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Title: Understanding cultural ecosystem services related to farmlands: expert survey in Europe

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Abstract

Cultural ecosystem services (CES) are nonmaterial benefits that people obtain from ecosystems. The CES subcategories cover a wide range of domains (e.g. recreation, conservation of cultural heritage, human-nature relations). The CES concept has been proposed to acknowledge the nonmaterial values linking people and nature in social-ecological systems. Agricultural landscapes are outstanding examples of complex social-ecological systems where synergies and trade-offs between production and conservation determine the CES values. Parts of Europe are still rich in such landscapes/systems with outstanding cultural and natural values that deliver a multitude of CES. In this paper, we address the knowledge and perceptions of identified experts on the role of CES in the management of European agricultural landscapes. To achieve this goal, we developed a questionnaire on CES which was answered by experts working with various issues of European agricultural landscapes, including sustainable agriculture, landscape ecology, grassland management, nature conservation, cultural heritage conservation, environmental policy, sustainability research and rural development. The results show a wide knowledge and acceptance of the CES concept within such expert communities. Especially the aesthetic, cultural heritage, educational and recreational values were considered the most relevant CES subcategories. Interdisciplinary approaches, landscape planning and integrative science-policy approaches were perceived as the most promising methodologies to improve the CES approach for policy and management. Our results also show that according to experts the CES concept is still far from practical implementation in policies that target agricultural landscapes. In order to sustain such systems, we suggest the better implementation of inter- and transdisciplinary research for the development of CES-integrative policy and decision-making.

Keywords: cultural ecosystem services; social-ecological systems; landscape planning and management; inter- and transdisciplinary; policy; expert

1. Introduction

Values linking human societies to the natural world are key for the implementation of sustainable development agendas (SDGs). The vision of the SDGs also highlights the importance of understanding and addressing the material and nonmaterial dimensions of the human-nature interactions to achieve sustainability (Ives et al., 2018; Kuenkel, 2019). The material dimension of human-nature interactions includes tangible values (e.g. commodities) and those goals that target the management of natural resources in order to assure that commodities can be sustainably extracted (Allen et al., 2018; Fischer and Riechers, 2019). The nonmaterial dimensions include intangible values (e.g. interpersonal and social relationships, regional or local identity, social and cultural norms, worldviews and individual interpretations of nature) and goals that foster social recognition of sustainability and reconnection of people with the natural world (Chan et al., 2016; Ives et al., 2018; Ives et al., 2019).

The tangible and intangible benefits of nature to humans are captured by the conceptual framework of Ecosystem Services (Millennium Ecosystem Assessment - MEA, 2005). These values or services are especially important for the sustainability of human-dominated landscapes such as the agricultural landscapes, which often have exceptional cultural and natural values in Europe (Paracchini et al., 2008). Some of these landscapes evolved as tightly coupled social-ecological systems (SES), often through millennia long social-ecological interactions and coadaptation (Fischer et al., 2012). Agricultural landscapes contribute to human wellbeing in several ways such as food and game production (Holmlund and Hammer, 1999; Schulp et al., 2014), human recreation and health (Bennett et al., 2015) and aesthetic and educational values (Poschlod, 2017). Local examples for the importance of intangible values for land stewardship are the traditional transhumant shepherds of Spain (Oteros-Rozas et al., 2014), the new ecovillage initiatives in Hungary (Bányai, 2018), the “traditionalist producer” farmers of Estonia, Romania and Spain (Roellig et al., 2016; Hartel et al., 2018; Balázs et al., 2019).

The MEA defines cultural ecosystem services (CES) as “*the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences*” (page 40 in: MEA, 2005). While the concept of CES is still developing and maturing, several subcategories of CES have been recognized and described in the academic literature, including: recreation and ecotourism, aesthetic values, spiritual and religious values, educational values, cultural heritage values, bequest, intrinsic

and existence, inspiration, sense of place, knowledge systems, social relationships, and cultural diversity (Milcu et al., 2013; Pascua et al., 2017). More recently, Chan et al. (2016) proposed a new conceptualization of values attributed to nature, where the “relational values” represent those values which targets the relationship between people and their environment, including ways of interaction, identity and sense of belonging. Some of the values from the “relational” domain (Chan et al., 2016) were classically also considered within the CES (Milcu et al., 2013). CES are also in the hearth of the emerging “biocultural diversity” paradigm that considers intangible values important in shaping the landscapes with high natural and cultural values (Bridgewater and Rotherham, 2019).

Furthermore, Fish et al. (2016) proposed a framework that facilitate operationalising CES in diverse contexts (e.g. natural resource management and decision making) while focusing on a more relational understanding of complex cultural issues. The CES may not be initial drivers of decisions due to their intangibility, difficulty of interpretation and context dependency, but they may be important when considering needs or benefits that people value highly (Blicharska et al., 2017). However, several studies (see a review in Milcu et al. 2013) stressed the underrepresentation of the CES subcategories in environmental decision making, while only few studies have shown that CES are important for local decision making (Szűcs et al., 2015, Riechers et al., 2017). Nowadays the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) fulfils and important role in facilitating integration of scientific concepts, implicitly CES, into decisions (IPBES, 2012).

Considering that Europe is still abundant in naturally and culturally rich agricultural landscapes, we aimed to assess the understanding and perceptions on the usefulness and acceptance of the CES concept by experts working in the science-policy-implementation interface related to agricultural landscapes of Europe. Expert opinions on CES are an important source of reflection, given that they arise from experiences with local communities, governmental and nongovernmental institutions and policy platforms.

In the first part of our paper we provide a brief overview on the scientific knowledge on CES in Europe`s agricultural landscapes, based on publications from Web of Science. Then we present the results of a questionnaire survey that explores the CES related knowledge of experts working on different dimensions of the agricultural landscapes of Europe (science-policy-practice). We discuss our results in the context of the recent conceptual advances in understanding non-material benefits and values linking people and nature.

2. Materials and methods

2.1 Peer-reviewed literature analysis

In 2019 we performed a Web of Science search in order to provide information about the distribution of scientific knowledge on CES in Europe (up to 2018) with the following keywords: TI=("cultural ecosystem services") OR TS=(("cultural ecosystem services") AND (Europe OR "Albania" OR "Andorra" OR "Austria" OR "Belarus" OR "Belgium" OR "Bosnia and Herzegovina" OR "Bulgaria" OR "Croatia" OR "Czech Republic" OR "Czechia" OR "Denmark" OR "Estonia" OR "Finland" OR "France" OR "Germany" OR "Greece" OR "Holy See" OR "Hungary" OR "Iceland" OR "Ireland" OR "Italy" OR "Latvia" OR "Liechtenstein" OR "Lithuania" OR "Luxembourg" OR "Malta" OR "Moldova" OR "Monaco" OR "Montenegro" OR "Netherlands" OR "Norway" OR "Poland" OR "Portugal" OR "Romania" OR "Russia" OR "San Marino" OR "Serbia" OR "Slovakia" OR "Slovenia" OR "Spain" OR "Sweden" OR "Switzerland" OR "Macedonia" OR "United Kingdom" OR "Ukraine" OR "England"))).

We exclusively focused on the term “cultural ecosystem services” in Title (TI) and Topics (TS) fields, in order to capture only those papers that integrated the CES concept. In total 210 publications resulted from the first search. Afterwards we limited our selection to papers that fulfilled the following criteria: (i) at least one case study has been performed in Europe, (ii) the first or the last author belonged to a European institution (for papers with universal focus on CES). In total, 157 publications were selected for data analysis (see details in 2.4 section).

2.2 Questionnaire survey

A questionnaire-based survey was conducted in the period of September-December 2016, where experts (science-policy-implementation interface related to agricultural landscapes) from across Europe shared their understanding of CES and their importance for their work. The questionnaire was titled *Assessing Cultural Ecosystem Services* and was sent to the experts online or in printed forms. In total, 81 respondents completed our questionnaire.

