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Report of Results of a Survey to Assess the Use of CICES, 2016 (Deliverable 2)

by

Prof Roy Haines-Young,

Senior Consultant, Fabis Consulting Ltd

The Paddocks, Chestnut Lane,

Barton in Fabis, Nottingham, NG11 0AE, UK

Contact e-mail: fabis_consulting@btinternet.com

Contact phone number:

0044 115 9831370

Fabis consulting

LIWAS consulting

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1. Introduction

The Common International Classification of Ecosystem Services (CICES) was designed to help measure, account for and assess ecosystem services. Although it was developed in the context of work on the System of Environmental and Economic Accounting (SEEA) that is being led by the United Nations Statistical Division (UNSD), it has been used widely in ecosystem services research for designing indicators, mapping and for valuation.

The current version of CICES (V. 4.3) was published at the beginning of 2013; this report takes stock of feedback from users, based on a questionnaire survey. The results will help identify the kinds of guidance people might need in using CICES, and to look at whether any changes in its structure or terminology might be needed to adapt it to national statistical systems and better link to other international statistical classifications, or to make it more generally useful and easier to understand for mapping and other purposes. The outcome of this work is expected to be useful in the context of wider international initiatives on the problem of classifying ecosystem services.

2. The structure of the survey and general pattern of responses

The survey was designed to gather responses from those who have used CICES and those who have not. The views of users were clearly important because the goal was to draw on this body of experience to identify where the strengths and weaknesses of V4.3 lie, and potentially how the structure might be improved. However, in designing the questionnaire it was also felt important to explore whether 'non-users' had in fact heard of CICES, and if they had what alternatives they had used in their work; this kind of information was considered to be helpful in terms of potentially identifying the limitations to using CICES and its general relevance. Those opening the questionnaire were directed to a different set of questions depending on whether they identified themselves as CICES users or not; a full copy of the questionnaire can be found in Appendix 1.

Altogether, 327 people attempted the questionnaire (317 before the deadline of 1/4/2016; all responses have, however, been used), from which there were 222 useable responses, in the sense that they provided answers to some or all of the questions posed in the main body of the survey; 125 (59%) recoded that they were CICES users and 87 (41%) that they were not.

2.1 Findings from the CICES user group

Table 1: Application areas covered by CICES users (multiple responses were permitted)

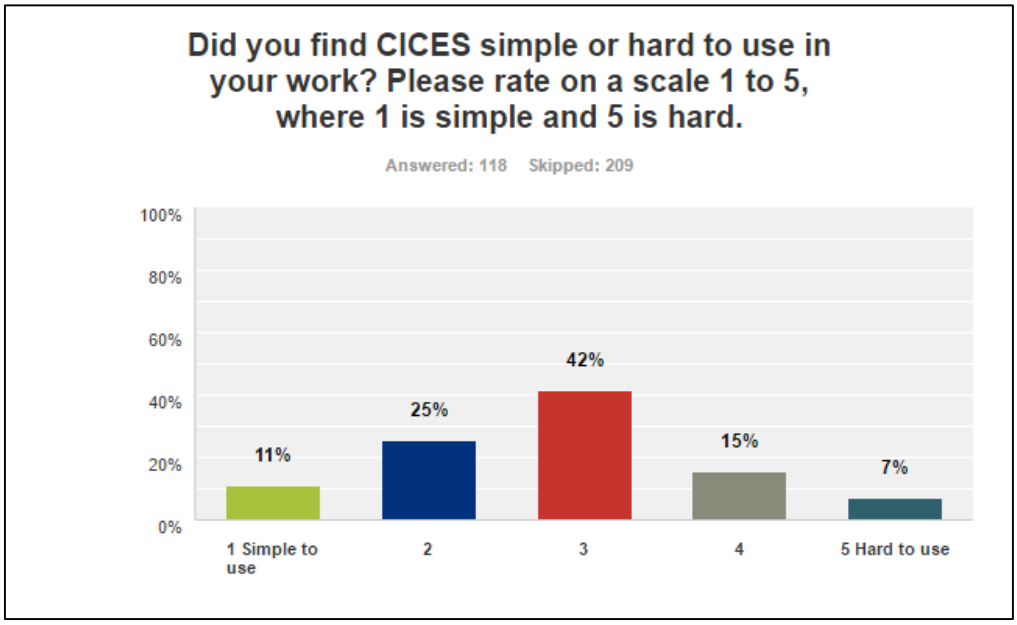
Applicaton area	Per Cent	Number
Mapping and ecosystem assessment	77%	94
Valuation	37%	45
The development of indicators	35%	43
Stakeholder Engagement	25%	30
Modelling	24%	29
Environmental Accounting	19%	23
Other	12%	15
The development of ecological production functions	3%	3

The CICES user group were asked to identify the broad application area in which they are working. The majority selected 'mapping and ecosystem assessment' (77%), followed by 'valuation' (37%) and 'the development of indicators' (35%); only 19% selected environmental accounting. Amongst the 'other catgory' users identified areas such as:

- Citizen mapping of ES using a Smartphone App (MapNet);
- Using CICES for development of classifications of the ecological capital;
- Development of and 'app' focussed on urban recreation;
- Conceptual framing of ES and their inter-relationships;
- Creating a list of ES, case study templates and questionnaires; and,
- Collecting information to inform decisions relating to licensing , river basin management, flood risk strategy, SEA.

