Assessing the ability of rural agrarian areas to provide Cultural Ecosystem Services (CES): a Multi Scale Social Indicator Framework (MSIF)

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• **Title**

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Abstract

Assessing the ways in which rural agrarian areas provide Cultural Ecosystem Services (CES) is proving difficult to achieve. This research has developed an innovative methodological approach named as Multi Scale Indicator Framework (MSIF) for capturing the CES embedded into the rural agrarian areas. This framework reconciles a literature review with a trans-disciplinary participatory workshop. Both of these sources reveal that societal preferences diverge upon judgemental criteria which in turn relate to different visual concepts that can be drawn from analysing attributes, elements, features and characteristics of rural areas. We contend that it is now possible to list a group of possible multi scale indicators for stewardship, diversity and aesthetics. These results might also be of use for improving any existing European indicators frameworks by also including CES. This research carries major implications for policy at different levels of governance, as it makes possible to target and monitor policy instruments to the physical rural settings so that cultural dimensions are adequately considered. There is still work to be developed on regional specific values and thresholds for each criteria and its indicator set. In practical terms, by developing the conceptual design within a common framework as described in this paper, a considerable step forward towards the inclusion of the cultural dimension in European wide assessments can be made.

Highlights

- This work develops a Multi Scale Indicator Framework (MSIF)

- MSIF is able to include Cultural Ecosystem Services (CES) such as aesthetics into multi scale assessments

- By using MSIF, rural areas' physical features were related to aesthetics, diversity and stewardship criteria

- Agricultural areas with higher land uses/ land cover ratio likely fulfil societal demands such as diversity, stewardship and aesthetics.

1. INTRODUCTION

It is well established that agricultural and forestry activities in Europe, in addition to providing provisioning services, i.e. food, fuel and fibre, provide a variety of non-material benefits to society. These include cultural ecosystem services (CES) such as: cultural identity; spiritual services (sacred, religious, or other forms of spiritual inspiration derived from ecosystems); inspiration (use of natural motifs or artefacts in art, folklore, etc.); aesthetic appreciation; and recreation and tourism (Burkhard, Kroll et al. 2009, Cooper, Hart et al. 2009, Sayadi, Gonzalez-Roa et al. 2009, García-Llorente, Martín-López et al. 2012, Pinto-Correia and Kristensen 2013). Societal demand for these cultural ecosystem services is well documented worldwide (MEA 2005, OECD 2006, TEEB 2010). In the European Union, for example, both the Common Agricultural Policy (CAP Pillar II, Axis 3) and the EU Biodiversity Strategy to 2020 (EU, 2011) recognise societal demand for CES by calling for the "maintenance, restoration and upgrading of the cultural and natural heritage of villages, rural landscapes and high nature value sites". However, despite such policy acknowlement, CES are not explicitly identifiable as policy instruments, but rather tend to be embedded within the landscape concept, with no attempt, for example, to link the maintenance of specific CES to landscape payments. Compounding this policy limitation is a lack of reliable assessment of the contributions of different farming systems, or farming practices, to the "non-material" qualities embedded into different cultural ecosystem services, such as aesthetics, identity or diversity, meaning that these relationships are understood largely in terms of whole landscapes contributing to bundles of CES.

Given that agricultural/rural policy decisions implemented at one scale of governance may have consequences on the delivery of CES at other scales, there have been calls for the application of multi-scale approaches to policy setting and monitoring (Cash, Adger et al. 2006, Dick, Maes et al. 2014, Lefebvre, Espinosa et al. 2014). The relevant literature on this subject is scarce and this exposes a number of conceptual and methodological difficulties. Foremost among these difficulties is the mismatch between the spatial scale at which environmental processes operate and are measured and the spatial scale at which agricultural management operates, a fact that is often not systematically captured in theoretical frameworks used to link these processes (Pelosi, Goulard et al. 2010). Particular challenges arise from data aggregation methods and the

establishment of indicators, as well as appropriate assessment of linkages across scales (Volk and Ewert 2011).

Something which particularly needs to be addressed is the question of how to assess and measure different CES at multiple scales of governance. A well-established approach for understanding the ways in which rural agrarian areas provide goods and services to society is that of deriving criteria and indicators for assessing the *ability* of rural areas to provide such goods. The existing literature on such indicators is vast and the indicators proposed can be broadly categorized into: i) *environmental indicators,* for example the United Nations Statistics Division Environmental Indicators (UNSD, 2014); ii) *sustainability indicators* (including the social, economic and environmental dimensions); and iii) *landscape indicators* (including landscape visual characteristics). The scalability and generalizability of these different classes of indicators varies. While environmental indicators are transferable between sites and regions, landscape indicators cannot be applied everywhere (Cassatela and Peano 2011). For this reason studies contributing to the very rich body of empirical work assessing visual concepts and attributes for deriving preferences for rural agrarian areas are often framed within the context of specific landscapes (see Section 2.2.1). This fact raises concerns about the generalizability (Cassatela and Peano 2011) of landscape-based indicators between different scales of analysis, and implies that multi-scale assessment of this class of indicators would be very challenging (van Zanten, Verburg et al. 2014).

In spite of these limitations, however, this very rich theoretical and empirical work on landscape preferences and perceptions should not be thought of just as a collection of case studies (van Zanten, Verburg et al. 2014). We argue instead that exploring the diversity of landscape preferences expressed in this literature, through different frameworks, might aid the development of a suitable framework for assessing the roles and values of landscape and its elements in provision of cultural ecosystem services (CES).

There is an extensive body of research on the assessment of the efficacy of public policies and planning approaches for delivering public goods and ecosystem services. However, the majority of the assessment frameworks proposed in this literature focus on fairly familiar environmental constructs, such as land use and water quality (for example, see the EU Common Monitoring Evaluation Framework (EC, 2006)) and do

not comprehensively address cultural ecosystem services (Paracchini, Capitani et al. 2012). With the possible exception of recreation (Paracchini, Zulian et al. 2014), current indicators fail to provide effective frameworks for either measuring the progress of wider social welfare, or for developing or reforming policy to cope with newly emerging social problems (Ahn, Choi et al. 2012). So far, most attempts to include these wider values and services have encountered difficulties when seeking translation into policy. In consequence, none of the frameworks so far suggested have demonstrated their utility for assessing the effectiveness of current policies in delivering various public goods and ecosystem services (Arler 2000, Turpin, Dupraz et al. 2009, Paracchini, Pacini et al. 2011, Pinto-Correia, Machado et al. 2013).

