



OpenNESS Conceptual Nexus (ONEX)

**Final Guidelines for testing the conceptual frameworks in
case study areas using methods and data resources
developed in WPs 2, 3 and 4**

Deliverable D1.4

15 March 2017

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Prepared under contract from the European Commission

Contract n° 308428

Collaborative project, FP7 Environment

Project acronym: OpenNESS
Project full title: Operationalisation of natural capital and ecosystem services: from concepts to real-world applications
Start of the project: 01 December 2012
Duration: 54 months
Project coordinator: Finnish Environment Institute (SYKE)
Project website: <http://www.openness-project.eu>

Deliverable title: OpenNESS Conceptual Nexus (ONEX). Final Guidelines for testing the conceptual frameworks in case study areas using methods and data resources developed in WPs 2, 3 and 4
Deliverable n°: D1.4
Nature of the deliverable: Report
Dissemination level: Public

WP responsible: WP1 “Key Challenges and Conceptual Frameworks”
Lead beneficiary: Fabis Consulting (Fabis)
Citation: EU FP7 OpenNESS Project Deliverable 1.4, Haines-Young, R., Potschin, M.; Jax, K.; Görg, C.; Heink, U.; Kelemen, K. and C. Schleyer (2017): OpenNESS Conceptual Nexus (ONEX). Guidelines for testing the conceptual frameworks in case study areas using methods and data resources developed in WPs 2, 3 and 4. European Commission FP7. 83 pp plus internet application “The ONEX lab” available at: <https://trello.com/b/sm1IX0S0/the-onex-lab>

Due date of deliverable: Month n° 48

Actual submission date: Month n° 52

Deliverable status:

Version	Status	Date	Reviewed by	Author(s)
1.0	Final draft	13.03.2017	All co-authors	
2.0	Final	16.03.2017	Submitted to coordinator	
	Accepted	18.04.2017	Heli Saarikoski	

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Executive Summary

When the idea of ecosystem services is used operationally, it usually involves groups of people coming together to resolve an issue, or at least to identify strategies for doing so. This type of problem solving can be complex because:

- it will almost certainly involve people sharing and criticizing ideas;
- it involves making judgments on the basis of uncertain or incomplete evidence; and,
- the positions of those involved may change over time as they learn more about the problem at hand.

This report describes the development of the OpenNESS Conceptual Nexus, or ONEX, which has been designed as way of using social media to help people manage these difficulties.

Thus, ONEX is a ‘working environment’ intended for groups of people needing to collaborate on an ecosystem service issue at local scales. It provides users with access to a network of key ideas used by the ecosystem service community. With the leadership of a knowledge broker, experienced in the ecosystem service concept, ONEX helps people to see how these ideas are linked to each other and how by looking at and discussing their juxtaposition, groups can develop a richer picture of the issue that has brought them together. By helping people to navigate between concepts, they can build a collective understanding of the issues that have brought them together and therefore identify what methods and evidence might be appropriate for answering their questions.

The structure of ONEX has been based on the analysis of the way OpenNESS case studies have applied the ecosystem service concept, and how local perspectives can be broadened by considering the ideas that surround the four OpenNESS Challenges of human well-being, sustainable ecosystem management, governance and competitiveness. However, ONEX is fully customisable and other topics can be added as experience develops within the use community. It can be downloaded from the [ONEX Lab](#) and changed in ways that makes sense to particular applications.

ONEX has been designed to support deliberative processes and structured decision making. By creating a working environment that enables ideas to be explored, evaluated and developed, ONEX can be used to help people with different backgrounds and levels of expertise to work through a problem and to develop a richer understanding of issues. For ecosystem concepts to be used operationally they need to be understood and seen as relevant to society’s needs. ONEX provides one way in which this complex task can be addressed.

We shall not cease from exploration. And the end of all our exploring will be to arrive where we started and know the place for the first time. T. S. Eliot, Little Gidding

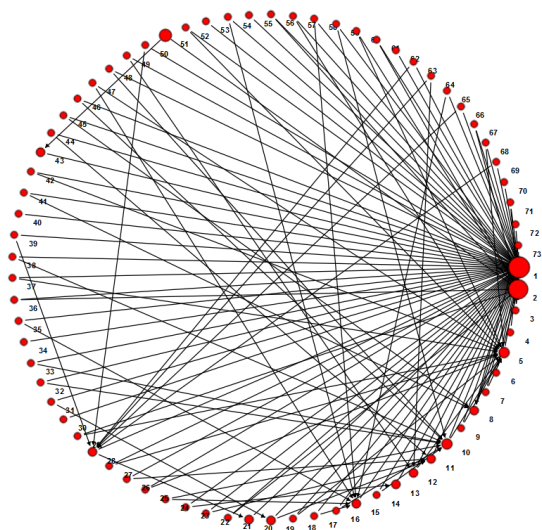
Part 1: Introduction – Scoping the Task

What are conceptual guidelines for?

The aim of these conceptual guidelines is to ‘map out’ the key concepts surrounding the idea of ecosystem services so that people can apply them more effectively to the resolution of issues that confront society. By ‘map out’, we mean showing how concepts in the field of ecosystem services are related to each other, and how by looking at (and discussing) their juxtaposition, groups can develop a richer picture of the issue that has brought them together. Problems involving ecosystem services are typically ‘wicked’ ones, and people’s understanding of what they may involve typically develops as they tackle them. We therefore intend the guidelines to be a way of helping people to navigate between concepts, and to build a collective view of a problem. The purpose of these guidelines is therefore to facilitate a social learning process, which we see as a process of refinement of ideas through trial and error, conjecture and revision.

In order to avoid the danger that these guidelines are seen or used in a *prescriptive* way, we prefer to see them as a rich but complex network of ideas or as a ‘conceptual nexus’, as we will call it; an overview of the idea of a nexus is given in Box 1. Given that this work has initially focussed on the concerns of OpenNESS, we have used the name OpenNESS Conceptual Nexus or ONEX to refer to the material that has been generated by WP1 (“Key challenges and conceptual frameworks”). However, we regard the task that we have tackled as a more general one in the field of ecosystem services, and our goal is to suggest ways that the experience gained in this work may be applied more broadly.

Box 1: What is ONEX?



ONEX seeks to help map out the network of ideas that constitute the field of ‘ecosystem services’ – this is what we describe as a ‘conceptual nexus’. The overarching idea is illustrated in the diagram to the left.

In ONEX the concepts are not treated in isolation, but captured in a set of more than 70 questions (these are represented by the circle of red dots). The questions are linked in terms of their logic and focus – this linkage is indicated by the lines. By considering the questions that make up ONEX, and how one leads to another, users can build up a rich picture of the problem that confronts them, and so identify what issues are relevant and need to be addressed first. The set of questions can also be an effective way of broadening the perspectives that users have on their particular issue, by helping them explore the wider context of their work.

The questions that make up ONEX, and how they were formulated and relate to each other, is the focus of this document.

Why is such a tool as ONEX necessary?

Given the operational focus of OpenNESS, the ambition for much of the work has been to provide tools and other kinds of support for people tackling real world problems, particular those at local scales. The case study or place-based focus has provided us with a great diversity of groups tackling different kinds of problems related to ecosystem services, often at very different stages in the 'project cycle'. While some of the OpenNESS case studies were, at the outset, already tackling reasonably well-defined questions, others were at the scoping stage. What unified them all, however, was the involvement of 'stakeholders' in the problem solving process, each with their different perspectives, different types of expertise, and potentially each with different goals and motivations. The transdisciplinary nature of most operational problems involving ecosystem services means that issues generally have to be addressed in an iterative way so that a shared understanding of the issues can be built up. Such a process will therefore often mean that interactions between stakeholders will take place over an extended period of time, and that positions may change as ideas are explored, applied and evaluated.

The assumption that many operational problems involving ecosystem services at local scales are to be addressed through a process of social learning has shaped the way we have approached the problem of developing conceptual guidelines in OpenNESS. Some of the work within the project has focussed on providing guidance on analytical methods and, in particular, valuation techniques (Gómez-Baggethun and Barton, 2013; EU FP7 OpenNESS Project Deliverable 3.3-4.4, Barton, D.N. and P.A. Harrison); while much valuable information has been provided, the challenge that such work faced was establishing the kinds of problem contexts in which methods and techniques are applied. The same issue arises on a larger scale in the development of OPPLA. This web-based platform is intended as a 'knowledge marketplace', where current information on ecosystem services, natural capital and nature-based solutions can be accessed and where networking and knowledge exchange between community members can be supported. While access to this rich body of 'state-of-the art' information will clearly help people develop their problem-solving strategies, such systems fundamentally require users to bring their problem to the system, rather than taking the system to their problem. ONEX is not a comprehensive knowledge base like OPPLA, although we do see it as containing information. Rather it is intended as a skeleton framework that groups can flesh out as they work together on an issue related to ecosystem services. Information from other sources, like OPPLA, can be linked to/via ONEX, and new location-specific evidence can be viewed side by side with this broader contextual information. Whereas systems like OPPLA are polished and 'ready to go', ONEX is a more open-ended, working environment that is created by the problem-solving process; the aim is to bridge the gap between *knowing* about concepts and *using* them operationally.

Managing the social learning process

Given that 'real-world' applications of the ecosystem service concept generally involve groups of people coming together to resolve an issue, or at least, to identify strategies, the structure and dynamics of this process must be considered. In creating ONEX we have made the assumption that the work of the group is facilitated by some kind of 'knowledge broker'¹. Reed et al. (2014) have

¹ Trusted individuals or organisations who connect and facilitate two-way dialogue between individuals of different knowledge groups (Reed et al., 2014); see also Pielke (2007).

emphasised the important role that knowledge brokers have in knowledge exchange within the field of environmental management. Their survey of experience from a number of catchment management projects in the UK found that a many interviewees felt that it was important to identify and involve people who could act as intermediaries in the knowledge-exchange process as early as possible. They also discovered that ‘effective knowledge brokers’ were typically well-known and trusted by many different groups with an interest in the project.

Reed et al. (2014) observed that if we see knowledge exchange as a social process then researchers have to do more than create and communicate new knowledge, and begin to act as knowledge brokers. Indeed, they argue that by assuming such a role researchers will be able to more effectively work with decision-makers to ‘co-produce’ new knowledge that better fits with policy needs. They conclude by suggesting a number of principles that should therefore shape knowledge exchange, and which ensures that it is designed into research from the outset, that needs of all stakeholders are systematically represented in the process, and that long-term relationships built on trust develop as a result of the dialogue between researchers and stakeholders.

Fezey et al. (2014) have also emphasised both the importance of knowledge exchange and the role of knowledge brokers in problem solving processes. However, they caution that effective knowledge exchange is not “just about the brokerage of knowledge” but also about the nature of the interaction between “different types of experts and, through this, the exchange of socially distributed, embodied, contextualized and skilful expertise” Fezey et al. (2013, p.27f.). Thus, while we emphasise that ONEX can be seen as a tool to facilitate such interaction, our work is also concerned with trying to understand the *process* of interaction itself. In setting out what they see as the research agenda for knowledge exchange in the environmental arena, Fezey et al. (2013) conclude that the changing relationship between science and society demands that researchers think more deeply about knowledge exchange. The contribution of this work package in OpenNESS must be seen in this light.

ONEX: Design principles

In addition to our assumption that ONEX is used in a group led by an individual or team that act as (a) knowledge broker(s), we have sought to provide access to our ‘conceptual nexus’ in ways that are recognised as supporting effective deliberative engagement. The importance of making deliberative processes effective goes beyond the field of ecosystem services and environmental management, and so in taking this work forward it has been useful to draw on the experience of other fields outside the traditional academic arena. For example, in business and public services ‘deliberative public engagement’ is seen as a process designed to involve people in decision-making by giving time to discuss and exchange ideas before coming to a considered view². In the UK, the National Consumer Council (NCC) has published nine design principles for creating such a process (Table 1), and although these seek to describe the deliberative process as a whole, the need to think about how ONEX might support each component has informed our decisions about how to implement the conceptual nexus idea.

² <http://www.publicagenda.org/media/beyond-business-as-usual-chart-p18>

Table 1: Principles of deliberative public engagement (after NCC, 2008)

Effective deliberative public engagement: Nine principles
The process makes a difference (in terms of outcomes or people's understanding of how decisions are made)
The process is transparent
The process has integrity
The process is tailored to circumstances
The process involves the right number and types of people
The process treats participants with respect
The process gives priority to participants' discussions
The process is reviewed and evaluated to improve practice
Participants are kept informed

Table 1 highlights, and other commentators (e.g. Bryson et al. 2013) have emphasised, any deliberative process must include review and evaluation if processes are to be improved and more effective learning is to be achieved. We will therefore use the principles in this Table as a way of assessing the strengths and weaknesses of ONEX in the final part of this document. For while ONEX is not presented as a complete answer to the needs of deliberative engagement it must, where appropriate, address those needs in effective and useful ways.

Part 2: Developing the OpenNESS Conceptual Nexus

Creating ONEX

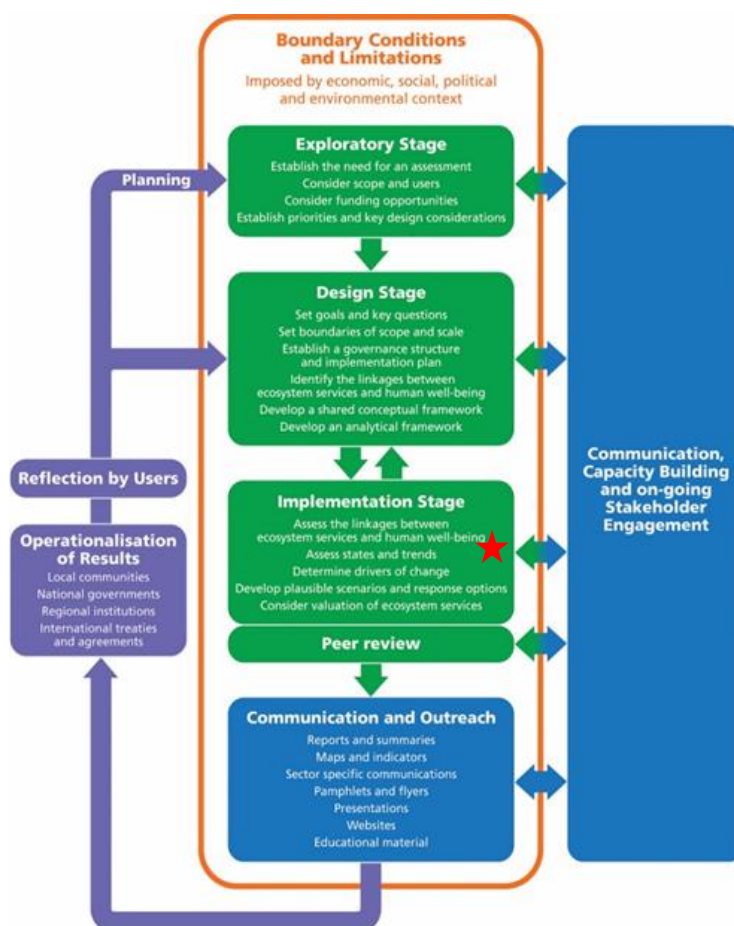
ONEX has emerged from the combination of the two lines of work that were undertaken in OpenNESS WP1. Both involved thinking through the problem of how key concepts in the field of ecosystem services can be made *operational*. The first looked at the role of conceptual frameworks, and especially their diagrammatic representation in the form of the cascade model. The second considered how key ecosystem service concepts sat within the broader policy contexts of securing human well-being, the sustainable management of ecosystems, promoting good governance, and competitiveness. The empirical work that was undertaken in relation to these two themes has been described in detail in EU FP7 OpenNESS Project Deliverable 1.2 (see Potschin et al. 2016). In this document, we review and highlight those findings that are relevant in the context of finalising the ‘conceptual guidelines’ required by the project brief, and therefore describe how those findings went on to shape the design of ONEX.

Conceptual frameworks and the Cascade Model

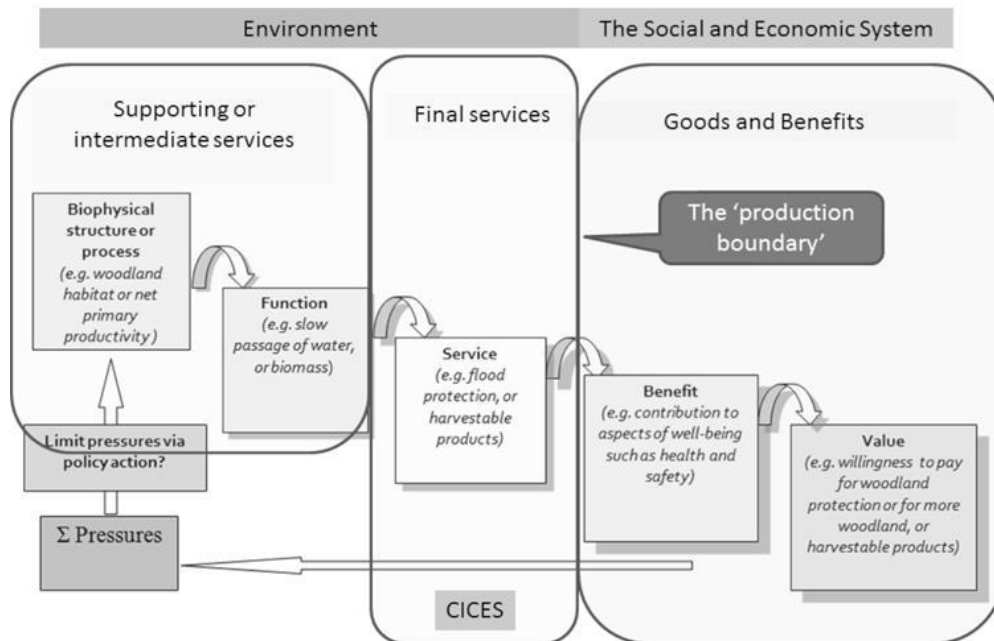
Conceptual frameworks have been identified as having a number of roles in the ‘ecosystem service paradigm’ (e.g. IPBES, 2014). These range from: devices that can be used to simplify complex ideas; things that can help prioritise a work programme; devices to facilitate communication across disciplines and between researchers and society; and, finally things that can serve as a common reference point to encourage buy-in from different stakeholder groups in a problem-solving process. Each of these roles can clearly be important in any study involving deliberative engagement, and indeed it has been suggested (e.g. Mace et al., 2011) that the development of a conceptual framework is an essential step in any ecosystem assessment.

Although we recognise that the co-creation of a conceptual framework is an important early stage in developing a common understanding in any group process, the danger is that each study develops its own perspective on the world, making comparisons between them more difficult. This was a particular issue in OpenNESS given the diverse range of case studies included in the project. If generalisations are to be made, or insights shared, then in designing the analysis some common framework was thought to be necessary or useful.

Figure 1: An overview of an [ecosystem] assessment process (After Ash et al., 2010). The location of developing a conceptual framework is indicated (red star).



Box 2: The Cascade Model (source: Potschin and Haines-Young, 2016)



The **cascade model** describes five key ideas that define the ecosystem services 'paradigm'. Ecosystems, and these are represented in the cascade model as the set of **ecological structures and processes** that we find in an area. Often we simply use some label for a habitat type, such as woodland or saltmarsh, as a catch-all to denote this box, but there is no reason why we cannot also refer to such things as 'the nitrogen cycle', with its various stores and transfers, as something that can also occupy the left-hand side of the diagram. In either case, given the complexity of most ecosystems, if we want to start to understand just how they benefit people, then it is useful to start to identify those properties and characteristics of the system that are potentially useful to people. This is where the idea of a **function** enters into the discussion. In terms of the cascade model, these are taken to be the 'subset' characteristics or behaviours that an ecosystem has that determines or 'underpins' its usefulness for people, or more formally is **capacity** to provide a service.

