Stakeholders' perspectives on the operationalisation of the ecosystem service concept: results from 27 case studies

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Abstract

The ecosystem service (ES) concept is becoming mainstream in policy and planning, but operational influence on practice is seldom reported. Here, we report the practitioners' perspectives on the practical implementation of the ES concept in 27 case studies. A standardised anonymous survey (n=246), was used, focusing on the science-practice interaction process, perceived impact and expected use of the case study assessments. Operationalisation of the concept was shown to achieve a gradual change in practices: 13% of the case studies reported a change in action (e.g. management or policy change), and a further 40% anticipated that a change would result from the work. To a large extent the impact was attributed to a well conducted science-practice interaction process (>70%). The main reported advantages of the concept included: increased concept awareness and communication; enhanced participation and collaboration; production of comprehensive science-based knowledge; and production of spatially referenced knowledge for input to planning (91% indicated they had acquired new knowledge). The limitations were mostly case-specific and centred on methodology, data, and challenges with result implementation. The survey highlighted the crucial role of communication, participation and collaboration across different stakeholders, to implement the ES concept and enhance the democratisation of nature and landscape planning.

Keywords Stakeholder perceptions, place-based implementation, evaluation, ecosystem services operationalisation

Highlights

- Questionnaire results from 246 stakeholders across 27 ES case studies are presented
- Communication, participation and collaboration amongst stakeholders is highlighted
- Potential of the ES concept to support planning at various scales is acknowledged
- Scientific credibility and new knowledge created are important concept advantages
- Resources required (time, money and skills) limit concept implementation

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1. Introduction

The dual concepts of natural capital (NC) and ecosystem services (ES) have matured over the last 30 years and are becoming mainstream in policy and planning. Major global initiatives such as the Millennium Ecosystem Assessment (MA 2005), The Economics of Ecosystems & Biodiversity (TEEB 2010), and the more recent Intergovernmental Platform on Biodiversity and Ecosystem Service (IPBES) (Diaz et al. 2015) have championed the concepts. The concepts are also becoming increasingly integrated in local-level decision-making, for example in urban planning (Kopperoinen et al. 2015, Maes et al. 2016), in national park management (Cairngorms National Park Authority 2012, García-Llorente et al. 2016, Gómez-Baggethun et al. 2013, Palomo et al. 2014), and within river basin management plans (Grizzetti et al. 2016a).

In recent years there has been an exponential rise in the number of academic papers reporting aspects of the implementation, or so called operationalisation of the ES concept (see Jax et al this issue). This includes work from the case study areas considered in this paper, which investigated: mapping ES (Baró et al. 2016, Clemente et al. in press, García-Nieto et al. 2015, Liquete et al. 2015, Palomo et al. 2013), modelling ES (Baró et al. 2014, Liquete et al. 2016b), valuation assessments (Martín-López et al. 2014), and integrated assessment of ES (Langemeyer et al. 2016). In addition, issues of scale (Bezák et al. 2017, Kovács et al. 2015), temporal aspects (Dick et al. 2016), and the linkages between biodiversity and ES (Gonzalez-Redin et al. 2016, Liquete et al. 2016a) have been studied in the case studies. Stakeholder engagement (García-Nieto et al. 2015), governance (Primmer et al. 2015) and the linkages between ES and human wellbeing (Kelemen et al. 2015, Tenerelli et al. 2016) are arguably less well researched. In the literature there are many similar examples where researchers draw on theory-based argumentation, large datasets and/or case studies, to test the utility of the ES concept. However large scale case study comparisons on how the ecosystem service concept can be operationalised, and how the knowledge is applied in practical terms are lacking. Few studies have assessed the impact of such research on the ES knowledge users (Posner et al. 2016; Saarela & Rinne, 2016), whose perspectives are vital if we are to make these concepts useful in real-world planning and decision-making. This paper addresses the apparent

knowledge gap in the systematic understanding of the usefulness of the ES concept for practitioners, by answering the question: *In what ways does the ecosystem service concept help practitioners address their specific real-world, ecosystem management needs?*

It is now acknowledged that the analysis of ES requires interdisciplinary approaches i.e. working across academic boundaries (Nesshöver et al. 2016). Despite the recent acknowledgment that funding bodies may discriminate against interdisciplinary research (Bromham et al. 2016), European funding streams are promoting not only interdisciplinary, but also transdisciplinary research (Lyall et al. 2015), which aims to integrate information from various scientific and societal bodies of knowledge (Hauck et al. 2015, Jahn et al. 2012, Lang et al. 2012, Röckmann et al. 2015). Transdisciplinary research offers conceptual and practical advances resulting from the synergy of different perspectives and contributions, which arguably are necessary for an ethical application of the ES concept to issues of societal relevance (Jax et al. 2013).The EU explicitly required a transdisciplinary approach to determine the advantages and limitations of the NC and ES concepts in real world situations, which is the focus of this paper. This paper reports the perspectives of users of ES knowledge in 27 case studies, following three years of ES research, addressing societally relevant ES issues selected by local stakeholders (Jax et al. this issue).

The case studies were co-developed with practitioners in a transdisciplinary way to ensure that they would address real-world practical concerns in the 27 localities. At an early stage in the ES research, the case studies assembled 'Case Study Advisory Boards' (CABs) (see Jax et al this issue). The goal of the CABs was to provide a forum where practitioners could work closely with researchers to identify topics to be investigated, discuss appropriate methods and tools, and to decide collectively about the process. Researchers worked with practitioners to: (i) identify the advantages/disadvantages they faced in operationalising the ES concept in their specific policy and decision-making context; (ii) apply and refine the methods and models to the case study's needs; and (iii) test the method/model relevance and usefulness in an iterative manner. As such, each individual case addressed different issues and used varied methodological tools to address their specific challenges. This paper draws out and characterises common lessons learnt, with respect to the operational potential of the ES concept, from the perspectives of the practitioners and stakeholders within these case studies.

Cross-case study comparisons of the tools, methods and perceptions of stakeholders are not the purpose of this paper, but these analyses have been addressed in other literature (See Carmen et al. this issue, Priess et al. this issue, Smith et al. this issue, Tenerelli et al. 2016, Turkelboom et al. this issue).

The design of the case studies reported in this study followed an approach described by Khagram et al. (2010), according to which the project or programme would constitute a "*self-identified community of scholars who share research questions or problems and are working on an interlinked set of research projects*". In line with the ideas of Khagram et al. (2010), the case studies explored three 'theories of knowledge' types, i.e. *prediction* (using models and scenarios; Hendriks et al. 2014), contextual situation-embedded *understanding* (e.g. analysis of conceptual frameworks; Dick et al. 2017, Liquete et al. 2016c), and *explanation* (through causal-pathways e.g. photoseries analysis; Martínez Pastur et al. 2016, Tenerelli et al. 2016, In press).

Similarly, the design of the case studies followed ideas from the general literature on the philosophy of science (e.g. Kuhn 1962, Lakatos 1970), from which Khagram et al. (2010) derive three major meta-philosophies (or paradigms) of research programmes for interdisciplinary environmental research. The paradigms, positivism, interpretivism and constructivism, define the nature of the phenomena researched, and can be mapped to components of the case studies contributing to this paper. For example, part of the Norwegian urban case study, coded as OSLO (Supplementary Material 1), which tested tools related to neoclassical economics, can be judged to have followed a positivist philosophy of knowledge, whilst the case studies that focused on socio-cultural and especially narrative methods can be judged to follow the interpretivism paradigm (Dick et al. 2017, Kelemen et al. 2013). A primary goal of interpretivist research is to understand the subjective views of individual actors, and the inter-subjective shared views of communities of actors. Some of the case studies which used discourse-based approaches e.g. participatory or deliberative mapping of ecosystem services can be judged to have followed the ideas of constructivist philosophy of knowledge, which seeks to explain and understand how reality is construed through social and natural processes (Hendriks et al. 2014, Smith et al. this issue, Zulian et al. this issue). The aim of the case studies and the meta-philosophies adopted was co-designed with the CABs.

The CABs were also consulted on the design and implementation of the evaluation process which was carried out towards the end of the study. This process allowed the CAB members and other local stakeholders to contribute as respondents to a comprehensive anonymous survey, in order to address the knowledge gap identified i.e. practitioners' perspectives of the ES concept.

This paper reports an assessment of the case study stakeholders' perspectives on the application of the ES concept, and in particular their views on the advantages and limitations of this concept as implemented in their own case study. To determine the advantages and limitations of the ES concepts, we use a combination of statistical and comparative research strategies. We specifically consider what factors in the ES appraisal the practitioners considered were associated with a 'change in action' in their case study, as this was considered the end point of the research evaluated.

The paper is structured as follows: the characterisation of the case studies and the design and implementation of the questionnaire are reported in section 2. The results are reported in section 3, and section 4 derives the lessons learnt from testing the ES concept in real-world case studies, and discusses these in the context of the value of integrating stakeholders into ES appraisals and the advantages for wider societal change.

2. Materials and methods

2.1 Characterisation of the case studies

The 27 case studies, used as testing grounds for exploring the challenges and opportunities for operationalising the ES concept, covered a range of locations (Fig 1). Twenty three were located in Europe and an additional one each in India (BKSU), Kenya (KEGA), Argentina

(SPAT) and Brazil (BIOB). Each case study was assigned a four letter code, which is listed alongside the full case study title in Supplementary Material 1.

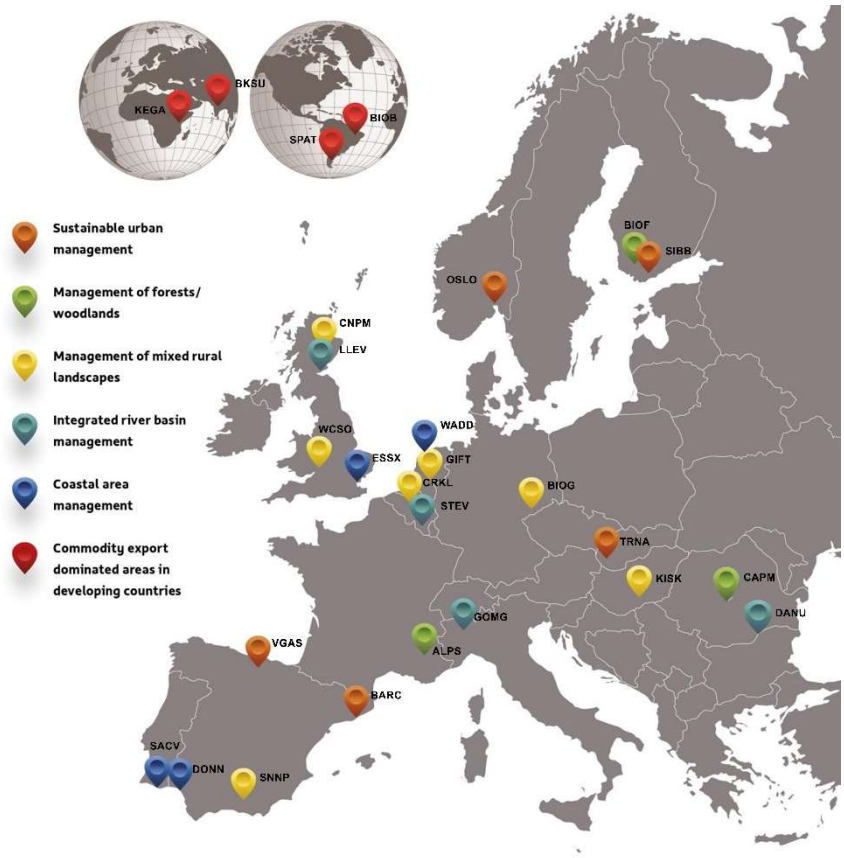

Figure 1 Map showing the location of the 27 case studies, about which the 246 stakeholders' offered their perspectives on the advantages and disadvantages of the application of the ES concept.

Details of all the case studies can be found in the 'Ecosystems in Operation case studies' brochure (EU FP7 OpenNESS Project 2016). The case studies were originally selected to represent a variety of landscapes and ecosystems specified by the commissioning body (EU) including urban areas, forests and woodlands, agricultural and mixed landscapes, rivers, lakes and coasts (Table 1).

A wide range of stakeholders were engaged in the case studies, including representatives of public agencies, natural resource management authorities, municipalities, and regional governments. Stakeholders in the form of ES users were also engaged, including land owners, farmers, foresters, urban dwellers, (eco)tourism business operators, tourists, NGOs etc.

Each case study explored one or more local societal issues which could be addressed by ES tools and approaches (Table 1). Given the diversity of settings, goals and issues, a wide selection of tools and methods were applied. An evaluation of some of these methods are detailed in other papers in this special issue (Barton et al., Dunford et al., Harrison et al., Priess et al., Smith et al., Zulian et al. this issue).

Table 1. Settings and issues studied across the 27 case studies, as identified by the case study research teams. The order of the case studies reflects the major ecosystems in the case study area and corresponds to Fig 1. Water, in this case, indicates freshwater bodies or rivers.

			Ecosystems				Context				ES category			Supply/demand		Study aim			Scale			
Original grouping	Case study code	Country	Urban areas	Forests	Agric.& mixed	Rivers, wetlands and coasts	Green infra-structure	Protected areas	Bio-energy	Economic offsetting / PES	Provisioning	Regulating	Cultural	Supply	Demand	ES Assessment	Valuation (£)	Planning / Management	Local	Regional	National	International
Urban	SIBB	FIN	✓										✓	✓	✓	✓			✓			
Urban	TRNA	SVK	✓				✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Urban	OSLO	NOR	✓				✓					✓	✓	✓	✓		✓		✓			
Urban	VGAS	ESP	✓				✓				✓	✓	✓	✓	✓				✓	✓		
Urban	BARC	ESP	✓				✓				✓	✓	✓	✓	✓	✓		✓	✓	✓		
Forest	ALPS	FRA		✓							✓	✓	✓	✓	✓	✓			✓	✓		
Forest	BIOF	FIN		✓					✓		✓	✓	✓	✓	✓					✓		
Forest	CAPM	ROU		✓				✓			✓	✓	✓	✓	✓			✓		✓		
Mixed	BIOG	DEU		✓	✓				✓		✓	✓	✓	✓	✓					✓		
Mixed	CNPM	GBR		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mixed	SNNP	ESP			✓			✓			✓	✓	✓	✓	✓		✓		✓			
Mixed	WCSO	GBR			✓					✓	✓	✓	✓	✓	✓	✓		✓		✓		
Mixed	KISK	HUN			✓			✓			✓	✓	✓	✓	✓	✓	✓	✓		✓		
Mixed	CRKL	BEL			✓						✓	✓	✓	✓	✓		✓		✓	✓		
Mixed	GIFT	NLD			✓						✓	✓	✓	✓		✓		✓	✓			
Water	GOMG	ITA				✓	✓					✓	✓	✓	✓		✓			✓		
Water	LLEV	GBR				✓							✓	✓	✓	✓			✓			
Water	DANU	ROU				✓					✓	✓	✓	✓	✓		✓			✓		
Water	STEV	BEL				✓					✓	✓	✓	✓	✓		✓		✓			
Coastal[1]	ESSX	GBR			✓								✓	✓		✓		✓	✓	✓		
Coastal	DONN	ESP			✓			✓			✓			✓	✓					✓		
Coastal	WADD	NLD				✓		✓			✓	✓	✓	✓		✓	✓	✓	✓	✓		
Coastal	SACV	PRT				✓		✓					✓	✓	✓	✓	✓			✓		
Non-Eu	BKSU	IND		✓	✓						✓	✓		✓	✓			✓	✓		✓	
Non-Eu	KEGA	KEN		✓	✓			✓			✓	✓	✓	✓	✓	✓		✓				✓
Non-Eu	SPAT	ARG		✓							✓	✓	✓	✓	✓			✓		✓		
Non-Eu	BIOB	BRA			✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

[1]Essex County is coastal but the CAB selected a mixed agricultural focal area.