The question was flowed-up by one asking them to rate the ease of use of CICES. They were asked to use a five-pint rating scale from 'simple' to 'hard'. While the majority (42%) found it moderately simple to use, more than three quarters of the people who responded rated at this level *or simpler* (Figure 1). Two open-ended questions (Q5 and Q6) were then used to identify what people though its main strengths and weaknesses were. The results from questions were code according to a set of general thematic areas and the results summaries in Tables 2 and 3. The full coding for these questions is provided in Appendix 2.

Figure 1: Ease of use for CICES



Within the set of 89 responses to the question about the advantages of CICES, those coded as relating to the system logic, its hierarchical structure its function as a standard and is coverage were the most common (Table 2). Those coded up as the 'logical' group included comments such as "its logic and definitions are clear and easy to follow" (ID: 4652222310), "Classification CICES is a simple to use and concretized" (ID: 4565886105), and "I like the parallels to the cascade model, which I personally find intuitive" (ID: 4498945266).

Table 2: Advantages of CICES identified by users

Coding Criteria	No of Reponses
Logical	17
Hierarchy	15
Standard	14
Coverage	14
Understanding	8
Other	4
Reference	3
Clarity	3
Communication tool	3
Examples	3
Integrated	1
Detail	1
Clear	1
Applicability	1
Flexibility	1
Total	89

Comments relating to the advantages of the hierarchical structure of CICES included comments such as "The different level of generality (levels) of the classification are useful" (ID: 4614264366), and "hierarchical structure is easy to understand, the system can easily be enhanced (concrete examples) or modify (delimitation of classes / class types) compatibility to the satellite accounts of the system of economic and environmental accounts (SEEA)" (ID: 4485414289).

Standardisation and coverage were the other most frequently cited advantageous characteristics of CICES, with comments such as "What is really useful is to have an international recognized classification of ES, which puts together MEA and TEEB ideas. To have only one reference is really laudable." (ID: 4539395544), and "it's very comprehensive" (ID: 4556074058). It is important to note, however, that many comments included several characteristics of CICES and the simple coding shown in Table 2 does not reflects the richness of some of the comments. For example, on response saw that advantage of CICES very much as a 'package', adding that an important feature was "The conceptual background (in particular the cascade), the hierarchical structure, the comprehensive list of services, the international collaboration or agreement it's based on." (ID: 4502584805).

In the context of the revision process that has prompted this study it is clearly important to identify those characteristics of CICES that users found problematic. Thus question 6 examined perceived shortcomings. Again the responses have been coded (Appendix 2) and the results summarised here (Table 3).

Table 3: Shortcomings of CICES identified in Survey

Coding Criteria	Number of Reponses
Complexity	16
Framing of cultural services	13
Terminology needs to be clarified	11
Lack of abiotic classification	6
Lack of definition of functions	5
Uncertain coding	4
Difficult to apply	4
Problematic classification of water	3
Role of biodiversity unclear	3
Conceptual framing	3
Relationship to benefits	2
Link to indicators needed	2
Mix of services and benefit	2
Not an accepted standard	2
Overlaps in categories	2
Link to supporting services needed	2
Extend to trade-offs	1
Gaps in coverage	1
Inflexible	1
Difficult to apply to marine	1
Coverage of urban	1
Difficulty of adding a spatial reference	1
Weak conceptualisation	1
Better description	1
Lack of guidance	1
Grand Total	89

An interesting feature of the responses was that characteristics of CICES that some thought were 'advantages' (Q5) were found to be 'shortcomings' by others. For example, in contrast to those users who found CICES to the simple to use its 'complexity' was cited as a shortcoming in a number of responses to Q6. One person surveyed suggested that "Its comprehensive nature although useful from a technical perspective is too detailed for use in stakeholder engagement where far simpler categorisations are needed." (ID: 4485558848).

Another observed that "The need for generic classes applied at a high level of aggregation makes it sometimes difficult to apply to place based studies. Translation of culturally meaningful ES terminology from a local setting does not always fit neatly. Especially for cultural services" (ID: 4501256540). The classification of regulating services was also highlighted as presenting difficulties for some: "The section regulating services is very complex. Not so useful for communication purpose." (ID: 4636153238). To a large extent the complexity issue therefore related more to the use of CICES as a communications tool with non-experts, rather than technical complexity of applying the system.

The classification of cultural ecosystem services in the current version of CICES was, however, the most frequently cited area of the classification that caused concern. A longer response by one of the people surveyed included the comment that "Cultural services need to be improved. Not clear where certain services (such as local identity, sense of place or attachment to a landscape) fit within CICES…." (ID: 4544465806). Another felt that "CES are not well thought through. Many are as a matter of fact benefits or hard to distinguish. Maybe also thinking about to whom might help." (ID: 4542099850). The consistency of these comments on cultural services seems to point to an important area of the classification that might need to be considered in any revision. This issue links closely with the need to clarify terminology, that was cited as the third most frequently cited shortcoming.

As Table 3 shows the list of feature of CICES regarded as shortcomings was longer than that for the positive features, which seems to reflect the fact that individuals were identifying particular, detailed issues that they wanted to share. These included the relationship of the services to underling functions and benefits, and the need to link the categories in CICES to indicators more explicitly. An important theme identified in the less frequently cited topics in Table 3 was the fact that some users found it difficult to use the system in particular application contexts, such as the urban and the marine.

