. 4), all refined

themes (research and data driven) were coded on (and “lifted” 13) to a higher level of abstraction into six general factors mediating the contribution of ES to human well-being, by using inductive experience and literature guided by the first-cycle thematic analysis (22). These six factors were integrated within a conceptual *model of mediating factors* (MMF). SI 5 presents how the refined research driven and emergent themes were reorganized to inform the six mediating factors, while section 2 of the results presents these factors in the light of the MMF. This more analytical organization of findings (MMF) pertains to Objective 2.

While acknowledging the dangers of quantifying qualitative data (25), we chose to show the number of GIs mentioning themes (in square parentheses [...]), as a metric for describing the prevalence of these themes – not their importance. Compelling selections of data (quotes) are given throughout the main text (and in SI 4, 5, 6) to illustrate our results. Self-reported statements (e.g. those pertaining to an individual’s own beneficiary group) were treated the same as statements pertaining to other beneficiary groups, because there was a level of consensus among groups regarding prompted content (see SI 7 and SI 8). Scoring exercises from GIs were analyzed using descriptive statistics to offer an overview of matrix scores per beneficiary groups.

SI 2

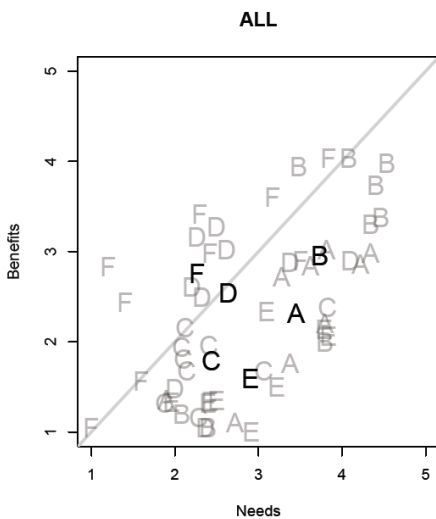


Fig. 1. Visualization of averages for the perceived needs of and benefits from all ES, per beneficiary groups: A - small farmers; B - large farmers; C - non-farmers; D - officials; E - poor people; F - external supertenants. Below the “equity line” perceived needs of groups are not fulfilled by perceived benefits. Above the “equity line” perceived needs of groups are met by perceived benefits. All groups typically fall below the line, with the exception of officials and external supertenants.

SI 3

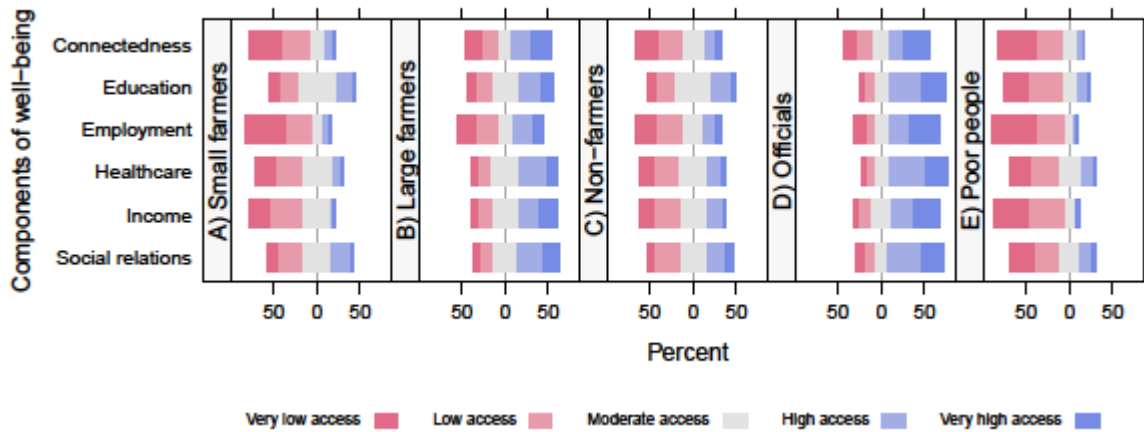


Fig. 2. Visualization of results to questionnaires on the perception of the access to non-ES well-being components of beneficiary groups. 129 respondents (73 men, 56 women, median age: 35; interquartile range: 25–45) were asked to score from 1 to 5 (1 – very low; 2 – low; 3 – moderate; 4 – high; 5 – very high) the access of each beneficiary group (A - small farmers; B - large farmers; C - non-farmers; D - officials; E - poor people) to different non-ES dimensions of well-being. The group of officials is perceived to have the highest access to non-ES well-being components.

SI 4

Table 1. Characterizing quotes for the research driven themes within the investigated topic of well-being contexts in relation to ES benefits. Discussions pertaining to well-being contexts were reduced during the first-cycle of coding (Fig. 4; SI 1) to perceptions of the level of wealth, level of needs for ES, level of vulnerability to changes in ES, and level of well-being aspirations.

Beneficiary group	Level of wealth	Level of needs	Level of vulnerability	Level of aspirations
A) Small farmers	Low P1: They can hardly live day to day! GI 14 P3: We have nothing, no pension; our years of work were not counted. We can't manage to live month to month because we have expenses. GI 1 P4: And we have nothing, except the animals. GI 10	Moderate P3: To support themselves only. P4: To be able to make a living. GI 25 P2: Well, personal needs and food. P4: There is a lot of income. P1: Yes, it is. P4: There is a lot of income...otherwise nobody would breed animals as a hobby. GI 13	High P2: [...] they have no other alternatives to replace hay from hay meadows. GI 13 P2: [...] they are 100% dependent on the cow because this is the only mean of subsistence. GI 2	High P1: The group of the small farmers would like to be large farmers. GI 11 P2: The small ones want the same thing. To catch up with the rich. GI 6 P2: And we want the pasture. And we want health. GI 24
B) Large farmers	High P2: Well, they have a lot of	High P2: The more sheep you own, the more needs you	High P2: The large farmers are	High P2: There is a saying: When you

	<p>animals... they can breed more animals... P3: Well, they have pastures...so, they afford [to breed more] P5: Money, money, money ... P1: They receive subsidies for the pasture... P3: They have other alternatives. [...] P5: Because they have the possibility... P3: They have tools, they have... P2: ...they sell... GI 12</p>	<p>have. GI 14 P1: This is what I wanted to explain. I, if I lose them, I lost... 2 cows... but him, 300... what will he do? P7: He'll hang himself. P1: He'll hang himself. P2: It's a big deal, then. GI 20 P2: Who has more cows, has more problems. P1: Exactly. The one with few cows, manages better. GI 9</p>	<p>earning from that, so they are dependent on sheep. GI 15 P2: This is what keeps us... if it wasn't for the cows... P2: We have nothing else. P3: There's no food for animals and without animals, we would finish everything. P2: Yes. This is what keeps you alive. The land keeps you... P1: You depend on it. P2: It feeds you, in the countryside. GI 18</p>	<p>have enough, you want more. P3: I think that they are like those who are taking drugs. Because they have enough, that's why they want more (smiling). GI 1 P1: They do, too. If they could, they would take everything. GI 6 P1: He wants to expand even more. GI 23 P5: We only ... namely ... we benefit from them, that's why we breed them. GI 16</p>
C) Non-farmers	<p>Moderate P4: We are poor, but we have what we need because we work. GI 12</p>	<p>Low P1: We have corn for our chickens... P5: ... for polenta. We have to take the corn to the city because there is no mill here. P3: We don't have to buy [corn], that's all. GI 12 P3: That one makes hay only to breed a sheep, to have a lamb to eat for Easter. GI 13</p>	<p>Low P2: Who used to have, sold them because those who had cattle couldn't manage both the cattle and working. P1: Yes. P5: So, they can live without them. P1: Yes. Of course. P6: Those can live without them. GI 1</p>	<p>Moderate P2: So, I told you. We got rid of the cows because we had no time to milk them and to take the milk to the shop and also to work at the same time... P2: Honestly, I regret this, but there wasn't a lot of money... P1: And, being sleepy in the morning you had to take care of the cows. GI 2</p>
D) Officials	<p>High P2: They have land and functions... P2: Those have jobs and animals and earn more, right? [...] P2: Those have</p>	<p>Moderate P5: This is the way I see it. So, an official needs hay to sell it... P1: Right. P5: ... because he doesn't have a guaranteed salary. Because the salaries are very low. [...]</p>	<p>Low P2: They are not that affected [by natural disaster]. Because financially... They could survive with the income they have from their</p>	<p>High P1: I can't understand them. When I see them, they have as many animals as I do... they fly to the moon... and I'm still with this little</p>

	<p>more than the others. [...] P5: They own a lot of animals and they have an income ... GI 17 P3: [...] The Barons of the village. P1: The Barons. P2: They benefit from nature, the officials. Starting with the counselors and finishing with the mayor. GI 1</p>	<p>P1: For example – I have a modest salary as a family doctor and I can only support myself if I work something else besides this. P5: We really wouldn't need sheep if the salaries would be higher. GI 23 P3: We have to rent some land, because we don't have enough land – it isn't ours. GI 22</p>	<p>job. GI 25 P5: They have alternatives, they have everything! GI 17</p>	<p>car, still with these tractors, the same animals. GI 7 P2: For those nothing is ever enough! GI 11 P1: Yes. They are greedy, too. The more they have, the more they want and they don't think that others don't have. GI 21</p>
E) Poor people	<p>Low P4: They don't own any animals. P2: They own nothing... P4: They have nothing! GI 10 P2: Poor people are happy if they have food from one day to another. P3: They are happy if they can buy on credit from the shop until they get their pension or the children's allowance. P1: Some bread, to eat... GI 21 P5: I don't have, so I work by the day... P4: ...no income, no social assistance, no product. GI 17</p>	<p>Low P1: We do live, but on air. GI 11 P2: So the poor would need tourism to live and the others to thrive. GI 25 P4: We don't need it because there's nothing we can do with the pastures, and we'll end up talking about the rich again. GI 19 P2: But if you don't have animals, what will you do with the hay? P4: I cannot do anything with the hay. [...] P1: I'd raise a cow with pleasure. I know how to clean after a cow, I know how to milk, I worked for some old people and I learnt there. But I have no conditions. What am I going to do with that cow? Cry next to it because I have no food for her? GI 19 P2: Those don't need the hay because they don't have animals... GI 15 P3: Poor people don't need pastures. They have nothing, so they don't need the pasture! What should they do with it? GI 23</p>	<p>Low P1: They are getting benefits from the pasture only when they are collecting snails. GI 3 P2: They usually don't have sheep, but if they have some, they have less than five because otherwise they won't receive social assistance... P2: So, can you guess that they are not dependent... GI 15</p>	<p>Low P2: Well, here, the poor live the moment. They don't worry about tomorrow, they don't see... P3: A future... GI 25 P6: They are not interested in it, they are young and they receive social assistance. They prefer to receive those 100 lei, rather than breeding animals, working. GI 1</p>

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Table 2. Characterizing quotes for the emergent and research driven themes within each mediating factor of the MMF (Model of Mediating Factors). Please note that refined emergent and research driven themes grouped under each mediating factor share a comparable level of generalization (1st cycle coding) and abstraction (2nd cycle coding). Refined research driven themes used to inform the mediating factors are presented in section 1 of the results while a list of refined emergent themes is found in section 2 of the results. The twelve refined emergent themes are marked with “*”. The number of GIs mentioning a given theme is reported in the second column of the table.

Factor name (in bold) and main data-driven and research-driven themes within each mediating factor	# GI	Characterizing quotes
1. Ecological availability and conditions		
1.1 Ecological conditions	25	P1: You can't cultivate anymore... It's useless to go on the field, cultivate corn, work it, because in August boars come... you don't find anything anymore. GI 20
1.2 Degradation of ES*	23	P1: I'll give you an example: when there was a flood, we were forced to buy flat or mineral water to drink. GI 19
2. Policies, formal institutions, and markets		
2.1. Transition to non-planned economy*	21	P1: The producer, the processor, the seller and the buyer. And the first three parts negotiate. But the forth, the buyer, is never invited at the negotiation process. I went and negotiated with them and they said a price, we said a price, and at the end they could not set a price. GI 7 P3: What happens with the snails is called: the exploit of the human being by another human being [...] because I have no idea how much that one who collects the snails is asking for them. The same thing happens with lambs, with calf, with milk and with everything! GI 13
2.1.1 Economic profitability of farming	25	P2: [...] we don't give up because this is profitable. Why should I sell my 6 cows while I get an income from them? So, I can't sell them because I can't. And how about the priest, why should he sell his 25 sheep? GI 8 P3: No. If I would calculate how much I earn and how much I spend, there would be nothing left for me... Let's calculate the power of <i>Leu</i> for the last 5 years. How much would you be able to buy with that money, or even with less money? But what can you do with a hayreek now? GI 16

- P2: If I didn't have a salary, in winter I would not have money to pay... Those who live only from agriculture, cannot hire someone to... GI 20
- P1: He doesn't benefit from cows, he just entered in a circle which he can't get out from because he can't sell the cow. Because otherwise he doesn't earn anything. GI3
- P1: Because I said that a cow is more cost worthy. GI 24
- P1: They are saying that if you have less than 50 sheep, you are just supporting them, and if you have more than 50 sheep, they are supporting you. GI 2
- P3: The salary we get we have to give it to that one who helps us mowing with his tractor.[...]
- P4: What you receive from apples, you spend on pears. Well, I get money from the Italian guy and I give it to G. because he ploughs and works my land. GI 12
- 2.2. Policy and institutional influence 25
- P5: According to laws... it changed, of course that it changed – you can't go with your animals where you want to, you have to take a break after 4 hours of walking, of course that nobody obeys this rule because the expenses are high. They move from one pasture to another, but not really. GI 10
- P1: Germans were more hardworking, the Government left them alone, to work, work... What about us? We maybe have a better land than the Germans. [...] But the Government encouraged them, let them work... us not. And what? Can I only earn with European money?
- P2: Of course, the Government lets them...GI 7
- P1: We have to make a living, they have to leave us alone, free, to work. Not to tell us that we're not allowed, we need a stable, this and that. GI 7
- P1: The bureaucracy that is everywhere nowadays. I don't think that you can expand more...
- P2: It's the same thing with the European projects and with everything else. The words sound great but when you try to put it into practice; you deal with a lot of shifts you won't be able to overcome. GI 4
- 2.2.1. Unfairness of exogenous policies and institutions* 10
- P3: Yes. There are equal chances because each one works his own land, has sheep, tries to earn as much as he can... but the problem would be 1

		year later when the authorities intervene. GI 16
		P2: We have to change the system. GI 8
2.3 Market access	22	<p>P3: As you can see, that one who owns 200 ha doesn't work for himself, works for the market. GI 16</p> <p>P5: ... but they don't have a distribution market, so they give up. GI 23</p> <p>P5: If we have that, the small farmers will overtake the large farmers. Because the large one already has a market for his products. Even if they still face some difficulties, the large ones have a distribution market. But the small ones don't have this. If we can have that for the small ones, at a normal price, then we're putting the things in motion, then you can have subsidies, social assistance, trucks from abroad...so the distribution. If I have 2 cows, to know I can sell the milk, the calf to be sold with 10 million and not 5 million to the guy who buys it from my porch for nothing. GI 23</p> <p>P3: They don't buy it anymore... they come and mock the shepherd. They give him 9 Ron per kilo and sell it for 18 Ron at the market. GI 7</p>
2.4 Illegal access	20	<p>P1: It's just that sometimes we are crossing from one to another's land. [...]</p> <p>P2: ... because the sheep are going everywhere, they stopped cultivating large surfaces of land, neither with corn, and neither with that... GI 2</p> <p>P5: One of the large farmers planted one ha of corn and he said that all poor people can go and get as much as they want from there on condition they don't steal from his land. GI 5</p> <p>P1: For example, those who are poor and have social assistance, when they are coming to my farm, they are coming because they want to steal something. Or to you... they are coming to steal, so you have a rod in pickle for them. GI 3</p>
2.5 Subsidies access	15	<p>P3: The subsidies... we wouldn't breed them anymore if there would be no subsidies. GI 10</p> <p>P4: And we don't have enough pasture.</p> <p>P1: Normally, there must be a cow for each hectare.</p> <p>P1: And we have 2 cows per hectare. GI 7</p> <p>P3: The things would be fine with the pasture if they will cut the subsidies because then, nobody would breed animals.</p> <p>P3: But, people breed animals because they</p>

		<p>receive subsidies, so, they have fights because there is not enough place on the pasture for animals.</p> <p>P1: There are more and more animals.</p> <p>P3: There are 10-12 sheep on a pasture ...the problem is that the [surface of] pasture doesn't increase, only the number of animals increases...</p> <p>P2: ...the number of animals. GI 13</p> <p>P5: I am forced to take care of it, otherwise they would cut my subsidy and everything! GI 23</p>
2.6 Capitalism and globalization influence*	15	<p>P3: We don't think about food anymore, we give it [the collected milk] all to get money...</p> <p>P2: To get money.</p> <p>P3: Who doesn't need money? GI 24</p> <p>P3: Why should I breed something if I don't earn anything? Just to know that I own something? This is my point of view: the result of each activity should be the earning. GI 16</p>
2.7 Historical political contingencies*	11	<p>P1: Romanians from this village and the Gypsies didn't have land. [...] My grandfather told me he didn't have a piece of land. He received 5 ha of land after the war. So he became a landlord. And from morning until night, he went to work as a servant for the Saxons. GI 7</p>
2.8 Corruption of political leaders*	10	<p>P2: Corruption is rampant! That one gives to that one, that one gives to that one, I cannot get the land because he gives it to that one... because that one has brandy and who knows what kind of cheese. GI 19</p>
3. Social and power relations, and informal institutions		
3.1 Power	25	<p>P2: Those who want power. They take advantage of the fact that people are poor, give them 2-3 sausages and a beer and they vote for them. GI 21</p> <p>P1: And they're hand in hand with the others.</p> <p>P4: He has money and he can solve this. If the mayor didn't solve it, who would? GI 24</p>
3.2 Social relations	24	<p>P1: Yes, and usually, in our region... how do I say this? The large farmers, for example, have very good relationships with the officials.</p> <p>P1: They are in the same social class and they have very good relationships. They have connections, like they say. The small farmers...</p> <p>P2: Have good relationships with the large farmers. [...] Meaning that you are a person with a very good position, no? We know each other, we become friends, you baptized my children, you marry them, and we become friends and you are my godmother.</p> <p>P1: Or just friends. For instance, I'm the mayor and</p>

		<p>you are a big farmer. And we are friends because we have money, we meet at parties...</p> <p>P2: I need something, it gets approved.</p> <p>P1: We're friends, we're sisters, like they say, I put a good word for you, I give you more land, you immediately have the possibility to invest more.</p> <p>P3: I come with my bag full on the other side. GI 21</p>
3.3 Lack of trust and low community spirit*	18	<p>P4: He doesn't collaborate with the others...</p> <p>P2: Each one is taking care of his own business ... GI 15</p> <p>P3: They all work for themselves. GI 20</p>
3.4 Farming associations	12	<p>P1: You can't become partner. [...]</p> <p>P1: Even brothers end up killing each other...</p> <p>P3: Yes.</p> <p>P1: Why would you want an Association with the village?</p> <p>P2: You can't.</p> <p>P1: They would kill you. GI 20</p>
4. Household decisions and individual contexts		
4.1 Well-being contexts (including level of wealth, needs for ES, vulnerability to ES changes, and well-being aspirations)	25	<p>P3: Let me tell you. Some of them like to work, others are too stingy, the more they have, the more they want...</p> <p>P4: ... they want more.</p> <p>P2: ... they want more. GI 1</p> <p>P3: They take the land...the more they have, the more they want. GI 17</p> <p>P1: In our region, those who have, the more they have, the more they want. GI 21</p>
4.2 Access to different forms of capital (financial, technology, labor, built, knowledge, management abilities)	25	<p>P1: And you should know that every farmer went to school and they have farming certificates.</p> <p>P4: Yes, we have diplomas. GI 18</p> <p>P2: They have winter stables and they have they own water sources there. GI 4</p> <p>P2: They have tools, they have money, they have power...</p> <p>P1: ... they have lands. GI 12</p>
4.3 Farming livelihood strategy and normativity	25	<p>P3: Well, they are doing just agriculture, there is nothing else... GI 22</p> <p>P2: And if it doesn't have to be [farming], it is necessarily so.</p> <p>P4: Yes.</p> <p>P2: As being willingly.</p> <p>P4: It has to be done for sure.</p> <p>P3: Because we don't know how to steal.</p> <p>P2: We don't know how to steal, and that's it. GI 13</p>

		P5: You can live from animals, you can offer something to your children, to those who don't need hay, you can give them a job...because there are no jobs here. GI 23
4.4 Personal histories	19	<p>P3: After the Revolution</p> <p>P5: They had money. They knew how to start from the beginning.</p> <p>P2: They had some roots, somewhere to start from.</p> <p>P5: They knew how to start it. Because those who knew how to start this after the Revolution. [...]</p> <p>P2: They had one of their parents. GI 12</p> <p>P3: We started doing agriculture when there were no subsidies, and now that we receive subsidies people talk about this: that we developed, that we receive subsidies.</p> <p>P5: We developed... but nobody was doing agriculture in those times. GI 16</p>
5. Perceptions of equity		
5.1 Attitudes of defeatism, fatalism, negativism, resignation*	25	<p>P2: Those who were born rich, die rich, who is born poor, dies poor.</p> <p>P1: There have to be rich and poor people in this world. It's not possible to have only poor or only rich people. There has to be one like this and one like that – God has left it to us like that from generation to generation. GI 11</p> <p>P5: Yes. People will never be equal, that's impossible. GI 16</p>
5.1.1 Everybody is in the same situation	20	P2: The same sun warms us all ... We all treading the same roads. Everybody... Everybody! GI 1
5.1.2 Disempowerment	11	<p>P2: We are poor.</p> <p>P4: We have to be small in front of them. [...]</p> <p>P2: We would need it [pasture] if we could have it, too. But we can't have. We are poor and we can't. GI 6</p>
5.1.3 Favoring the rich	9	<p>P3: They always land on their feet.</p> <p>P2: Because they are wealthy.</p> <p>P5: Because they are wealthy.</p> <p>P4: Because they are wealthy. GI 11</p> <p>P2: Regarding the land... I remembered something. I don't have animals, so they didn't give me my 50 acres. For others, the one we're talking about, he gave him 3 hectares. He gave him 3 hectares!</p> <p>P3: He already had...</p> <p>P2: He was rich! He gave him 3 hectares because poor him, he doesn't have. GI 19.</p> <p>P1: If one needs, they give it to that one who is more...</p>

		P2: If he's poor, they will give it to the rich one. GI 20
5.1.4 The human nature of wanting more (conflation between wants and needs)	8	P1: Because this is the human nature, humans are always looking for more. GI 11
5.2 Distorted perception of equity (inverted marginal utility)*	23	P1: They have a very big income... The one who has 2 cows... if he loses them, it's not such a big disaster... but the one who has 300, what will he do? P1: This is what I wanted to explain. I, if I lose them, I lost... 2 cows... but him, 300... what will he do? P7: He'll hang himself. P1: He'll hang himself. P2: It's a big deal, then... GI 20 P1: The large farmers are the first to be affected [by a natural disaster]. GI 25 P1: Large farmers need arable land. P2: Those need it. P2: Because they have equipment and they can work. GI 25
5.3 Lack of juridical and administrative knowledge and distorted sense of property*	8	P1: Yes, but if he wants to say he doesn't take your sheep, he will not take them. And that's it. P2: But he gives permission to others. Because they share. P1: What do they share? P2: The pasture of the sheep. P1: Yes, but how do they share it? P2: I don't know. P1: Because I, when I have a contract in my hand, I can respect that, no? I respect it. I have leased that land and that land and I don't need your animal. P2: He should be forced, somehow... GI 9
6. Individually held values		
6.1 Value of work*	17	P1: It's a pity because they are making fun of people who are just working hard! GI 3 P1: The same for us. We worked hard, achieved results, worked hard again and so on. This is what life is, right? GI 18 P3: This is what I said. Those who don't work don't have. P5: That one who works, has, that one who doesn't work, doesn't have. GI 23 P6: We need hay, we need to work, to work all the time. GI 1 P2: The milk is not paid. We work... hay... we milk... but 1 <i>Leu</i> ? A bottle of juice is more expensive. GI 24

6.2 Normative of making the land worthwhile and agrarian identity 16

P3: Most of the time you would like to give up. Most of the time you would like to give up because it's very expensive. The gas and others became more expensive. But you have no choice! You can't waste it! God helps you! [...]

P1: And us, and us, and us... For example, we wouldn't even need to breed them, but we breed them because we love it and we have something to do. GI 1

P6: We just love it and because we have something to do.

P4: We just love it!

P3: In order to have something to do.

P6: To have what you need.

P1: Because we could live solely with our pension. It's just as my husband said, better to have something to do than standing in front of the gate and watching how the people walk up and down. GI 1

P1: Nobody needs animals. You really don't need it; nobody really needs them, that's the reason why there are no young people who want to become farmers. But if you have them, you have to breed them... So, missy, you have to understand that we don't need them! We are stupid we are still breeding these animals and we are giving ourselves a rough ride.

P2: We are working for nothing!

P1: We are working for nothing! But the time goes on and I can't do anything. GI 3

P2: In the case large farmers won't have enough fodder, they would sell them, they won't let them die, it would be such a pity, God would punish them. GI 22

P3: Aside of this, we were raised like this here. And we are used to this. This is how we're used to and this is how we were all raised. So we are not good at anything else.

P2: The peasant is connected to land. There cannot be a peasant without land or land without a peasant. GI 18

P5: Do you know how things work with the animals? If I would have a shop and it wouldn't work today, it wouldn't work tomorrow, it wouldn't work the day after tomorrow, I would close it next week. Go to hell, shop! But, what should I do if I have animals? They would scream because they are hungry.

		<p>P2: You have to feed them, there is nothing you can do.</p> <p>P1: You have to give them food, it doesn't matter if you have it or not [food].</p> <p>P5: This would be a torture for the animals. GI 10</p> <p>P1: I don't consider animals as... hm... how would I say this? Not slaves... I don't know... I don't regard them as a big income source to get me rich. I, with my employees, with my cows, we are like allies, living together. The animal needs me and we need the animal to survive. For thousands of years... GI 7</p>
6.3 Humanness towards the poor*	10	<p>P1: I believe that you can't develop knowing that somebody was hurt because of this. GI 8</p> <p>P1: I had a family here, who lived at the farm for 21 years. I gave them each year a calf for breeding. It became mature, it gave birth, they got a calf, so they had a cow and a calf. GI 2</p> <p>P5: If we don't breed them, they have nothing. I breed [sheep], so I give a lamb to that one because I feel pity for him, I give a lamb for Easter to that one because he might help me in the autumn. GI 23</p>

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Table 3. Characterizing quotes for the emergent themes within the mediating factor of social and power relations (3rd factor in Fig. 3). The number of GIs mentioning a given theme is reported in the second column of the table.

Power relations	# GI	Characterizing quotes
Officials create inequities and hinder access (e.g. to land)	14	<p>P5: The conflicts are born from politics. If you voted me, I will give you pasture where you like, if you didn't vote me, I won't give you pasture.</p> <p>P3: Yes.</p> <p>P5: ... and things like this. Or they might do an auction for the pasture... even yesterday they bid, but the pasture isn't worth so much. GI 10</p>
External supertenants impede on all groups through capturing land	10	<p>P1: We have 200... 160 hectares, let's say... And we have 300 animals. We have to decrease the number of animals, if he doesn't give us the pasture.</p> <p>P1: That he... he took it on lease for 49 years. And he will not end the leasing contract, to give us the pasture back so we can have it for animals, he holds it with his teeth, he has power. [...]</p> <p>P3: He doesn't have animals but keeps the land.</p> <p>P1: They leave the animals on the [village] pasture</p>

Difficult relations experienced between officials and poor people	8	and there's nothing to eat. GI 7 P2: Sometimes they pay attention to you, sometimes they don't, because this is the way that things work. GI 11
Poor people need farmers to be productive	8	P2: I have nothing against the town hall here but since the State grants aids of food in the village and they don't give it to people, that small right for poor people... at the end of the day, this is why these aids were sent, right? GI 19 P5: Poor people need that big farmers and small farmers have productivity so they can hire them. P2: To pay them, to hire them... GI 5 P2: Well, automatically... let me explain it to you. When you, as a big farmer, go bankrupt, I'm affected, too. Because I'm poor and I come to you to buy milk. P1: Exactly! P2: And if you don't give it to me, how am I going to eat? GI 21
Small famers compete with large farmers	7	P5: [...] if we don't breed them [sheep], they have nothing. I breed, so I give a lamb to that one because I feel pity for him, I give a lamb for Easter to that one because he might help me in the autumn... GI 23 P2: The small ones want the same thing. To reach the rich from behind... P2: To become like the rich ones. P3: Competition. P2: There's a competition between them. GI 6 P1: There must be [competition], otherwise... P2: It probably is between small and big ones. A competition... GI 25
Officials are dependent on poor people (but also non-farmers and small famers) for workforce	7	The poor ones live because they are needed by the rich ones. GI 12
Small and large farmers are providing ES benefits for everybody	7	We, who if we are sending the cows to pasture, they graze there, they dung there, and so on... GI 1 P1: [...] Yes, you are fertilizing the land ... [laughing] P2: You are fertilizing the land with the sheep – it's called like that. P1: The next year, you will see grass growing there. P2: Grass will grow, otherwise ... P1: But not only the next year, but also in the autumn, if there will be any September rain, those lands will become very green. P2: Yes, but you have to take care of how much you will let them stay there. GI 3 P1: Everything starts from here... If it wasn't for us, the peasants...If it wasn't for the peasants, people from

Large farmers impede on small farmers especially through trespassing

the city would starve to death. Because everything comes from here. GI 24

P4: Some of them, but they also take the water from people to give it to the animals and they also leave it running. GI 17

P7: Of course, he mows a slice of my land... I'm his neighbor...

P2: They took it from our land, too.

P1: There, behind, they cut and they put two rows of corn.

P2: The little piece of land you have, they will take it. GI 20

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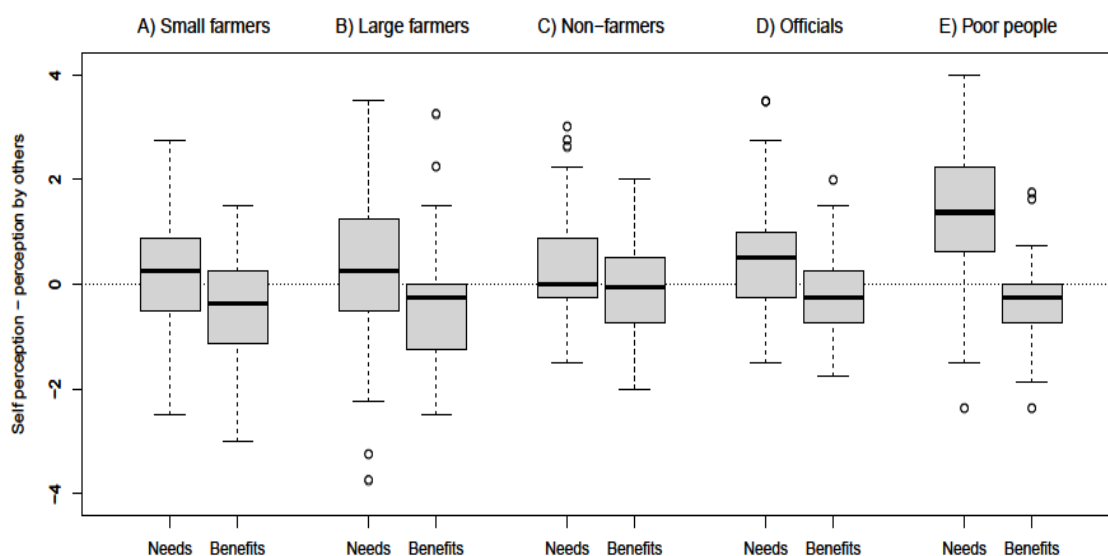


Fig. 3. Comparison between scores for needs and benefits respectively, assigned by all GIs pertaining to a given beneficiary group, and scores for needs and benefits respectively, assigned by all GIs pertaining to the other beneficiary groups. This supports the idea that there was a relatively high level of consensus among beneficiary groups regarding prompted content and that the topic of well-being contexts of poor people generated most of the deliberations.

SI 8

Self-assessment of access mechanisms by each of the GIs pertaining to a given beneficiary group. For example, the first column shows the access mechanism of small farmers to the farming set of ES most widely quoted during all five GIs with small farmers.

A) Small farmers	B) Large farmers	C) Non-farmers	D) Officials	E) Poor locals
Economic profitability [5]	Financial capital [5]	Livelihood strategy and normativity [5]	Power and authority 3	Policies and institutions [5]
Land access [5]	Business and management abilities [5]	Agrarian identity and normativity [4]	Livelihood strategy and normativity[3]	Land access [4]
Market access [5]	Labor access (paid) [5]	Personal history [3]	Land access [3]	Social relations [4]
Subsidies [5]	Economic profitability [5]	Policies and institutions [3]	Agrarian identity and normativity [3]	
Association [5]	Market access [5] Livelihood strategy and normativity [5]			

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Chapter V

Social factors mediating human-carnivore coexistence: understanding coexistence pathways in Central Romania

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Submitted to AMBIO



“I come from under the hill, and under the hills and over the hills my paths led. [...] I am the friend of bears and the guest of eagles.” The Hobbit, J.R.R. Tolkien

ABSTRACT

Facilitating human-carnivore coexistence depends not only on the biophysical environment but also on the social factors shaping human-carnivore coexistence. Focusing on Central Romania, we used questionnaires (n = 252) and semi-structured interviews (n = 70) to examine human-bear (*Ursus arctos*) coexistence. The questionnaires highlighted four distinct groups of respondents and revealed general patterns of important social drivers. Qualitative content analysis of interviews identified three coexistence pathways. These pathways showed different ways in which interactions between the ecological and the social system shape the willingness of people to coexist with bears. While the connection between humans and the landscape had important mediating effects on perceived coexistence, the generally positive perception of coexistence could be undermined by perceived flaws in official bear management. The concept of coexistence pathways, coupled with a comprehensive approach to their analysis, may help landscape managers identify drivers that facilitate or hinder coexistence, and thus target interventions accordingly.

Keywords: brown bear, carnivore conservation, conflict mitigation, human-carnivore conflict, *Ursus arctos*

INTRODUCTION

Where humans and large carnivores share the same landscape, there are inevitable conflicts: for example, humans can experience attacks and predation on livestock, with resultant economic impacts (Thirgood et al. 2005; Holmern et al. 2007); and carnivore populations decline as a result of persecution and growing human pressure on carnivore habitat (Woodroffe 2000; Ripple et al. 2014). Therefore, successful carnivore conservation depends not only on the biophysical environment but also on understanding the social factors that shape human-carnivore coexistence (Treves & Karanth 2003). Importantly, human tolerance towards carnivores is not only shaped by the experience of damage (Hazzah et al. 2009; Dickman et al. 2014; Kinsky et al. 2014). Rather, it is constructed through a variety of factors related to economic, aesthetic, ecological, cultural, religious, and intrinsic values ascribed to carnivores (Zinn et al. 2000; Dickman 2010). For example, traditional and cultural differences between pastoralist and agriculturalists lead to differences in their tolerance towards lions in South Africa (Gusset et al. 2008; Legendijk & Gusset 2008). Moreover, in many places the political environment is an additional factor influencing human-carnivore interactions, for example through the implementation of top-down conservation management, financial incentives, or tight legislation (Redpath et al. 2012), which may clash with the priorities of rural populations (Skogen et al. 2008; Majić et al. 2011).

To design effective tools that facilitate coexistence, studies need to account for the complexity of social factors that shape it (Dickman 2010). Despite an increasing recognition of the need to integrate social science into understanding the extent of human-carnivore conflicts (Carter et al. 2012; Inskip et al. 2014), the majority of studies to date have described conflicts or patterns of attitudes towards carnivores, whereas fewer studies have focused on the underlying drivers and impacts of conflict, or on conflict resolution and coexistence (Barua et al. 2013; Can et al. 2014; Madden & McQuinn 2014). In Europe, such knowledge is particularly important because recent expansions of brown bear (*Ursus arctos*) populations have caused increased conflicts (Enserink & Vogel 2006; Can et al. 2014), and illegal killing could undermine the recovery of bear populations (Ciucci & Boitani 2008; Kaczensky et al. 2011). To understand coexistence, regions where humans and carnivores have successfully co-occurred for a long time could provide particularly useful case studies (Boitani 1995).