We developed a 16-question survey, which had three sections (see Appendix A). First, we asked whether respondents were familiar with the concept and since when; and asked them to give their own definition of the concept. We also evaluated experts’ perceptions by a set of pre-determined statements (pro and contra) about CES on a 5 points Likert scale (Likert, 1974). All the statements in the questionnaire (see Question 3 in Appendix A) were proposed and discussed by the research team of the STACCATO project (<http://staccato-project.net/>),

based on the current challenges experienced in the field of CES research. Secondly, participants marked the relevance of CES subcategories for their expertise, from a preselected list. The following CES subcategories were selected from Milcu et al.(2013): recreation and ecotourism, aesthetic values, spiritual and religious values, educational values, cultural heritage values, inspiration, sense of places, knowledge systems, social relationships, and cultural diversity. We excluded bequest, intrinsic and existence values because of their strong subjective character. Third, we requested the expert's profile in order to identify relevant domains and interests for CES.

2.3 Selection of participants

We were interested in a target group that by their professional activities also targeted the recognition of non-material values for sustainability initiatives in human-dominated landscapes. We defined as “expert” a person who has relevant experience (theoretical and practical) with various issues of agricultural landscapes such as sustainable production, agro-environmental and climate actions, high nature value farmland, conservation of biodiversity, agribusiness, preservation of cultural heritage, agrotourism, recreation, human-nature connectedness. Experts from the following areas of activity formed our target group: (A) sustainable agriculture, landscape ecology, grassland management (i.e. sustainability profile); (B) nature conservation, cultural heritage conservation (i.e. conservationist profile); (C) ecosystem services research (i.e. ES profile); (D) policy on environment and rural development (i.e. policy profile). The A-D categories were chosen on the assumption that experts from these categories were likely to know about, or integrate the CES concept in their practice.

We reached the persons via professional networks using the snowball sampling principle, asking for recommendation of a minimum of three experts in total, in fields A-D (see above), to those who were addressed. The addressed persons worked in governments, research institutions, NGOs, and the private sector. The participants performed professional activity in 22 European countries – some of them in more than one: Austria (n=1), Belgium (2), Bulgaria (1), Czech Republic (5), Estonia (1), Finland (2), France (3), Germany (21), Greece (1), Hungary (6), Iceland (1), Italy (2), Latvia (1), Norway (1), Poland (2), Portugal (3), Romania (22), Serbia (1), Slovenia (1), Sweden (1), Switzerland (4) and United Kingdom (5). A detailed description of the participants (e.g. education, gender, frequency of working with CES, geographical scale of interest, profile of organization) is presented in Appendix B.

2.4 Data analysis

The literature analysis was limited to the distribution of scientific knowledge production on CES in Europe, the diversity of studies, and their spatial relevance. We categorized (coded) the 157 papers, selected for the analysis, based on their full length using the following criteria: (1) content (conceptual, review, methodological & practical), (2) type of studied environment (multiple, agricultural, wetlands, forests, urban, not landscape specific), (3) scale (local, regional, national, global), (4) country of study (first/last author host institution; when multiple institutions existed, we considered the one for correspondence). The analysis was performed using Citavi 6, a reference management and knowledge organization software.

We created a database using ArcGIS 10.4 software containing the number of papers published per country and papers that explicitly targeted agricultural landscapes in Europe. Then we created a distribution map of these studies.

The results of the survey were divided in closed and open questions. Open questions were analysed by qualitative content analysis, specifically by interpreting and coding open questions systematically (Kuckartz, 2014). We coded how experts defined CES, compared it with the original definition of MEA (see 1 Introduction), and identified (coded) those aspects that were considered by experts as cultural provisions that ecosystems provide to people (e.g. experiences, local history, experiences/feelings associated with landscape features, spiritual values). The coding was performed using data analysis software, NVivo 11 Pro (QSR International). Closed questions were processed quantitatively, using IBM SPSS Statistics.

3. Results

3.1 The distribution of CES research across Europe

Based on our peer-reviewed literature analysis, the scientific knowledge hot spots in CES research of the European continent (figure 1) are: United Kingdom (n=30 publications), Germany (27), Spain (19), Italy (13), Sweden (12), the Netherlands (7), Poland (7), Portugal (7) and Switzerland (6). From the 157 publications, the majority were methodological and practical (n=133), while reviews (13) and conceptual publications (11) were less represented. The majority of publications in Europe in the last decade (2010-2018) focused on human-nature interactions in different landscape categories that relate to CES research (figure 2). CES were addressed in complex studies covering multiple landscape categories (n=44), either in a specific landscape category (98), or with no focus on a specific landscape (14). Studies that focused on a specific landscape category include analyses of urban and peri-urban areas

(n=38), wetlands with urban or rural significance (30), while agricultural landscapes (22, see Appendix C) and forests (9) were less well represented. CES research in the analysed period, with agricultural landscapes underrepresented compared to other landscape types (figure 2).

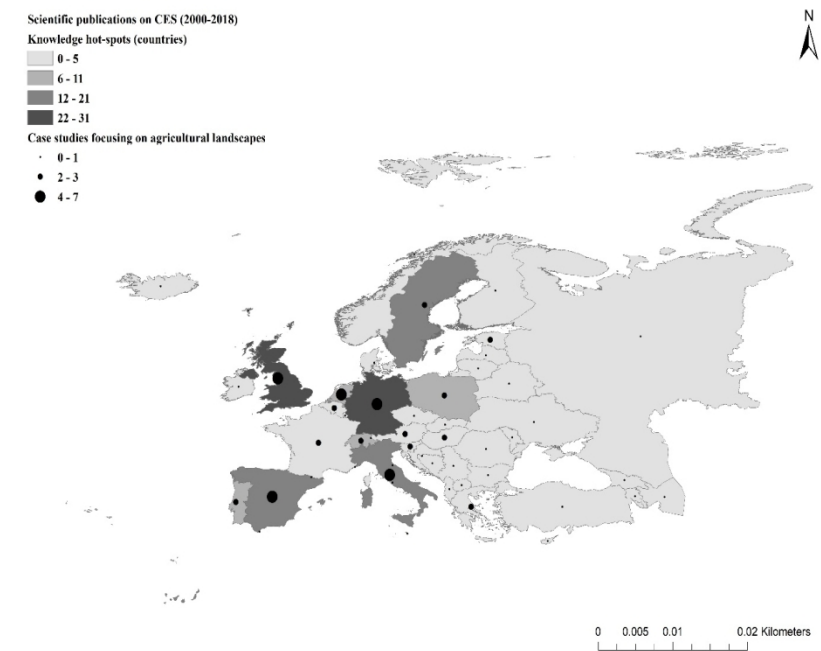


Figure 1. Distribution of countries generating CES research (knowledge hot spots) in Europe and the distribution of CES research focusing on agricultural landscapes (Web of science query of peer-reviewed journals on CES).

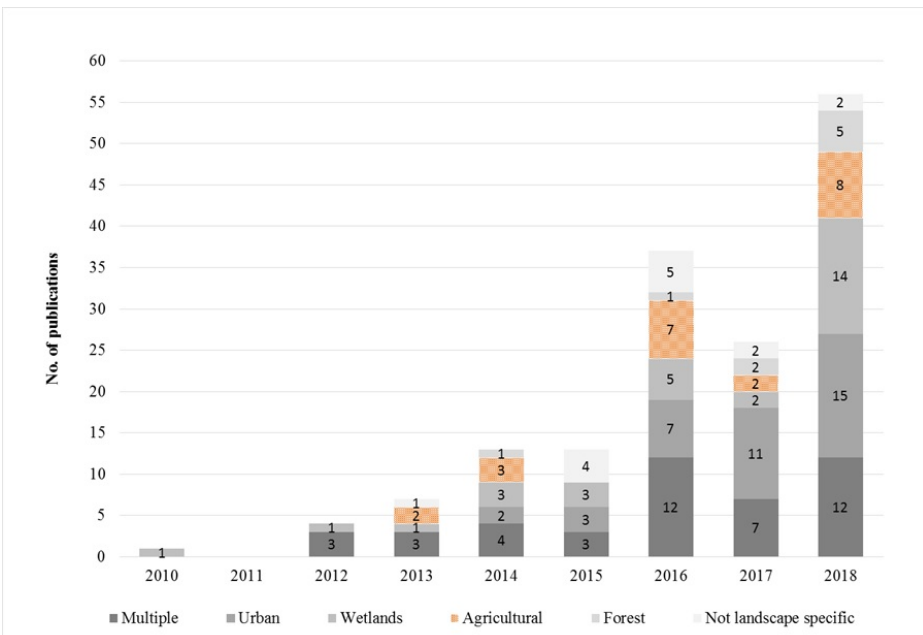


Figure 2. CES research in Europe by categories of studied landscapes. (The numbers on the graph means no. of analysed papers).