For example, one respondent reflected on their work on urban ecosystems and suggested that all services must, by definition, link to one or more beneficiaries "… in planning practice when defining goals and measures it is very important to consider the complete range of ecosystem services available, and not only those actually being used. The consideration of the gap between currently used services and potentially usable services leads to important arguments for the conservation and development of the capacity (productivity) of the natural environment" (ID: 4539509178). The extent to which the identification of beneficiary groups is a perquisite for using CICES is a moot point, and certainly not one unique to this system. In fact the difficulty of identifying beneficiaries in some context is worth noting, given the desire of other respondent to have benefits and beneficiaries built into or lined to the classification. Another person surveyed cited 'coverage' as an issue for those working in the urban environment, arguing that: "Its [CICES] background is agricultural or near-natural landscapes - it does not capture well ecosystem services relevant in urban contexts - e.g. health issues are not represented" (ID: 4480094647). Whether or not "health issues" can or should be built into the classification is clearly a point that might need to be explored, not least in terms of clarifying the way specific health *benefits* can be linked to particular biophysical ecosystem characteristics or outputs that could be regarded as final services.

Comments from those working in the marine sector also indicated at better explanation of that constituted a final service in different types of environment might be necessary. One respondent, for example noted the apparent: "Lack of service definitions (one has to be guided by each class and related examples to find out what the service is actually about) and of service 'interpretations' for each 'biome' (land, freshwater, marine)" (ID: 4545109065). They went on to suggest that this was a shortcoming because "…. what makes sense for the terrestrial environment, on which the development of CICES was based, is not of direct application for the marine environment, in particular that is quite difficult (if not impossible) to perceive most of the 'regulation and maintenance' services as 'final' in that context" (ID: 4545109065). This was an issue taken up by another person working in the marine sector who also cited problems with the classification of regulating services: "Some conceptual difficulties can be encountered for example in regulating services. There is (sic) few good quality indicators that correlates with CICES, all the rest are proxies." (ID: 4539969268). They went on: "…. Difficulties in distinguishing between the supply and the demand side of ecosystem services classification. Also difficult to include some indicators that are more associate to ecosystems functions and ecosystem benefits. It might be useful to integrate these dimensions in CICES. Maybe CICES should also clearly acknowledge other uses than accounting" (ID: 4539969268). Once again, therefore, the need to clarify terminology and definitions therefore emerges as an issue that any revision must address.

2.2 Findings from those who have not used CICES

Of the 87 people who completed the survey who identified themselves as having not used CICES a third of the had not been aware of the classification system; of the remaining group roughly equal numbers were either 'aware' or 'somewhat aware' of it. When asked about which ecosystem service classification systems the MA was the most frequently cited, followed by TEEB (Table 4). Since many people reported as having used more than one system in their work, the numbers shown in Table 4 exceed the number of respondents.

Table 4: Alternative classification frameworks identified by those who had not used CICES

System	No of responses
MA	23
TEEB	11
FEGS/NESCS	3
Other	10
Blank	44

Having identified any publications arising from their work the questionnaire took the 'non-users' to the set of general questions relating to the scope of any classification that were at end of the survey, which they then answered along with the 'user' group. All of these responses are reported in the next section.

2.3 Findings from all respondents

2.3.1 Abiotic ecosystem outputs

Although the lack of a classification of abiotic services was not amongst the three 'top' shortcomings identified by CICES users shown in Table 3, the general issue was covered in a later question in the survey which asked ***all*** respondents whether abiotic ecosystem outputs should be covered in the classification (Q13). One hundred and sixty two people responded to the question; 54% said it would be useful to include abiotic outputs and 25% said that it would not, while 22% said that they could not comment. Comments from those who supported adding abiotic outputs into CICES included: "I understand that abiotic outputs may not fit in the initial rationale of ecosystem services, but I found it difficult to omit them from discussions with stakeholders as they largely contribute to scenery/use/acceptance of the landscape" (ID: 4652222310). Another suggested: "There is a need for a complementary approach for all environmental services. There are sometimes trade-offs between the use of the different resources. For environmental accounts, it would be helpful to have this extended classification" (ID: 4539420741). Several respondents suggested that since, under provisioning, water is already included in CICES, it would be more consistent to include other abiotic outputs as well (ID: 4493445824). However, comments from those who suggested extending the classification also revealed the wide range of different types of abiotic outputs that might also be considered. These included not only those suggested in the question, such as wind, hydropower and salt, but also "space (or offering territory or etc.). Also air (wind), water (transport, energy etc.), minerals (mining) are very important" (ID: 4591640851).

Those who felt that abiotic outputs should not be included in CICES cited the problem of added complexity (e.g. ID: 4570988202 and 4495118973), and the danger that "inclusion of the abiotic services into CICES could somehow destabilize ecosystem services understanding. E.g., SEEA-EEA makes quite clear distinction between these two types of services - ESS and abiotic services. If we will go deep into physical processes and minerals, etc. (salt, crude oil, saltpetre...) …..we could lose still quite fragile definition of ESS, and it could have some undesirable consequences for one of the main

purposes of ESS approach - to maintain and restore of ECOSYSTEM services" (ID: 4546977792). A number of respondents who felt that abiotic outputs should not be included argued that these factors were either already dealt with in the accompanying 'abiotic table' published with V4.3 (e.g. ID: 4502584805 and ID: 4476351443), or covered in other systems (e.g. ID: 4550890476). The latter observed that "…the abiotic section is largely covered by established resource accounting methods". Taken in conjunction with the comments from people who felt that abiotic output's should be included, these responses suggest that better information on the rationale for what was included in the classification was needed and what the scope of the system was, and whether abiotic outputs were included in the mind body of the classification uses should be given points to how they might be handled in different contexts.