In this study, we aimed to elicit the social drivers of coexistence by taking a combined approach of questionnaires and inductive semi-structured interviews to examine human-brown bear coexistence. We focused on the foothills of the Carpathian Mountains in Transylvania, Romania. Here, people and bears have co-occurred for extended periods of time, and the close proximity of the forest to villages and farmland, as well as the reliance of people on forest ecosystem services (e.g. firewood) provide ample opportunities for human-bear interactions. Furthermore, traditional practices such as shepherding and bee keeping are potential areas of conflict with bears (Zedrosser et al. 2001). Our specific objectives were (i) to obtain an overview of how social drivers affect people's perception of human-bear coexistence; and (ii) to generate a deeper understanding of the mechanisms and causal factors underlying people's perceptions of coexistence. One of our key outcomes is the concept of coexistence pathways, which show how ongoing interactions between elements of the ecological system and the social system shape the willingness of people to coexist with carnivores. We outline specific coexistence pathways for our case study, and discuss their potential general relevance for carnivore conservation. In addition, we discuss how the concept of co-existence pathways could be extended to other species and locations by providing a general framework for unpacking the social factors mediating human-carnivore co-existence.

METHODS

Our research design was based on a sociological triangulation approach which combined quantitative and qualitative methods to broaden understanding rather than to validate each other (Olsen 2004). In particular, we used quantitative questionnaires to identify general patterns, and inductive, semi-structured qualitative interviews to gain a deeper understanding of the social factors mediating human-carnivore coexistence. We used an inductive approach to generate

insights on human-carnivore coexistence, rather than a deductive approach to test specific theories or hypotheses (Pratt 2009). This approach was chosen to construct a holistic framework of understanding that would account for a wide range of social factors that shape co-existence. Indeed, inductive research has previously been useful in gathering detailed information for understanding human-carnivore relationships (Inskip et al. 2014).

Questionnaires for an overview

We used questionnaires to identify general patterns in the social drivers underlying coexistence (objective i), by assessing how combinations of predefined social factors influenced people's perception of current and future coexistence. Questionnaires are useful when the researchers know what they are seeking, give the opportunity to sample many individuals and thereby obtain an impression of average opinions, and simplify the comparison between respondents by enabling quantitative analyses (Huntington 2000). We utilized these strengths by basing questions on social factors we deemed relevant to our study area, including socio-demographic factors, interactions and conflicts with bears, general attitudes, knowledge acquisition and culture, perceived benefits and disadvantages of bears, and bear management (e.g. Kaczensky et al. 2004; Dickman 2010; Redpath et al. 2012; Dickman et al. 2014). For all questions on perceptions we used a 5-point Likert scale (from strongly disagree to strongly agree), whereas for all other questions we either used multiple choice or yes/no answers (46 questions total; Supplementary Material Text S1). Questions that could not be answered by the respondent were noted as "don't know".

We randomly selected 30 villages of the over 400 villages scattered throughout the 7441 km² study area spanning the full range of biophysical and social conditions (see Dorresteijn et al. 2014 for a more detailed description). The average number of inhabitants per village was 584 (min–max cc. 30–1900) (INS 2011). We aimed to ask 7-10 persons per village for the questionnaires in all 30 villages, based on chance encounters, and obtained 252 responses.

General patterns on how social drivers influenced people's perception of coexistence were analyzed using hierarchical agglomerative cluster analysis (Wards clustering based on Euclidean distances: agglomerative coefficient of 0.95) and principal component analyses (PCA). First, we used a cluster analysis to identify groups of people that were similar in their perceptions of the importance of different social factors (questions based on a 5-point Likert scale). We characterized these groups based on their perceptions of coexistence, interactions and conflicts with bears, and socio-demographic factors. Second, we used PCA to extract the main social drivers of coexistence and related these to four groups previously obtained from the cluster analysis. We calculated four separate PCAs for each of the following themes: (i) attitudes

towards bears; (ii) cultural values and bear knowledge acquisition; (iii) benefits and disadvantages related to bears; and (iv) bear management (Supplementary material Fig. S1-S4). For each theme, we plotted the first two axes and overlaid them with the four groups from the cluster analysis. Twenty individuals missed one question, and their responses were replaced with imputed values (i.e. the average of the total sample pool). All questions that were answered with “don’t know” were scored with a 3 (neutral opinion about a statement). All statistical analysis were implemented in the ‘R’ environment (R Core Team 2014).

Semi-structured interviews for in-depth analysis

In contrast to questionnaires, semi-structured interviews give the opportunity to go deeper into certain topics by guiding participants into discussions but allowing the interview to follow the thoughts of the participant (Huntington 2000). Therefore, interviews can generate insights into the mechanisms and causal factors underlying people’s perception of human-bear coexistence (objective ii), and can help interpret the patterns derived from questionnaires. Although the interviews were guided to prompt discussions, we allowed for discussions on unanticipated themes. The themes covered were the same as in the questionnaire (Supplementary Material Text S2). All interviews were conducted by a local Romanian and Hungarian speaker, digitally recorded, and later transcribed and translated into English.

We aimed to interview 3-4 people per village in a total of 20 of the villages where the questionnaires were also conducted. We selected the 10 villages with the highest and 10 with the lowest perceived human-bear conflicts as indicated by previous research (Dorresteijn et al. 2014) to ensure a broad gradient in perceived conflicts, and thus a broad range of responses on conflict and coexistence. We purposefully sampled to include some shepherds, foresters and hunters to obtain a wide variety in human-bear interactions. In total, we conducted 70 interviews.

We analysed the interview transcripts by first grouping all interview participants into three groups regarding their perception of human-bear coexistence (positive, negative and neutral). For ease of communication we only show the results here for people with positive or negative perceptions. We applied qualitative content analysis by coding the interviews for themes using NVivo 10 (QSR International Pty Ltd 2012). Coding was conducted in an exploratory way to extract themes that related to those covered in the interview guide as well as to unprompted content or emerging themes. To gain a deeper understanding of the mechanisms driving coexistence, we combined themes in an emergent conceptual framework that included three coexistence pathways. These coexistence pathways reflected how different elements of the social and ecological systems interacted to create mechanisms that shaped human-bear coexistence according to local people. Each coexistence pathway consisted of different themes, and in a

second round of coding, we categorized the statements of the participants to the different themes within each pathway.

RESULTS

Social drivers affecting perceptions, based on questionnaires

The cluster analysis revealed four distinct groups of respondents (Fig 1), which differed in their perception of coexistence, interactions with bears, and socio-demographic factors (Table 1). The majority of people clustered in groups 1 and 2 and had a more positive perception of current and future human-bear coexistence compared to groups 3 and 4. Respondents from group 1 had the fewest interactions with bears, and respondents from groups 3 and 4 most frequently experienced damage to crops and predation on livestock. The largest proportion of women was in group 1 and the largest proportion of men was in group 2. Respondents in group 4 were oldest on average.

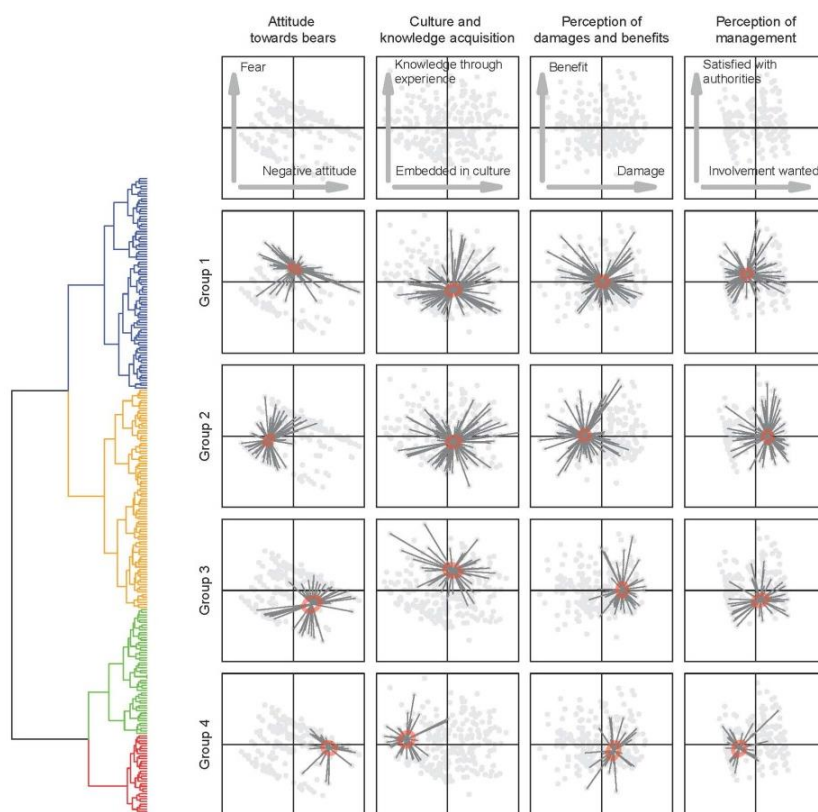


Fig. 1. Classification and ordination of the 252 questionnaire respondents according to their perceptions of bear-related themes. The left panel shows the dendrogram and the four groups of people derived from hierarchical agglomerative cluster analysis. The other panels show the principal components analyses of the four different themes. The upper row shows the main gradients, whereas the lower four rows show the loadings for each group on the different PCAs. The legs of the spider diagrams indicate each person belonging to a given group and the circle indicates the standard deviation of the weighted average of each group.

The identified groups revealed that attitudes towards bears, culture and knowledge acquisition, perception of damages and threats, and opinion of management, may be important social drivers influencing people’s perceptions of human-bear coexistence. The four groups of respondents were characterized by their position along the main gradients of the four themes (see PCAs in Fig. 1; full ordinations can be found in Appendix S3, Fig. S1-S4). Overall patterns were more similar between groups 1 and 2, who had a more positive attitude towards bears and between groups 3 and 4, who held a more negative attitude (Fig. 1). Similarly, groups 1 and 2 perceived bears to be less harmful than groups 3 and 4, while in contrast different beliefs regarding the benefits provided by bears were not reflected in the grouping (Fig. 1). Also, responses on the influence of culture, knowledge acquisition, and management had relatively little influence on the grouping. However, group 4 ascribed low cultural importance to bears, and group 3 acquired most knowledge through experience (Fig. 1). Opinions on management most importantly were characterized by the desire to be more actively involved, which was especially high for group 2, whereas the overall satisfaction with bear management differed only slightly between the groups (Fig. 1).

Table 1. Perception of current and future coexistence, socio-demographics, frequency of actual bear encounters and conflicts, and average knowledge score, of the four different groups derived from the cluster analysis based on the questionnaires. The number of people and the percentage in parentheses within a certain group are given.

	Group 1 (n = 84)	Group 2 (n = 87)	Group 3 (n = 50)	Group 4 (n = 31)
Current Coexistence				
Positive	70 (83)	82 (94)	24 (48)	18 (58)
Negative	14 (17)	4 (5)	25 (50)	13 (42)
Future Coexistence				
Better	9 (11)	20 (23)	2 (4)	2 (6)
No change	35 (42)	44 (51)	15 (30)	7 (23)
Worse	23 (27)	13 (15)	29 (58)	15 (48)
Gender				
Male (n = 181)	46 (55)	78 (90)	34 (68)	23 (74)
Female (n = 71)	38 (45)	8 (9)	16 (32)	8 (26)
Average age	47	46	47	62
Frequent bear observations	7 (8)	22 (25)	19 (38)	9 (29)
Frequent damage to crops, orchards and hives	6 (7)	5 (6)	21 (42)	6 (19)
Frequent attacks on livestock	1 (1)	2 (2)	8 (16)	2 (6)

Mechanisms that shape perceptions, derived from interviews

Coexistence pathways

Similar to the questionnaires, the majority of respondents in the interviews had a positive perception of human-bear coexistence (61%; n = 50), whereas 18 people (25%) had a negative perception, and 10 people (14%) did not have a very strong opinion. Three coexistence pathways emerged from the data and showed how people's attitudes towards different aspects of bears, the human community, and management support or oppose their willingness to live with bears (Fig. 2). Furthermore, the pathways related to bears and humans were affected through interactions with the landscape (Fig. 2). However, the identified pathways do not predict perceptions of coexistence, and each pathway can lead to both positive and negative perceptions of coexistence, depending on the respondent. Rather, a pathway refers to the mechanisms that create a person's relationship with bears, and how that relationship is perceived depends on how the respondent experiences those mechanisms.

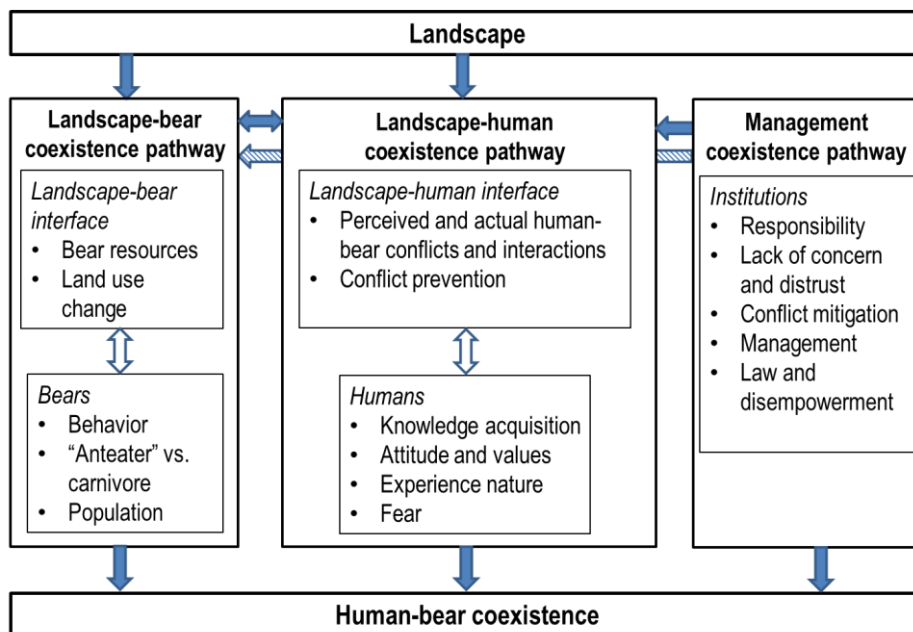


Fig. 2. Conceptual framework showing three identified coexistence pathways based on qualitative content analyses of 70 interviews. A coexistence pathway shows how ongoing interactions between elements of the ecological system and the social system shape the willingness of people to coexist with bears.

Landscape – bear coexistence pathway

The landscape-bear coexistence pathway contained two components. The first component was related to how people conceptualize interactions between bears and the surrounding landscape, while the second component described people's opinion on bear behavior and ecology. The pathways demonstrated that coexistence was supported by people's understandings of bear behavior, and hindered by concerns about inadequate bear habitat, deforestation, and increasing

bear populations. The make-up of the surrounding landscape played an important role in people’s perception of current and future coexistence (Table 2, row a). People with a positive perception deemed forest size and food supply in the region sufficient, while people with a negative perception deemed it insufficient. Deforestation and land use change were major concerns of both groups because they expected an increase in future conflicts with increasing disturbance to bear habitat (Table 2, row b).

Table 2. Characterizing quotes for the themes within the landscape-bear coexistence pathway. The respondents were grouped into two groups based on their perception of coexistence (positive or negative). The number of people mentioning a given theme is reported and the percentage within each group is given in parentheses. The “P” or “N” behind each quote indicates whether the person had a positive or negative perception of coexistence.

Landscape-bear coexistence pathway			
Perception of coexistence			
	Positive (n = 43)	Negative (n = 18)	Characterizing quotes
a. Bear resources	17(40)	6(33)	<p>So long as forests remain I don’t think something bad can happen, I don’t think the bear will come down in the village (ALM4; P);</p> <p>As long as it has food in the forest it won't eat up the people's potatoes or corn. Then it has no reason to come into the village (SAC2; P);</p> <p>We have only a few, small forests here! There's no place for the bear to stay there (BLA3; N).</p>
b. Land use change	17(40)	4(22)	<p>The bear typically stays far from humans. Only when it is being attacked or when it has cubs they are dangerous (ALM1; P);</p> <p>I'm thinking about deforestation. You destroy the bears’ habitat. It needs to adapt as well. It can't hide anymore; it gets more and more in contact with humans, its hunting area disappears and that becomes a problem. This is how the bear may become a problem! (MAL1; N).</p>
c. Bear behavior	21(72)	14(78)	<p>The bear is not an animal that attacks without being provoked (BLA1; P);</p> <p>The shepherd was always saying: “Hey, the bear is coming, the bear is coming!” [I answered]: “Let it come, man! Let it come” When it comes, it takes [one/ a few]... It's not like the wolf! A wolf, once it jumps into a compound, it kills 4-5-10 sheep, and then it takes one and leaves! But the bear takes one under its arm and leaves (DEA1; N).</p>

d. The anteater vs. the carnivore	12(28)	5(28)	<p>There are only ant-eating bears. They don't attack the sheep (MAL2; P);</p> <p>Doesn't matter what point of view we take on them: As long as they eat plants, there's no problem with them, but once it gets to taste meat, it'll get aggressive (SAC1; N).</p>
e. Bear population	25(58)	12(67)	<p>No, there aren't 'urgent' problems – it's just that they appear more and more often! (VAD3; P);</p> <p>Because there are more of them, it attacks animals and man more often! (SAC4; N);</p> <p>We have knowledge about the fact that bears have been brought here. There haven't been that many bears in the past, by far (ALE1; P);</p> <p>It has been brought here. And then it reproduced (VAL3; N).</p>

The “peaceful” behavior of bears and their relatively low damage compared to other species (e.g. wolf) were character traits considered important to coexistence by both groups (Table 2, row c). The importance of perceptions of bear behavior to coexistence was further expressed through the local belief of the existence of two types of bears, namely the primarily vegetarian “ant-eating bear”, and the “carnivorous bear” (Table 2, row d). Coexistence with the ant-eating bear was perceived to be unproblematic, whereas the carnivorous bear was perceived as a dangerous animal. Despite the view of bears being relatively harmless, the perceived increase in the bear population was considered a major problem to coexistence (Table 2, row e). Several people even mentioned that bears were only present recently and that they either came down from the mountains or had been brought to the area from overpopulated areas or for hunting purposes.

Landscape – human coexistence pathway

The landscape-human coexistence pathway also contained two components. The first component described the relationships between people and the landscape (including interactions with bears), while the second component related to people’s values. Experiencing bears and nature, and the values ascribed to them, were key in shaping people’s perceptions of coexistence. The perception of coexistence was especially positive for people that had positive interactions with bears, while negative perceptions were related to higher livestock predation and the levels of perceived damage and danger by bears (Fig. 3a). Interestingly, such damage beliefs appeared to have more influence on coexistence than actual conflict (Fig. 3a). In contrast, crop damage and indirect knowledge of conflicts had little effect on the perception of coexistence (Fig. 3a). Moreover, preventing conflicts by adjusting human behavior or using traditional shepherding

techniques was seen as an integral component of coexistence by both groups and was mentioned in 62% and 23% of the cases respectively.

Family, community members, and education all played a role in acquiring knowledge on how to live with bears, but people with a positive perception mentioned more often that they learned through experience (Fig. 3b). Attitudes towards bears were especially positive for people with a positive perception of coexistence (88% positive attitude; 0% negative attitude), compared to people with a negative perception (19% positive attitude; 28% negative attitude). Non-use values, such as cultural, existence, and historical values, were more often associated with bears than use values by both groups, although these values were more prominent among people with a positive perception (Fig. 3c). The genuine and continuous relations between people and nature, where they experience and value nature, seemed to be more important to support coexistence than financial incentives or other use-values: “Well, for us the bear is like our neighbor. (...) like the neighbor at home. There's no difference between my neighbor and the bear that comes every second evening. We're somehow used to it. (VID4)”; “When you love nature I don't think that you need a lesson, necessarily, to live with them [bears] (CIN3)”; You don't want to see a dead forest [without animals], right? It's different when you see a bird on a tree, a bear, a deer. “That makes the difference! You see life in nature! Dead nature is like a village without inhabitants (LAS4)”. Fear was one of the emergent themes but only mentioned by several people (afraid: n = 6; not afraid n= 9), without large differences between the two groups.

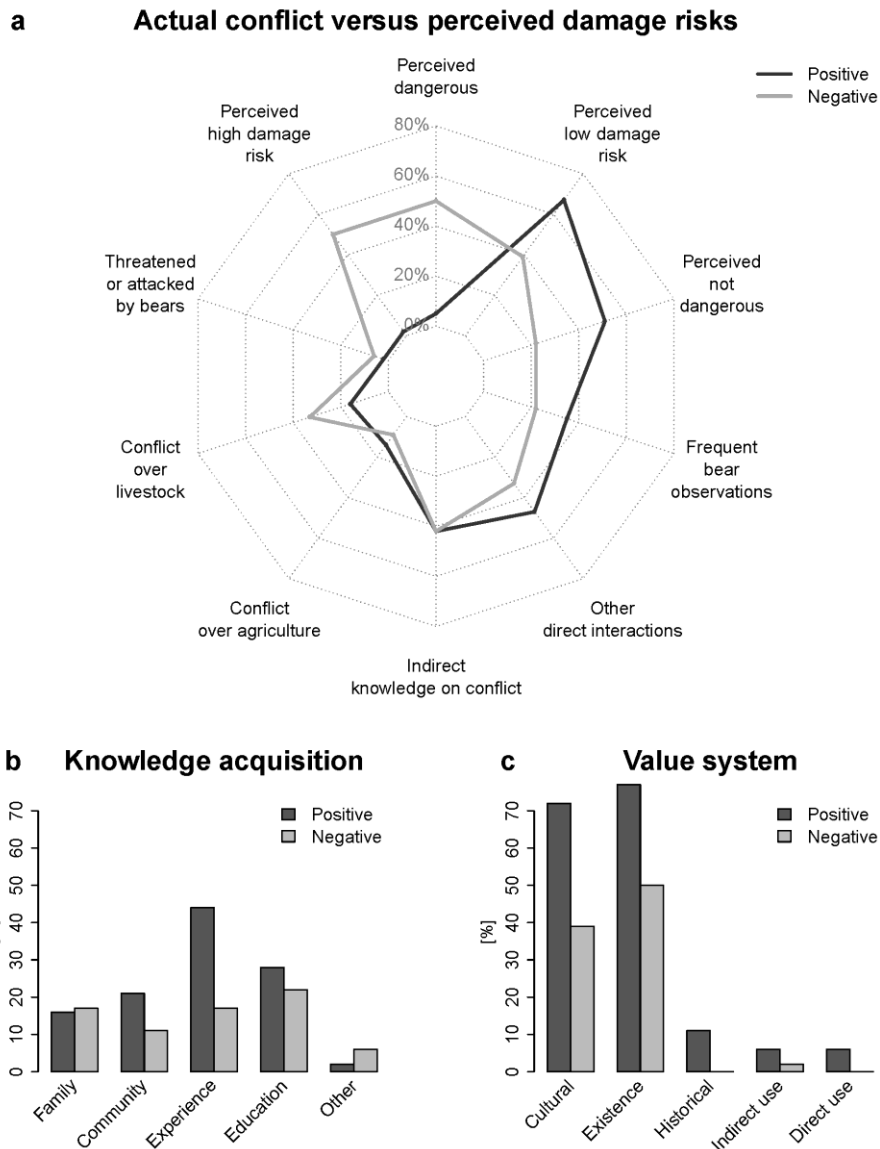


Fig. 3. Human-bear interactions, bear knowledge acquisition, and values ascribed to bears between two groups of respondents – those with a generally positive perception ($n = 43$) of human bear-coexistence versus those with a generally negative perception ($n = 18$). a) The difference between actual conflicts, bear interactions and perceived damage risks. The actual conflicts and bear observations were derived from direct questions asked at the beginning of the interview (see Appendix S2), while perceived damage risk, other direct interactions, and indirect knowledge of conflicts was interpreted from the interviews. b) Sources where people acquire knowledge on how to live with bears. c) Values ascribed to bears. The importance of cultural values was a question in the interview guide (see Appendix S2) whereas all other types of values emerged from the interviews.

Management coexistence pathway

The management-coexistence pathway was related to the institutions managing bears and how people perceived these institutions. The majority of people were dissatisfied with current bear management mainly due to a lack of concern for their problems with bears, disinterest from the management authorities, distrust towards them, lack of conflict mitigation, and perceived bad management (Table 3). The only 12 people that were satisfied with management believed that

the provision of supplemental or divisionary feeding was enough to prevent conflict (Table 3, row c). However, the majority of people believed that authorities and hunting organizations failed to mitigate conflict by not feeding the bears (enough), by not controlling the bear population, and by not providing compensation after damage (Table 3, rows i-k). Furthermore, six people expressed concerns about trophy hunting, indicating that common people carried the burden of living with bears so that hunting organizations could earn money from trophy hunting (Table 3, row l). Although the law and protection status was perceived to aid coexistence by people with a positive perception of coexistence, people with a negative perception viewed it as an artificial tool that they could not influence or even felt disempowered by, because they were not able to take care of problem animals themselves (Table 3, row g and m).

Table 3. Characterizing quotes for the themes within the management coexistence pathway. The respondents were first grouped into two groups based on their perception of coexistence (positive or negative), and second, based on their opinion whether they were satisfied with current bear management. The number of people mentioning a given theme is reported and the percentage within each group is given in parentheses. The “P” or “N” behind each quote indicates whether the person had a positive or negative perception of coexistence.

Management coexistence pathway			
	Perception of coexistence		Characterizing quotes
	Positive (n = 11)	Negative (n = 1)	
Satisfied with current bear management			
a. Lack of concern and distrust			
b. Conflict mitigation: compensation	1(9)		Yes, there is the principle when an animal caused damage, the person affected will be compensated. (...)There is this principle of compensation at local level (BLA1; P).
c. Conflict mitigation: feeding	9(82)	1(100)	Yes, they feed them – the “paznic de vanatoare”. This has been done in the past as well, when they brought them dead animals in a big open pit (CIN1; P).
e. Management: control bear population	1(9)		I'm against their killing and wiping them out, but I think that their population growth should be controlled a bit, as well as their spreading (CIN3; P).
f. Management: legal and illegal hunting	6(55)		Every year we shoot one bear which is pretty ok. That's the money of the hunting association. They pay something to the state as well. Don't know if they pay something to the local community (VAN2; P).

g. Law and disempowerment	5(45)		They'd almost disappeared and [you can shoot them today] only with a special permit where the cause big damage. The wolf, the wild cat, the bear – they're all protected (GRA1; P).
	Positive (n = 21)	Negative (n = 13)	
Dissatisfied with current bear management			
h. Lack of concern and distrust	11(52)	3(23)	But they don't do anything. Nobody cares for nothing! Nothing. I've been to the mayor and he said: "Should I come and guard them instead of you?" (VID4; P). A bear values four human lives. Yes! Once it has killed four humans, you're allowed to shoot it. Therefore, it is worth four human lives. (VAL3; N).
i. Conflict mitigation: compensation	5(24)	5(38)	The one who has the damage, stays with the damage. Only when the damage is bigger. Only then. Otherwise nobody cares/makes an effort (ALM1; P); I guard the fields that I have paid for, otherwise the wild animals destroy the harvest and nobody pays me the damage. Nobody pays for it! Cause we don't have such a big output (...).We don't have a big production but we're living of it. The damages aren't big for them [authorities], but we have to live from this (GHI1; N).
j. Conflict mitigation: feeding	8(38)	4(31)	When there are many bears, they should guarantee them feed so they don't come and attack...I2: They don't guarantee them the feed, that's why they attack! (CRI2; P). They must be fed as well! It's not enough to let them free in the forest, but to feed them as well. The forest authority has fed them in the past! (PRO3; N)
k. Management: control bear population	3(14)	3(23)	Let the bear population grow but keep it under control (AGA1; P). The population management is a bit out of control. I don't think there is a true population management. (...) But the true control was in the past the fact that the bears were kept under a certain number/density in a certain area (MAL1; N)
l. Management: legal	13(62)	8(62)	For the locals it's just disadvantages, cause the

and illegal hunting			hunters are not from this region so that we can say: “We keep the earnings from the hunting!” In case they shoot a bear. The problem is that those who shoot the bears are not locals and the truth is that, as far as I see, they don't even care for compensating for losses that locals might have (SAC3; P); The management of bears by the state is not working properly. This could be improved – but as long as a hunter may come to shoot a bear for a certain amount of Euros, without caring that this causes to others a double amount of damage or even a human's life... We'd need to think about all this! Then bears and humans would get along well (MAD1; N).
m. Law and disempowerment	8(38)	5(38)	How should I say: They could live together. Cause you can't do them anything! You can't go in the forest and shoot them. What can you do else, but live next to them (BLA2; P); A human life is worth more than a bear's, Sir. Protecting bears is good, but it's somehow overprotected, Sir (MIH1; N).

DISCUSSION

Our methodological approach provided two different perspectives on the social drivers to human-bear coexistence. First, questionnaires revealed general patterns of important drivers within groups of people. Grouping people with similar perceptions may be beneficial for the design of more specific conservation programs targeted at different groups or societal concerns. Second, semi-structured interviews identified coexistence pathways highlighting the causal mechanisms driving people's willingness to coexist with bears. Our research showed that perceptions of coexistence were negatively influenced by negative attitudes, past negative interactions with bears, perceived risks of damage, and respondents' age, which is in line with previous studies (e.g. Naughton-Treves et al. 2003; Kaczensky et al. 2004; Carter et al. 2012). Nevertheless, other factors such as culture and management were also found to be important.

Our study showed that human-carnivore coexistence is possible, and we identified three major pathways consisting of different social drivers that influenced human-carnivore coexistence from the perspective of the rural population. These pathways serve as a framework for identifying the drivers that shape co-existence and how they interact. Identifying such drivers is essential in

shaping management approaches, but also to linking the drivers to broader theoretical and research areas that help to understand how these factors are shaped. Thus the concept of coexistence pathways and the research approach to elicit them offers a conceptual framework to assist in facilitating human-carnivore facilitation worldwide.

Factors mediating coexistence

The two landscape-mediated coexistence pathways showed that conservation management geared towards facilitating coexistence needs to address the beliefs shaping people's tolerance towards carnivores, and maintain or re-establish people's connections to carnivores and nature. Similar to other regions (Lescureux et al. 2011), direct interaction with bears and experiential knowledge acquisition was particularly important in shaping perceptions and beliefs about bears (e.g. behaviour, anteater vs. carnivore, population size).

The importance of direct interactions was further emphasized through reduced tolerance of people that experienced livestock predation, while positive direct interactions were distinctively higher among people with a positive perception of coexistence. Nevertheless, beliefs about bear-related conflicts and damage risk more strongly determined people's perception of coexistence than the actual negative experiences, which has also been observed elsewhere (Kaczensky et al. 2004; Carter et al. 2012). More importantly, a stronger impact of affective risk perceptions compared to cognitive risk perceptions can influence human behaviour and has been associated to motivations of tiger killing (Inskip et al. 2014). To fully comprehend human-carnivore coexistence therefore requires an understanding of the links between beliefs and risk perceptions.

The landscape-human coexistence pathway also showed that key social drivers for people's perceptions of human-bear coexistence were landscape-mediated attitudes and non-use values. These were constructed through the existence of genuine links between people and nature, where people valued their surrounding landscape and considered bears as part of their natural heritage. Thus, human-carnivore coexistence may be influenced by factors such as sense of place, and understanding which specific dimensions of sense of place affect human-carnivore coexistence could be an important domain for further research (Williams & Stewart 1998). Such values may be more important drivers of people's perceptions towards carnivores than damage risks (Lagendijk & Gusset 2008; Glikman et al. 2012; Dickman et al. 2014). Tolerance may have been further facilitated by low fear levels, most likely resulting from sharing the landscape with bears (Roskaft et al. 2003; Majić et al. 2011). Moreover, in intact social-ecological systems cultural tolerance to carnivores is not uncommon (Lagendijk & Gusset 2008) and can reduce carnivore extinction risk (Karanth et al. 2010). Such a genuine link to nature is perhaps facilitated by the continuous coexistence with large carnivores over long periods of time. Such long-term

coexistence most likely also influenced human behaviour to avoid conflict with bears and prevent livestock predation by using traditional livestock husbandry techniques. Thus, the continuous coexistence with large carnivores presumably shaped the emotional component of human culture to accept and adapt to human-bear coexistence (Glikman et al. 2012). While a history of continuous coexistence cannot be re-created in places where carnivores were once extirpated, a key conservation challenge for settings without a continuous history of human-carnivore coexistence is to (re-)connect people to nature and carnivores.

The management coexistence pathway underlined the perceived gaps in current management and showed that perceptions of (mis-)management could become a major obstacle to coexistence. Consistent with the varying responses to management in the questionnaire, strong negative opinions about current management did not necessarily lead to a negative perception of coexistence. Nevertheless, people's negative opinions on various aspects of current bear management and the feeling of being treated unfairly have the potential to erode the built-up tolerance towards carnivores through human-human conflicts. For example, a perception of inadequate governance can compel people to retaliatory killing (Treves et al. 2002), and poaching in Greece is partly motivated by a desire to defy the authorities (Bell et al. 2007). The approach of seeking coexistence pathways was particularly useful to detect where people perceived mitigation as necessary, which strategies were culturally accepted, and whether current efforts were satisfactory. For example, the beliefs and concerns around an increasing bear population and its control should receive high priority because increasing carnivore populations, rumours about "secret" carnivore introductions, and inequality over benefits and disadvantages, could reduce people's tolerance towards carnivores (Skogen et al. 2008).

Managing coexistence

To avoid such disagreements between management bodies and local stakeholders, management may facilitate coexistence through participation and education. Distrust and the feeling of disempowerment can be reduced by including people in carnivore management through participatory processes or active management (Treves et al. 2006), and conflicts could be reduced through a holistic set of mitigation strategies geared towards the needs of both humans and bears (Can et al. 2014). Although the interviewed respondents did not express the wish to be involved in bear management, several respondents to the questionnaires showed this aspiration. This potential for co-management of different local stakeholders may increase or maintain tolerance through shared responsibilities, accepted management and good relationships between local people and management bodies (Treves et al. 2006; Lagendijk & Gusset 2008).

Such participation or collaboration could also provide an education component or function. Under the landscape-mediated pathways, experience and education were mentioned as the most important sources to acquire knowledge about bears, and conservation could use these tools to address people's beliefs and concerns to facilitate coexistence. For example, by fostering positive interactions with bears, people may feel less threatened and their tolerance towards bears may increase (Majić et al. 2011). Education can help to foster tolerance towards large carnivores by targeting specific (local) beliefs (Zinn et al. 2008).

Finally, direct actions such as well-regulated and managed options for local people to react against certain "carnivorous" problem animals through lethal control could increase empowerment of people (Lescureux & Linnell 2010; Majić et al. 2011). Yet, non-lethal interventions are still more effective in reducing livestock predation rates (Bergstrom et al. 2014), and socially accepted methods like divisionary feeding need more attention. The anger around compensation payments may be harder to resolve when it is governed by perceived "weak" institutions (Ferraro & Kiss 2002). Although compensation payments or other financial benefits can aid conservation (Dickman et al. 2011), they often do not improve tolerance (Naughton-Treves et al. 2003; Hazzah et al. 2009) or are distributed unequally among society (Hemson et al. 2009). Therefore it could be worthwhile to explore other alternatives for social-ecological systems to manage human-carnivore conflicts such as bottom-up community organized payments like contributions to a local livestock insurance program (Mishra et al. 2003).

CONCLUSION

Facilitating human-carnivore coexistence is a conservation goal worldwide. By highlighting the existence of coexistence pathways, and then unpacking these pathways, it is possible to derive meaningful recommendations for approaches to manage coexistence. In our case study, the content of conservation programs should be designed to target these mechanisms in a way that meaningfully engages with people's coexistence perceptions, both in terms of content and how it is delivered. In particular, we advocate for a more collaborative, participatory approach to carnivore management in this area. The approach should foster people's connection to their landscape, provide education on bears and management approaches, and provide transparency around management.

More broadly, we believe that our approach of combining questionnaires for large scale patterns with the concept of coexistence pathways could be extended to regions worldwide. In particular, the inductive approach of generating an understanding of coexistence pathways could be used to understand human-carnivore coexistence for different regions and species. Whether the specific

pathways and their outcomes are transferable to other regions remains yet to be tested in future studies. However, by constructing co-existence pathways through inductive research, a broad range of factors that influence co-existence can be identified, and how these factors interact with each other can be understood. We therefore encourage scientists to use interdisciplinary research to obtain a comprehensive understanding of social drivers to human-carnivore coexistence, and thus to work towards holistic conservation efforts. Through the framework concept of coexistence pathways, and a comprehensive analysis of such pathways, landscape managers can identify factors that facilitate or hinder coexistence, and thus target interventions accordingly.