This research aims to fill this gap by developing a methodological framework to evaluate the ways in which rural agrarian areas provide cultural ecosystem services (CES). We call this approach the *Multi Scale Social Indicator Framework* (MSIF). In order to address the multi scale issue, the framework distinguishes indicators into two groups based on whether they are (i) generalizable over all regions (G), or (ii) applicable only to one, or a few, specific regions (RS). In this context, an indicator is considered G if it is possible to apply it throughout Europe, even though its range and thresholds might vary from region to region. To provide examples, an indicator related to olive groves could only be applied in Mediterranean regions, and would therefore be classified as RS, while an indicator related to outdoor recreation is applicable to the whole of Europe and therefore would be classified as G.

This approach is built upon the assumption, supported by some previous studies, that it is possible to capture and assess societal preferences, in the context of the rural agrarian areas, at different spatial scales, ranging from the European, national and regional scales to the landscape and local level (Carvalho- Ribeiro, Madeira et al. 2013, Dick, Maes et al. 2014). Previous studies, when measuring societal preferences at broader spatial scales, have used a ‘top-down’ approach, based on use of proxy indicators (mostly environmental indicators), derived from Europe-wide datasets, often integrated into composite indices (for example, see Paracchini et al, Pinto Correia et al. and Jones et al this issue). At the local and regional scales, landscape preference surveys (see Section 2.1.2.), have used a ‘bottom-up approach, eliciting data through primarily data collection, i.e. surveys, of the preferences of groups that are local to the specific landscape in question (for an example of this approach, see Almeida et al this issue).

However, the problem of bridging these different scales remains unresolved, as is the problem of how to validate the results from broader scale assessments, i.e. based on proxy indicators, while overcoming downscaling issues (Mander, Muller et al. 2005). The MSIF attempts to overcome these problems.

The effectiveness of any social indicator framework in capturing preferences for landscape hinges on the extent to which it can discern preferences from among the complex perceptions of rural agrarian settings in which they are embedded. In this context *preferences* towards rural landscapes are understood to be pre-cognitive responses to specific landscape features, elements or characteristics, which generate feelings of liking or disliking (Antrop 2000, Surova and Pinto-Correia 2008, Swanwick 2009, Carvalho-Ribeiro, Migliozzi et al. 2013). *Perceptions*, on the other hand, are cognitively based and hence more difficult to assess. As defined by Antrop (2000:19) "perception, as complex learning processes, analyses the observation immediately and interactively and links the results with our knowledge and past experience". In view of the subtly of these distinctions, and the difficulties involved in measuring perceptions, this study focuses predominantly on the preferences of society as a whole, and not on the particular preferences, or perceptions of individuals or particular user groups.

One further question that had to be addressed in constructing the MSIF is the possibility of achieving any kind of consensus on the list of measures to be used as indicators of the contribution of different elements of the physical rural agrarian areas to cultural ecosystem services. This study directly explores this issue and describes a novel approach for identifying and evaluating a range of possible measures/indicators that are both available and meaningful at multiple levels of governance. This study therefore addresses three broad questions:

1. Is it possible to identify a meaningful set of measures/indicators for conveying social preferences for the rural agrarian areas of Europe?
2. Are available measures/indicators only region specific, or can a set be defined that are broadly applicable to all rural agrarian areas of Europe?
3. At what scale(s) are these measures/indicators most meaningful, and as a corollary, are these measures/indicators scalable and therefore relevant to inform policy making at different levels of governance?

2. METHODOLOGICAL FRAMEWORK

The research questions were addressed by means of a two-stage methodology:
1. A comprehensive literature review, based on a Science Direct web search.
2. A symposium and participatory workshop with scholars and practitioners in landscape science was held, during the International Association of Landscape Ecology (IALE EU) congress held in Manchester in September 2013 (http://www.iale2013.eu/). The literature review explored the criteria and visual concepts /attributes relating to preferences towards landscape by society as a whole. The participatory workshop was designed as a forum for gathering assessments by landscape researchers and practitioners on the characteristics, elements, or features of rural areas which contribute to the criteria and visual concepts highlighted in the literature as important in preference formation. As illustrated in Figure 1, the primary purpose of this study was to combine these two methodologies to construct a robust framework of indicators (i.e. the MSIF) capturing societal preference for rural agrarian areas, applicable to different spatial scales, as a means to informing policy making at multiple levels of governance.

Figure 1 here

2.1 A SYSTHEMATIC LITERATURE REVIEW ON PREFERENCES BY SOCIETY CONCERNING RURAL AGRARIAN AREAS OF EUROPE

The literature review was initiated using the advanced search tools available on the Science Direct web platform (http://www.sciencedirect.com/science/search) using the following search terms: "landscape preferences in Europe", "rural agrarian areas", "scale" and "indicators". This search identified 466 articles in this topic area (as of June 2013). The literature review involved the identification, from within this body of literature of multi-scale measures that might be suitable for use as indicators conveying social preferences concerning rural agrarian areas (Flick 2002). This was followed by a systematised classification of these measures as a means to making more sense out of the disparate (and confusing) state of both theoretical and empirical work on societal preferences for rural agrarian areas. The classification identified existing measures into one of three hierarchical categories: i) *criteria* upon which preferences might be based (preferences framed on a user based activity e.g. collecting mushrooms might be different for the same individual´s preferences for aesthetically pleasing landscapes); ii)

visual concepts or attributes conveying preferences; and iii) *features, elements or characteristics* of the rural areas able to represent these concepts/attributes. This last group, at the base of the hierarchy, then formed the pool from which we hoped to derive a list of measures and ultimately a robust set of indicators (Tveit, Ode et al. 2006).