Ecosystem services obviously play a pivotal role in the cascade. They are quite distinct from the functional characteristics of the ecosystems that make them useful, and the benefits that people ultimately enjoy. A defining feature of them is that they are the **final** outputs from an ecosystem, in the sense that they are still connected to the structures and processes that gave rise to them but that they also contribute directly to some benefit or good that can be valued by people. A **benefit** is something that can change people's 'well-being', which is understood to cover such things as people's health and security, their social relations, or the kinds of choices that can make. Such benefits are important to people, and that importance is therefore expressed by the **values** they assign to them. Alongside monetary values, people can express the importance they attach to benefits using moral, aesthetic or spiritual criteria. The cascade model suggests that the way people value ecosystems shapes their responses to the pressures that drive change at the ecosystem level.

The model also shows where the **Common International Classification of Ecosystem Services (CICES)** sits in relating to these five major concepts. CICES is a way of standardising how we describe and measure ecosystem services.

Thus, for OpenNESS it was decided that we would use the cascade model (Potschin and Haines-Young, 2016) as a 'jumping off point' for the conceptual work in the project. The goal was to examine critically the extent to which the cascade could capture thinking across the range of place-based case studies included in the Project, and whether it was sufficiently flexible to allow case studies to adapt it to represent their own needs and interests.

The conceptual framing of the 'ecosystem service paradigm' that is provided by the cascade model is summarised in Box 2, and discussed in greater detail in Potschin and Haines-Young (2016). In the first phase of OpenNESS, case studies were asked in a workshop in 2013 to consider the issues that they were addressing through the Project, and to critically examine the extent to which their thinking could be captured by the conceptual framework represented by the cascade. Following this meeting, the experience of seven of the 27 case studies was tracked during the project and they were interviewed again in 2016 to find out how their ideas had changed and the relevance of the cascade to their work.

As EU FP7 OpenNESS Project Deliverable 1.2 (Potschin et al. 2016) and Potschin-Young et al. (2017) report, there was evidence from the OpenNESS case studies that the cascade could be used as a way of structuring discussions within groups of stakeholders. This conclusion has been underpinned by Dick et al. (2016), who provide a detailed and independent analysis of the reactions to the cascade by a range of different people concerned with land-use planning on Glenlivet Estate Scotland ([Case Study# 16](#)). The meeting was organised in conjunction with the Tomintoul and Glenlivet Landscape Partnership, which aims to promote rural regeneration across the estate. In the facilitated workshop, participants were asked whether from their perspective the cascade framework was useful, and what its advantages and disadvantages were. Dick et al. (2016) present the findings around three themes, relating to the use of the cascade as a tool for communication, understanding and coordinating action (Table 2).

The cascade was found (Table 2) to be useful in structuring discussions and for finding a way of representing collective views to the wider community, but it was noted that the ability to add terminology that is relevant locally would also improve its use. In terms of understanding, Dick et al. (2016) report that participants found it helpful in developing an integrated understanding of issues by simplifying what initially seemed a complex situation, and therefore a useful tool for 'working out where things fit in'. The disadvantages identified in relation to the understanding theme were that the cascade seemed to imply things were 'linear', which tends to over-simplify issues. In relation to coordinating action, it was found that it was a useful framework for identifying where actions might be taken within the system and what the priorities were, both of which could aid transparency. However, the lack of explicit reference to beneficiaries, the different values that they might have and the trade-offs that often exist in the real world was seen to be a shortcoming of the model.

We have focussed initially on the findings of Dick et al. (2016) because they provide a useful triangulation with the result of our earlier analysis with the wider OpenNESS community; it is also a useful source of evidence in that it is based on interactions with stakeholders, rather than researchers directly involved in the OpenNESS Project. In addition to finding in our work with case studies that the cascade despite its simplicity was a useful tool for simplifying and structuring discussions, some guidance was probably helpful at the outset when groups tried to engage with it. The 2013 workshop in OpenNESS and the meeting reported by Dick et al. (2016) were facilitated, and so some of the problems of basic understanding of concepts were easily overcome. If the cascade were to be more generally used then unless a knowledge broker could play this facilitation role, then the work would probably need to be supported by explanatory guidance of some kind.

Table 2: Strengths and suggested improvements for the usefulness of the cascade model (after Dick et al., 2016)

Themes	Strengths	Suggested Improvements
Communicating	<ul style="list-style-type: none"> • Structuring discussions • Transparency of decision making 	<ul style="list-style-type: none"> • Local nomenclature to link with local context better
Understanding	<ul style="list-style-type: none"> • Links between different parts of the system • Simplifying complexity 	<ul style="list-style-type: none"> • Less linear representation with different starting points possible
Coordinating	<ul style="list-style-type: none"> • Identifying actions to progress • Identifying collective objectives • Transparency of decision making 	<ul style="list-style-type: none"> • Identify beneficiaries to: link values with different groups of people • more explicitly signpost possible trade offs • better link with funders goals

We also found that the cascade provided something of a common framework within which a diverse range of studies could be represented. It therefore could be used as a way of looking at the similarities and differences in the way issues are approached in a variety of place-based studies – such transparency is an essential task if the experience of locally-focussed studies is to be generalised and shared. A particularly interesting finding in the follow-up work done on the application of the cascade was the ways in which some case studies went on to simplify or expand the basic framework, while others represented the basic concepts using terminology more familiar to planners, say. The possibility of customising the cascade to reflect local issues was also identified in the Glenlivet study as a possible line of development. We found that the cascade was sufficiently flexible to allow users to adapt it to their needs while retaining its underlying conceptual structure.

The case study workshop in OpenNESS suggested that in relation to conceptual frameworks like the cascade, the **process** of constructing them had an important ‘awareness-raising’ role, a finding that was also suggested in the work of Dick et al. (2016). However, from the material generated, we observed that while the co-construction of a conceptual framework may have enabled those concerned to achieve a common understanding of their problem situation, the **outcomes** in terms of the lessons learned during this collaborative process are often more difficult to convey to others using a simple graphical representation. As users modified the cascade to reflect their own concerns the diagrammatic elaborations could rapidly become more complex. Thus, while the different schemas were rich, relevant and useful in the context of specific applications, the general features of ecosystem-service thinking could be hidden by the details. As a result that it was probably necessary to find ways to make the process of constructing and developing a conceptual framework, like the cascade, more easily communicated to others. We will return to the ways in which this need has shaped the development of ONEX following our review of the second thematic approach to conceptualisation that we have explored in WP1.

Framing problems: The OpenNESS Challenges

Although the cascade was an important focus of the conceptual work in OpenNESS, it was recognised from the outset that the Project needed to examine the relevance of the ecosystem-service thinking to wider societal problems. Four broad areas of concern, known as the ‘OpenNESS Challenges’ were identified as a focus for the work. These were the contribution that nature makes to human well-being, the added value of ecosystem-services thinking to current approaches to the sustainable management of natural resources, the operation of regulatory frameworks and governance systems in environmental management, and the contribution that ecosystem-service thinking could make to questions about the competitiveness of different places relative to each other. The challenges and the links between them are summarised in Table 3.

Human well-being is widely regarded as a central component of the ecosystem service paradigm, and it has been argued that decisions about what it represents and how it is to be assessed are of major importance in such work (Polishchuk and Rauschmayer, 2012; Summers et al., 2012). In OpenNESS, it is viewed as a state that is also intrinsically, and not just instrumentally, valuable (or good) for a person or a societal group (after Alexandrova, 2012; see Jax and Heink, 2016). This definition was thought to be sufficiently pluralistic to accommodate the different perspectives of the OpenNESS case studies. The definition also suggests that we need to go beyond economic wealth, to include such things as health and good social relations. When looked at in this way, key questions that emerge for OpenNESS were therefore to understand how different ecosystem services relate to different components of well-being, and what trade-offs might be involved at individual and group levels.

Understanding how changes in the output of ecosystem services impact on well-being are closely related to the challenge of sustainable ecosystem management, which clearly entails issues of what is being sustained and why, as well as how human well-being and sustainability can be achieved by managing ecosystem services. In the context of OpenNESS it was decided that a key focus would be the relationships between biodiversity and ecosystem services, and how through management of natural capital, biodiversity might be conserved or restored. While on the one hand this connects to human well-being issues, this challenge raises the question how the sustainable ecosystem management can be supported by governance processes and institutions. Thus, we defined governance as a third conceptual challenge.

In OpenNESS, the analysis of governance covers a wide-ranging set of issues. In addition to exploring the operation and effectiveness of different policies and regulatory frameworks at the national and EU-level. It also involves the analysis in different place-based contexts, of who is affected by ecosystem change, who makes decisions and which power relations are involved, whether different actors or groups make their voices heard, and how account is rendered. Such analyses are complex because they can involve actors and organisations operating at different spatial and temporal scales, with different motives and responsibilities. Although the effectiveness of governance mechanisms and institutions will have implications for human well-being and the goals of sustainable ecosystem management, it can also affect the standing or status of a region or country relative to others. This comparative aspect is covered by the final OpenNESS challenge, namely that of competitiveness.

Table 3: An overview of the links between the four OpenNESS Challenges

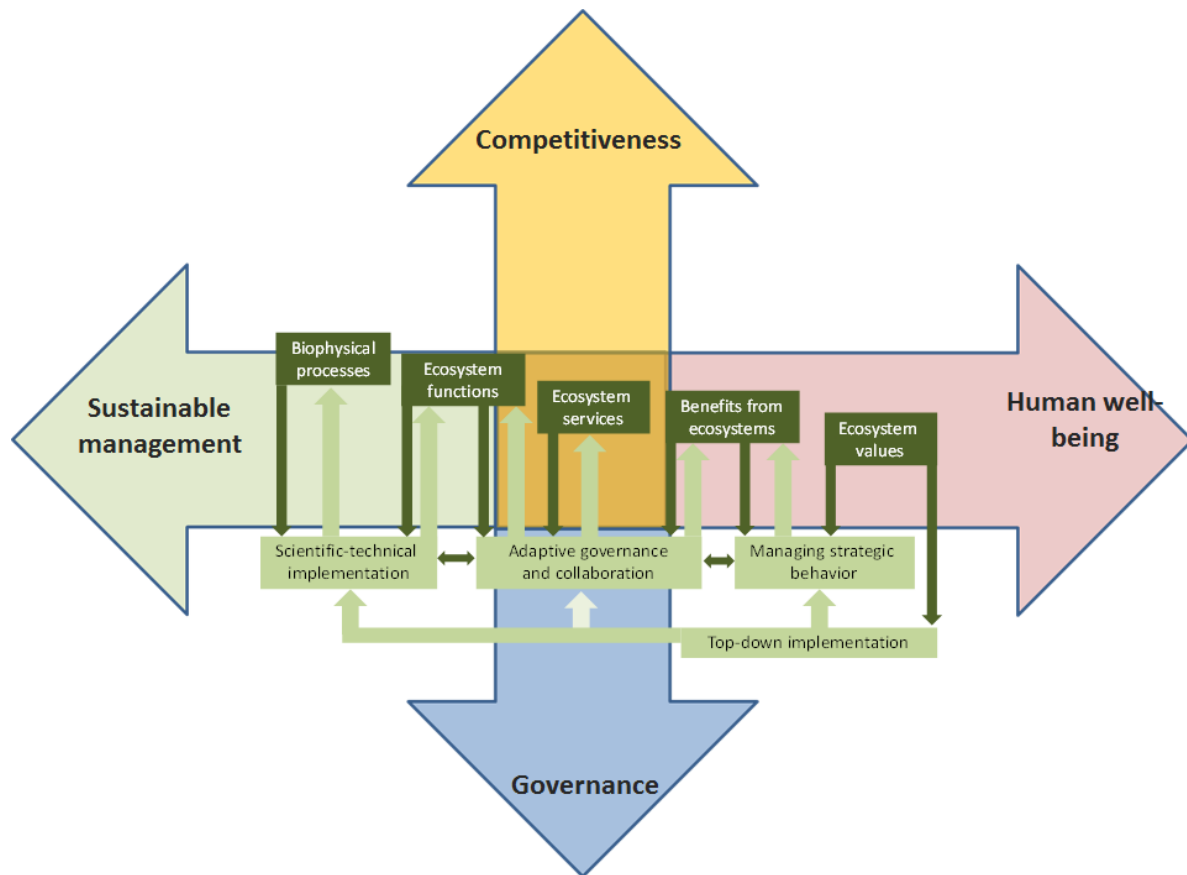
	Human Well-Being	Sustainable Ecosystem Management	Governance	Competitiveness
Human Well-being		Sustainable ecosystem management must be in accordance with the aim of fostering human well-being.	Good governance must reflect the aim of enhancing human well-being and harmonising the different interests involved.	Competitiveness affects human well-being in different ways. The role of competitiveness for human well-being needs to be explored.
Sustainable Ecosystem Management	Sustainable ecosystem management is necessary to preserve the long term ability of ecosystems to deliver the services that underpin human well-being. This may involve trade-offs between short term wellbeing and long term sustainability. It will also involve trade-offs between different ES, which in turn depends (partly) on the benefits of each service for well-being, including the cultural value of managing an area for particular species. We should be aware of the need to use a range of approaches for ES valuation, and avoiding over-reliance on monetary values, and we need to explore ways of maximising synergies and minimising trade-offs.		Effective governance is critical for the negotiation and management process, and requires co-ordination between stakeholders and administrative agencies. Key governance needs include: inclusion of all stakeholders in the negotiation process; regular monitoring and review of goals to enable adaptive management; enforcement of protected areas; regulation to protect ecosystems from pollution, development and over-exploitation; managing offsets (if appropriate); incentives for sustainable use (e.g. PES, organic farming, eco-tourism).	Choice of ecosystem management techniques (e.g. restoration, enforcement of protected areas): how much will they cost? What is the value of ES benefits and the wider social and economic impacts, for example, for long-term sustainability of agricultural production (soil erosion and fertility, water availability, genetic resources, pollination, pest regulation), employment, social cohesion, health and well-being (reduced health care costs, impacts on productivity of work force), education, innovation?
Governance	How is human well-being perceived and addressed, and balanced with other aims (e.g. biodiversity protection)?	Depends on inclusive and effective governance processes: what does that mean in practise?	How are normative considerations linked to the design and analysis of governance processes?	Represent a specific policy goal which must be balanced with other goals through appropriate processes.
Competitiveness	Social competitiveness links with equity, justice, health, livelihoods. Environmental competitiveness links with access to / sharing benefits from ecosystem services and natural capital for example through biodiversity conservation. Economic competitiveness links with livelihood security, potentially also linked with quality of life, where business acts to secure wider societal benefits. Trade-offs with aspects of human well-being may occur	Management can enhance flow of or access to important ecosystem services for various beneficiaries: the challenge is to ensure that management promotes equity, reduces trade-offs, and enhances resilience. Competitiveness connects also to ecological footprinting, particularly in terms of reliance on external resources.	Governance structures to address links between ecosystem services and natural capital and the other dimensions of competitiveness as a way to develop in the sustainable development strategy	

The notion of competitiveness is often equated with economic performance. However, it is now widely acknowledged that investment in natural capital can benefit a place or a region both socially and economically (Ambec et al., 2013; Haines-Young et al., 2016). This view was promoted under the Lisbon Treaty, but it remains unclear yet whether environmental quality is regarded as a means for achieving economic competitiveness or whether it represents a goal in itself. The Lisbon Treaty set out the goal for Europe of a highly competitive social market economy founded on social progress and “a high level of protection and improvement of the quality of the environment” (EU, 2007); investment in Europe’s natural capital is now one of the seven flagship initiatives under the Europe 2020 Strategy (EC, 2011). Most recently, the EU Framework Programme for Research and Innovation ‘Horizon 2020’ has linked sustainability and competitiveness across its societal challenges as a means of promoting raw materials security, improving well-being, and enhancing resilience to future social and economic shocks (EC, 2014). In OpenNESS, the theme of competitiveness was therefore seen as a way of exploring how the ecosystem service concept can be applied beyond the ‘environmental agenda’, taken into account that competitiveness as a means to achieve sustainability does not always work and that it is an empirical question whether enhanced competitiveness leads to more sustainability or not.

The four challenges of human well-being, sustainable ecosystem management, governance and competitiveness were identified as being of concern at EU level in the call for FP7 funding in 2011, to which the OpenNESS consortium responded. Each of them is important in their own right as a focus of research. However, in the context of the conceptual work in OpenNESS they also allowed us to investigate how concepts could be linked and applied in ways that were relevant operationally. While the diversity of the OpenNESS case studies is a strength, because the case studies each had their own concerns it was recognised early on that generalisation across that spectrum of experience might be difficult. The four challenges allowed us to examine if and how these broad societal issues were embedded in their work, and whether the themes either singly or collectively represented useful discussion ‘entry-points’ when people in the case studies worked together to conceptualise their work. An initial line of enquiry was to examine how each of the four challenges could be represented in the context of the cascade model. Alongside the work in OpenNESS, several papers published early on in the Project cycle had illustrated how this could be done. A review of this work suggested an initial working hypothesis that, in terms of linking the cascade to the four challenges, they might be thought of as ‘outputs’ or ‘performance characteristics’ of the socio-ecological system represented by the model. In terms of developing guidance, the conceptual elements of the cascade might be used to trace the implications of a given situation (represented by a case study, for example) for specific aspects of human well-being, sustainable management, governance, and competitiveness.