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11. Bear cubs leave the mother in their first year of their life a) yes b) no
12. Bears are protected animals in Romania a) yes b) no

The following questions will ask about how you achieve knowledge about bears

Please indicate the extent to which you disagree or agree with the following statements:

1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree

13. My parents told me how to live in a landscape with bears
- 1 2 3 4 5
14. At school we learned about bears and how to live with them
- 1 2 3 4 5
15. Local authorities provide information on how to live with
- 1 2 3 4 5
16. Local NGO's provide information on how to live with bears
- 1 2 3 4 5
17. What I know about bears, I learned from experience
- 1 2 3 4 5

The following questions will ask about bears in your culture

Please indicate the extent to which you disagree or agree with the following statements

18. Bears are important in our culture
- 1 2 3 4 5
19. Hunting bears is important in our culture
- 1 2 3 4 5
20. I grew up hearing stories about bears
- 1 2 3 4 5
21. In the stories I know, bears mainly have a positive character
- 1 2 3 4 5
22. It is important for our culture that bears persist in the landscape
- 1 2 3 4 5

The following questions are regarding your feelings towards bears in general

Please indicate the extent to which you disagree or agree with the following statements

23. I generally like bears

1 2 3 4 5

24. It is bad to have bears in Transylvania

1 2 3 4 5

25. Bears should remain part of our landscape in the future

1 2 3 4 5

26. I am afraid to meet a bear

1 2 3 4 5

27. Bears do not have the same rights as humans to exist in the landscape

1 2 3 4 5

The following questions are regarding the usefulness of bears in the landscape

Please indicate the extent to which you disagree or agree with the following statements

28. Bears have a negative impact on hunting opportunities

1 2 3 4 5

29. In areas where there are bears and sheep, bears kill a lot of sheep

1 2 3 4 5

30. Bears damage a lot of orchards and fields 1 2 3 4 5

31. Bears are dangerous to humans 1 2 3 4 5

32. Bears increase the value of a hunting area 1 2 3 4 5

33. Having bears increases tourism in the area 1 2 3 4 5

34. Bears keep the forest clean of dead and sick animals

1 2 3 4 5

35. Bears keep nature in balance 1 2 3 4 5

The following questions are regarding the management of bears

Please indicate the extent to which you disagree or agree with the following statements

36. Bears should be completely protected

-
- 1 2 3 4 5
37. Local authorities put in enough effort to prevent damage by bears
- 1 2 3 4 5
38. Hunting associations put in enough effort to prevent damage by bears
- 1 2 3 4 5
39. I would like to be involved in the management of bears in the
- 1 2 3 4 5
40. We receive compensation for damage by bears
- 1 2 3 4 5
41. Trophy hunting benefits the entire community
- 1 2 3 4 5
42. Hunting bears should be possible to everybody in the community
- 1 2 3 4 5

The following questions are about your opinion on how humans and bears share the landscape

43. In your opinion, how do bears and humans live together in this region
- a) Peacefully without conflicts
 - b) Relatively peacefully with tolerance for occasional conflicts
 - c) Relatively unpeacefully due to occasional conflicts
 - d) Unpeacefully due to escalating conflicts
44. In your opinion, how do you see the relationship between humans and bears in the future?
- a) Better
 - b) Worse
 - c) No change
45. Explain shortly your answer under question 44
-

46. Would you like to add any additional information about bears?

The following questions are with respect to you

- i. Gender : a) M b) F
- ii. Age: _____ years
- iii. Profession: _____
- iv. Ethnicity:
a) Romanian b) Hungarian c) Roma d)Saxon e) Other, namely: _____
- v. Where did you grow up:
a) this region b) a different region, but with bears present c) a different region without any bears present

Thank you very much for your participation!

APPENDIX S2.

The interview guide used for semi-structured interviews with 70 people (original in Romanian).

The following questions will ask about your experience with bears

The following questions will ask about your experience with bears

Please indicate how often:

1. You see a bear
 - a) never
 - b) rarely
 - c) several times a year
 - d) often
2. A bear damages your fields and/or orchards, and/or beehives
 - a) never
 - b) rarely
 - c) several times a year
 - d) often
 - e) not applicable (no fields/ orchards/ beehives)
3. A bear attacks your animals
 - a) never
 - b) rarely
 - c) several times a year
 - d) often
 - e) not applicable (no animals)
4. Which other animals cause problems in the village? Do you think these problems are worse than the problems caused by bears?

(Traditional ecological) knowledge on how to live with bears

Romania is a special country regarding bears because it has one of the largest populations in Europe. Furthermore, Transylvania is especially unique, because people and bears live alongside each other and share the same landscapes. This is very different from Western Europe. There are few bears in Western Europe, and in many places they have been hunted to extinction. However, at the moment in many places bears are returning to Western Europe. Therefore, we would like to know and learn more on how you manage to live together with bears in Transylvania.

5. How do you manage to live together with bears?
6. Where and how do you learn to share a landscape with bears?

Which factors could disturb human-bear relationships

The Transylvanian country side has changed rapidly over the last years. For example, tourism from foreign countries has increased and the architecture of the houses has changed. In your opinion, are there certain changes that have changed or might change the relationships between humans and bears?

7. Do you think the way people and bears live together now is different from the past?
8. Do you think people and bears can live together in this region in the future?
9. What do you think are the major factors that could change the way people currently live with bears?

Cultural values and attitudes towards bears

In some countries bears are important for their culture and there are stories and beliefs around bears. For example, Sleeping Bear Dunes, a huge sand dune in America, is named after a Native American legend. A female bear and her cub swam across a big lake (Lake Michigan). Exhausted from their journey, the bears rested on the shoreline and fell sound asleep. Over the years, the sand covered them up, creating a huge sand dune. Or for example, in Finland and Russia the bear is the national animal. In your opinion, does the bear play an important role in your culture?

10. Are bears an important part of your culture?
11. Can you remember any particular stories that include bears? Which one and what kind of character did the bear have?

Germany and Switzerland have had similar recent experiences with bears. In both countries one bear came back and lived in the country for a while. However, in both countries they decided to shoot the bear as it was classified as a problem bear and a threat to human safety. How do you feel about this approach?

12. What would you do in this case? What are your feelings in general towards bears?
13. Do you think it is important that bears persist in the Transylvanian landscape in the future?

Management of bears

Not everybody in a country, region or village is affected in the same way by sharing the landscape with bears. Do you think that there are any benefits or disadvantages of sharing the landscape with bears?

14. Are these benefits or disadvantages equally distributed between community members?
15. Do local authorities/hunting associations help to prevent damage caused by bears? Do they take care to close the difference in the distributions of benefits/disadvantages indicated in the previous question?

People living in countries that lack large carnivores such as bears are often very impressed by the presence of these animals. Therefore, many countries have developed tourism based on large carnivores. This includes guiding tourists around the landscape with the chance to see and photograph carnivores, or tourists pay for a license to hunt for carnivores and they can take home the fur and parts of the skeleton (trophy hunting). Are there any of these examples present in your village?

16. If yes, are they managed well and does the community benefit from this? Who benefits?
17. If no, do you see a future for tourism based on bears in this region?

The following questions are with respect to you

- i. Gender : a) M b) F
- ii. Age: _____ years
- iii. Profession: _____
- iv. Ethnicity:
a) Romanian b) Hungarian c) Roma d)Saxon e) Other, namely: _____
- v. Where did you grow up:
a) this region b) a different region, but with bears present c) a different region without any bears present

Thank you very much for your participation!

APPENDIX S3 – the four full ordinations from the Principal Component Analyses.

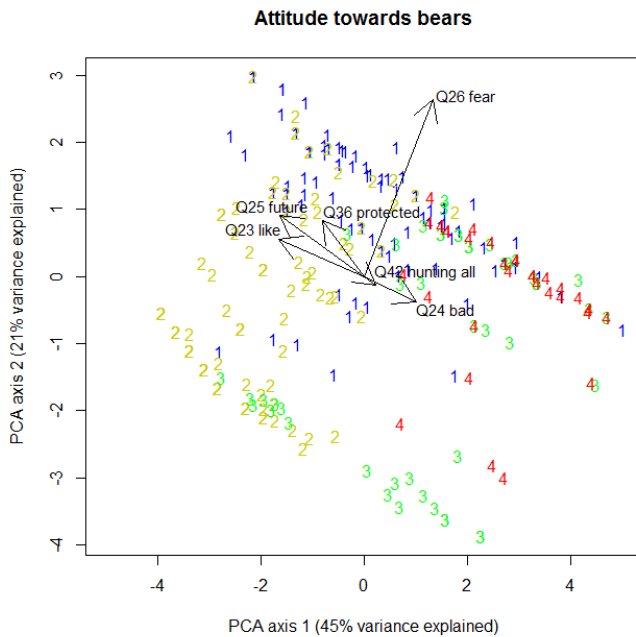


Fig. S1. Principal Component Analyses of all questions reflecting the participant’s attitudes towards bears. The numbers reflect the four different groups derived from the hierarchical agglomerative cluster analysis. The “QX” indicates the question from the questionnaire in Appendix S1. The PCA was based on the following six questions: 23-26, 36, 42.

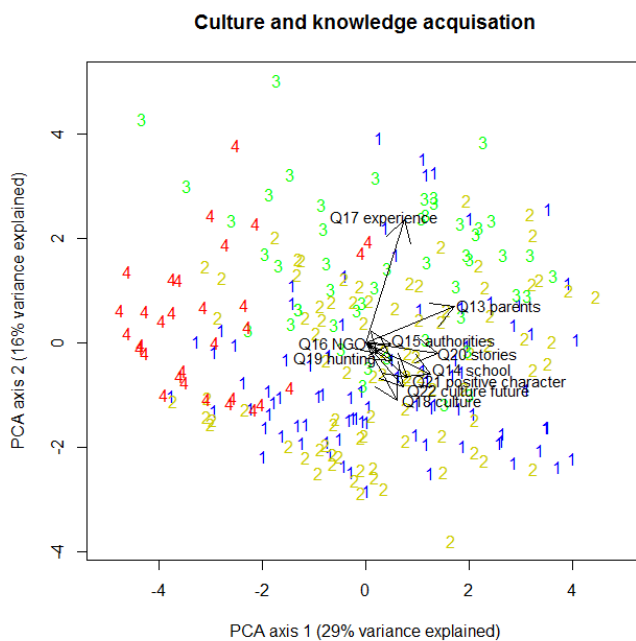


Fig. S2. Principal Components Analysis of all questions reflecting the participant’s perception of cultural values of bears and knowledge acquisition about bears. The numbers reflect the four different groups derived from the hierarchical agglomerative cluster analysis. The “QX” indicates the question from the questionnaire in Appendix S1. The PCA was based on the following ten questions: 13-22.

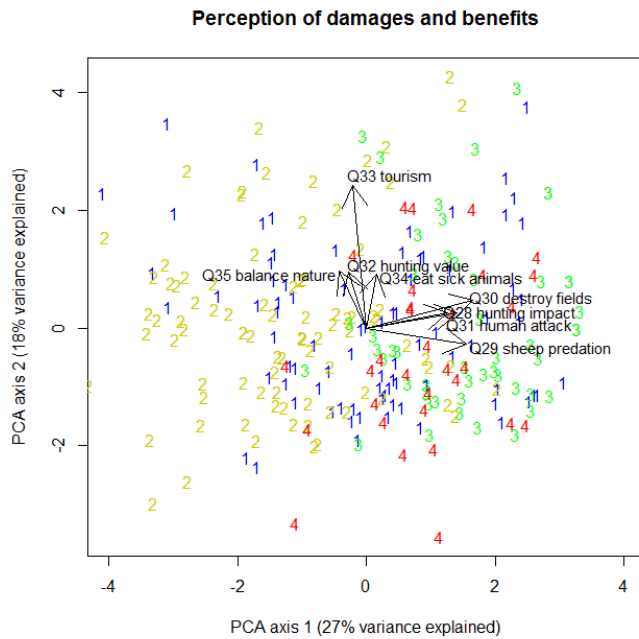


Fig. S3. Principal Components Analysis of all questions reflecting the participant’s perception of bear-related benefits and disadvantages. The numbers reflect the four different groups derived from the hierarchical agglomerative cluster analysis. The “QX” indicates the question from the questionnaire in Appendix S1. The PCA was based on the following eight questions: 28-35.

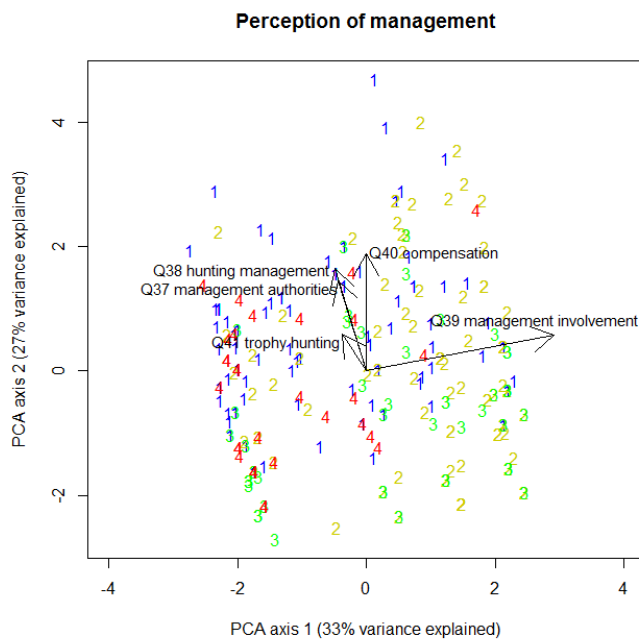


Fig. S4. Principal Components Analysis of all questions reflecting the participant’s perception of current bear management. The numbers reflect the four different groups derived from the hierarchical agglomerative cluster analysis. The “QX” indicates the question from the questionnaire in Appendix S1. The PCA was based on the following five questions: 37-41.

Appendix I

Integrating rural development and biodiversity conservation in Central Romania

Friederike Mikulcak, Jens Newig, Andra Ioana Milcu, Tibor Hartel and Joern Fischer

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SUMMARY

Unlike most parts of the European Union (EU), Southern Transylvania (Central Romania) is characterized by an exceptionally high level of farmland biodiversity. This results from traditional small-scale farming methods that have maintained extensive areas of high nature value farmland. Following the post-socialist transition, Southern Transylvania faces serious challenges such as under-employment and rural population decline, which put traditional farming at risk. With Romania's accession to the EU in 2007, Southern Transylvania became part of a complex multi-level governance system that in principle provides mechanisms to balance biodiversity conservation and rural development. To this end, the most important instruments are the 'Natura 2000' network of protected areas and EU rural development policy. Structured questionnaires and semi-structured interviews with town hall representatives from 30 villages in Southern Transylvania and local EU experts revealed that EU policies are often poorly aligned with local conditions. To date, the implementation of EU rural development policy is strongly focused on economic development, with biodiversity conservation being of little concern. Moreover, relevant EU funding opportunities are poorly communicated. Bridging organizations should be strengthened to foster the implementation of a rural development strategy that integrates local needs and biodiversity conservation.

Keywords: biodiversity governance, Common Agricultural Policy, farmland biodiversity, high nature value farming, multi-level governance, Romania, Transylvania

INTRODUCTION

With the accession of Romania and Bulgaria to the European Union (EU) in 2007, the proportion of agricultural land increased to over 45% of the total EU area (Henle *et al.* 2008). Contrary to the EU-15 member states, the agricultural sector in Romania is largely dominated by subsistence and semisubsistence farming (Davidova *et al.* 2012), resulting in part from a profound land restitution process after the collapse of communism in 1989 (Stringer *et al.* 2009; Vidican 2009). At the time of Romania's accession to the EU, more than 2.5 million people were employed in agriculture, with the average working farm area being only 3.2 ha (Gorton *et al.* 2009). Subsistence and semi-subsistence farming is characterized by low-intensity management practices, such as small-scale cultivation, extensive livestock grazing, and the maintenance of traditionally managed hay meadows and grasslands. In combination, these practices are closely associated with the notion of high nature value (HNV) farming, and provide a wide range of ecosystem services (Bignal & McCracken 1996; Paracchini *et al.* 2007). Notably, they have

maintained a rich farmland biodiversity (Clark 2006), much of which has severely declined in Western Europe as a result of agricultural intensification (Poschlod *et al.* 2005; Young *et al.* 2005). Given the high nature value of much of Romania's farmland, agricultural policy and biodiversity conservation are inextricably linked.

The EU has developed several co-existing governance frameworks that in principle serve to harmonize biodiversity conservation and rural or agricultural development (Paavola *et al.* 2009; European Commission 2011). Biodiversity conservation is primarily based on the Birds Directive (79/409/EEC, see URL http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm) and the Habitats Directive (European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora 92/43/EEC, see URL http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm), which together form the basis for the EU-wide 'Natura 2000' network of protected areas. The Habitats Directive, in particular, interacts horizontally with the Common Agricultural Policy (CAP) (see Paavola *et al.* 2009). The CAP accounts for approximately 42% of EU expenditure in 2007–2013 and makes up the largest constituent of EU funding, whereby direct payments to farmers (Pillar I) constitute the biggest share of CAP measures (Gorton *et al.* 2009). The introduction of the Rural Development Regulation as a 'second pillar' to the CAP in 2000 created a broader rural agenda aiming to support public good provision (Hubbard & Gorton 2011). Notably, some Rural Development measures have been established that specifically target the preservation of habitats and biodiversity, for instance Natura 2000 payments (Council Regulation (EC) No. 1698/2005, see URL http://europa.eu/legislation_summaries/agriculture/general_framework/160032_en.htm). These are specified in the individual National Rural Development Programs (NRDP) of each EU member state.

Despite substantial EU governance frameworks for both agriculture and biodiversity conservation, harmonizing rural development and conservation objectives provides serious challenges to new member states such as Romania (Beckmann & Dissing 2004). In many cases, the on-going dominance of (low-intensity) semi-subsistence farming, associated with high biodiversity, appears in direct contradiction to the desire for economic development. Navigating this challenge is further complicated by the fact that new member states are confronted with a series of profound institutional changes and an unprecedented social, environmental and economic transition (Beckmann & Dissing 2004; Pavlínek & Pickles 2004; Bromley 2007). Central and Eastern European (CEE) countries were subject to institutional breakdown after 1989, followed by a post-socialist market liberalization and democratization phase, and finally

the renewed restructuring, as well as decentralization, of institutions to meet the Copenhagen criteria for EU accession (Grabbe 2001; Carmin & Vandevveer 2004).

Prior to their integration into the EU, CEE countries could be considered ‘single polities’ (Schmidt 2006), characterized by a majoritarian system of representation (Bache 2010) and weak collaborative relations between state and civil society (Buzogány 2009; Börzel & Buzogány 2010). With their accession to the EU, CEE countries became part of a complex multi-level governance (MLG) system. MLG has caused a series of changes in domestic politics, leading to increasingly complex vertical relations between actors organized at various territorial levels, and growing horizontal relations between actors from public, private and voluntary spheres (Bache 2010). Unlike in the past, a wide range of new actors now influence how policy and legislation is implemented on the ground (Fairbrass & Jordan 2001; Grabbe 2001; Newig & Fritsch 2009; Börzel & Buzogány 2010). These actors include not only supranational institutions, lobby groups and non-government organizations (NGOs), but also governments at different jurisdictional levels, such as the counties and communes.

Interactions between multiple levels of governance are critically important in the successful implementation of EU policies. Jordan (1999) commented that even the most well-intentioned policies at the EU level risk becoming a ‘paper exercise’ if they are not properly implemented at the local scale. Particularly for EU nature conservation policy and rural development measures, strong support by local stakeholders is required, including communities and town halls (Beckmann & Dissing 2004). Previous studies suggest that several problems stemming from new MLG arrangements have not been adequately resolved to date. Focusing on conservation policy in Romania, Buzogány (2009) found that weak coordination within the state administration and inter-institutional conflicts hampered the designation of Natura 2000 sites. Although the implementation of the Natura 2000 network enhanced the professionalization and institutionalization of civil society groups and particularly environmental NGOs, the overall ‘weakness’ of state and non-state actors impeded the advancement of cooperative, sustainable state-society relations (Börzel & Buzogány 2010). A study by Wegener et al. (2011) on administering the CAP in Romania and Bulgaria reached similar conclusions. In both countries, overcentralized decision-making processes and limited coordination among agricultural agencies hampered the adequate delivery of crucial services needed for the proper implementation of the CAP.

To date, there has been little focus on the role of local level governance within studies of MLG frameworks for integrated biodiversity conservation and rural development in Central and Eastern Europe. In this paper, we analyse the implementation of EU rural development policy within Romania at the local level, highlighting perceptions and expectations of local actors in

relation to EU policy. We focus on Southern Transylvania (Central Romania). This area is interesting because it is characterized by particularly high farmland biodiversity, and like the rest of Romania, has undergone profound institutional changes since 1989. In addition, the area is experiencing major demographic changes, owing to the emigration of many inhabitants and the low profitability of traditional farming methods (Fischer et al. 2012). We asked: (1) How is EU rural development policy being perceived by community leaders and local experts? (2) Is EU rural development policy likely to support sustainable rural development, especially with respect to the intricate link between traditional farming practices and biodiversity? (3) What should the priorities be for the improvement of EU rural development policy (with respect to both content and implementation)?

METHODS

Selection of study villages

We focused on an area within a 50-km radius around the town of Sighișoara, which encompasses more than 300 villages and four counties, namely Brașov, Harghita, Mureș and Sibiu (Fig. 1). Our primary interest was to compare locations within the Natura 2000 network with locations outside, while covering a wide range of biophysical conditions in both cases. We selected 30 villages using random stratified sampling: ten were located in areas with complex (rough) terrain, ten were located in areas with gentle slopes, and ten were located in areas with intermediate topographic complexity. Within each terrain class, we randomly selected villages whose surrounding land included Natura 2000 Sites of Community Importance (SCIs) as defined by the EU Habitats Directive, villages whose surrounding land included Special Protection Areas (SPAs) as defined by the EU Birds Directive, and villages whose surrounding land was without protection status.

Structured questionnaires

Because town halls, and especially mayors, are critically important local actors in our study area, and are officially in charge of implementing and enforcing EU legislation at the level of the commune (with each commune comprising several villages; Ministry of Agriculture and Rural Development [MADR] 2008), we conducted interviews with representatives of all 27 town halls in charge of our 30 focal villages (some administered more than one focal village) in November 2011. In 12 cases, the mayors were not personally available but nominated an appropriate representative (deputy mayor, communal or agricultural assistant). In three communes we interviewed two different town hall staff, resulting in a total of 30 interviews.

To obtain an overview of inherent development problems and opportunities or impediments in relation to EU rural development policy, we prepared a structured questionnaire with 12 statements (Fig. 2) that covered three topics: (1) the role of EU accession for Romania in general and in particular for the respective commune and local farmers; (2) the role of EU rural development funding measures for sustainable rural development, including potential challenges; and (3) the impact of the Natura 2000 status on biodiversity conservation and sustainable rural development. We posed single statements that could be answered on a five-point Likert scale.

To test whether perceptions differed between villages, we arranged data in a contingency table, differentiating between villages whose land was completely within a Natura 2000 site versus other villages. We tested for the independence of association between agreement type and protection status using Fisher's exact tests in the software R. As we did not find any significant dependencies, we pooled answers across all villages. Results are therefore presented in descriptive terms, showing how many town hall representatives agreed to different extents with a given statement in the questionnaire.

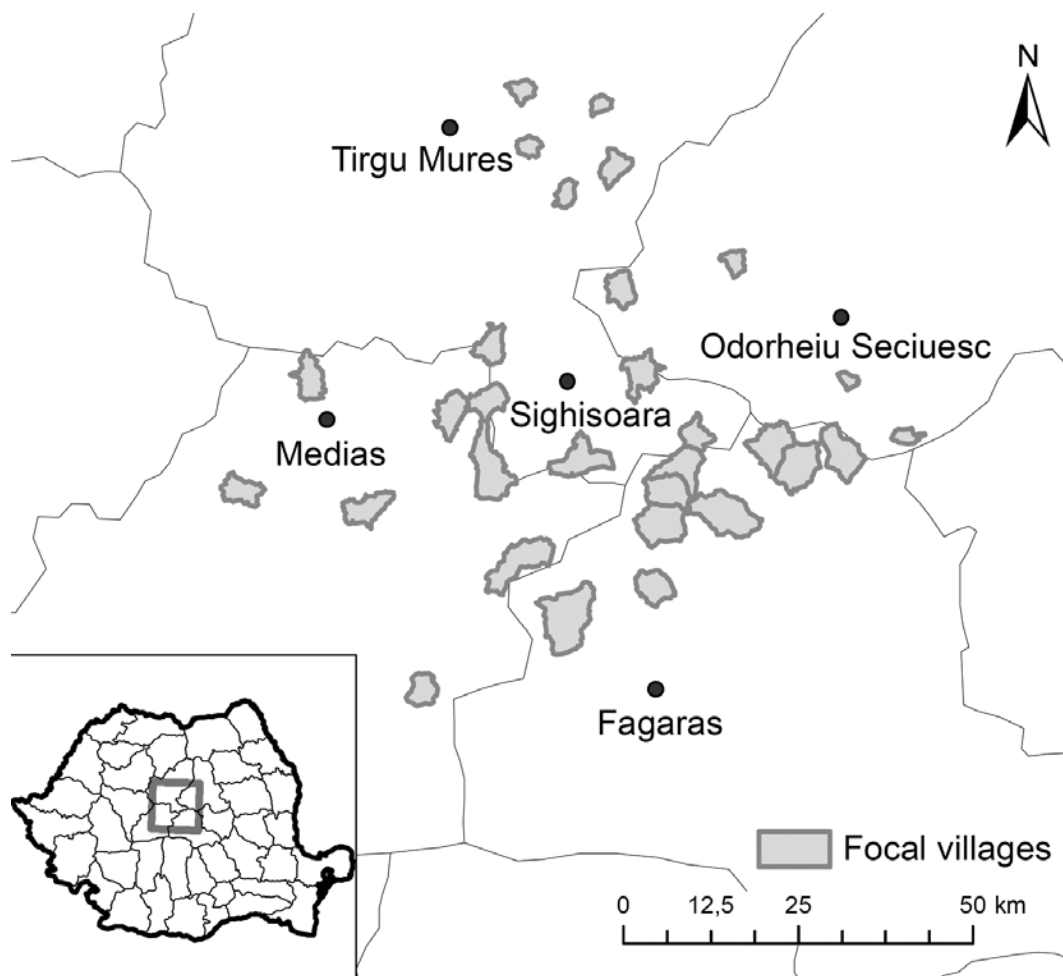


Fig. 1. Study area indicating the locations of the 30 focal villages. The inset shows the location of the study area within Romania.

Semi-structured interviews

To capture important nuances concerning how locals perceived EU rural development policy, the distribution of structured questionnaires was accompanied by semistructured interviews. These were structured around the same three topics outlined above, and sought to elucidate further detail on the answers provided to the structured questionnaire (Appendix 1, see supplementary material). Town hall representatives were free to discuss matters at depth, and were allowed to raise additional issues not covered in the questionnaire.

To obtain information on the local perception of EU policy from a different governance perspective, we also interviewed four individuals in charge of CAP funds (hereafter referred to as CAP experts) at the level of Mureş county; and three representatives of local NGOs specifically interested in biodiversity conservation and sustainable rural development (referred to as NGO representatives). Interviews with both CAP experts and NGO representatives followed the structure of the questionnaires, but questionnaires were not completed by these individuals.

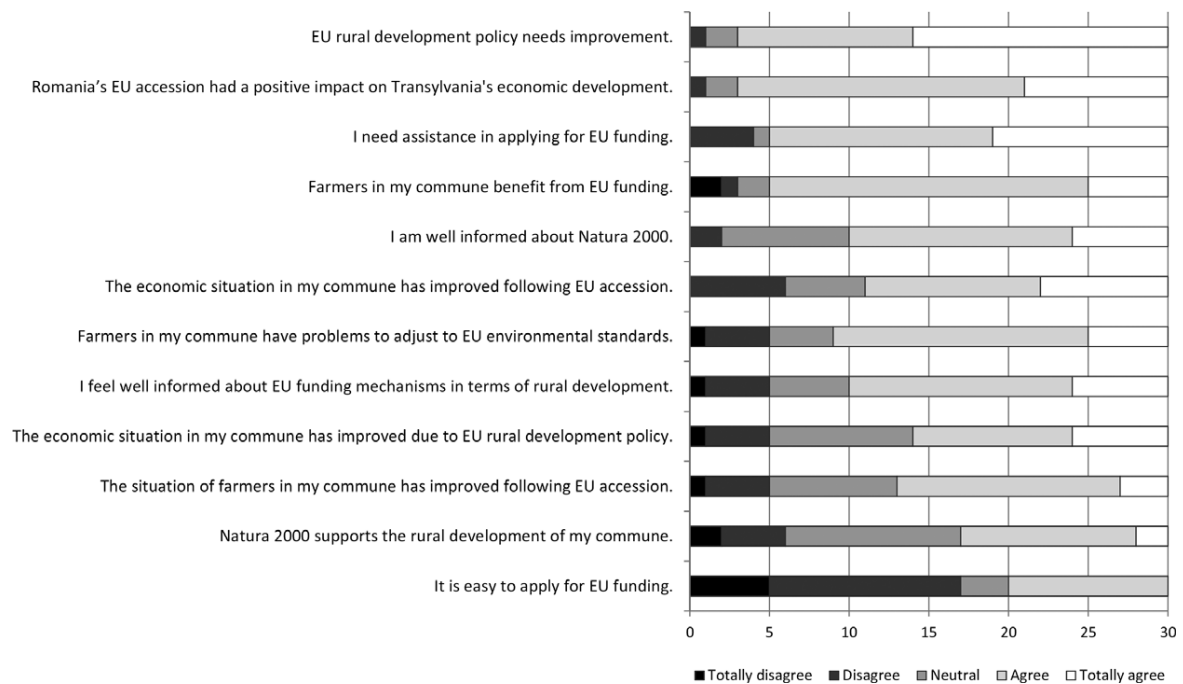


Fig. 2. Perception of EU rural development policy, as provided by 30 local mayors or their representatives in Southern Transylvania.

In combining structured questionnaires and semistructured interviews, we obtained a rich narrative about problems in our study area and a solid overview of local perceptions on EU rural development policy at both individual and village level. We did not record the interviews because we deemed this culturally inappropriate, but instead took notes which were transcribed. Approximately half of the interviews were conducted with the help of translators. The quotes

given by us therefore correspond to the translation of our intermediaries, and do not reflect the exact wording of the respective interviewee. When analyzing the interviews by means of word processing and spreadsheet software, salient topics emerged that were raised independently by different interviewees. These topics were grouped into categories or ‘themes’ (Ryan & Bernard 2003).

RESULTS

Structured questionnaires

Twenty-five interviewees (83%) were older than 40 years, and 26 (87%) were male. Twenty-seven respondents (90%) agreed or totally agreed that EU accession had a positive impact on regional economic development. Agreement was substantially lower, however, when interviewees were asked about economic benefits at the commune level (Fig. 2).

Two-thirds of respondents felt well informed about EU rural development funding opportunities. However, 57% thought it was difficult to apply for funding, and 83% admitted to requiring assistance with funding applications. Regarding the relationship between EU accession and farming, 57% felt the situation of local farmers had improved since 2007. Although the vast majority of respondents (83%) saw farmers as benefiting from EU funding, most (70%) also perceived that farmers had difficulties in adjusting to EU environmental standards.

Two-thirds of respondents felt well informed about Natura 2000, but 57% disagreed with or were neutral about the statement that Natura 2000 supported the development of their commune. Twenty-seven respondents (90%) agreed or totally agreed that EU rural development policy needed improvement.

Semi-structured interviews

Interviewees were asked about the effects of EU accession: (1) with respect to effects on the commune in general, (2) specifically with respect to EU funding, and (3) with respect to any possible effects of the newly established Natura 2000 site. Salient themes in the responses related to the changing role of agriculture, CAP support for small-scale farming, access to information, social and economic problems, village-based rural development measures, and compromises between rural development and nature conservation.

The changing role of agriculture

Town hall representatives explained that agriculture played a key role in most communes. With the exception of few big farmers (*fermieri*), most communes were dominated by subsistence or

semi-subsistence farmers (*agricultori*), who use little machinery or agrochemicals. Small-scale farmers typically sell low quantities of milk products, honey, meat or wool. However, agriculture was changing in many ways. For economic reasons, cows increasingly were being replaced by sheep, whose grazing behavior contributes to vegetation degradation (NGO representative 3). ‘Informal institutions are [also] rapidly changing: Shepherds move away and no longer fulfill their traditional role’ (NGO representative 1); and ‘many [farmers] don’t make cheese in a traditional way anymore’ (NGO representative 2). With an ageing rural population it appears that ‘the Romanian tradition of subsistence agriculture will disappear in favor of farmers who practice agriculture for profit’ (mayor 1, Mureş county). In fact, this transition may be actively ‘enhanced by current EU payment schemes’ (mayor 6, Braşov county).

CAP support for small-scale farming

Many small-scale farmers were not eligible for rural development funding because most measures require a minimum parcel size of 0.3 ha and a cumulative total field size of 1 ha (vice mayor 1, Sibiu county; CAP expert 3). Mayors stated that most farmers who were eligible were applying for direct payments under CAP pillar 1 and agri-environmental payments under CAP pillar 2. According to NGO representative 1 and CAP experts 1, 3 and 4, farmers of the region were further applying for support measures for semi-subsistence farming (measure 141) and for young farmers (measure 112), as specified in the Rural Development Regulation (MADR 2008).

Increasingly, small-scale farmers signed leasing contracts to formally join fields for funding applications (mayors 5 and 7, Braşov county). However, such joint applications were sometimes abused by the lead applicant who might not share the received funding equally (communal assistant 5, Mureş county). In a few communes, there were Local Action Groups created under the EU rural development programme ‘LEADER’ (Council Regulation (EC) 1698/2005); however in many communes farmers were hesitant to apply for funding applications due to mistrust or a lack of knowledge about the benefits with respect to CAP measures. According to some town hall representatives, farmers often claimed to work more land than they actually did, because official authorities were unable to validate such claims. This problem was also mentioned by the CAP experts 1 and 3.

According to the interviewed CAP experts, small-scale farmers are ‘not real farmers’ (CAP experts 2, 3 and 4) because they are ‘not economically viable’ (CAP expert 4) and ‘a barrier to regional development’ (CAP expert 1). CAP expert 1 further explained that the small size of most parcels in the study region led to massive bureaucratic effort to monitor compliance with CAP funding requirements: ‘Bureaucracy simply eats up more money than all these micro-farmers receive in the end’.

Access to information

Many interviewees felt there was an information deficit regarding EU policy and funding. Although the CAP payment agencies for agriculture (Payment and Intervention Agency for Agriculture [APIA]) or rural development (Payment Agency for Rural Development and Fisheries [APDRP]) held workshops in all communes about funding opportunities, participation was typically low (mayor 12, Sibiu county). ‘People are simply not interested in politics’ (CAP expert 4). Moreover, the ‘smart farmers’ who knew about leasing contracts and other means to access funding often received their information ‘via informal networks’, while ‘the ordinary farmer usually has no access to information about EU funding’ (communal assistant 5, Mureş county).

For farmers with low levels of education, it was virtually impossible to consult the CAP funding guide (*ghidul solicitantului*), which was distributed by CAP agencies to town halls (NGO representative 1). Some NGOs assisted in the distribution of funding information to mayors and farmers, and thus acted as intermediaries: ‘But sometimes the information is misleading, so we prefer to hand out information ourselves’ (CAP expert 4). Even when people knew about application procedures, they often faced difficulties in gathering all requested documentation, for example, because of unclear land ownership rights (communal assistant 5 and mayor 9, both Mureş county). Moreover, many farmers were reluctant to enroll in the officially required ‘Farm Register’ because they feared additional taxes and the involvement of the State (CAP expert 3; NGO representative 1).

Another problem was that farmers needed to make a business plan prior to their application: ‘Yet, most of them don’t know how to do this’ (CAP expert 3). Mayors themselves had difficulties with EU funding policy. For example, mayor 1 (Mureş county) stated that the benefits of EU funding had not been properly communicated to the town halls. Another mayor (mayor 2, Sibiu county) explained that farmers would be at a loss about how to manage their land if EU funding ceased. According to CAP expert 4, mayors themselves were part of the problem through their lack of leadership: ‘If a mayor does not proactively promote EU funding, of course no farmer will know how to benefit from EU accession.’