2.3.2 Classifying benefits and beneficiaries

Questions 15 and 16 asked all respondents whether CICES should 'be extended' to illustrate the 'kinds of goods and benefit that services might support' and to identify 'different types of beneficiary'. In both cases the overwhelming majority (~80%) of the 158 who responded to these questions felt that in both cases these kinds of links should be made. Around 10% argued that they felt this was not needed, and around the same number said they could not comment.

Amongst those who argued that the classification should link to goods and benefits, one user observed that it should be done "But not at the expense of clarity. If this follows the current 'illustrative' section in the spreadsheet this is useful" (ID: 4550890476). In fact, a number of respondents (24) who gave a positive response to Q15 argued that the link is probably best made by way of providing examples (e.g. IDs: 4652222310, 4477764127) and that the main priority was to improve understanding (ID: 4652222310) and communication of key ideas (ID: 4512011683). Many of the comments that cited the use of examples as a way forward echoed the concern so those who felt it was undesirable to make the formal link because of the complexity that this might introduce. Amongst those who felt that the link to goods and benefits should *not* be a major focus of future work comments included "I would not make the CICES framework any more complicated than it is currently. I currently do not see the added value that the time investment would generate." (ID: 4547673465). Despite giving a positive response to the question another person surveyed was worried about the feasibility of the task: "As an example only, perhaps. It would be impossible to cover all the goods and benefits that ecosystem services support" (ID: 4482881279).

In terms of the links to beneficiaries some respondents argued that it was "crucial" (ID: 4664369261) or "critical" (ID: 4539265011) or "really important for better finance of natural capital" (ID: 4580881553). However, amongst those who gave a positive response some worried about the complexity that this might introduce: "This seems rather complex to make a full review. A general methodology to identify beneficiaries and examples might be sufficient" (ID: 4539420741). Once again a strategy based on providing examples was cited as the way forward by a number of those responding to Q16 (e.g. IDs: 4539739706 and 4480268424). As in the case of the links to goods and services, those providing a negative response to this question mainly did so on the basis of the complexity of the task and indeed the practicality. One respondent observed: "In my opinion these would make CICES to complex. There might be recognition issues if not all beneficiaries are listed" (ID: 4544465806), while another suggested that: "The link with beneficiaries is done depending on the context. Doing this ahead of time makes the classification system more convoluted than what it should be" (ID: 4514579556). Finally, yet another added: "this is impossible. If CICES would do that, it would further

funnel and limit scope of valuations and become more biased. Maybe examples for different value types could be given, always widening rather than narrowing the scope" (ID: 4476113025).

In the case of the links to goods and benefits and the links to beneficiaries, therefore, the consensus seemed to be that people felt that it would be useful to provide examples and guidance on *how* the links can be made rather than attempting to include classifications of goods and benefits, or beneficiaries within the system itself. To do so, they felt, would possibly make the system too complex and potentially limit its flexibility in any application.

2.3.4 Improving the structure and logic of CICES

Questions 17 and 18 were included in the survey to elicit suggestions on how the structure and logic of the present version of CICES might be improved. The ambition was to gather information on a wider set of issues than might have been identified in exploring what people thought were the advantages and shortcomings of the system. However, as Table 5 shows, the topics identified strongly reflected those found in the earlier questions. Moreover, for the most frequently cited issues, responses were similar in relation to the questions about structure and logic.

Table 5: Issues identified relating to CICES structure and logic (note some responses were given more than one code given the range of issues they covered)

Code	Q17 (Structure)	Q18 (Logic)
Terminology	22	3
Guidelines	13	19
Framing of cultural services	9	4
Simplify	9	7
Uncertain coding	7	7
Classification of regulating services	4	1
Examples, indicators	4	2
Link to structure and function	3	9
Link to biodiversity	2	1
Link to other classifications	2	1
Link to health	1	0
Coverage	1	0
Clarification of status of water	0	2
Clarifying production boundary	0	1
Coding	0	1
Extension to valuation	0	1
Framing	0	3
Link to beneficiaries	0	1
Relationship to abiotic outputs	0	1
Revision of soil classification	0	1
Widen consultation	0	1

Thus clarification of terminology and the provision of clear guidelines often cited, together with related issues such as the need for examples, the need for simplification and the potential revision of the classification of cultural services and some areas relating to regulating services. The strong support for providing examples was also evident from the answers to Q14; 80% of respondents felt that the CICES framework should be extended to include examples of ecosystem services in each class type and how they can be measured.

In reviewing the responses to these questions particular attention was therefore paid to new topics and alternative ways of approaching the classification task not identified elsewhere in the survey. In this context, there was an interesting observation by one respondent to Q18 on the problem of 'double counting' and that was a focus of attention in designing CICES around the concept of a 'final service':

> *"The classification system should be hierarchical and flexible. It should be explicit about the scale and resolution at which it works best, and what kinds of decision support it provides, and cannot be expected to provide. It should recognise that despite these efforts it cannot eliminate the problem of double counting which the very classification sets out to eliminate. Given the pervasiveness of double counting*

when dealing with plural values and functional interdependence of ecosystems and their structures, it should explore what its capabilities [are]. For example, better identification of overlapping - double counted values - can be the basis for identifying common agendas or conflicts between stakeholders. Overlapping values in an awareness raising or political debate context can be mutually supporting as evidence, rather than seen a drawback…." (ID: 4501256540)

What is interesting here is that the respondent is suggesting that we should not necessarily attempt to design a system that prevents double counting, but rather be aware of it and in the application of the system look at where it occurs and use this information to better understand the issues that characterise a particular application. This response was coded up under the heading of 'guidelines' which clearly have to address *how* the classification is used in different *analytical contexts* as well as definitional, conceptual and framing issues. The problem of double counting is certainly one recognised by others who answered Q18 (e.g. ID: 4627662382, and 4567878839).