2.2. Creation, structure and implementation of the standard questionnaire protocol

After three years of work in close consultation with case study stakeholders, a standard questionnaire approach was adopted to allow the stakeholders to feed back their experiences of the operationalisation of the ES concept conducted in their case study. The questionnaire protocol (Supplementary Material 2) was designed to be adaptable, appropriate and sensitive to local case study conditions, and to allow assessment of the operationalisation of the ES concept across a range of contexts, including different land-use and ecosystem management issues. To avoid biases in the answers, the following principles were adhered to: (i) the list of individuals selected to complete the standard questionnaire must be agreed with the local stakeholder representatives (CABs), which controlled for biases in the selection of participating respondents; and (ii) questionnaires were presented in a way that strived for independence from the research team and allowed for free and frank completion of the questionnaire by the respondents. Survey implementation teams were used in each case study, who were responsible for the delivery of a standard questionnaire, collection of the responses and delivery of the data to the core analysis team. These implementation teams and core analysis teams were independent of the case study research teams (for full details see Supplementary material 2). Furthermore the protocol required that questionnaires be completed anonymously, but the respondents could choose if they wished to declare their identity.

Three main approaches were used for selecting respondents: (i) restricting the respondents to CAB members (eight case studies), (ii) complementing all CAB members with stakeholders outside the CAB (eight case studies), and (iii) stakeholders, but not all CAB members (11 case studies). As the questionnaires were completed anonymously no demographics of the stakeholders can be provided. Rather their role in the case study was captured in the questionnaire.

The questionnaire was structured to cover four topics, and consisted of 12 themes, which each contained a number of statements. The four main topics were (i) self-characterisation of users, (ii) perception of the participatory process followed in the case study, (iii) perceived impact, and (iv) practical usefulness of tool(s) (Fig 2). There were four question formats: a set of statements with a 5 point ordinal scale and a single associated open question for all the statements (format A, Fig 2); a set of statements with a 5 point ordinal scale and an associated open question for each statement to allow fuller reporting (format B, Fig 2); open questions (format C, Fig 2); and finally a question where respondents were asked to rate their opinion of the overall usefulness of the method/tool on an 11 point ordinal scale ranging from -5 to +5 and an associated open-ended question (format D, Fig 2). The formatting of the questions was structured following consultation and strived to provide stakeholders with a sufficient range to fully express their opinion. The evaluation of the tools which used an 11 point scale will be considered in another publication.

[1]

Question	#	F
Self-characterisation of users		
1. The level of participation of the respondent in the project	6	A
2. The interest that the respondent has in the study area	6	A
3. The role of the respondent in relation to the addressed problem	5	A
4. The allegiances to social groups in the study area	10	A
The perception of the participatory process		
5. How the respondent experienced the cooperative process within the project	6	A
6. How well the process was organised	5	A
The perceived impact		
7. The impact of the project on their personal perception	5	B
8. The impact of the project on the study area	5	B
9. The main practical advantages of the work conducted	1	C
10. The main practical limitations of the work conducted	1	C
The practical usefulness of the methods/tools		
11. Aspects of the method/tool used	10	B
12. Overall usefulness of the method/tool	2	D

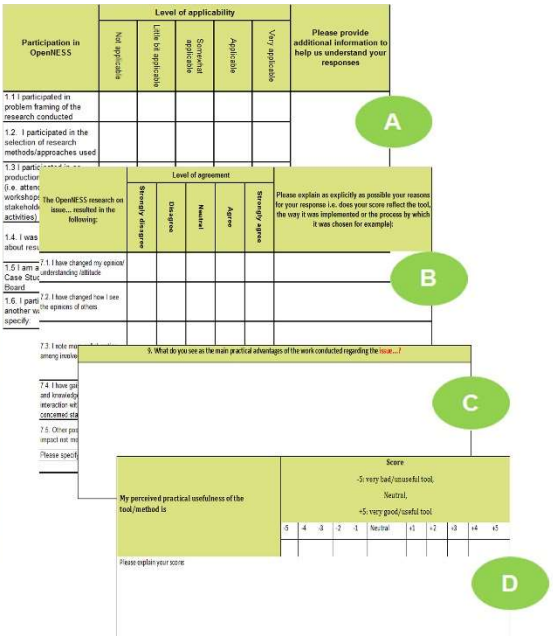

Figure 2 Structure of standard questionnaire with four topics, 12 themes, 63 statements (#) and 4 question formats (F), examples of which are shown and labelled A-D (see Supplementary Material 2 for full questionnaire).

When the questionnaires were presented to stakeholders, the majority of the case studies (22 out 27) provided the respondents with detailed summary information on the tools and methods applied in the case study and the results obtained. The methods used to deliver this information are listed in Table 2. The content of the background information documents focused mainly on the applied tools and methods (21 case studies) and on the results (22 case studies). CAB members also had an opportunity to ask questions related to the presented information. Half of the cases also provided basic information about the OpenNESS project. The majority of the cases (23 cases) provided the background information in their national language, resulting in the use of 15 languages: Bengali, Catalan, Dutch/Flemish, English, Finnish, French, German, Hungarian, Italian, Norwegian, Portuguese, Romanian, Slovak, Spanish, and Swahili.

Table 2 Delivery mechanisms of information/questionnaires and forms of information provided by the case studies (n = 27) to their respondents prior to completion of the evaluation questionnaire.

	Delivery mechanism of questionnaire/information			**Forms of information provided to respondents**		
	E-mail in advance	Printed copy	At a meeting	PowerPoint slides	Fact-sheet or similar	Academic papers/long documents
Number of CSs employing this method	15	7	17	16	14	4

2.3 Number of responses

Some case studies investigated multiple issues during the lifetime of the project; these were termed sub-projects. For five case studies these sub-projects were assessed separately by the stakeholders in the questionnaires. In three case studies the same individuals answered the questionnaire for each of the separate sub-projects, while for two case studies, which each had three sub-projects, different people were recommended by the CAB to complete the questionnaire for each sub-project. When multiple questionnaires were received from an individual concerning different sub-projects, they were treated as discrete responses for the subsequent analysis. In total 230 people evaluated 36 projects/sub-projects and returned 246 questionnaires; 239 fully completed questionnaires were received from 25 case studies and included in the statistical analysis (case studies GIFT and WADD did not complete Q5 or Q6).

The number of questionnaires returned varied between case studies (Fig 3), reflecting the collaboration mode and the method of implementing the standard questionnaire. Some case studies that interacted with a wide range of stakeholders delivered over 10 questionnaires while those that primarily interacted with a few decision makers returned fewer than five questionnaires. The return rate varied depending on the delivery method applied in the case study (Supplementary Material 3). The lowest response rates were in case studies with e-mail questionnaire delivery, whereas the highest response rates resulted from questionnaire delivery at meetings/workshops. For example, the Kenya case study (KEGA) conducted a stakeholder workshop and 30 people completed the questionnaire.

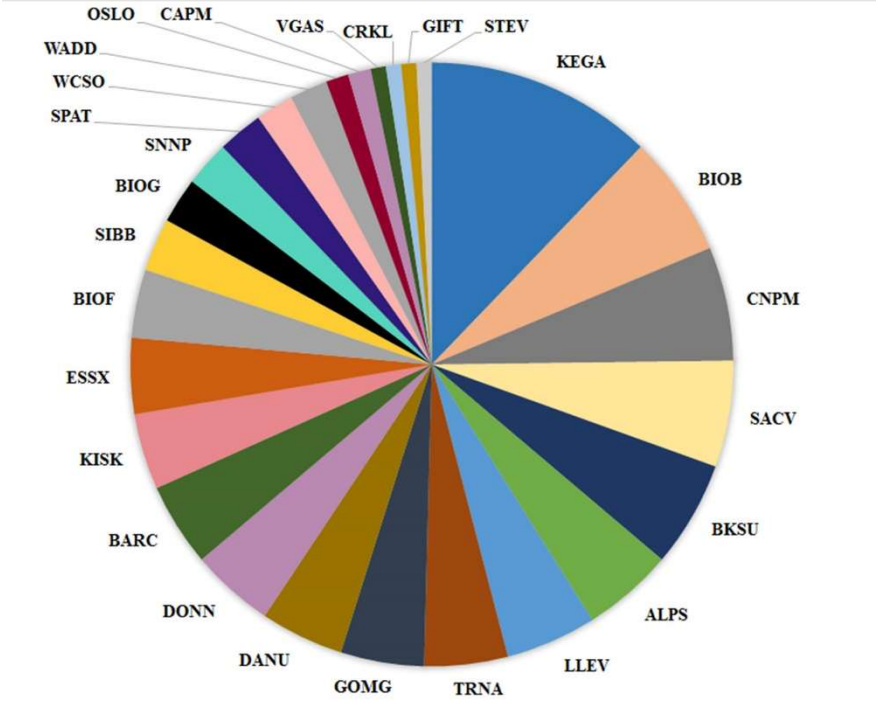

Figure 3 Proportion of total responses, to an anonymous questionnaire completed by stakeholders reporting the practical advantages and limitations of the ES concept, from each of 27 case studies (n=246). Case study codes explained fully in Supplementary material 1.

2.4 Analysis of responses

The practitioners' open-ended answers to questions on the practical advantages and limitations of the work conducted (Q9 and Q10) were analysed by two core writing teams. First, the lead group member in each team read all responses and derived categories of advantages and limitations of the ES concept that were identified in the responses; the whole team then iteratively coded each response according to the identified categories. Each response could be coded into multiple categories, as some statements mentioned multiple advantages and/or limitations. Secondly, the leader of each team checked and revised the coding and categories of both advantages and limitations, which resulted in some changes that were iterated across the team members, until an agreement was reached.

The responses to the two blocks of process questions (Q5 and Q6) were not completed by two case studies (i) Planning with Green Infrastructure in five linked cases, the Netherlands (GIFT) and Ecosystem services in coastal management, Wadden Sea, the Netherlands (WADD), as the research processes involved in these case studies did not involve a CAB. They were therefore considered too different to be included in the analysis of these questions or in the stepwise linear regression analysis.

To determine whether, and how much the likelihood of a 'change in action' (addressed by one single question and considered the endpoint of an ES study) was influenced by the numeric responses to questions on self-characterisation, the research process, and perceptions of the impact of the research, an auto-stepwise regression analysis was carried out. This statistical technique was used because of the high correlation between questions (Supplementary Material 4), and provided a means of determining the aspects which most influenced stakeholder perspectives on the likelihood of a 'change in action' in the case studies. Statistical analysis was performed using the statistical software package Genstat 16th Edition (VSN International 2013). The analysis was conducted centrally and not influenced by the research case study leaders.

3. Results

3.1 Characterisation and role of the respondents

The involvement of the respondent in the case study research was evaluated through questions on CAB-membership and engagement in research formulation and knowledge sharing (Table 3). Around half of responses indicated they were members of the CAB, whilst over a third reported they were not members, and the remaining responses indicated some involvement with the CAB. This may reflect, in part, the dynamic nature of CAB membership with individuals leaving, and new members joining during the lifetime of the project in some case studies.

Although almost 40% of responses indicated involvement in framing the issue, only 28% considered that they had been involved in the selection of the tools (Table 3). Overall, two thirds of the responses reported contributing to the production of knowledge by attending workshops and other stakeholder engagement activities. Most considered they had been fully informed about the results of the research, but 20% indicated they had not been fully

informed. The open-ended responses of those who considered they had not been fully informed of the results revealed that they felt they had not been informed about all aspects of the project as they were only active on a limited part of the case study. For example respondents wrote '*I only took part in a QuickScan workshop of honey'.* This highlights that the use of the ecosystem service concept in practice often involves many stakeholders working in different areas of assessment and over different time spans.

As regards personal connection to the area two thirds of the responses indicated personal/professional involvement in the geographical area of the case study. Overall 63% scored the statement 'I permanently live in the area' as applicable or very applicable. The open-ended answers indicated that those who were not closely involved in the area were very precise about the actual geographical location of the study area when answering this question. For example some wrote '*I live there but not in the case study area*'.

Overall, 38% of responses reported economic dependence on a land/water based activity in the area while 28% reported economic dependence that was not land/water based. A cross tabulation of economic dependence on land/water and non-land/water based activities revealed that 11% of responses indicated economic dependence on both land/water based activity and non-land/water based activity in the area. Respondents in this group were often involved in tourism, for example '*We operate four self-catering cottages'* or they were engaged in farming plus another activity e.g. '*I have many entrepreneurships around. I have bees and a small farm and I do other things as well*'. In contrast, 33% of responses reported they are not economically dependent on either a land/water or a non-land/water based activity in the case study area. The open-ended answers revealed that many of the respondents were planners and managers who may be responsible for a larger area than the case study, and therefore considered that they were not economically dependent on just the case study area. The open-ended answers also revealed that some respondents were researchers associated with the area but not part of the funded research team: '*I have scientific interest in the area'; 'My interests are related to research on biotic components in aquatic ecosystems'.* There were also individuals in this group who indicated they were volunteers receiving no economic reward e.g. '*I am also a Volunteer Park Ranger for High Woods Country Park'.* There is evidence that some respondents were unsure how to score these two economic questions if they were employed by a government agency engaged in management of a land/water based activity. Some scored both these questions as not applicable, e.g. '*I am forest staff, I am an employee of Kenya Forest Service (KFS)',* while others scored such situations as very applicable (i.e. '5'), e.g. '*I am a professional studying forest sciences'*.

The characterisation of the respondents, revealed that nearly half made decisions related to the issue studied in the case study, while 23% considered they had some degree of decision-making power and the rest answered that they had none. However when asked if they contributed to decision-making related to the issue investigated, 85% of responses indicated some level of contribution. A majority of responses considered that they were affected by the issues investigated in the case studies to some degree, with only 14% stating that they were unaffected by the issues. Similarly, 93% of responses reported that they were interested in the issue investigated in the case study to some degree, which is not unexpected, as the majority of respondents were either members of the CAB, or had attended workshops or meetings.