Social and economic problems

According to local administrators, most villages were suffering from poverty, insufficient off-farm employment opportunities, poor education and poor development perspectives. Moreover, many villages experience social tensions and the emigration of young and skilled people. Land abandonment was reported as a common consequence, which is a major challenge to regional farmland biodiversity (NGO representative 1). Many town hall representatives complained about

poor infrastructure, a lack or low quality of drinking water, and rising tensions between ethnic groups. Regarding rural development opportunities beyond farming, mayor 3 from Mureş county said: ‘How can we develop tourism if we don’t even have running water?’

Village-based rural development policy

With the exception of CAP payments to individual farmers, many mayors complained about inadequate funding for rural development at the village level. Several town hall representatives explained their funding applications had been rejected. Mayor 1 (Mureş county) stated that ‘the Romanian Government isn’t able to get hold of [sufficient] EU funds through the present mechanisms. I sincerely hope that this will change in the next funding period’. Several town hall representatives explained that to be eligible for renewal projects, communes needed a development strategy. Developing such a strategy typically required the use of a consulting agency, which many communes could not afford (communal assistant 1, Sibiu county; mayor 1, Mureş county).

Some mayors hoped for foreign investment and actively promoted their commune because ‘agriculture serves to nourish people but doesn’t provide any income. Hence, it’s not a viable long-term development strategy for our commune’ (agricultural assistant 2, Sibiu county). Several interviewees stated that they would need to make better use of the communes’ natural and cultural values. The sale of certified organic products or increasing tourism were seen as the most promising options.

Development versus conservation

Several town hall representatives considered the recently acquired Natura 2000 status a barrier to rural development. They deemed the need to implement environmental impact assessments before applying for development projects an undue administrative burden, with many proposals being rejected (mayor 6, Braşov county; mayor 10, Sibiu county). Notably, not all mayors were in agreement on this issue. Mayor 17 (Mureş county) argued that ‘people tend to see the restrictions rather than the benefits derived from having Natura 2000 status. Natura 2000 can be important if it’s used properly. Our region doesn’t have many development alternatives. So the designation should be better linked to its positive aspects’. NGO representative 1 stated that payments for Natura 2000 were obligatory according to EU law, but could not be distributed until management plans were in place. Several NGOs were developing such plans for Romania, which will be ready for implementation in 2014. Moreover, unlike other EU members, the Romanian government had not opted for integrating compensatory Natura 2000 payments into its Rural Development Programme (NGO representative 1).

Overall, the interviews with CAP experts suggest a tendency of the country's government to prefer economic development over farmland biodiversity. CAP expert 4 stated that 'in unnecessarily supporting these small scale farmers Romania will never catch up with the West and lose any kind of competition'. CAP expert 1 reasoned that 'the problem with smallholder farmers will be solved by itself: as soon as they die out, Romania can finally modernize'. NGO representative 1, by contrast, argued that small-scale farmers were 'not the conservation problem'. The EU did not understand that Romania was so rich in biodiversity because of traditional land uses: 'To keep this biodiversity, there is no point in supporting only large-scale farms' (NGO representative 1). According to NGO representative 2, the biggest problem was ignorance. Owing to EU subsidies, people turned into 'fake farmers: They build houses they don't need, get susceptible to bribery, and burn their fields to pretend working their land for EU funding. They don't care about nature preservation anymore. Socialism killed all values and ties to nature'. Consequently, the mentality of both farmers and government officials may need to change: Whereas small-scale farmers need to develop 'a more economic way of thinking' and 'innovative capacity' which they have lost 'during socialism', Romania's 'political elite' should 'come to its senses and start working towards the whole country's benefits' (CAP expert 4).

DISCUSSION

Accession to the EU has provided both threats and opportunities for farmland biodiversity conservation in Southern Transylvania. According to mayors and local experts, the implementation of EU rural development policy is heavily biased towards economic development, with relatively little explicit acknowledgement of the interdependencies between economic, social and environmental development. How EU rural development policy and its implementation on the local level develop in the future will, to a large extent, shape the type, scale and intensity of farming, and consequently the trajectory of the region's farmland biodiversity. Agricultural intensification appears likely at the moment because it is widely seen as desirable by government officials. The environmental consequences of intensification would undoubtedly be negative, as highlighted by experiences in much of Western Europe (Donald *et al.* 2001). Although a large part of our study area is located within a Natura 2000 site, the status as a 'protected area' is very unlikely to effectively safeguard biodiversity; there were no apparent differences between the perceptions of mayors within and outside the Natura 2000 site regarding EU policy, or regarding their preferences for economic development. Based on our analysis, priorities for the improvement of EU rural development policy should focus on the following five areas.

EU policy needs adjustment to better fit local conditions

Our findings underlined that most villages are dominated by semi-subsistence farming, which often contributes substantially to rural livelihoods (Davidova *et al.* 2012). Because of poor income alternatives and weak infrastructure, villagers of Southern Transylvania should be able to expect substantial support through EU rural development funding. However, existing funding schemes are poorly suited to local conditions. The small scale of arable parcels and the necessity to develop business plans make funding essentially unattainable for many villagers (Gorton *et al.* 2009; Redman 2010). This ‘misfit’ between EU funding measures and rural realities becomes apparent when looking at the expenditures of the Romanian Rural Development Programme (RDP) during 2007–2010 (ENRD [European Network for Rural Development] 2011): measure 141 (semi-subsistence farming support) used less than 5% of its programmed expenditure, whereas measure 121 (modernization of agricultural holdings) used 33%. These figures show that neither EU measure was fully implemented and at the same time support our findings that government officials prioritize economic development over sustainability concerns (compare Beckmann & Dissing 2004). Bache (2010) suggested the ‘misfit’ between EU requirements and domestic institutional structures can create pressure for domestic governance to adapt to EU policy, implying that domestic change is desirable whereas EU policy must be taken as given. In contrast, our case study indicates that, particularly in poor settings, greater flexibility is needed at the EU level to account for local conditions. Consequently, local governments and capacities need to be strengthened to better represent local needs at the national and EU levels (Young 2002; Galaz *et al.* 2008).

EU rural development policy needs to be more clearly communicated

Our findings suggest that available funding measures are often poorly communicated to those who could benefit from them, including both small-scale farmers and mayors. Indeed, the main obstacle to successful rural development may not be a lack of well-intended policies, but their inadequate implementation (Jordan 1999; van der Ploeg & Renting 2000). Communication failure can occur at multiple levels (national, county and local), involve multiple actors (Ministry of Agriculture, its county Directorates, payment agencies or councils), and can even occur between different agencies at the same level (Dobre 2010; Wegener *et al.* 2011). Local mayors are therefore highly dependent on functioning links between many actors, especially at higher levels. Even if mayors are well informed, information flows within communes can be poor because of a historically grounded lack of trust (Beckmann & Dissing 2004; Fischer *et al.* 2012) and unequal access to informal networks. The poor information exchange within our study area reveals a deficient multi-level governance system. Despite well recognized information deficits,

CAP experts were reluctant to involve non-state actors in the dissemination of information, which may indicate a prevailing top-down mind-set and scepticism towards public participation (Buzogány 2009; Börzel & Buzogány 2010). To improve information flows, the midterm evaluation of the National Programme for Rural Development (MADR 2011) recommended better targeting advisory and consultancy services at small-scale farmers, and improving direct communication to raise awareness about available CAP measures (see Wegener *et al.* 2011).

Cooperation among stakeholders needs to increase

Many EU rural development measures target only relatively large arable plots, groups of producers, or Local Action Groups within the LEADER axis of the EU Rural Development Regulation (Council Regulation (EC) No. 1698/2005). Our findings suggest that unless small-scale farmers find ways to cooperate and associate, they will emerge as losers from their integration into the EU. However, at present, many communities are characterized by mistrust, a lack of participation and scepticism towards the government (T. Hartel, unpublished interviews with villagers, 2011). Many communities suffer from tensions, including ethnic conflicts, demographic change, economic fragmentation and perceived inequalities in land restitution following the collapse of communism (Fischer *et al.* 2012). To facilitate cooperation, a greater level of participation will be necessary, which will need to be based on rules and norms that are acceptable to all stakeholders involved (Fazey *et al.* 2010; Rustagi *et al.* 2010).

Bridging organizations need to be strengthened

‘Bridging’ organizations can play a crucial role in encouraging farmer associations and fostering a vertical information flow between funding agencies, local governments and villagers, including subsistence farmers who play a critical role in maintaining regional biodiversity. Initially introduced by Cash and Moser (2000) as boarding organizations designed to mediate the linkages between researchers and decision makers, the term bridging organization now typically encompasses any organization that bridges local actors and communities with other organizational levels (Olsson *et al.* 2007). Bridging organizations provide valuable links between actors with various interests and worldviews (Olsson *et al.* 2007; Berkes 2009; Börzel & Buzogány 2010). Bridging organizations thus provide an arena for building social capital through fostering trust, learning, vertical and horizontal collaboration, and conflict resolution (Folke *et al.* 2005). Although there is no designated bridging organization in our study area, some NGOs fulfil this role in practice. For example, the ADEPT foundation organizes workshops on CAP measures for farmers (Akeroyd & Page 2011) and engages in lobbying at county, national and EU levels. Similarly, the Mihai Eminescu Trust has helped to promote community cohesion by setting up communal centres and conducting vocational training in some

villages. Given the potential value of bridging organizations, these should be further strengthened in the future.

Rural development goals cannot be pursued in isolation from social and ecological goals

Compared to most of the EU, Southern Transylvania is relatively poor in monetary terms, which explains the strong interest in economic development voiced by interviewed mayors and CAP experts. However, greater recognition is needed that economic development can be achieved in many ways, with intensification of farming being just one option. Within the agricultural sector, an alternative would be to focus on developing certified organic agriculture. This is known to be less harmful to biodiversity than conventional agriculture (Bengtsson *et al.* 2005; Hole *et al.* 2005), would be much more compatible with high nature value farmland (Kuemmerle *et al.* 2009) and would not cause difficulties with respect to Natura 2000 regulations. In addition, Southern Transylvania most likely still exhibits unused potential to develop rural enterprises of greater value, such as agro environmental tourism or specialty foods (Davidova *et al.* 2012). To realize this potential, local innovation capacity needs to be fostered. This, in turn, will require a more holistic approach to rural development policy at the national and EU levels, which more explicitly recognizes the multiple functions of agriculture (Beckmann & Dissing 2004; Clark 2006; Hubbard & Gorton 2011). Such a shift in mind-set could also positively contribute towards the re-coupling of people and nature in Southern Transylvania, which could have major benefits for biodiversity conservation (Fischer *et al.* 2012).

CONCLUSIONS

Accession to the EU has exposed the villages of Southern Transylvania to a complex system of multi-level governance which, as our study indicates, provides both challenges and opportunities. Notably, the new governance system was superimposed onto a political culture characterized by a history of central control, state-led decision making, weak public participation and suppression of non-state actors. Regarding EU rural development policy, we found that current EU requirements are poorly aligned with many existing rural realities. Among these are land-use patterns characterized by very small agricultural plots that are not eligible for most measures, and a culture of mistrust and political disinterest that prevents the development of associations necessary to access EU funding. A comprehensive approach to rural development is needed to tackle the existing implementation deficit of EU policy, while at the same time supporting the ecological and social infrastructure of the study area. At the EU level, future policies may need to be more flexibly designed to account for the particular challenges of semi-subsistence areas such as Southern Transylvania. At the national and county levels, administrative capacities and information flows need to be improved to foster the cooperation

and knowledge transfer between CAP funding agencies and local communes. Finally, within communes, community cohesion needs to improve. Active bridging organizations are likely to play a key role in assisting the harmonization of local needs and EU policy. A key concern is that biodiversity is not forgotten in the process. Existing incentives provided by rural development policy will favor agricultural intensification, despite its likely ecological costs. Under a scenario of only minor changes to the CAP and its implementation post 2013, the EU is thus well on the way to (once again) miss its goal of halting farmland biodiversity decline.

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SUPPLEMENTARY MATERIAL FOR APPENDIX I

Questionnaire provided to town hall personnel

The questionnaire was developed by Friederike Mikulcak and distributed to 30 town hall representatives of Southern Transylvania, Romania, in November 2011. The original questionnaire was in Romanian.

Opinion poll on EU nature conservation and rural development policy

Date:

Location:

1. General Information

1.1 Sex M F

1.2 Age 20-30 31-40 41-50 51-60 >60

1.3 Position _____

2. Impact of EU Accession

	Totally disagree	Disagree	Neutral	Agree	Totally agree
2.1 Romania's accession to the EU had a positive impact on the economic development of Transylvania.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2 The economic situation in my commune has improved following EU accession.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.3 The economic situation in my commune has improved due to EU rural development policy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. EU Funding

	Totally disagree	Disagree	Neutral	Agree	Totally agree
3.1 It is easy to apply for EU funding.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2 I feel well informed about EU funding mechanisms in terms of rural development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3 I need assistance in applying for EU funding.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.4 Farmers in my commune benefit from EU funding.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. EU nature conservation policy and rural development

	Totally disagree	Disagree	Neutral	Agree	Totally agree
4.1 The situation of farmers in my commune has improved following EU accession.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2 Farmers in my commune have problems to adjust to EU environmental standards.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.3 I am well informed about Natura 2000.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4 Natura 2000 supports the rural development of my commune.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.5 EU rural development policy needs Improvement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix II

The importance of ecosystem services for rural inhabitants in a changing cultural landscape in Romania

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Ioan Fazey

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ABSTRACT

Many traditional cultural landscapes evolved as coupled social-ecological systems. It is important to understand how such systems navigate novel challenges posed by globalization. To address this issue, we bring together two components of a pilot study carried out in a cultural landscape from Central Romania. The region was affected by major social and economic perturbations in the past century, affecting ethnic composition, community cohesion, land property regimes, and the management of common resources. The first component of our study investigated how rural inhabitants appreciated ecosystem services through questionnaires with 98 people in 30 villages. The second component aimed to assess the perception of people about ongoing changes in their communities through semistructured interviews with 50 people in 5 villages. Rural inhabitants particularly valued provisioning ecosystem services such as firewood, water, and crops, but also healthy soils. Rural communities were characterized by a number of social and economic issues, especially individualism, lack of trust, corruption, and poverty. People from communities with many initiatives, e.g., NGOs, associations, and active individuals, were more optimistic regarding the future of their communities than people from villages with few or no initiatives. A major challenge for cultural landscapes such as those in Central Romania is to find new, meaningful ways to keep the social and ecological systems connected. Otherwise there is a risk that (short-term) socioeconomic interests may impair the provisioning of important ecosystem services.

Key Words: change; cultural landscape; Eastern Europe; globalization; rural communities

INTRODUCTION

Traditional cultural landscapes occur worldwide including in Japan (Takeuchi 2010), India (Ranganathan et al. 2008), China (Liu et al. 2013), and Europe (Solymosi 2011, Molnár 2012, Oteros-Rozas et al. 2013). A special feature of these landscapes is that they evolved as, and often still are, tightly coupled social ecological systems, i.e., rural communities and local ecosystems that are strongly interdependent (Bugalho et al. 2011, Fischer et al. 2012). Tight links between the human and natural systems typically developed over centuries and created a cultural and ecological setting that can be cumulatively termed a ‘cultural landscape’ (Plieninger and Bieling 2012). Rural societies in traditional cultural landscapes are characterized by a well developed system of ecological knowledge to assess the quality of the goods and services provided by ecosystems and to sustainably manage natural systems (Whiteman and Cooper 2000, Molnár 2012, Oteros-Rozas et al. 2013). Moreover, many traditional rural societies developed a series of individual and collective rules, norms, and behaviors that ensured critical resources were shared by all members of the community (Fischer et al. 2012, Sutcliffe et al. 2013). In many traditional

cultural landscapes, sustainable management of natural resources resulted in landscapes with high aesthetic, ecological, and cultural values (Plieninger and Bieling 2012). Many ecosystem components of cultural landscapes directly depend on human use, including internationally protected species, habitats (Halada et al. 2011, Wilson et al. 2012), or specific landscape elements, e.g., wood pastures (Plieninger and Schaar 2008) and drove roads (Oteros- Rozas et al. 2013).

Many traditional cultural landscapes in Europe are rapidly changing. Changes are occurring in social, ethnic, cultural, institutional, and economic spheres (Bell et al. 2009, Plieninger and Bieling 2012, Sutcliffe et al. 2013). These changes in turn can lead to landscape changes such as land-use intensification or land abandonment (see Plieninger and Bieling 2012 for an overview). Moreover, they affect the nature of the relationship between people and the environment (Fischer et al. 2012). Many valuable cultural and ecological elements and ecosystem services may be lost because of these changes (Fischer et al. 2012, Plieninger and Bieling 2012).

Given ongoing change, there is an urgent need to understand how traditional social-ecological systems navigate through the new challenges posed by globalization. Such an understanding is crucial to more realistically assess the limits and possibilities for conserving the rich cultural and ecological heritage in traditional cultural landscapes. Ecosystem services (ES) represent the direct and indirect benefits that people derive from ecosystems (MEA 2005), and therefore they play an important bridging role in connecting human systems with ecological systems (Fischer et al. 2012, Martín-López et al. 2012). Recent studies suggest that exploring the cultural perceptions and preferences toward ecosystem services can be useful to identify the most relevant services to people (Martín-López et al. 2012, Plieninger et al. 2013). This, in turn, can help to anticipate possible changes in the future because typically, there are trade-offs between different ecosystem services, e.g., the enhancement of provisioning services typically causes the decline in many other ecosystem services (Foley et al. 2005).

In this pilot study, we focused on a traditional cultural landscape in Transylvania, Central Romania. The region is regarded as rich in cultural and landscape heritage (sometimes termed an ‘historic landscape;’ Akeroyd and Page 2007), which is widely agreed as demanding careful conservation management (Mihai Eminescu Trust http://www.mihaieminescutrust.org/content/nd_standard.asp?n=82; ADEPT Foundation <http://www.fundatia-adept.org/>). Our study had two goals: (1) to assess the importance of various ecosystem services for local communities, as perceived by local inhabitants; and (2) to provide a glimpse into historic and recent changes in the local communities, as well as the expectations of the inhabitants regarding the future. In assessing the changing relationship

between people and nature, we also assessed which actors were perceived as particularly important in shaping the future of local communities.

METHODS

Short history of the study area: Transylvanian Saxons

Saxons colonized Transylvania from various parts of Germany peaking Europe in the 12th-13th centuries, when it was ruled by Hungary. Although other ethnic groups such as Romanians, Hungarians, and Roma were also present in the region, Saxons were privileged to govern and own the landscapes inhabited by them. In this way, Saxon culture was the social and institutional driver of all major community events in the region. Even decades after the collapse of Saxon formal and informal institutions, Saxon culture continued to live in the memories of many people belonging to other ethnic groups. Therefore a short overview of Saxon history is useful to understand the nature of recent social changes and their potential consequences regarding possible changes in the cultural landscape.

In 1485, the Sächsische Nationsuniversität, i.e., the university, was constituted at the request of the Saxons. All major strategic decisions were made by this institution. The (evangelic) church and the various types of *Nachbarschaften*, literally meaning neighborhoods, were important in organizing communities at the local level (Dorner 1910, Baltag 2004). Saxon communities were structured around a large set of norms and rules, which led to many social conflicts being resolved peacefully and informally within this ethnic group (Dorner 1910).

Saxon culture was also reflected in the use of natural resources. For example, forests and pastures were communally owned and managed. This was supported via policy decisions, such as the demarcation of prohibition forests in which wood extraction was prohibited. Forest management was conducted on a scientific basis with many foresters trained in Germany, and often, locals were involved in forest management practices, e.g., as forest guards (Oroszi 2004). Communal pastures were controlled by pastoral committees, and measures to maintain pastures, e.g., regular scrub removal, were agreed upon and carried out by all users (Sutcliffe et al. 2013). There were clear rules regarding different types of livestock and when these were allowed to graze.

In the late 18th century and then again in the 20th century, Transylvania and the Saxon region experienced several major socioeconomic, territorial, and political perturbations (Fischer et al. 2012). These changes led to a gradual weakening of the Saxon institution and ultimately its collapse (Nägler 1992, Baltag 2004). Following agrarian reform in 1945 and subsequent collectivization (1949-1962) imposed by the Romanian communist regime, most farmers in

Romania, including the Saxons, lost their individual and communal properties (Nägler 1992, Verdery 2003, Baltag 2004). Many Saxons emigrated to Germany and Austria. Finally, following German reunification and the collapse of the Romanian communist regime in 1989, a last major wave of Saxon emigration occurred, and Saxon houses were increasingly inhabited by members of other ethnic groups, i.e., Romanians, Hungarians, and Roma. Massive changes in property regimes occurred even after 1989: land restitution and widespread privatization occurred in the 1990s, causing, among others, changes in pasture and forest management. Most villages once dominated by Saxons now have none or only a handful of Saxons.

The most common land tenure in traditional Saxon times was communal land management for forests and pastures, although arable fields were individually owned (Dorner 1910, Sutcliffe et al. 2013). Currently there is a high diversity of land tenures, ranging from individual properties, e.g., the arable fields and some parts of forests, to communal pasture lands, and church and state owned lands, e.g., in the case of forests (Fischer et al. 2012, Mikulcak et al. 2013).

Study area and selection of villages

Our study was conducted in the Saxon area of southern Transylvania (Fig. 1). Altitudes range from ~250 m to ~800 m above sea level. Land cover is dominated by meadows and pastures (~40% cover), deciduous forests (~30%), and arable land (~15%). Approximately 5% of the area is urban or industrial, and other land uses such as orchards and vineyards make up for the remainder. Rural communities are generally small: the average number of inhabitants in the 30 villages subjected to this research was 584 (range ~30-1900; Institutul National de Statistica 2011). Villages covered gradients in land covers, with different amounts of forest, arable land, and pasture cover, as well as ethnic composition, e.g., significant presence of Saxons, Romanians, Hungarians, and Roma, and activities by major local actors, such as nongovernment organizations.

Component 1: questionnaires to assess the perceived importance of ecosystem services

Questionnaire surveys were conducted in 2012 by one person in Romanian. A total of 98 people from 30 villages were asked to complete short questionnaires about ecosystem services (Appendix 1). People were randomly approached in the street as part of a more comprehensive interview exercise. They were asked to rate the importance of 17 different ecosystem services to people in their villages. Ecosystem services included provisioning, supporting, regulating, and aesthetic/cultural services (Fig. 2). These ecosystem services were selected based on the field

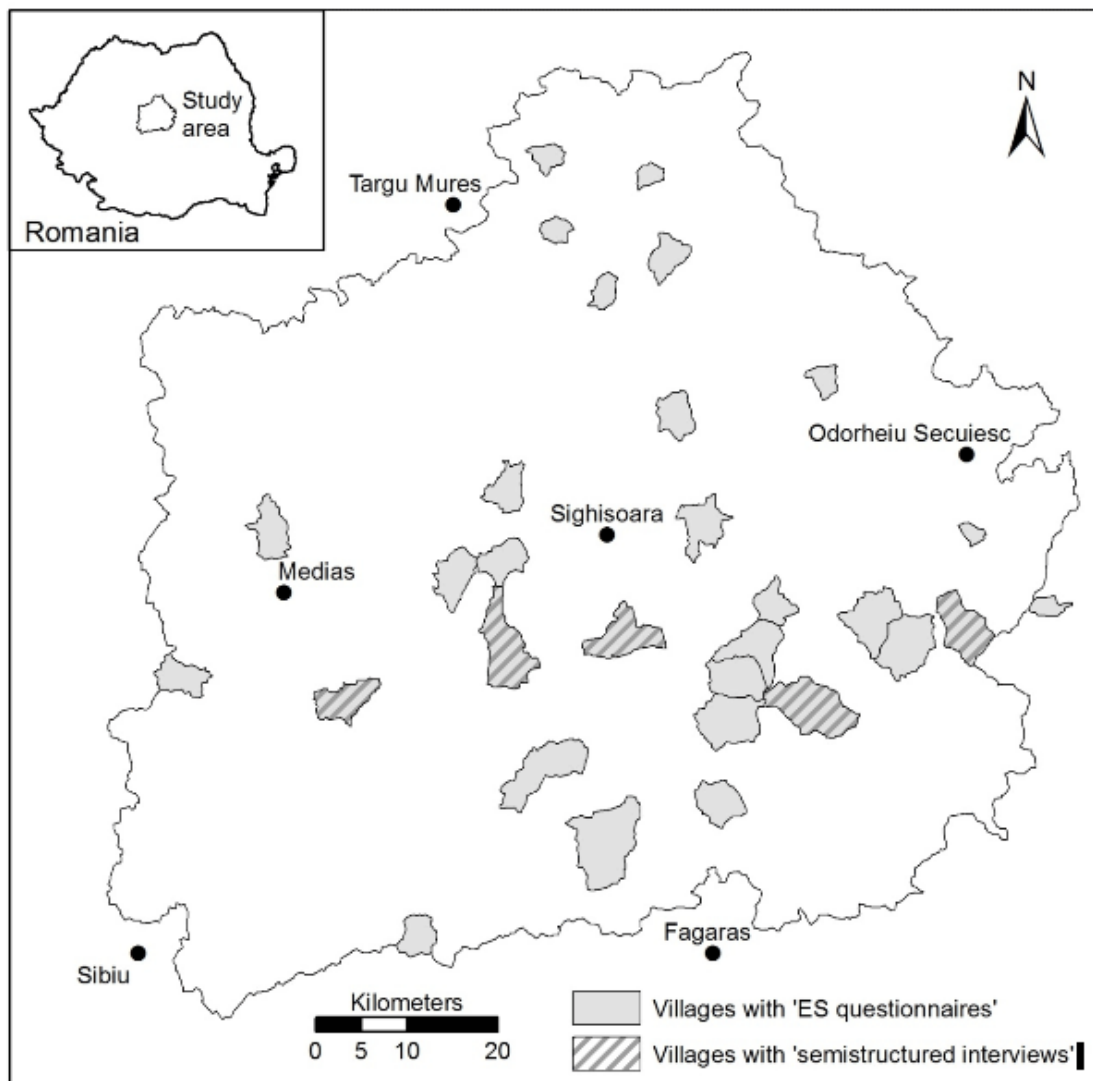


Fig. 1. Study region from Central Romania indicating the locations of the 30 focal villages and the villages where ecosystem service (ES) questionnaires were completed. Dots represent the major towns in the region.

observations of all authors in 2011 and our previous knowledge. Besides ecosystem services that were obviously important in local communities, e.g., crops and firewood, we also considered ecosystem services that in our perception were used less intensively by local communities, but may nevertheless be important for a significant minority of people, e.g., fishing and hunting. Completing the questionnaire took ~7-10 minutes per person. Details about the age, ethnic, gender, and professional structure of the people surveyed are presented in Table 1.

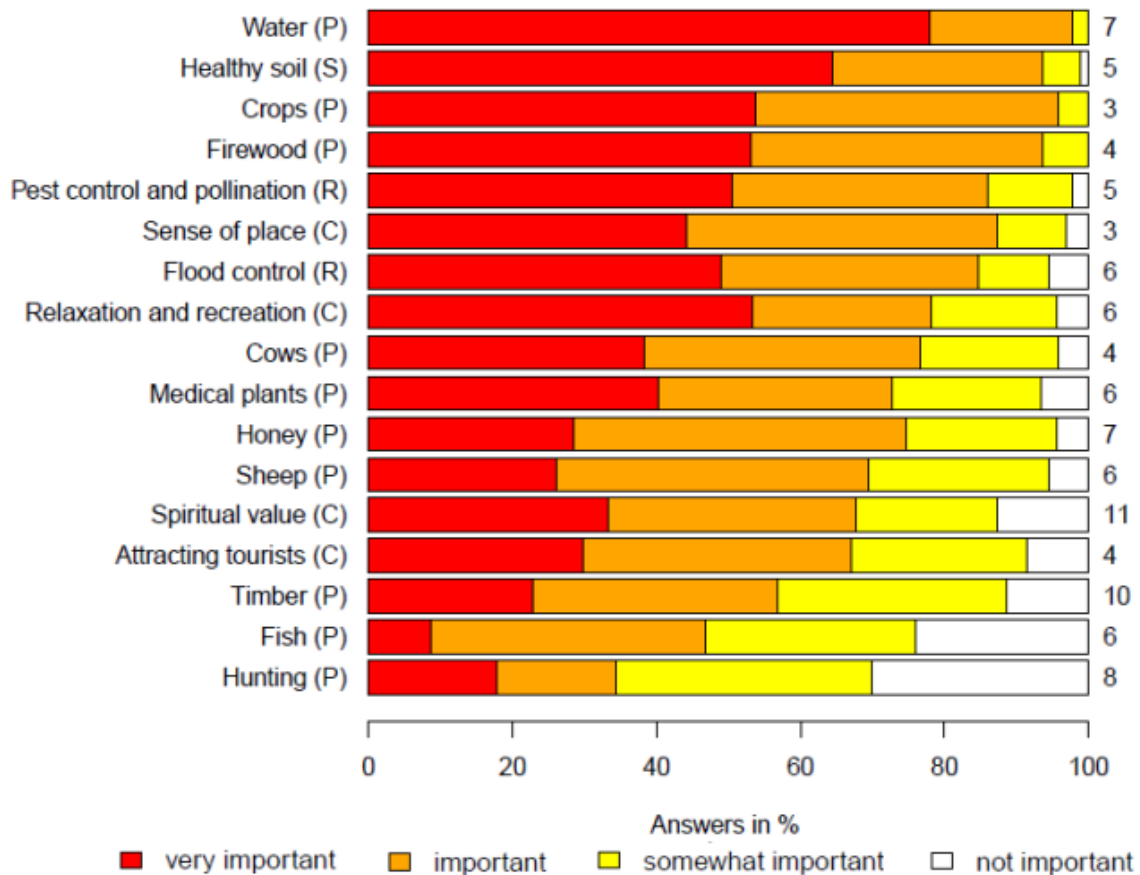


Fig. 2. The importance of ecosystem services for the rural communities. (P = provisioning service, S = supporting service, R = regulating service, C = cultural service; the number of people responding “I don’t know” is given on the right side of the figure).

Component 2: semistructured interviews

In the summer of 2011, 50 face-to-face semistructured interviews were conducted in 5 villages, i.e., 10 in each village. For ethical reasons, we abbreviated the names of these villages as AV, M, A, V, and D. The villages M and V had major regional actors active for a decade, i.e., nongovernment organizations (NGO) and individual persons, AV was targeted by major actors (NGO) in the past five years, sporadic activities, i.e., small initiatives, had occurred in A, and virtually no major actors had been active in D.

The interviewees were different individuals than the people addressed by the questionnaires. The interviews were conducted by one person in Romanian or Hungarian. Detailed notes were taken, but interviews were not recorded to encourage more open and honest responses. Moreover, as this was the first step in a broader research project, the aim was to not only gather basic information about the system as a whole, but also to make the first contact with the local communities. In this context, we aimed to be less formal in our interactions with the interviewees. Interesting sentences were quoted literally by asking the interviewees to repeat

them. Representatives of all relevant ethnic groups were interviewed. People were identified by randomly approaching them in the street and at their homes and then through the snowball method. Table 1 presents an overall summary of the structure of the sample. The general approach for this component was inductive and followed a broadly critical realist perspective similar to that discussed by McLaughlin and Dietz (2008), which recognized inherent linkages between human agency, social structure and dynamics, and their relationships to the environment.

Table 1. The structure of the groups studied for the environmental services (ES) survey and the semistructured interviews.

	Questionnaire survey for ES (n = 98)	Semistructured interviews (n = 50)
Age (mean, min-max)	41 (18-74)	47 (18-80)
Gender	31 Females	28 Females
	68 Males	22 Males
Ethnic group	49 Romanians	23 Romanians
	39 Hungarians	7 Hungarians
	7 Rroma	13 Roma
	2 Saxons	7 Saxons
	1 Foreigner	
Occupation	33 Farmers	22 Farmers
	31 Employees	6 Employees
	14 “Workers” (e.g., carpenter, break maker, mechanic)	3 “Workers”
	7 Teachers	6 Teachers
	13 Other (retired, director, priest)	12 Retired 1 Priest

The interviews were structured along the following broad themes: (1) the past, which included communist-socialist times for the middle to old-aged people: “Tell me about the major events and changes of any kind, happening in the past that affected this community, including your own life”. (2) The present, referring to the past five years: “Tell me about the major events and changes of any kind, happening in the last five years that affected this community, including your life”. (3) The future, referring to the next decade and beyond: “How do you see the future of this village? What types of changes will occur?” (4) The main actors in the village: “Tell me about important local actors, e.g., persons, organizations, ethnic groups, and parties, in this village, and why they are important?” This last question was interpreted by all interviewees with a positive connotation. Therefore interviewees mentioned those actors whom they perceived to make a positive difference for the local community. Formal institutions, e.g., police, local council, and schools, were mentioned in various responses, typically highlighting their overall

weak character in the present compared to the past. The interviews took on average 30-40 minutes.

Data analysis

Questionnaire data were analyzed with descriptive statistics over all interviewees and villages. We performed an initial screening for grouping of interviewees and for variation related to village characteristics, but did not find any clear pattern, which was most likely because the dataset was too small for a multivariate analysis.

Interviews were analyzed using open coding techniques to determine broad themes discussed by participants (Gibbs 2007). First, we identified words or phrases that succinctly summarized key parts of the narratives. For example such words or phrases included “inability to associate,” “individualism,” “trust,” “aggression,” “Saxons,” “Roma,” “jobs,” “infrastructural development,” “farmland,” “cattle,” “school,” and “police.” The narratives told by interviewees were decomposed using such codes. We iteratively repeated this process and grouped or split words or phrases as necessary. In the final stage, we grouped words and phrases into four broad categories: social, e.g., “individualism,” “aggression,” and “trust;” institutional, e.g., “police” and “school;” economic, e.g., “cattle,” “job,” and “infrastructural development;” and environmental, e.g., “farmland.” Based on this, we created short synthetic stories about the past, present, and future of the villages. These condensed stories were then validated by comparing them with the original narratives. Words and phrases that were mentioned at least five times, an arbitrarily set threshold, were all used to create these synthetic stories. We selected this threshold because we felt that in this way we could succinctly mirror the broad realities of the individual stories. Less frequently mentioned words and phrases were occasionally included to give a glimpse into the diversity of perceptions about a given issue. We also used one or two characteristic quotes to capture some of the wording used by the interviewees.

We noted each local actor mentioned by the interviewees, and based on these records, we grouped actors into the following seven categories: ethnic groups, e.g., when a certain ethnic group had a major effect on any aspect of community life, NGOs with an important role for the village, individuals, foreign organizations, the church and priest, farmer associations, and volunteer groups. We summarized the results in a table (Table 2), listing the types of local actors, and how many interviewees referred to them in each of the five villages.

We acknowledge that our method used for the semistructured interviews may appear partly subjective. We chose to employ it because our research was the first step of a broader research project, which involved interviews with a higher sample size for two years. This being the case,

our goal was to generate a broad understanding of the social system, and more specific aspects will be addressed in subsequent research. Our findings, i.e., the synthetic stories, match well with the results gathered by subsequent interviews (Mikulcak et al. 2013), scenario workshops (J. Hanspach, T. Hartel, A. Milcu, F. Mikulcak, I. Dorresteijn, J. Loos, H. von Wehrden, T. Kuemmerle, D. Abson, A. Kovács- Hostyánszki, A. Báldi, and J. Fischer, *unpublished manuscript*), other workshops (T. Hartel, *personal observation*), and the results of a photo elicitation method (A. Ioana Milcu, *personal observation*). Based on these consistencies, we are confident that the methods used in our study were satisfactory to achieve the goals.

Table 2. Major local actors mentioned by the interviewees. Numbers show how many interviewees referred to a particular actor type in a given village, for example, two interviewees in Village A mentioned a lack of major local actors.

	Village M	Village A	Village V	Village AV	Village D
No major actors*		2			
Ethnic groups (Saxons)	3				
NGOs	8	2	8	9	
Individuals	4	5	2	5	1
Foreign organizations		3			
Churches or priests	5		1		
Farmer associations	2				
Volunteer groups	4				
No actors mentioned**			2	1	1

* Interviewees said that there were no major actors.

** Interviewees did not mention any actors during the interviews.

RESULTS

The importance of ecosystem services to local communities

Ecosystem services considered very important by most respondents were freshwater (over 75% of respondents), healthy soil (> 65%), crops and firewood (> 50%), and cattle and medical plants (~40%; Fig. 2). In terms of cultural services, sense of place (> 45%) and relaxation and recreation (> 55%) were considered very important by many respondents. Pest control and pollination (~55%) and flood control (~45%) were considered as the most important regulating services (Fig. 2). No valuations as unimportant were associated with water, crops, and firewood, whereas fishing and hunting were most often considered unimportant (~50% and ~30%, respectively; Fig. 2).