Primmer et al. (2015) have suggested how the cascade can be viewed in the context of their work on governance and ecosystem services. They argued that little, if any empirical attention is paid to ways in which the actual decisions are made or ecosystem services are governed, and suggested how different types of interventions or governance processes can be considered by associating them with the various elements of the cascade (Figure 2). They emphasise, for example, the need to understanding the bi-directional nature of the links describing the relationships between ecological structures and governance processes. Furthermore, they illustrate how by focussing on one Challenge (initially governance) people can quickly be led on to consider issues related to the other Challenges. For example, issues of ‘strategic behaviour’ can be looked at from the perspective of

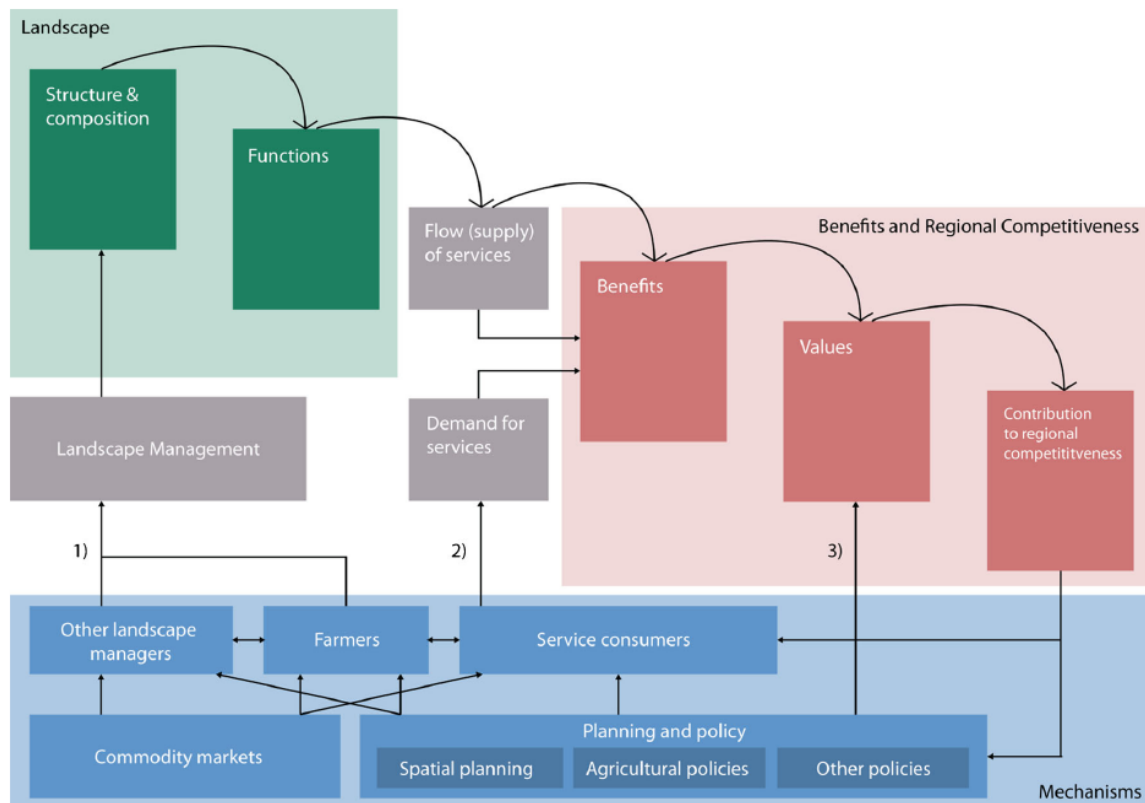
Figure 2: Governance issues incorporated into the modified conceptual framework (modified from Primmer et al., 2015)



questions about human well-being and inclusiveness. Similarly, the scientific and technical implementation of specific governance strategies can be considered from the stand-point of achieving the sustainable management of natural capital stocks (i.e. biophysical structures and associated processes) and ecosystem service flows (via functions, etc.). Finally, they emphasise the need to consider cross-scale processes and how they are related to different levels of decision making, and the trade-offs and synergies between ecosystem services.

A further example of the cascade being used to explore issues embedded in the four challenges comes from the work of Van Zanten et al. (2014), in their work in Winterswijk, The Netherlands. In this study, the cascade was used to represent the relations between landscape structure and composition and its contributions to regional competitiveness, which is seen as being dependent on the values realised from the benefits arising from ecosystem services (Figure 3). However, the relationships are not simply linear ones. Instead, these authors argued that they arise from a complex set of connections between the actors and policies that impact on agricultural landscapes; in this sense, 'competitiveness' is seen as one of the outputs from the system represented by the cascade. Thus, farmers and other land managers are seen as affecting landscape structure and composition through landscape management; consumers of different ecosystem services can also generate a demand for services and, therefore, create benefits; and, ecosystem service benefits themselves can be influenced by policy and planning through such mechanisms as payments for ecosystem services schemes.

Figure 3: Analytical framework addressing the relationship between agricultural landscape structure and composition, the supply and demand of ecosystem services, and the contribution of these services to regional competitiveness (after Van Zanten et al., 2014).



Van Zanten et al. (2014) argue that the policy and planning measures have an impact by ‘valorising’ ecosystem services, and that this can shape the actions of land managers through ‘regulatory’, ‘economic’, and ‘information’ instruments. For example, they suggest agri-environmental measures that are part of the EU Common Agricultural Policy as a type of a voluntary economic instrument, which has been taken up, for example, by dairy farmers through compensation schemes for the maintenance of landscape elements that are considered valuable. Such measures contribute to maintaining the landscape character of the area, which attracts many walkers and cyclists; tourism benefits the regional economy in various ways, not least by stimulating ‘recreation-orientated diversification’ by farmers and investment in agricultural areas by ‘hobby farmers’ from neighbouring urban areas. These authors find that the combined contribution of tourism, recreation, and retail to the local economy far exceed that of agriculture in terms of value added.

The examples of Primmer et al. (2015) and Van Zanten et al. (2014), coupled with our review of the way the OpenNESS case studies viewed the four challenges (Potschin et al., 2016) suggest that while diagrammatic representations can contribute to the conceptual debate around ecosystem services, it does not follow that ‘unpacking’ the cascade necessarily involves further graphical elaborating of the model. Rather, the message taken from such work is that we need to find ways of helping people read, understand and represent the basic relationships contained in the ecosystem service paradigm in richer and more insightful ways. Thus, in looking for ways in which the conceptual work in WP1 could proceed towards ‘operationalisation’, we did not seek to develop a comprehensive template

on to which any case study or problem situation involving ecosystem services can be represented. Rather, we decided to explore ways of developing heuristics that people could employ when formulating or framing problems and problem-solving strategies.

Our initial work built on our review of the four OpenNESS challenges, from which we identified a series of generic questions that practitioners might pose when considering each of them in the context of a place-based case study (Table 4). We discussed these questions with the OpenNESS case studies at a workshop in 2013. Participants were given a briefing on the background to the challenges, and asked to record if, or how, the issues they were dealing with related to them. To do this they were presented the set of generic questions for review. They could either indicate that the question was relevant to their work as it stood, or provide their 'own version' of the question.

Table 4: Priority assigned to generic research questions by case studies

Question	Question Text	Priority						Total
		H	MH	M	LM	L	UN	
Q1.1	What are the relations between specific ecosystem services (types) and specific components/types of human well-being (positive or negative)?	12	1	4		2	1	20
Q1.2	What are the trade-offs in terms of well-being-effects of different ecosystem services between the stakeholders (i.e. is there a gain of some aspect of well-being for some stakeholders at the expense of other stakeholders and/or other components of well-being brought by ES); what are the appropriate scales (local, EU, global)?	12		4		1	1	18
Q1.x	New overarching question	2		3				5
Q2.1	How does biodiversity contribute to ES provision, and vice versa?	8	1	3		1		13
Q2.2	What are the trade-offs and synergies between biodiversity conservation and ES provision?	10		4	1	1	1	17
Q2.3	How can ecosystems be managed sustainably to support biodiversity and ES provision?	9		6			1	16
Q2.4	How do value assumptions influence biodiversity and ES evaluations (trade-offs)?	1		3		1		5
Q2.5	Can ecosystem management for biodiversity conservation support the adaptive potential (resilience) of ES provision to long-term environmental change?	3		2		1	2	8
Q2.x	New overarching question	3		3		1		7
Q3.1	What do people mean by effectiveness? Coherence of policies?	2		2		1	1	6
Q3.2	What are the determinants for policy effectiveness?	2		3		1	1	7
Q3.3	How does the ES concept affect the determinants of effectiveness?	2		2		1		5
Q3.4	How does socio-economic valuation have an impact on policy and action? And modelling impact on policy and action?	2		3		1	1	7
Q3.5	What is the appropriate method for socio-economic valuation of ES?	2		4		1	2	9
Q3.x	New overarching question	7		1	1		2	11
Q4.1	How do people conceptualise the notion of competitiveness, and can ES/NC concepts transform our understanding of it?			1		3	1	5
Q4.2	How does notions of competitiveness relate to aspects of human well-being and quality of life at different scales?			2		1	3	6
Q4.3	Who is competing with whom over what and why? And what is the relationship between concepts of competitiveness and those of cooperation, collaboration and resilience?	4		4			1	9
Q4.4	How do we measure change in competitiveness? What indicators could be used to compare different areas?	1		1		1	1	4
Q4.5	Where can the EU, as a collection of states, invest in ES to reduce costs and risks, and promote market stability?			2		1		3
Q4.6	What kind of governance structure would be needed to sustain ecological and cultural diversity and hence build competitiveness and resilience?	1		2		2		5
Q4.x	New overarching question	5				1	2	8

Key: Question sets numbered 1, 2, 3 and 4 refer to human well-being, sustainable ecosystem management, governance and competitiveness, respectively. For priority assigned by case studies to questions, H, M, L = High, Medium and Low, with UN = unspecified.

Table 5: Case study specific questions linked to the four challenges stimulated by the workshop

QUES#	Challenge	Quesiton text
1	HWB	What are the attitudes of local stakeholder groups towards the main ES in relaiton to human well-being?
2	HWB	Who's well-being is targeted in the management of ES? E.g. How does the mode of management affect the scale at which ES benefits occur?
3	HWB	What is the relationship between selected NC stocks in the case study area and their associated ES and the livelihoods of local SH? We are particularly interested in the value of ES to the local economy (e.g. as main basis of income for local populations, complementary sources of food and income) and to social fabric (e.g. social interaction, collaboration, leisure...).
4	HWB	How the trade offs in terms of well being of different stakeholders affect the well being of the forest ecosystem?
5	HWB	What are the health effects of loss of green infrastructure in Oslo? This type of study has yet to be carried out in Oslo.
6	SEM	How does GI contribute to EU BD goals? (this can be viewed as an ES)? What is the role in and contribution of GI-ES to local biodiversity and sustainability?
7	SEM	How can the flood of Stevoort be organized so that desired, multiple ES can be provided in a sustainable way?
8	SEM	Which forest species provide key ES? (fuel wood, medical plants, recreation/tourism = top 3 ES?) (also linked to Q1.1)
9	SEM	What are the benefits/troubles related to losses of local ES (e.g. PNN of grasslands, carbon storage) related to different management alternatives? The last decade showed here a decline in the PPN of all the terrestrial ecosystems (-15%), so, the ES provision were significantly affected.
10	SEM	Considering different green areas as a source of multifunctional green infrastructure. How ES provided by green areas relate? What are the synergies and trade-offs among them? What is the appropriate management system?
11	SEM	How to define precisely areas for planning ES in particular for forest management? Is there spatial coherence between different ES and spatial patterns? (intensification – heterogeneity)
12	SEM	Which are the forest adaptive management measures for mediating the conflict between BD conservation and timber production
13	GOV	Which role do informal institutions have, such as irrigation communities, in the sustainable management of water-related services?
14	GOV	What is the effective planning process of GI? How to use GI is it to best advantage?
15	GOV	Is institutional diversity important for the resilience of social-ecological systems? How to preserve or restore non formal institutions for ES management?
16	GOV	How can NC and ES concepts be used to design improved rules and governance mechanisms for access and use of resources with the participation of interested SH? We want to study policy instruments that can be used to regulate access and use of resources and develop proposals in a participatory process engaging the main stakeholder groups in the area.
17	GOV	What does experience in CS 11 and 22 tell us about effective governance arrangements for offsetting and to what extent might these be applicable to other EU MS?
18	GOV	How the concept of ES can be integrated in the public and community governance system to develop methods of non destructive harvesting of forest resources?
19	GOV	Which method of valuation (monetary or non-monetary) is most effective in influencing policies for sustainable mgt of forests?
20	GOV	How much compensation do the ranch owners or sawmills want to rescue to increase the usable retention (conservation)?
21	GOV	In Brazil the ways to access the monetary compensation are difficult and bureaucratic. Some different interests are in conflict here. Maybe a mechanism could be, for example, some taxes that they could be exempted, or access easier for financial programs that help the farmers, etc. But, how to ensure these mechanisms?
22	GOV	How are the EU policies RED and CAP implemented on a regional level?
23	GOV	Who has the responsibility to govern the infection problem? Who is responsible for keeping the water clear of infection?
24	COMP	How can planning with GI-ES increase the competitiveness of rural regions? How can it help to realise a more sustainable future?
25	COMP	What are the benefits to the Loch Leven Fishery of improving the water/habitat quality of Loch Leven?
26	COMP	How can we improve the well-being of local populations and competitiveness of the region while preserving NC stocks and ES provision?
28	COMP	What are the overall costs or benefits to business (as a whole) from BD offsetting? How does this affect GDP? 2. What are the costs and benefits/savings for developers arising from BS offsetting? What are the overall costs and benefits (economic - social - env) of BD offsetting and how does this impact on sustainable growth?
29	COMP	Which is more effective in sustainable mgt of forest ecosystems? (Community vs. government protected)
30	COMP	The competitiveness change in different scenarios management over time? E.g. further management type, grassland management, beaver control, silvi-pastoral management)
31	COMP	How does the implementation of ES approach towards the preservation and valorisation of rural and natural hinterland could become a component of competitiveness?

Key: HWB = Human Well-being, SEM = Sustainable Ecosystem Management; GOV = Governance; COMP = Competitiveness

The results of the workshop session on the generic research questions have been discussed in detail by Potschin et al. (2016). The summary in Table 4 groups them by challenge and indicates which were considered by the case studies as most pertinent to their work. In terms of relevance, all the questions, and hence aspects of the challenges that prompted them, were of concern to one or more case studies. In terms of overall interest, the case studies ranked questions relating to human well-being (Q1.1, Q1.2) as being especially important for them, followed by those relating to the potential trade-offs between conservation of biodiversity and ecosystem services, issues of sustainable management and the underpinning role of biodiversity in the supply of services (Q2.3, Q2.2 and Q2.1). Although there are, of course, many ways to explore case study concerns, the first point that we took from the results was that the four challenges were helpful, general 'starting points' around which to have a discussion.

The second point that we took from the analysis was that while a number of the case studies found that the generic questions in their original form captured many of their concerns across the four challenges, the exercise stimulated the generation of new questions that more directly related to their interests in each of the four areas. These additional questions are listed in Table 5. Discussion of the governance challenge stimulated the identification of the most new issues, followed by competitiveness. Particular issues identified included trade-offs within human well-being, and the need to understand attitudes of stakeholders (Q4 & Q1). The impact of ecosystem change on benefits was also identified under sustainable ecosystem management as being of interest (Q9), a question that also implicitly entailed consideration of trade-offs; trade-offs were also explicitly mentioned under this challenge in Q10. Themes identified under governance included questions related to effectiveness of institutions (Q17) and the integration of governance structures (Q18), together with questions about how EU policies are implemented on the ground (Q22). Finally, the links between competitiveness and well-being were highlighted by consideration of the final challenge (Q26), together with how the status of a region might change over time in relation to different scenarios (Q30), how valuation and competitiveness are linked (Q31), and how investment in green infrastructure can increase competitiveness (Q24).

The overall conclusion that we drew from the analysis of the research questions linked to the four challenges, was that the challenges themselves were sufficiently general to be useful entry-points for discussing ecosystem service issues in a range of different situations. Moreover, although they may not exhaust the range of topics that could be considered, they seemed appropriate for looking at how we might develop heuristics that people could employ when seeking to frame their operational questions. Given the need to go beyond simple graphical devices that was suggested by our work on the cascade, we found that the question format adopted as a way of exploring the four challenges seemed a promising way forward. The questions seemed to stimulate ways of reflecting on the specific concerns of each case study and how their perspectives might be broadened. They also appeared to be useful in stimulating people to the cascade in different ways, thus helping them to build up a richer picture of the issues that confront them. These findings provided the background to the final phase of our work relating to the design and testing of the OpenNESS Conceptual Nexus, ONEX.

Part 3: Constructing ONEX and making it operational

Our work on ONEX has involved two components. First, the conceptual nexus itself, which is essentially a set of linked questions designed to help people scrutinise and reflect on issues involving ecosystem services. The second concerns how to make this material available to people so that it can be used as simply and flexibly as possible. In the discussion that follows we will refer to these two parts of our work as ‘content issues’ and ‘platform issues’. In the next two parts of this report we describe how ONEX was populated with questions and how these were then refined by preliminary testing with a case study partner. We then conclude this section on constructing ONEX by looking at a number of implementation or ‘platform issues’.

Populating ONEX

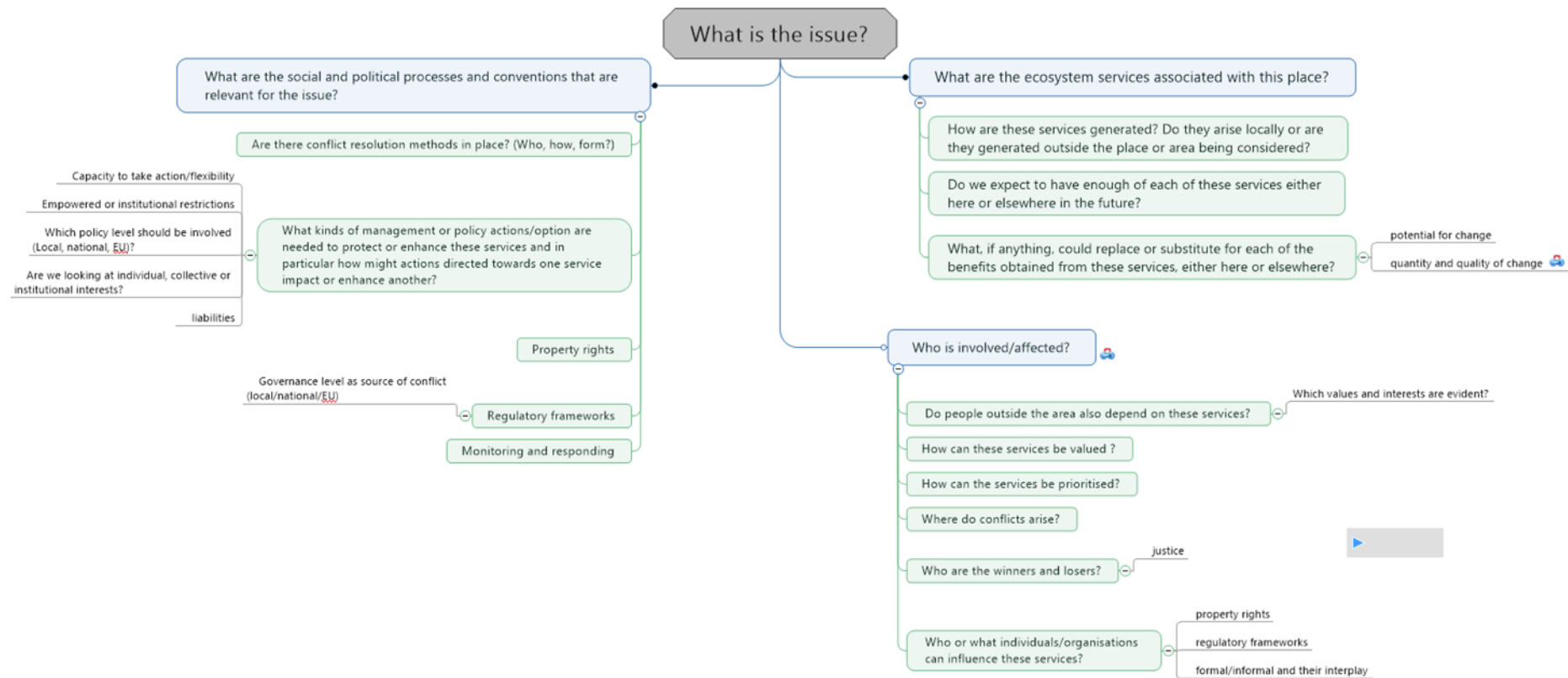
The set of questions that comprise the conceptual nexus was created in an iterative way. The WP1 team came together in May 2015, and in a three day workshop reviewed potential approaches and began to develop prototype versions of the guidelines that eventually became ONEX. In order to ensure that decisions were grounded in terms of operational issues, the team worked with an OpenNESS partner from the Kiskunság case study in Hungary, which is dealing with issues of water management in a region experiencing increasing shortages ([Case Study #12](#)).