3.2 Expert understanding of Cultural Ecosystem Services (CES) concept

The majority of respondents (n=42, table 1) defined CES as “*benefits*” (occurrence in open question n=56), “*services*” (n=15) or “*values*” (n=62) that people obtain from nature, ecosystems or landscapes. Few respondents (n=3) considered CES an “*old concept*”, being used under various “*concept titles*” in inter- and transdisciplinary fields. CES were associated with socio-cultural aspects like human-nature interactions (n=35, table 1) and landscape-related issues (n=24). The following definition was a typical example of how respondents related CES to landscapes and socio-cultural values: „*Ecosystem and cultural services provided by artificial and natural elements of the landscape, which on the one hand enhance the quality of the life of the local population and on the other hand contribute to the preservation of cultural heritage.*” (Expert 1, expertise: research, restoration of cultural monuments, gender: M). A respondent disagreed with the idea that nature delivers free services for humans, like a “*commercial service provider*” (E28, social scientist, M). Other CES definitions included “*Nonmaterial benefits and biofilia - the need of humans to natural environment!*” (E4, ecologist, F); “*A system in which people and nature coexist, live in harmony or symbiosis, do as less harm as possible to each other*” (E47, natural scientist – protected area management, F) or “*Beneficial services that different cultures can provide to other people through their way of living.* (E20, biodiversity monitoring, M)”.

Table 1. Coding categories and their frequency of occurrence within the respondents. The table contains coding categories of individual definitions as response to “*Could you please briefly define your understanding of CES?*”, Appendix A).

When respondents became familiar with CES concept		before 2005	2005-2010	2010-2015	after 2015	not familiar
% of respondents		8.6	27.2	44.4	9.9	9.9
Familiarity of respondent with the CES concept		7*	22	36	8	8
Definitions of CES						
First-degree coding category	Second-degree coding categories					
Experts' definitions on CES	Benefits that ecosystems provide to people (not quantifiable, intangible, important for health and soul)	3*	11	22	5	1
	Capital for human well-being (social and human)		1			
	Gifts provided to humans				1	

Human - nature interactions and perceptions about natural environment (e.g. experiences, knowledge systems, local perception of history, homeland, memory)	5	10	16	2	2
Opportunities for different interactions with nature (physical, intellectual, spiritual)			1		
Services provided by nature		2	9	2	2
Structures and functions of ecosystems with cultural significance (e.g. landscapes, ecosystems transformed by human land-use)	3	5	11	1	4
Values received by people (e.g. aesthetical, historical, spiritual, religious, identity, sense of place)	5	16	20	2	6

* No. of respondents

The period of 2010-2015 was a momentum when 44% of the experts became familiar with the CES concept (table 1). There was a *strong agreement* with the official definition (see in 1 Introduction and figure 2) of the Millennium Ecosystem Assessment (MEA, 2005) among the experts (92%).

There was also a *strong agreement* among the experts on the following points: CES providing non-material benefits (over 60%); semi-natural grasslands as important contributors to CES (over 50%); the need for explicitly recognizing and valuing CES (over 40%); the need for better policy coverage of CES (over 40%; figure 2). Furthermore, respondents *agreed* about the importance of CES for the urban society; the fact that CES have monetary value; the attractive but difficult-to-implement-nature of CES; the subjective nature of CES (over 30% for each CES feature, figure 3). Experts showed *disagreement* (or *strong disagreement*) with the following statements: measurability of CES with standardized methods; CES are so eroded in the current rural communities that it is not worth addressing them; consideration and the implementation by CES in the real world decisions (over 65% of the respondents for each of the mentioned CES features, see figure 2).

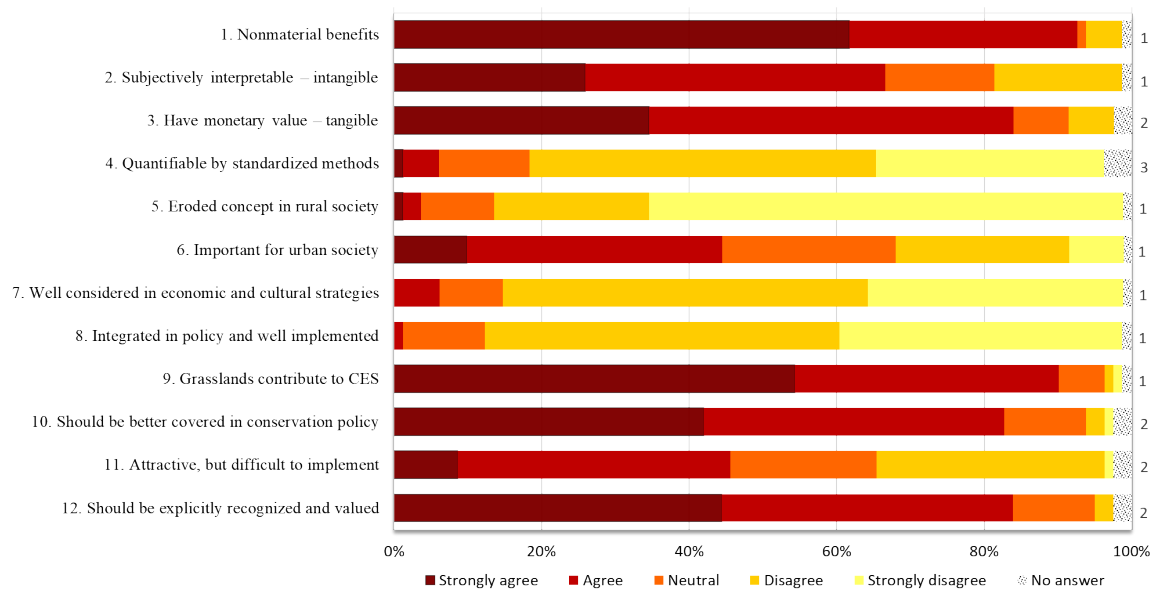


Figure 3. Understanding of experts on CES (1-12 represent general statements on CES where respondents ranked their agreement/disagreement using a 1-5 Likert scale. The list of statements is accessible in Appendix A (Full questionnaire); the number on the right side of the graph represents the No answer category).

3.3 Relevance of CES categories for experts' work

Strong agreement was expressed by experts regarding the relevance of CES to their work through its aesthetic values (65%); recreational and ecotourism potential (over 55%); cultural heritage values (over 50%); educational values (over 40%); inspiration (over 40%); and sense of place (over 40%; figure 3). *Agreement* was expressed particularly for the role of CES for building social relations (over 60%) and cultural diversity (40%; figure 3). Most disagreements were expressed regarding the relevance of the spiritual and religious aspects of CES for the everyday work of experts (20%, figure 4).