Perceptions of changes: past, present, future

How the past differed from the present

The most common social theme was related to the community and the attitude of people toward shared values and other people (referred to 27 times). The local community was perceived as stronger in the past (referred to 18 times) than in the present. “In the past it was much better from a social perspective: people were more united than today” (Romanian, 47, Village A). “In the past people were hard working, they were good neighbors, they respected each other, they were like brothers” (Saxon, 70, Village V). The Saxon ethnic group was mentioned in 28 interviews. Without exception, the Saxon era was associated with high community cohesion, principles, dignity, and respect by all members of ethnic groups interviewed in this study and in all villages. “Saxons were very organized people; there was order in those times in the village” (Roma, 70, Village A). “In the past people were more united, because of the Saxons. The Saxons were correct, valuable and punctual people” (Hungarian, 70, Village D). Some interviewees recognized that in the past individual freedom was more limited than currently (11). “The past was much worse than the present: especially because there were far fewer opportunities for people to take initiative than today” (Saxon, 47, Village V). Institutions, e.g., local governance, police, church, and school, were referred to 21 times in the narratives. The institutions and their representatives were perceived to have a higher authority in the past than at present (7). There were more cultural events in the past (6) and more jobs (25) than currently. The stability of jobs and income was higher in the past relative to present (11), even though the purchasing power of money was lower in the past than at present (3). “During communism people had work, all were employed in an obligatory way” (Romanian, 40, Village AV). “In the past it was not as hard to survive from one day to the next compared to today” (Roma, 60, Village AV). Farmlands were used, cleared, and maintained in the past, compared to the present when they are increasingly being abandoned (5).

The present

The most common social themes dominating the present were the disintegration of the local community (9) caused by the inability of people to cooperate (17), increasing individualism (12), ethnic fragmentation (5), and the formation of interest groups (5). “People don’t work together, can’t decide together.” (Hungarian, 70, Village D). The importance of NGO activity for some villages, e.g., restoration and tourism, was commonly mentioned (15). Some people were aware of the existence of specialization courses (4) and an increase in the regional image of their village (2) because of NGO activity. “The specialization courses recently organized by the ‘Organization X’ were initially seen with skepticism by locals, even by me, but later people liked

them, and it was a success overall for the village” (Male, 65, Village AV). Many local institutions were seen to have low authority (5), be corrupt, and characterized by poor leadership (7). Jobs (9) and working opportunities (12) were seen to be lacking. Agriculture was characterized as largely traditional (25), but some people reported a gradual shift toward mechanized agriculture (7). When people talked about traditional agriculture, it was largely in the context of poverty and a lack of other options: “Those people with money use mechanized agriculture. Poor people use traditional agriculture” (Romanian, 23, Village A). Young people often left the village for seasonal or permanent work (10). By contrast, people from three villages (Village AV, Village M, and Village V) reported increases in tourism (10) and with this, some opportunities to generate extra income (7), an increase in the number of restored houses (4), and improvements to public infrastructure (4). “There are employment opportunities in Village M, we have farms and the orchard where people work. There are milk collection centers where people work” (Romanian, 36, Village M). “The present brings a lot more opportunities for people than the past: there are many initiatives in the village and if people really want something they can achieve it if they are persistent, open-minded and hard working” (Saxon, 47, Village V). Members of the Roma ethnic group were associated with poverty, demographic growth, conflicts, and ethnic and economic marginalization (8). An illustrative quote for the marginalization of this ethnic group comes from the village M: “Look, the road ends here” (Roma, 41, Village M; referring to the situation when paving of the road ended at the border of their neighborhood). In terms of the environment, much agricultural land is being abandoned (6) because of economic unprofitability and an ageing population. “It is easier to earn 1000 RON in a factory today than from agriculture” (Male, 65, Village AV). “Agriculture is still traditional. The gasoline is very expensive ... many lands are abandoned” (Hungarian, 70, Village D).

The future

Some people expected that indifference (5) and individualism (6) would increase and the young would continue to emigrate (9). “Look around, and see... The future will mean much more degradation, depopulation. People are unable to coalize, to do something good for their lives. We need a lot of help from the outside” (Male, 65, Village AV). Some people believed that the future would be highly dependent on appropriate leadership (10). Employment prospects would remain relatively poor (5), and the economic future of the villages would depend on people’s ability to cooperate (14). This was captured by a 72-year-old Saxon who said: “I don’t blame times. I blame people.” In two of the villages (Village V and Village M), the possibility to generate alternative incomes could increase (5), especially as a result of increased tourism and other initiatives (11). In Village M and Village V, more people were optimistic regarding their future than in the other three villages. Cultural tourism and ecotourism were perceived by interviewees as important for the future socioeconomic state of these villages. They felt that

many initiatives already existed, creating fertile ground for complementary seasonal incomes: “Usually people generate small incomes while working a little bit in many areas in the village: for example I work in the school, I work in tourism and agriculture” (Romanian, 40, Village M).

Local actors

The local individuals and NGOs were mentioned as the most important local actors (Table 2). Cultural tourism and restoration of houses were considered particularly important in Village V. The most common activities associated with NGOs were: helping in building restoration, construction of milk collection centers, organization of courses for farmers in agro-tourism and languages, and various other initiatives to help in developing marketing and income opportunities. For example, the sock making association in Village V contributed not only to the livelihoods of its members, currently ~70 women, but also to a sense of common purpose for the community as a whole. Interviewees from Village V and Village AV also suggested that the presence of a major NGO in the village gave a strong incentive for people to cooperate. Negative references to the activity of NGOs were made by five interviewees, the main reason being the perceived inability of these actors to involve a larger part of the community or to extend their activities to address other social and economic issues.

DISCUSSION

Our results can be summarized as follows: first, three provisioning ecosystem services, i.e., water, crops, and firewood, one supporting service, i.e., healthy soils, and one cultural ecosystem service, i.e., the value of landscapes for relaxation and recreation, were considered very important by more than 50% of the respondents. Second, the traditional cultural landscape is undergoing major social and economic changes. People reported sharp increases in individualism, lack of trust, conflicts, and poverty after the 1989 revolution. Third, people from villages with a diversity of strong local leaders appeared to have more positive perceptions about the current and future socioeconomic states of their villages.

Our finding regarding the importance of ecosystem services is in line with other studies showing that rural communities show high appreciation toward provisioning ecosystem services (Iftekhar and Takama 2008, Agbenyega et al. 2009, Martín-López et al. 2012), in contrast to urbanized communities who mostly appreciate the aesthetic and recreational values of landscapes (Martín-López et al. 2012, Plieninger et al. 2013). Industrial activity and opportunities for stable jobs in the study region are poor; therefore the majority of people still largely depend on provisioning ecosystem services in their everyday lives (Fischer et al. 2012, Mikulcak et al. 2013). At least some of the rural inhabitants practice subsistence farming because of a lack of other options at

local and regional scales (Mikulcak et al. 2013). A similar return to traditional practices caused by poor economic conditions was described in Spain for transhumant shepherds (Oteros-Rozas et al. 2013).

Moreover, the semistructured interviews revealed a number of social and economic issues challenging local communities, such as the weakening of local communities and institutions, corruption, conflicts, an overall lack of job opportunities, and a general sense of poverty. The Saxon cultural landscape and its communities went through several social, institutional, political, and economic changes during the past decades. It is possible that these relatively rapid and drastic ethnic and cultural changes negatively affected the personal identification of people with their land, ecological respect, and caretaking (defined as ecological embeddedness in Whiteman and Cooper 2000), which had been very strong historically in previous times (Dorner 1910). More recently, with accession to the European Union, people's aspirations, needs and behaviors are increasingly influenced by Western culture. Many young people have emigrated permanently or temporarily (Horáth 2008). These many changes coupled with a poor economic environment and weak formal institutions could erode the social capital of rural communities (sensu Adger 2003, Hero 2003).

Traditionally, much of people's energy went into the active maintenance of those elements of the landscape that provided ecosystem services for them, e.g., clearing of shrubs and dead trees from the pastures and the managing and guarding the forest (Dorner 1910). At present, the landscape continues to be important for many rural inhabitants, but many aspects of modern life, e.g., access to information, formal education, transport, and health care, depend on financial capital and infrastructure. Ecosystem services, including provisioning services, which once were at the heart of the rural institutions and communities (Dorner 1910, Oroszi 2004), can no longer satisfy the modern needs and aspirations of people.

Interviewees in three villages identified local initiatives that aimed to support small-scale farmers, created incentives for them to associate with, and assisted them in developing local businesses to generate extra income. Regionally important NGOs such as the Mihai Eminescu Trust and the ADEPT Foundation assist farmers in various ways, e.g., in restoring traditional buildings, in accessing agri-environment payments, or by lobbying internationally for cultural and ecological tourism. Similarly, Local Action Groups are new associations of rural inhabitants that bring together various local actors from neighboring villages to develop a common vision for regional development. The more optimistic views about the future in communities with a range of initiatives underline that diverse and pluralistic leadership can contribute significantly to the adaptive capacity and social cohesion of communities (Goodman et al. 1998, Norris et al. 2008, Islam and Morgan 2011).

CONCLUSION

In conclusion, rural communities in the cultural landscape of Southern Transylvania rate a number of provisioning ecosystem services as being very important for their everyday lives. Rural communities, however, are affected by a large number of socioeconomic challenges. Traditional land-use practices, which have maintained ecologically valuable landscapes, seem to be the result of poverty and lack of other opportunities for many rural inhabitants rather than resulting from an active desire to maintain traditional landscapes. With aspirations shifting increasingly toward Western ideals, reliance on local provisioning ecosystem services is not a choice actively made by most people. Environmental resource managers, conservation biologists, and those advocating Western-style socioeconomic development need to consider simultaneously the social and ecological challenges associated with economic development in this region.

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SUPPLEMENTARY MATERIAL FOR APPENDIX II

The questionnaire used to assess the importance of various ecosystem services for the inhabitants of the rural landscape.

Questionnaire nr.:

Age and ethnic origin:

Day:

Profession:

Village:

Benefits people obtain from the surrounding environment

People obtain a number of benefits from the surrounding environment, in multiple forms. How important are in your village the following benefits provided by the natural environment? Please mark in the above table.

	Not important	Somewhat important	Important	Very important	I don't know
Crops					
Firewood					
Sense of place					
Honey					
Attracting tourists					
Sheep					
Relaxation and recreation					
Water					
Flood control					
Cows					
Hunting					
Fish					
Medical plants					
Healthy soil					
Timber					
Spiritual value					
Pest control and pollination					

Appendix III

A holistic approach to studying social-ecological systems and its application to Southern Transylvania

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ABSTRACT

Global change presents risks and opportunities for social-ecological systems worldwide. Key challenges for sustainability science are to identify plausible future changes in social-ecological systems and find ways to reach socially and environmentally desirable conditions. In this context, regional-scale studies are important, but to date, many such studies have focused on a narrow set of issues or applied a narrow set of tools. Here, we present a holistic approach to work through the complexity posed by cross-scale interactions, spatial heterogeneity, and multiple uncertainties facing regional social-ecological systems. Our approach is spatially explicit and involves assessments of social conditions and natural capital bundles, social-ecological system dynamics, and current development trends. The resulting understanding is used in combination with scenario planning to map how current development trends might be amplified or dampened in the future. We illustrate this approach via a detailed case study in southern Transylvania, Romania, one of Europe's most significant biocultural refugia. Our goal was to understand current social-ecological dynamics and assess risks and opportunities for sustainable development. Our findings show that historical events have strongly shaped current conditions and current development trends in southern Transylvania. Moreover, although external drivers (including EU policies) set the general direction of regional development trajectories, local factors, including education, leadership, and the presence of bridging organizations, can enhance or counteract their effects. Our holistic approach was useful for generating an in-depth understanding of a regional social-ecological system and could be transferred to other parts of the world.

Key Words: ecosystem service bundles; landscape sustainability science; Programme on Ecosystem Change and Society; regional scale; Romania; scenario planning

INTRODUCTION

The Anthropocene is characterized by unprecedented, rapid, and uncertain socioeconomic and environmental changes (Schröter et al. 2005, Rockström et al. 2009). A major challenge for sustainability science is to identify plausible changes that may occur in the future of a given system, and identify ways to reach or maintain socially and environmentally desirable system states (Gibson 2006). The concept of social-ecological systems (also termed human-environment systems or coupled human and natural systems) highlights that people and nature are interconnected, with their inter-relationships constantly coevolving, thus making them analytically inseparable (Folke 2006, Liu et al. 2007). Although social-ecological systems are characterized by dynamic complexity, many are fundamentally shaped by a relatively small number of variables (Walker et al. 2006). Identifying and investigating the relationships between

such key variables reduces the often seemingly intractable complexity of the systems studied, allowing useful scientific and policy insights.

Landscape and regional scales (spanning hundreds to thousands of square kilometers) have been suggested as particularly useful for studying social-ecological systems (Liu et al. 2007, Carpenter et al. 2012). Regions are also often the scale at which policy is implemented, and they represent institutional, social, and physical “spaces” that are tangible and meaningful for humans (Brown and Raymond 2007, Angelstam et al. 2013). However, most research to date has investigated future development pathways either at the global scale or at very fine scales (e.g., individual villages) while intermediate scales have been neglected (Rounsevell et al. 2012). Many studies that have been conducted at landscape or regional scales have focused on relatively narrow sets of issues or applied a relatively narrow set of methodological tools.

Here, we present a holistic analytical approach to study the risks and opportunities facing social-ecological systems. This approach considers cross-scale interactions, spatial heterogeneity, and multiple uncertainties (Fig. 1), and could be usefully applied to a wide range of social-ecological systems worldwide. It systematically combines several tools, namely the documentation of system dynamics (Allison and Hobbs 2004, Liu et al. 2007), scenario planning (Enfors et al. 2008, Palomo et al. 2011), and spatial mapping (Anderson et al. 2009, Nelson et al. 2009). The documentation of system dynamics involves identifying the most important variables in a given system and evaluating (qualitatively or quantitatively) how they interact with one another (Walker and Salt 2006, Meadows 2009). It provides an understanding of the current state of a system and its functional relationships, but not necessarily of its plausible future pathways or people’s aspirations to alter the system. For this reason, we combine our assessment of systems dynamics with scenario planning, a foresight methodology specifically used to envision future pathways of a given system (Peterson et al. 2003, Biggs et al. 2010). Scenario planning provides a structured approach to identify different plausible developments for the future, typically to evaluate the possible outcomes of alternative management options (e.g., Henrichs et al. 2010, Palomo et al. 2011). Finally, because socioecological changes in any given region are typically spatially heterogeneous, spatially explicit mapping offers additional benefits to regional case studies (Santelmann et al. 2004, Polasky et al. 2005, Nelson et al. 2009). Spatial variation can arise for numerous reasons. Both biophysical and socioeconomic conditions may vary across a region, and different drivers of change may be more or less pronounced in different locations (Baumann et al. 2011). Spatial mapping can help to elicit spatial variation and can highlight trade-offs and synergies among different system properties (such as ecosystem services; see Raudsepp-Hearne et al. 2010, Qiu and Turner 2013). Our overall approach, which combines these different tools (Fig. 1), is integrative and participatory because it considers both ecological

and social aspects of the study system and because it involves consultation of and collaboration with local stakeholders.

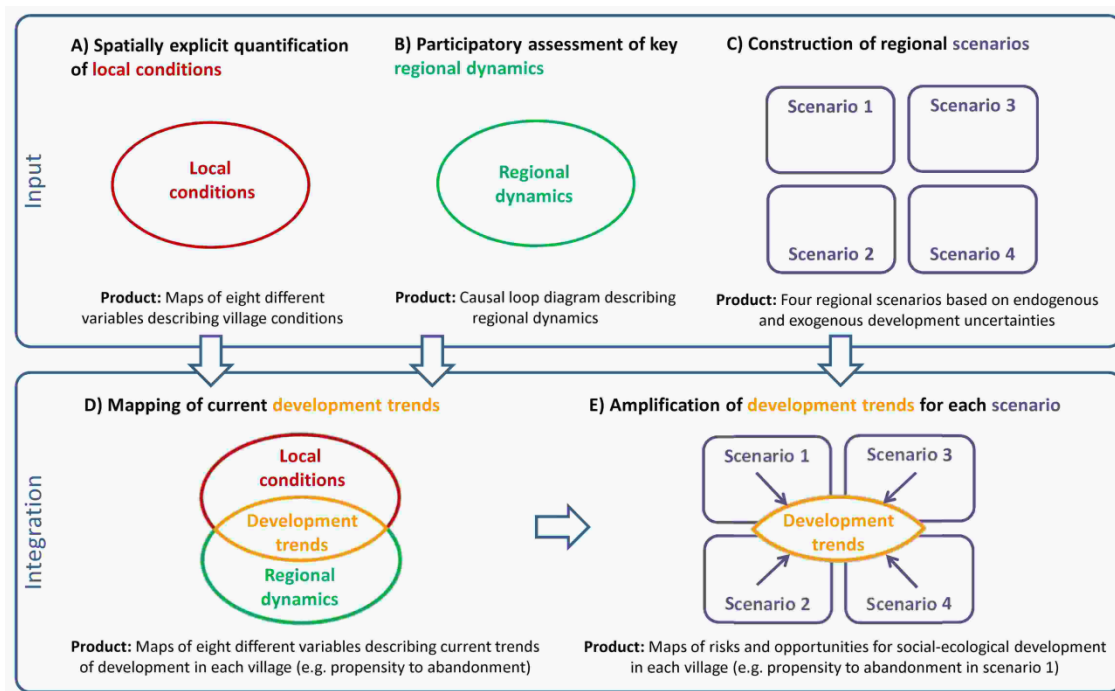


Fig. 1. Schematic summary of the five main methodological steps followed (A–E). Combining an understanding of local conditions (A) with an understanding of regional dynamics (B) resulted in spatially explicit maps depicting current social-ecological development trends in different locations (C). Maps of development trends, combined with regional scenarios (D), were then used to generate spatially explicit maps of social-ecological conditions under the different scenarios (E).

To illustrate our approach, we present a detailed application to the region of southern Transylvania, Romania (Fig. 2). This region is used primarily for semi-subsistence, small-scale farming, and traditional land-use practices have sustained a flora and fauna that is unusually rich compared to other parts of Europe (Akeroyd 2007, Akeroyd and Page 2011). With its ethnic Romanians, Hungarians, Roma, and Saxons, it also embraces an unusually high diversity of cultures and traditions. However, through a series of recent changes, the region now has become one of Europe’s most vulnerable frontiers of global change. The collapse of Romania’s communist regime in 1989, in combination with the general breakdown of socialism in Eastern Europe, led to a substantial reorganization of institutions, economies, and societies, with far-reaching social-ecological consequences, including mass emigration (especially of ethnic Saxons, but also Romanians), farmland abandonment, and changing land-use patterns stemming from the privatization of land (Ioffe et al. 2004, Lerman et al. 2004, Rozelle and Swinnen 2004, Kuemmerle et al. 2009, Baumann et al. 2011). Moreover, Romania’s 2007 accession to the European Union (EU), as well as ongoing globalization, continue to alter the socioeconomic and institutional fabric of the region, threatening both social and natural capital (Dobre 2009, Gorton

et al. 2009, Mikulcak et al. 2013). Navigating the rapid and fundamental changes taking place in southern Transylvania poses major challenges to local stakeholders and provides both risks and opportunities for sustainable development (Fischer et al. 2012b).

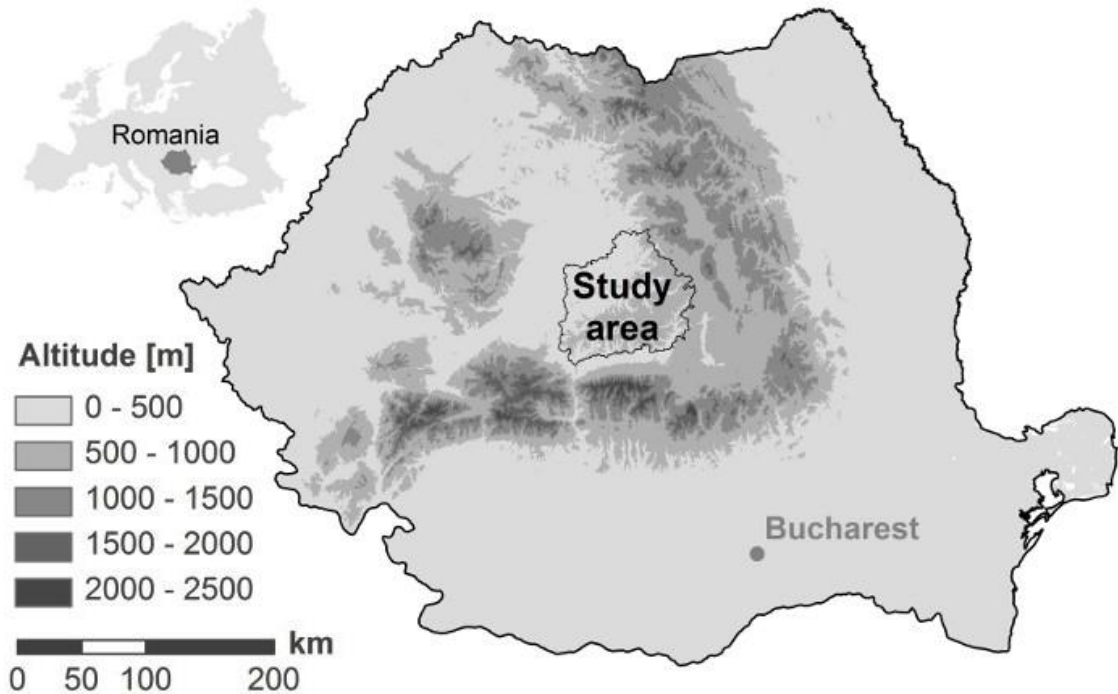


Fig. 2. Map of the study area in southern Transylvania, Romania, in the foothills of the Carpathian Mountains.

To investigate these risks and opportunities, we first classified and spatially mapped local conditions of several hundred villages in the study area in terms of their natural capital, social and demographic characteristics, terrain, and connectivity via roads to major towns. Second, we performed participatory workshops with local organizations and individual experts to develop causal loop diagrams describing regional social-ecological system dynamics. Third, we combined our understanding of local conditions and regional dynamics into maps depicting current social-ecological development trends. Fourth, we developed four contrasting, plausible future scenarios for a 30-yr horizon, again drawing on local expertise. Finally, we combined the maps of current development trends with the scenarios to ascertain where within the study region existing trends would be amplified or dampened under different scenarios. These methods are exemplified here using an in-depth regional case study, but the general approach could be used to explore plausible future development pathways in regional social-ecological systems worldwide.

METHODS

Study area

The study was conducted in central Romania and covered an area of 7440 km² at altitudes between 230 and 1100 m above sea level (Fig. 2) that is characterized by a mosaic of different land-cover types (28% forest, 24% pasture, and 37% arable land). Historically, most of the study area was shaped in terms of culture and land use by ethnic Saxons, immigrants from Western Europe who first settled Transylvania 800 years ago. However, most Saxons left the area after the collapse of communism in 1989. Today, the area is predominantly populated by Romanian, Hungarian, and Roma ethnicities.

Local conditions

We used the village as the basic unit of analysis because it represents a useful scale for the analysis of social-ecological systems in rural landscapes (Angelstam et al. 2003). The study area contained 448 villages. Because no official village borders were available, we delineated the area belonging to a given village using a cost-distance algorithm that allocated each pixel to the village with the lowest travel cost to this pixel (slope-penalized distance, implemented in ArcGIS). We defined the area thus associated with a given village as a village catchment (Appendix 1). This algorithm performed well because most villages were located in valleys, and a screening of results revealed that many boundaries of village catchments closely matched the borders of communes (administrative units containing four villages on average).

We applied a two-fold approach to characterize the biophysical and socio-demographic conditions in the villages. First, to obtain an in-depth understanding, we assessed an extensive set of local conditions for a subset of 30 villages (Appendix 1) and then generalized our findings to all 448 villages in the study area. The 30 villages were selected randomly from all villages, but were stratified to cover: (1) the full gradient in terrain ruggedness, measured as the variation in altitude within a given catchment; and (2) conservation status, i.e., no protection, protection under the EU Birds Directive, protection under the EU Habitats Directive. We estimated ecological and socio-demographic variables for the 30 selected villages.

Variables describing the natural capital of a given village catchment were based on the proportions of arable land, pasture, orchards, scenic beauty, utility as hunting area, carbon stocks, farmland biodiversity, and pollinator abundance (for details see Appendix 1). Socio-demographic data, derived from commune level statistics, were: total population size, proportions of the main ethnic groups, unemployment rate, net migration levels, and the number of pupils relative to the total population in a given commune (Appendix 1). We intended no judgment by the use of ethnic group as a variable to describe socio-demographic conditions, and we emphasize that possible relationships with other socio-demographic variables (see below)

indicate correlations, not causalities. Moreover, no alternative sociodemographic data were readily available for the whole study area.

The main gradients and groups of the local characteristics in the 30 villages were analyzed using cluster analysis (Wards clustering based on Euclidean distances) and principal components analysis on standardized data (zero mean, unit variance), separately for natural capital and socio-demographic data (Fig. 3, Appendix 1). Based on the initial in-depth analysis of a subset of 30 villages (Fig. 3, Appendix 1), we concluded that the proportion of the main land-cover types (arable, pasture, forest) provided a good indication of the natural capital bundles in a given village, and that the proportion of Hungarians and Roma could be used to summarize the main socio-demographic characteristics of a given village. Therefore, we used these variables to summarize local conditions in all 448 villages (Fig. 4). Finally, we estimated village area, terrain ruggedness, and isolation from the nearest town for all villages in the study area. While we acknowledge that our assessment of local conditions was a “snapshot” of the dynamic social-ecological conditions, we believe it was nevertheless a useful means of identifying broad social-ecological differences within the study area.

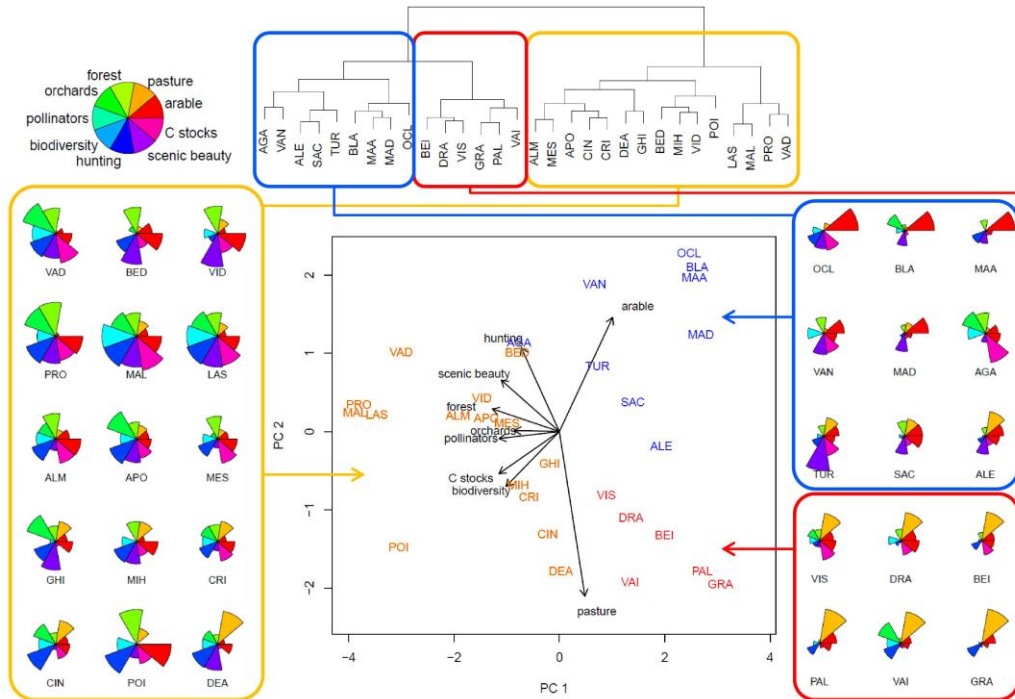
Regional dynamics and scenarios

The assessment of regional dynamics and the development of scenarios were based on participatory workshops with local organizations and key individuals representing social, environmental, and economic interests. They included members of all relevant ethnic groups, political parties, churches, and schools, as well as local police officers and organizations concerned with nature conservation, regional development, forestry, agriculture, and tourism. Based on our expertise in the region, groups were subjectively chosen to be broadly representative of different interest groups within the study area. To give all groups equal opportunities to express their views, we first held individual workshops with each stakeholder group, and only later conducted joint workshops, which were led by a professional facilitator (see below). From all groups, we received positive feedback about the quality of the workshops.

Scenario planning workshops broadly followed the suggestions by Henrichs et al. (2010). Workshops were led by us, and stakeholders provided input via consultations and a review of the final products. In a first round of workshops (summer 2012), we separately met representatives of 16 local organizations to collate their understandings of changes in the region, as well as of socialecological system dynamics and key uncertainties. Organizations were asked to list the main social, economic, and ecological changes in the past and present, as well as potential changes in the future. We asked participants to focus on the most important changes and to indicate how they influenced one another, leading to the development of causal effect chains and

draft causal loop diagrams. We also asked which possible changes were within and beyond their control, and how uncertain they were (Daconto and Sherpa 2010).

Fig. 3. Statistical classification of the 30 focal villages according to their natural capital assets. Upper panel: Three village types were derived from agglomerative cluster analysis (Wards method on Euclidean



distances; agglomerative coefficient: 0.86). Central plot: Principal component analysis of relevant village characteristics (explained variance of axis 1 is 50%, axis 2 is 18%). Flower diagrams: Extent to which different types of natural capital are represented in the different villages. Three main groups of villages are apparent and relate to dominant land use: forest, yellow; arable, blue; pasture, red.

Based on the insights obtained from these initial workshops, we developed a single, integrative causal loop diagram describing regional systems dynamics (Fig. 5). This was achieved by combining cause-and-effect chains consistently identified by stakeholders into a single draft diagram. For the purposes of this diagram, we used the term “social capital” to summarize broadly key interrelated themes such as trust, shared norms, and the involvement in social networks. We are aware of various conceptions and criticisms of social capital (Putnam et al. 1993), but believe that this term adequately captured an appropriate amount of detail for our purposes.

Drawing once again on insights obtained in the initial stakeholder workshops, we developed internally consistent scenario logics by distinguishing between two main axes of potential uncertainties, namely exogenous versus endogenous uncertainties (Fig. 6). Within the space characterized by these two axes, we developed four plausible storylines describing sequences of social, ecological, and economic changes. In a second set of two separate workshops, we presented our draft integrative causal loop diagram and drafts of our scenario logics and narratives to the local organizations initially consulted and to some additional local experts who were interested in participating (nine organizations and three individual experts in total; December 2012). Based on the (positive) feedback obtained in this second set of workshops, we refined and finalized our causal loop diagram and scenario narratives and considered these as final products representing local expert consensus (Fig. 7).

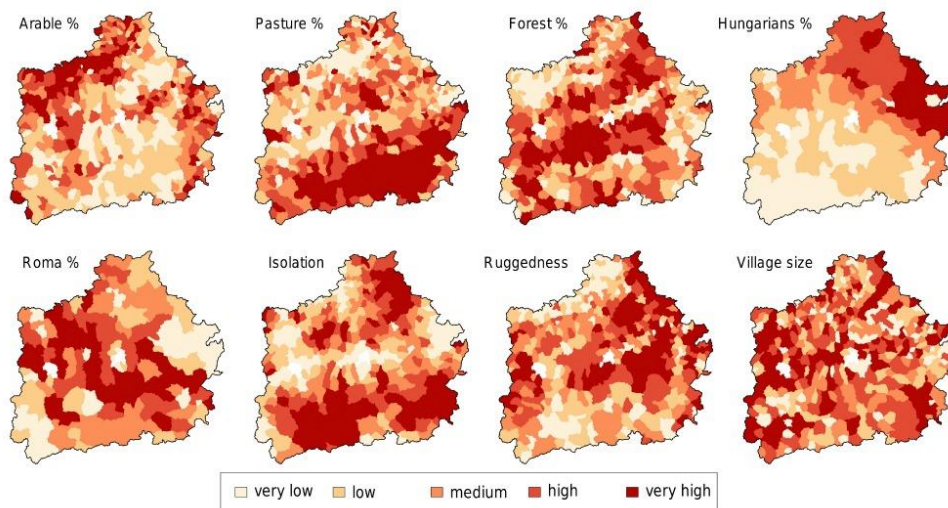


Fig. 4. Maps describing local conditions in the village catchments with respect to selected variables. The classes “very low” to “very high” correspond to quintiles of the raw data.

Notably, scenario planning inherently focuses on endpoints, that is, the outcomes of possible social-ecological developments in the future. In this way, it leaves space for complementary methods such as backcasting or adaptation, which provide a normative framework and tools to decide which development would be most desirable and which steps should be taken to achieve certain future conditions (Dreborg 1996, Wise et al. 2014).

Mapping social-ecological development trends

We combined our knowledge about local conditions and regional systems dynamics by mapping current perceived trends of socialecological development for each village. During the initial workshops, we asked participants how changes in eight key variables (boxes in the causal loop diagram; see Fig. 5) would relate to one or more of eight different village characteristics. All consistent and reasonable answers were collated into a table via a simple scoring system

(Appendix 1). For example, local experts typically perceived that the trend for abandonment was more likely in small, remote, hilly villages with a lot of Roma, and less likely in large, flat, well connected villages. For a given village, we then translated these subjective expert assessments into a positive (+1) or negative (−1) score and summed the scores obtained for each characteristic. The possible range of summed scores for a given village and a given variable was between −5 (a trend toward a particular change is highly unlikely) and +5 (a trend toward a particular change is highly likely). In combination, the resulting values represent the social-ecological development trends of a given village and were mapped to visualize patterns across the study area (Fig. 8, left column).

Scenario maps

Finally, we combined regional maps of development trends with changes taking place in the four different scenarios to describe the possible amplification or dampening of current trends in the future. Drawing on the scenario narratives, we subjectively rated the main changes relating to the eight variables under each scenario by adding scores ranging between −3 (strong dampening) and +3 (strong amplification) to the existing scores of socialecological development trends (Appendix 1). For example, a village with a moderate trend toward abandonment (e.g., a score of 2) would, under a scenario with fairly strong dampening of that trend (e.g., a score of −2), result in a scenario-specific land abandonment score of 0 (i.e., no trend toward abandonment). Notably, this simple scoring system served as a heuristic tool to compare relative differences between villages and scenarios, and not as an absolute indication of specific levels of any given variable.

RESULTS

Local conditions

With respect to ecological conditions, villages could be classified by the relative proportions of major land covers, namely arable land, pasture, or forest (Fig. 3, Appendix 1). Villages with a high proportion of forest had high carbon stocks, high scenic beauty, and a high abundance of pollinators. Villages with a high proportion of pasture also tended to contain high carbon stocks and supported high farmland biodiversity. Villages with a lot of arable land were characterized by low stocks of natural capital, with the exception of high capacity to generate agricultural products. We found that dominant land cover varied considerably across the entire study area (Fig. 4). The proportion of arable land (median: 57%, interquartile range: 39–83%) was relatively high in the northwestern parts of the study area, whereas the proportion of pastures (21%, 13–30%) was relatively high in the southern parts. Villages with extensive areas of forest (23%, 14–36%) tended to be located in the central parts of the study area.