Table 3 Percentage of stakeholder responses in each category of the 5 point scale, in response to statements about their involvement in the case study project (1= not applicable and 5 = very applicable).

Themes + statements	Scale of applicability				
1. Level of participation	**1**	**2**	**3**	**4**	**5**
In problem framing	42	10	9	19	21
In selection tools	48	13	11	19	9
In co-production of knowledge	18	8	8	30	36
I was fully informed of results	8	3	10	36	43
Member of Case Study Advisory Board	37	6	3	15	39
2. Level of personal involvement					
Live in area	31	3	4	13	50
Economically dependent on land/water based activities	48	9	6	16	22
Economically dependent on non-land/ water activities	56	8	8	14	14
Own land in the area	50	3	3	14	30
Use area for leisure	26	8	14	18	35
3. Role in the area					
Make decisions related to issue studied	32	9	14	23	22
Contribute to decision-making	16	11	14	33	27
Affected by issue studied	14	9	19	27	31
Interested in issue investigated	2	1	4	29	64

3.2 Analysis of the process conducted to co-produce knowledge

Most respondents thought that the process was well organised in the case study (Fig 4). In general, most responses (>80%) agreed with the statements that, 'the process was transparent', 'the people involved were trusted', 'the process was inclusive' and 'there was good facilitation'. One aspect with a relatively high level of dissent was for the statement 'All the relevant stakeholders were represented'. Analysis of the comments associated with this statement indicated that respondents recognised that not all stakeholders can be consulted, for example '*It would be impossible to consult all, everyone has their own opinion'*; '*it was a small workshop, many of the key players were present but they could not represent all interests'*. One respondent suggested that a group was represented by the wrong people: '*Some entities were not present in some relevant steps of the project or were represented by technicians with no decision-making capacity'.* However it was suggested that sometimes the lack of representation was not the fault of the project, e.g. '*The problem is that the relevant stakeholders often do not have time to get involved in these processes (reachability of the stakeholders)'*.

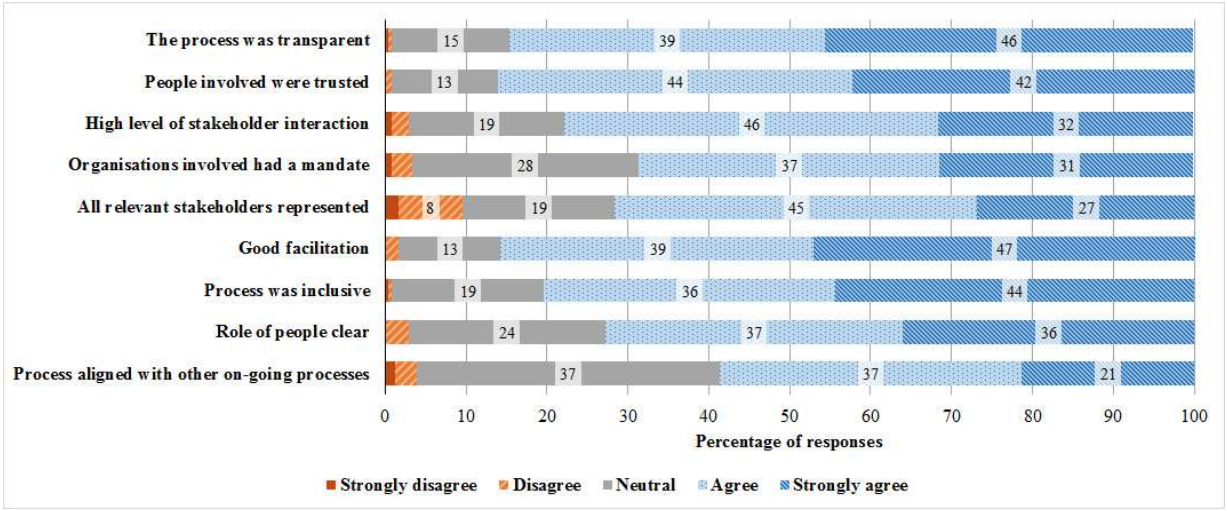

Figure 4 Agreement or disagreement of 246 stakeholders to statements related to the process used in the case studies. Where the number of responses for a given answer was more than 5% the value is shown on the graph. Responses on a 5 point ordinal scale: (1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree).

Most of the replies (86%) indicated that the respondents were satisfied with the facilitation during the stakeholder meetings or workshops and during the stakeholder process in general e.g. '*The workshop process was perfectly clear and I felt everyone was given the opportunity to fully participate'*.

In order to increase the (potential) impact of the assessments in terms of practical implementation, the involvement of stakeholders with a clear mandate is also important (i.e. to do these assessments, to negotiate with other stakeholders during decision-making, and to implement things afterwards). Therefore, participants were asked if they felt that the organisations involved had a mandate to address the issues, and 69% of the responses were positive.

3.3 Analysis of the expected impact of the research conducted in the case study

The respondents reported that ES research had generated change in their case study. A majority of responses (91%) reported that they gained new insights and knowledge through their interaction with researchers and concerned stakeholders (Fig 5). Approximately two thirds considered they had changed their understanding and noted more collaboration among involved stakeholders. Fewer respondents reported they had changed how they see the opinions of others (41% agree).

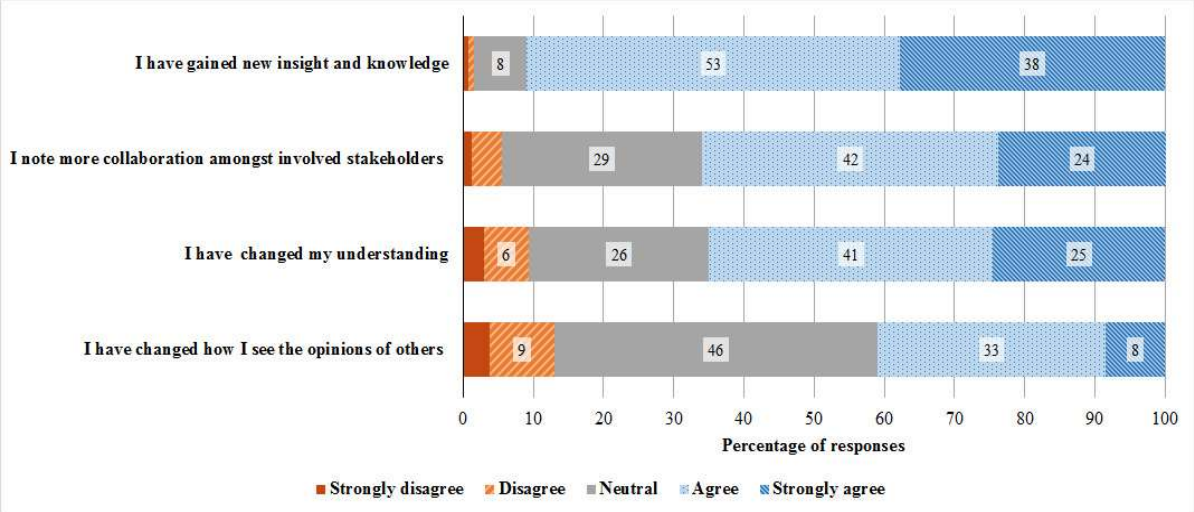

Figure 5 Agreement or disagreement of 246 stakeholders to statements related to changes in their personal views and knowledge. Where the number of responses for a given answer was more than 5% the value is shown on the graph. Responses on a 5 point ordinal scale: (1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree).

A majority of responses (61%) considered that the ES research will result in a change in the future vision of the area (Fig 6), while some said it had already happened (15%). The accompanying open-ended responses revealed that this result was often not within the power of the participants but with the decision-makers, e.g. '*The usage of the methods and research results very much depends on the persons doing the planning and decision-making',* or that the time frame of the project was too short, e.g. '*Time too short to be policy relevant'*. However, many were hopeful and wished for a change to happen as a result of the research, for example '*I hope so, as it should have raised awareness of spatial issues & trade-offs'*. The uncertainty is reflected in 31% of stakeholders scoring that they were 'not sure', for example '*It's difficult to say in this phase'*.

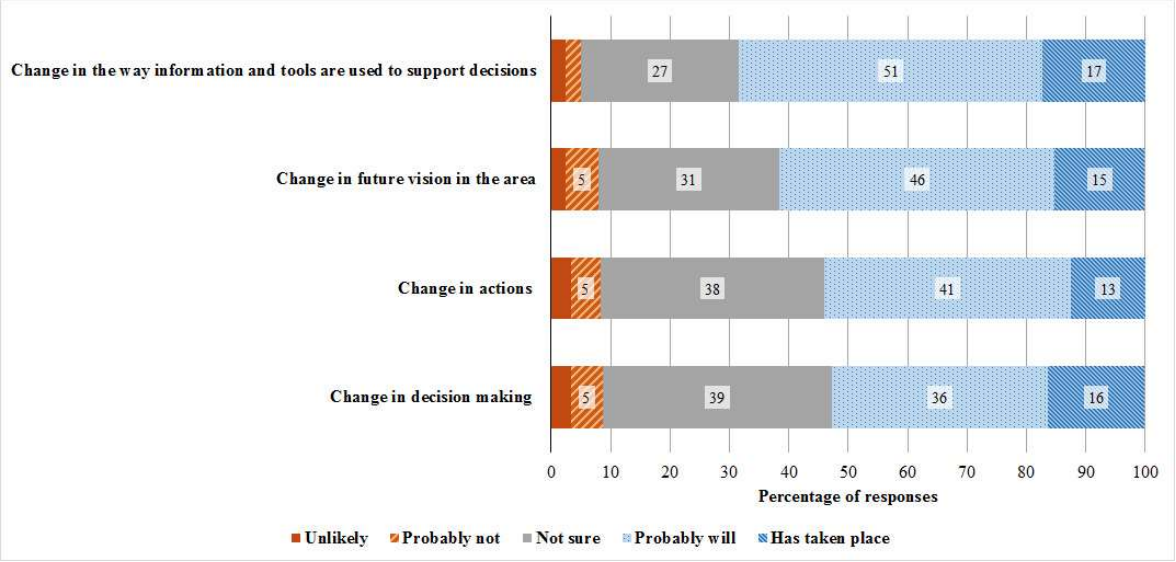

Figure 6 Responses of 246 stakeholders to statements related to the intended or realised use of the ES research conducted in each case study. Where the number of responses for a given answer was more than 5% the value is shown on the graph. Responses on a 5 point ordinal scale: (1 = It is very unlikely, 2 = Probably not take place, 3 = Not sure, 4 = Probably will take place and 5 = Already took place).

A majority of respondents reported that it was likely that the ES research conducted in the case studies will result in a change in the way information and tools are used to support decisions (68%). Although only 13% of responses reported that the ES research had already resulted in a change in actions, 40% considered that it was likely to happen, with an almost equal proportion being unsure. In general the comments suggest the respondents are not yet sure about the impact, but see potential and are hopeful, Approximately a third of the responses considered that the research will result in a change in decision-making (36%) or indicated that this has already happened (16%). However, over a third (39%) reported they were 'not sure'. Participants noted that the ES concept can influence decision-making, but in many cases considered it was too early to tell when completing the questionnaires. They think that scientific information resulting from ES research can be used as arguments and contribute to planning and decision-making. In some cases additional testing or efforts are needed before this can be realized.

3.4 Analysis of the open-ended answers on advantages and limitations

In total, 246 responses to the open-ended question on the main practical advantages of the work conducted in the case study were received. Some responses mentioned advantages that respondents had already experienced, while others indicated they expected certain advantages to eventuate. Some responses were personal, indicating learning or improved awareness; some referred to a project or decision-making process likely associated with the case study; and others referred mainly to the case study itself. Certain issues were mentioned multiple times, and we consider these to represent themes or categories of advantages. All responses were coded according to these categories.

608 The responses identified with 11 advantage groups (Table 4) related to: increased awareness
609 and information; communication, participation and collaboration; comprehensive and
610 science-based knowledge production; spatial knowledge and its input to planning; and
611 decision and management system support.
612
613 Many of the identified advantages were reported factually, just naming the advantage, e.g.
614 '*communicational connection'*. At other times the sentence included a statement that reported
615 an experience of the advantage, e.g., '*It provided an external stamp of academic approval...*',
616 and some other responses anticipated or expected the advantages to materialize, saying
617 '*could*', '*would*', '*is important*' or '*is good*'.
618
619 Table 4 Categories identified from the practitioners' responses to the open-ended questions
620 on the practical advantages of the work conducted in the case study (n=246 responses across
621 27 case studies).

Category	**Number of statements**	**Description of category**
Awareness, language, concept	57	Personal experience of improved awareness or a deeper conceptual understanding as well as awareness-raising among stakeholders more broadly. This was the most frequently identified benefit.
Information or data	45	New information or data, sometimes with an expectation that it would be used, and at other times a specific use was mentioned. Some mentioned simply that the project produced information, e.g.: '*gathered and developed important information and data on the case study area that can be useful for further research'*.
Input to an existing decision-making process or management system	43	Input to already existing decision-making processes or systems, sometimes also anticipated input: '*The application in land-use planning and other strategic documents'* ; '*The project will be the basis for better legislative integration of ES*'; '*Detailed ES analysis developed , which could be used for land-use planning*'.
Science-based methods, scientific support	41	Scientific evidence or academic approach, sometimes mentions of ways in which the scientific basis would support decision-making: '*It has provided arguments and scientific elements*'; '*It provided an external stamp of academic approval to our work*'; '*Method development of planning. Including the scientific methods*'.
Ecosystem service evaluation and valuation	33	Supports identifying and comparing values: '*Gives a wider overview of present value of areas; facilitates people to make trade-offs*'; '*Valuing the ecosystem services in euros makes comparisons between apples and pears easier*'.

GIS / Land-use planning tools	33	Spatial, geographical, territorial analysis and its anticipated benefits or identified support to land-use planning: '*Useful research – place based, site specific information on where people go for land based activity*'; '*Better planning and management in the landscape*'; '*Modelling + mapping is an important tool for achieving consensus and for framing discussions*'.
Engagement, participation	26	Facilitated dialogue, hearing stakeholder views; authorities or researchers inviting other actors to participate: '*It is helpful to involve people*'; '*Improves interaction and participation*'; 'facilitation of dialogue…'
Comprehensiveness, broadness	25	Comprehensive or broad treatment of ecosystem services; new ways of identifying more ecosystem services: '*Gives wider overview of present value of ecosystem services*'; '*A comprehensive look at the landscape in terms of its protection and utilization*'.
Communication across interests	25	Distinct or opposing views discussed and communicated, sometimes named specifically, e.g. agriculture and environmental interests: '*.it promoted a positive interaction and discussion among different stakeholders that usually do not communicate',* '*unification of different stakeholders'; 'New positive dynamics between stakeholders to realize the vision'*.
Collaboration	16	Co-operation within the project or new collaboration opportunities across stakeholders: '*The cooperation of various stakeholders*'; '*Learn how to collaborate, different type of people had to work together'*.
Communication across administrative sectors	15	Communicating with different sector representatives and different administration units as well as related learning about other views and discussing to find consensus or an agreement: *'..., good to integrate in planning for forest management'; 'regionality, cooperation, and sufficient communication'*.