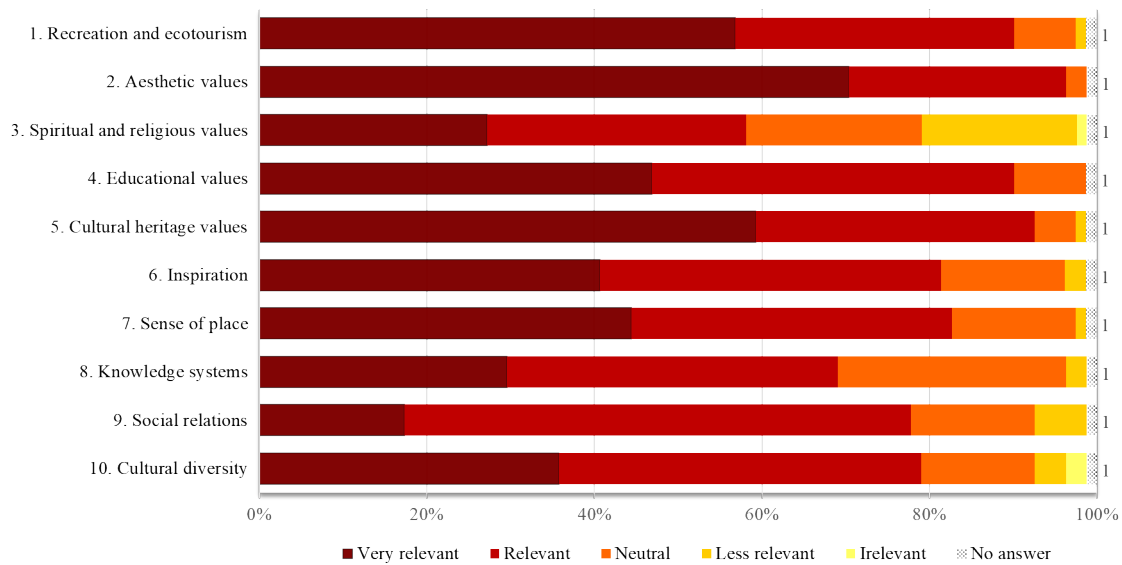


Figure 4. Relevancy of CES-related subcategories (following Milcu et al. 2013) for experts profile.

3.4 How to address CES?

The most suitable way to approach CES in the experts' opinions (figure 5) is through *interdisciplinarity* (over 70%) and landscape planning (50%). On the contrary, the category technological development was highlighted as less important for addressing CES by most of the respondents.

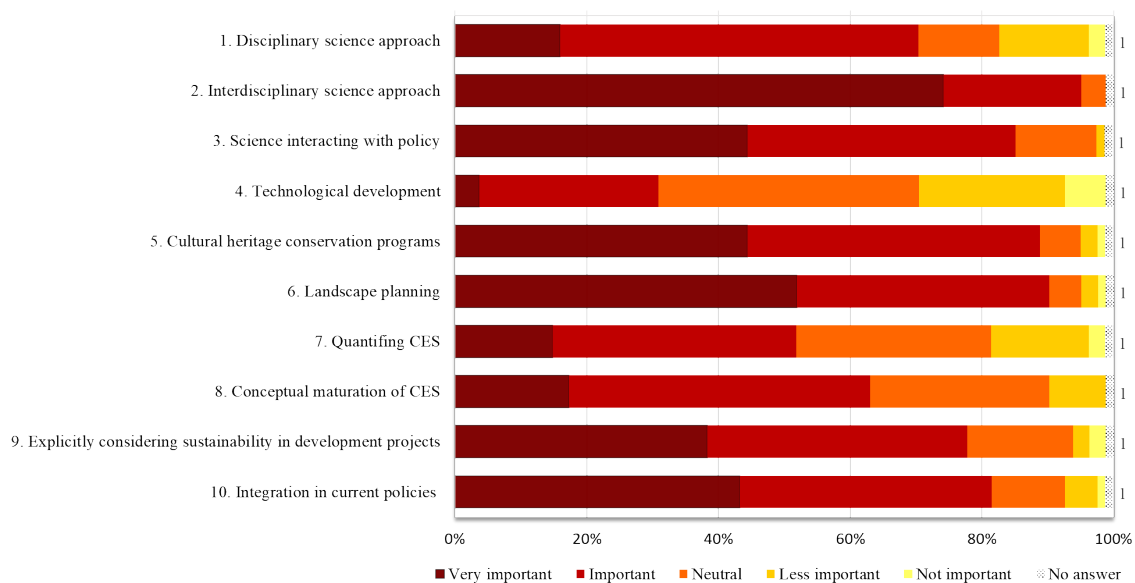


Figure 5. The most relevant ways to approach the CES concept to better integrate it into policy and management.

4. Discussion

4.1 Research on CES in agricultural landscapes and experts' opinion on the CES concept

Our results show that research on CES in agricultural landscapes is still sporadically implemented compared to green areas in peri-urban landscapes and wetlands. This result is surprising because the agricultural landscapes with high nature value in Europe (Paracchini et al., 2008) are also farmlands with high cultural values (Bridgewater and Rotherham 2019). We found that the following examples of agricultural landscapes, part of the European natural and cultural identity, are less covered by CES research: the species rich mountain hay meadows in the Carpathians (Mitchley et al., 2012; Babai and Molnár, 2014), wood-pastures (Plieninger et al., 2015b), scenic landscapes of Germany's mountain regions (Bieling et al., 2014) and of the Alps in Switzerland, Austria and Italy (Haida et al., 2016; Rewitzer et al., 2017; Assandri et al., 2018). The conservation of these landscapes, would benefit from considering their intangible – cultural values (Bieling and Plieninger, 2013; Nesshöver et al., 2016; Birkhofer et al., 2018).

Our survey suggests that experts were familiar with the CES concept in Europe and they considered CES to have a great potential in policy-making and management decisions regarding agricultural landscapes. Furthermore, they recognized the importance of certain landscape components, such as semi-natural grasslands for the provision of a wide range of CES. Nevertheless, a large proportion of the experts also pointed towards the difficulties related to the conceptualization and integration of CES in policies. Accordingly, in the last decade, several scholars stressed that CES are unquestionably difficult to measure, which creates difficulties when implemented (Groot et al., 2010; Chan et al., 2012; van Berkel and Verburg, 2014). The emerging novel concepts, similar to CES, (e.g. nature's contribution to people – in Díaz et al., 2018 and relational values – in Chan et al., 2016 and Ives et al., 2017) highlight the need for a shared definition and genuine recognition of the benefits of the nonmaterial dimension of human-nature connections in resource management decisions.

These novel conceptualizations of human-nature connections and values related to nature allow an integrated assessment of the different value dimensions classically encapsulated in the CES concept. Balázsi et al. (2019) and Riechers et al. (2020) building on the five dimensions of human-nature connectedness, apply for the first time a methodological framework by Ives et al. (2017). They addressed multiple values linking people and nature in agricultural landscapes from two regions of Romania and Germany by discussed the interplay between material, experiential, emotional, cognitive and philosophical connections and how

the socio-political changes in the past decades influenced these connections. Furthermore, Hartel et al. (2017) highlighted several relational values (*sensu* Chan et al., 2016) attached to large old trees from the ancient wood-pastures of Transylvania, including their historic importance, age and components of local identity.

Several methodologies (e.g. preference assessments, photo-elicitations, psychometric surveys, Q methodology) are now available to explore the different dimensions of tangible and intangible values linking people and nature (Norton et al., 2012; Mouchet et al., 2014; Arias-Arévalo et al., 2018). Developing a better understanding of CES categories and defining typologies which are applicable to different SES (e.g. agricultural landscapes) could diminish tensions between standardization and polarization of CES concept and its subcategories (Martín-López et al., 2017; Ainscough et al., 2019). It is important to stress that CES became “vulnerable” when unsustainable landscape management or planning is implemented. For example, Plieninger et al. (2015a) highlight the importance of landowner behaviour, community engagement for initiatives that maintain CES diversity (e.g. landscape heterogeneity), rather than only profit generating activities. Therefore, more CES-related research is necessary in different socio-cultural and environmental contexts to increase the applicability and usability of the concept (Riechers et al., 2016; Brunet et al., 2018).