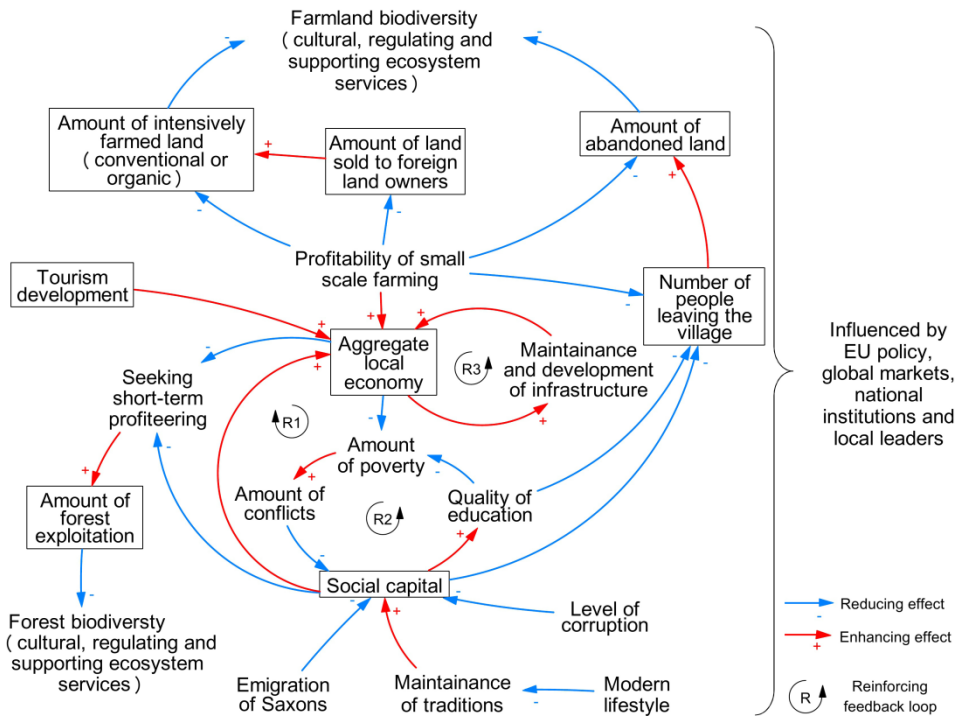


Fig. 5. Causal loop diagram summarizing the dynamics of the regional social-ecological system. Red arrows, enhancing effects; blue arrows, reducing effects. Variables in boxes were considered by local stakeholders to vary spatially in response to locally variable socioeconomic or ecological characteristics. Although the same system dynamics apply to the entire region, intensities vary through space. The spatially heterogeneous variables depicted in boxes were used to inform socialecological development trends and scenario maps (see Fig. 6). R1 refers to the reinforcing feedback loop around local economy, poverty, conflicts, and social capital.

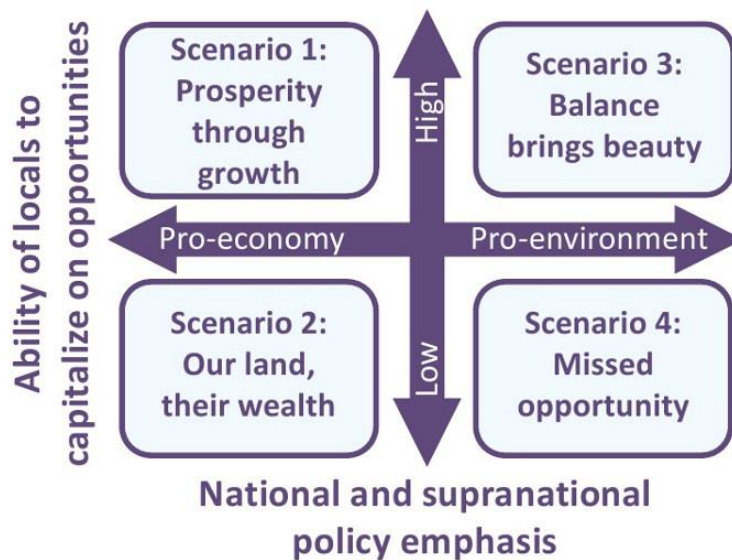


Fig. 6. Scenario matrix highlighting four plausible alternative futures arising from the combinations of two axes describing key uncertainties regarding future development. The horizontal axis relates to exogenous uncertainties, namely, whether national and supra-national policies emphasize economic development or environmental sustainability. The vertical axis relates to uncertainties within the study area, namely, whether local communities are able to capitalize on social and economic opportunities that may arise in the future.

With respect to socio-demographic conditions, Romanians were the most abundant ethnic group on average (median: 57%, interquartile range: 2.2–82%), especially in the southwestern part of the study area. Hungarians (12%, 1.2–73%) constituted the major ethnic group in the northeast, and the proportion of Roma (9.5%, 3.7–18%) was highest in the historically Saxon area in the center of the study area. The analysis of data from the random subset of 30 villages showed that the proportion of Hungarians was positively related to immigration and negatively to emigration. Communes with relatively higher proportions of Roma tended to have many school pupils and a high unemployment rate (Appendix 1). Isolation from towns (median: 24 min, interquartile range: 15–33 min) was highest in the south and in parts of the north of the study area. Terrain ruggedness was highest in the central and northeastern parts (49%, 43–58%). No clear spatial pattern was apparent with respect to village area (median: 57 ha, interquartile range: 39–83 ha).

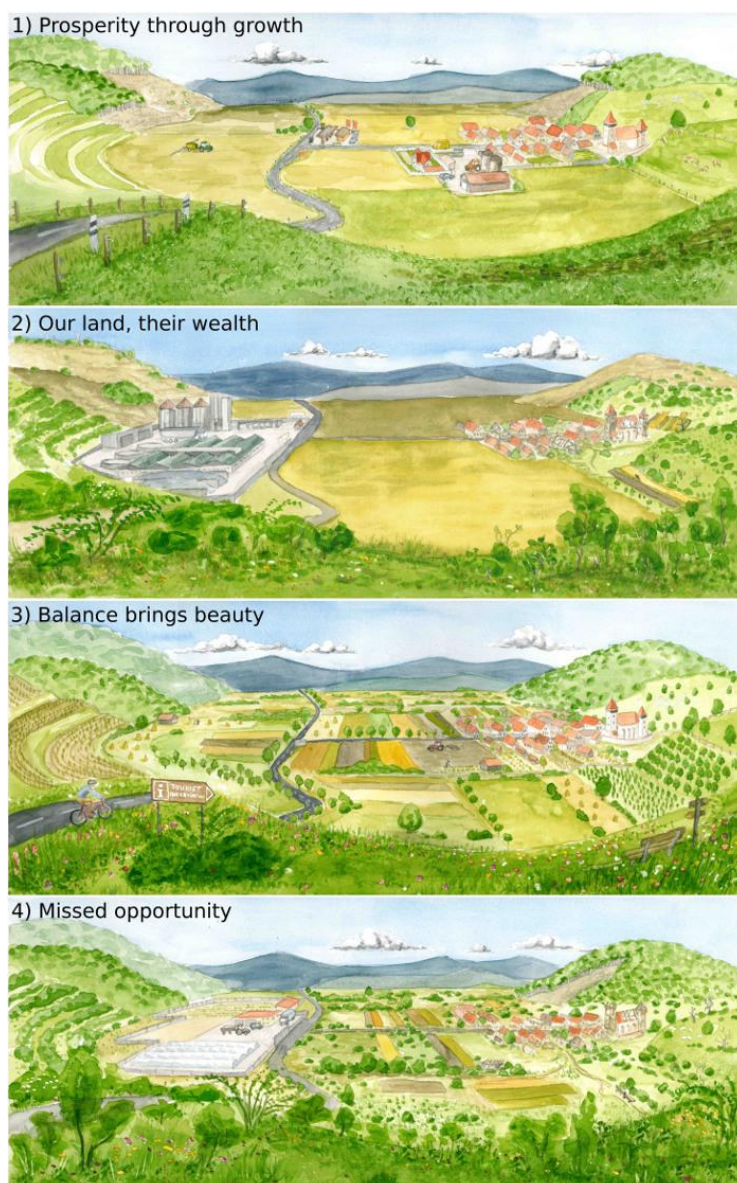


Fig. 7. Visual representations of key features of the four scenarios in terms of their effects on the landscape. Proeconomy settings lead to landscape simplification (scenarios 1 and 2), whereas pro-environment settings are likely to maintain landscape heterogeneity (including some land abandonment in scenario 4). Social and economic development for local villagers is particularly poor in scenario 2, and to a lesser extent in scenario 4; in both cases, villages are physically isolated from international farm businesses.

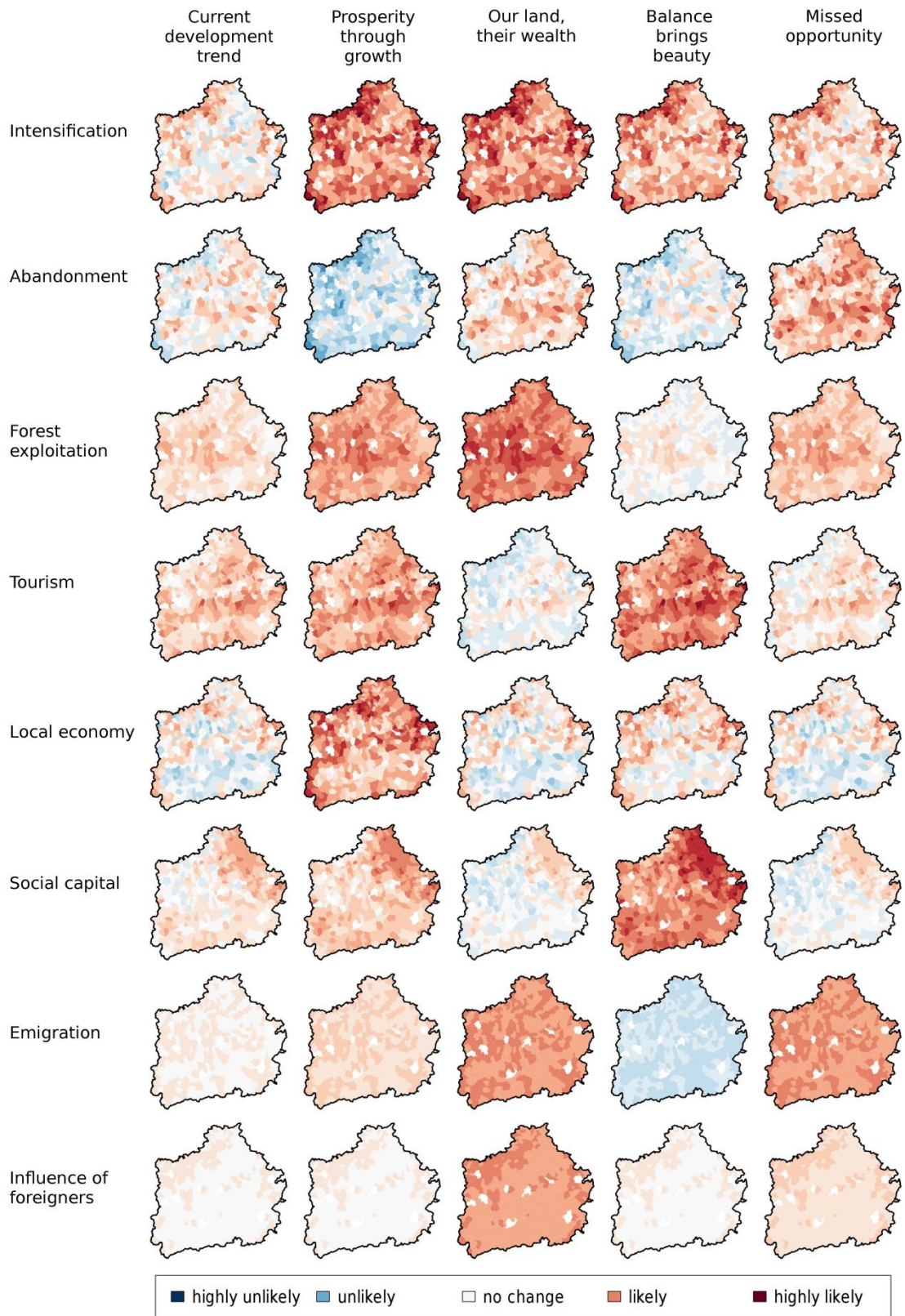


Fig. 8. Maps of current social-ecological development trends (left column) and social-ecological risks and opportunities under the four scenarios (other columns).

Regional dynamics

Participatory workshops led to a single consensus causal loop diagram (Fig. 5). Results suggest a strong link between the economy of a given village and its social capital. The low profitability of traditional small-scale farming was widely seen as a key reason for poor economic conditions, which in turn caused emigration (especially among the young) and land abandonment. Alternatives to small-scale farming (as raised by stakeholders) were the conversion to larger, more intensive farms controlled by either wealthy locals or by foreign investors. Larger-scale, more capital-intensive farms could practice conventional or organic agriculture.

Poor economic conditions were seen to be reinforced by poor infrastructure and low social capital (R3 and R1 in Fig. 5, respectively), whereas tourism development was suggested as having the potential to positively influence the local economy. The desire for economic development could also lead to short-term profiteering, causing the unsustainable exploitation of some resources (e.g., forests). The communist regime and its collapse were believed to have fundamentally shaped the social-ecological system. Most importantly, the collapse of communism was associated with high levels of corruption and the near complete exodus of Saxons after 1990 (mostly via emigration to Germany). These changes, combined with a shift toward a more modern lifestyle, appear to have reduced social capital in the region. Stakeholders reported a reinforcing feedback loop around poverty, conflict, low social capital, and poor education (R2 in Fig. 5), which caused rural emigration to Romanian towns or cities or to Western Europe. Finally, the dual processes of farmland intensification in some areas and abandonment in others was believed to lead both to a decrease in traditional small scale farming and consequently was seen to affect negatively farmland biodiversity, as well as cultural, regulating, and supporting ecosystem services. Similarly, forest exploitation for timber and firewood was considered a threat to forest biodiversity and the ecosystem services provided by forests.

Social-ecological development trends

Maps of social-ecological development trends show strong spatial variation for most variables assessed (Fig. 8, left column). For example, trends toward farmland intensification, abandonment, tourism development, and a strong village economy were likely in some villages, but less likely in other villages. Other variables (e.g., role of foreigners, emigration, forest exploitation) had less pronounced variation in social-ecological development trends. Farmland intensification and abandonment were correlated and showed an inverse pattern, that is, the trend toward abandonment was reported to be likely where intensification was reported to be unlikely, and vice versa.

Regional scenarios

Participatory workshops suggested that key uncertainties regarding future development could be categorized along two axes, namely exogenous versus endogenous uncertainty (Fig. 6). The exogenous (horizontal) axis showed that national and supranational policy settings might either favor a narrow vision of economic growth or more holistically foster environmentally sustainable development. The endogenous (vertical) axis represents the extent to which local communities are able to capitalize on opportunities provided by policies or markets (e.g., because of strong or weak local leadership, or high or low corruption). Within the resulting space, together with stakeholders, we developed four different scenarios describing alternative plausible futures over a 30-yr time horizon beginning in 2012 (Figs. 6 and 7; see Appendix 1 for full scenario narratives).

In the first scenario, “prosperity through growth”, small-scale farming is replaced by intensified, larger-scale, conventional agriculture. Forests are exploited where profitable, and tourism is restricted to the entertainment sector (e.g., fun parks). Economic development is driven by local people, and consequently, people are wealthier than 30 years previously. These developments cause losses in farmland and forest biodiversity, as well as the deterioration of regulating, supporting, and cultural ecosystem services.

In the second scenario, “our land, their wealth”, land use is also intensified and also causes the loss of regulating, supporting, and cultural services. However, economic development is driven by foreign investors, and consequently, few locals benefit from it. The gap between rich and poor widens. Crime and conflicts are frequent, including between ethnic groups. People leave their villages for Romanian towns or Western Europe, and most farmland that is unprofitable for foreign companies is abandoned. Due to the difficult socioeconomic conditions and a highly disturbed landscape, tourism all but vanishes from Transylvania.

The third scenario, “balance brings beauty”, describes a future in which locals are organized and able to capitalize on high national and international demand for organic agricultural products. Sustainable use of resources coexists with intensified land use via modern organic farming methods. Vibrant cultural tourism and eco-tourism stabilize people’s incomes from the agricultural sector. Although few people are financially wealthy, economic and social inequalities are reduced and community spirit is high. Cultural and natural capital is valued and actively maintained.

In the fourth scenario, “missed opportunity”, locals are unable to capitalize on the opportunities provided by a pro-environment policy setting. Instead, foreign companies set up modern organic

farms in the region, exploiting easy access to cheap land and labor. Semi-subsistence farming as it has been practiced for many decades is ongoing in the villages, while forests are exploited for firewood and sometimes logged illegally. Most locals are poor, and those who are able to, leave the area. Corruption, crime, and conflict are common. Farmland biodiversity experiences moderate decreases due to intensification in some areas and abandonment in others.

Scenario maps

The combination of current social-ecological trends with the four scenarios resulted in a set of “scenario maps”, which give a spatial representation of how key variables in the regional system are amplified or dampened under each scenario (Fig. 8). For example, under current trends, tourism development was deemed most likely in villages with high scenic beauty, and the overall likelihood of tourism development was highest in the scenario “balance brings beauty”. By contrast, even in villages with high scenic beauty, tourism development would face severe challenges in the scenario “our land, their wealth” because of unfavorable conditions for tourism development throughout the region. Similar contrasts were apparent for several development trends. Land-use intensification took place across all scenarios, but was least pronounced in the scenario “missed opportunity”. By contrast, major changes in several other variables were pronounced only in single scenarios (e.g., forest exploitation in “our land, their wealth”; tourism development, high social capital, and low emigration in “balance brings beauty”).

DISCUSSION

We illustrated a structured five-step approach to explore holistically the development trajectories of social-ecological systems; the approach considers multiple sources of uncertainty, spatial heterogeneity, and cross-scale interactions. With respect to the study area, this approach effectively highlighted both risks and opportunities for sustainable development. Based on our analysis, we see the main opportunities for the future of southern Transylvania in maintaining and carefully capitalizing on its high natural capital and cultural heritage, for example, through promoting biodiversity conservation and eco-cultural tourism. Major risks relate to the careless exploitation of natural capital and the possible deterioration of socioeconomic conditions driven by political decisions that favor short-term interests at the expense of building social capital.

In the following sections, we further discuss particular risks and opportunities for future development in southern Transylvania and use these to substantiate three general postulates, namely that trajectories of social-ecological systems are (1) shaped by their specific historical contexts, (2) influenced by external drivers, and (3) modified by internal dynamics. These three postulates, as well as our holistic analytical approach, are also likely to be relevant to other social-ecological systems.

Historical contingency shapes social-ecological dynamics

The history of a given social-ecological system fundamentally influences its development trajectory (Dearing et al. 2010, Costanza et al. 2012). In our results, this is most prominently shown in the causal loop diagram of the regional system dynamics (Fig. 5), as well as in the maps of current development trends (Fig. 8). Although it might appear trivial to note that history shapes the current nature of social-ecological systems and that current conditions constrain development options for the future, such an understanding is missing from many conceptual frameworks used to analyze land-use options (Fischer et al. 2008).

The role of historical legacies is readily apparent in settings that have experienced major shocks, such as did the study system in southern Transylvania. Similarly to other Eastern European countries, Romania's social fabric is still suffering from the aftermath of an era of systematic oppression during communism. The country has a long history of communities being exploited by a relatively few influential individuals (Spendzharova and Vachudova 2012), and widespread corruption continues to take a heavy toll on social capital, eroding trust and general community engagement (Ristei 2010, Hartel et al. 2014). Many communities find themselves in social or social-ecological poverty traps (Platt 1973) characterized by a reinforcing feedback loop involving poor education, unemployment, and susceptibility to conflicts and corruption (Fig. 5; Carter and Barrett 2006, Carpenter and Brock 2008).

In contrast to often dire social problems stemming from a turbulent history, the ecosystems of Transylvania are characterized by rich biodiversity and a highly heterogeneous farming landscape that provides a comprehensive set of ecosystem services, as shown by our results (Fig. 3), as well as in previous studies (Akeroyd and Page 2006, Hartel et al. 2014). After the collapse of communism, poor economic conditions prevented the widespread intensification of farming, and many local people continue to practice low-intensity, semi-subsistence agriculture (though often not by choice).

Our study shows that current stocks of both social and natural capital have arisen as a consequence of past system dynamics, and that current conditions and system dynamics provide both challenges and opportunities for the future. Current social dynamics largely present themselves as challenges, with a high risk that historical contingency will continue to cause the erosion of social capital and prevent economic development (as depicted in two of the scenarios; Fig. 6). In contrast, the high level of remaining natural capital provides a series of largely untapped opportunities, for example, for eco-tourism and nature conservation.

A unique opportunity for a sustainable development in southern Transylvania lies in the combination of the ongoing existence of traditional practices, knowledge, and fine-grained landscapes supporting high levels of biodiversity. Although communism and the emigration of ethnic Saxons have disrupted some of the traditional connections between nature and people in southern Transylvania, in comparison to most other parts of Europe, many genuine connections between people and nature have survived into the present. Southern Transylvania thus is one of Europe's last "biocultural refugia", defined by Barthel et al. (2013:1143) as "places that not only shelter species, but also carry knowledge and experiences about practical management of biodiversity and ecosystem services." Biocultural refugia potentially hold tremendous value for the future because they may help to generate visions and ideas for the reconnection of people and nature (Folke et al. 2011, Fischer et al. 2012b).

External drivers set the general direction of regional development pathways

External drivers fundamentally influence future developments in social-ecological systems through their interactions with local conditions (Cash et al. 2006). National and supra-national policy settings are particularly important in this context, both because they are highly influential and because they are amenable to being actively changed (and improved). In this case study, external policies and market settings were identified by local stakeholders as important drivers of a series of local changes, including the degree of forest exploitation, land abandonment, and emigration (Fig. 8).

In systems with explicit multi-level governance structures (such as in the EU), higher level institutions shape and constrain legislation, jurisdiction, and policy making at lower levels (Grabbe 2001, Bache 2010). In the EU, rural development, farmland biodiversity, and the ecosystem services flowing from farmland are strongly influenced by the Common Agricultural Policy (CAP; Henle et al. 2008, Plieninger et al. 2012). The CAP is a complex system of direct and indirect payments to rural communities. With regard to the study area, the CAP, its recent reform, and potentially more far-reaching reforms in the future, will greatly affect whether general development pathways are primarily pro-economy or pro-environment (as depicted in the scenarios; Fig. 6). To date, the CAP has favored economic interests over ecological concerns, although the latter have been addressed more explicitly in the most recent reform. Over a time horizon of several decades into the future, a more fundamental re-orientation toward the provision of public goods (including biodiversity and ecosystem services) is possible, and from a sustainability perspective, highly desirable.

In addition to the intent of a given policy, e.g., its emphasis on economic or environmental issues, the process of policy implementation will also change sustainability outcomes, and in the

worst case, can even prevent the attainment of intended goals. The impact of exogenous drivers is also determined by the degree to which regional social-ecological systems are prepared for external changes, for example, in market regulations or legislation. In this respect, national governments need to be able to anticipate and buffer potentially negative impacts and to build societal capacities to capitalize on the opportunities provided by change. Both national and sub-national governments in Romania, for example, currently appear to favor economic growth in the farming sector over the support of smallholder farmers and nature conservation (Mikulcak et al. 2013). Potentially useful EU policies for rural development are not used to their full potential (Mikulcak et al. 2013), and weak governmental agencies and ill enforced legislation support the exploitation of Romania's natural capital (Nichiforel and Schanz 2011, Knorn et al. 2012). In contrast to existing conditions, sustainable development could be positively influenced, for example, by more effective downward delegation of government authority to competent local actors (Folke et al. 2005, Lebel et al. 2006, Ostrom 2009), which might be more responsive to local needs and aspirations (Crook and Sverrisson 2001).

In summary, it is the combination of the intent of externally set policies and of their regional implementation that shapes the general direction of development pathways. Although much discussion tends to focus on policy intent (e.g., in the context of CAP reform), on-the-ground outcomes in multi-level governance systems are just as strongly influenced by the details of national and sub-national policy implementation.

Local system properties can enhance or counteract the effects of external drivers

Our results highlight that, despite the importance of external drivers (including higher level policy settings), local system properties such as overall levels of education, competent leadership, and presence of effective bridging organizations strongly influence sustainability outcomes. This is because local system properties can either facilitate or counteract the effects of external drivers. In the scenarios, such local system properties were captured by the second scenario axis (i.e., the ability of locals to capitalize on opportunities). Both the scenario narratives (Appendix 1) and scenario maps (Fig. 8) underscore that the same external policy settings can lead to fundamentally different development outcomes, depending on local conditions. For example, the trends toward abandonment and tourism development showed not only strong spatial variation within the region, but also rather distinct patterns between different scenarios (Fig. 8). This underscores that it is the interaction of external drivers with local system properties that shapes local development pathways.

The overall level of education was one of the key variables in the case study that was mentioned repeatedly in workshops as having a particularly large influence on local system dynamics (Fig.

5). Drèze and Sen (1996) argue that there is a direct relationship between literacy, the capability to understand rights, laws, and policies, and collective (political) action. A low education level hence reduces the capability of people to influence democratic processes and to hold (local) authorities accountable for their action or inaction (Agrawal and Ribot 1999), considerations that are particularly important in settings with high levels of corruption such as parts of Romania (Ristei 2010).

In addition to education, social networks and local leadership mediate how external drivers act on social-ecological systems. Social networks can increase the accountability of political elites (Lebel et al. 2006, Berkes 2009) and also enhance the adaptive capacity of vulnerable groups to transform a system configuration into a desired state (Carpenter et al. 2001, Holling 2001). Similarly, local leadership, for example, through mayors, teachers, or proactive citizens, can be an important source of clear, long-term visions and can encourage learning and innovation in local communities (Olsson et al. 2004, Black et al. 2011). Both social networks and leadership can be assisted by organizations that bridge gaps between citizens, civil society organizations, and government bodies at multiple levels. Such “bridging organizations” (Cash and Moser 2000, Olsson et al. 2007) serve to increase transparency in policy making and facilitate information transfer, both from higher to lower levels of administration and to other potentially interested parties (Olsson et al. 2007, Berkes 2009). For example, in Transylvania, some local organizations assist farmers in acquiring EU rural development funding and in marketing their products (Mikulcak et al. 2013), support the maintenance of cultural heritage, or inform people about legal issues around recently created conservation areas. Bridging organizations can also help to foster trust, lower the costs of conflict resolution and collaboration, and increase community cohesion, and thus, support the development of social capital (Folke et al. 2005). Commitment by leaders and bridging organizations to the community can also foster the development of rural enterprises of greater value such as specialty foods or agro-environmental tourism (Marsden and Smith 2005, Davidova et al. 2012).

CONCLUSIONS

Identifying pathways for sustainable development is an urgent need globally. We illustrated a holistic approach that combines existing methods to explore plausible future development pathways at the regional scale. At the heart of this approach is the recognition that biophysical and socioeconomic conditions fundamentally constrain and facilitate development pathways, that they influence one another, and that social-ecological conditions can vary within a given region. We applied this approach to a case study in central Romania, but we believe it could be applied similarly in other settings and could be particularly useful for spatially heterogeneous social-ecological systems facing high levels of uncertainty. Despite a need for global studies and

global policy initiatives, in-depth regional-scale analyses deserve more attention by sustainability researchers than they currently receive (Wu 2013). On-the-ground sustainability outcomes arise from the interaction of higher level (exogenous) drivers and local-level (endogenous) system dynamics; therefore, it is important that local and regional data remain adequately valued within the scientific community (Lindenmayer and Likens 2011). The integration of findings from a variety of regional social-ecological case studies (e.g., via the Programme on Ecosystem Change and Society; Carpenter et al. 2012) can then be used to guide regional, national, and supra-national policy more effectively. Moreover, engaging with people at local to regional scales may be our best chance yet to trigger behavioral and institutional changes that are the backbone of sustainable development (Reid et al. 2009, Fischer et al. 2012a).

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SUPPLEMENTARY MATERIAL FOR APPENDIX III

Appendix A1.1

Local conditions

We assessed local conditions in terms of natural capital and socio-economic conditions in the study area (Table A1.1). For an in-depth understanding, we initially analyzed a subset of 30 randomly selected villages (Fig. A1.1).

First, we characterized these villages with respect to their natural capital and statistically classified them into three groups. Villages in the first group (yellow in Fig. A1.2) were characterized by high proportions of forest, orchards, high carbon stocks, high species richness, high pollinator abundance and high scenic beauty. Villages in the second group (blue in Fig. A1.2) were characterized by a high proportion of arable land, and villages in the third group (red in Fig. A1.2) had high proportions of pasture. Based on this grouping, we concluded that village conditions could be effectively summarized by the amounts of the main land cover types (arable, pasture, forest).

Second, we described socio-economic conditions in the communes that the target villages belonged to. We used data from the commune level because socio-economic data were not available at the level of individual villages. Because some villages belonged to the same communes, this analysis was restricted to data from 22 communes. Again, we statistically classified the communes according to their characteristics and found two major groups of communes. Communes belonging to the first group (light blue in Fig. A1.3) were characterized by a high proportion of Romanians, few Hungarians, and relatively high emigration rates, whereas communes from the second group (orange in Fig. A1.3) had a high proportion of Hungarians, few Romanians, and relatively high immigration rates. Notably, the cluster analysis did not pick up the gradient that was described by the second ordination axis in Fig. A1.3. This second gradient related to unemployment rate, proportion of pupils and proportion of Roma. Because the plight and influence of ethnic Roma were frequently discussed by stakeholders as important socio-economic variables, we considered the proportion of Roma in a village in subsequent analyses.

In summary, we used the proportion of forest, arable land and pasture to summarize natural capital bundles characteristic of different villages; and we used the proportions of Hungarians and Roma to summarize socio-economic conditions of different villages. In both cases, these variables were derived from detailed data obtained for a subset of villages, but the resulting

general variables were subsequently used to characterize conditions in all villages throughout the study area.

Full scenario narratives

Scenario 1: “Prosperity through growth”

European Union (EU) incentives and global markets have created a favorable business environment. Demand is high for conventionally produced agricultural and forest products. National policies are strongly favoring economic development, including in rural areas.

Drawing on the natural capital available, local entrepreneurs (and a small number of foreigners) are using this institutional setting to take advantage of business opportunities, and partnerships between Western European and Romanian companies are common. Both farmland and forests are being used intensively wherever the landscape allows it, including the use of fertilizers and irrigation of farmland. The scenic beauty of the landscape suffers as a result, but plenty of money is flowing from commodities such as fuel and food crops, as well as wood.

Although the incomes of most people are modest compared to those running the new businesses, economic development has improved the region’s overall material well-being. The education system also has improved, and there are many opportunities to obtain vocational training.

Tourism is centered on cultural heritage sites and newly emerging fun parks. Neither the natural environment nor traditional festivals contribute significantly to the tourism sector.

Land use intensification has caused the loss of biodiversity throughout the landscape, including the local extinction of several species of conservation concern. The water from local fountains is no longer safe for consumption, but people are largely indifferent to this because, unlike in the past, their houses are now connected to running water. Intensive forestry has left some hilltops without trees. As a result, runoff events are more intense than they used to be, causing the erosion of slopes and occasional floods.

Conflicts in the communities are less pronounced than earlier in the millennium, largely because fewer people suffer from poverty. Although individualism is more notable than in the past, community spirit has increased in many villages due to improved material conditions. Corruption levels have decreased, but doubts remain about the inner workings of some of the most successful farm businesses.

In aggregate terms, people in the region are better off than at the beginning of the millennium – but improvements to aggregate welfare have not reached everybody equally, and natural capital has paid a high price.

Scenario 2: “Our land, their wealth”

The business environment in Europe is very favorable: There is high demand both for agricultural and forest products, as well as for tourism. However, local conditions in Southern Transylvania are in stark contrast to the larger-scale context. For decades, Southern Transylvania has been trapped in conditions of community fragmentation, poor infrastructure, and corruption.

Owing to low social capital and poverty, the people in Southern Transylvania are unable to capitalize on the opportunities provided by global market settings. Both national and local governments are failing to support the development of markets and necessary infrastructure that would benefit smallholder farmers. Yet, the region’s natural capital does not go entirely unnoticed: Romanians from outside Transylvania and foreigners increasingly move into the area to set up large businesses focusing on forestry and agriculture. Where regulations stand in the way of development, corruption usually finds a way around these obstacles – as a result, forest exploitation is now characterized by intensive clearcuts, and industrial-style farms controlled by foreign companies occupy most of the larger valleys (referred to as “land grabbing” by some locals).

In some remote villages, land use has not intensified. In some locations, subsistence agriculture continues to exist, and some locals have found viable economic niches to produce specialty products such as goat cheese and honey. In other locations, much of the land has been abandoned. Regrowth forest is expanding into these areas.

Tourism has mostly disappeared, or it is controlled by foreigners. Most of the cultural heritage is in poor shape, and natural heritage is rapidly deteriorating. Whoever is capable of leaving the region – even for poorly paid seasonal work in other countries – does not hesitate to go. The people remaining are mainly the elderly and the very poor, including many Roma. Community spirit is declining and many traditional cultural values are being lost.

While ecosystems were once rich in biodiversity, many species have declined over the last few decades. Only the most remote villages still feature the species that Transylvania once was famous for among naturalists. With deteriorating ecosystem integrity, many of nature’s services have also taken a heavy toll – for example, fountain water is no longer safe for consumption, some of the steeper logged areas are rapidly eroding, and intense runoff after heavy rainfall occasionally causes flooding.

Overall, local people have suffered and the traditional landscape character has been lost. Only few individuals, mostly from outside the local area, have benefited from the developments.

Scenario 3: “Balance brings beauty”

Demand for environmentally friendly practices was already high in Western Europe, when in 2020, France narrowly avoided a major nuclear accident. This event precipitated rapid political changes throughout the European Union (EU). Social justice and ecological sustainability were adopted as guiding principles underpinning all EU regulations. Unlike its predecessor, the latest reform of the Common Agricultural Policy brought about fundamental changes, and is considered worldwide as a milestone towards sustainable development. Subsidies are now strongly focused on organic farming, available only to associations of farmers who can demonstrate a holistic, landscape-scale vision for sustainable resource use.

Romania’s education system improved substantially over the past few decades, enabling many locals in southern Transylvania to access the new EU subsidies for sustainable farming. Farms continue to be relatively small, but almost all farmers are now part of agricultural associations and practice modern organic farming, growing a variety of crops.

The forestry sector has also changed. Demand for wood products is high, but the majority of Romania’s forestry sector is based on sustainable, low-intensity harvesting. Moreover, forest regrowth rates have increased substantially. While few forested areas remain untouched, Romania’s forest estate is managed according to the best available science.

Farmland and forest biodiversity initially declined when land use was upgraded to modern organic practices, but the losses were relatively minor. Water from the fountains is just as clean as it was decades ago, and continues to be favored as the cheapest source of drinking water in many villages.

A vibrant rural tourism industry has developed in the most scenic villages. Guesthouses are common, as are cafes and traditional festivals. Local people are proud that their cultural and natural heritage is attracting tourists from all over Europe.

Few people in the region are rich in monetary terms, but hardly anybody is suffering from poverty. People coped well with the recent drought, and are largely immune to the fluctuations in agricultural commodity prices that recently shook many farmers in Western Europe. Ethnic divides have all but disappeared, partly aided by common visits by foreigners and increasing openness towards different cultures. A healthy service industry is developing in addition to the most important income sectors, namely agriculture, forestry and tourism. While many young

locals leave the region for a while, many of them come back because they are attracted by the lifestyle and scenic beauty in their home region.

Scenario 4: “Missed opportunity”

The latest reform of the Common Agricultural Policy provides major subsidies for organic farming across Europe. Minimum size requirements of agricultural parcels can be met by forming farmer associations.

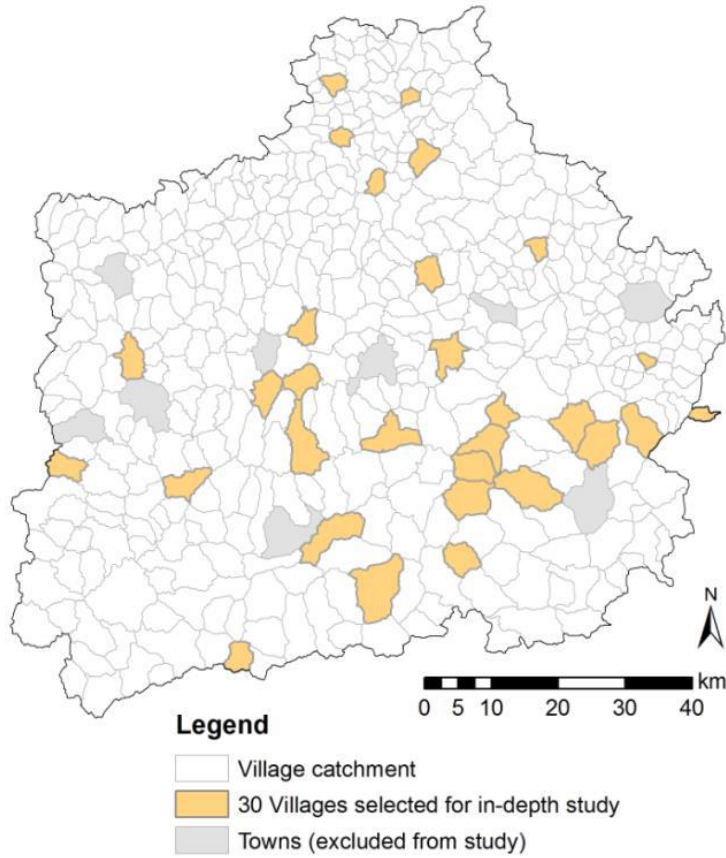
However, only few communities are able to capitalize on this opportunity, despite all relevant information being readily available via standard technologies such as the internet. Many villages are caught up in a vicious cycle of poverty, conflict and corruption. In these villages, a long history of mistrust, conflict, and crime stands in the way of the formation of farmer associations.