The literature review found an extensive array of possible criteria and visual concepts which could be related to preferences for rural agrarian areas (presented in sections 2.1.1.and 2.1.2. respectively). In order to screen out unsuitable indicators, an approach proposed by Tveit et al (2006) was employed. This filters the selection according to a number of technical criteria, i.e. the soundness and clarity of the theoretical basis; transferability; quantifiability; mappability; availability; and policy relevance.

2.1.1. A review of the criteria used to describe preferences for rural agrarian areas

One of the major findings of the literature review is that preferences for rural agrarian areas vary markedly according to the criteria on which preference is expressed (Coeterier 1996, Gobster, Nassauer et al. 2007, Rogge, Nevens et al. 2007, Sevenant and Antrop 2009, Swanwick 2009, Sevenant and Antrop 2010). These criteria, which are anthropegenically mediated, may represent the nature of the interaction of the user with the landscape, or represent perceptions of physical or cultural aspects of the landscape (Coeterier 1996, Gobster, Nassauer et al. 2007, Rogge, Nevens et al. 2007, Sevenant and Antrop 2009, Swanwick 2009, Sevenant and Antrop 2010). Six criteria can be identified from the literature.

1. Preferences with a **functional basis**, largely in the context of a user based activity- for example, preferences of tourists (recreation, bird watching), preferences of hunters, etc. Here, preferences vary over specific user groups (Schmitz, De Aranzabal et al. 2007, Fyhri, Jacobsen et al. 2009);
2. Preferences on the basis of **visual concepts** such as: stewardship, coherence, disturbance, historicity, visual scale, imageability, diversity, naturalness and ephemera (Ode, Tveit et al. 2008, Fry, Tveit et al. 2009, Ode, Fry et al. 2009, Ode, Hagerhall et al. 2010, Ode and Miller 2011, Ode Sang and Tveit 2013);
3. Preferences for certain **attributes** of landscapes**,** such as refuge and security, or legibility and mystery (Appleton 1975, Appleton 1998, Kaplan and Kaplan 2011);

4. Preferences based on **scenery,** i.e. scenic beauty, tranquility, etc. focussing on beautiful and idyllic countryside (Carlson 1977, Van Den Berg, Vlek et al. 1998, Daniel 2001, Barrett, Farina et al. 2009, Tempesta 2010)
5. Preferences in the context of **landscape identity**, i.e. elements of the physical landscape that conveys sense of place (Proshansky, Fabian et al. 1983, Duncan and Ley 1993) such as preferences for traditional farming practices-in some cases relating to quality and certified products (Antrop 1997, Sayadi, Gonzalez-Roa et al. 2009, Wu 2010, Stanchi, Freppaz et al. 2012); and
6. Preferences for particular types of **land cover** (Ulrich 1986, Dramstad, Fry et al. 2001, Dramstad, Tveit et al. 2006, Carvalho-Ribeiro, Ramos et al. 2013). Preferences for different land cover seem to vary across Europe. For example in southern Europe the *montado* agro forestry system is highly valued, whereas other land cover types e.g. orchards, are valued in other parts of Europe.

The authors' contend that using different "criteria" such as these for identifying and classifying preferences for rural agrarian landscapes is not only possible but also desirable. This assumption is based on an acknowledgement that the basis of preferences may vary, even for the same individual, according to the criteria by which their preferences are expressed. For example, preferences for someone picking berries, i.e. so called functional preferences, might be different from the same individual when seeking aesthetically pleasing landscapes, i.e. aesthetics (Tahvanainen, Tyrvainen et al. 2001).

The literature review also made clear that there is a need to further address visual concepts relating to landscape preferences, as this is a focus of a considerable body of work within the literature. This question is revisited in Section 2.1.2 below.

2.1.2. A review of landscape preferences

Before beginning the process of selecting an indicator set for the multi-scale indicator framework (MSIF) further consideration needs to be given to the landscape scale. The European Landscape Convention defines landscape as "*an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human*

296 *factors*" (ELC 2000). This definition captures the notion that landscape is a multi-
297 dimensional concept. Landscapes result from the ways that different components of the
298 environment, both ecological (geology, soils, climate, flora and fauna) and cultural
299 (institutions formal and informal), and society as a whole, interact together in material
300 and imaginary ways (Selman 2006). Modern theories therefore present landscapes as
301 holistic entities, within which natural and human processes merge. Communities,
302 legislators, industry, local stakeholders and the public at large have different
303 expectations from landscape, and their particular preferences all have an influence on
304 landscape planning (McMichael, Butler et al. 2003). Whilst recognising that
305 assessments must take place at multiple scales, the landscape scale itself is of particular
306 importance, as it is here that conflicting interests, e.g. production and conservation, need
307 to be coordinated (Tress, Tress et al. 2001). It is therefore here, at the landscape scale,
308 that societal demands for cultural ecosystem services unfold and provision of them
309 occurs (Selman 2006).

310 Because of the multi-dimensional nature of landscapes, the body of work on "landscape
311 visual concepts" or "landscape attributes" is vast. A Web of Science search using these
312 expressions as search terms undertaken in 2013 found 16,916 articles, and by April
313 2014 this number had risen to 18,046. Space does not permit a full review of such a
314 huge quantity of literature, or even a review solely of existing frameworks for analysing
315 visual qualities, such as, for example, the Landscape Character Assessment (LCA)
316 (Swanwick 2002).

317 However, from the literature review a number of key concepts emerged as important in
318 determining preference for rural agrarian areas, such as the concept of *stewardship*.
319 While stewardship has been identified as an important determinant of landscape
320 preference (Nassauer 2011, Ode Sang and Tveit 2013), the manner and extent of
321 operation of stewardship remains obscure, in part because the effect seems to vary both
322 between and within individuals and groups (Tips and Vasdisara 1986) and according to
323 landscape context (Ode Sang and Tveit 2013). In this study, therefore, rather than try to
324 identify a set of features, elements and characteristics contributing to preference for
325 landscapes in general, we have constrained the analysis to landscapes under
326 stewardship, i.e. where management gives the landscape a 'cared for' appearance. No
327 attempt was made to identify variation in the weightings given to these elements,
328 features or landscape characteristics reflecting relative importance expressed by

329 different groups. However, the study did assess which of these features, elements and
330 characteristics were and were not readily scalable.