4.2 Relevancy of CES concept for experts

We found that the most relevant CES subcategories for experts in agricultural landscape management were recreation and ecotourism, aesthetic values, educational values, cultural heritage values, inspiration and sense of place. We believe that experts value these CES subcategories because of their in-depth experience with various landscapes through which they realize the strong interrelation and interdependence of the cultural and natural heritages (Proshansky et al., 1983; Gustafson, 2001; Graham, 2002; Bridgewater and Rotherham, 2019). Further, we suppose that some subcategories of CES became much “popular”, having direct implications in practice than others with abstract conceptual meanings. For example, cultural heritage, recreation and tourism values are sometimes addressed by policies in cultural heritage and biodiversity conservation, greening and economy (Verburg et al., 2016; Su et al., 2018), while e.g. inspiration and sense of place or other values might be addressed with higher difficulty. Furthermore, a substantial proportion of experts highlighted the importance of inter-and transdisciplinary approaches to understand and sustain CES; especially the trans-disciplinary approaches are powerful for understanding visions, intents

and intangible values related to nature and co-developing solutions for integrating them in regional development strategies (Lang et al., 2012).

The potential of the CES for regional development policies for farming landscapes was highlighted by a recent seminar organized by the European Committee of the Regions (within the event: European Week of the Regions and Cities, November, 2019: https://europa.eu/regions-and-cities/programme/sessions/522_en), entitled “Biocultural Regions – a Powerful Tool in Achieving EU Sustainability Goals”. The proponents of the workshop (Council of Harghita County, Romania) recognized the strong interlinks between the natural and cultural heritage and the need for mainstreaming biocultural approaches in the regional socio-economic development policies in the European Union. However, Simoncini et al. (2019) argue that CES are indirectly and insufficiently supported (i.e. country dependent) by the EU Common Agricultural Policy (e.g. by supporting high nature value farmlands). Moreover, the relatively few references on CES in 12 EU policies (e.g. biodiversity, forest and water policies and policies for rural and urban areas) focus mainly on tourism and recreation targeting the use of natural resources and land in the EU (Bouwma et al., 2018). These policy instruments are of key importance in halting the loss of biodiversity and the degradation of ecosystem services in cultural landscapes in Europe. We believe that these instruments could be more effective in promoting ecologically sustainable landscapes if they would promote also the understanding and integration of the biocultural diversity (Bridgewater et al., 2019). While global policies, such as the Rural Development Goals (SDGs) and Aichi Targets picked up the CES concept, developing cultural service indicators would, in fact, increase the capacity to build pragmatic objectives in CES implementation (Geijzendorffer et al., 2017).

Conclusions

The research of CES related to the agricultural landscapes of Europe is still scarce in comparison with green areas in peri-urban landscapes and wetlands. Research targeting CES in high nature value farmlands, which have also high cultural values, is especially missing. Most of the CES research in Europe is carried out in the economically developed regions. We stress out the need and importance of CES research in economically developing regions too, considering the impacts of undergoing major socio-economic changes on cultural landscapes (especially those with traditional features). The concept of CES is widely known by experts working with the various issues of the sustainability of European agricultural landscapes.

Experts show general agreement on the non-material character of CES, the importance of semi-natural grasslands for CES, the need for addressing CES in conservation policies and the utility of the concept in urban society and in conducting monetary valuations. However, they also highlighted potential issues regarding the applicability of CES components, such as ecotourism, aesthetic values, education, cultural heritage, inspiration and sense of place. Importantly, the great majority of experts considers that inter- and transdisciplinary approaches (i.e. the collaboration between various academic professionals as well as the academic and non-academic world) are of key importance in further understanding and broadening the application of the CES concept in policy and practical decision-making targeting European agricultural landscapes.

When e.g. designing Natura 2000 sites, supporting high nature value farmlands or planning multifunctional landscapes, considering the intangible (i.e. “cultural”) values is an essential insurance for securing the values of these systems, on which locals also count. In Romania, Spain, Hungary, Czech Republic for example, CES related to high diversity traditional cultural landscapes are not recognized by policy and are largely ignored also by transdisciplinary research (Varga and Molnár, 2014; Babai et al., 2015; Hanaček and Rodríguez-Labajos, 2018), as well as among policy and decision makers or stakeholders. Therefore, we underline the importance of future research projects to deliver better conceptualization and suited typologies of CES subcategories for different social-ecological contexts in order to counter-balance the polarization of the concept and to improve on-ground implementation.

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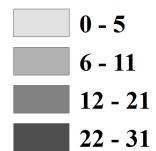
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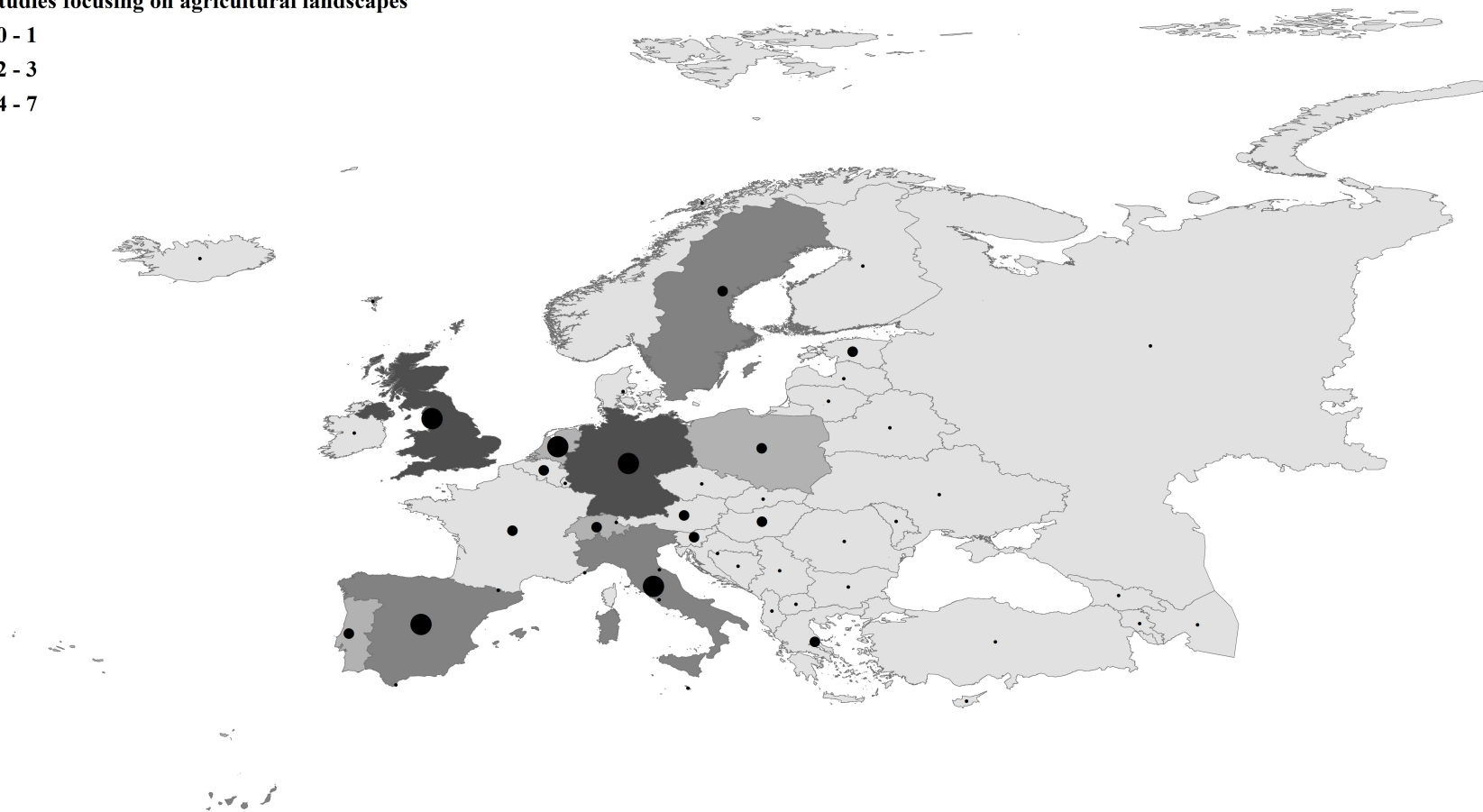
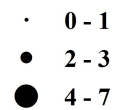
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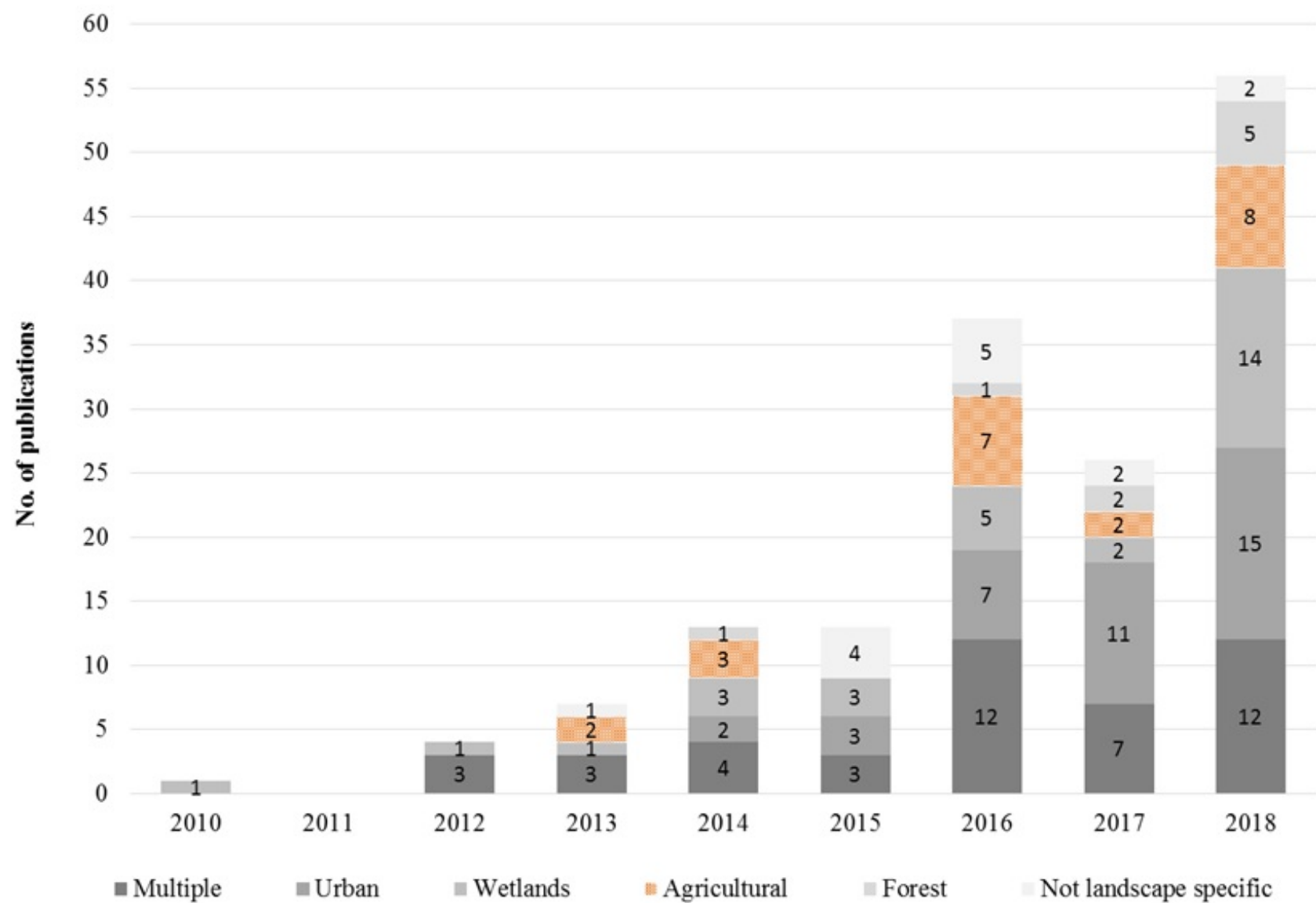
Scientific publications on CES (2000-2018)