Fewer respondents answered the open-ended question on the main practical limitations of the work conducted in the case study. In total 186 responses were analysed (i.e. in a quarter of the returned questionnaires this question was left blank). In addition to these blank boxes, in twelve responses no limitations were specified, i.e. the respondents simply acknowledged the process of the project implementation and the results achieved. Categorisation of the 256 statements revealed 13 categories (See Supplementary Material 5), with 'shortages in method used or its application' being the most commonly mentioned limitation (61 mentions).

The 13 categories can usefully be clustered into four groups: limitations linked to implementation of results, limitations in methodology, data limitations, and case-study-

related limitations (Table 5). Most of the statements from the responses related to limitations linked to implementation of results.

Table 5 Clusters of categories identified from the practitioners' responses to the open-ended questions on the practical limitations of the work conducted in the case study.

Cluster	**Number of statements**	**Description of cluster**
Limitations linked to implementation of results/working context	155	Limitations in the implementation of the ES concept was perceived by respondents as crucial. It was driven by: lack of time, finances or interest; current legislation or decision-making settings. The most important limitation reported was a problem in transfer of knowledge/low awareness, which resulted in difficulty in transferring information to the wider public (e.g. land users): '*the replicability of the work is very much affected / conditioned by the availability of stakeholders'* Similar limitations emerged when existing decision-making or territorial planning institutions were not harmonised with implementation of the ES concept: *'limitation in looking to achieve all social spheres, according to their needs and interests'* Lack of interest, especially among land owners, decision-makers or some other stakeholders, was also noted as a practical limitation: *'ignorance of competent authorities resulting from the lack of interest and insufficient information flow'*
Limitations in methodology	74	Respondents reported certain limitations of the method used or in its implementation, or found ES valuation difficult in general. Some comments were specific and related to particular processes performed or methods applied in the case study, while other comments were more general: '*not enough time to deepen the analysis on some methods'*
Limitations with data	18	Data availability was specifically mentioned as an issue, indicating data is not always available, especially for ES valuation: '*Data limitations - availability, format, cost of including, processing etc.'*
Other limitations	9	Other problems related to case study specific issues, which were not directly connected to the ES concept: *'the protection scheme that the winery sector formed...'*

As indicated above, the responses varied in their identification of the limitations: some reported detailed comments on the implementation of the ES concept in the case study (e.g. comments on the particular model used), while others commented very generally (e.g. on the difficulty of ES valuation). Comments within the same case study were sometimes similar, i.e. they related to a particular category, which indicates that the main goal specified in a particular case study had a large impact on the limitations perceived by the respondents.

3.5 Factors associated with a reported 'change in action'

The stepwise regression analysis involving all factors found that, from the full dataset of 31questions, only six were significantly associated with the respondents' score for the question 'The OpenNESS research resulted in a change in actions' (61% of the variance accounted for by the model)**.**

The stepwise regression (Table 6) revealed significant associations with the factor 'OpenNESS Case Study' and the responses to the statements (i) 'Change in decision-making' (ii) 'All the relevant stakeholders were represented' (iii) 'I have changed my understanding' (iv) 'The process was inclusive and provided opportunities to get involved' and (v) 'Change in the way information and tools are used to support decisions'. All associations were positive. The term 'OpenNESS Case study' was the least significant term in the model indicating commonality between case studies. These five questions were good predictors of a change in action in the case studies. However, with the high correlation between questions, the selection of one question does not mean the other correlated questions are unimportant. For example, while the response to the questions *'*All the relevant stakeholders were represented' was fitted in the model, the high correlation with the other four questions in that block ('There was a high level of interaction among the represented stakeholders'; 'The process was transparent'; 'The organisations involved had a mandate to address the issues'; 'I trust the people involved') meant that this group of questions were also associated with a 'change in action'. Similarly responses to the question 'The OpenNESS research resulted in a change in decision-making' accounted for the most variance in the fitted model but it was also highly correlated with other questions. While dropping this term from the model reduced the overall model fit, it did not significantly change the factors in the analysis. The model presented in Table 6 includes the factors which collectively accounted for maximum variance.

685 Table 6 Accumulated analysis of variance from a stepwise regression following ten iterations.
686 Significant terms appear in bold.

	Degrees of Freedom	Mean square	Variance ratio	F pr.
Change in decision-making	1	**74.951**	**247.12**	**<0.001**
All the relevant stakeholders were represented	1	**3.8773**	**12.78**	**<0.001**
I have changed my understanding	1	**1.6446**	**5.42**	**0.021**
The process was inclusive and provided opportunities to get involved	1	**1.2776**	**4.21**	**0.042**
Change in the way information and tools are used to support decisions	1	**1.3011**	**4.29**	**0.04**
OpenNESS Case Study	1	**1.1808**	**3.89**	**0.05**
I participated in problem framing of the research conducted	1	1.0827	3.57	0.061
I note more collaboration amongst involved stakeholders	1	0.8608	2.84	0.094
I participated in the selection of research method/approaches used	1	0.8257	2.72	0.101
The role of all people involved were clear	1	0.6692	2.21	0.139
Residual	165	0.3033		

687
688 4. Discussion
689
690 The results of this study have shown that the ES concept was operationalised in the 27 case
691 studies, and consequently supports the generally held expectation that the ES concept helps
692 practitioners address their specific real-world management needs.
693
694 In this study we specifically enquired if a 'change in action' had occurred as a result of the
695 ES research, and around half the responses identified that a change in action had occurred or
696 was likely to occur. The ES research conducted and 'change in action' reported encompassed
697 all three decisions types proposed by McKenzie et al. (2014) and Waylen and Young (2014)
698 namely (i) *conceptual*, i.e. to raise awareness and reframe dialogue; (ii) *instrumental*, to make
699 specific decisions; and (iii) *strategic*, to build support for plans or policies. For example the
700 Italian case study (GOMG) is an example of conceptual use. The work in the Italian case
701 study showed the added value of building an artificial wetlands from different perspectives
702 (technical, ecological, recreational). The respondents reported that there had been a change in
703 the future vision in the area i.e. a reframing of the dialogue locally. Water and planning
704 managers also reported they will use the results when updating the river basin management
705 plan, and they asked to work with the research team again to develop other similar case
706 studies. The work conducted in Brazil (BIOB) on a payment for ecosystem service scheme
707 has been included in the Directive Plan for the area, and is contributing to a change of

legislation i.e. an example of instrumental and strategic use of the ES research. While in the northern Scottish case study (CNPM), the work was used strategically to help lever funding for development projects (£3.6m from the UK National Heritage Lottery Fund). A map showing the integrated valuation of recreational use of the area was used as evidence to support the development of walking trails. We do not claim that the proposal for funding was successful solely as a result of the ES assessment, but CAB members reported that they considered the work, which highlighted collaborative working and participatory planning, had certainly helped to convince the awarding committee to approve the funds (Tomintoul and Glenlivet landscape partnership, 2016). The decision context of all 27 case studies is reported in Barton et al. (this issue). They found, in their analysis of this same set of case studies, that the majority of appraisals conducted were for informative purposes and significantly fewer had a decisive or technical policy design focus. As the case studies were conducted in real world situations it was noted that sometimes the stakeholders insisted that the assessment should not be conducted with a real decisive endpoint (e.g. Dick et al. 2017). Analysis of the knowledge needs expressed by the stakeholders and the temporal shift in conceptual understanding of the researchers are explored in Carmen et al. and Potchin et al. this issue.

Change in action, takes time, and even in the case of CNPM where the ES work was used to successfully lever development funds, the majority of respondents completing the questionnaire only scored this activity as 'likely to happen' (as the application for funding had not been submitted at the time of questionnaire completion). This temporal mismatch between the evaluation of the ES concept in this study and the final delivery was echoed in many case studies, when respondents indicated that it was too early to tell if the work would result in a change in action. but indicated that they thought it likely. Also many statements about advantages echoed an anticipation for future improvements. The need to monitor such changes over time has been highlighted in the literature (Carpenter et al. 2012, Posner et al. 2016), leading Maass et al. (2016) to recommend the long-term social-ecological research platform approach (Haberl et al. 2006) in order to follow ES decision-making.

A 'change in action' resulting from ES research also requires a change in decision making (identified as the most important factor in the step-wise regression). The lack of political will, and the current governance structures were mentioned as limitations to the operationalisation of the ES concept in the open-questions. These limitations were identified in the urban Slovak case study (TRNA), based on a review (Bezák et al. 2017) of national and local policy and planning documents and stakeholder feedback. They report a certain resistance of the decision-makers to change their accustomed routine planning procedures, which are grounded in sectoral planning and lack accredited ES assessment methodologies and communication strategies to raise awareness of the ES concept.

Analysis of the questionnaires from the 27 case studies revealed that the most reported benefits that the ES research has provided relates to knowledge accumulation. However, almost as important are the directly applicable methods and tools that can connect science to the development and implementation of decision-making, management and planning. A third advantage of ES research identified by practitioners is one of bridging and communicating which advances collaboration and engagement. These findings help to expand on the existing

754 understanding of ES knowledge use. For example, the review of Martinez-Harms et al.
755 (2015) evaluated the degree to which ES assessments have addressed management decisions,
756 and found that less than half of the studies specified management alternatives and only 3% of
757 the studies documented how the study has been used for decision-support. Furthermore with
758 regards to ES valuation knowledge, Laurans et al. (2013) found that only a fraction of studies
759 have analysed the use of knowledge.
760
761 Many of the methods and tools tested involved stakeholders directly, and as noted,
762 stakeholder communication and collaboration were highlighted positively in the survey
763 responses. The work conducted across the case studies follows a growing trend in the use and
764 development of decision support tools, which have shifted towards participatory approaches
765 in recent years (Carberry et al. 2002, Grizzetti et al. 2016a, Grizzetti et al. 2016b, Martín-
766 López et al. 2012, McCown and Parton, 2006, Nelson et al. 2002, Verweij et al. 2014).
767 Central to participatory processes is the principle of actively involving stakeholders and their
768 knowledge, instead of treating them as passive recipients of knowledge (Kloppenburg, 1991;
769 Massey et al. 2006). The link between researchers and stakeholders has historically been
770 patriarchal. In their review of urban ecosystem service assessments, Haase et al. (2014),
771 found that only six of a total 217 papers (3%) reported communicating the results of the study
772 to stakeholders. Stakeholders are commonly involved in ES studies in three ways: (i)
773 determining the planning relevance of the ES concept, (ii) developing frameworks and
774 selection of relevant ES to assess, and (iii) collecting data and assessing ES (Haase et al.
775 2014). The approach adopted in the case studies reported here involved much closer working,
776 with stakeholders co-designing the study in a place-based approach, and the results of the
777 survey indicate that this was appreciated by the stakeholders. The researchers' views of the
778 process of operationalisation were surveyed and reported in Saarikoski et al this issue. They
779 note that researchers also reported positively on the experience of co-design facilitated by the
780 creation of Case Study Advisory Boards which they considered facilitated the uptake,
781 utilization and influence of ecosystem service knowledge.

782 The ES research carried out in the case studies is an example of transdisciplinary science
783 involving stakeholders, aiming to deliver salient, legitimate and credible science to the
784 decision-making process (Lang et al. 2012, Röckmann et al. 2015). This link between science
785 and decision-making is considered 'boundary work' (Gieryn 1983, Gieryn 1995, Guston
786 2001, Huutoniemi et al. 2010) at the interface between science and the real world, to help
787 protect science from potential biases caused by what is at stake in decision-making.
788 Communication and collaboration is crucial to forge the links between different interfaces
789 and world views. Analysis of the open-ended questions in this study revealed that both
790 awareness-raising and communication were key advantages of the operationalisation of the
791 ES concept (Table 4). This confirms the potential of the ES concept to cross boundaries and
792 to translate real-world problems into boundary research objects, thus further linking science
793 with the real world (Lang et al. 2012).
794
795 The purpose of this study was to investigate the practical application of the ES concept across
796 case studies that reflected a diverse range of different challenges, and to test the concept in a
797 broad range of user-defined contexts making use of an evaluation by stakeholders. There
798 have also been calls for a standardised score-card approach in order to compare ES
799 approaches across case studies and identify when the ES approach is most appropriate (Furst

et al. 2014), considering advantages and limitations. Our approach has been developed over three years of consultation with case study researchers and stakeholders and has resulted in parallel questions. The benefits identified by the survey respondents are similar to the criteria developed by Furst et al. (2014): 'Shared knowledge base: integrating disciplinary knowledge', 'Building a shared vision', 'Social network and collaboration' (which they considered as advantages) and 'Requested knowledge basis and training, actor inequality', 'Supporting the detection of supply demand relationships', 'Involvement of socio-ecological–economic system aspects in planning' (which they considered critical aspects). Furst et al. tested their approach with researchers and found it suitable, but to date the views of stakeholders are unknown.

Stakeholders found the evaluation method in this study comprehensive, but time consuming to complete (one respondent reported it took 2 hours although it commonly took 30-45 min). The correlation and step-wise regression analysis revealed that within blocks of questions there was much redundancy i.e. the answers to questions within a block were the same. This was especially true for the questions related to the evaluation of the process. Therefore, we would recommend keeping the structure of the blocks of questions but reduce the number of questions in each block. The mix of numerical and open questions was useful to cross-check the reasons for the scores and to aid understanding of the stakeholders views. There is some evidence that stakeholders also welcomed the mixed approach as it indicated a desire to fully understand their perspective.

This study, conducted across 27 diverse case studies, found that the ES concept was broadly 'operational' and accommodated positivist, interpretivist and constructivist research strategies. The ES concept and participatory approaches applied in the different case studies opened a constructive dialogue among the different parties, supporting an important rationalisation of common problems. This exchange is pivotal in revealing the interdependencies between policy sectors, and spatial and land use planning at different levels according to the case study scale. In contrast, the natural capital concept, which is arguably more limited to monetary, accounting and valuation methods (positivist approaches) (e.g. Obst et al. 2016), was adopted by the CABs to a very limited extent in framing the research. Potentially the full 'community capitals' approach, which includes social, cultural, built, political, human and financial capital rather than focusing only on natural capital, may have resonated more with the CABs. The 'community capitals' approach can embrace positivist, interpretativist and constructivist methods (Fey et al. 2006).