The form of the workshop initially took the form of a semi-structured interview of the case study partner, with members of the WP1 team exploring with them issues around the four OpenNESS challenges. The aim of the dialogue was to examine how relevant issues linked to the challenges were to the case study and to discover whether by thinking about them any new insights could be generated about the case study issues. The preparation of the semi-structured interview and the debrief that followed allowed team members to distil a set of general questions that might be used with others.

Table 6: Framework and rationale for developing a place-based assessment of ecosystem services (after Potschin and Haines-Young, 2013)

Question		Rationale
1.	What are the ecosystem services associated with this place that matter to people’s well-being?	Helps in setting the conceptual and spatial boundaries to the assessment; defines the place of concern.
2.	How are these services generated? Do they arise locally or are they generated outside the place or area being considered?	Identification of dependencies and cross-scale issues in relation to the supply of services; helps explore the links between the place of interest and other places.
3.	How important is each of these services, to which individuals or groups, and for what reasons? Do people outside the area also depend on these services?	Helps to identify who has a stake in the deliberations about the place and their needs, and develops understanding of the spatial relationships between one place and other places.
4.	How can the importance of these services be prioritised or valued?	Opens up discussions about how values should be assessed and compared (e.g. using individual vs community values; monetary vs non-monetary).
5.	Do we expect to have enough of each of these services either here or elsewhere in the future?	Highlights the issues surrounding the notion of living with environmental limits and questions about sustainability of natural capital.
6.	What, if anything, could replace or substitute for each of the benefits obtained from these services, either here or elsewhere?	Links to question 4, and further explores the nature of criticality, compensation and substitutability of benefits.
7.	What kinds of management or policy actions are needed to protect or enhance these services and in particular how might actions directed towards one service impact or enhance another?	Helps in understanding the acceptability of management or policy interventions to different stakeholder groups and the identification of potential trade-offs and conflicts and how they might be resolved.

Figure 4: Mind-map describing the key conceptual themes considered to be relevant to a place-based study



An initial suggestion for generating a set of relevant questions was the template for making a ‘place-based ecosystem assessment’ made by Potschin and Haines-Young (2013). Following the discussion that followed it was agreed that while this template captured some important information about ecosystem services, and the values and concerns that stakeholders in an area held about them, the explicit focus on ecosystem services may not be sufficient to capture all of the concerns that local people might have. For example, it was argued that it cannot be assumed that the need to assess or manage ecosystem services would be the main idea that stimulated engagement between actors at the local level. Rather, the task might be to make stakeholders aware about the possibility of using ecosystem services as the basis of a ‘nature-based solution’ to some social or economic problem, and of increasing their capacity to realise that potential. It was also argued that as they stood the questions did not explicitly draw out information on the different interests that might need to be considered in the context of a local study, nor the social and political processes and conventions that shape the behaviour of the actors and potentially constrain action. A mind-mapping exercise was therefore undertaken to capture these different ideas and themes, and to structure them systematically in relation to the four challenges.

The mind-map generated by the workshop is shown in Figure 4. The consensus was that the ‘stem’ of the mind map should be the overarching question: ‘What is the issue? It was then agreed that the purpose of the questions nested below it should be to help ‘users’ explore various ideas and concepts so that they could articulate and refine the way they frame the problem at hand. The mind-map included elements of the place-based framework shown in Table 6, nested under the question ‘what are the ecosystem services associated with this place?’, but additionally has two further major sections. These deals with the people and groups involved or affected by the issue, and the social and political processes and conventions that need to be considered. The sub-questions under each of the main branches then lead to further more detailed issues and questions, and potentially to resources and methods that ‘users’ might find helpful.

In reviewing this mind-map it is important to note that it was an early snap-shot of thinking, and not as it stood intended as an operational tool. The purpose of the mind-mapping exercise was to structure their thinking about conceptual guidelines so that different options could be examined critically. It was apparent, for example, that it was difficult to envisage approaching the task of operationalising concepts through anything like a ‘decision tree’. The notion of decision trees as a way of structuring guidelines across a number of the OpenNESS work packages had previously been proposed as a way forward. The experience at the workshop on conceptual issues suggested, however, that the kinds of question that needed to be explored did not lead to clear-cut answers of the kind needed to navigate a decision structure. Rather, it was agreed that whatever form the conceptual guidelines took they must enable and facilitate a deliberative process, in which ideas are explored, discussed and potentially refined in an iterative way. Furthermore, it was also evident that while there was a rich pattern of linkages between the different parts of the mind-map, there was no single best or logical way to traverse it. Once the question set had been definitively refined, it was agreed that the task for the WP1 team was to find ways of helping people to navigate their way around it, and ultimately deepening their understanding of the issues that face them and the strategies that they might use to address them.

The task of refining the question set that would form the core of ONEX was undertaken in several stages. First, the initial set of questions developed at the workshop was considered in detail by the

Kiskunság case study partner, who provided detailed responses and further feedback on the usefulness of the process. The feedback allowed the initial set of questions to be refined and these were scrutinised further at a second workshop held in December 2016 with partners from two additional OpenNESS case studies, namely those concerning landscape-ecological planning in the urban and peri-urban areas of Trnava, Slovakia ([Case Study #2](#)), and ecosystem services in multifunctional Mediterranean landscapes of the Sierra Nevada protected area in southeast Spain ([Case Study #10](#)). This workshop, which also included the same partner from the earlier Kiskunság case study, allowed the questions to be tested and refined for a third time, and for the team to explore how the case study partners would navigate the nexus in ways that made sense to them.

Testing ONEX

The first phase of testing ONEX focussed on the Kiskunság case study. Our case study partner agreed to play the role of a potential knowledge broker. Their task was to look at the set of questions making up the initial version of ONEX from the perspective of their work to consider their relevance, and, where appropriate, provide an answer based on their understanding of the issues addressed in their case study. The work generated a rich body of information, which is provided in full in Appendix 1; only the conclusions that were drawn by our case study partner are discussed here.

Our case study partner confirmed that by working through the questions, and answering them step-by-step, a ‘comprehensive picture’ of the case study could be built up. They found the experience could ‘shed light on non-trivial relationships’ between different aspects of the problems and issues that were the focus of the case study in ways that were ‘previously not so well articulated’. The point was illustrated by reference to the insights gained on how conflicts and social justice issues that were highlighted by the question set; the case study partner found that the questions prompted deeper thinking about policy and governance issues, as well as about ecological characteristics and processes within the case study area.

In attempting to answer the questions, the case study partner found that some could be addressed if the user has some basic knowledge about ecosystem services and natural capital, and had a good general overview of the social and ecological contexts of the case study area. However, they also reported that many questions required quite detailed knowledge and that considerable time might be needed to gather all the information required. They therefore confirmed that a tool like ONEX would have to be used iteratively, perhaps over an extended period. These challenging questions were considered valuable, however, because potentially they are ‘able to drive the users of ONEX to new research directions by shedding light on the different aspects of the issue at hand’.

Despite the specific characteristics and concerns of the Kiskunság case study, our case study partner reported that none were identified as ‘irrelevant’, although some were clearly more important or central to the study’s concerns than others. They suggested that ‘operationally’ the user should be encouraged to identify the questions that were of primary concern to them, and perhaps tackle those first. They emphasised that one of the potential strengths of ONEX was that it was able to ‘expand the horizon of the researcher and bring new viewpoints into the discussion’, and so it was important that the questions in ONEX could be tackled in a way that allowed secondary issues tackled at a later stage. It was suggested that with an iterative approach, when the more fundamental aspects of the case study are covered, importance of these apparently secondary questions could better be appreciated and used to expand thinking still further.

Table 7: Current and potential future relevance of trial set of ONEX questions identified by three case study partners.

Element	Question#	Question	Kiskunság, Hungary	Trnava, Slovakia	Sierra Nevada, Spain
GEN	61	What is the issue?			
GEN	62	0.1. What are the ecosystem services associated with this place?			
GEN	63	0.1.1 How are these services generated? Do they arise locally or are they generated outside the place or area being considered?			
GEN	65	0.1.2 Do we expect to have enough of each of these services either here or elsewhere in the future?			
GEN	66	0.1.3 What, if anything, could replace or substitute for each of the benefits obtained from these services, either here or elsewhere?			
GEN	67	0.1.4 What kinds of changes to these services do you anticipate in the future? What are the main drivers of change?			
GEN	68	0.2. Who is involved or affected by changes in the services associated with the area?			
GEN	69	0.2.1 Do people outside the area depend on the services being considered?			
GEN	70	0.2.2 Which values and interests are evident?			
GEN	71	0.2.3 What values are associated with the services?			
GEN	72	0.2.4 Do conflicts arise between stakeholder groups?			
GEN	73	0.2.5 Are there winners and losers? Do issues of social justice arise?			
GEN	74	0.3. What are the social and political processes and conventions that are relevant to the issue?			
GEN	75	0.3.1 Are there methods to resolve conflicts in place?			
GEN	76	0.3.2 What kinds of management or policy actions are relevant?			
GEN	77	0.3.3 What kinds of regulatory framework are relevant?			
GEN	78	0.3.4 What policy levels are involved (local, regional, national EU)?			
GEN	79	0.3.5 What alternative policy or management actions can be identified?			
GEN	80	0.3.6 What seems to be the most appropriate pool of policy options/actions to achieve positive outcomes?			
HWB	1	1. In many studies it is useful to consider human well-being as an important target of applying the ES concept.			
HWB	2	1.1.1 Are you focussing on the well-being of groups or individuals?			
HWB	3	1.1.1 To understand the hwB issues of individuals then...			
HWB	4	1.1.2 To understand the issues at group level then...			
HWB	5	1.2 Looking at the actors and stakeholders you have identified, what dimensions of human well being mainly concern you in your study/case?			
HWB	6	1.2.1 Are there major differences between groups and individuals that you have identified in terms of their well-being? Consider issues of social			
HWB	7	1.3 Looking at the well being issues you have identified - it is useful to identify how they relate to ecosystem services			
HWB	8	1.3.1 How do the different groups or individuals value the services? How does this relate to their well-being?			
HWB	9	1.3.2 How do the dimensions of HWB relate to the prioritisation of ES?			
HWB	10	1.3.3 For each group how would they be affected by changes in ES?			
HWB	11	1.3.4 Are there synergies and trade-offs between the services in terms of their impacts on well-being?			
SEM	12	2. In many ecosystem service studies issues of sustainable management arise....			
SEM	13	2.1 Do the services you are dealing with arise naturally or are dealing with a cultural landscape?			
SEM	14	2.1.1 If you are dealing with a cultural landscape how do traditional land management practices influence service output?			
SEM	15	2.1.1.1 Are these practices sustainable?			
SEM	16	2.1.1.2 What are the drivers of change?			
SEM	17	2.1.2 If you are dealing with a natural landscape what are the key ecosystem processes that underpin the services?			
SEM	18	2.1.2.1 What are the major drivers of change?			
SEM	19	2.2 In what ways are the services unsustainable?			
SEM	20	2.2.1 Is the capacity of ecosystems being undermined?			
SEM	21	2.2.2 Does demand exceed supply?			
SEM	22	2.2.3 Are there trade-offs and synergies between services?			
SEM	23	2.2.4 Are there critical ecological, social and economic thresholds that need to be considered?			
SEM	24	2.3 What kinds of management or policy intervention are relevant?			
SEM	25	2.3.1 In what ways do current policy or management interventions affect the sustainability of services?			
SEM	26	2.3.2 Who has the power or capacity to intervene to sustain service output?			
SEM	27	2.3.3 How do issues of sustainability impact on the interests and values of stakeholders?			
SEM	28	2.3.4 What future visions do the different interest groups have and how do they conflict or support each other?			
GOV	29	3. In many ecosystem service studies it is useful to identify the key governance issues and what are the driving forces are behind them.			
GOV	30	3.1 Types of governance issue			
GOV	31	3.1.1 Are you concerned with a site-specific and/or with ecosystem service(s)-specific governance issue?			
GOV	32	3.1.1.2 Are you concerned with policy processes?			
GOV	33	3.1.1.2 Are you concerned with more general public debates?			
GOV	34	3.2 How do regulatory frameworks and related design and implementation processes link to your issue?			
GOV	35	3.2.1 How do the regulatory frameworks and related design and implementation processes relate to scale and how do the scales conflict/support			
GOV	36	3.2.2 What conflicts can be identified in terms of regulatory frameworks?			
GOV	37	3.2.3 Who is affected by these conflicts and how - what roles do formal/informal institutions and governance mechanisms conflict management?			
GOV	38	3.3 Which ecosystem services link to the areas of concern that you have identified			
GOV	39	3.3.1 Is there a concern for / awareness of underlying biophysical processes			
GOV	40	3.3.2 Are trade-offs evident/important?			
COMP	41	4. In many studies the status and trends of ecosystem services in an area can affect its status relative to other places through the impact on			
COMP	42	4.1 What is the status of your study area relative to others in the region or country you are dealing with?			
COMP	43	4.1.1 Is it regarded as disadvantaged in some way?			
COMP	44	4.1.2 Is there any understanding amongst stakeholders that the study area is losing out relative to other areas?			
COMP	45	4.1.3 Do stakeholders have a view about the how the status of the area can or should be improved?			
COMP	46	4.2 What opportunities for investing or restoring natural capital and ecosystem services are there			
COMP	47	4.2.1 What would the impact of such investment have?			
COMP	48	4.2.1.1 Does it impact on human well being?			
COMP	49	4.2.1.2 Does it impact on economic prosperity?			
COMP	50	4.2.1.3 How does it relate to sustainability issues?			
COMP	51	4.2.2 In what ways is the status of the place relative to others sustained by the current output of ecosystem services?			
COMP	52	4.2.2.1 How is this valued?			
COMP	53	4.3 What mechanisms are there for generating action?			
COMP	54	4.3.1 Is the investment needed to secure/improve the output of public or private goods or benefits?			
COMP	55	4.3.1.1 Can PES or other incentive schemes be designed and implemented?			
COMP	56	4.3.1.2 How is the investment in public goods to be generated and sustained?			
COMP	57	4.3.2 What indicators of success or failure can be identified?			
COMP	58	4.3.3 Do stakeholders understand the potential of nature-based solutions?			
COMP	59	4.3.3.1 How are nature-based solutions seen relative to other types of intervention?			
COMP	60	4.3.3.2 Is there merit in showing the areas to be a flagship or leader in the field?			

Key: Currently relevant Future relevance Relevant now and in the future

Our case study partner felt that what while the questions had been answered solely on the basis of her knowledge of the work, in a 'real-life situation' questions could be used either as a platform to initiate discussion among the stakeholders, with the aim of developing a joint problem definition. The questions could also be used as a way of creating a 'roadmap to structure the process of problem solving'. The latter would include the identification of relevant concepts, methods and tools, and links to other sources of information. The case study partner confirmed that the implication here was that an iterative use of ONEX would potentially stimulate co-learning within the stakeholder group. They went on to suggest that to better understand how ONEX might work in real life, in transdisciplinary settings, it would probably be necessary to use it in case studies which are at an earlier stage of the project cycle. She suggested that the 'best way' would be to apply ONEX in case studies from the very beginning when the stakeholders and researchers meet first to discuss the problem(s) at hand.

On the basis of the feedback from the Kiskunság case study, the WP1 team concluded that it would be worthwhile to develop the conceptual nexus idea further, and that in order to do this, two major steps were required.

- First, to refine and extend the question set to cover each of the four challenges. This would ensure that as much of the potential conceptual landscape could be covered as possible. The idea was that users should have the possibility of explicitly examining one of the Challenges, in which case ONEX should be 'customised', so that more detailed or specific information can be elicited. Alternatively, it might be that users start with the more generalised questions and then drill down to one or more of the Challenges as their thinking develops.
- Second, to consider how ONEX might be implemented operationally so that users could go through the questions in an order that is appropriate for them. It should also allow preliminary question responses to be discussed and conclusions developed in an interactive way. Any suitable platform should also allow information to be shared and be capable of providing links to other resources and sources of expertise.

For the follow up workshop in December 2016, with three case study partners, the initial question set was revised and extended. Eighty questions were posed, divided more or less evenly across five main areas of concern: (1) issues of general relevance to the issue and place being considered; (2) issues related to human well-being; (3) issues related to sustainable ecosystem management; (4) issues related to governance; (5) issues related to competitiveness.

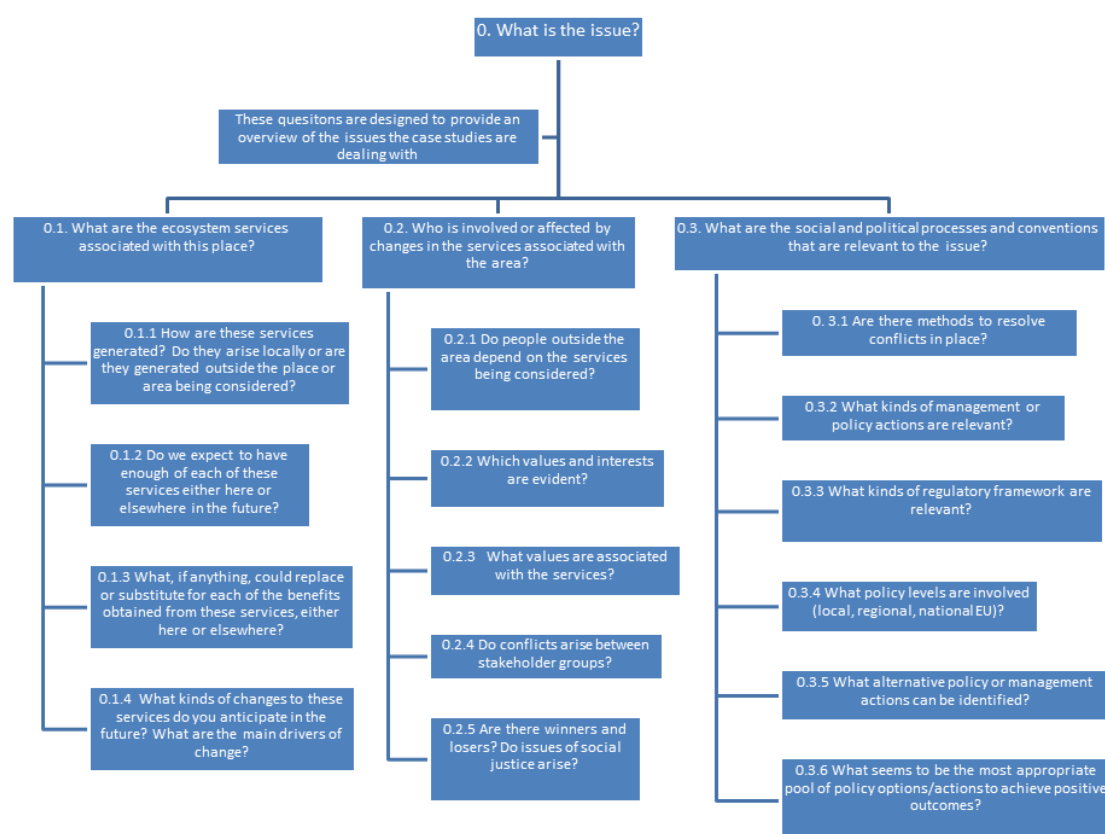
In the workshop the participants were given graphical overviews of the questions and their relationships (an example is provided in Figure 5, for the questions of general relevance). They were asked to review the question wording and the logic of the way they were nested. They were also asked to indicate which questions are relevant in terms of current work in the case study (i.e. relevant in the sense of valuable to explore with stakeholders now) or potentially relevant in the future as work progresses. The results are summarised in Table 7.