The need to clarify the link between services and 'biodiversity' was a further new theme to emerge in the responses to these questions, with one respondent making the suggestion in relation to Q18 that: "Even without embedding into the system, the cascade level one stuff (biodiversity, natural capital, integrity, degradation status) should be associated to framework some way, with some theoretical and practical explanation how to use them together with the framework" (ID: 4633253844). Clarification of the ways soils provide services was a further area identified where the structure of CICES might be looked at: "The system does not currently take account of the services provided by soil very well. [Our] soils scientists identified that the services provided by soil extend beyond the soil formation and composition service identified in the classification" (Q18, ID: 4534648031). This same respondent went on to observe that within the regulating category "ventilation and transpiration or dilution by atmosphere are much broader services that are harder to understand and relate to specific ecosystem types" and suggested that "they are huge categories that feel a bit meaningless when making assessments" (Q18, ID: 4534648031).

Although the link to benefits and beneficiaries was highlighted as important by a number of respondents for Q14 & 15, in terms of suggestions for alternative approaches or classification logics it was cited only by a few responses to Q17 & Q18. There was, however, one extensive comment (Q17 & 18 ID: 4614264366), which argued that to classify services two components need to be considered, the "biophysical" and "socio-economic". They observed that "It seems that an additional level to the current classification is required so that each ES is a unique combination of an ecosystem process (or element) and benefit". In terms of a way forward, they felt that "An idea could be to get a unique set of elementary services and to propose two classifications of them, one according to the underlying processes, another according to the type of benefits". Such a suggestion echoes the comments made elsewhere in the questionnaire responses involving making the link to underlying ecosystem functions more explicit, as well as the link to benefits and beneficiaries; whether this can be done in a single classification system or whether these issues are best handled by better guidance is a question that needs to be addressed in this review.

3. Key messages from the survey and next steps

A clear message that emerges from the questionnaire was that there appeared to be an established user-base for CICES. Moreover, while users identified difficulties in working with the classification, the comments suggest that many of these could potentially be overcome by providing better guidance

and examples. The survey identified nearly 40 published papers and links to other sources describing work based on CICES (Appendix 3); these provide a useful starting point for developing a set of examples around which strategies for handling analytical and conceptual issues can be described.

The kinds of issue that these examples need to illustrate include the links to underlying structures, processes and functions, and the links to benefits and beneficiaries. It seems apparent that whether or not formal classifications of benefits and beneficiaries are developed in the future, these examples could serve to help users of CICES in the short to medium term. The important analytical issues that need to be considered include the problem of 'double counting' and how to handle it in the classification, and how the classification might support the analysis of 'trade-offs'.

The review of examples and applications would also be a useful way of testing the hierarchical structure of the classification – given that some users felt the need to "simplify". The extent to which examples used aggregated metrics to characterise collections of services at the group and division level, would be a particular feature to examine in the evidence-base. The lack of detailed guidelines for the application of V4.3 has clearly been a limitation for users. In addition to helping understanding, the development of new detailed guidelines would be a way of useful exposing and working through the logic of the classification, and potentially of addressing the difficulties that users identified in relation to water, soils, and especially cultural services. The detailed comments that users provided about specific services could be looked at in detail at this stage.

Whether or not the structure of the classification is simplified by modifying the hierarchal structure, it seems apparent that to support the wider range of uses that the current version of CICES has, there would be advantageous to have a less technical set of descriptors and service names that could be used with non-experts during, say, a participatory process. While it seems unlikely that a lay version of the classification could replace the more technical one (given the need for better definitions suggested by a number of respondents) the ability to have consistent but customised naming conventions that suit a wider range of applications would seem useful. The approach could also be used to cross reference service categories that make more sense in the context of specific ecosystem types, such as marine.

Appendix 1: Questionnaire

Appendix 2: Coding used for responses

Coding used for responses to Q5,

'From your experience of CICES what would you say are its most useful or helpful features?'.

For full data and coding see accompanying database.

Row Labels	Count of Code
Logical	17
Hierarchy	15
Standard	14
Coverage	14
Understanding	8
Other	4
Reference	3
Clarity	3
Communication tool	3
Examples	3
Integrated	1
Detail	1
Clear	1
Applicability	1
Flexibility	1
Grand Total	**89**

Appendix 2: Coding used for responses, cont.

Coding used for responses to Q6,

'From your experience of using CICES what would you say are its major shortcomings?'.

For full data and coding see accompanying database.