331 Two further concepts identified in the literature review as important determinants of
332 societal preferences for landscape were *diversity,* i.e. the diversity embedded in
333 landscapes and the *aesthetic values* associated with landscapes (Ribe 1989, Hamilton
334 2001, Van Eetvelde and Antrop 2004, Ode, Hagerhall et al. 2010, Kaplan and Kaplan
335 2011, Ode and Miller 2011). The concern with these concepts, in the context of the
336 MSIF, is that considerable challenges have been demonstrated in trying to make them
337 operational as well as scalable. A number of rigorous studies have shown that both the
338 perceptions of diversity in landscapes and their associated aesthetic qualities are fully
339 anthropogenic and occur at a "human" scale dubbed the "perceptible realm" by Gobster
340 et al. (2007). Only a few researchers have taken up the challenge of
341 upscaling/downscaling indicators of diversity or aesthetics in order to frame cross scale
342 policy making.

343 In order to fully develop the MSIF, it will be necessary to build upon the work of
344 previous studies and identify, for each one of these criteria or visual concepts (see
345 Section 2.1.2) identified in the literature, i.e. stewardship, diversity or aesthetics, a list
346 of landscape features, elements or characteristics contributing to these. If this is
347 possible, it will be then be feasible to assess preferences by society as a whole at
348 different levels of governance. It was to explore these possibilities that the symposium
349 and participatory workshop mentioned in Section 2.2 were organized.

350 **2.2. SYMPOSIUM AND PARTICIPATORY WORKSHOP**

351 Seven papers presented during a symposium of the IALE 2014 conference
352 (http://www.iale2013.eu/scaling-social-indicators) were identified which focussed on
353 the three research questions introduced at the end of the Introduction section above. The
354 authors of these papers, along with other expert stakeholders, subsequently attended the
355 workshop where the criteria/visual concepts of stewardship, diversity and aesthetics as
356 described in Section 2.1.1 were tested. Three "stations" or discussion areas were located
357 in the room, each with a wall-mounted table to collect stakeholder input on one of the
358 criteria/visual concepts. Alongside each table (see Table 1) was a full definition of each
359 of the criteria/visual concepts, accompanied by the following generic discussion
360 question:

'What are the landscape characteristics or features which you feel would be the best indicator(s) for: Stewardship/Diversity/Aesthetics?'

Table 1 here

In each one of these "stations" one facilitator helped participants to fill in the wall-mounted table (Figure 2).

Figure 2 here

The participants moved around the stations in a carrousel approach. As soon as the participants arrived at each station, the facilitators read the definition of the criteria and prompted the discussion by reading the question.

Participants were given 15 minutes at each station. If a participant suggested a possible indicator, the facilitator prompted discussion of that suggestion among the other members of the group. There was no imperative to reach agreement within the group on the choice of features or characteristics for use as indicators for the different criteria; the only requirement was to discuss each suggestion within the group. The tables were filled in one row at a time, to collect specific data and judgements about each suggested indicator using the columns in the table. The same measure/ indicator could be repeated for different criteria/visual concepts. The group discussions were tape recorded. Each time the group changed station, the facilitators changed the colour of their pen so that the contributions of each participant group could be subsequently identified. This permitted the post-workshop identification of participants with particular sets of indicators. After this carrousel exercise there was a plenary discussion. To start the plenary session participants were asked to vote, i.e. expressing their own preferences, on the relevance of each suggested indicator. They did this by sticking five coloured dots against indicators at the three stations. Participants could place one dot against each of the five most relevant indicators, or place multiple dots against any single indicator to express weighting. Following the voting, indicators and their scores were presented to the whole group by the facilitator of each station. This was followed by a group discussion and an evaluation of the session.

3. RESULTS

This results section is organized into two sub-sections: Section 3.1 covers the content of the indicator dataset derived from the workshop; while Section 3.2 describes and critiques the process by which the data in the indicator dataset was gathered, and then considers ways in which the three research questions can be answered using this data.

3.1 The proposed indicator set

Table 2 shows, for the three criteria analysed, i.e. stewardship, diversity, aesthetics (column 1), the set of potential measures/indicators that were derived from the workshop participants (column 2). Column 3 of the table shows the score that each measure/indicator obtained in the voting. Column 4 highlights the possibility of measuring each indicator at different geographical scales and Column 5 classifies measures/ indicators as either Region Specific (RG) or General (G) on the basis of their level of generalizability.

A set of 40 putative indicators were gathered from the three workshop stations (see anexxe1). From the 13 indicators identified with stewardship, those that scored highest in the voting were:

- *"quality" of man-made structures*, and
- *man-made structures with a function*

Both of these indicators denote active farm management. Twelve diversity indicators were suggested, with three scoring highly in the voting:

- *edges between agriculture and other land uses*
- the *number of elements and land covers in a view shed, and*
- *high diversity indexes* (e.g. Simpson's Diversity Index 'D' or Shannon Index 'H')

For aesthetics, high voting scores were obtained for two of the 15 suggestions, namely:

- *water bodies*
- *sublime features* (such as mountains)

Some of the workshop participants noted (see Section 3.2.2) that some of the measures/indicators listed in annexe 1 cannot be classified, because of various limitations. To remove these weaker measures the list of measures was filtered using an

approach proposed by Tveit et al (2006) (please see the filtering criteria in Section 2.1. and the detailed assessment in Annexe 1). The results of this filtering exercise are shown in Table 2.

A review of all the measures/indicators retained after the filtering exercise (Table2) revealed that some physical landscape characteristics, or features, are important contributors for more than one of the three preference criteria.The indicators that are important to more than one criteria are shaded in grey. For example, hedges were identified to as important for both the stewardship and diversity criteria. Also, traditional elements/features were felt to be important for both stewardship and aesthetics, while the presence of waste/litter is negative for both stewardship and aesthetics. There are two landscape elements and characteristics that are important for all 3 criteria. Those are (i) elements indicating traditional farming practices and activities and (ii) a high number of land uses on a land cover type (i.e. a high land use/land cover ratio)(Table 2 Columns 6 and 7, respectively).