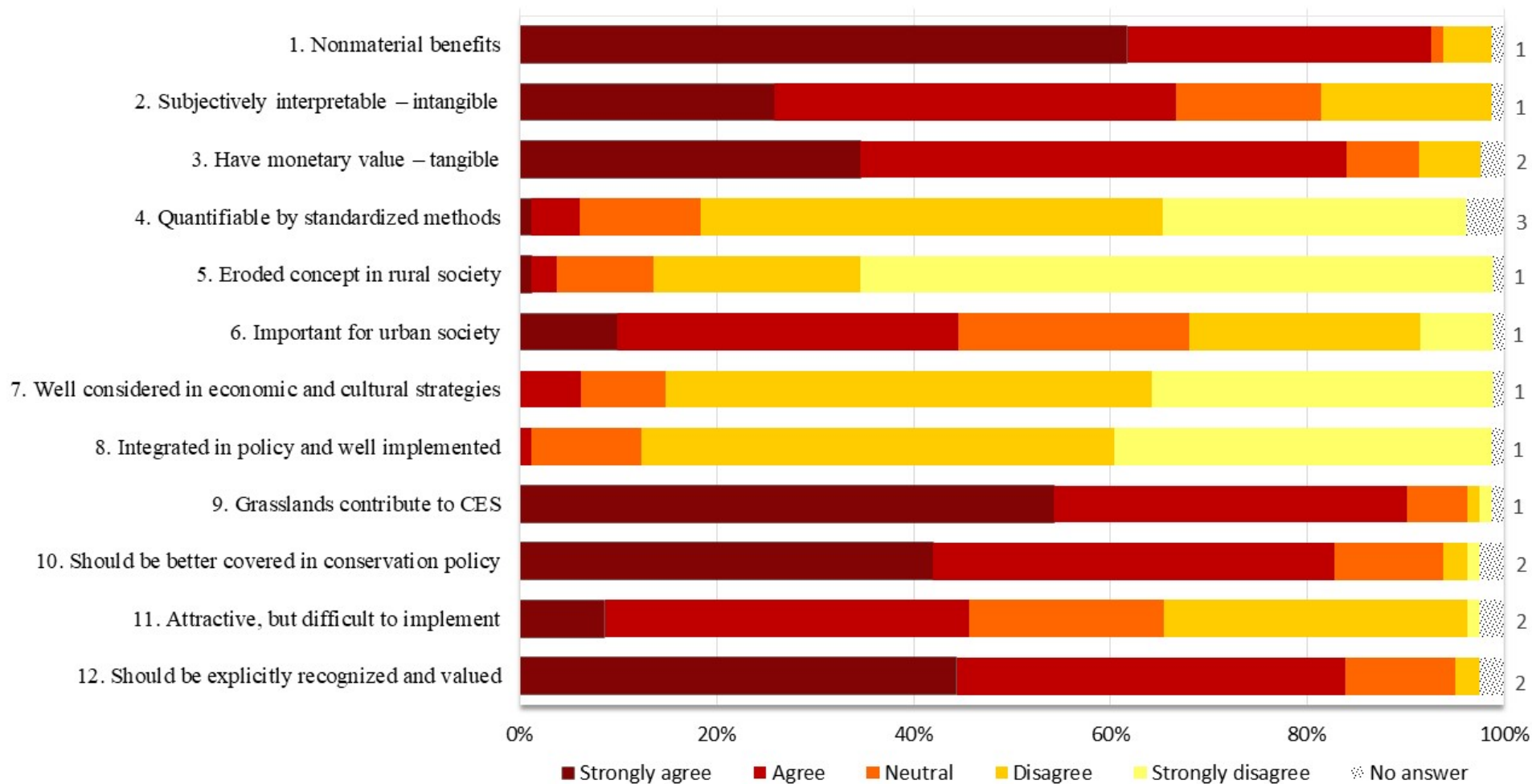
Knowledge hot-spots (countries)