Row Labels	Count of Code
Complexity	16
Framing of cultural services	13
Terminology needs to be clarified	9
Lack of abiotic classificaiton	6
Lack of definition of functions	5
Uncertain coding	4
Difficult to apply	4
Problematic classificaiotn of water	3
Role of biodiversity unclear	3
Concpetual framing	3
Terminology	2
Relationship to benefits	2
Link to indicators needed	2
Mix of services and benefit	2
Not an accepted standard	2
Overlaps in categories	2
Link to supporting services needed	2
Difficulty of adding a spatial reference	1
Extend to trade-offs	1
Gaps in coverage	1
Inflexible	1
Difficult to apply to marine	1
Coverage of urban	1
Weak conceptualisation	1
Better description	1
Lack of guidance	1
Grand Total	**89**

Appendix 2: Coding used for responses, cont.

Coding used for responses to Q13,

'A number of people have suggested that one way to develop CICES is to include an equivalent classification of the abiotic outputs from ecosystems - to cover such things as wind, hydropower, salt, etc. Do you agree?'.

For full data and coding see accompanying database.

Row Labels	No, exclude	Yes include	Grand Total
Conceptual framing of ES	1		1
Focus on human use rther than abiotic outputs	1		1
Guidelines on application		4	4
Makes classificaiton too complex	10		10
Need a parallel classification	1	9	10
Need to be consistent (e.g. water)		3	3
Need to be inclusive		36	36
Need to be inclusive - guidelines		1	1
Need to be inclusive and link to supporting structures, processes etc.		1	1
Need to be inclusive for accounting purposes		1	1
Need to better reflect status of soils		1	1
Need to clarify role		1	1
Parallel classificaiton useful		1	1
Risks double counting	1		1
Shifts focus from biodiversity	4		4
Uncertain coding	5	4	9
Undermines defintion of ES	1		1
Unnecessary	6		6
Grand Total	**30**	**62**	**92**

Appendix 2: Coding used for responses, cont.

Coding used for responses to Q17 & Q18. For full data and coding see accompanying database; the same coding was used for each question.

'Whether you have worked with CICES or not, from your knowledge of it, do you have recommendations for how the descriptions or naming of the services can be improved? Please be as detailed as you can'. (Q17)

'Whether you have worked with CICES or not, from your knowledge of it, do you have recommendations for how the logic of the system or its classification approach could be improved? Please be as detailed as you can.' (Q18)

Code	Q17 (Stucture)	Q18 (Logic)
Terminology	22	3
Guidelines	13	19
Framing of cultural services	9	3
Simplify	9	7
Uncertain coding	7	7
Classification of regulating services	4	0
Examples, indicators	3	2
Link to structure and function	3	8
Link to biodiversity	2	0
Link to other classifications	2	1
Link to health	1	0
Coverage	1	0
Link to metrics	1	0
Clarification of status of water	0	2
Clarifying production boundary	0	1
Coding	0	1
Extension to valuation	0	1
Framing	0	3
Link to beneficiaries	0	1
Relationship to abiotic outputs	0	1
Revision of soil classification	0	1
Widen consultation	0	1

Appendix 3:

Publications and links identified by respondents using CICES in answer to question “Have the outcomes of the work in which you used CICES been published? If so please provide links or references.”

Respondent	Paper	Type
4627036231	Alahuhta, J., Joensuu, I., Matero, J., Vuori, K-M. & Saastamoinen, O. 2013. Freshwater ecosystem services in Finland. Reports of the Finnish Environment Institute 16/2013. 35 p. Available at: http://hdl.handle.net/10138/39076	Paper
4485414289	Albert, C., Burkhard, B., Daube, S., Dietrich, K., Engels, B., Frommer, J., Götzl, M., Grêt-Regamey, A., Job-Hoben, B., Keller, R., Marzelli, S., Moning, C., Müller, F., Rabe, S.-E., Ring, I., Schwaiger, E., Schweppe-Kraft, B., Wüstenmann, H., 2015. Development of National Indicators for Ecosystem Services Recommendations for Germany. Discussion Paper. BfN-Skripten 410, Bon-Bad Godesberg.	Paper
4627036231	Arovuori, K. & Saastamoinen O. 2013. Classification of agricultural ecosystem goods and services in Finland. PTT Working Papers 155. 23 p. Available: http://ptt.fi/fi/prognosis/155-arovuori-kja-saastamoinen-o	Paper
4480167446	Baró F, Haase D, Gómez-Baggethun E, Frantzeskaki N (2015) Mismatches between ecosystem services supply and demand in urban areas: A quantitative assessment in five European cities. Ecol Indic 55:146–158. doi: 10.1016/j.ecolind.2015.03.013	Paper
4570763034	Bujnovský, R. 2015 Evaluation of the ecosystem services of inland waters in the Slovak Republic – to date findings. Ekológia 34, No 1, p. 19-25.	Paper
4495027295	Bürgi, M., Silbernagel, J., Wu, Jianguo, Kienast, F., 2015: Linking ecosystem services with landscape history to inform future scenarios. Landscape Ecology 30: 11-20. 3 Kienast, F., Helfenstein, J., in press: Modeling Ecosystem Services. Earthscan Routledge Handbook Series.	Paper
4476302179	Campagne, C.S., et al. The seagrass Posidonia oceanica: Ecosystem services identification and economic evaluation of goods and benefits. Mar. Pollut. Bull. (2015), http://dx.doi.org/10.1016/j.marpolbul.2015.05.061	Paper
4502584805	Grizzetti, B., Lanzanova, D., Liquete, C., Reynaud, A. (2015). Cook-book for water ecosystem service assessment and valuation. JRC report EUR 27141 EN. Luxembourg, Publications Office of the European Union. doi:10.2788/67661.	Paper
4495027295	Haines-Young, R., Potschin , M., Kienast, F., 2012: Indicators of ecosystem service potential at European scales: mapping marginal changes and trade-offs. Ecol. Indicators 21: 39-53.	Paper
4539509178	Hartje, V., Heiland, S., Kalisch, D., Schliep, R., Wüstemann, H., Kahl, R., Sander, H. (2016): Ökonomische Effekte der Ökosystemleistungen städtischer Grünräume. Abschlussbericht zum Forschungs- und Entwicklungsvorhaben (FKZ 3512 82 1400). Bundesamt für Naturschutz, Bonn. In preparation.	Paper
4495027295	Helfenstein, J., Bauer, L., Clalüna, A., Bolliger, J., Kienast, F., 2014: Landscape ecology meets landscape science. Landscape Ecology 29: 1109-1113.	Paper
4495027295	Helfenstein, J., Kienast, F., 2014: Ecosystem service state and trends at the regional to national level: a rapid assessment. Ecological Indicators 36: 11-18.	Paper
4495027295	Kienast, F., Frick, J., van Strien, M.J., Hunziker, M., 2015: The Swiss landscape monitoring program - a comprehensive indicator set to measure landscape change. Ecological Modelling 295: 136-150.	Paper