3.2.2. The process of gathering the list of indicators

The workshop involved 16 participants from 7 different countries: Greece, Belgium, Italy, the Netherlands, Switzerland, Germany, Japan, Poland, Norway, the UK and Portugal. There were four participants with landscape planning and management expertise, three with expertise in geography, two in environmental sciences (agriculture and forestry), one in biology (biodiversity), two in economic sciences, and one in psychology. Thirteen out of 16 participants were academic researchers (including principal investigators, post-doctoral researchers and PhD students) and three participants considered themselves to be practitioners.

The majority of the participants (14 out of 16) classified the workshop as well organized, while 12 out of 16 felt they were able to communicate and were listened to. The aspects of the workshop that participants liked the most were the organization of the event and the opportunity for brainstorming (14 out of 16).

The three aspects of the workshop that the participants liked the least were the lack of time for discussion (identified as a problem by five participants), the fact that the facilitators handled discussions around the three criteria in different ways (identified by four participants), and that some of the concepts being suggested were ambiguous and might have been explained to the group at an earlier stage (identified by four

452 participants). Participants also experienced some difficulties in accepting other people´s
453 views on these topics. In addition, the dominance of particular individuals also
454 apparently hampered the participatory process to some extent. Six of the participants
455 (around a third) were not completely satisfied with the outcomes of the workshop,
456 pointing out that more work was needed on refining the list of indicators suggested by
457 participants.
458 As already indicated, it was to address this particular concern that the indicators were
459 subsequently filtered to derive a final robust set of 29 (out of 40) indicators using the
460 approach suggested by Tveit et al (2006) (Annexe1, where retained indicators are
461 shaded grey). It should be noted that some of these 29 indicators scored relatively
462 poorly on data availability and in order to retain them it was necessary to make some
463 assumptions about the feasibility of additional data collection at moderate costs. There
464 are still several screening issues that still need addressing and this work on indicator
465 selection is progressing. Despite these remaining data quality issues, the data gathered
466 at the workshop suggests that it is indeed possible to achieve some degree of consensus
467 on a list of meaningful and relevant indicators for the three criteria/visual concepts. As
468 participants came from a range of disciplines and geographical regions, there was
469 considerable heterogeneity in the suggested measures and justifications for these. This
470 suggests that it would have been very difficult to achieve complete agreement on all
471 indicators, a view supported by the fact that some participants voiced strong opposition
472 to some suggestions.

473 Addressing the first of three research questions, it can be stated that, although
474 arguments remain on the relevance and validity of some of the indicators proposed, this
475 study has at least demonstrated that this methodological approach is sufficiently robust
476 to derive a preliminary indicator set appropriate for the MSIF.

477 In addressing the second of the research questions, it was expected, *a priori*, that the
478 majority of indicators would be framed in a region-specific manner due to issues of
479 landscape specificity. However, the results of the workshop demonstrated (see Column
480 5, Table 2) that the majority of the indicators can be classified as general (G) – meaning
481 that it would be possible to use them throughout Europe, even though their range and
482 thresholds might vary from region to region (please see * in Table 2). The workshop
483 participants did identify a few RS indicators, such traditional irrigation systems, which
484 are prominent only in Southern Europe due to drier climate. It is perhaps important to

reflect on these results in light of the background of the workshop participants. Participants were generally experienced academic researchers and practitioners they were therefore very knowledgeable on what indicators might be applied everywhere, or only locally. A less experienced group might have drawn more on the specificities of the rural areas they were personally familiar with, rather than thinking in more general terms.

In terms of the third and final research question, i.e. the scalability of indicators, as shown in column 4, the majority of the potential indicators elicited by participants can be measured at a range of spatial scales (and therefore levels of governance): namely site, landscape, regional and national scales. Indeed most can be derived through the use of high resolution satellite imagery, using both remote sensing and GIS technologies. It should be pointed out, however, that many of the indicators believed to be available through remote sensing, would only be available for the whole of Europe with an enormous input of time and financial resources. This is a significant problem which the use of MSIF needs to address. One cost effective way of approaching the data acquisition issue would be to deploy expenditures preferentially on those indicators that contribute to more than one criteria/visual concept and which better target policy across different levels of governance. Our suggestion would be to focus on the land uses/land cover ratio, as this also will tell us about the level of multi-functionality– this being an important issue to other policy instruments within CAP, particularly Pillar II.

4. DISCUSSION

In addition to providing provisioning outputs, agricultural and forest areas are today understood and expected to meet multiple societal demands (Pinto Correia and Carvalho Ribeiro 2012, Pinto-Correia and Kristensen 2013). In spite of policy recognition of this fact, societal expectations for, and provision of, cultural ecosystem services from rural landscapes barely register in extant indicator datasets, official or otherwise (Paracchini, Zulian et al. 2014).

Cultural ecosystem services (e.g. aesthetics) delivered by sites, landscapes or other geographical units, are particularly difficult to assess due to their multi-faceted and often perception-based nature. One of the innovations of the current study is that it builds upon the theoretical and empirical work of landscape sciences, particularly in the areas of landscape preferences, landscape attributes and visual concepts, as a means to

characterising cultural ecosystem services. We have demonstrated the usefulness of such an approach through the construction of the MSIF framework, through which bundles of cultural ecosystem services provided by rural areas can be framed into a set of three criteria, with associated indicators, to account for societal preferences. In addition, the study has identified, by means of a literature review and participatory workshop, through a transdisciplinary approach, the links between the material/physical elements of landscapes and the different cultural ecosystem services that they provide.