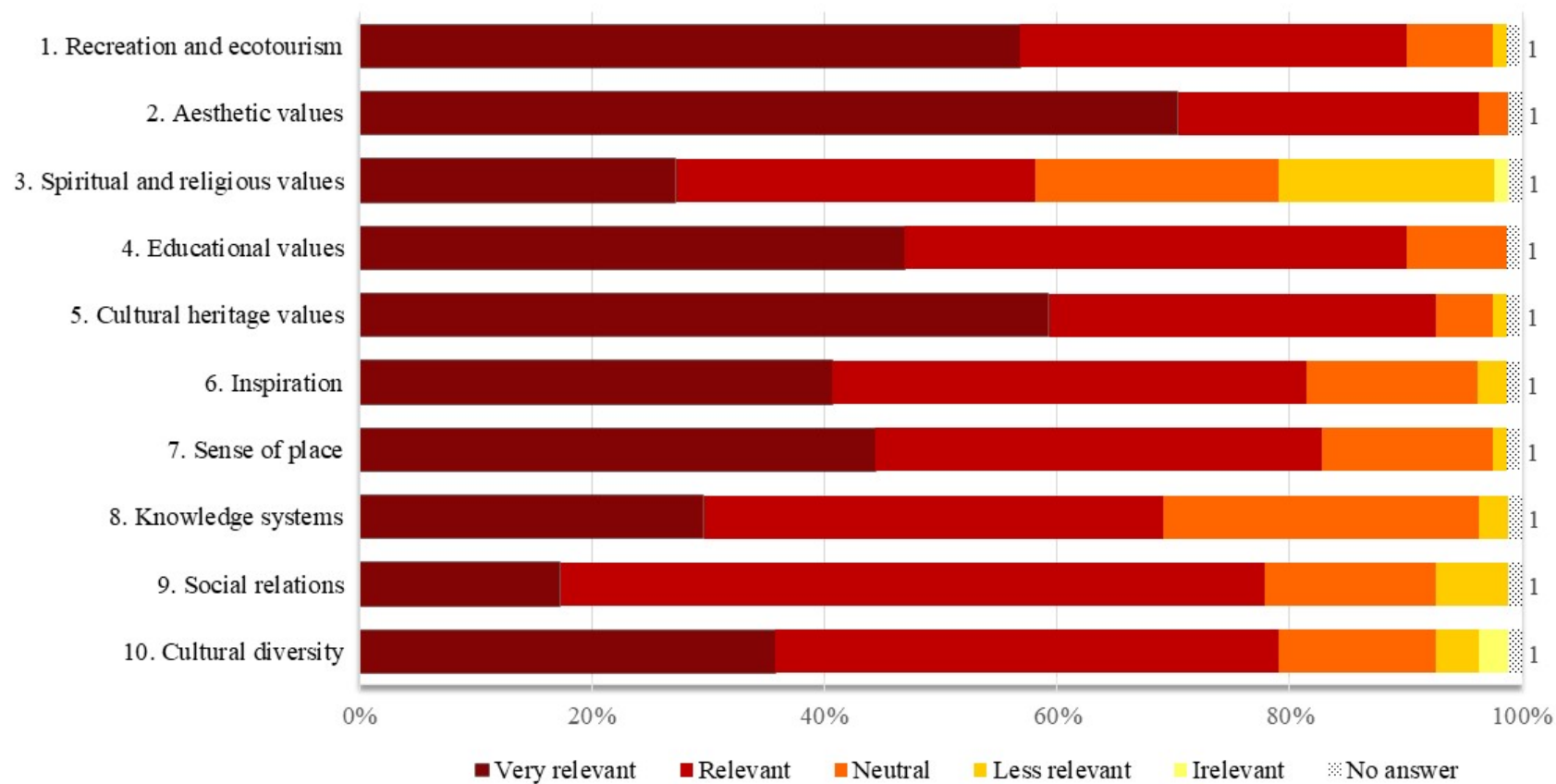


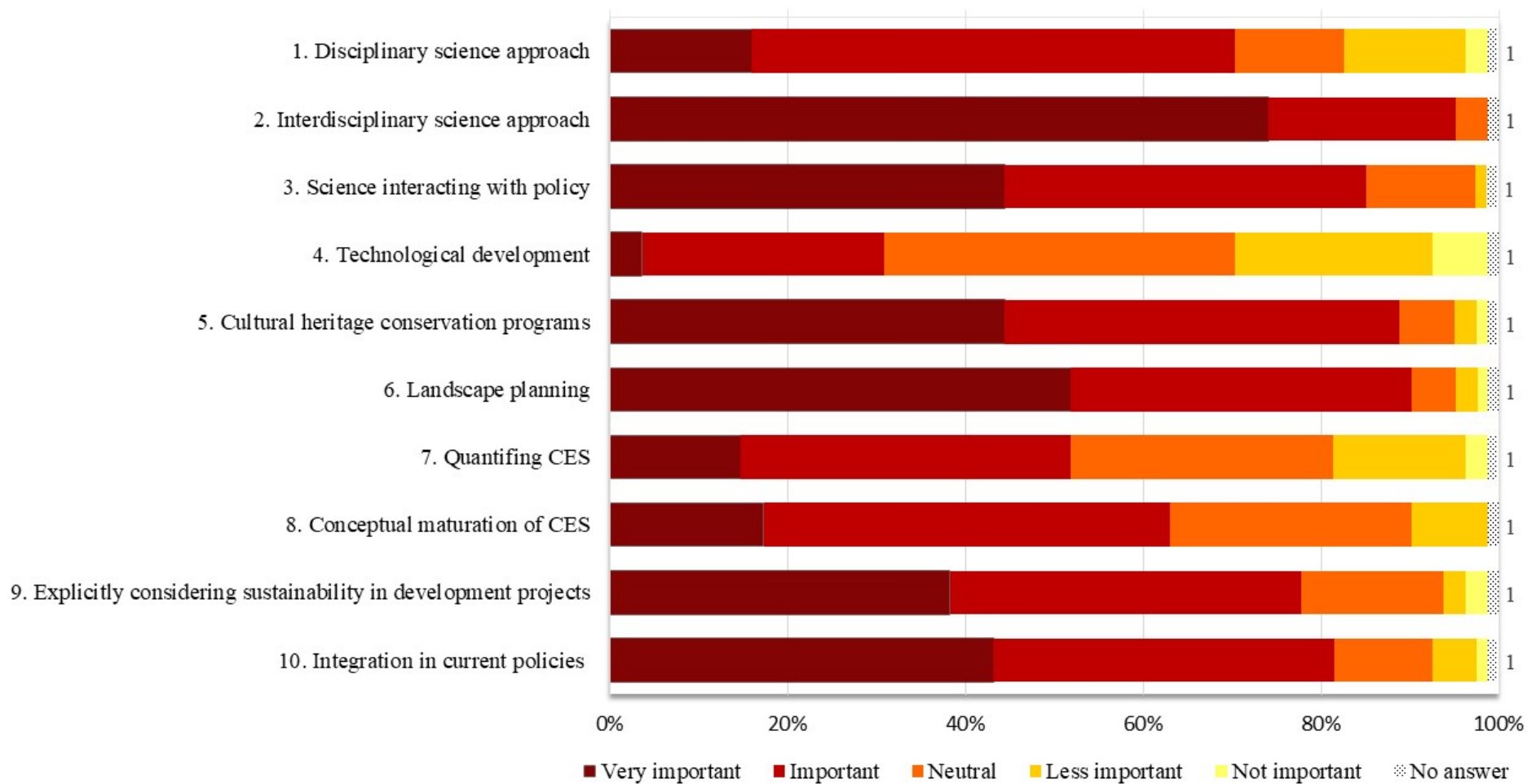
Case studies focusing on agricultural landscapes











Balácsi Ágnes: Conceptualization, Methodology, Formal analysis, Investigation, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization. **Juliana Dänhardt:** Methodology, Writing - Review & Editing. **Sue Collins:** Methodology, Writing - Review & Editing. **Oliver Schweiger:** Methodology, Writing - Review & Editing. **Josef Settele:** Writing - Review & Editing, Project administration, Funding acquisition. **Hartel Tibor:** Conceptualization, Methodology, Data Curation, Writing - Review & Editing, Visualization, Supervision, Funding acquisition, Project administration.