Over the last century, human domination and modification of the planet has led scientists to refer to the current geological age as the 'Anthropocene' (Crutzen 2002), on account of the unparalleled intensity and magnitude of the role of humans in the changes affecting the Earth's ecological systems. Three changes are commonly advocated as required for transformational change on Earth: (i) change in the hearts and minds of individuals, (ii) change in human behaviours, and (iii) change in social institutions. The case studies show that the operationalisation of the ES concept in this study, which embedded the transdisciplinary approach, can indeed lead to each of these types of changes. The stakeholders reported new insights and knowledge (91%), more collaboration (66%), changed understanding (65%), a change in the way information was used (68%) which lead to a change in decision-making (53%), and ultimately the probability of a change in action (54%).

The evidence for changes in social institutions was less obvious (Bezák et al 2017) but is recognised to be a long term process. Stakeholders have reported that the ecosystem service concept can help address their specific real-world ecosystem management needs.

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1239 **Supplementary material 1**

1240 Table detailing the case study titles, codes and the main issues investigated

Code	Case Tile	Setting	Issue investigated
ALPS	Operationalising ecosystem services in regional and national forest management planning in the multifunctional landscape of the French Alps	Forests, focus on mountains	How to simultaneously maintain economically and ecologically sustainable forestry at the landscape scale and reconcile it with biodiversity conservation
BARC	Mapping ecosystem services to inform landscape and urban planning in the Barcelona metropolitan region, Spain	Urban	ES mapping and assessment in order to foster sustainable urban planning and management in the Barcelona Metropolitan Region through the integration of the ecosystem service framework in existing decision-support tools.
BIOB	Biofuel farming and restoration of natural vegetation in the São Paulo sugarcane belt, Brazil	Sugar cane farms; mixed	Assessing the potential for operationalization of ES and PES; PES as a tool for increasing environmental protection while keeping agricultural production; promoting food security and the conservation of bees; Elaboration of compensation mechanisms for ES
BIOF	Forest bioenergy production in Finland	Forests	Assessing the short and long term impacts of forest bioenergy production on the provisioning of ecosystem services. Investigating, stakeholder's preferences and perceptions of different forest bioenergy production options
BIOG	Bioenergy production in Saxony, Germany	Forest, farmland	Assessing people's perceptions about aesthetic impacts of the fast growing areas of bioenergy crops; land-use modelling approach by improving assessment of climate change effects on erosion, and adapted a EU-scale pollination model to the regional conditions of Central Germany

BKSU	Participatory biodiversity management for ecosystem services in Bankura and Sundarbans, India	Forests, farmland	Examine the process of effectiveness of (i) community institution which favours NC conservation to improve ES; (ii) Examine the process of effectiveness of community institution which favours NC conservation to improve ES; Refining the framework developed for participatory criteria and indicators for sustainable biodiversity and ES conservation; Test methods of sustainable harvesting practices of NC
CAPM	Forest management in the Carpathian Mountains, Romania	Forests, National Park	Identification and mapping of main ecosystem services (including cultural - PSA) provided by forests based on 4 functional categories; Identification of the indicators associated with ES and their relationship with the human wellbeing components
CNPM	Improved, integrated management of the natural resources within the Cairngorms National Park, Scotland	Mountain, national park	Recreation opportunity mapping, aid natural resource planning to maximise ES and NC of Glenlivet Estate, establishing the environmental (water, livestock and wildlife) prevalence of Cryptosporidium species selected catchment area(s) identifying actions and payment to enhance the ecosystem services of such landscapes; farmers' perceptions of payments for ecosystem services
CRKL	Reintroducing green corridors in the agricultural land of the Province of Limburg, Belgium	Traditional apple orchards	Stakeholder analysis of burden-benefit) and identified ES & disservices; societal cost-benefit analysis will be completed; investigation of potential financial (or other) instruments to sustain traditional orchards.
DANU	Operationalising ecosystem services for an adaptive management plan for the Lower Danube River, Romania	River, Wetlands	Assessment of relationships between biophysical structure and functions of the river and supplied ES; Assessment of conflicts and trade-offs of sectoral and multilevel relevant policies objectives for improvement the management plan; Enhancement of the operational capacity for assessment and valuation of the key ES
DONN	Operationalization of ecosystem services in the cultural landscapes of	National park; vineyards	Assessment of ES through interviews and questionnaires; multi-criteria evaluation of policy alternatives to maintain ES from traditional vineyard landscapes

	Doñana, south-west Spain		
ESSX	Ecosystem service mapping in Essex, England	Mixed farmland	Exploration of methods of demonstrating the value of natural capital and ecosystem services as assets; Participatory mapping of cultural ecosystem services and possible areas for improvement; photo analysis to map the areas that provide aesthetic beauty, the opportunity to see wildlife and a place for outdoor recreation; Modelling the future impact of climate change on habitats.
GIFT	Planning with Green Infrastructure in five linked cases, the Netherlands	Connection between Nature 2000 sites	planning of GI and innovative implementation; assessment of economic, ecological and social drivers and the differing planning cultures; business plans
GOMG	Nature-based solution for water pollution control in Gorla Maggiore, Italy	Wetlands	Testing the feasibility of a nature-based solution or GI (constructed wetlands) as an alternative to the traditional grey infrastructure to treat the Combined Sewer Overflow coming from a small urban area before flowing into the river; assessing multiple ES benefits that the GI provides and its relevance for water management; valuation
KEGA	Operationalising ecosystem services for improved management of natural resources within the Kakamega Forest, Kenya	Forests	Mapping and evaluation of the management of Plantations Enterprise and Livelihood Improvement Scheme; Mapping supply and demand of ES; Mapping Pollination services; evaluate recreation and nature-based tourism potential
KISK	Supporting sustainable land use and water management practices in the Kiskunság National Park, Hungary	Farmland	Water conflicts: Developing land-use alternatives in a process of regional water planning; Develop exploratory scenarios, identify drivers of future LU change; Scenario quantification applying a novel approach; Deliberative evaluation of the four scenarios
LLEV	Quantifying the consequences of	Wetlands	Recreation opportunity mapping; evaluation of Habitat Quality (WFD status) & Fishing

	European water policy for ecosystem service delivery at Loch Leven, Scotland		
OSLO	Valuation of urban ecosystem services in Oslo, Norway	Urban	Demonstrating methods for mapping and valuation (non-monetary and monetary) of recreational and pollination; hedonic pricing
SACV	Operationalising ecosystem services in the Sudoeste Alentejano e Costa Vicentina Natural Park, Portugal	Coasts, marine	Mapping and Assessment of ES deliberative mapping of selected ES, mapping pollination and recreation services; Assessment of nature based tourism; Operationalization of ES into territorial planning; Mapping of coastal and marine ES.
SIBB	Operationalising ecosystem services in urban land-use planning in Sibbesborg, Helsinki Metropolitan Area, Finland	Urban	Integration of ES into land use planning, multi-functional GI, natural areas conserved
SNNP	Ecosystem services in the multifunctional landscape of the Sierra Nevada, Spain	National Park	Identify and assess the delivery of ES & their importance to local stakeholders' wellbeing (non-monetary and monetary values); analyse how conservation strategies could promote the delivery of ES that contribute; reconcile conservation and rural development objectives to local stakeholders' wellbeing; use of ES approach for delineating traditional livestock management plans.
SPAT	Retention forestry to improve biodiversity conservation and ecosystem services in Southern Patagonia, Argentina	Forestry	Improvement of biodiversity conservation and ecosystem services in managed landscapes. : (1) quantify economic, biodiversity and ES values at regional levels; (2) quantify the impacts of traditional management over biodiversity and ES values; (3) monitoring these effects in a long-term plots and (4) develop new forest management strategies using the variable retention approach.

STEV	Integration of ecosystem services in the planning of a flood control area in Stevoort, Belgium	River, wetlands	Use ES tools to assess ES; ES scenarios; ES demand, trade-offs
TRNA	Landscape-ecological planning in the urban and peri-urban areas of Trnava, Slovakia	Urban and peri-urban	Analyses of the ES framework implementation in Slovakia, Evaluation of landscape capacity to provide ES in Trnava area (based on GIS methods and participatory approaches), Urban vegetation and open spaces function and ES valuation in the Trnava town, Recreation valuation - ESTIMAP model.
VGAS	A Green Infrastructure strategy in Vitoria-Gasteiz, Spain	Urban	Demonstrate the benefits of design and implementation of a green infrastructure strategy in supplying ES, as part of sustainable urban management
WADD	Ecosystem services in coastal management, Wadden Sea, the Netherlands	Coasts, marine	Examination of management scenarios related to dredging deposited sediment within a Natura 2000 area
WCSO	Tools for investigating biodiversity offsetting in Warwickshire, England	Mixed, farmland	Develop an operational model for biodiversity offsetting and habitat banking; apply multiple methods for mapping of ES; potential impacts of climate change on offsetting

1241

Supplementary material 2

Practitioners' perspective questionnaire and technical handbook.

PRACTITIONERS' PERSPECTIVE QUESTIONNAIRE TECHNICAL HANDBOOK

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With contributions from all WP5 Case study research teams, representatives of WP3 and WP4 and the Project Steering Committee

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Table of contents

SUMMARY

As part of the Work Package 5 (WP5) deliverable, D5.4, the practical advantages and limitations of ecosystem services (ES) and natural capital (NC) assessments need to be evaluated by practitioners from the 27 case studies. **The agreed strategy for D5.4 recognised the dichotomy between (i) a brief standard format questionnaire approach which is applicable in all 27 case studies, and (ii) a more in-depth analysis of the practical advantages and limitations of ES and NC assessments. This manual is focused on the former (i) i.e. only the standard evaluation across the 27 case studies. More in-depth interview(s) of** Case Study Advisory Board **(CAB) members will be conducted by individual case studies and/or as part of a Joint Research Activity (JRA).**

This manual details the survey design; planning and preparation; implementation; quality control; data entry & data analysis associated with the standard evaluation of all 27 case studies. The standard questionnaire (Annex 1), and implementation report template (Annex 2) are also included.

1. BACKGROUND TO PRACTITIONERS' PERSPECTIVE QUESTIONNAIRE

Evaluation of the practical advantages and limitations of the ecosystem services and natural capital assessments conducted in the 27 case studies of OpenNESS from the practitioners' perspective is a deliverable from WP5 namely D5.4:

> *Quote from Description of Work: "D5.4 Review paper reporting the case study representative's and CABs assessment of the practical advantages and limitations of ES and NC assessment from the practitioners' perspective"*

The essence of D5.4 is to evaluate the opinions of the practitioners on the practical advantages and limitations of the new knowledge created during the OpenNESS project. The case studies are investigating a wide variety of issues, they have not used a standard methodology, nor have they researched the same question/problem, nor engaged with the same type of practitioners. Hence a diverse delivery strategy was agreed with the case study leaders and project steering committee (PSC).

2. STANDARDIZED SURVEY DESIGN

The standardized survey was created over the first three years of the project by the case study leaders and the strategy approved by the OpenNESS project steering committee.

This manual was produced, following a series of workshops and meetings, to provide a set of detailed and uniform instructions on survey methods In order to achieve high methodological standards and data quality and ensure a strict cross-case study comparability.

Collectively, the case study teams have produced rigorous methodological rules documented in this comprehensive technical manual. This includes information on sampling, questionnaire structure and delivery, interview instructions, procedures of quality control, and instructions on coding and data entry. This technical manual will be used as a reference during the data collection process, and any necessary deviations must be documented and reported via a reporting template (annex 2) to the core analysis team.

An associated contextual report (Annex 3 and 4), to allow analysis of the D5.4 Stakeholder Questionnaires, will be delivered by the case study research teams to the OpenNESS extranet. This report is made up of two documents, (i) a word document of questions regarding policies and impact in the case study (Annex 3), and (ii) an excel sheet with questions on the social context, tool use and land cover in the case study (Annex 4). These documents are available via the extranet, and the full list of questions are also detailed here in Annex 3 and 4.

2.1 SURVEY IMPLEMENTATION TEAMS

The OpenNESS case study practitioners' perspective survey methods will be carried out by 27 survey implementation teams. The survey agencies and lead from each case study are listed on the extranet.

The survey implementation teams in each case study are responsible for delivery of a standard questionnaire (Annex 1), collection of the responces and delivery of the data to the core analysis team. The standard questionnaire (Annex 1) was written in English, but translation into the most appropriate languages for the case studies may be necessary, and is the responsibility of the case study lead. The survey implementation team could deliver the questionnaire in person or remotely via web based survey or (e)mail.

The survey implementation team are not the same individuals as the ones that conducted the ecosystem service and natural capital research in the case study. In the case studies which opted for face-to-face delivery of the questionaire, the survey implementation teams have considerable experience in conducting stakeholder surveys to the highest standards of rigor by means of face-to-face interviewing and/or participatory workshops, as well as an understanding of the particular social and environmental issues being studied in the case study. These survey implementation teams were selected on account of their reliability, professionalism and academic excellence in the case study.

Confidentiality of responses and anonymity of the practitioners completing the questionnaire will be ensured, as their personal details and original copies of their written responses will never be shared with the case study research teams (unless the respondents expressly stated that they wished to be identified).

Every survey implementation team is expected to ensure:

1. Timely reporting (18th June 2016) and accurate deliverables,
2. An immediate reporting on problems or considerable deviations from this survey protocol to the WP5 core analysis team,
3. Scanning the questionnaires completed by case study stakeholders and uploading these into the relevant case study folder on the OpenNESS extranet such that it is available to all project partners.
4. Typing answers to numerical questions and preferably also text in open questions via a standard reporting template - Microsoft Excel file called "D5.4 data template" found on extranet. Please name completed template file starting with your case study number followed by a short title e.g. CS27 Barcelona
5. Delivery of a case study specific evaluation report via a standard reporting template i.e. Annex 2, to be uploaded to the OpenNESS extranet for analysis.

Operative contacts between the survey implementation teams and WP5 D5.4 core analysis and writing team will be maintained via e-mail, Skype etc. A list of the case study D5.4 contact person is available to all project partners and can be found on the extranet.

2.2 PRESENTATION OF THE PRACTITIONERS QUESTIONNAIRE BY SURVEY IMPLEMENTATION TEAM

Prior to the start of the work, all persons presenting the standard questionnaire to evaluators will receive training based on this 'Practitioners' perspective questionnaire technical handbook'. The list of the training materials provided by the core D5.4 delivery team and case study leaders includes:

- Practitioners' perspective questionnaire technical handbook (this manual) which includes: principles for sampling design, instructions for survey implementation teams presenting the standard questionnaire to evaluators, reporting format to describe the survey work conducted in the case study;
- Practitioners' Perspective Questionnaire (Master version, in English Annex 1 – translations are the responsibility of the case study leader);
- Examples for the 'Introduction of case study to practitioners' supplied in the form of a PowerPoint to support consistent evaluations across the case studies. Available on the extranet in the D5.4 folder Case study presentations 'Introduction to D5.4 evaluation". This material is designed to be either used prior to the presentation of the practitioners questionnaire, when presented face-to-face or delivered along with the e(mailed) questionnaire or survey monkey link to ensure a consistent knowledge base of practitioners completing the questionnaire in each case study. It will also serve to ensure the survey implementation team are aware of the background to the case study. Examples of this material for the Cairngorms and Loch Leven case studies are on the extranet. Case studies should upload the material they present to stakeholders in this folder to aid the core D5.4 analysis and writing team
- Excel file with data entry template see file called "D5.4 data template" found on extranet.