Previous work on landscape preferences has not notably addressed the issues involved in upscaling/downscaling of societal preferences for rural agrarian areas. The few studies that have touched on scale issues have been limited to reviews of landscape preference case studies through meta-analysis (van Zanten, Verburg et al. 2014). The authors' contend that, because MSIF achieves multiple goals simultaneously, i.e. it: (i) engages with the complexity of findings from a comprehensive set of landscape preference studies; (ii) frames landscape preferences into different "criteria"/"visual concepts" linked to different cultural ecosystem services; and (iii) identifies features linked to these criteria/visual concepts that can be mapped at different scales of governance, it successfully addresses the ways in which physical landscape elements contribute to the non-material qualities of different CES. Further, the MSIF addresses not only the issue of upscaling/downscaling of rural landscape preferences, but also goes some way to understanding how elements of the physical landscape contribute to the bundle of cultural ecosystem services generated by rural agrarian landscapes. This represents considerable innovation.

The results of the study have shown that it is indeed possible to build a "moderately consensual" list of indicators for conveying aesthetics, stewardship and diversity of rural agrarian areas in Europe. The process of gathering this list of indicators was very much "negotiated" amongst participants, in spite of strong divergences of opinion. For example, where participants defended their favoured indicators rigidly, negotiation could become very complex. Because the workshop was held during an interdisciplinary conference, participants came from a diversity of backgrounds, i.e. social sciences, environmental sciences and geography, encompassing both researchers and practitioners and this contributed to the heterogeneity of the workshops outputs. Fortunately, there was a clear commitment within the participating group to deal with problems that may arise from this inter-disciplinarity and they welcomed the challenge

551 involved in this task and made a serious effort to ensure the quality of the outcomes.
552 This goal was facilitated by a recognition that good dialogue between participants from
553 different backgrounds was imperative. Even with a very high commitments from all the
554 stakeholders involved into the exercise, from a total of 40 possible indicators elicited by
555 workshop participants, only 29 met the criteria of robustness as adapted from the work
556 of Tveit et al (2006). Those 29 were afterwards screened, to eliminate overlap and
557 ambiguity, yielding 19 unique and preliminary indicators. Review of these data revealed
558 that some landscape elements, such as hedges, are important for more than one criterion
559 (stewardship and diversity). It is therefore likely these particular indicators, where they
560 exist, will be among the most useful for the assessment of cultural ecosystem services,
561 particularly if these are further developed through qualitative analyses of complimentary
562 data (e.g. data for the conservation status of hedges).
563 It is recognised that measuring some of these indicators would be both time consuming
564 and very expensive. For example, vertical diversity, or land uses:land cover ratio are
565 difficult to measure when using information derived from remote sensing alone. Thus it
566 would be necessary to reconcile remote sensing data with field surveys. Although there
567 are already some widely available field survey datasets available, (for example the
568 Eurostat LUCAS survey, http://ec.europa.eu/eurostat/statistical-
569 atlas/gis/viewer/?myConfig=LUCAS-2012.xml), which include photographs of each
570 data point, it is still not known whether this is adequate for creating indicators such as
571 vertical diversity, or land uses:land use ratio, in a systematic manner. Therefore a
572 continuous monitoring of these elements, namely through remote sensing and GIS
573 technologies, might further help to develop this indicator set. As these elements and
574 characteristics can be measured through time and at multiple scales, it is possible to
575 derive list of those that, if properly addressed and calculated, might help to frame policy
576 making at multiple levels of governance. For example in Europe there are, at the
577 moment, two operational indicators sets, namely the EU agri-environmental indicators
578 (AEI) and the Common Monitoring Evaluation Framework (CMEF). While AEI
579 monitor the integration of environmental concerns into the CAP, the common
580 monitoring and evaluation framework (CMEF) measures the performance of the CAP
581 both in Pillar I and II. By definition, the AEI framework focuses on the environment,
582 but includes some indicators belonging to the social domain, such as “farmers’ training
583 levels and use of environmental farm advisory services” and “risk of land
584 abandonment”, necessary to build a storyline of the reasons why integration of

environmental concern in the CAP may or may not have happened. The CMEF framework hosts instead a more consistent number of social indicators, since some of the CAP objectives specifically aim at improving the social context of rural areas, such as "Improving the competitiveness of the agricultural and forestry sector" and "Improving the quality of life in rural areas". The indicators presented in this work (Table 1) can be of use for enhancing the CMEF framework. One indicator that might be of particular interest is the land uses/land cover ratio. High ratio scores suggests that the more uses that are made of a single land cover the more likely it is that a rural area will be able to fulfill criteria such as aesthetics, diversity and stewardship. The land uses/land cover ratio can be assessed on the basis of a combination of land cover maps with agricultural data (Verburg and Overmars 2009, Verburg, van de Steeg et al. 2009). There are land cover maps at different spatial scales (e.g. CORINE for the whole Europe and different member country land cover databases). However, it is acknowledged that CORINE land-cover classes might hide considerable diversity of land uses and ecosystem service provision in contrasting European areas. Another related issue is that for some of the social indicators even a high resolution land cover map might not provide the details needed. As an alternative, there are farm-databases, such as FADN[1] and FSS[2], which provide relatively easy-access data for land use. This work shows that having data on landscape elements such as hedges, water bodies, litter, traditional farming practices, as well as data on land uses/land cover ratio, can be informative for assessing the ability of rural agrarian areas in supplying cultural ecosystem services. This might contribute to better target policy making by relating those social dimensions to physical rural settings. This is a crucial test for the achievement of the EU Biodiversity Strategy to 2020 targets. A main target of the Strategy is to map and assess ecosystems and their services. In MAES (EC, 2014) it is reported that cultural ecosystem services for agro-ecosystems can be mostly calculated on the basis of data which may be regionally available, while for some of these services further conceptual development is needed. The approach presented in this study fills an important gap, related to the possibility of calculating indicators for cultural ecosystem services at the EU level. This is very important as integrated assessments in this

[1] FADN http://ec.europa.eu/agriculture/rica/database/database.cfm
[2]Farm Structure Survey http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/ef_esms.htm both (accessed 27.05.2014)

615 category are currently severely under-represented (EC, 2014). Furthermore, results
616 presented in this study provide an important conceptual advance for the inclusion of
617 cultural ecosystem services in established indicator frameworks on which EU policy
618 assessments are based (e.g. Eurostat agri-environmental indicators, CMEF indicators
619 etc).