4495027295	Kienast, F., Huber, N., Hergert, R., Bolliger, J., Segura Moran, L., Hersperger, A.M., submitted: Conflicts between decentralized renewable energies and ecosystem services - a spatially-explicit quantitative assessment for Switzerland. Submitted Renewable and Sustainable Energy Reviews.	Paper
4627036231	Kniivilä, M. & Saastamoinen, O. 2013. Markkinat ekosysteemipalveluiden ohjaus- ja edistämiskeinona. PTT:n työpapereita 154. 30 s.]. Available at: http://ptt.fi/wp-content/ uploads/2013/11/tp1541.pdf	Paper
4627036231	Kniivilä, M., Arovuori, K., Auvinen, A-P., Vihervaara, P., Haltia, E. Saastamoinen, O. & Sievänen, T. 2013. Miten mitata ekosysteemipalveluita: olemassa olevat indikaattorit ja niiden kehittäminen Suomessa? PTT työpapereita 150. 68 s. Available at: http://ptt.fi/fi/prognosis/150-kniivila-(etc).	Paper
4627036231	Kosenius, A-K., Haltia, E., Horne, P., Kniivilä, M. & Saastamoinen, O. 2013. Valuation of ecosystem services? Examples and experiences on forests, peatlands, agricultural lands, and freshwaters in Finland. PTT raportteja 244. 103 s. http://ptt.fi/wp-content/uploads/2014/02/rap244.pdf	Paper
4488389181	Kostrzewski A., Mizgajski A., Stępniewska M., Tylkowski J. 2014: The use of Integrated Environmental Programme for ecosystem services assessment. Ekonomia i Środowisko 4(51), Białystok: 94-101, available in English on-line: http://www.fe.org.pl/uploads/ngrey/!%20eis51.pdf -	Paper
4555536685	Lee and Lautenbach, 2016. A quantitative review of relationships between ecosystem services, Ecological Indicator, 66, 340-351	Paper
4502584805	Liquete, C., Cid, N., Lanzanova, D., Grizzetti, B., Reynaud, A. (2016). Perspectives on the link between ecosystem services and biodiversity: The assessment of the nursery function. Ecological Indicators 63: 249–257. http://dx.doi.org/10.1016/j.ecolind.2015.11.058	Paper
4502584805	Liquete, C., Kleeschulte, S., Dige, G., Maes, J., Grizzetti, B., Olah, B., Zulian, G. (2015). Mapping green infrastructure based on ecosystem services and ecological networks: A Pan-European case study. Environmental Science & Policy 54: 268–280. http://dx.doi.org/10.1016/j.envsci.2015.07.009	Paper
4502584805	Liquete, C., Piroddi, C., Drakou, E.G., Gurney, L., Katsanevakis, S., Charef, A., Egoh, B. (2013). Present stage and future prospects in the analysis of marine and coastal ecosystem services: a systematic review. PLoS ONE 8(7): e67737. http://dx.doi.org/10.1371/journal.pone.0067737.	Paper
4502584805	Liquete, C., Zulian, G., Delgado, I., Stips, A., Maes, J. (2013). Assessment of coastal protection as an ecosystem service in Europe. Ecological Indicators, 30: 205–217. http://dx.doi.org/10.1016/j.ecolind.2013.02.013.	Paper
4502584805	Maes J., Barbosa A., Baranzelli C., Zulian G., Batista e Silva F., Vandecasteele I., Hiederer R., Liquete C., Paracchini M.L., Mubareka S., Jacobs-Crisioni C., Perpiña Castillo C., Lavalle C. (2015). More green infrastructure is required to maintain ecosystem services under current land-use change in Europe. Landscape Ecology 30(3): 517-534. doi: 10.1007/s10980-014-0083-2.	Paper
4502584805	Maes J., Liquete, C. et al. (2016). An indicator framework for assessing ecosystem services in support of the EU Biodiversity Strategy to 2020. EcosystemServices 17: 14–23. http://dx.doi.org/10.1016/j.ecoser.2015.10.023	Paper
4502584805	Maes, J., Egoh, B., Willemen, L., Liquete, C., Vihervaara, P., Schägner, J.P., Grizzetti, B., Drakou, E.G., La Notte, A., Zulian, G., Bouraoui, F., Paracchini, M.L., Braat, L., Bidoglio, G. (2012). Mapping ecosystem services for policy support and decision making in the European Union. Ecosystem Services, 1 (1): 31–39. http://dx.doi.org/10.1016/j.ecoser.2012.06.004.	Paper