Yet, the productive soils and ready availability of cheap labor do not go unnoticed internationally. Increasingly, western European entrepreneurs see opportunities in being able to buy Transylvanian land and start large organic farm businesses, drawing on substantial EU subsidies in the process. These farms create some employment opportunities for local villagers, but primarily favor skilled workers who are able to operate modern machinery. To meet this demand for skilled labor, vocational training opportunities have increased.

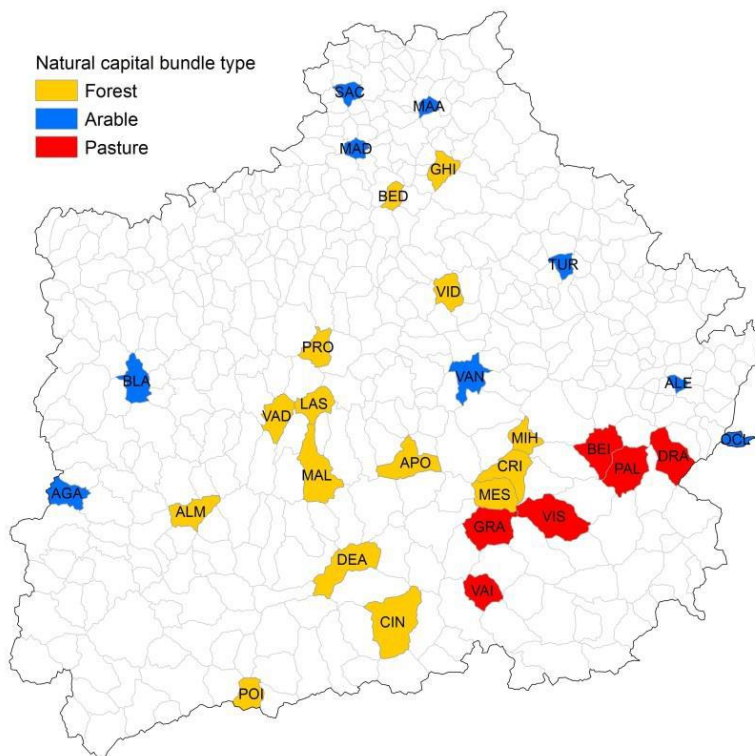
Under new EU regulations, large parts of the forest estate are formally protected. Commercial forestry operations are led by a small number of international companies. Antilogging regulations are being actively enforced in large parts of Southern Transylvania, but some illegal logging continues – driven by corrupt local governments turning a blind eye to illegal operations, and by locals who prefer to take a risk rather than pay for their firewood.

The population of Southern Transylvania is declining. Many remote villages are almost entirely abandoned, or comprise only poor households practicing subsistence agriculture. Around abandoned villages, pastures are overgrowing and turning into regrowth forest.

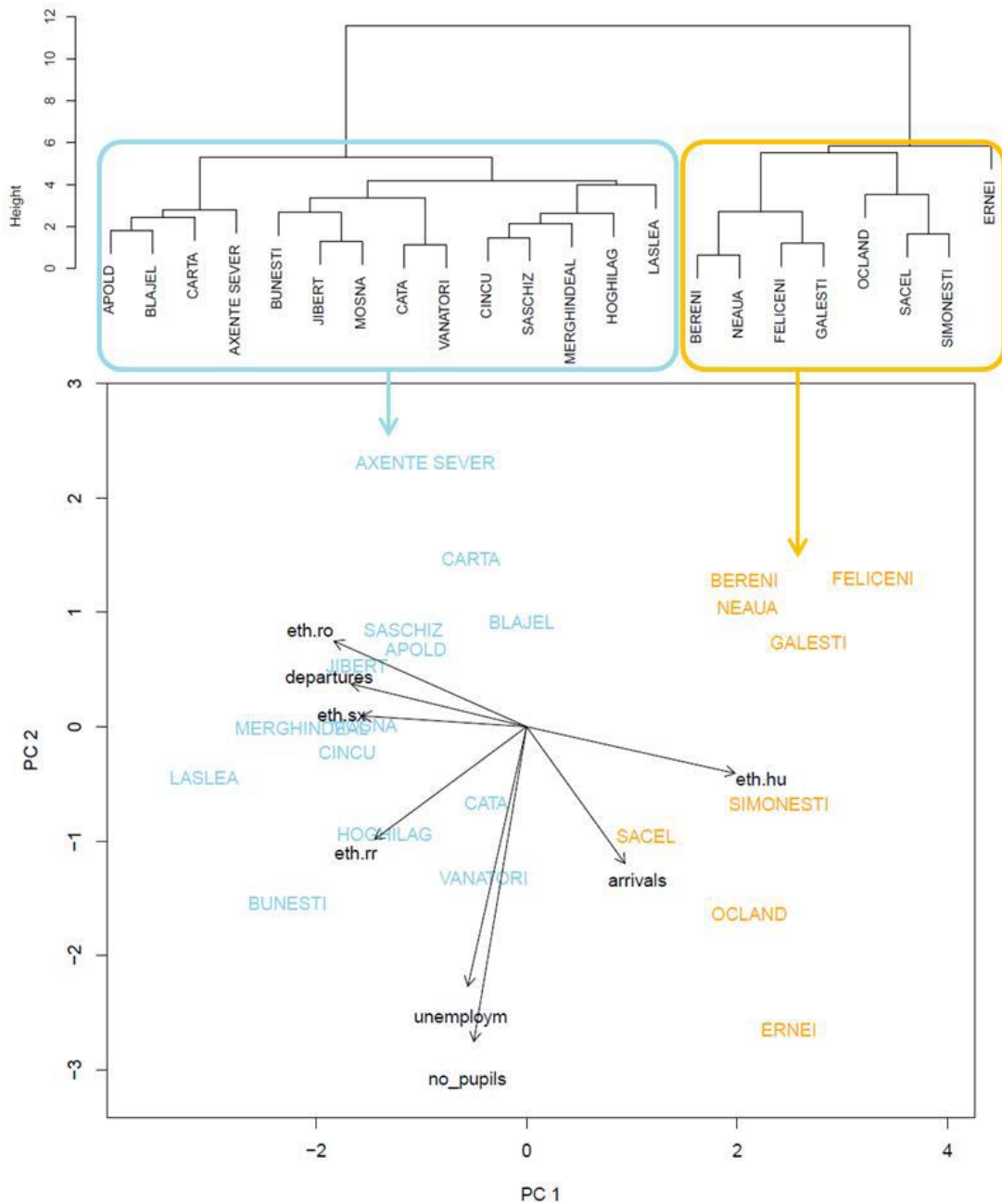
Farmland biodiversity is declining where large organic farms have simplified the landscape. However, in less suitable areas, subsistence agriculture remains and continues to provide a stronghold for farmland species that are threatened with extinction elsewhere in Europe. If it was not for the free services provided by nature – clean water and plenty of food – many Transylvanians would be in serious trouble. As it stands, many are poor, but not lacking the essentials they need for survival.



Appendix Fig. A1.1. A subset of 30 villages was selected for in-depth characterization of local village conditions. Villages were chosen randomly within pre-defined strata relating to their protection status under EU Natura 2000 regulations and terrain ruggedness.



Appendix Fig. A1.2. Statistical classification of the 30 focal villages according to their natural capital assets. The three village types (forest – yellow, arable - blue, pasture - red) were derived from agglomerative cluster analysis (see Fig. 3).



Appendix Fig. A1.3. Structure of demographic and socio-economic data of the 22 communes in which the 30 focal villages were located. The figure shows the results of an agglomerative cluster analysis (upper panel; Wards method on Euclidean distances; agglomerative coefficient: 0.83) and a centered principal components analysis (lower panel; all variables scaled; explained variance of the first axis: 46 %; and of the second axis: 19 %). Two main groups of villages, relating to dominant ethnicity, are apparent. (Abbreviations: eth.ro – proportion of Romanians [%]; eth.hu – proportion of Hungarians [%]; eth.rr – proportion of Roma [%]; eth.sx – proportion of Saxons [%]; unemploy – unemployment rate; no_pupils – number of pupils; arrivals – number of people arriving relative to total number of people in a commune; departures – number of people departing relative to total number of people in a commune).

Appendix Table A1.1. List and detailed description of variables used to describe local characteristics. Asterisks indicate variables that were assessed for the whole study area. All other variables were additionally used for an in-depth description of the random subset of 30 villages.

Ecological variables	Description
Arable*	Proportion of arable land (all non-permanent crops according to Corine 2006 Land Cover Map (EEA 2006)) relative to total village area as a proxy for the potential to generate food and other agricultural products.
Pasture*	Proportion of pastures according to Corine 2006 relative to total village area as a proxy for the potential to generate milk, cheese, meat, and wool.
Forest*	Proportion of forest according to Corine 2006 relative to total village area as a proxy for the potential to obtain timber, firewood and non-timber products, but also non-provisioning services like flood protection and water purification
Orchards	Proportion of orchards according to Corine 2006 relative to total village area as a proxy for the potential to grow fruit.
Scenic beauty	Expressed as a village ranking based on a scoring system that was informed by our personal experience in the field and stakeholder discussions. The score of a given village was the sum of individual scores derived from forest cover (village belongs to the lower tercile, i.e. has low forest cover: -1; village belongs to the upper tercile, i.e. has a high forest cover: +1), terrain ruggedness (lower tercile: -1, upper tercile: +1), landscape heterogeneity (lower tercile: -1, upper tercile: +1), presence of fortified churches or castles (+1) and the presence of major roads (-1).
Hunting	To estimate utility as a hunting area, we extracted the estimated population sizes of red deer, roe deer, boar and hare between 2001 and 2010 from official sources (http://www.mmediu.ro/paduri/vanatoare.htm), normalized the data to unit area and ranked the villages according to the relative total count of hunted individuals per unit area.
Carbon stocks	Carbon stocks were derived by calculating an average amount of carbon (aboveground, belowground, soil) per ha and per land cover type (arable, pasture, forest) and subsequently calculating the total carbon stock per catchment. Information on carbon concentration was derived from the IPCC (IPCC 2006).
Farmland biodiversity	Farmland biodiversity was estimated as the number of plant, butterfly, and bird species in 1 ha grid cells in the farmland of each village catchment based on field data, and was then averaged to the village catchment. The estimate per grid cell was based on field surveys in 120 circular 1 ha sites (2 sites in pasture and 2 in arable in each of the 30 villages) during spring and summer of 2012. Within a given village catchment, survey sites were chosen using stratified random selection. Stratification was performed by fully covering gradients in landscape heterogeneity (measured as the variation in the panchromatic channel of SPOT 5 satellite imagery (CNES 2007, Distribution Spot Image SA) in a 1 ha circle) and amount of woody vegetation (derived by a supervised classifications of the monochromatic channels of SPOT 5 data using a support vector machine algorithm, Huang et al. 2002). Plant surveys were conducted in spring/summer 2012 using eight randomly selected 1 m ² squares within each 1 ha site, and noting all present species. Butterfly richness was estimated by conducting four standard Pollard walks (Pollard & Yates 1993) of 50 m length within a given site, repeated at four different times during spring/summer 2012. Bird richness was estimated by conducting three 10 min point counts within each site in spring 2012. All singing males were recorded. The richness estimates thus obtained for each of 120 sites for each group were modelled in response to percent woody vegetation and heterogeneity within the site as predictor variables in linear models (using linear and quadratic terms as predictors). Based on these models we predicted the richness of the different groups for the whole farmland area of the catchments,

excluding areas outside of the calibration range of the independent variables. We calculated the averaged richness for each taxonomic group for each of the 30 village catchments. Finally, to visualize the relative level of farmland biodiversity in a given village, we ranked villages according to their average rank of the richness in each of the three groups.

Pollinator abundance
Pollinator abundance was assessed by counting pollinating insects in 2 m wide and 200 m long transects within a subset of 76 of the 120 1 ha sites described above. Each site was sampled three times for 20 min periods between May and July 2012. The total number of individuals from all relevant groups of pollinators (honeybees, wild bees, bumblebees, hoverflies, and butterflies) was modelled as for biodiversity to obtain an index of pollinator abundance for each village catchment.

Social variables	Description
Ethnic groups*	Proportion of the main ethnic groups (Romanians, Hungarians, Roma and Saxons) relative to the total population in a given commune in 2010 as derived from the National Institute for Statistics (Institutul Național de Statistică; data received 6 February 2012).
Unemployment rate	Proportion of people unemployed relative to the total population in a given commune in 2010 (source: see ethnic groups).
Arrivals	Proportion of people arriving in a given commune between 1995 and 2005 relative to the total population in a given commune in 2010 (source same as ethnic groups).
Departures	Proportion of people departing in a given commune between 2005 and 2010 relative to the total population in a given commune in 2010 (source: see ethnic groups).
Pupils	Number of registered pupils relative to the total population size in a given commune in 2010 (source: see ethnic groups).
Additional variables	Description
Village area*	Built up area per village catchment according to Corine 2006 Land Cover Map (EEA 2006).
Isolation*	Isolation from the nearest town was estimated as the travel time by car to the next town with >20 000 inhabitants, distinguishing between four different types of road for all villages in the study area.
Ruggedness*	Terrain ruggedness was calculated as the standard deviation of altitude from ASTER GDEM v2 within a given catchment.

Appendix Table A1.2. Scores describing how variables of regional system dynamics relate to certain local village condition. Values represent reasonable and consistent trends that were mentioned in the stakeholder workshops.

Driver	Description of driver	Intensification	Abandonment	Forest exploitation	Tourism	Local economy	Social capital	Emigration	Influence of foreigners
Proportion of Roma	high: upper third		+1	+1		-1	-1		
Proportion of Hungarians	high: upper third	+1				+1	+1		
Isolation	high	-1	+1		0	-1	+1		
	medium	0	0		+1	0	+0.5		
	low	+1	-1		0	+1	0		
Village size	small	-1	+1	0	+1	-1	+1	+1	
	medium	0	0	+0.5	+0.5	0	+0.5	+0.5	
	large	+1	-1	+1	0	+1	0	0	
Ruggedness	low	+1	-1		0		0		
	medium	0	0		+0.5		+0.5		
Proportion of arable land	high	-1	+1		+1		+1		
	upper third	+1				+1			+1
Proportion of pasture land	high: upper third	+1			+1				
Proportion of forest	high: upper third			+1	+1				

Appendix Table A1.3. Scores describing how trends in variables of regional system dynamics are expected to change under the four different scenarios. Values are based on the relative changes as described in the scenario narratives. Possible changes are: strong dampening (-3); intermediate dampening (-2); weak dampening (-1); no change (0); weak amplification (+1); intermediate amplification (+2); strong amplification (+3).

Scenarios	Intensification	Abandonment	Forest exploitation	Tourism	Local economy	Social capital	Emigration	Influence of foreigners
Prosperity through growth	+3	-2	+2	+1	+3	+1	+1	0
Our land, their wealth	+3	+1	+3	-2	0	-1	+3	+3
Balance	+2	-1	-1	+2	+1	+3	-2	0

**brings
beauty**

**Missed
opportunity**

+1 +2 +1 -1 0 -1 +2 +1

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Appendix IV

Who benefits? Power struggles around forest resources in post-socialist Romania

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Manuscript

ABSTRACT

Decentralized natural resource management is advocated as a means to empower local resource users and to improve resource conservation. This paper qualitatively examines the state of forestry decentralization in Southern Transylvania (Romania), a process which has been accompanied by profound land restitution reforms after the collapse of socialism. Based on a stakeholder analysis and in-depth interviews in three villages with predominantly public forest regimes, we explore the distribution of powers, benefits, and interests in relation to the forest. The paper elicits diverse mechanisms through which the State forest administration could retain control over the resource. It further finds that both the politico-historical context and the social structures in which the Romanian forest regime is embedded more strongly influence environmental and social outcomes than legally granted property rights. While the devolution of forest management and control rights to local level actors may increase local participation and the powers of forest users, we find that decentralization can be challenging in settings characterized by low social capital and low trust in decision makers.

Keywords: access, benefits, decentralization, forest, power, restitution, Romania, socialism, transition

INTRODUCTION

Forests are the ‘lungs’ of the globe, providing oxygen and sequestering carbon from the atmosphere (e.g. Cesaro, Gatto, & Pettenella, 2008). They also provide a wide range of cultural values and economic benefits, such as timber and non-timber forest products (Bouriaud and Schmithüsen, 2005; Lwanga Namubiru, 2002). However, despite national agendas for sustainable forest management (Bouriaud, 2005; Elbakidze et al., 2010) and climate change mitigation programs such as REDD+ (Gupta, 2012; Kanowski et al., 2011), global forest cover is disappearing at alarming rates (Forest Trends, 2014; Sunderlin et al., 2005).

A vast body of research has addressed the drivers of forest loss (e.g. Rudel, 2007; Rudel et al., 2005; Knorn et al., 2012). Institutional factors and analyses of appropriate forest governance have thereby been central to work (e.g. Agrawal, 2007; Chhatre and Agrawal, 2008). Proponents of classical common property theory have focused on the ‘common-pool’ nature of forest resources, including the extractability of, and rivalry around timber and non-timber forest products which is costly to control (e.g. Ostrom, 1999), as well as the rights and duties of resource owners (Bromley, 1992; Schlager and Ostrom, 1992). Governance theorists, in contrast, have challenged the focus on property rights – commonly understood as the socially acknowledged and supported claims (by law or custom) over a natural resource (von Benda-Beckmann et al., 2006) – and have instead emphasized the role of powers that govern access to a

resource (Ribot and Peluso, 2003; Sikor and Lund, 2009). Such powers relate to a wide range of formal and informal mechanisms as well as the social relations that affect people's ability to access a resource (Dandy et al., 2014; Ribot and Peluso, 2003).

The notions of power and access are particularly relevant in debates around the decentralization of natural resource management (Clement, 2010; Colfer and Capistrano, 2005). Decentralization typically describes the formal transfer of powers from a central authority to institutions and actors at lower levels in a territorial-administrative hierarchy (Ribot, 2002; Ribot et al., 2006). Because local institutions are potentially more acquainted with local needs and have better access to place-specific information, the political and legal process of decentralization could increase the responsiveness of local governments to citizen demands, and may empower people through local democratic representation (Agrawal and Ribot, 1999; Larson, 2003). Successful resource management often hinges on the support of local stakeholders (Andersson, 2006; Macdonald et al., 2013). For this reason, decentralization has been considered a promising approach by international development agencies, and may contribute to better resource conservation (Larson and Soto, 2008) as well as to poverty alleviation (Sunderlin et al., 2005; Tacconi, 2007).

Despite the potential benefits of decentralization, various studies have revealed that 'real' decentralization has been rare and may only be successful if it goes hand in hand with the devolution of discretionary powers to local governments – that is, the autonomy to exercise powers in a way that matches local needs (Ribot, 2004; Tacconi, 2007). Moreover, successful decentralization often requires the improvement of livelihoods of poorer forest users (Larson et al., 2007) and a bottom-up mobilization of local (non-State) actors (Larson, 2004, 2003). To date, the primary focus of research on decentralized forest management has been on tropical forests, while other forested areas have received less attention. This is particularly the case for the transition economies of Central and Eastern Europe (CEE).

Since the breakdown of socialism in 1989, CEE countries have faced profound socio-economic and institutional changes (Grabbe, 2001; Kluvánková-Oravská et al., 2009). The transition towards democratic and free market-oriented economies required, among others, market liberalization, administrative and constitutional reform, decentralization, and the restitution of agricultural and forest land to pre-World War II owners (Ioras and Abrudan, 2006; Spendzharova and Vachudova, 2012). In consequence, the relationships among, and powers of the various actors constituting the State were altered, thus challenging the role and authority of national governments (Bache, 2010; Sikor et al., 2009). Because the control over access and use of natural resources constitutes one of the main traditional powers of State actors in CEE (Sikor and Lund, 2009; Sikor et al., 2009), the processes of decentralization, restitution, and

privatization of forest resources have created a new ‘web of actors’ (Ribot and Peluso, 2003). These actors, in turn, are likely to have conflicting claims and powers over the forest. Because forest management has both political and economic dimensions, and therefore can be highly contested, the potential for conflict among actors is high (Larson and Soto, 2008). To understand this new *mélange* of actors and their claims, as well as potential social and environmental outcomes, empirical evidence from the local level is needed.

In this paper, we focus on Southern Transylvania (Romania), a region in the foothills of the Carpathian Mountains. Southern Transylvania contains some of Europe’s most biodiverse cultural landscapes and mixed forests, harboring endemic flora, and viable populations of threatened large carnivores such as the European brown bear (*Ursus arctos*) (Dorresteijn et al., 2014; Roellig et al., 2014). For this reason, large parts of Southern Transylvania have been designated as Natura 2000 ‘Special Protection Areas’ (EC, 2009) and ‘Sites of Community Importance’ (EC, 1992) following Romania’s accession to the European Union in 2007 (Mikulcak et al., 2013; Stancioiu et al., 2010). The landscapes of Southern Transylvania have historically been shaped by tight interactions between rural inhabitants and local ecosystems (Akeroyd and Page, 2006; Fischer et al., 2012b), particularly by Saxons who dominated land and forest use until the nationalization of both resources in 1948 (Abrudan, 2012; Schuller, 1895). The gradual outmigration of Saxons, both during communism and especially after its collapse, and the immigration of other ethnicities such as Roma and Hungarians led to a reconfiguration of natural resource users (Hanspach et al., 2014; Milcu et al., 2014). After the collapse of communism in 1989, Romania initiated a comprehensive restitution and decentralization process, which has caused changes in forest ownership and administration (Abrudan, 2012; Kuemmerle et al., 2009; Stancioiu et al., 2010). Due to the high prevalence of semi-subsistence livelihoods in Southern Transylvania, the inhabitants of Southern Transylvania are highly dependent on natural resources (Hartel et al., 2014; Mikulcak et al., 2015). In light of structural poverty, high unemployment rates and high gas prices, firewood is the primary source of household energy for most rural dwellers (Bouriaud and Marzano, 2014; Hartel et al., 2014). At the same time, the rising international value of timber has sparked competition around Romania’s forests (Bouriaud, 2005; Knorn et al., 2012b; Kuemmerle et al., 2009).

The aim of this paper is to examine the current state of forestry decentralization in Southern Transylvania. To this end, we conducted semi-structured interviews and a stakeholder analysis in three villages with predominantly public forest property regimes (Bouriaud and Schmithüsen, 2005). Stakeholder analysis refers to a range of tools to understand a system and to identify key actors (Mushove and Vogel, 2005). It is useful to conceive (1) *who* has a stake in a natural resource, (2) the *nature* of each respective stake, and (3) *how* stakeholders interact (Reed et al., 2009). Only by understanding the web of actors, stakes and powers, as well as their effects on

social and environmental outcomes, all stakeholders (including potentially marginalized ones) can be meaningfully involved in forest management (Macdonald et al., 2013). Our paper reveals an unequal distribution of powers between State actors and forest users, and identifies various mechanisms that hamper further decentralization. We discuss possible adjustments to Romanian forest policy which may help to ensure that a wider range of stakeholders is able to benefit from forests.

BACKGROUND: Forest management in Romania

Romania possesses some of Europe's last tracts of primary old-growth forests. These are particularly species-rich and hence valuable for biodiversity conservation (Knorn et al., 2012a; Kuemmerle et al., 2009). Forestry in Romania has a long tradition, and is based on the principles of sustained timber yields and multi-functionality, that is, the simultaneous provision of multiple services and goods (Cesaro et al., 2008). Total forest cover has been relatively stable over the past century (Abrudan et al., 2009; Sandulescu et al., 2007). From the early 1990s until approximately 2001, however, illegal logging severely increased (Bouriaud and Marzano, 2014; Nichiforel and Schanz, 2011). This was attributed to an ill-enforced forest restitution process starting in 1991, which resulted in widespread tenure insecurity, the creation of black markets for wood, and over-harvesting by newly restituted private forest owners (Bouriaud, 2005; World Bank, 2007).

With three main phases of land restitution, Romania's forestry sector was subject to profound reforms that aimed at separating ownership, management and regulatory functions – which previously had been performed exclusively by the State (Nichiforel and Schanz, 2011; World Bank, 2005). While the first two restitution laws (18/1991 and 1/2000) contained certain limits to size, location and types of forests to be restituted, law 247/2005 aimed at restituting all nationalized forest to its pre-1948 owners (Abrudan et al., 2009). In consequence, the public forest estate was reduced by 50 percent, while about 830.000 new forest owners were created, challenging the management capacity of public institutions (World Bank, 2011). Notably, the restitution process began without an established institutional framework, because the first post-Socialist Forestry Code was only established in 1996, and specific rules for the management of private forests were adapted only in 2000 (Nichiforel and Schanz, 2011).

Based on the current Forestry Code (law 46/2008, Parliament of Romania, 2008), the management of public forests owned by the State is performed by the National Forest Administration (NFA or *Regia Națională a Pădurilor, RNP*) Romsilva, an autonomous agency under the authority of the Ministry of Environment, Water and Forests (Government of Romania, 2009). Romsilva is hierarchically structured into forest directorates (*direcție silvice*) at

the county level, and forest districts (*ocoale silvice*) at the local level (Government of Romania, 2009). It is primarily responsible for the management of today's 3.3 million hectares of State forest (World Bank 2011). Because every forest owner is obliged to set up a 10-year forest management plan that needs approval by the Ministry of Environment (Parliament of Romania, 2008), and to contract a forest guard against timber theft (Nichiforel and Schanz, 2011), Romsilva administers an additional one million hectares of private and municipal forestland (World Bank, 2011). Large-scale forest owners (individuals, associations of individual owners, or local municipalities) can establish private forest districts whose structure is similar to the NFA, and which need to respect the same forest legislation (Lawrence and Szabo, 2005; Stancioiu et al., 2010). Regional Forestry Inspectorates (*Inspectoratele Teritoriale de Regim silvic și de Vânătoare*, ITRSV), as part of the Ministry of Environment, control the compliance of forest management – irrespective of ownership type – with the multitude of national and subsidiary legislation, technical norms, and forest management plans (Abrudan et al., 2009).

According to the Forestry Code (Parliament of Romania, 2008), forest is divided into four categories: (1) public property of the State; (2) public property of 'administrative territorial units' such as villages or towns ('municipal property'); (3) private property of forest communities (*obște*); and (4) private property of physical persons and legal entities such as churches or schools.

METHODOLOGY

Based on an in-depth literature review, we designed a semi-structured and in-person questionnaire as well as a preliminary checklist of potentially relevant forest stakeholders in Southern Transylvania. Stakeholders can generally be defined as any individual or group that affects or is affected by a policy, decision, or the state of a natural resource (Reed et al., 2009). Three case study villages were then selected, based on two criteria. First, using a land cover map (Hanspach et al., 2014), we searched for forested villages in the vicinity of Sighisoara, a central town in Southern Transylvania. Second, we asked local project partners for communes (i.e. the lowest administrative unit, comprising several villages) with predominantly public forest property regimes to guarantee comparability in terms of forestry decentralization and power distribution across stakeholders. To grant our interview partners full anonymity, as agreed upon during an ethics statement prior to each interview, we renamed the selected villages into A, B, and C (Table 1).

Table 1. Overview of study villages, including their forest ownership and forest management status.

	Village A	Village B	Village C
Size of commune (no. inhabitants)	3250	3260	2300
Interviewees per village	14	12	9
Forest ownership	Predominantly public property of the State and of the local territorial-administrative unit (municipality). A minor area is the private property of churches and physical persons.	Public property of the State and of the local territorial-administrative unit (municipality). No private property by individual owners or churches.	Public property of the local territorial-administrative unit (municipality). A minor area is the private property of churches. No individual owners.
Forest management	All public (State and municipal) as well as privately owned forest is managed by a local forest district (<i>ocol silvic</i>) of the NFA Romsilva	All public (State and municipal) forestland is managed by a local forest district (<i>ocol silvic</i>) of the NFA Romsilva	Municipal and church-owned forestland is managed by a private forest district (PFD).

Sources: Statements of interviewees; Population census of 2012 (Institutul Național de Statistică, 2012)

Based on our initial inventory of stakeholders, we selected the first interview partners, and subsequently used a combination of snow-ball sampling, expert opinion, and interest-influence matrices (explained below) to identify a total of 39 stakeholders for semi-structured interviews (Reed et al. 2009). Notably, our sample is not extensive because it did not include the full variety of forest-related actors, such as research bodies or trade associations (e.g. Nichiforel, 2011). Yet, by relying on local expert opinion we are confident that we included the most important actors. Interviews addressed (1) past and present forest ownership, management, and sanctioning mechanisms; (2) perceptions of the ecological forest state, its development, and its future; (3) services and benefits derived from forests; (4) relationships between different actors, and perceptions of powers and interests; and (5) potential barriers to (personal/ community) involvement in forest management.

Each of these topics was discussed for approximately 15 to 20 minutes. Interviewees were free to reflect on the topics they were most interested in (Willis, 2006). We did not ask directly for sensitive issues such as potential mechanisms to exert or retain power, but relevant information emerged naturally. All interviews were conducted in Romanian (by A. I. Milcu) and recorded upon the interviewees' consent. Because there were no publicly accessible data at the communal level regarding the state of restitution or forest management plans, we could not triangulate our

information, but needed to rely on the statements of our interviewees. Moreover, four interviewees lived in Sighisoara. These individuals did not deliver details regarding our three study villages, but provided us with background information on forest management in general, and were included in the analysis of stakes in the forest resource.

As part of each interview, interviewees completed interest-influence matrices to identify further stakeholders, and to elicit their powers and interests (Murray-Webster and Simon, 2006). For simplicity, we divided action arenas around the forest resource into two extremes, namely ‘conservation’ and ‘exploitation’. Stakeholders were asked to place themselves, as well as other stakeholders they identified, on four axes, each ranging from 0 (lowest) to 10 (highest): power to exploit the forest; interest to exploit the forest; power to conserve the forest; and interest to conserve the forest. Here, ‘power’ represented a stakeholder’s ability to influence the conservation or exploitation of the forest, relative to other stakeholders (Murray-Webster and Simon, 2006; Ribot and Peluso, 2003). ‘Interest’ represented the willingness of a stakeholder to actively engage in forest conservation or exploitation (Murray-Webster and Simon, 2006).

Interviews were translated into English, transcribed, coded, and explored using the software NVivo QSR. Data from our interest-influence matrices was analyzed by averaging the rankings ascribed to each stakeholder group per village. Information was then converted into tables indicating the power-interest distribution in terms of forest conservation and exploitation of each stakeholder category as low (+), medium (++), or high (+++) (see Supplementary Material for details).

Next, we sought to complement our understanding of powers and interests in relation to forests with an understanding of the actual stakes of different actors. To this end, we clustered the interviewees’ answers related to the third topic covered during our interviews, namely the benefits they derived from forests, along an ecosystem service ‘coding matrix’ (Macdonald et al., 2013). In line with the Millennium Ecosystem Assessment (MA, 2005), we divided ecosystem services into *provisioning* services, *regulating* services, *cultural* services, and *supporting* services. We then calculated (1) the ten most mentioned ecosystem services across all interviewees; and (2) a ranking of ecosystem service categories per stakeholder group (see Supplementary Material for details).

We present our results in two sections. In the first section, we introduce relevant stakeholders, and explain how they were grouped into categories. We further summarize findings from the power-interest matrices and assessments of ecosystem services. In the second section, we describe how power-interest dynamics play out differently in our three study villages. This description draws exclusively on the perceptions of interviewees, and is guided by a narrative

framework to compare the three study villages. This narrative first describes the state of forest restitution and forestry decentralization. We then present interviewees’ perceptions about the ecological state of the forest, as well as perceived reasons for this state, potential conflicts, and expectations for the future. This, in turn, leads to a narrative of the perceived relationships among stakeholders. Finally, we present perceptions about current forest management and beneficiaries, as well as suggestions for improvements.

RESULTS

Overview of stakeholder groups

Interviewees identified a variety of stakeholders, some of whom were clustered into groups (Table 2). For instance, many interviewees separated the National Forest Administration (NFA) Romsilva or, in case of village C, the Private Forest District along its administrative hierarchy (Background section). Because all of the thus mentioned actors were involved in forest administration, and had decision-making power, we grouped them together into the category “forest official”. However, although the forest ranger is employed by the forest administration, he implements administrative decisions at the local level, physically managing the forest. Thus, we treated this stakeholder separately from the administration. Besides, some interviewees mentioned the town hall as a separate entity from the Local Council, but most grouped these. In theory, the town hall has no jurisdiction and puts into practice what the Local Council, the deliberative authority, decides. However, because the mayor is a member of the Local Council, we grouped both in the category “local administration”.

Table 2. Overview and definition of forest stakeholder groups in Southern Transylvania. Stakeholders in *italics* were mentioned during the stakeholder analysis, but were not interviewed.

Stakeholder group	Definition
Church	Legal entity owning forest. Stakeholders include members of the Evangelic or Catholic church.
Exploitation	Representative of a wood company (processing or transport), an individual cutting wood on a contractual basis, or a charcoal maker.
Forest official	Includes employees of the National Forest Administration (NFA) Romsilva or a private forest administration structure, and their branches at the regional and communal levels.
Forest user	Villager who is neither a private forest owner, nor a forest worker (exploiter). Includes Romanians, Hungarians, and Roma. Villagers usually receive purchase vouchers by the local ranger to buy wood (for heating or construction).
Hunter	Usually a member of the hunting association who can obtain game management rights from private forest owners, or through public auctions for State forests.
<i>ITRSV</i>	Regionally based forestry inspectorate. Controls the compliance of forest management plans and exploitation with national law.

Local administration	Includes representatives of the town hall (vice-mayor, mayor, and staff) and of the local council. The local administration can, among others, determine the wood price at the local level, and influence forest management.
NGO	Individual working for a non-governmental organization dealing with nature conservation
Police	Employee of the traffic police or county police, with the right to control logging permits (for economic agents) or wood vouchers (granted to forest users to obtain wood).
Private owner	Individual privately owning forest.
Ranger	Rangers operate at the lowest forest management unit, the ‘canton’, and are supervised by the brigadier, the head of a forest district.
<i>Wood thieves</i>	Individuals believed to illegally log trees, typically referring to people from marginalized social groups.

Power-Interest rationales

Our analysis of the power-interest distribution showed substantial variation across the three study villages (Table 3). While the National Forest Administration (NFA) Romsilva and the Private Forest District (PFD) were considered the most powerful and interested actors to conserve the forest in villages B and C, Romsilva was considered less interested in village A (Table S2). In all three villages, the local administration, police, and rangers were perceived as most powerful and interested in forest conservation. Wood thieves, in contrast, were considered least interested in conservation in villages A and C, but least powerful at the same time. Interestingly, while in villages A and C non-government organizations were deemed powerful in terms of forest conservation, there was no mention of NGOs in village B. Instead, hunters and private owners were perceived as having the power to protect the local forest. Only in Village C, forest users were considered to have the power to conserve the forest.

Table 3. Overview of powers and interests to exploit and conserve forest resources in three study villages of Southern Transylvania.

	High power, high interest	Little power, little interest	Medium power, high interest	Medium power, medium interest
Conservation				
Village A	Church, Local administration, NGO, Police, Rangers	Wood thieves	Private owners	–
Village B	Hunters, Local administration, Police, Private owners, Romsilva	–	Church	Exploitation, Forest users, Wood thieves
Village C	Forest users,	Wood thieves	Church	Exploitation

	ITRSV, Local administration, NGO, Police, PFD, Rangers				
Exploitation					
Village A	Rangers, Romsilva	Police	Exploitation, Forest users, ITRSV	Church, Local administration, NGO, Wood thieves	
Village B	Private Owners, Romsilva	Church	Exploitation, Wood thieves	Hunters, Local administration, Police, Rangers	
Village C	Church	ITRSV, Police	Exploitation, Local administration, PFD, Wood thieves	Forest users, Rangers	

In terms of exploitation, most stakeholders were considered having medium power across all villages. While Romsilva was perceived most powerful and interested in forest exploitation in villages A and B, the private forest district (PFD) appeared to have only medium power in village C. Unlike in villages B and C, the ranger seemed influential in terms of exploitation in village A. Exploitation companies were considered as having high interest, but medium power in all three villages. Interestingly, private owners (individuals and church) were considered highly interested in forest exploitation in the villages B and C. The local administration was perceived as having medium power to influence exploitation in all three villages, but was considered highly interested in exploitation in village C, and medium interested in the other two villages.