Several features are important to note in the results shown in Table 7. First, that all the questions in the set were considered either relevant now or potentially interesting for the future by at least one of the three case study partners. Second, that there were clear differences between case studies in terms of which questions were considered relevant, reflecting their different concerns. For example, many more of the general set of questions (i.e. Q61-80) were considered currently interesting by the Kiskunság case study, compared to that of Trnava or Sierra Nevada. Similarly, the latter felt that

many more questions relating to competitiveness were potentially of interest in the future compared to the Hungarian case. Moreover, questions relating to sustainable ecosystem management appeared to be especially relevant to the Trnava case study compared to the others. The conclusion drawn here is that the question set is sufficiently diverse to reflect the different concerns of case studies. Finally, for one case study (Kiskunság) some questions were highlighted as being relevant both now and in the future, indicating that further exploratory work needs to be undertaken to resolve the issues.

In reporting back the case study partners made comments on the wording of the questions and suggested how they might be clarified. They also discussed how they would have traversed the question set, and it was apparent that they would have approached the task in different ways. For example, while the questions in the general set were considered relevant, the Sierra Nevada case study reported that given their concerns they would probably have started by looking at questions in the competitiveness set, but then returned to issues linked to sustainable management and some of the general ones. This case study thought that it would be helpful to link across the five areas of concern, so that combinations of questions in the different sectors could be considered together.

Figure 5: Example nested hierarchy of questions used to evaluate ONEX content and structure



In terms of ‘gaps’ within the question set, it was suggested that the questions on ‘values’ and ‘valuation’ probably needed to be expanded, and possibly brought together as a separate area of concern, and that it might be helpful to add questions relating to the relationships between stakeholder groups, to expose patterns of power and influence, as well as conflict in relation to formal and informal property rights on land and other resources. Finally, the participants felt it would

be useful to support the questions with some statement of the rationale that lies behind them and hence how the answers lead into other areas, together with links to resources such as the OpenNESS Synthesis Papers generated by WP1, and methodological fact sheets generated by the work of WP3&4. On the basis of this feedback the WP1 went on to finalise the ONEX question set that is presented later in this document.

The ONEX Platform

Given that the broad aim of OpenNESS is to create tools, strategies and other resources to enable people to use the idea of ecosystem services to solve problems, the development of ‘guidelines’ to help navigate this complex field has been a major focus of the work. When faced with the need to explore and apply the core concepts of the ecosystem service paradigm, the task has proved especially difficult. The conceptual landscape of ecosystem services and natural capital is fluid and multi-faceted, and from the out-set it seemed unlikely that any simple guidance in the form, say, of a ‘checklist’ or ‘decision tree’, could usefully be provided to assist those new to the field or those more familiar with it.

Clearly, the questions developed in the original mind-mapping exercise, and further elaborated in relation to the four challenges, could be viewed as a putative set of guidelines. However, they are not in a form that can be used easily in an operational context. The approach used by the key informant in the case study test, who worked through the questions in a prescribed order is probably not one that would be taken up widely. Rather, in the context of a real world, ‘wicked’ problem, the task of exploring such ideas would need to be undertaken iteratively over a period of time, and also collectively, through some kind of deliberative process involving a number of different interest groups. These types of ‘user requirement’ begin to map out the kind of platform that might be suitable for ONEX, which we see essentially supporting **structured decision making**, which Gregory et al. (2012, p. iv) define as “finding ways of helping individuals and groups to think through multi-dimensional choices characterised by uncertain science”.

A key assumption of that has underpinned the work on conceptual guidelines is that there is no ‘solution’ that can somehow be offered or revealed via the application of conceptual guidelines. In designing ONEX, the expectation is that users build, test and refine their *own* solutions. The function of the question sets that makes up ONEX is that they stimulate and expand thinking, and ultimately through discussion, focus effort. Our proposition that these questions can best be thought of as a ‘conceptual nexus’ rather than a ‘checklist’ or simple ‘decision tree’, is intended to capture the flexible and deliberative nature of what is required operationally.

The experience gained in working with case study partners on our ONEX prototypes was that any platform selected to make the question set available to the more general user should have to support a number of tasks or types of interaction. Initially, for example, it can be seen as a **knowledge elicitation tool**. The questions that constitute ONEX are intended to help the users structure their thinking around the main concepts, draw on existing expertise and insights to document openly what they know, and to identify knowledge gaps that potentially need to be resolved.

By highlighting the kinds of relationship and links between ideas that can be examined in different contexts, ONEX can also be seen as a device for building a kind of **semantic network**. This is the second major task that any platform for ONEX must support. While the notion of a conceptual nexus has the idea of connections between concepts ‘built in’ to the basic framework, it is anticipated and

expected that any serious users would begin to enrich this network structure for themselves as insights are developed. While links to resources are also provided in ONEX, users would also be expected to link their thinking to other underpinning resources, such as the relevant scientific literature or evidence and data relevant to their work.

Finally, any platform selected for ONEX must be capable of providing a ***collaborative environment***, in which ideas can be discussed, explored and refined. If ONEX is to be effective then it must be able to support the ‘co-production of knowledge’ and ‘social learning’, and recognise that this might need to be done iteratively, over an extended period of time. While knowledge elicitation and semantic mapping can be achieved in a number of ways, the need to share thinking and interact systematically suggested some kind social media platform might be a way of making ONEX operational.

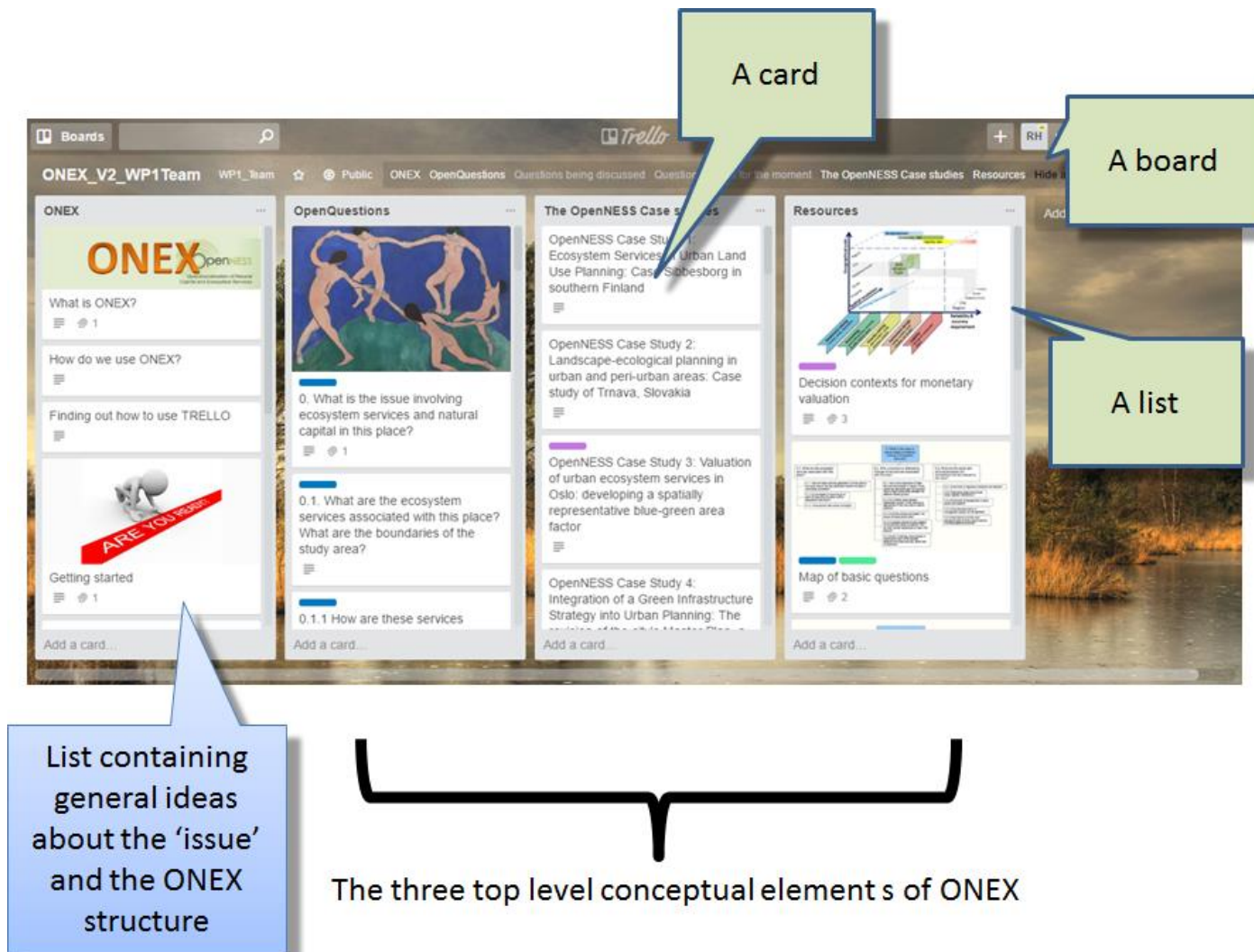
The resources available in OpenNESS for the development of a web-based platform for ONEX were limited, so from the outset it was recognised that a bespoke approach was not feasible. In any case, given the novelty of the work a measured approach to understanding operational needs and user requirements seemed wise, before any significant investment of time and resources in platform development was proposed. Thus, a review of potential ‘off-the-shelf’ tools was made in order to find a way of enabling further exploratory work to be undertaken.

Mind-mapping software was used as part of the initial scoping work for ONEX, and so this was considered as one potential platform for an operational version. The approach has the advantage that it can provide a graphical representation of the relationship between questions. Moreover, the most recent versions of mind-mapping software such as MindManager can generate web-based versions; thus ‘interactive’ versions of the mind map can easily be built. However, our review of the software suggested that the approach came with the disadvantage that once generated as web pages the structure and content are fixed without the intervention of an editor. Since a key operational objective is to allow users to customise and refine the material in real time, as a case study is explored, this meant that this software was rejected as potential platform.

Given the strong knowledge elicitation requirement in the ONEX approach, an alternative initial idea was to implement the conceptual nexus using a web-based survey tool like ‘Survey Monkey’. While these kinds of tool can capture a range of detailed information and store it for later use, our preliminary review of the capabilities that this type of software offered suggested that their limitations outweighed any advantages. For example, they depend on the user following a prescribed route through a set of questions, and although some logical routing can be attempted, these facilities are limited in terms of directing users to subsequent questions on the basis of previous answers. Perhaps the biggest disadvantage of these on-line survey tools that we found were that they did not allow users to review answers and change them on the basis of experience gained over an extended period, nor did they allow any kind of collaboration and discussion of answers.

As a third alternative, web-based software for collaborative project management was considered as a potential platform for ONEX. These kinds of software are designed to help individuals and teams organise and track tasks, and add comments and links to other resources that are considered relevant. While ideas can be developed in a fluid and dynamic way, some structure can initially be brought to the process by means of their initial set up. TRELLO is a widely used example of such software, and to examine whether its capabilities might help to implement ONEX an evaluation of its capabilities was undertaken.

Box 3: Structure of ONEX using the TRELLO platform



TRELLO organises thinking using three basic structural elements. A 'board' is used to capture or house all the elements of a project or topic; it is the digital equivalent of a 'whiteboard'. Within a given board things are arranged in 'lists', which are simply columns that can be used to organize tasks or ideas into logical groups. The tasks and ideas are then represented on 'cards' that are assigned to the various lists; these cards are the basic building blocks of a TRELLO Board, and are the digital equivalent of post-it notes. The card contains a header block that provides a description of what it is about. That description can include images and tables, and can include web-links and attachments. An example TRELLO Board prepared from the material generated by the mind-mapping work on ONEX is provided in Box 3.

In terms of collaborative working the TRELLO can be set up to allow only a specified team to view and change the material, and users can subscribe to the board and be notified when changes to all or specific parts are made. Moreover, users can email their comments to the board (they would appear in a defined place) or to an individual card; each card has a unique URL, so users can refer to them directly in other applications, and hence link to them. Finally, check-lists and 'due dates' can be added to cards, to flag up consultation periods on particular issues and time windows for the completion of particular tasks. Using these kinds of capability, the TRELLO Board therefore rapidly becomes a project management tool, or in the case of ONEX a potential tool for managing a *deliberative process*.

While other web-based project management software is also available, TRELLO was selected as a platform for further testing and developing ONEX because it seemed to meet the key operational requirements that we have identified. In addition to its capabilities for capturing people's knowledge and views, for structuring conceptual thinking and for supporting collaborative working styles, it also has the advantage of being freely available on the web and of being supported by an active user community that could provide example applications and software extensions.

We will review the final structure of the 'ONEX operational prototype' and how it has been set up in TRELLO in a later section of this document. While platform issues are important, the content of the conceptual nexus is fundamental. Thus, before we move on to these more technical matters, we must consider the ONEX question set in detail and the rationale underpinning of its design.

Part 4: The ONEX operational prototype

Introduction

Although the four OpenNESS Challenges of human well-being, sustainable ecosystem management, governance and competitiveness were framed as separate issues it became clear early in the work that they were in fact closely linked. Consideration of any one rapidly led on to the need to consider one or some of the others. Thus, the notion of a network of ideas and how to represent it has been a key concern throughout our work. In addition to the linkages identified by the work in WP1, the suite of ‘Synthesis Papers’ proved a further useful resource (Table 3). In preparing these papers the authors, who were drawn from across the OpenNESS consortium, were asked to note the relevance of each of the challenges to the issue they were discussing and how they related to each other. In creating ONEX our task has therefore not only been to identify key questions that might stimulate thinking about each challenge, but also to indicate **how** the questions relate to each other and **what** can be achieved by reflecting on the knowledge gained in one topic area in the context of another.

Following the work on the early ONEX prototypes the WP1 team reviewed the set of questions in the light of the feedback received, and developed a final set that could populate what we refer to here as the ‘operational prototype’ based on the TRELLO platform. The aim has been, at the end of OpenNESS, to provide a tool that can be used and evaluated, and developed further if users find it valuable. In other words, it represents a ‘proof-of-concept’ device, designed to critically test an approach to providing support for ‘real-world’ collaborative problem solving involving ecosystem services.

Establishing the basics

Although there are many potential ‘entry points’ for ONEX, there is a set of basic knowledge that needs to be discussed and documented. This concerns such things as the nature of the issue being investigated, the types of ecosystems being considered, what stakeholders are involved and what the dominant social and political processes are within the study area. Thus, a set of questions labelled ‘basics’ has been developed to draw out this information from the user group. The questions and their rationale are presented in Table 8. The relationships between the questions in this set are illustrated diagrammatically in Figure 6.

The set of basic questions has been adapted from the framework for place-based assessments by Haines-Young and Potschin (2013), and was discussed in the section on ‘Populating ONEX’. Following work on the early ONEX prototype with case study partners the set was expanded to link more explicitly to the issues covered by the four challenges. Thus, while the basic set might be sufficient in its own right, it provides the opportunity to link to these other areas and to ‘drill down’ as the interests of the user group dictate. It is important to note, however, that while presented as a basic set of questions, it is anticipated that the initial responses may be provisional and will probably need to be refined as further issues in the nexus are explored.

Figure 6: Relationship between the questions making up the 'basic' set within ONEX