4485414289	Marzelli, S., Grêt-Regamey, A., Köllner, T., Moning, C., Rabe, S.-E., Daube, S., Poppenborg, P., 2014. TEEB-Deutschland Übersichtsstudie. Teil A: Bilanzierung von Ökosystemleistungen. Forschungsvorhaben 3510 81 0500 im Auftrag des Bundesamtes für Naturschutz –	Paper
4485414289	Marzelli, S., Grêt-Regamey, A., Moning, C., Rabe, S.-E., Köllner, T., Daube, S., 2014. Die Erfassung von Ökosystemleistungen. Erste Schritte für eine Nutzung des Konzepts auf nationaler Ebene für Deutschland. Natur und Landschaft 2014 (89), 66–73. Naturkapital Deutschland – TEEB DE, 2012. Der Wert der Natur für Wirtschaft und Gesellschaft. Eine Einführung, Bonn.	Paper
4488389181	Mizgajski A., Stępniewska M., 2012: Ecosystem services assessment for Poland – challenges and possible solutions. Ekonomia i Środowisko 2(42): 54-73, available in English on-line: http://www.fe.org.pl/uploads/ngrey/eis42.pdf	Paper
4480065342	Natuurlijk kapitaal als nieuw beleidsconcept. Balans van de Leefomgeving 2014 – deel 7 © PBL (Planbureau voor de Leefomgeving) , met medewerking van Wageningen UR Den Haag, 2014 PBL-publicatienummer: 1545 http://themasites.pbl.nl/balansvandeleefomgeving/2014/wp-content/uploads/2014/PBL_2014_Natuurlijk-kapitaal_Balans_deel-7_1545.pdf	Paper
4627036231	Saastamoinen, O., Kniivilä, M., Arovuori, K., Kosenius, A-K., Horne, P., Otsamo, A. & Vaara, M. 2014. Yhdistävä luonto: ekosysteemipalvelut Suomessa. [Extended abstract]. Publications of the University of Eastern Finland. Reports and Studies in Forestry and Natural Sciences. No 15. 203 s. Available at: http://epublications.uef.fi/pub/urn_isbn_978-952-61-1426-2/urn_isbn_978-952-61-1426-2.pdf	Paper
4627036231	Saastamoinen, O., Matero, J., Haltia, E., Horne, P., Kellomäki, S., Kniivilä, M. & Arovuori, K. 2013. Concepts and considerations for the synthesis of ecosystem goods and services in Finland. Publications of the University of Eastern Finland. Reports and Studies in Forestry and Natural Sciences. No 10. 108 p: http://epublications.uef.fi/pub/urn_isbn_978-952-61-1040-0/urn_isbn_978-952-61-1040-0.pdf	Paper
4539969268	Santos-Martín F, Martín-López B, García-Llorente M, Aguado M, Benayas J, Montes C. (2013) Unraveling the relationships between ecosystems and human wellbeing in Spain. PLoS ONE 8(9): e73249. (IF: 3.73) DOI:10.1371/journal.pone.0073249	Paper
4539969268	Santos-Martín F., Montes C., Martín-López B., González J., Aguado M., Benayas J., Piñeiro C., Navacerrada J, Zorrilla P., García Llorente M., Iniesta I., Oteros E., Palomo I., López C, Alcorlo P., Vidal M, Suarez M. 2014. Spanish National Ecosystem Assessment. Ecosystems and biodiversity for human wellbeing. Synthesis of the key findings. Biodiversity Foundation of the Spanish Ministry of Agriculture, Food and Environment. Madrid, Spain. 90 pp. NIPO: 280-14-055-5	Paper
4488389181	Stępniewska M. 2014: Resources of the Polish official statistics for valuation of provisioning ecosystem services. Ekonomia i Środowisko 4(51): 102-110, available in English on-line: http://www.fe.org.pl/uploads/ngrey/!%20eis51.pdf	Paper
4539969268	Vidal-Abarca MR, Suarez-Alonso ML, Santos-Martín F, Martín-López B, Benayas J, Montes C. (2014) Understanding complex links between fluvial ecosystems and society: an ecosystem services approach. Ecological Complexity 20:1-10. (IF: 2.34) DOI: 10.1016/j.ecocom.2014.07.0	Paper
4542099850	Winkler, Klara J. & Kimberly A. Nicholas (2016): More than wine - cultural ecosystem services in vineyard landscapes in England and California. Ecological Economics 124, 86-98. authors link: http://authors.elsevier.com/a/1SciO3Hb~0AtMh doi: 10.1016/j.ecolecon.2016.01.013	Paper

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	Saastamoinen, O. (Undated) Observations on CICES-based classification of ecosystem services in Finland http://ageconsearch.umn.edu/bitstream/199244/2/Saastamoinen,%20O.pdf	Paper
	Vallés-Planells, M., Galiana, F., van Eetvelde, V., 2014. A classification of landscape services to support local landscape planning. Ecol. Soc. 19, 44. http://dx.doi.org/10.5751/ES- 06251-190144.	Paper