Stakes to the forest expressed in terms of ecosystem services

Provisioning ecosystem services were most valued by all stakeholders combined (Table 4). Of these, firewood was considered a particularly important service (mentioned by n=35 out of 39 interviewees), and wood for construction was also frequently stated. Cultural ecosystem services emerged twice in the list of the most widely mentioned services, with the recreational value of forests being considered second most important (n=25). Two regulating services were among the ten most valued ones, namely, the regulation of air quality, and the protection against natural hazards such as torrents or landslides. Economic viability was mentioned as the single non-ecosystem service.

1. Provision of firewood (35)	Table 4. Forest ecosystem services most valued by all stakeholders combined, with (n) indicating the number of interviewees mentioning a given service (total n=39).
2. Recreation (25)	
3. Regulation of air quality (22)	
4. Economic viability (16)	
5. Provision of berries (14)	
5. Landscape aesthetics (14)	
7. Provision of mushrooms (12)	
8. Protection against natural hazards (11)	
9. Provision of wood for construction (10)	
10. Provision of fresh water (9)	

While all stakeholder groups alike mentioned the provision of firewood as a major ecosystem service, five stakeholder groups specifically underlined the economic value of forests, both in terms of the creation of (their) jobs, and the incomes derived from the sale of timber (Table 5). Hunters and private forest owners (church members and individuals) predominantly valued cultural aspects of the forest resource, whereas forest users strongly favored regulating services of the forest. Finally, the biodiversity value of forest resources was exclusively mentioned by NGO representatives.

Table 5. Most valued forest ecosystem services and benefits per stakeholder group.

Group	Description	Involved Stakeholders
“Biodiversity”	Beside the provision of firewood and berries, stakeholders focused on the biodiversity value of forests	NGO
“Culture”	Beside the provision of firewood, stakeholders favored recreational, spiritual, and aesthetic services provided by forests	Church, Hunters, Private owners
“Economic viability”	Beside the provision of firewood and recreational services, stakeholders mostly valued economic benefits derived from forests (i.e. income and jobs)	Local administration, Forest officials, Rangers, Exploitation, Police
“Regulation”	Beside the provision of firewood and	Forest users

berries, stakeholders mostly valued air quality, climate regulation, and the protection against natural hazards by forests

Perception of forestry decentralization as well as environmental and social outcomes

The forests of the three study villages were either the public property of the State and the local governments (Villages A and B), or of the local government alone (Village C) (Table 1). While the forests of villages A and B were managed by the National Forest Administration (NFA) Romsilva, the forest of village C was managed by a public forest district (PFD). In the following section, we show how differences in powers and interests of the identified stakeholder groups in relation to the forest resource play out differently across these villages.

Perceptions about the restitution process

Forest restitution in villages A and B started approximately in 1997/98 (I.1, I.11, I.25). While restitution appeared to still be ongoing in village A (I.31, I.35), largely due to slow bureaucracy (I.1), it was completed between 2006 and 2008 in village C (I.25, I.26, I.28). In village B, the local administration was restituted tracts of forest in 1995, and the remaining area around 2003 (I.16). In village A, interviewees complained that due to large-scale forest management during socialism, some restituted forest owners received land with no trees (I.10, I.14), only young trees (I.13), or “*in a very bad shape*” (I.12). While there were no complaints in village B, restitution apparently “*worked only partially*” (I.31) in the villages A and C. One forest owner of village A reported that “*many people got huge areas of land through illegal procedures*” (I.35). According to the vice-mayor of village C, the National Forest Administration (NFA) Romsilva extensively logged a vast area historically owned by the commune right before the property transfer took place (I.25). Finally, interviewees from villages A and B reported that many people (especially Saxons) did not claim the land they owned prior to nationalization (I.15), or sold it after emigrating (I.10). Unclaimed land apparently remained property of the State, and went under the administration of Romsilva (I.15).

Perception of restituted forest owners

While interviewees from village B were content with current forest management and would have considered a restitution to non-public owners a “*disaster*” (I.24), (individual and public) forest owners of village A complained about their lack of rights. Despite possessing land, they were not allowed to remove shrubs without permission (I.10), which was difficult to obtain (I.7). They further criticized the need for contracts with Romsilva for services such as marking trees or guarding the forest (I.1, I.3, I.5, I.7). Timber sales from private and municipal forests were

managed by Romsilva, but costs and revenues from wood sales were considered nontransparent (I.1, I.9). At the same time, timber sales were deemed a profitable source of income for the municipality (I.1, I.8). Although the local government of village A theoretically should be able to influence management goals for the municipal forest, and could oppose the forest management plan (I.1), local administrators complained that the municipality could be easily overruled by higher levels of government (I.8): *“It’s painful, but we can’t do anything. We have no competence”* (I.1). The local administration of both villages A and C started collaborating with a private forest district (PFD), but faced various obstacles through Romsilva. According to a local administrator, the forest of village A had to go back to State administration *“due to numerous controls”* (I.1). A forest official (I.9) and a ranger (I.13), in turn, reasoned that the PFD staff was insufficient and unqualified. According to the vice-mayor (I.25), village C managed to move under a private forest administration in 2002 after various conflicts over the budget plan with Romsilva. But, in line with statements from village A, it also has faced more frequent controls by the State since then (I.25-27). Yet, under the PFD administration, the local government of village C had more control over exploiting companies and the wood price; it could guarantee ‘non-stop supervision’ of the forest, and could keep larger shares from wood sales (I.25, I.31): *“Forest administration is the biggest source of income for the town hall”* (I.25). Besides, forest management was more transparent because all forest exploitation activities were announced on a public town hall board (I.25).

Perception of recent logging and the current forest state

When asked for the development of logging, interviewees from all villages reported a rapid increase immediately following the end of socialism (e.g. I.15, I.24, I.31, I.38), largely due to an *“institutional vacuum”* (I.9). Interviewees from villages A and B perceived a decrease in illegal logging from the mid-1990s (I.12, I.15, I.18, I.36.), but a recent increase in ‘legal logging’ (I.1, I.12, I.15, I.18, I.24) – even a *“drastic”* one in village A (I.4, I.12). Yet, 11 out of 12 interviewees from village B perceived no major change in the overall forest cover, and felt the forest was in a good condition. In contrast, 10 out of 14 interviewees from village A viewed the forest condition rapidly deteriorating. In village A, the only stakeholders considering the current forest state as good were the police, forest officials, and local administrators. In village C, opinions were mixed about the development of logging. Out of nine interviewees, four believed logging had increased, but an equal amount of respondents stated the opposite. Six considered the forest in a good state.

Perceptions about the drivers of logging, and the future of the local forest

Asked for the reasons of the changing state of the forest, half of the interviewees from village A (n=7) believed the forest was heavily logged or “*aggressively exploited*” (I.14), apparently authorized by forest officials and local authorities (e.g. I.4, I.7, I.8, I.10, I.12). Several logging companies in the area seemingly worked also weekends and at night (I.2, I.35, I.36). Heavy machinery was reported to cause damage to roads and houses, but owners were not compensated (I.2). While tree species were perceived less diverse (I.13) and birds less abundant (I.35), landslides appeared to be increasing: “*The hills are rolling over the people*” (I.8). Two interviewees explicitly spoke of a local “*wood mafia*” (I.12, I.14) collaborating with local and forest authorities as well as the police (I.1, I.2, I.35, I.36), in order to export wood (I.2). These stakeholders were apparently supported by “*middlemen*” (I.1, I.2) or high-ranking government officials: “*Absolutely everything here is controlled by politicians*” (I.1). Beside ‘criminal (authorized) exploitation’ (n=7), poverty (n=6), profit-orientation of authorities (n=4), and a lack of (obligatory) replantation after exploitation (n=6), interviewees also deemed timber theft by poor people (n=5), especially Roma, to cause forest degradation. At the same time, Roma were hired by richer villagers to transport wood (I.13, I.36), or to collect forest fruits for rangers (I.10). Apparently, Roma were also bribed by local authorities: “[*d*]uring the election campaign, they give free wood to the Roma so that they vote for them” (I.2). When asked for the forest future, only two interviewees predicted a stable forest cover, while eight expected a ‘massive loss’ or even ‘no more forest’.

In stark contrast to village A, 10 out of 12 interviewees from village B believed the exploitation of their local forest was reasonable and in line with the management plan (e.g. I.22, I.34). According to the ranger, exploitation was necessary because many old trees had reached their ‘cutting age’ (I.19). He believed that many people had a wrong perception: “*Whenever [villagers] see logging in the forest, they think people are stealing*” (I.19). According to a local administrator, wood theft occurred occasionally (I.16). Just like in village A, theft was largely ascribed to poorer villagers (n=5), in particular Roma people (n=2): “*There are very few sources of income, no production. It's a poor country*” (I.38). Several reasons for the relatively positive state of the forest were given, including that laws were respected by all stakeholders (I.16, I.22, I.23). Exploiting companies stuck to their “*cutting program*” (I.17), and the local administration employed workers to maintain the roads (I.19). Importantly, the ranger was born in village B and appeared to be “*well respected*” by everyone (I.16). Eleven out of 12 interviewees predicted no change; or even an improved forest state in the future.

Respondents from village C were undecided about changes in logging. Though most (n=5) interviewees believed forest exploitation was consistent with the management plan, logging rates

were considered relatively high (I.27-29, I.31, I.34). Small-scale wood theft occurred occasionally (I.27-28). Like in the other two villages, such theft was attributed to Roma (n=7), largely due to poverty (n=6), but also because sanctions were insufficient (n=2): *“There are people with 100 criminal files, and they are still free”* (I.30). Interviewees believing in illegal activities blamed logging companies working in the area (I.35), and the profit-orientation by *“big actors”* such as the mayor (I.34). According to the head of one logging company, however, people were negatively influenced by the media (I.27). A forest official explained that due to insufficient communication, locals did not understand that the whole commune benefited from timber sales (I.26). Because of the village structure, *“people can easily hear and see everything. Nothing illegal can be done”* (I.32). While six interviewees believed the forest state would not change in the future, two expected ‘no more forest’ if logging continued at current rates.

Perception of stakeholder relationships

Relationships among stakeholders differed greatly between the villages. In village A, 10 out of 14 interviewees considered the relationships among forest officials, local administrators, and forest users as very bad. According to one forest user, stakeholders only got along within their own group: *“Who is in the group, takes as much wood as he likes; who is not, takes what he needs – and pays”* (I.2). Because politicians, police, and forest officials apparently collaborated, there was *“nobody to complain to”* (I.2). In contrast, most interviewees from village B (n=11) considered the relationships between stakeholder groups as good. As indicated above, here, the ranger played a central role. Villagers occasionally helped him with activities such as planting trees, and received firewood in return (I.17, I.19). Moreover, the ranger was a local councilor, and thus *“the official representative of the mayor”* (I.21). In village C, the vast majority (n=7) thought the relationships between stakeholders were good, while two interviewees had no opinion. For instance, the vice-mayor regularly participated in council meetings of the private forest district (I.25). However, the local government faced occasional problems with logging companies: *“They start exploiting and transport wood, but don't pay when they have to”* (I.31).

Perceptions about benefits, responsibilities, and possible improvements

The vast majority of interviewees from village A (n=10) was dissatisfied with forest management. In contrast, most interviewees from the villages B and C were content (n=10 and 7, respectively). Similarly, while most interviewees (n=10) from village A felt unable to conserve the forest, half of the interviewees of village B (n=6) did, for instance by notifying responsible authorities when facing theft (n=4), or helping to keep the forest ‘clean’ (n=3). In village C, too, more than half of the interviewees (n=5) felt they were able to contribute to forest conservation.

When asked for who benefitted the most from the forest resource, most people from village A (n=9), and half of the respondents from village B (n=6), believed this was Romsilva. Interestingly, unlike in the other villages, the local government (n=4) and logging companies (n=3) were considered the main beneficiaries of the forest resource in village C.

We further asked which stakeholders were responsible to stop illegal logging. While in villages A and B, Romsilva was considered the most powerful actor (n=8 each), interviewees from village C attributed this role equally to the private forest department and local authorities (n=4 each). Finally, to improve forest management, most interviewees from village A (n=7) wished for the respect of the rule of law, independent controls of forest staff (n=6), and the empowerment of non-state actors and local authorities (n=4). Interviewees believed that the positive forest state in village B should be maintained by continuing replanting programs after exploitation (n=7), by raising awareness of the importance of forests (n=2), and by implementing independent controls of forest staff (n=2). In village C, interviewees suggested to improve communication between forest officials and forest users (n=3), to increase transparency (n=3), and to enforce the rule of law (n=2).

DISCUSSION

Our stakeholder analysis in three Transylvanian villages showed that the processes of forestry decentralization and restitution involve a diverse set of actors with partially conflicting claims over the forest resource. An analysis of the most valued ecosystem services revealed that those actors considered to have the highest power and interest in exploiting the forest underlined the economic benefits of forests, whereas the least powerful actors favored regulating and cultural forest ecosystem services. Our findings further suggested that while forest management reforms in theory aimed at loosening government control and at devolving decision-making and management responsibilities to local administrators (World Bank, 2005), forest management remains tightly regulated by the State. Decentralization of forest management thus was primarily a process of deconcentration of decision-making authority (Colfer and Capistrano, 2005) – that is, decision-making and management responsibility were shifted from central authorities to regional forestry departments (*ocoale silvice*). Through newly defined private forest districts (PFD), the area further faced some privatization of forest management. However, many mechanisms effectively serve to maintain a high level of State control. In the following sections, we embed our findings into a broader discussion about forestry decentralization.

Reluctance to give up central control

Following Schlager and Ostrom (Schlager and Ostrom, 1992), the State, an individual or a community can hold different property ‘rights bundles’ towards a (set of) natural resource(s),

with the rights to *manage* the resource, to control access (*exclusion*), and to sell the property (*alienation*) being considered the central pillars of resource ownership.

Our study suggested that, despite substantial reforms, local governments and newly restituted owners had received only limited rights with regard to the forest. For instance, owners were apparently obliged to sign service contracts with a State or private forest administration, and pay for the supervision of their property. The State also regulates the timber harvest volumes, and auctions timber exploitation rights to economic agents. Incomes from timber sales from non-State forestland are deducted from forest management expenditures, in a process that is not always transparent (e.g. Village A). Similarly, some local administrators complained that while they were involved in designing the forest management plan, they could be overruled by higher levels of government. Finally, analyses of powers and interests revealed that Romsilva and rangers were considered the most powerful actors in terms of resource exploitation in the villages A and B – in the same villages, people considered the State forest administration to benefit the most from forest resources. In consequence, it appears that the State substantially limits resource access, management, withdrawal, and control rights of restituted forest owners (Bouriaud and Schmithüsen, 2005; Bouriaud et al., 2013; Nichiforel and Schanz, 2011). As Verdery (2002) observed, resource ownership in Romania thus is ‘ineffective’. To understand the meaning of property in Romania, a classical assessment of rights and obligations appears insufficient, but needs to also encompass social, political, and cultural relations and powers (Irimie and Essmann, 2009; Kissling-Näf and Bisang, 2001; Verdery, 1998).

A reluctance of central governments to transfer rights – and thus to give up power and economic gains – has been found in several studies on forestry decentralization (Larson, 2004; Ribot, 2004; Ribot et al., 2006). Sometimes, decentralization even specifically aimed to increase government revenues (Larson and Soto, 2008). In the case of Romania, State resistance may partly be explained by the country’s history. According to Lawrence & Szabo (Lawrence and Szabo, 2005), foresters constituted a ‘self-enclosed’ subculture during socialism and enjoyed many political freedoms. However, with the emergence of private forest districts and the restitution of forest, the government no longer had a monopoly on forest management (Abrudan, 2012; Lawrence and Szabo, 2005). Restitution, however, coincided with a massive increase in illegal logging, which has been attributed to a lack of silvicultural knowledge and short-term profit-orientation on the side of newly restituted owners (Bouriaud, 2005; Nichiforel and Schanz, 2011). Intentions to retain State control over the forest thus could be partly understood from the perspective of wanting to maintain sustainable harvest regimes (Abrudan et al., 2009; Angelova et al., 2009). However, because forest officials and local authorities highly valued the economic benefits from forests, the fear of losing economic gains and political power are the more likely reasons for resistance to give up central control.

Mechanisms to retain power and resource access

Negotiations over resource property and access are often closely linked with contestations over authority (Sikor et al., 2009). Comparing institutional change in a variety of countries, Ribot (Ribot, 2004) found various mechanisms through which central governments extenuated forestry decentralization. Often, the transfer of certain powers was limited or obstructed (see previous section), or local institutions were chosen that served State interests. Following Ribot and Peluso (2003), mechanisms are the (legal or illegal) means or processes through which social actors exercise their powers to derive benefits from a resource, hence to gain resource access and control beyond legally granted property rights. Access mechanisms, in turn, are shaped by broader socio-economic relations, and depend on an individual's or group's positional or relational power (Dandy et al., 2014; Sikor and Lund, 2009). Comparing our three study villages, we found a number of mechanisms; four of which are exemplified below.

Mechanism 1: Postponing forest restitution

Our findings suggested that restitution was still ongoing in villages A and C. In village A, interviewees reported about extended bureaucratic procedures, and about illegal practices through which some people obtained vast tracts of land. These findings are consistent with a study on farmland restitution in Romania by Verdery (Verdery, 2002). The author explains how local governments delayed land titling, dragged out lawsuits, and obstructed the restitution process by means of their relations with the central government, their knowledge in pursuing a claim, and by using land to accumulate political capital. Besides, reports of the Romanian anti-corruption department DNA reveal various cases of illegal land appropriation by political and economic elites (National Anticorruption Department, 2015, 2014a, 2014b), with lawsuits still ongoing.

Mechanism 2: Suppressing the privatization of management

Also in villages A and C, interviewees mentioned various obstacles to move under the administration of private forest districts (PFD). While village A apparently had to revert to State administration because of multiple controls, people from village C reported conflicts over the forest management and budget planning with Romsilva prior to their shift to a PFD, and confirmed that State controls had increased. Our findings are consistent with an opinion poll among private forest district managers who partly perceived the application of different standards to PFDs compared to state forest districts, as well as complicated procedures to authorize and license PFD staff (Abrudan, 2012). The actions by Romsilva may be a sign of resistance against the general trend of privatization in the Romanian forest sector over the past two decades, which affected forest management, but also the wood harvesting and processing

sectors (Abrudan et al., 2009). As of 2012, about 23 percent of the Romanian forested area was managed by PFDs, providing about one third of the total harvested wood at country level (Abrudan, 2012). Given that PFDs could only be set up from 2002 (Stancioiu et al., 2010), these numbers indicate a quickly rising importance of private forest management structures in the Romanian forest sector, especially with view on the economically important wood market.

Mechanism 3: Group membership

Beside (political or financial) capital, knowledge, and authority, another mechanism to retain resource access is the maintenance or formation of social relationships or groups (Ribot and Peluso, 2009; Sikor and Lund, 2009). Group membership thus expresses positional power within a web of actors (Ribot and Peluso, 2003). Our findings from village A suggested strong clientelistic relationships between local authorities and economic agents (“*wood mafia*”); at the detriment to village infrastructure and the forest resource, and thus also to villagers with lower power. In village A, the trust in local level actors and the perceived ability to conserve the forest by forest users were lowest. The notion of “middlemen” further indicated the involvement of what has been termed local ‘barons’ or ‘patrons’, that is, important citizens with high political and relational power (Kolstad and Søreide, 2009; Sikor et al., 2009; Vasile, 2007). Such patronage relationships appear to be common in the Romanian forest sector (Bouriaud and Marzano, 2014; Lawrence, 2009), and are closely related to the notion of corruption. While corruption can take many forms (e.g. Brack, 2005), it is broadly understood as “the misuse of public or entrusted authority for personal gain” (Kolstad and Søreide, 2009), and often manifests when property rights are ambiguous (Bouriaud and Marzano, 2014).

Mechanism 4: Manipulation of poor villagers

Our study revealed another access mechanism closely related to group membership and corruption, namely the collaboration between actors with contrasting powers (Ribot and Peluso, 2003). Statements from village A suggested several informal arrangements between the ranger, richer villagers, and local authorities with marginalized groups, in particular Roma people. ‘Services’ such as the collection of timber and non-timber forest products, wood transport, and the re-election of the mayor were apparently rewarded with firewood. While this relational access mechanism may be of short-term benefit for all stakeholders involved, it also serves to perpetuate existing power relations (Mikulcak et al., 2015; Vasile, 2007), and may further erode the legitimacy of local authorities (Sikor and Lund, 2009; Verdery, 2002). At the same time, prejudices and discrimination against Roma, common across Romania (Sikor and Dorondel, 2004; World Bank, 2014), are likely to be nurtured. The perception of Roma as being among the main culprits for forest degradation in all three villages may, at least partly, be an indicator of

such prejudice. Interestingly, although the collaboration of authorities with marginalized people was generally considered illegitimate, small-scale wood thefts due to poverty seemed socially acknowledged; a finding that is in line with other studies on forest restitution in Romania (Sikor and Dorondel, 2004; Vasile, 2007).

Policy implications

Analysts of forestry decentralization have found several factors influencing the social and environmental outcomes of institutional reform, including upwardly and downwardly accountable decision-makers (Agrawal and Ribot, 1999; Ribot, 2004), government commitment to protect marginalized social groups (Larson, 2004, 2003; Tacconi, 2007), and the granting of rights rather than privileges (Ribot et al., 2006). The previous discussion highlighted serious weaknesses in these areas. Moreover, it showed that formal decentralization is no blueprint for democratic governance, participation, or local empowerment, but can even serve as an “aid to enhancing corruption” (Vasile, 2007: 1).

Our results are consistent with Ribot (Ribot, 2004) who found that decentralization held some inherent dangers because elites could sometimes be more powerful in local areas, while non-local groups might have a better appreciation of long-term (environmental) issues. Larson (Larson, 2004) argued that successful decentralization, usually a top-down process, required decentralization ‘from below’ – that is, organized public demands and a mobilization of local-level actors. Yet, bottom-up pressure is difficult to achieve in many post-socialist countries such as Romania because it involves, among others, cooperation and interpersonal trust as well as a certain level of citizen involvement in politics (Glück et al., 2010; Letki, 2004). Previous studies of Southern Transylvania, however, suggest that social capital and the overall ‘political society’ are relatively weak (Hanspach et al., 2014; Mikulcak et al., 2015), largely resulting from historical legacies of systemic top-down suppression (Dorresteijn et al., 2014; Hartel et al., 2014; Mikulcak et al., 2013).

While neither private nor governmental management of natural resources are necessarily beneficial to the resource (Bromley and Cernea, 1989; Ostrom and Cox, 2010), there is widespread agreement that common pool resources are best prevented from depletion when resource users are involved in resource management, can reap the benefits of the resource, feel capable to control resource access and usage, and have access to conflict resolution mechanisms (Alden Wily, 2004; Chhatre and Agrawal, 2008; Ostrom, 2009b). Our results from the villages B and C support this argumentation. While in both villages forest users had no formal rights over the forest, the majority of interviewees felt capable of preventing resource degradation by informing relevant actors, largely because of good relations with, and trust in local authorities

and forest officials. In village B, locals were further actively involved in forest management activities.

Given the positive experiences in villages B and C, our results thus indicate that the devolution of certain forest management and control rights to local administrators and forest users could be favorable to protect the resource. This, in turn, would likely increase the trust in, and legitimacy of policy makers in Southern Transylvania. Such devolution of rights, however, can only be successful if it goes hand in hand with inclusive policies regarding marginalized villagers and the creation of income opportunities for them (Larson, 2004; Ostrom, 2009b; Ribot, 2004). In line with the suggested improvement measures by our interviewees, independent controls of forest authorities could be useful, as well as non-governmental and anti-corruption institutions supported to serve as ‘watchdogs’ over potentially clientelistic or corrupt relationships among stakeholders (Arts and Buizer, 2009; Börzel and Buzogány, 2010). To improve non-State (privatized) forest management structures, the focus of forest policy should be on minimizing bureaucracy, training newly restituted owners, and improving extension services (Abrudan, 2012; Nichiforel and Schanz, 2011). Finally, to develop sustainable forestry practices across post-Socialist transition countries, further research into the changing forestry culture as well as power-interest rationales is essential (Bouriaud and Marzano, 2014; Lawrence and Szabo, 2005; Sikor et al., 2009).

CONCLUSION

Based on a stakeholder analysis and in-depth interviews in three villages, this study analyzed the state of forestry decentralization in Southern Transylvania (Romania). The paper showed that decentralization in Romania took the form of deconcentration and privatization, as the State forest administration still possesses disproportionate powers in terms of forest management and usage. Our results further indicated that the politico-historical context and social structures in which the Romanian forest regime is embedded appeared to more strongly influence environmental and social outcomes than the legally granted regime of property rights. Because of an internationally rising value of timber, extensive decision-making powers of the State forest administration, and an uneven distribution of powers between forest officials, local administrators, and forest users, the Romanian forest sector is prone to corruption and illegal resource access mechanisms. While the devolution of forest management and control rights to local level actors may increase local participation and the powers of forest users, it can be challenging in settings characterized by low social capital and low trust in decision makers. It thus appears that a reform of the Romanian forest sector can only be successful if it goes hand in hand with policies that foster the inclusion of marginalized groups, the development of income opportunities in rural areas, and substantial anti-corruption measures.

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SUPPLEMENTARY MATERIAL FOR APPENDIX IV

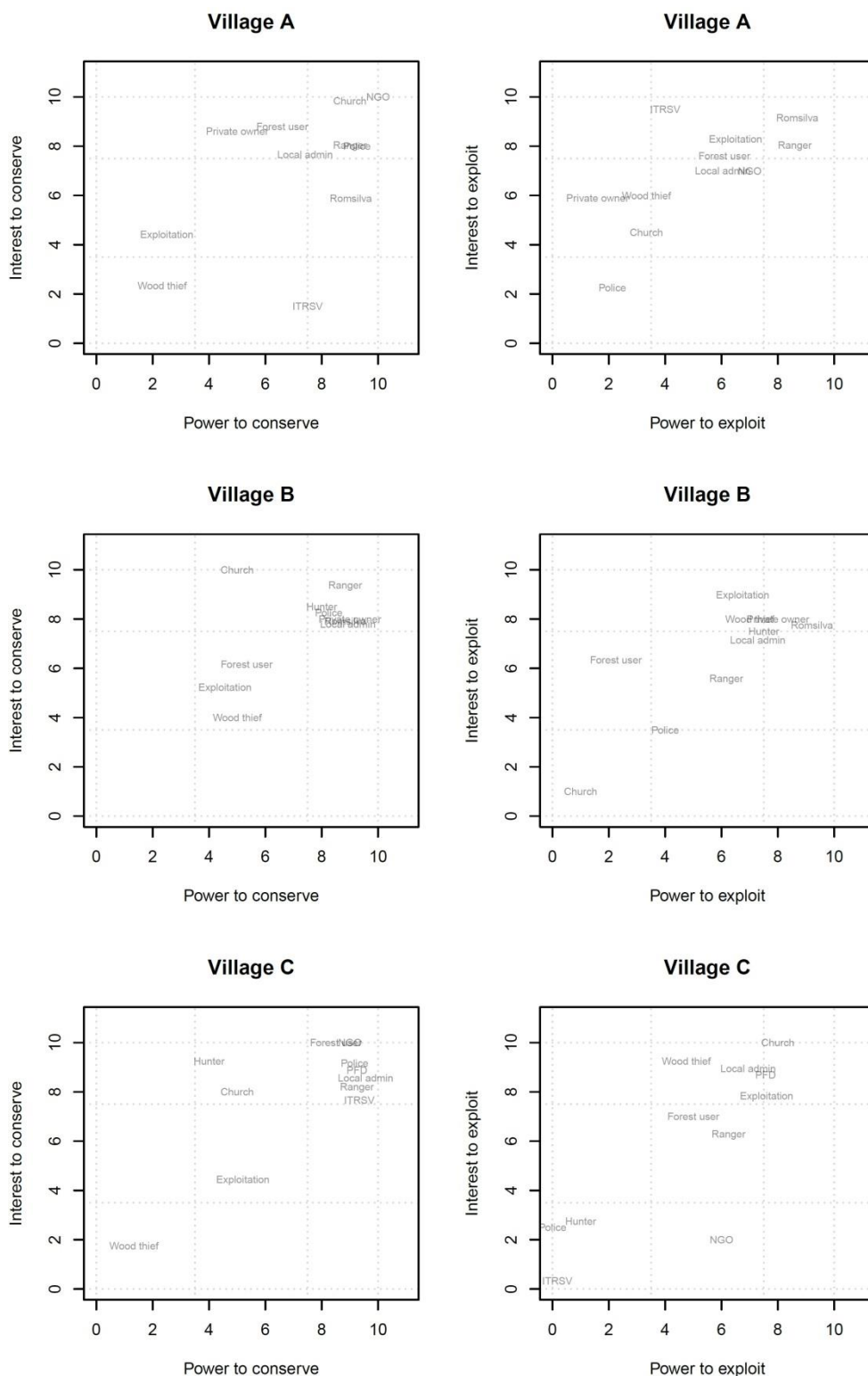


Fig. S1. Visualization of power-interest matrices in terms of forest exploitation and conservation per stakeholder group and village. (0-3) indicates little, (4-7) medium, and (8-10) high power or interest, respectively. The results of these graphs were translated into the tables S1 and S2.

Table S1. Power-Interest matrix to conserve the forest per village. (+) indicates little, (++) medium, and (+++) high power or interest, respectively. Values are derived from Figure S1.

	Village A		Village B		Village C	
	Power to conserve	Interest to conserve	Power to conserve	Interest to conserve	Power to conserve	Interest to conserve
Romsilva/ PFD	+++	++	+++	+++	+++	+++
Ranger	+++	+++	+++	+++	+++	+++
ITRSV	+++	+	No data	No data	+++	+++
Police	+++	+++	+++	+++	+++	+++
Local admin	+++	+++	+++	+++	+++	+++
Hunter	No data	No data	+++	+++	++	+++
Wood thief	+	+	++	++	+	+
Exploitation	+	++	++	++	++	++
Church	+++	+++	++	+++	++	+++
Private owner	++	+++	+++	+++	No data	No data
NGO	+++	+++	No data	No data	+++	+++
Forest user	++	+++	++	++	+++	+++

Table S2. Power-Interest matrix to exploit the forest per village.

	Village A		Village B		Village C	
	Power to exploit	Interest to exploit	Power to exploit	Interest to exploit	Power to exploit	Interest to exploit
Romsilva/ PFD	+++	+++	+++	+++	++	+++
Ranger	+++	+++	++	++	++	++
ITRSV	++	+++	No data	No data	+	+
Police	+	+	++	++	+	+
Local admin	++	++	++	++	++	+++
Hunter	No data	No data	++	++	+	+
Wood thief	++	++	++	+++	++	+++
Exploitation	++	+++	++	+++	++	+++
Church	++	++	+	+	+++	+++
Private owner	+	++	+++	+++	No data	No data
NGO	++	++	No data	No data	++	+
Forest user	++	+++	+	++	++	++

Explanation of the analysis of power-interest data

The analysis of the power-interest matrices in terms of forest exploitation and conservation was conducted in three steps. First, we integrated all rankings per interviewee, stakeholder group, and village, from 0 (lowest) to 10 (highest), into a spreadsheet and averaged the data by means of R. Second, the averaged rankings were visualized in Fig. S1. The information from figure S1 was converted into the tables S2 and S3, with an ascribed value between 0 and 3 indicating low power or interest (+), between 4 and 7 indicating medium power or interest (++), and a value between 8 and 10 indicating high power or interest (+++). Because we ranked exclusively the stakeholders mentioned during each interview per village, with some not being brought up and ranked, not all stakeholders are equally represented in the tables. Respective gaps are highlighted with 'no data' in the tables. In a third step, we converted the findings of tables S1 and S1 into table 3 of the main text.

Table S3. Forest ecosystem services and benefits per stakeholder group. Abbreviations in parenthesis indicate the type of service or benefits, with (C) for cultural ecosystem services (ES); (P) for provisioning ES; (R) for regulating ES; (E) for economic viability, and (B) for biodiversity value.

SH group	Most valued services	Ranking of all services mentioned per stakeholder group	Category (Table 5)
Local administration	Recreation (C), Firewood (P), Economic viability (E)	Provisioning, Regulating, Cultural, Economic viability	1
Private owner	Recreation (C), Firewood (P), Berries (P)	Provisioning, Cultural , Regulating	2
Police	Economic viability (E), Recreation (C), Firewood (P), Air quality (R)	Provisioning, Cultural, Regulating, Economic viability	1
NGO	Biodiversity (B), Firewood (P), Protection against natural hazards (R)	Provisioning, Regulating, Biodiversity, Cultural	3
Forest user	Firewood (P), Air quality (R), Recreation (C)	Provisioning, Regulating , Cultural	4
Exploitation	Firewood (P), Wood for construction (P), Air quality (R), Economic viability (E)	Provisioning, Regulating, Cultural, Economic viability	1
Forest official	Firewood (P), Economic viability (E), Recreation (C)	Provisioning, Cultural, Economic viability , Regulating	1
Ranger	Firewood (P), Economic viability (E), Recreation (C)	Provisioning, Cultural, Economic viability , Regulating	1
Church	Recreation (C), Firewood (P), Spiritual value (C),	Provisioning, Cultural , Regulating	2
Hunter	Game for hunting (P), Firewood (P), Landscape beauty (C)	Provisioning, Cultural , Regulating	2

Explanation of the analysis of forest ecosystem services per stakeholder group

The analysis of forest ecosystem service-related data was conducted in various steps. First, respective quantifiable information derived from the analysis of each semi-structured interview (e.g. meaning of the forest; activities conducted in relation to the forest; forest benefits) was converted into spreadsheet software. To derive at Table 4 (main text), we calculated the services and benefits most valued by all interviewees combined, irrespective of stakeholder group or ecosystem service category. In a second step, we grouped the answers given per interviewee, where possible, along four ecosystem service categories as suggested by the Millennium Ecosystem Assessment (MA, 2005). Other mentioned forest values (biodiversity value and economic viability) were no ecosystem service, but listed as benefits in a ‘coding matrix’ provided by MacDonald et al. 2013, and were grouped accordingly. Table 5 (main text), then, was derived at based on table S3. To this end, we first calculated the most valued ecosystem services and benefits per stakeholder group (second column). In a second step, we made a ranking of ecosystem service and benefit categories per stakeholder group (third column). Finally, we grouped the stakeholders either with a similar ecosystem service ranking, or some particularity, into four different stakeholder categories (Table 5). For instance, only the NGO representatives mentioned the biodiversity value of forests, so we put them into one group. And only the forest users mentioned regulating services more than cultural services, so they were grouped separately as well. Stakeholders from category 1 exclusively mentioned ‘economic viability’.

Epilogue

What this thesis has meant to me goes beyond immediate outputs such as acquired methodologies and journal publications. It was an academic, yet superb exploratory journey. One surprising lesson was that understanding is not the same as knowing. There are things one cannot know, even when one tries hard. And this is the real knowing lesson. When talking about complex SES, positivist knowledge has too many limits and those cannot be ignored. At a certain moment during the PhD, I told my project colleagues the study subsystem I had put under my own microscope couldn't be known. Perhaps it could be understood, but not necessarily as we wanted to understand it. It was a liberating conclusion for that time. My argument was that findings are bound to a certain time and space. We took a snapshot of the system "here and now" (even if "now" may mean longer time periods). Future research might add another piece to the puzzle. We were indeed successful in studying and knowing isolated elements and dynamics, which may serve for this and that purpose, but the system as a whole... well, it is still full of surprises.

It is only just recently that I stumbled upon the words of Donella Meadows, and immediately tuned in to their revealing wave length: "The future can't be predicted, but it can be envisioned and brought lovingly into being. [...] We can't impose our will upon a system. We can listen to what the system tells us, and discover how its properties and our values can work together to bring forth something much better than could ever be produced by our will alone. We can't control systems or figure them out. But we can dance with them!"

I guess she said much better what I tried to grasp in my whole PhD. To my mind, this also means we have to give in and sometimes... give up on the system. Instead of answering the wrong questions, we could direct our energy to other ways of knowing. We can only give in to the system, provided it doesn't give up on us. Just as often, in the field, I felt giving in to my interviewees. Who was the researcher and who was the researched? The border was many times

too blurry and vague, but the haze around it... felt too natural and too beautiful to be defined or overcome.



The author, happily peeling tomatoes for one of her interviewee's winter supplies of "bulion".