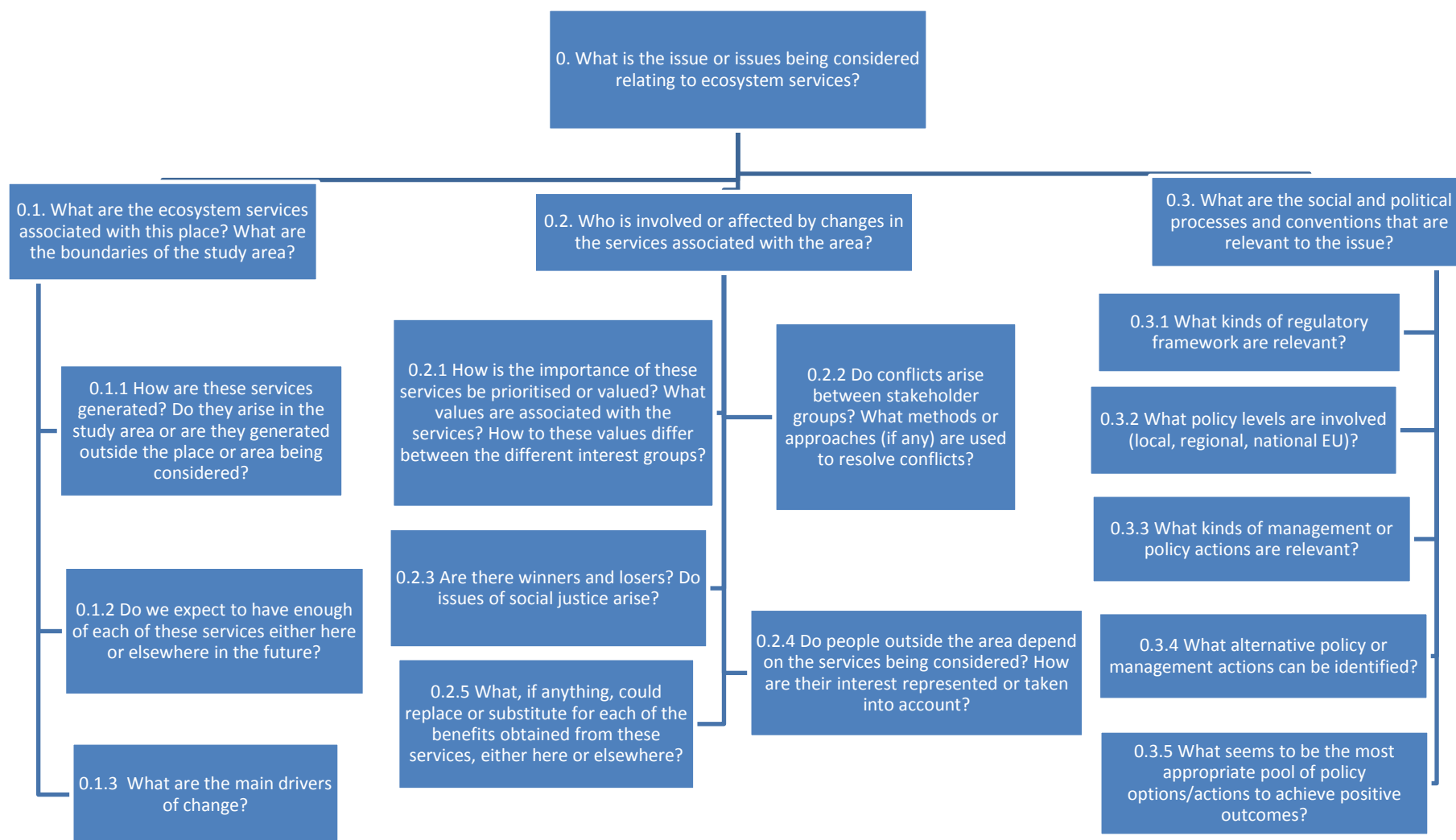


Table 8: The set of 'basic' questions in ONEX and their rationale

Question#	Question	Rationale
57	0. What is the issue involving ecosystem services and natural capital in this place?	This is a simple but entirely open-ended question and may undergo many iterations as the understanding of the problem develops. Different stakeholders may also initial fame different responses to this question.
58	0.1. What are the ecosystem services associated with this place? What are the boundaries of the study area?	Helps in setting the conceptual and spatial boundaries to the assessment; defines the place of concern. A number of approaches can be used to identify the important or relevant ecosystem services, including stakeholder consultation or analysis of management or policy material. Understanding the boundaries of the study area, and how the staeholders see it, is also important to establish. Is the study area defined by the problem or issue, or it an arbitrary administrative or cultural unit? These geographical characteristics will determine who is involved, who is affected and who has the capacity to act.
59	0.1.1 How are these services generated? Do they arise in the study area or are they generated outside the place or area being considered?	Identification of dependencies and cross-scale issues in relation to the supply of services; helps explore the links between the place of interest and other places. This question is open-ended and may require considerable research if the influence of local conditions are to be understood. General modes or general understanding may of course also be used.
60	0.1.2 Do we expect to have enough of each of these services either here or elsewhere in the future?	Highlights the issues surrounding the notion of living with environmental limits and questions about sustainability of natural capital. This question opens up issues of supply and demand and may therefore involve working with stakeholders. Scenario techniques may be highly relevant here in terms of exploring the assumptions about the key drivers of change and the uncertainties associated with them. The exploration of this question also assumed good knowledge of present-day mechanisms and the balance between supply and demand.
61	0.1.3 What are the main drivers of change?	An understanding of the direct and indirect factors that drive change is often essential, especially if policy or management interventions are anticipated. The exploration of this question should identify where interventions are possible and what the barriers to success are.
62	0.2. Who is involved or affected by changes in the services associated with the area?	This question links strongly to those on human well-being, and may be examined either in the light of what has already been discussed in that topic area or looked at in its own right and the information used to open up the human well being debate.
63	0.2.1 How is the importance of these services be prioritised or valued? What values are associated with the services? How do these values differ between the different interest groups?	(1) Opens up discussions about how values should be assessed and compared (e.g., using individual vs community values; monetary vs non-monetary). (2) Helps to identify who has a stake in the deliberations about the place and their needs, and develops understanding of the spatial relationships between one place and other places
64	0.2.2 Do conflicts arise between stakeholder groups? What methods or approaches (if any) are used to resolve conflicts? Can trade-off be identified?	The identification of where conflicts arise between stakeholders is important in its own right, but often these can only be understood in terms of impacts on the well-being of different groups. Tis this question links strongly to those in the HWB cluster.
65	0.2.3 Are there winners and losers? Do issues of social justice arise?	See rationale for 0.2.2
66	0.2.4 Do people outside the area depend on the services being considered? How are their interest represented or taken into account?	The extent to which people outside a study area who depend on the services generated re stakeholders, is often overlooked. Decisions need to be made as to whether these interests are significant and need to be taken into account.
67	0.2.5 What, if anything, could replace or substitute for each of the benefits obtained from these services, either here or elsewhere?	Links to question 0.2.1, and further explores the nature of criticality, compensation and substitutability of benefits. The answer t this question may be partly determined by the different values that stakeholders have.
68	0.3. What are the social and political processes and conventions that are relevant to the issue?	The issue identified as the focus of the study may arise from governance issues, and so an awareness of the relevant social and political processes, and conventions. This question opens up some preliminary thinking in relation to the governance challenge.
69	0.3.1 What kinds of regulatory framework are relevant?	This question opens up the governance challenge and so if it is considered relevant users should follow the links to the other area of concern. Preliminary notes on this question will help, although users may need to reframe the answer here on the basis of a detailed discussion of the governance challenge.
70	0.3.2 What policy levels are involved (local, regional, national EU)?	This question opens up the governance challenge and so if it is considered relevant users should follow the links to the other area of concern. Preliminary notes on this question will help, although users may need to reframe the answer here on the basis of a detailed discussion of the governance challenge.
71	0.3.3 What kinds of management or policy actions are relevant?	Helps in understanding the acceptability of management or policy interventions to different stakeholder groups and the identification of potential trade-offs and conflicts and how they might be resolved.

When reviewing the structure of the question set shown in Table 8, it is also important to note that while framed in a simple way, they may be difficult to answer. Moreover, they will often require the users to assemble and discuss a body of evidence before an adequate response can be made. For example, when exploring the apparently straightforward query ‘What are the ecosystem services associated with this place? What are the boundaries of the study area?’ (0.1) a variety of sources of information might be relevant for resolving these questions. As the underpinning rationale for the question highlights, users need to consider whether the study area is defined by the problem or issue, or if it is an arbitrary unit defined by administrative or cultural factors. These geographical characteristics are important to consider because they will determine such things as who is involved, who is affected and who has the capacity to act. The answer to these questions may be clear early on, but they may also need to be revised as more detailed issues relating to human well-being and governance are explored.

Thus, ONEX does **not** provide answers but support in terms of what kinds of question are relevant and how by considering them users may benefit by considering ancillary issues that might also throw light on their issue. These issues may be examined through other questions or the resources linked to the question sets. The TRELLO platform used for the ONEX operational prototype allows discussion threads to be established for each question and facilities for summarising the discussion. New links to locally relevant evidence can be added to the system and new cards added to the TRELLO Board as additional lines of investigation are identified.

Exploring Human Well-being

A major task for the development of the OpenNESS conceptual framework in relation to the human well-being challenge has been to characterise components of human well-being in such a way that it can be clearly conceptualised, measured and applied in the context of ecosystem services. A review of the field (EU FP7 OpenNESS Project Deliverable 1.2, Potschin et al., 2016) suggested that this is a necessary step for assessing the links between well-being and ecosystem services in different situations and at different scales, and for describing the evidence needed to map and analyse supply and demand relationships in different situations within Europe. Further, it was considered important to clarify how different components of human well-being affect the valuation of ecosystem services.

The initial work for OpenNESS was based on a preliminary definition of well-being, which was conceived as that which arises from adequate access to the basic materials for a good life, that are needed to sustain freedom of choice and action, health, good social relations and security (see Potschin et al., 2015, 2016). Although this was based on the Millennium Assessment’s characterisation of human well-being, the review suggested that any final conceptualisation needed to go beyond this, to encompass a broader, anthropologically, culturally, and philosophically substantiated understanding of human well-being. Thus, a generic definition of human well-being that followed Alexandrova (2012, p. 697) was adopted. For OpenNESS, it was therefore proposed (Potschin et al., 2015, 2016) that human well-being should be understood as a state that is intrinsically and not just instrumentally valuable (or good) for a person or a societal group.

In terms of the ONEX the question set has been designed to enable users to move from more general understandings of well-being to a more context specific understanding of the concept, in which the specific components considered have been determined through the involvement of stakeholders.

The questions relating to human well-being and their rationale are presented in Table 9 Table 8. The relationships between them are illustrated diagrammatically in Figure 7. The questions have been designed around the assumptions that:

- accounts of human well-being should embrace both ‘objective’ dimensions (such as basic material needs) and ‘subjective’ dimensions (e.g. positive emotions, life satisfaction); and,
- as the framing and measurement of human well-being is dependent on specific cultural and social conditions, and this needs to be taken into account in place-based applications by involving stakeholders into the operationalisation of the concept.

The question set on human well-being thus encourages a discussion of the dimensions of human well-being that need to be considered (Q1.1) and how any response might be informed by investigating the different types of value held by stakeholders at either individual or group level (Q1.2); users are encouraged to think about whether they need to employ participatory methods to resolve these questions. The questions also signpost consideration of non-use values and how they are related to the different dimensions of human well-being and ecosystem services (Q1.3.1). This is considered important because such values arise, for example in the context of the conservation of biodiversity and its management and can provide insights into motivations related to sustainable ecosystem management and how governance issues are handled.

The question set on human well-being places particular emphasis on the need to identify **who** is involved in the issue, and **who** is affected by it, and what this means in terms of social justice. The users are encouraged to think about how stakeholders weigh or prioritise the different dimensions of well-being against each other, in terms of questions that are focussing on ‘who benefits?’ and ‘who decides?’ (Q1.3 and those that follow). While questions of justice are part of most ideas of living a good life, they are especially important in the context of work being done in relation to the governance and competitiveness, and ONEX flags up how they link across to these other areas. Examination of trade-off issues is especially important in this context (Q1.3.4), both in terms of ecosystem services and the benefits that are associated with them.

Figure 7: Relationship between the questions making up the human well-being set within ONEX

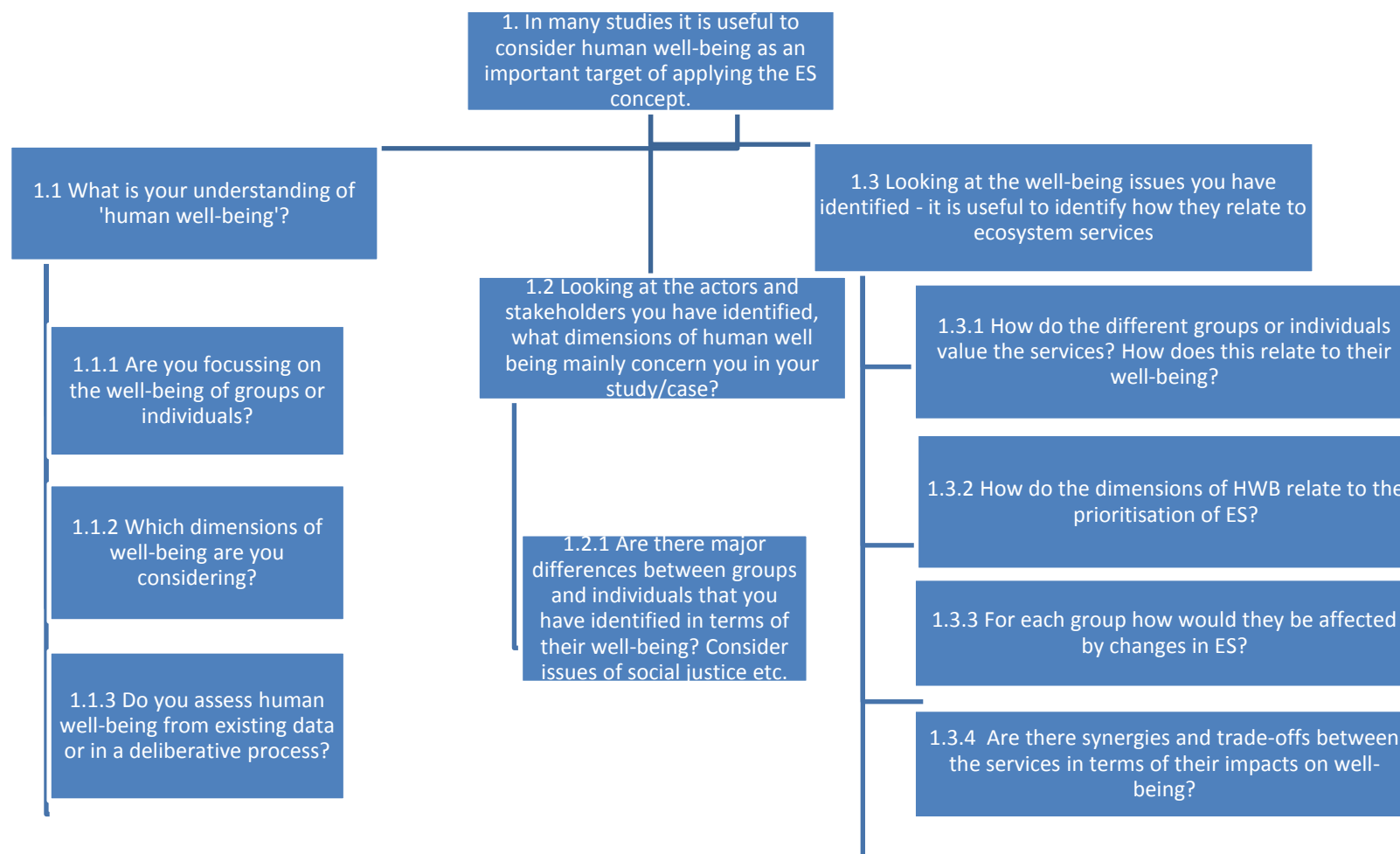


Table 9: The set of questions relating to human well-being in ONEX and their rationale

Question#	Question	Rationale
1	1. In many studies it is useful to consider human well-being as an important target of applying the ES concept.	Maintaining or improving human well-being is the main target at which ES and NC concepts are aiming and they may even define and explain what phenomenon specifically constitutes a service and/or what are the relevant services
2	1.1 What is your understanding of 'human well-being'?	There are many different understandings of what constitutes human well-being, often not made explicit in local contexts, and depending to some degree on the specific natural and social/culture settings. It is important to become aware of the possible options to understand and conceptualise human well-being. The following questions, though not exhaustive should provide some ideas and raise awareness of what might be included/considered. The specific understanding of human well-being is also closely linked to the specific values that are held by societies, stakeholder groups and individuals.
3	1.1.1 Are you focussing on the well-being of groups or individuals?	There may be differences between individual ideas of human well-being and shared social values. Both are important but it may need different methods to assess them. This means especially that summing up individual preferences not automatically will be the same as a group idea of well-being or 'social well-being' and that different methods will be required to assess them.
4	1.1.2 Which dimensions of well-being are you considering?	Some classical indicators of well-being (such as GDP) have focused only on limited range of dimensions of well-being to express them only in a single dimension (e.g. money). We suggest here to view human well-being in a broad manner as a multidimensional concept which should include at least three major categories of human well-being, in order to account also for nonmonetary, social and relational criteria: - material conditions of life, quality of life (including human development components such as education and health, but also extends to 'conditions of being' like security and subjective well-being), and relational dimensions (nonmaterial relations to others and to nature which contribute to human well-being).
5	1.1.3 Do you assess human well-being from existing data or in a deliberative process?	In both cases you may either use an existing framework (or list) for conceptualising human well-being or develop them on your own. Mostly an intermediate solution will be best: neither starting completely from scratch and/or develop intuitively ad hoc classifications, nor be so detailed that it cannot be accounted for the specific local setting (see 1.1.2 and recommendation given there). Deliberative processes require specific social science methodologies, such as questionnaires and focus groups. Different lists may were constructed for different purpose and will serve well for specific tasks. As almost all of these lists where not developed in an ES context they may require some adaptation.
6	1.2 Looking at the actors and stakeholders you have identified, what dimensions of human well-being mainly concern you in your study/case?	The scope of what is included in an assessment of well-being strongly influences any overall judgement of human well-being outcomes. Given the many lists which enumerate dimensions of human well-being (see question 1.1.3) it is important that studies should be clear on which classification of human well-being they use and which dimensions they specifically address. Further, the classification adopted should be consistent with the well-being approach chosen (for example, Nussbaum's list on capabilities needs some adaptation to conform with the MA approach, see Polishchuk & Rauschmayer 2012).
7	1.2.1 Are there major differences between groups and individuals that you have identified in terms of their well-being? Consider issues of social justice etc.	We cannot assume that – even in the same area and with the same cultural background, people have the same interests and the same ideas about human well-being (e.g. the weighing/ prioritization of different dimensions of human well-being). We thus may have to differentiate between the interests and well-being ideas of different groups to visualise and discuss possible conflicts that may arise from these differences. The fair distribution of benefits is a major goal in many well-being concepts (and also a question in Challenge 4). So it is important to analyse who profits from ecosystem services and who is deprived. For the sake of practicality, projects might not address the concerns of all stakeholders but it is important to acknowledge who is considered and what the reasons were for the selection of (groups of) stakeholders.
8	1.3 Looking at the well-being issues you have identified - it is useful to identify how they relate to ecosystem services	Human well-being is the major target for using the ES concept. So it is important to relate the human well-being-dimensions identified in the specific setting to how it affects the demand of ES and vice versa who expected changes in ES affect human well-being. The relation between ES and HWB is complex. One and the same ES can affect several dimensions of HWB and one dimension of HWB can be affected by several ES. It is often impossible to account for all these relations in a project. Therefore, the more important it is to deliberately decide which relations to address and which part of the overall picture is not reflected.
9	1.3.1 How do the different groups or individuals value the services? How does this relate to their well-being?	A valuation of services should be closely linked to human well-being dimensions as human well-being is per definition the baseline for the valuation of services. So there should be a close correspondence between both. It is also important to consider groups affected in the study area as well as those outside.
10	1.3.2 How do the dimensions of HWB relate to the prioritisation of ES?	This is an important cross-check, both in the scientific as on the social side. Do the ES identified as the most relevant ones really match those needed to fulfil the human well-being dimensions considered as being most important? This might change the original prioritisation of ES as new aspects come in. It may even be that not all ES relevant to human well-being have been considered before, urging for including other services not considered before.
11	1.3.3 For each group how would they be affected by changes in ES?	see rationale for 1.3.2 and 1.2.1
12	1.3.4 Are there synergies and trade-offs between the services in terms of their impacts on well-being?	see rationale for 1.3.2

Sustainable Ecosystem Management

Understanding the link between biodiversity and the output of ecosystem services has been fundamental to the objectives of OpenNESS. The significance of this topic goes beyond the biophysical realm, however, and provides important entry-points for discussion of the three other challenges. In the context of the governance challenge, for example, we need to determine whether a focus on ecosystem services can contribute to a more sustainable ecosystem management, and if the maintenance of a sustainable flow of a broad range of services depends on conserving the ecological value and biological diversity of these systems. In relation to competitiveness, local economies that prosper are also likely to be the ones that are most environmentally stable or resilient in the long term. Finally, given the key proposition of the Ecosystem Approach that decisions about biodiversity are matters of ‘social choice’, then questions about sustainable ecosystem management inevitably impinge on issues of human well-being.

The need to promote an Ecosystem Approach has therefore underpinned the design of the question set for sustainable ecosystem management, which seeks to encourage users to examine the long term balance between the interests of people and the protection of the natural environment, and consider ‘the overlap between what people collectively want [...] and what is biologically and ecologically possible’ (Bormann et al., 1994, p.6). Thus, while the analysis of biodiversity and ecosystem service relationships has to be grounded in natural-science methods, it is assumed in ONEX that the development of any operational guidelines for such work must take account of social context. The questions making up the set for sustainable ecosystem management are summarised in Table 10. The relationships between them are illustrated diagrammatically in Figure 8.

The first group of questions (Q2.1) shown in Table 10 seek to establish the basic characteristics of the place in which sustainable management strategies are being developed and whether issues of sustainability arise in relation to a cultural landscape, or one that is regarded as natural or semi-natural. Given that sustainable ecosystem management seeks to restore, maintain or enhance the output of ecosystem services and their associated benefits, the second block of questions listed in Table 10 **Error! Reference source not found.** is designed to help users examine the supply-demand relationships in the area, and how they might be changed through management action or other drivers of change (Q.2.2). The importance of understanding the way the balance between the different services might change when bundles of ecosystem services are being considered is an especially important theme here, and by focusing on the types of trade-off that might arise, the questions seek to move beyond an understanding of the biophysical underpinnings of service output to a more complete picture of the socio-ecological system as a whole.

Recent work (see OpenNESS SP on SEM; Smith et al., 2016) has emphasised that conflict resolution strategies are often part and parcel of any sustainable management plan, and so the social theme has been carried over into the design of the final group of questions (Q2.3) that seek to understand the policy and management options that are relevant to the issue. These issues link strongly with the governance challenge (Q2.3.2) and so provide important entry-points for discussion in this area. However, an effective resolution of the questions will also entail understanding stakeholder attitudes and values, and so links to the well-being challenge are also flagged up in relation to these questions (Q2.3.3). Scenario techniques may be important in establishing the visions that the different interest groups have for the study area, and so this possibility is highlighted in the way Q2.3.4 is framed.