2.3 SAMPLING OF PRACTITIONERS WHO COMPLETED THE PRACTITIONERS QUESTIONNAIRE

The decision as to whom should be invited to complete the Practitioners Questionnaire should be done jointly between the case study leader and an independent stakeholder (commonly the Case Study Advisory Board chairman). The societal representation of evaluators who complete the questionnaire will be agreed according to the case study peculiarities. Each partner will decide individually about the necessity of including particular types of stakeholders (policy makers, town

planners, land owners etc.). A minimum of 10 individual evaluations was recommended per case study.

2.4 SURVEY METHOD

Data will be collected through the standard Practitioners Questionnaire via face-to-face individual interviews, or in meetings or gatherings e.g. CAB meeting (but where the questionnaire is still filled in individually). If the above is not possible, the questionnaire can be completed remotely, for example by translating it into a web-based survey, or via an (e)mail with a request to return the form to the survey implementation team (not a member of the case study research team in order to ensure confidentiality of responses see section 2.1 above).

2.5 CORE ANALYSIS TEAM

A core analysis and writing team consisting of at least one person per case study will analyse the data and be responsible for writing the report. The authorship of the report will be unlimited and names included will be the responsibility of the case study leader. The authorship of any peer review papers arising from the data will be decided on merit and again will be the responsibility of the case study leaders. The ownership of the data remains with the case study leader at all times and the core WP5 team are not at liberty to pass the data of any case study to any other persons in the OpenNESS consortium.

2.6 PRACTITIONERS' PERSPECTIVE QUESTIONNAIRE: GENERAL APPROACH

A substantial effort of the OpenNESS consortium has been focused on developing a comprehensive methodology to evaluate the practical advantages and limitations of the research conducted in the case studies in order to fulfill deliverable D5.4.

The OpenNESS Practitioners' Perspective Questionnaire consists of 12 questions and was designed around four main survey topics (i) Self-characterization of users, (ii) Perception of participatory process, (iii) Perceived impact, and (iv) Practical usefulness of tools. In addition the contextual details of the case study will be reported by the case study leader (Figure 1).

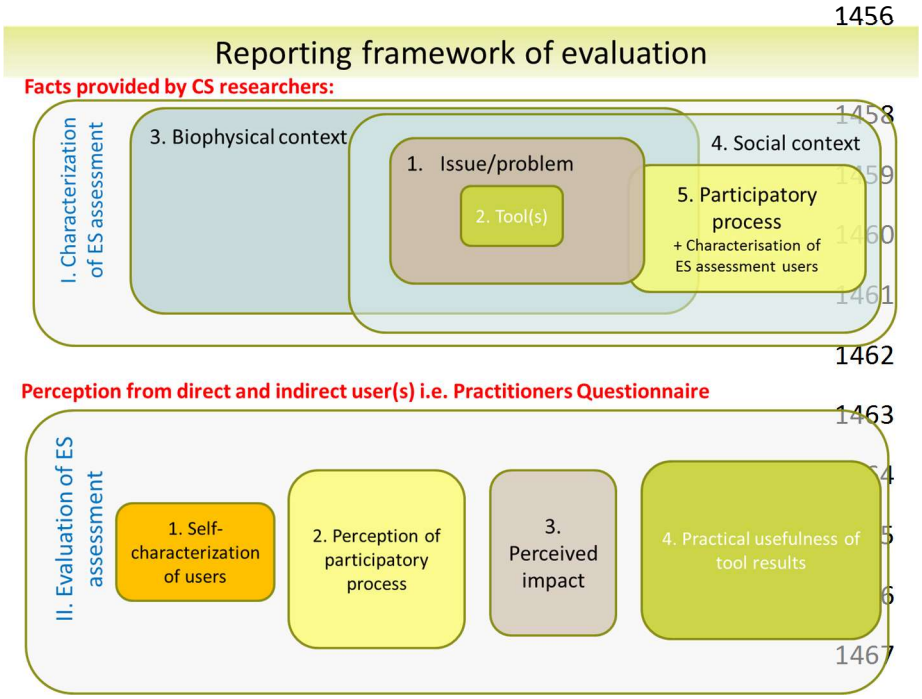


Figure 1 - Schematic representation of the Practitioners Questionnaire and associated contextual information. Section I will be delivered by case study leaders and section II will be completed by the case study practitioners. I.e. individuals who complete the questionnaire.

Each case study leader will be responsible for 'customizing' the master questionnaire for their case study to explicitly mention local names, organizations, tools tested etc. Pre-testing of the questionnaire highlighted this as important for practitioner comprehension. This does not mean changing the questions as obviously the case study member of the core WP5 team will need to ensure that their results are compatible with all other case studies. Examples from Case study 09 Cairngorms and 16 Loch Leven are lodged on the extranet.

2.7 SURVEY QUALITY ASSURANCE MEASURES AND PROCEDURES

The OpenNESS consortium recognizes the necessity for quality assurance of the data collected in the evaluation of the research conducted across the 27 case studies. They also recognize the need for anonymity of the person completing the Practitioners Questionnaire. Although it would be useful to perform an independent check of the responses by re-contacting the individuals who completed the Practitioners Questionnaire, in order to preserve anonymity contact information to allow this will not collected.

Quality assurance will be guaranteed via the use of independent survey implementation teams and peer scrutiny by the core analysis team which involves at least one member of each case study team. The original paper forms and copies of the email form of completed Practitioners Questionnaires will be lodged on the extra-net.

3. ANNEXES

3.1 ANNEX 1 PRACTITIONERS' PERSPECTIVE QUESTIONNAIRE

Master version of D5.4 questionnaire

This version of the questionnaire is also provided as a word document as it is expected that each case study leader will alter it slightly to name the issues, location and tools which were used in their case study, rather than present a generic questionnaire to stakeholders. There are several places marked with red text which we assume should be customized for individual case studies.

Some case studies have researched more than one 'issue' i.e. have conducted sub-projects as described in D5.2

Definition of sub-projects when completing D5.2

A sub-project is defined as a research activity in the case study with a specific objective (e.g. specific issue, conflict, opportunity, desired change) which often has a specific user group and focus at a specific scale. Tools and approaches will usually be selected based on the stated objective.

For example, in the Cairngorms Case study (CS09):

- The first sub-project will be an assessment of the recreational ecosystem services at the level of the whole Cairngorms National Park. The users of the research results will be the park managers and the tool is ESTIMAP. The aim is to identify areas as hotspots for recreation and hotspots for biodiversity conservation.
- The second subproject will focus on land management in a sub-region of the Cairngorm National Park with the aim of determining trade-offs in land use options on Glenlivet Estate. For this sub-project we will used interviews, social media and GIS spreadsheet tools, and the user of this research will primarily be the estate managers.

It would not be sensible to ask stakeholders to complete this questionnaire for both subprojects at the same time, as we would not be able to understand fully what aspects they found useful (or unhelpful). Therefore as described in the Technical Protocol case study leaders should consult with their stakeholders (e.g. Chairman of the CAB) to determine who they will ask to complete the questionnaire and if they will ask specific stakeholders to answer only one specific sub-projects or repeat the questionnaire for several sub-projects or use a numbering system to distinguish the answers. Customised questionnaire examples from the Cairngorms and Loch Leven case studies, which both tested two sub-projects, are available to all project partners on the extranet.

If you have only 1 sub-project in your case study, but have used several tools then only section 4 should be repeated and each tool named, so the respondent understands which tool they are providing answers for. Please see example for the Cairngorms case study on the extranet (folder WP5/Deliverables D5.4) If you are not sure how to deal with sub-projects in your case study please contact Jan (jand@ceh.ac.uk).

In order to be scientifically rigorous all questions must be asked as presented here and translations should follow as precisely as possible the wording of the questions. If questions are 'adapted' or their meaning 'altered' in translation, it will not be possible to compare the results across case studies. The responsibility for ensuring the questions in the questionnaire adhere to the meaning of the questions in this master questionnaire is the responsibility of the case study representative in the WP5 D5.4 core analysis team.

If anyone has any doubt about the meaning of English terms please contact Jan Dick (jand@ceh.ac.uk) who will happily discuss via Skype or telephone.

Please note we have made no attempt to make the questions fit neatly on pages in this document, as we appreciate you will alter the format of the text (i.e. customising the questionnaire). This introductory text should be deleted and replaced by case study specific introductory text. Please also ensure that there is sufficient space for people to write comments when compiling the final version for your case study. An example from the CS09 Cairngorms and CS16 Loch Leven are on the OpenNESS extra net.

What is your background and involvement in OpenNESS case study

Please mark with an X which of the following applies to you and provide further information to help us understand your knowledge and experience. This questionnaire is confidential so no name or contact details are requested.

1. **Please rate your level of participation in the OpenNESS research CS leaders should customise the question and write in the case study title or sub-project titles**

Participation in OpenNESS	Level of applicability					Please provide additional information to help us understand your responses
	Not applicable	Little bit applicable	Somewhat applicable	Applicable	Very applicable	
1.1 I participated in problem framing of the research conducted						
1.2. I participated in the selection of research methods/approaches used						
1.3I participated in co-production of knowledge (i.e. attended workshops/meetings/ stakeholder engagement activities)						
1.4. I was fully informed about results						
1.5 I am a member of the Case Study Advisory Board						
1.6. I participated in another way. Please specify:						

2. **Please rate your interests in the location of the case study** CS leaders should write in the specific location of the case study

Interest in the location	Level of applicability					Please provide additional information to help us understand your responses
	Not applicable	Little bit applicable	Somewhat applicable	Applicable	Very applicable	
2.1. I permanently live in the area						
2.2. I am economically dependent on a land/water based activity in the area						
2.3 I am economically dependent on a non-land/water based activity in the area						
2.4 I own land or property in the area						
2.5. I regular use the area for leisure activities						
2.6. I have another interest in the area (please specify)						

3. **Please rate your role in relation to the issue/problem addressed** CS leaders may write in the specific issue here if helpful

Your role(s)	Level of applicability					Please provide additional information to help us understand your responses
	Not applicable	Little bit applicable	Somewhat applicable	Applicable	Very applicable	
3.1. I make decisions related to the issue investigated						

3.2 I contribute to decision making related to the issue investigated						
3.3. I am effected by the issue investigated						
3.4. I am interested in the issue investigated						
3.5. I have another interest not mentioned above (Please specify)						

1568

1569 **4. Please indicate your personal allegiances to social groups in the study area related to**
1570 **the focus issue of the case study**
1571

Organisations/groups	Allegiance to groups					Please add comments to help us understand your responses in relation to personal allegiances and/or support to social groups
	Strongly opposed to organisation/ group	Opposed to organisation/ group	Neutral	Member/ part-time employment	Active member/ main employment	
4.1. Municipality/local government (provide names of relevant case study groups)						
4.2. Regional government (provide names of relevant case study groups)						
4.3. National government (provide names of relevant case study groups)						
4.4. Government implementing agency (e.g. forestry agency, park management, agricultural extension, etc.) (provide						

names of relevant case study groups)						
4.5. Non-Governmental Organisation (NGO) (provide names of relevant case study groups)						
4.6. Lobby organisation/syndicate(provide names of relevant case study groups)						
4.7. Facilitating organisation (i.e. bringing organisations to work together) (provide names of relevant case study groups)						
4.8. Scientists/technical organisation/consultancy (provide names of relevant case study groups)						
4.9 Private sector (industry, agriculture, services or trade) (provide names of relevant case study groups)						
4.10. Other employment/group. Please specify:						

Evaluation of the Process

With 'process' we mean the cooperative process where OpenNESS researchers worked together with practitioners in the case study (or Case study Advisory Board, CAB). Please mark with an X your level of agreement with each of the following statements. Again please provide additional comments to help us understand your answer.

1583 **5. Please rate how you experienced the process**

1584

Aspects of the process	Level of agreement					Please explain your reasons for your responses
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
5.1. All the relevant stakeholders were represented						
5.2. There was a high level of interaction among the represented stakeholders						
5.3. The process was transparent						
5.4. The organisations involved had a mandate to address the issues						
5.5. I trust the people involved						
5.6. Other aspect not mentioned above						

1585

1586 **6. Please rate how well the process was organized**

1587

Aspects of the process organization	Level of agreement					Please explain your reasons for your responses
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
6.1. The process was inclusive and provided opportunities to get involved						
6.2. There was good facilitation						
6.3. The roles of all people involved were clear						

6.4. The process was aligned with other on-going processes						
6.5. Other aspects not mentioned above						

Impact and expected use of the research in the Case study

When assessing the advantages and limitations of the OPENNESS research in the section that follows please mark with an X your level of agreement with the statements; please consider the full OpenNESS process. You may want to include comments on 1) the ecosystem service and natural capital concepts, 2) the individual methods and 3) the way that the process was run in terms of how they impacted on the practical implications of the approach. If you could be as explicit as possible it would be very much appreciated (e.g. linking your comments to specific methods/ aspects of the process).

7. Please rate the following statements related to the impact of the research

The OpenNESS research on issue… resulted in the following:	Level of agreement					Please explain as explicitly as possible your reasons for your response i.e. does your score reflect the tool, the way it was implemented or the process by which it was chosen for example):
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
7.1. I have changed my opinion/ understanding /attitude						
7.2. I have changed how I see the opinions of others						
7.3. I note more collaboration among involved stakeholders						
7.4. I have gained new insights and knowledge through my interaction with researchers and concerned stakeholders						
7.5. Other positive or negative impact not mentioned above; Please specify:						

8. Please rate your assessment of the intended or already realized use of the OpenNESS research

The OpenNESS research on issue… resulted in the following:	Probability of change in actions					Please explain as explicit as possible your reasons for your responses. In case 'it has already happened', please provide reference to evidence.
	It is very unlikely	Probably not take	Not sure	It will probably	It already took place	
8.1. The OpenNESS research resulted in a **change in future vision in the area** (e.g. vision document on the future landscape, policy etc.) (e.g. vision document on the future landscape, policy etc.)						
8.2. The OpenNESS research resulted in a **change in the way information and tools are used to support decisions**						
8.3. The OpenNESS research resulted in a **change in decision making**						
8.4. The OpenNESS research resulted in a **change in actions**						
8.5. The OpenNESS research resulted in **another positive or negative impact(s).** **Please specify:**						

9. What do you see as the main practical advantages of the work conducted regarding the issue….?

10. What do you see as the main practical limitations of the work conducted regarding the issue….?

Technical aspects of usefulness

The questions that follow are about the specific methods, tools and approaches that have been used in the ?? case study: referred to simply as "methods" below. NOTE please remove the following sentence if only one tool In the ?? case study multiple methods have been used: we would like you to fill in the following section for each one. Below is a visual reminder of the tools

INSERT Visual reminder of the tools used

The following section is designed to assess the qualities of the methods in the context of the Cairngorms case study. Please assess each statement in turn for each method (i.e. questions repeated for each tool); mark an X in the box that matches your level of agreement from strongly agree to strongly disagree. You can use the explanation box that follows to provide additional detail that explains your choice. If you do not feel the question is relevant in your context please note this in the explanation box.