Appendix A - Questionnaire used in this survey

1. When did you become familiar the cultural ecosystem services (CES) concept? □2005 - 2010

□2010 – 2015

□after 2015

□I am not familiar

2. Could you please briefly define your understanding of CES?

3. At which extent do you agree with the following statements about the CES?

1. Strongly agree; 2. Agree; 3. Neutral; 4. Disagree; 5. Strongly disagree

	1.	2.	3.	4.	5.
1. CES are nonmaterial benefits such as spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences.					
2. CES are intangible services, subjectively interpretable according to bio-cultural differences.					
3. Some CES are tangible (e.g. recreational experiences) and can be assigned a monetary value as well as being recognized in a non-material way.					
4. CES are tangible services, easily quantifiable by well-developed and standardized methods.					
5. CES are so eroded in the current rural communities that it is not worth addressing them.					
6. CES are especially important for urban societies because urban populations have less access to substantial natural ecosystems close to where they live.					
7. CES are currently well considered in economic and cultural strategies.					
8. CES are sufficiently represented in the current policy framework and receive enough institutional support for on-ground implementation.					
9. Hay meadows and pastures are cultural heritages which contribute to CES.					
10. CES should be better covered in the current conservation policy such as the CAP and Natura 2000.					
11. CES look attractive but I think it is difficult to effectively implement the concept in policy.					
12. CES should be explicitly recognised and valued in the conservation and					

restoration of semi-natural areas and green infrastructure.					
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4. How relevant are the following CES-related features for you?

1. Very relevant; 2. Relevant; 3. Neutral; 4. Less relevant; 5. Irrelevant

	1.	2.	3.	4.	5.
Recreation and ecotourism					
Aesthetic values					
Spiritual and religious values					
Educational values					
Cultural heritage values					
Inspiration					
Sense of place					
Knowledge systems					
Social relations					
Cultural diversity					
Other:					

5. How relevant are the following approaches for addressing CES in your perspective?

1. Very important; 2. Important; 3. Neutral; 4. Less important; 5. Not important

	1.	2.	3.	4.	5.
Disciplinary science approach (e.g. sociology <i>or</i> ecology <i>or</i> other)					
Interdisciplinary science approach (e.g. combining multiple disciplines such as sociology <i>and</i> ecology <i>and</i> other)					
Science interacting with policy					
Technological development					
Cultural heritage conservation programs					
Landscape planning					
Quantifying CES					
Conceptual maturation of CES					
Explicitly considering sustainability in (urban, rural) development projects					
Integration in current policies					

6. How do CES relate to your work? Please describe (e.g. methodologically, practically or conceptually).

☐ They are not related (**Skip question 7, 8**)

7. How frequently do you work with the CES?

☐ Daily

☐ Several times per week

☐ Monthly

☐ Several months in one year

8. Which spatial scale is the most relevant in your work regarding the CES? ☐ Global

☐ International

☐ National

☐ Regional (e.g. village clusters, wider landscapes)

☐ Local (e.g. village)

Which is your expertise?

☐ Research (mention category e.g. social, ecology, political):

☐ Policy (mention level):

☐ Protected area management (exemplify):

☐ NGO (mention profile):

☐ Practice (e.g. farmer, company, tourism, etc.):

☐ Other: _____

9. What is your country of origin (birth)? _____

10. What is the country of your professional activity? _____

11. What is your level of education? _____

12. What is your gender?

☐ Male

☐ Female

13. What is the profile of your organization?

☐ Research

☐ Education

☐ Government

☐ Company

☐ Non profit

☐ Other: _____

14. Do you have any other comments, questions, or concerns?

Appendix B – Additional information about experts’ profile

Table B.1 Experts involved in the survey according to education, gender, frequency of working with CES, the spatial scale most relevant in their work in relation to CES, their area of expertise, and profile of organization.

Education	Frequencies	% of respondents
PhD student or higher	47	58
Master	16	19.8
University degree	17	21
High school	1	1.2
Gender		
Male	45	55.6
Female	36	44.4
Frequency of working with CES		
Daily	6	7.4
Several times per week	15	18.5
Monthly	9	11.1
Several months in one year	24	29.6
Not work-related	20	24.7
No answer	7	8.6
Spatial scale		
Global, International and National	1	1.2
International	1	1.2
International and National	3	3.7
International, National, Regional	1	1.2
International and Regional	2	2.5
International, Regional and Local	1	1.2
National	3	3.7
National and Regional	2	2.5
National, Regional and Local	1	1.2
Regional	22	27.2
Regional and Local	13	16
Local	4	4.9
Not work-related	20	24.7
No answer	7	8.6
Field of expertise		
	%	

Research	25	30.9
Education	4	4.9
Government	12	14.8
Company	1	1.2
Non-profit	4	4.9
Research and Education	21	25.9
Research and Government	3	3.7
Research and Company	1	1.2
Research and Non-profit	1	1.2
Research, Education and Government	1	1.2
Research, Education and Company	1	1.2
Research, Education and Non-profit	2	2.5
Government, Company and Non-profit	1	1.2

Appendix C - CES research in Europe focusing on agricultural landscapes

Table C.1 Studies addressing CES in agricultural landscapes from the 157 reviewed papers (RE - Review, M&P - Methodological&Practical, E - European, G - global, N - national, R - regional and L - local)

Type	Scale	Source	CES research in agricultural landscapes
RE	E	Carvalho-Ribeiro et al. 2016	identify measures/indicators for conveying social preferences
	G	Hanaček and Rodríguez-Labajos 2018	review of relevant CES subcategories
M&P	L	Valkó et al. 2018	conservation initiatives of cultural heritage
	R	Assandri et al. 2018	quantifying aesthetic and cultural heritage values
	R	Bernués et al. 2016	assessing the perception of farmers and non-farmers on CES
	R	Bieling and Plieninger 2013	analysing the character, significance and spatial distribution of CES
	R	Eliasson et al. 2018	including existing knowledge and practice in local and regional heritage planning
	R	Häfner et al. 2018	tourists' preferences for landscape attributes
	R	King et al. 2017	assessing the links between biodiversity and cultural ecosystem benefits
	R	López-Santiago et al. 2014	compare visual perceptions of CES in different landscapes by different people
	R	Nave et al. 2017	native plants as cultural ecosystem providers and links with insect biodiversity
	R	Ripoll-Bosch et al. 2013	assessing sheep farming multifunctionality, carbon print and CES
	R	Soy-Massoni et al. 2016a	exploring linkages between agricultural landscapes and human wellbeing
	R	Soy-Massoni et al. 2016b	assessing different social perceptions on coastal agrarian landscapes
	R	Ungaro et al. 2016	mapping CES via visual choice experiment approach
	R	van Berkel and Verburg 2014	quantifying cultural services by a willingness to pay exercise with tourists
	R	van Zanten et al. 2016	assessing the contribution of landscape features to aesthetic and recreational values
	R	Winkler and Nicholas 2016	assessing CES in vineyard landscapes
	N	Hall 2018	presenting a business model for beef farming and CES delivery as alternative to abandon
	N	Herzog and Seidl 2018	summarise the agronomic and ecological status of Swiss summer pastures
	E	Marsoner et al. 2018	assessing the breeds' contribution to cultural heritage and identity
	E	Schulp et al. 2014	highlighting the importance of wild food collection and consume as CES

List of reviewed publications - CES research in agricultural landscapes

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3. Bieling, Claudia; Plieninger, Tobias (2013): Recording Manifestations of Cultural Ecosystem Services in the Landscape. In *Landscape Research* 38 (5), pp. 649–667. DOI: 10.1080/01426397.2012.691469.
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11. López-Santiago, César A.; Oteros-Rozas, Elisa; Martín-López, Berta; Plieninger, Tobias; González Martín, Esther; González, José A. (2014): Using visual stimuli to explore the social perceptions of ecosystem services in cultural landscapes: the case of transhumance in Mediterranean Spain. In *Ecology & Society* 19 (2). DOI: 10.5751/ES-06401-190227.
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