Figure 8: Relationship between the questions making up the sustainable ecosystem management set within ONEX

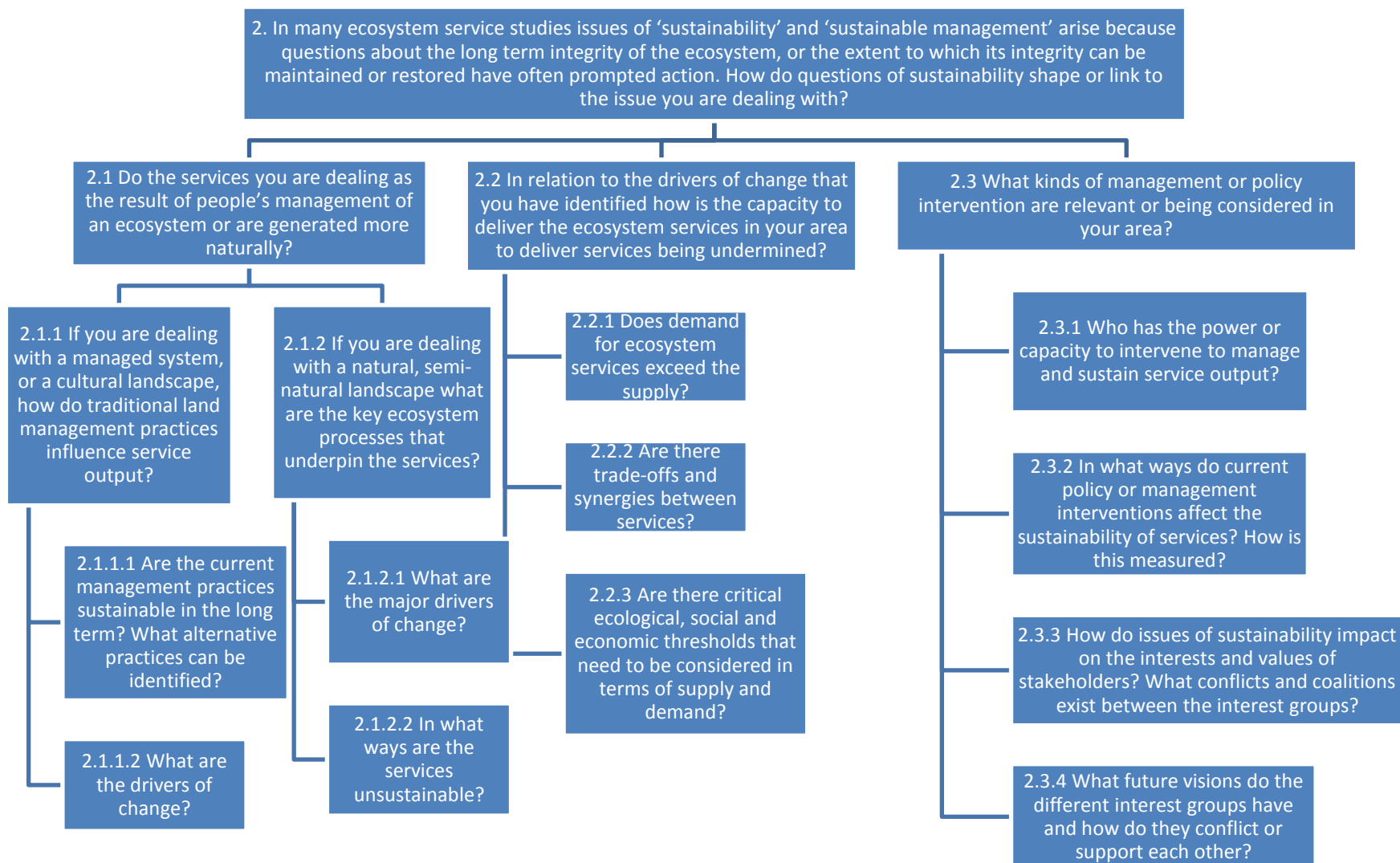


Table 10: The set of questions relating to sustainable ecosystem management in ONEX and their rationale

Question#	Question	Rationale
13	2. In many ecosystem service studies issues of 'sustainability' and 'sustainable management' arise because questions about the long term integrity of the ecosystem, or the extent to which its integrity can be maintained or restored have often prompted action. How do questions of sustainability shape or link to the issue you are dealing with?	This is an open-ended question and the answers may initially be provisional and in need of refinement as the other questions are worked through. Sustainability is largely an anthropocentric concept and so to answer this fully it may be necessary to look at the views and values of stakeholders via the human well-being challenge, or the way governance practices are impacting on the ecosystem. An understanding of sustainability questions may also entail the analysis of historical trends.
14	2.1 Do the services you are dealing as the result of people's management of an ecosystem or are generated more naturally?	It may be helpful to consider highly managed ecosystems separately from semi-natural or natural ones in order to understand how ecosystem services in an area are generated. The questions that nest under this one primarily focus on managed systems. These can either be cultural landscapes in which traditional management practices sustain particular ecosystem attributes that people value, more contemporary ones, or even cultural landscapes that are being restored. Note, however, while the impact of people management may be the focus, the underlying biophysical mechanisms and drivers cannot be ignored.
15	2.1.1 If you are dealing with a managed system, or a cultural landscape, how do traditional land management practices influence service output?	An understanding of the ways in which specific management practices sustain the output of ecosystem services and the extent to which such inputs can be maintained into the future is often a key insight in identifying how future policy or management interventions are designed. Taken with Q2.1.1.1, these questions are designed to help users build up picture of the factors shaping the supply of ecosystem services.
16	2.1.1.1 Are the current management practices sustainable in the long term? What alternative practices can be identified?	See 2.1.1
17	2.1.1.2 Are changes in landscape management practices driving change in ecosystem services? How might they change in the future?	See 2.1.1
18	2.1.2 If you are dealing with a natural, semi-natural landscape what are the key ecosystem processes that underpin the services?	The analysis of the supply side of ecosystem services in natural and semi-natural landscape will mainly focus on biophysical processes, and so this question is designed to open up this area of investigation. Sustainability issues may arise in terms of the way in which biophysical processes and conditions change over time (e.g. through climate change). However, in natural and semi-natural landscapes the role of people in shaping and impacting the system cannot be overlooked and so these factors must also be factored in. The exploration of this question should therefore be looked at in relation to those concerning more highly managed systems.
19	2.1.2.1 What are the major drivers of change in these natural or semi-natural systems? How have they changed over time? How might they change in the future?	See 2.1.2
20	2.1.2.2 In what ways are the output of services unsustainable?	See 2.1.2
21	2.2 In relation to the drivers of change that you have identified how is the capacity to deliver the ecosystem services in your area to deliver services being undermined?	Although questions of capacity imply the analysis and understanding of biophysical factors, the impact on the demand for ecosystem service by people needs to be considered. A full answer to this question may require consideration of whose well-being is affected by unsustainable changes in the output of ecosystem services.
22	2.2.1 Does demand for ecosystem services exceed the supply?	See 2.2
23	2.2.2 Are there trade-offs and synergies between services?	A full answer to this question will include an examination of the different bundles of ecosystem services in the study area and the extent to which the output of any group of services impacts positively or negatively on another. The analysis can clearly be done in terms of the biophysical conditions responsible for service supply, but also in terms of the ecosystem service that what different groups of people want or need.
24	2.2.3 Are there critical ecological, social and economic thresholds that need to be considered in terms of supply and demand?	The notion of critical thresholds is an important one in terms of sustainable management. Is ecosystem change linear or are there points beyond which significant regime shifts occur and there is a collapse in the supply of ecosystem services. While biophysical or ecological thresholds are important, critical shifts in the socio-economic part of the system can also cause collapse, when, say economic or social conditions mean that traditional land management practices are no longer viable.
25	2.3 What kinds of management or policy intervention are relevant or being considered in your area?	This block of questions established the framework in which stakeholders can participate or interact, and hence the dynamics of the socio-ecological system. In addition to public policy, interventions involving Payments for Ecosystem Services (PES) might also be considered.
26	2.3.1 Who has the power or capacity to intervene to manage and sustain service output?	Stakeholder analysis can reveal patterns of responsibility and influence. This question may need to be considered alongside the analysis of the well-being of different groups, and how this determines their interests and motivations. The power relationship between groups is also often a key factor to consider.
27	2.3.2 In what ways do current policy or management interventions affect the sustainability of services? How can this be measured?	The analysis of the drivers of change can help identify how policy or management interventions currently affect the output of services, and how, by changing them more sustainable outcomes can be achieved. It may be necessary to distinguish between biophysical types of intervention and socio-economic ones.
28	2.3.3 How do issues of sustainability impact on the interests and values of stakeholders? What conflicts and coalitions exist between the interest groups?	This question links closely with those relating to human well-being, and will require an analysis of who is involved and what values they hold. It may also entail the identification of winners and losers in terms of changes in the output of ecosystem services.
29	2.3.4 What future visions do the different interest groups have and how do they conflict or support each other?	The goals of the different stakeholder groups can drive change or determine the range of acceptable policy or management interventions. Visioning and scenario exercises may help to provide the evidence needed to address this question, but the response is likely to change over time as the different interest groups learn more about the system they are dealing with.

Governance

Understanding and refining the governance arrangements that affect ecosystem services is often a major concern of those attempting to use the concept operationally. In the multi-level policy-making context of the EU, the effectiveness of regulatory frameworks and other policies is strongly dependent on the vertical and horizontal integration of the respective policies and processes of policy making. While the first highlights the need to consider the interplay of different tiers of decision making and the competencies or authorities on these levels (on supranational, national or subnational levels), the latter concerns the interplay of different policy sectors, such as agriculture, regional policy, and environment and nature protection. All may affect the status of ecosystem services in different and sometimes conflicting ways. Further, given that different stakeholders at different levels may have different perceptions, values and interests, and may try to influence the policy system in different ways, the issue of inclusiveness of policy making, i.e. the form and degree of stakeholder involvement, is an important concern that needs to be addressed.

While some of these important governance issues are covered in the basic set of questions in the ONEX, there are a number of more detailed and specific matters that are helpful to explore. These are brought out through the specific question set shown in Table 11, and summarised in Figure 9.

The queries that nest under Q3.1 are designed to help users identify and better understand crucial governance-related characteristics of the resource management problem they are facing. They are asked to examine whether the issue they face concerns the policy process itself or more general public debates, or not, and then use this understanding to identify the role that regulatory frameworks have in the issue that concerns them. In other words, although it is important to understand the governance arrangements within a study area, it is often necessary to examine how the local issue sits in relation to wider policy issues on EU or national scales. For example, amongst those OpenNESS case studies that have been concerned with governance issues, issues examined included understanding the consequences of EU Water Policy (i.e. the Water Framework Directive) for the delivery of ecosystem services ([Case Study #16](#)), or how to develop a robust method for planning of Green Infrastructure, in the context of the national implementation of the EU Green Infrastructure Strategy ([Case Study #14](#)). Here, from a governance perspective, it is essential to start the analysis by focussing at the respective policy at EU level, before addressing more place-based issues in the remainder of the analysis. The dichotomy is reflected in the structure of the first block of questions in the governance set, being especially emphasised in Q3.1.1.

The second block of questions nested under Q3.2 in the governance set shift the emphasis to understanding stakeholder dynamics in the study area and how these may generate conflicts. These issues have strong links to the concerns covered in the human well-being set and so may either be informed by work already done there or may provide an entry-point for more deeper investigation of this topic area. Whatever the case, to answer all of the questions a number of iterations may be necessary because the evidence required may need to be gathered via detailed institutional analyses and conflict mapping, often involving participatory engagement with stakeholders. The emphasis that Q3.2.1 places on scale is designed to draw out those aspects of the issue that may arise because of the way in which ‘horizontal’ and ‘vertical’ governance mechanisms interact at case study level. The questions in this block conclude by asking the users to review the interplay of formal and informal institutions in the governance arrangements that affect the issue (Q3.2.3).

Figure 9: Relationship between the questions making up the governance set within ONEX

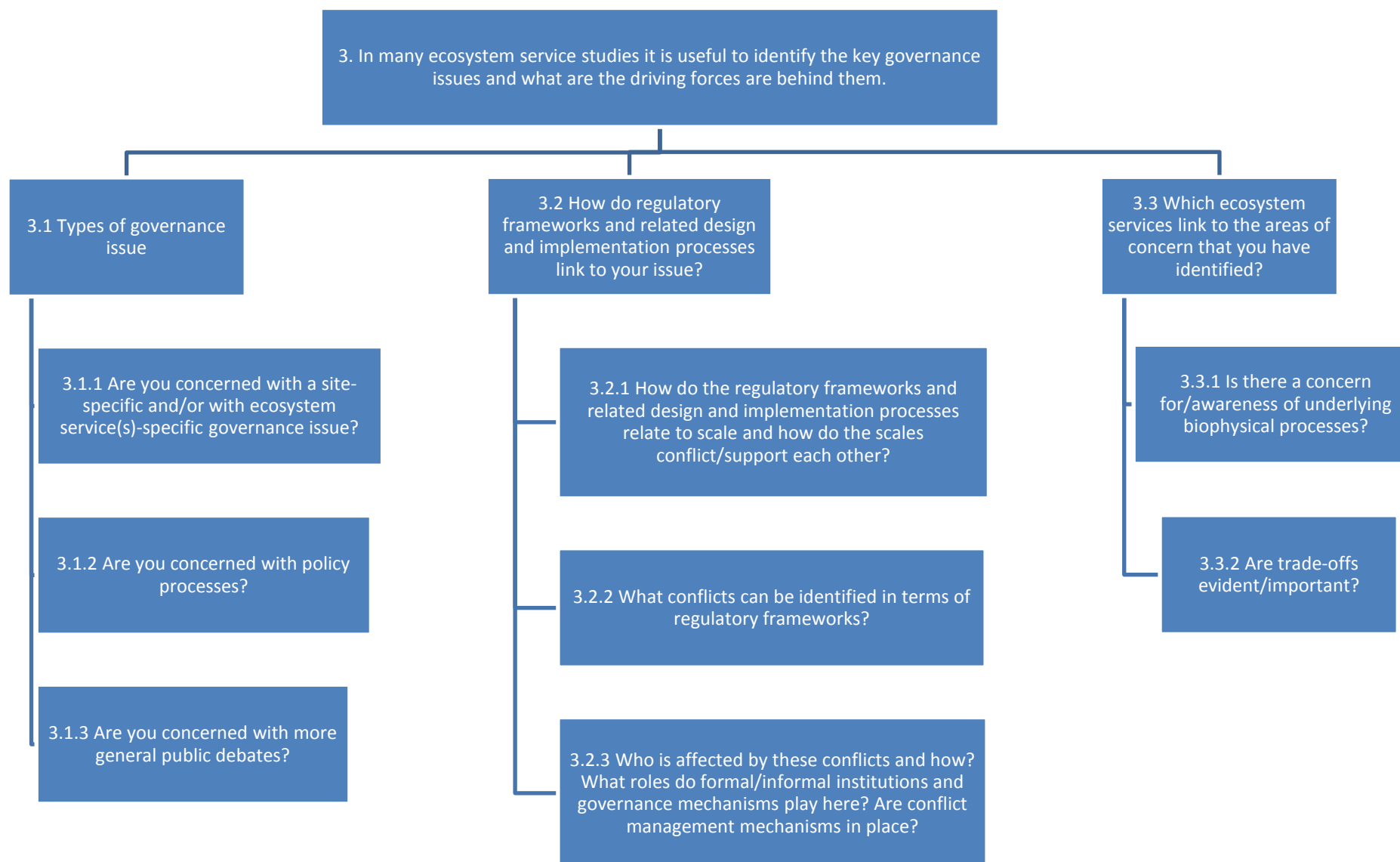


Table 11: The set of questions relating to governance in ONEX and their rationale

Question#	Question	Rationale
30	3. In many ecosystem service studies it is useful to identify the key governance issues and what are the driving forces are behind them.	(Changes in) The provision of ecosystem services are/is determined, among others, by various forms of governance, i.e. processes of formulating decisions and guiding the behaviour of humans, groups and organisations in formally, often hierarchically organised decision-making systems or in networks that cross decision-making levels and sector boundaries
31	3.1 What types of governance issue are you dealing with?	Different types of governance issues may induce different starting points for the analysis
32	3.1.1 Are you concerned with a site-specific and/or with ecosystem service(s)-specific governance issue?	There are many different site-specific factors, including socio-economic, political, and institutional determinants and actor constellations that influence the suitability/ performance of potential governance options and thus need to be analysed. The same is true for ecosystem service(s)-specific governance issues: for example, provisioning services like timber might provide different challenges for the design of effective governance forms than regulating services like pollination or cultural services like landscape aesthetics.
33	3.1.2 Are you concerned with policy processes?	Policy processes like actual or potential policy reforms at different scales/levels and their actual/potential implementation might be the starting point for an analysis of their effects on the (changes in) provision of concrete and place-based ecosystem services.
34	3.1.3 Are you concerned with more general public debates?	General public debates (e.g., on health issues, urban environment, sustainable development) might be the starting point for an analysis of governance issues and determine the suitability and range of (place-specific) governance options. Among others, these debates determine the expectations concerning the benefits of specific ecosystem services.
35	3.2 How do regulatory frameworks and related design and implementation processes link to your issue?	Regulatory frameworks, including their design and implementation features, influence the feasibility and range of governance options to manage ecosystem services provision or might even induce the development of those governance options in the first place.
36	3.2.1 How do the regulatory frameworks and related design and implementation processes relate to scale and how do the scales conflict/support each other?	Relevant regulatory frameworks might be designed at different scales (EU to regional level) and might be implemented at different scales (again, EU to regional/local level). Regulatory frameworks at different scales might complement each other with respect to a certain (ecosystem service-related) objective, or might be conflicting in this regard. Further, authorities tasked to implement a concrete regulatory framework designed at higher scale(s) might (intentionally or unintentionally) support/ foster or impede effective implementation.
37	3.2.2 What conflicts can be identified in terms of regulatory frameworks?	Regulatory frameworks designed/ implemented at different scales/levels or from different sectors might have conflicting objectives and/or might provide contradictory incentives for resource use.
38	3.2.3 Who is affected by these conflicts and how - what roles do formal/informal institutions and governance mechanisms conflict management?	Different actor groups or actors at different levels might be affected differently by conflicting regulatory frameworks. Specific formal/informal property rights on natural resources might foster or mitigate conflicts. Further, conflict resolution mechanisms might be in place to effectively reduce conflicts, or not; or they might not be sufficiently effective.
39	3.3 Which ecosystem services link to the areas of concern that you have identified?	Similar to Q #31 (3.1.1)
40	3.3.1 Is there a concern for / awareness of underlying biophysical processes?	If underlying biophysical processes are (sufficiently) clear and known, or not, determines the range and feasibility of specific governance options. Knowledge gaps or substantial uncertainties, for example, might make the design and implementation of specific adaptive forms of governance necessary.
41	3.3.2 Are trade-offs evident/important?	Concrete regulatory frameworks might result in fostering the provision of a specific - or of bundles of - ecosystem services while having negative effects on the provision of other services. Appropriate forms of governance might be necessary that foster the identification and assessment of these trade-offs and address/mitigate resulting conflicts.

In designing the question set for governance the aim has been to encourage users to build up a picture of the effects of, and interdependencies between, relevant regulatory frameworks and formal and informal institutional arrangements. The assumption is that identifying and structuring the governance-related conceptual and operational issues the question set then encourages users to examine possible short-, medium- and long-term solutions to overcome these problem(s) at hand. These avenues of enquiry are brought out in the final block of questions nested under Q3.3, which focus more particularly on ecosystem services, and especially how policy or management interventions act in biophysical terms (Q3.3.2), and what trade-offs are apparent (Q3.3.3).