Please copy and paste the tables for question 11 and 12 as many times as necessary to allow space for all tools/methods tested

11. Please mark with an x in the appropriate cell the following aspects of the tool

	Level of agreement					Please help us by explaining your reasons
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
11.1 The **results** were b**elievable**						
11.2 The **results** were **easy to understand**						
11.3 The **method was easy to use**						
11.4 The **assumptions** underlying the method are **clear**						
11.5 The **results** are **easy to communicate** to others						
11.6 The method **encourages discussion**						
11.7 The availability of **data was not limiting**						
11.8 We **could apply** this method **without external assistance**						
11.9 The **results** from this tool **identified something I didn't already know**						
11.10 I **will do something differently** as a result of this method's results						
11.11 I **would encourage others** to use this method						
11.12 **Other aspects** of the tool you feel is important Please specify:						

Overall usefulness of the tool/method

OPENNESS is trying to work out the extent to which these tools have assisted you, the practitioners, in addressing your specific question – so please let us know *both what worked and*

what didn't work so that we can help better understand how to guide others as to which tools are most appropriate to them.

12. Please rate your opinion of the usefulness of tool/method

My perceived practical usefulness of the tool/method xxx is	**Score** **-5: very bad/unuseful tool,** **Neutral,** **+5: very good/useful tool**										
	-5	-4	-3	-2	-1	Neutral	+1	+2	+3	+4	+5
Please explain your score:											

3.2 ANNEX 2 CASE STUDY EVALUATION REPORTING FORMAT

Please report the following information and provide a copy of any background materials presented to the users completing the Practitioners Questionnaire.

Section headings for this report i.e. to detail how Practitioners Questionnaire was executed are:

- Case study number and title
- Authors and full affiliation
- Method for selecting people who completed Practitioners Questionnaire
- Method of presenting Practitioners Questionnaire, including dates
- Number of people completing Practitioners Questionnaire
- Translation procedure if undertaken

A copy of the information presented to the people completing the Practitioners Questionnaire must be lodged in the OpenNESS extranet. This will be in the form of a PowerPoint or report, as decided by the case study leader, and although not obligatory it would be useful if it was translated into English as this may be used as part of Annex 4 i.e. needed for the cross case study analysis. The format of the material presented to people prior to completing the Practitioners Questionnaire will be standardize only in as far as the main subject heading including (i) introduction to OpenNESS project (ii) aim of evaluation and introduction to Practitioners Questionnaire and (iii) case study specific information. WP5 leaders will distribute suggested slides for sections (i) and (ii) but section (iii) is the responsibility of the case study leader.

3.3 ANNEX 3 CASE STUDY CONTEXT REPORTING FORMS PART 1

Please report the following information to provide relevant case study context to the analysis of the D5.4 Stakeholder Questionnaires.

D5.4- Annex 3: Questions regarding policies and impact in your OpenNESS case study (if needed, can be sub-divided on sub-project level)

Q1. Which EU policies significantly impacted the focussed ecosystems and ecosystem services in your case study? Can you explain how?
Q2. Which EU policies had a significant constraining or fostering effect(s) on the processes and/or results in your case study? Can you explain how?
Q3. Are any of the EU policies mutually conflicting in relation to the focussed ES in your case study? □ Yes □ No □ Not sure If yes, please describe the conflict briefly.

Q4. Are EU policies conflicting with national and/or regional policies in relation to the focussed ES in your case study? □ Yes □ No □ Not sure If yes, please describe the conflict briefly.

Q5. Please rate the following statements related to the impact of the research in your case study:

➔ This has to be filled in individually by a CS researcher. The more researchers that can fill in this question, the better (please duplicate these questions if more than one researcher answers).

The OpenNESS research on issue… resulted in the following:	**Level of agreement**					**Please explain as explicitly as possible your reasons for your response i.e. does your score reflect the tool, the way it was implemented or the process by which it was chosen for example):**
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
1. I have changed my opinion/ understanding /attitude						
2. I have changed how I see the opinions of others						
3. I note more collaboration among involved stakeholders						
4. I have gained new insights and knowledge through my interaction with researchers and concerned stakeholders						

5. Other positive or negative impact not mentioned above; Please specify:						

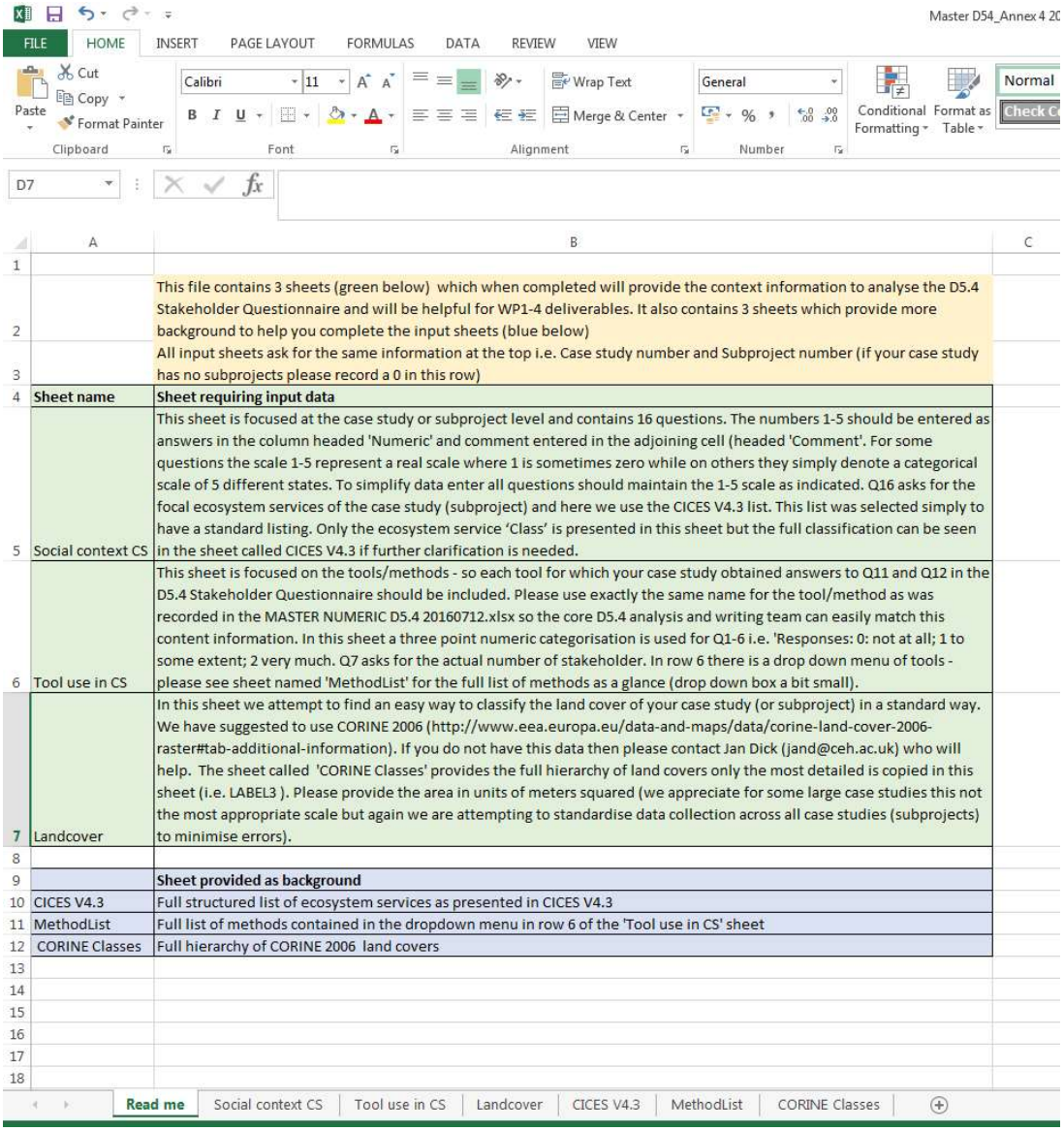
Q6. Please rate your assessment of the intended or already realized use of the OpenNESS research in your case study:

The OpenNESS research on issue… resulted in the following:	**Probability of change in actions**					**Please explain as explicit as possible your reasons for your responses.** **In case 'it has already happened', please provide reference to evidence.**
	It is very unlikely	Probably not take place	Not sure	It will probably take	It already took place	
1. The OpenNESS research resulted in a **change in future vision in the area** (e.g. vision document on the future landscape, policy etc.) (e.g. vision document on the future landscape, policy etc.)						
2. The OpenNESS research resulted in a **change in the way information and tools are used to support decisions**						
3. The OpenNESS research resulted in a **change in decision making**						
4. The OpenNESS research resulted in a **change in actions**						
5. The OpenNESS research resulted in **another positive or negative impact(s).** **Please specify:**						

3.4 ANNEX 4 CASE STUDY CONTEXT REPORTING FORMS PART 2

Questions on the social context, tool use and land cover in the case study

This table simply shows the questions asked – these were presented to the case studies in an excel format to aid standardized completion. The figure below is a screen shot of the excel template instruction guide:



	A	B
1		
2		This file contains 3 sheets (green below) which when completed will provide the context information to analyse the D5.4 Stakeholder Questionnaire and will be helpful for WP1-4 deliverables. It also contains 3 sheets which provide more background to help you complete the input sheets (blue below)
3		All input sheets ask for the same information at the top i.e. Case study number and Subproject number (if your case study has no subprojects please record a 0 in this row)
4	**Sheet name**	**Sheet requiring input data**
5	Social context CS	This sheet is focused at the case study or subproject level and contains 16 questions. The numbers 1-5 should be entered as answers in the column headed 'Numeric' and comment entered in the adjoining cell (headed 'Comment'. For some questions the scale 1-5 represent a real scale where 1 is sometimes zero while on others they simply denote a categorical scale of 5 different states. To simplify data enter all questions should maintain the 1-5 scale as indicated. Q16 asks for the focal ecosystem services of the case study (subproject) and here we use the CICES V4.3 list. This list was selected simply to have a standard listing. Only the ecosystem service 'Class' is presented in this sheet but the full classification can be seen in the sheet called CICES V4.3 if further clarification is needed.
6	Tool use in CS	This sheet is focused on the tools/methods - so each tool for which your case study obtained answers to Q11 and Q12 in the D5.4 Stakeholder Questionnaire should be included. Please use exactly the same name for the tool/method as was recorded in the MASTER NUMERIC D5.4 20160712.xlsx so the core D5.4 analysis and writing team can easily match this content information. In this sheet a three point numeric categorisation is used for Q1-6 i.e. 'Responses: 0: not at all; 1 to some extent; 2 very much. Q7 asks for the actual number of stakeholder. In row 6 there is a drop down menu of tools - please see sheet named 'MethodList' for the full list of methods as a glance (drop down box a bit small).
7	Landcover	In this sheet we attempt to find an easy way to classify the land cover of your case study (or subproject) in a standard way. We have suggested to use CORINE 2006 (http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2006-raster#tab-additional-information). If you do not have this data then please contact Jan Dick (jand@ceh.ac.uk) who will help. The sheet called 'CORINE Classes' provides the full hierarchy of land covers only the most detailed is copied in this sheet (i.e. LABEL3). Please provide the area in units of meters squared (we appreciate for some large case studies this not the most appropriate scale but again we are attempting to standardise data collection across all case studies (subprojects) to minimise errors).
8		
9		**Sheet provided as background**
10	CICES V4.3	Full structured list of ecosystem services as presented in CICES V4.3
11	MethodList	Full list of methods contained in the dropdown menu in row 6 of the 'Tool use in CS' sheet
12	CORINE Classes	Full hierarchy of CORINE 2006 land covers

1705

1706 All questions should be completed for your case study, answer separating for different sub-projects if applicable. Do not leave any of the boxes
1707 blank.

Social Context of the case study		
Topic	**Question**	**Sub-question**
Researcher team background	**Q1. How many researchers where involved in the (sub) project?**	Staff members
		Students (paid)
		Unpaid volunteers
		Other (please specify)
	Q2. What was the disciplinary background of researchers actively involved in each (sub) project? Please give the number of actively involved researchers (at least involved about 10% of their research time)	Natural scientist
		Social scientist
		Hybrid trained natural scientist experience with social science techniques
		Hybrid trained social scientist experience with natural science techniques
		Other:
Interaction between researchers and practitioners	**Q3. What was the familiarity of researchers with the stakeholders of the (sub) project before OpenNESS?**	Number of years working with the stakeholders in the area before OpenNESS started (may enter part of one year)
	Q4. What is the personal and professional relationship between researchers and/or stakeholders during the (sub) project? (We appreciate that in a group of stakeholders there will be variable levels of trust here we ask only an overall score) Score: 1= signs of mistrust; 3=neutral; 5= a good level of trust was observed	Please estimate the level of trust among the researchers in the research team
		Please estimate the level of trust among the stakeholders
		Please estimate the level of trust between the research team and the stakeholders

	Q5. What was the level of co-design of the research conducted in the (sub) project? 1= stakeholders were not involved in the process of designing the research 2=stakeholders determined the overall aim and researchers designed the study 3=stakeholders collaborated with the research team to identify the aim and design the research conducted 4= stakeholders decided the design of the research conducted 5= stakeholders decided the design of the research conducted and suggested the tool/method
	Q6. What was the level of new knowledge provided by stakeholders to the (sub) project? New knowledge may also include additional datasets which were not available at first 1= no stakeholders provided new knowledge/data to the research team 3= a few stakeholders provided new knowledge/data to the research team 5= many stakeholders provided new knowledge/data to the research team. For clarification we discuss only stakeholders involved in the research e.g. attending workshops etc.
	Q7. What was the level of co-production of the knowledge conducted in the (sub) project? 1= stakeholders were not involved in the production, analyses and interpretation of the results 3= some stakeholders were involved in analyses and interpretation of the results 5= stakeholders were actively involved in production, analysis and interpretation of the results
Institutional and governance issues	**Q8. On which governance scale did the (sub) project focus? (more than 1 response is possible):;** 1= local scale; 2 = regional scale; 3=national scale; 4=international scale
	Q9. Was there a 'local champion' among the stakeholders during the (sub) project? A local champion is a person who has an extensive network with the involved organisations, and who can mobilize and motivate stakeholders to participate. 1= not present; 3= somehow present; 5 = clearly present
	Q10. Was there a common goal among involved stakeholders in this (sub) project? 1= conflicting goals; 3= compatible goals; 5 = same goals
	Q11. What was the attitude of the majority of the stakeholders regarding the participatory consultation processes in the (sub)-project? 1= most stakeholders had a negative attitude; 3= neutral attitude; 5 = positive attitude