620 What still is missing in the evaluation undertaken here is the required thresholds of the
621 indicator set to each regional context. Some indicators (i.e. hedges) do not have the
622 same role everywhere, while diversity in land cover compositions can be valued
623 differently in different regions. The way to approach these regional specificities still
624 needs to be developed through a European-wide framework. It is therefore necessary to
625 put the regional contexts into the broader European picture. The merits of different
626 approaches to fine-tune this approach, together with suggestions for improving the
627 workshop process are discussed in Table 3.
628 Table 3 here.

629 **5. CONCLUSION**

630 Three major research questions set the frame of this study. The first question asked: "*Is*
631 *it possible to summarize a reliable set of insightful measures/indicators for conveying*
632 *societal preferences for rural agrarian landscapes of Europe?"* Both the literature
633 review and the transdisciplinary process developed through the workshop revealed that
634 it is indeed possible to derive a moderate consensus on a list of indicators and so the
635 work on elaborating such list needs to be continued.
636 Question 2: "*Are these indicators region specific? Or is there a set that can be said to*
637 *be generally applicable for all the rural agrarian landscapes of Europe?*" The majority
638 of the indicators can be classified as general (G), meaning that it is possible to use them
639 throughout Europe, although value ranges and thresholds might vary from region to
640 region. Consolidation of thresholds and ranges regionally still needs to be developed.

641 Question 3: "*At what geographical scale(s) are these measures/indicators be most*
642 *meaningful? Is it possible to transfer a selected set of measure/indicators across scales*
643 *in such a way those can inform policy making at different scales of governance?"* The
644 majority of possible indicators elicited by participants can be derived at multiple scales
645 of governance, namely: site, landscape, regional and national scales, mostly through the

use of high resolution satellite imagery, using both remote sensing and GIS technologies.

From a policy perspective these findings suggest that it would be possible to undertake Europe-wide assessments of societal preferences for a number of critical land use strategies across Europe. This could include the extension of the biodiversity and habitat enhancement strategies, the widening of the rural forestry and tourism programmes, the introduction of aesthetics and stewardship considerations to ecological assessments, and the scope for designing landscapes of health and exercise as part of any forthcoming wellbeing strategy. What is particularly exciting is that this work could lead to a better participatory planning process for designing fresh approaches to the shaping of ecological and cultural values for "new landscapes".

These results might also be of use for improving existing European indicators frameworks by incorporating cultural ecosystem service provision into them. This would likely have major implications for policy at different levels of governance, as this would make it possible to target to, and monitor policy instruments in, physical rural settings so that the cultural dimension is adequately considered. Taking into consideration the diversity of landscape and regional contexts in Europe, there is still work to be done to allow for region-specific values and thresholds to be applied to each criteria and its indicator set. In practical terms, by developing the conceptual design within a common framework, as described in this paper, using common data sets and sources, a considerable step towards to the inclusion of the cultural ecosystem services in official European wide assessments can be made.

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881

882

Figures

Figure 1. Schematic representation of the whole methodological framework of MSIF

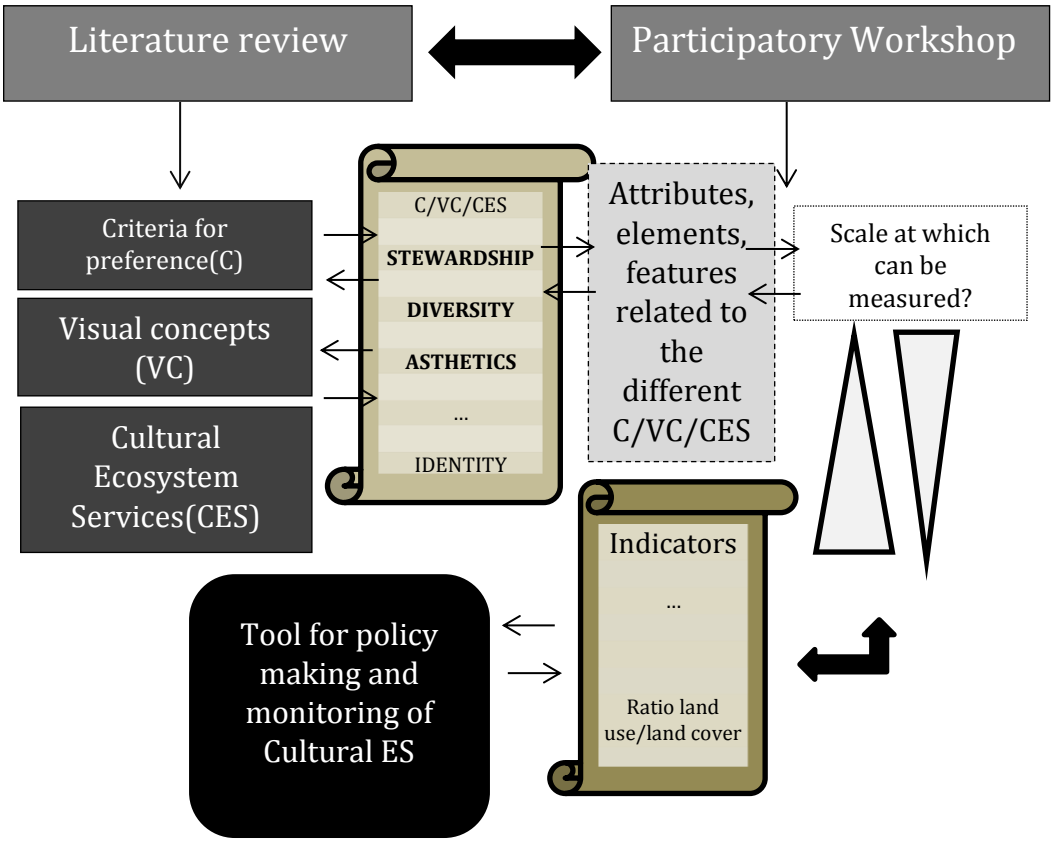

Figure 2. The participatory workshop in action

902 Tables

903 Table 1. Criteria and related definitions

Criteria	Definition
STEWARDSHIP	Refers to the sense of order and care present in the landscape reflecting active and careful management (Ode Sang and Tveit, 2013).
DIVERSITY	Is defined as the richness and diversity of landscape elements and features noted for their proximity and location, as well as the grain size of the landscape (Tveit et al., 2006).
AESTHETICS	Relates to landscape characteristics or features which are able to promote a feeling of liking or disliking (adapted from Gobster et al., 2007).