	Q12. What was the freedom to act for stakeholders in the (sub)project? Freedom to act depend on employers instructions, political decisions, and legal border conditions,... 1=most stakeholders had little freedom to act 3= some stakeholders had a reasonable freedom to act 5= most stakeholders had a large freedom to act	
	Q13. What was the financial freedom for stakeholders to participate in the (sub) project? Financial freedom depends on if they were paid to participate / participated as part of their job or some other institutional settings regarding reimbursement of (labour) costs 1=most stakeholders had very few financial freedom 3= some stakeholders had a reasonable financial freedom 5= most stakeholders had a large financial freedom	
	Q14. What was the level of power imbalances among stakeholders involved in the (sub) project? There are strong power imbalances if one or few stakeholders have a strong say in the final decision. 1= not present; 3= some power imbalances; 5 = strong power imbalances	
	Q15. Did you observe a change in empowerment among the involved stakeholders of the (sub) project? i.e. able to represent their interests in a responsible and self-determined way 1= decrease of autonomy and/or self-determination among stakeholders 3= equal autonomy and/or self-determination compared to start of case study 5= increase of autonomy and/or self-determination among stakeholders	
	Q16. What were the focal ecosystem services of the (sub) project? From the list below please mark each service and use the comment box to provide additional knowledge for the analysis 1= not relevant to focus of the study	Provision - Cultivated crops
		Provision - Reared animals and their outputs
		Provision - Wild plants, algae and their outputs
		Provision - Wild animals and their outputs
		Provision - Plants and algae from in-situ aquaculture

	3=some relevance to the focus of the study 5= primary focus of the study. Here we use the CICES Version 4.3 to conform with other WPs	Provision - Animals from in-situ aquaculture
		Provision - Surface water for drinking
		Provision - Ground water for drinking
		Provision - Fibres and other materials from plants, algae and animals for direct use or processing
		Provision - Biomass- Materials from plants, algae and animals for agricultural use
		Provision - Biomass- Genetic materials from all biota
		Provision - Surface water for non-drinking purposes
		Provision - Ground water for non-drinking purposes
		Provision -Biomass-based energy sources- Plant-based resources
		Provision - Biomass-based energy sources- Animal-based resources
		Provision - Biomass-based energy sources - Animal-based energy
		Regulation & Maintenance - Mediation of waste, toxics and other nuisances- Mediation by biota - Bio-remediation by micro-organisms, algae, plants, and animals
		Regulation & Maintenance - Mediation of waste, toxics and other nuisances- Mediation by biota -Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals

		Regulation & Maintenance- Mediation by ecosystems- Filtration/sequestration/storage/accumulation by ecosystems
		Regulation & Maintenance- Mediation by ecosystems- Dilution by atmosphere, freshwater and marine ecosystems
		Regulation & Maintenance- Mediation by ecosystems- Mediation of smell/noise/visual impacts
		Regulation & Maintenance - Mediation of flows- Mass flows- Mass stabilisation and control of erosion rates
		Regulation & Maintenance - Mediation of flows- Mass flows- Buffering and attenuation of mass flows
		Regulation & Maintenance - Mediation of flows- Liquid flows- Hydrological cycle and water flow maintenance
		Regulation & Maintenance - Mediation of flows- Liquid flows- Flood protection
		Regulation & Maintenance - Mediation of flows- Gaseous / air flows- Storm protection
		Regulation & Maintenance - Mediation of flows- Gaseous / air flows- Ventilation and transpiration
		Regulation & Maintenance - Maintenance of physical, chemical, biological conditions- Lifecycle maintenance, habitat and gene pool protection- Pollination and seed dispersal

		Regulation & Maintenance - Maintaining nursery populations and habitats
		Regulation & Maintenance - Pest control
		Regulation & Maintenance -Disease control
		Regulation & Maintenance -Soil formation and composition- Weathering processes
		Regulation & Maintenance - Soil formation and composition- Decomposition and fixing processes
		Regulation & Maintenance -Water conditions- Chemical condition of freshwaters
		Regulation & Maintenance -Water conditions- Chemical condition of salt waters
		Regulation & Maintenance- Atmospheric composition and climate regulation- Global climate regulation by reduction of greenhouse gas concentrations
		Regulation & Maintenance- Atmospheric composition and climate regulation- Micro and regional climate regulation
		Cultural- Experiential use of plants, animals and land-/seascapes in different environmental settings
		Cultural- Physical use of land-/seascapes in different environmental settings
		Cultural- Intellectual and representative interactions- Scientific
		Cultural- Intellectual and representative interactions- Educational

		Cultural- Intellectual and representative interactions- Heritage, cultural
		Cultural- Intellectual and representative interactions- Entertainment
		Cultural- Intellectual and representative interactions- Aesthetic
		Cultural- Spiritual and/or emblematic- Symbolic
		Cultural- Spiritual and/or emblematic- Sacred and/or religious
		Other cultural outputs- Existence
		Other cultural outputs- Bequest

Tool use in the case study – please answer separately for each tool used – use the comments box to explain		
Question	**Sub-question 1**	**Sub-Question 2**
Q1. What method are you discussing/reporting	Method group name according to WP3/4 classification (please select from the dropdown list - full list in sheet/tab called Method List in this file). Click on cell to reveal drop down menu	
	Further detail (optional): if you wish to provide further detail on the method, or you feel the method does not fit perfectly into the class you've selected above please put additional information here.	
Q2. To what extent are the following relevant to the selection of this method in your case study? 0 = definitely not 1 = to some extent	I am interested in supply of ES	
	I am interested in demand for ES	
	I am interested in collecting information across the full range of ES	
	I am interested in provisioning ES	

2 = definitely	I am interested in regulating ES	
	I am interested in supporting ES	
	I am interested in cultural ES (quantifiable e.g. recreation)	
	I am interested in cultural ES (intangible e.g. spiritual value)	
	I am interested in collecting information across the range of ES	
Q3. To what extent is the way that you use the method in your case study described by the purposes listed below? 0 = no relevance 1 =relevant 2 = primary purpose	Explorative (conduct research aimed at developing science and changing understanding of research peers)"	Theory and concept development
		Hypothesis formulation and testing
		Method development and testing
	Informative (change perspectives of public & stakeholders)	Assessment of current state
		Assessment of long-term historic trends
		Assessment of potential future conditions
		Evaluation of existing projects and policies
		Raising awareness of the importance of ES
		Raising awareness of trade-offs and conflicts between ES
	Decisive (generate action for specific decisions by stakeholders)	Decision problem formulation and structuring
		Criteria for screening alternatives

		Criteria for ranking alternatives
		Criteria for spatial targeting (zoning & planning of alternatives)
		Arguments for negotiation, shared norms & conflict resolution
	Technical design (produce outcomes through design and implementation of policy instruments with stakeholders)	Standards & policy target-setting
		Land and natural resource management rules & regulations
		Licencing / permitting / certification
		Pricing, setting incentive levels
		Establishing levels of damage compensation
		Standards & policy target-setting
	Other:	
Q4. To what extent are the following practical/research-related considerations factors that influenced your choice of this method? 0 = not at all	Existing expertise with the method within the team	
	Existing expertise with the method within OPENNESS	
	Data constraints led me to choose this method over another	
	Time constraints led me to choose this method over another	

1 = to some extent 2 = very much	Budget constraints led me to choose this method over another
	Interested in learning/trialling a new method
	Method recommended/requested by stakeholders
	Method is comparable with methods used elsewhere
	Method is an established or well-recognised tool
	We needed to develop a new method to address our issue
	Other
Q5. To what extent did the following factors influence your choice of methods? **NB - don't forget we are interested in knowing why you chose the method - not what the method can do.** 0 = not at all 1 = to some extent 2 = very much	Method addresses uncertainty explicitly
	Method is spatially explicit
	Method readily applicable at spatial scale suitable for detailed spatial planning
	Method readily applicable at scale appropriate for strategic overview
	Method can be applied across spatial scales
	Method can be applied across temporal scales (e.g. time series analysis)
	Method can generate and/or evaluate future scenarios or alternative options
	Method covers many ecosystem services
	Method allows trade-offs and/or conflicts to be evaluated
	Method produces monetary output

	Method produces non-monetary output
	Method helps to gain an understanding of the system studied
	Method can facilitate stakeholder participation and/or engagement
	Method can facilitate the inclusion of local knowledge
	Method was selected in a joint decision with stakeholders/case study leaders
	Method encourages dialogue and deliberation
	Method is easy to communicate/use with stakeholders and/or citizens
	Results are easy to communicate to stakeholders and/or citizens
	Other
Q6. To what extend did the method have the following functional attributes as used in your case study (please score all functional attributes) 0 = not at all 1 = to some extent 2 = very much	Input data was spatial (i.e. maps)
	Input data obtained from 'experts'
	Input data obtained from public
	Input data was free publically available
	Input data collected from stakeholders via social media or digital means e.g. APP
	Input date temporally short (as opposed to long term i.e time series data)
	Local data sets used i.e. data collected to local specifications
	National data sets used i.e. data collected to national specifications

	Another form of input data (please write in 'Comment' cell the form of input data and put the appropriate score in 'Numeric' column - please enter score 0 if there were no other forms of input data used)
	Results were presented spatially (e.g. maps_)
	Results were presented diagrammatically (e.g. charts, graphs, cascade framework)
	Results presented interactively e.g. via web or laptop
	Results were in form of narrative (either as paper or digital reports)
	Results were presented in another form (please write in 'Comment' cell the form of reporting the results and put the appropriate score in 'Numeric' column - please enter score 0 if no other forms of reporting were used)
Q7. Please quantify stakeholder involvement	How many stakeholders provided data
	How many stakeholders were involved in co-production of the knowledge
Land Cover in CS	
Please provide total area in units of 'm square' (NOT as %) for each land use type from the CORINE or other landuse classification.	

1708

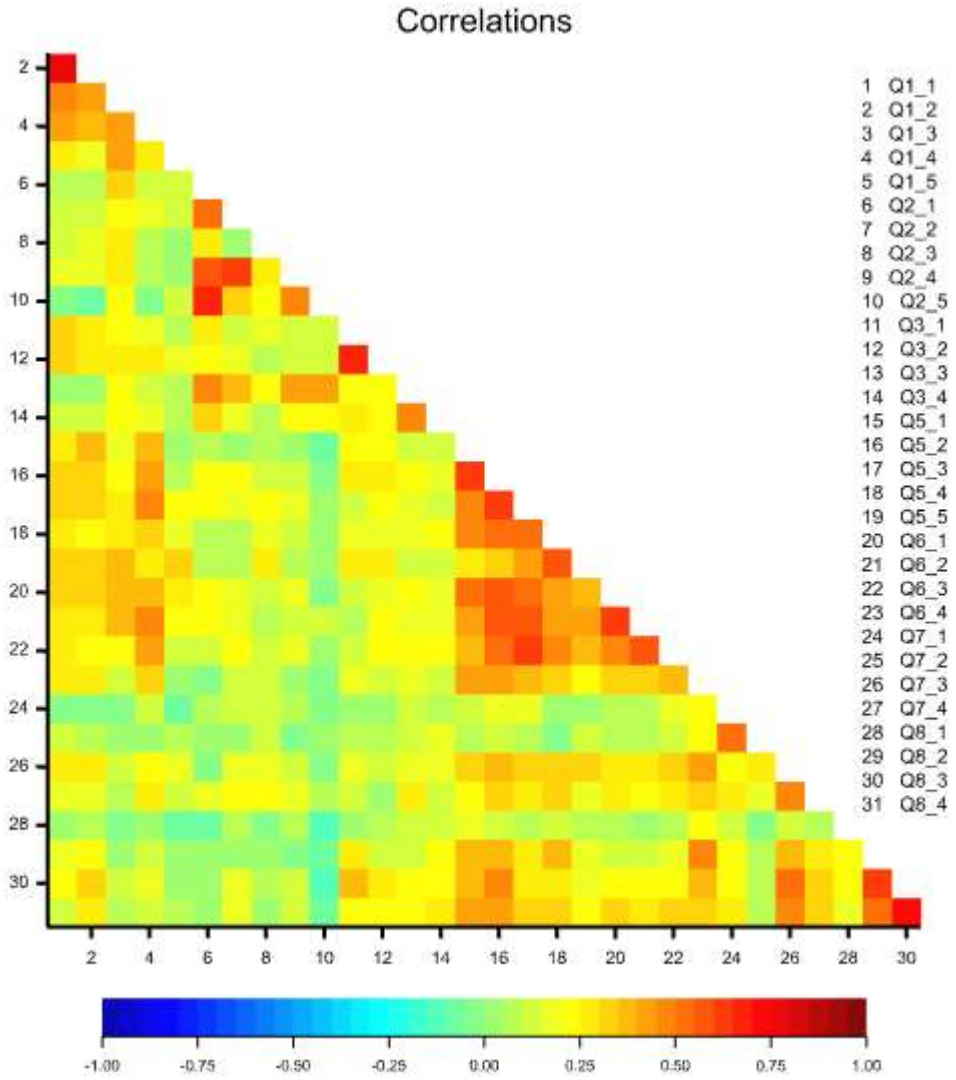
Supplementary material 3

Table detailing the number of people per case study invited to complete the standard questionnaire, and the methods by which the respondents completed the questionnaires.

			Types of response		
Case study	**Number of users invited to answer survey**	**Number of respondents**	**Individual Interviews**	**E-Mail /Online survey**	**Meeting**
ALPS	15	7	0	0	7
BARC	25	11	0	11	0
BIOB	10	6	6	0	0
BIOF	13	9	0	1	8
BIOG	6	6	0	0	6
BKSU	14	14	0	0	14
CAPM	12	3	0	3	0
CNPM	33	15	7	6	0
CRKL	6	2	2	0	0
DANU	15	11	0	11	0
DONN	11	11	9	2	0
ESSX	30	11	0	11	0
GIFT	2	2	0	2	0
GOMG	11	11	0	0	11
KEGA	33	33	0	0	33
KISK	14	10	9	1	0
LLEV	11	5	0	5	0
OSLO	1	1	1	0	0
SACV	20	14	0	2	12
SIBB	15	7	0	0	7
SNNP	6	6	0	0	6
SPAT	6	6	6	0	0
STEV	2	2	1	1	0
TRNA	12	11	0	1	10
VGAS	2	2	0	2	0
WADD	6	5	5	0	0
WCSO	29	5	0	5	0

Supplementary material 4

Correlation plot between all of statement scores from Q1 – Q8 of the practitioners questionnaire (refer to Supplementary material 2 for full text of each question)



Supplementary Material 5

Graph showing the number of statements placed in each of the 13 category types relating to the practical limitations of the work.