904

905 Table 2. List of measures/indicators derived from the workshop and its preliminary

906 assessment

Criteria	Indicators	Score	Appropriate scale to measure	General (G) or Region specific (RS)	Traditional features	Ratio land use/land cover
STEWARDSHIP	The "quality" of man- made structures (hedges in good condition status and made with local resources e.g. stone walls)	5	S,L;N	G*	X	
	Regularity of the landscapes (as man introduces regular shapes) number of man-made structures with a function: hedges,	5	S,L;N	G*	X	
	Adequate stocking rate of livestock- according to environmental conditions	2	S,L,R	G*	X	X
	"Knowledgeable and wise" land management (multifunctionality, different uses of the same plot)		S,L,R	G*		X
	Maintaining traditional irrigation systems		S,L,R	RS	X	
	Amount of shrubs in agriculture/ forest land – stewardship might also mean low vertical diversity-		S,L;N	G*		X
	Land abandonment and discontinuation of farming (is seen as negative)		S,L;N	G*	X	
	No waste		S,L,R	G		
DIVERSITY	Hedges between agriculture and other uses		S,L,R	G*	X	
	Richness-number of elements, land cover types in a view shed	7	S,L,R,N,E	G *		X
	Diversity of high-shanon,gini,simpson	6	S,L,R,N,E	G*		X
	Types of use per land covers (e.g. grass and trees)	3	S,L,R	G *		X
	Number of endemic plant/animal species per ha	3	S,L,R	G *		X
	Presence of trees/woodlands in field (no agreement)	2	S,L,R	G*		X
	Diversity of use in time		S,L,R	G*	X	X
	Number of crops in crop rotation		S,L,R	G *	X	X
	Vertical diversity		S,L,R	G*		X
AESTHETICS	Water bodies (no agreement) society in general likes water bodies-but not all of them…	4	S,L,R,N,E	G*		
	Sublime features e.g. mountains	4	S,L,R,N,E	G*		
	No litter	3	S,L,R,N,E	G*		
	Variety of colours/smell e.g. different land uses on a single land cover (no agreement as too much variety might be confusing)	3	S,L	G*	X	X
	Number of listed trees classified as monuments in agrarian areas	2	S,L,N	G*		X
	Density of classified trees in agricultural landscapes	1	S,L,N	G*		X
	"Old landscapes still functional", time	2	S,L	G*	X	X

	depth, time origin is long				
	Listed built elements	1	S,L,N	G*	X
	Sound/tranquillity		S,L,N	G*	
	Features associated with stewardship (no agreement) we like to see cared for rural areas, neat, ordered and clean		S,L,N	RS	X
	Amount of waste and decay of man-made structures (is seen as negative)		S,L,N	G*	X
	Light pollution (negative)		S,L,N	G	

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909 Table 3. Advantages and disadvantages of the workshop method

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Advantages	Disadvantages	Ways to improve the approach
The division of participants into small groups is useful: - gives time for all participants to contribute and encourages participation from less confident individuals, -the cross-talk taking place in the small groups provided an opportunity for participants to learn from each other. - the fact that there is very little structured process that needed to be followed meant that individuals were allowed to contribute as much or as little as they wanted; the process did not dominate the spirit of the group.	Because there was little opportunity to discuss the merits of ideas within the whole group, there is a danger that the merit of good ideas might be missed by the wider group through lack of understanding.	**Provide more time for the plenary discussion-**This can be done by for example reducing the time in the stations. It might have been better to allow more time for the first round of small group discussions and less time for subsequent rounds instead of a fixed 15 minutes in each station. When a group comes to a station previously occupied by other groups, they are building on the information already provided by the earlier group(s), i.e. some of the thinking has already been done.
The process of dissolving groups between stations was useful in that it altered the dynamics of the groups, particularly breaking up negative interactions between individuals, such as dominance of passive by assertive individuals.	As the group was changing every 15 minutes there was not a lot of opportunity for the testing of the merits of ideas being suggested by participants cross-questioning.	**Organize a second round of voting after the plenary session.** If there had been wider discussion of the ideas raised a second round of voting would have been possible, so that participants could revise their opinions in light of new information received in the plenary discussion. This will also encourage participants cross questioning
The very explicitly goal oriented tasks, coupled with clear instructions of a straightforward methodology, meant that there was little wastage of time (in clarifying purpose of methods) and	The facilitation process was not homogeneous.	**To give more "strict rules" to the stations facilitators** in order to have similar processes occurring in the different stations. (Rules and ways to proceed were given to facilitators beforehand,

participants could be productive immediately. The use of strictly time-constrained tasks kept participants focussed and maintained energy.		however, different facilitations styles were obvious.)
It was beneficial that there was no requirement to achieve group agreement within the small groups at the point of identifying issues. This encouraged the generation of more speculative and controversial ideas,; i.e. there was no inhibition derived from anticipation of counter argument.	Some participants got confused and did not understand well the other participant´s ideas. Furthermore some participants felt sad that one idea he/she not agreed at all was written in the Table because other participants views.	
There was no top-down input thus the risk of biasing the outputs of participants is small. Participants came from a range of disciplines and geographical regions, providing greater heterogeneity of ideas. Anonymous voting for favoured ideas eliminated any residual 'dominant character' effect.	Discussions were sometime confusing. Concepts were not common to all participants.	

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912 Annexe 1. Assessment of the workshop indicators using the criteria listed by Tveit et al
913 (2006)