Competitiveness

Although the links between social equality, solidarity and competitiveness have been long established, our understanding how they are sometimes connected to environmental issues is often poor. The questions in this part of ONEX have therefore been designed to overcome this gap in thinking that was frequently revealed in discussions with OpenNESS case studies, who often initially did not see the topic as relevant to their work, but who on close inspection recognised that consideration of competitiveness did provide some unexpected insights.

When discussing competitiveness with case studies it was also apparent that the concept itself was often misunderstood. It is important to be clear that the analysis of ‘competitiveness’ is not as much do to with individuals, businesses or other groups within a case study area competing for resources, but rather about the overall standing or status of the area relative to others in social and economic terms. For OpenNESS, the focus has been on how nature, and in particular ecosystem services can affect the way people regard an area compared to others and how this might shape patterns of social and economic investment. In designing the questions on competitiveness in ONEX the aim has been to highlight that the topic is therefore more than one of business growth and economic power, and includes social aspects that enhance the self-sufficiency and investment potential of the place in question.

The focus in ONEX is based on the fact that the EU has recognised that economic competitiveness needs to be considered against, or balanced with, ‘social competitiveness’ and ‘environmental competitiveness’. In relation to the former the EU stresses the need to support social innovation, strong social networks, social justice and equity. In the context of the environment it flags the importance of conservation and sustainable use of heritage, community engagement in conservation, and equitable access and benefit sharing of ecosystem services. This policy has been promoted in a number of ways, including: the Lisbon Treaty, which sets out the goal of a highly competitive social market economy founded on social progress and “a high level of protection and improvement of the quality of the environment” (EU, 2007); and, the Europe 2020 Strategy which aims to work towards a more sustainable competitiveness and “a resource efficient Europe” (EC, 2011). Investment in natural capital is seen as one of the seven flagship initiatives under the Strategy, which also commits to an industrial policy which reduces resource use and promotes sustainability in resource management. Elsewhere, Horizon 2020 has sought to link sustainability and competitiveness across its Societal Challenges as a means of promoting raw materials security, improving well-being, and enhancing resilience to future social and economic shocks (EC, 2014).

Figure 10: Relationship between the questions making up the competitiveness set within ONEX

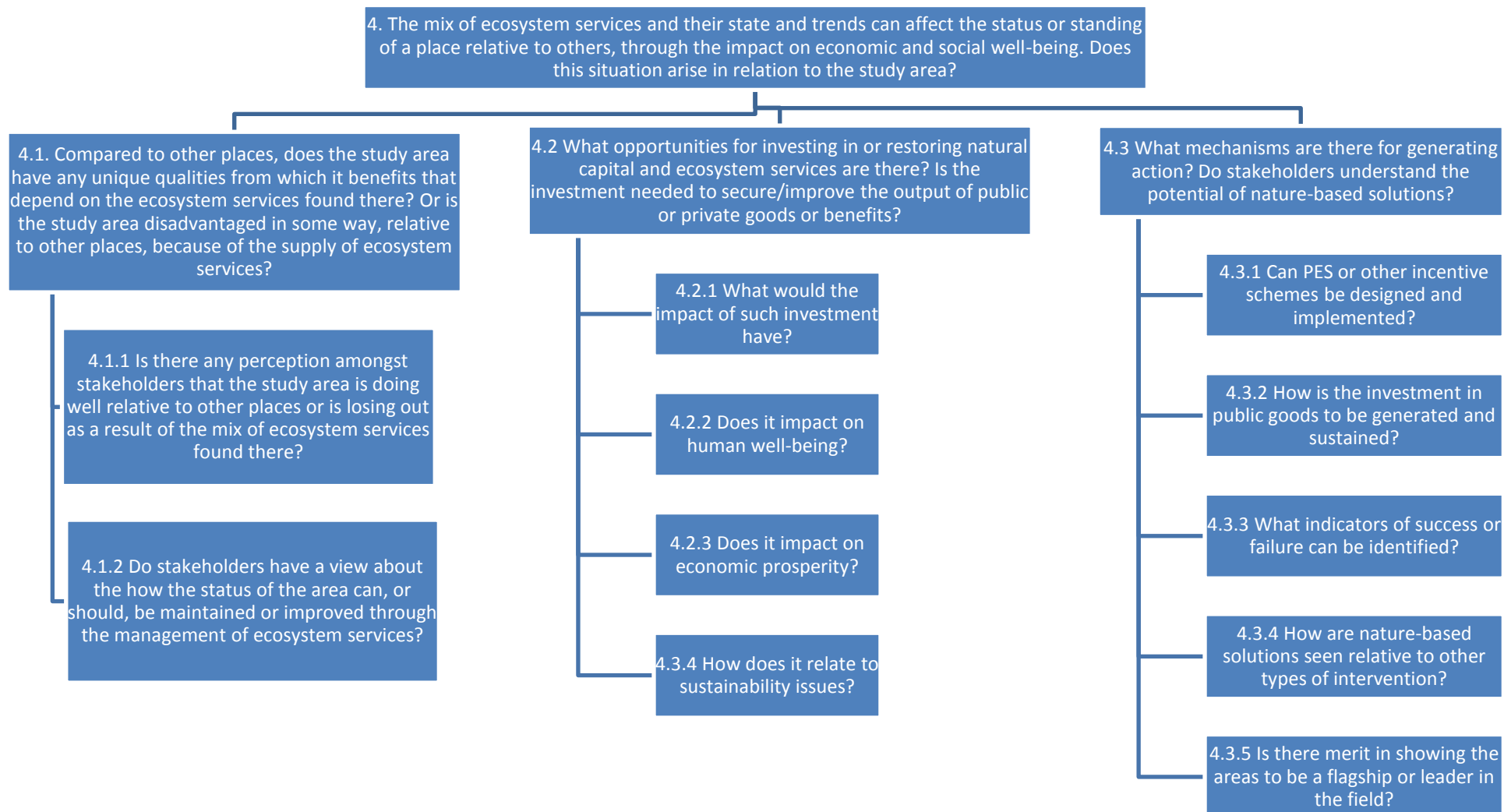


Table 12: The set of questions relating to competitiveness in ONEX and their rationale

Question#	Question	Rationale
42	4. The mix of ecosystem services and their state and trends can affect the status or standing of a place relative to others, through the impact on economic and social well-being. Does this situation arise in relation to the study area?	This set of questions is designed to explore the contribution that the ecosystem services associated with an area make to its standing or status relative to other areas. Although the notion of 'competitiveness' is often interpreted in economic terms, the coal and environmental qualities of a place can also determine how a place is regarded compared to other locations. Is it a good place to live and work in? Often environmental qualities can determine the way people respond. An understanding of competitiveness is therefore not simply about competition between individuals, businesses or other groups, but about how managers of an administrative area – be it a city, rurality, administrative county or wider regional grouping of states – can enhance the standing of that area through the conservation, sustainable use and management of its living natural resources
43	4.1. Compared to other places, does the study area have any unique qualities from which it benefits that depend on the ecosystem services found there? Or is the study area disadvantaged in some way, relative to other places, because of the supply of ecosystem services?	Often the environmental status or standing of a place relative to others, and its implications for social and economic well-being, is a key stimulus for investigating ecosystem services. Often, however, these issues are more hidden - by they can nevertheless be important. This question encourages an exploration of the ways in which nature contributes the unique qualities of the place or locality being studied. In examining the issue it might also be that environmental problems limit overall well-being in some way. Documentation of the contributions or limitations that ecosystem services have in terms of the overall prosperity of an area can be a useful way of identifying the broader impacts of a study.
44	4.1.1 Is there any perception amongst stakeholders that the study area is doing well relative to other places or is losing out as a result of the mix of ecosystem services found there?	Whether people think that an area is competitive, or able to hold its own relative to other places is often a matter of perceptions. This is important to examine people views and this can partly be done by looking at how their well being is supported or undermined by the status and trends of ecosystem services in the area. It is also important to look beyond, however, and understand how those outside the area regard the place and whether the state of nature within it encourage or discourage their involvement the socio-ecological system.
45	4.1.2 Do stakeholders have a view about the how the status of the area can, or should, be maintained or improved through the management of ecosystem services?	This question builds on the understanding of the stakeholders involved in the issue, and how their well-being is affected. This question seeks to identify which dimensions of well-being of the different groups is dependent on the status of the area relative to other places and what role ecosystem service play in this relationship. This kind of understanding is helpful in understanding what environmental qualities need to be sustained or restored over time.
46	4.2 What opportunities for investing in or restoring natural capital and ecosystem services are there? Is the investment needed to secure/improve the output of public or private goods or benefits?	This question seeks to explore what kinds of intervention might secure or enhance the environmental competitiveness of a place. While interventions in the form of public investment might be important (e.g. in terms of improving green and blue infrastructure), private sector investment opportunities should not be overlooked.
47	4.2.1 What would the impact of such investment have?	Understanding the social and economic impacts of investing in nature is often key to making a strong case for support. This question helps identify why 'nature-based solutions' are something that should be considered.
48	4.2.2 Does it impact on human well-being?	See 4.2.1
49	4.2.3 Does it impact on economic prosperity?	See 4.2.1
50	4.3.4 How does it relate to sustainability issues?	Understanding how economic and social sustainability is underpinned by the environment is often key to making the case for conservation or restoration measures.
51	4.3 What mechanisms are there for generating action? Do stakeholders understand the potential of nature-based solutions?	Acceptance of 'nature-based solutions' to social and economic problems will often be determined by the social and economic processes and characteristics of a place. These may facilitate or hinder uptake. This question seeks to identify the context in which action might be framed.
52	4.3.1 Can PES or other incentive schemes be designed and implemented?	Payment for Ecosystem Service schemes (PES) may be a way of securing outside investment, especially if people outside an area depend on the ecosystem services it provides. The design of such schemes requires an understanding of the different groups who have the power to act and who will be affected by the outcomes, and how changes are valued by all the parties concerned.
53	4.3.2 How is the investment in public goods to be generated and sustained?	Nature-based solutions' are only viable if the type of intervention can be sustained in the long term - this question seeks to explore the issues surrounding the viability of such measures and how social and political processes in an area might be changed to ensure sustainability.
54	4.3.3 What indicators of success or failure can be identified?	If competitiveness is about the relative standing or status of a place, then it is important to think of ways in which this can be measured over time so that the success of investment can be monitored. Such monitoring is not just about the changes within the study area, but how the place is regarded from outside by others, and how people living there see their locality in a 'global' context.
55	4.3.4 How are nature-based solutions seen relative to other types of intervention?	Stakeholder and investor attitudes are often vital to the uptake of any nature-based solution. This question seeks to identify what the alternatives are and the kinds of argument that one would need to make for the case of investment in the environment rather than some other type of social or economic measure.
56	4.3.5 Is there merit in showing the areas to be a flagship or leader in the field?	Stakeholder engagement is often key to the generation of action, and in some cases it is apparent that the involvement in a project or initiative that is innovative can motivate people or groups. This is especially so if the work gains attention from outside. This question seeks to examine some of the reasons why the different interest groups might want to be involved or not.

The questions in ONEX have been designed to encourage users to see the concept of competitiveness as an integrating idea that exposes the way in which aspects economic and social prosperity are often underpinned by the qualities of nature. Thus, the first block of questions in the set (Q4.1) are intended to encourage users to think about the standing of the case study area relative to others and how the environment might play a role in how it is perceived, both by the people living and working in the place, and those outside. On the basis of understanding what parts of the environment might need to be conserved or restored, users are encouraged to identify how interventions or ‘investments in natural capital’ can change the output of ecosystem services and the benefits they bring to the area (Q4.2). The questions in this block link strongly to questions on human well-being and sustainable ecosystem management. Thus, the responses may be informed by work done there or may serve to lead the users into these other areas of potential interest.

The final block of questions (Q4.3) in the competitiveness set seeks to identify the types of ‘investment’ that can be made, such as the development of Payments for Ecosystem Service (PES) schemes (Q4.3.1). Users are encouraged to examine how the investments can be sustained (Q4.3.2), and how their success can be monitored (Q4.3.3). The final two questions explicitly use the terminology of ‘nature-based solutions’ because our experience with some of the OpenNESS case studies is that they saw themselves as being a kind of advocate for nature. These questions therefore encourage them to examine how others see the advantages of investing in nature to improve the standing of the place, and hence what the barriers to success might be. The status of a place can often be enhanced by showing that policies and practices are innovative, and so the extent to which this perspective might be important is flagged up in Q4.3.4.

Using the conceptual nexus

As noted in Part 3 of this document, the conceptual nexus (that is the set of questions and their links) must be seen as distinct from the TRELLO platform selected as a way of prototyping the approach. Indeed, users are free to use the question set as a spreadsheet, in the format of the Tables provided in Part 4, or more the material to a mind-mapping tool. The knowledge broker may even simply select questions from the lists provided and use these on flip-chart or questionnaires in order to gather the views and reactions of stakeholders. The important point is that users should adapt the material in ways that best suit their needs. Moreover, users should be encouraged to adapt and change the questions as their problem or issue dictates. However, while the question set is the essential core of ONEX, the need to provide people with flexible and distributed access to the material and to find ways of sharing the outcomes of discussions with others does mean that we have to consider how the material might most easily be accessed. With such considerations in mind we have therefore selected TRELLO as a suitable ‘means of delivery’. In the final part of this document we provide an account of the way ONEX has been set up in TRELLO and explain how it can now be used operationally.

Part 5: Using ONEX on the TRELLO Platform

Introduction

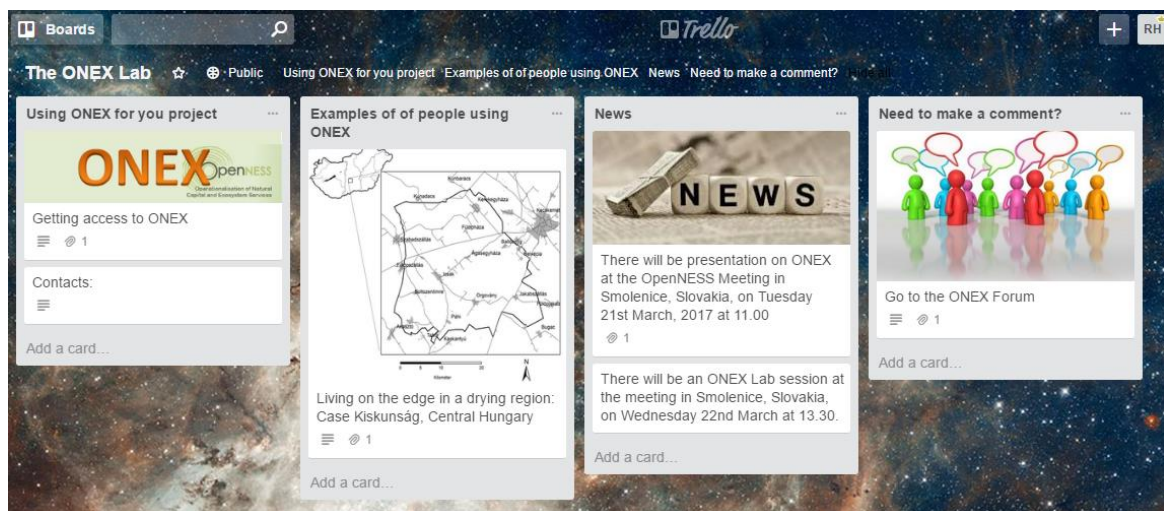
The purpose of making the OpenNESS conceptual network available via TRELLO is to provide a sufficiently advanced implementation to enable the approach to be tested and discussed. ONEX is best seen as a ‘working environment’ intended for groups of people needing to collaborate on an ecosystem service issue. The aim is to help them explore how ideas are linked and how a richer picture of a problem can be developed by discussing them collectively. TRELLO provides a sufficiently robust and flexible platform on which this approach can be tried and evaluated.

In this final part of the Report, we describe how users can get access to the working prototype of ONEX and how it can be customised. We also provide an example application.

Getting Access to ONEX

Although ONEX on TRELLO is a ‘stand-alone’ application, we anticipate that many potential users will find it via the OpenNESS website or OPPLA. By following the appropriate link users will be directed to what we have called the ‘ONEX Lab’ (Figure 11), which acts as an intermediate step or gateway into the system.

Figure 11: The ONEX Lab – the Gateway to the conceptual nexus



The purpose of the ‘Lab’ is five-fold:

1. To provide a single web-link that can be used by OPPLA or any other web tool, to direct users to all the ONEX resources. This enables new versions of ONEX to be developed and made available without the need to update every link address on all other systems.
2. To provide a means of downloading a copy of ONEX that can be customised by the user once they have registered to use TRELLO. We will refer to this version of ONEX as the ‘**ONEX Template**’
3. To provide access to case study applications that have used ONEX on the TRELLO platform so that the experience of using the approach can be shared.

4. To provide a 'news' portal that could be used to stimulate and develop a community of ONEX users.
5. To provide access to a public forum in which users can make comments about ONEX.

Although the cards on the ONEX board can only be edited by the administrator, the system has been set up so that users can make comments on all the lists – including that labelled 'forum'. This is to ensure that as much feedback can be provided as possible.

The ability to download and make a copy of the ONEX question set and associated resources is perhaps the most important function for the 'Lab'. The intention is that the structure provided is a starting point and that user groups develop the material on the ONEX Board as they explore their own problem or issue. Since their problem is unique and potentially confidential, it is essential that they have controlled access to their own ONEX Board and that they can modify it in any way they want.

Thus, when new users new to TRELLO are directed to the 'Lab' they will be invited to register for free use of the system, and this will enable them to make a copy of the ONEX Template. They can name their version of the template board in any way they wish. From this point on users have full editing and commenting rights, and the ability to share their version with others. The ONEX Template from the 'Lab' can only be changed by the administrator. For all other users it is 'read-only'.

Once users have registered on TRELLO they can open the 'Lab' Board and their version of ONEX like any other TRELLO user who has logged in; they do not have to visit the ONEX 'Lab' unless they want to.

While the ONEX Template has a unique web address, users are not encouraged to circulate this directly for others to use, because when new versions of ONEX are created then the link will no longer be available. If users want to share information about ONEX then they should use the 'Lab' address: <https://TRELLO.com/b/sm1IX0S0>.

Using the ONEX Template

The downloadable ONEX Template is shown in Figure 12. Four of its constituent lists are shown³. Users are provided with a list of cards on the far left, describing what ONEX is, how to use it and information about the work that has generated it. The list second from the left is the set of questions making up the conceptual nexus. Note that both these lists contain many more cards than those shown in Figure 12; users can display them by scrolling down.

The left hand list contains all the information that users will need to use ONEX on TRELLO. In terms of the operation of the TRELLO Board users are directed to the extensive tutorial, help and community resources that have developed around the application. When using it to work with ONEX users are advised to proceed according to the description on the card 'Working with ONEX' (Figure 13).

Experience with early versions of ONEX suggests that users should try to keep the structure as simple as possible, especially when working with groups over extended periods. Thus, the card shown in Figure 13 suggests that it is assumed that there is an individual or a small team acting as a knowledge

³ Note, these screenshots are taken using a version of Chrome that has a number of TRELLO extensions implemented, including one that allows lists to be hidden and displayed using the strip to the right of the board name.

broker, who will be responsible for moderating and summarising the discussion (and editing the cards where appropriate).

Figure 12: The downloadable ONEX Template

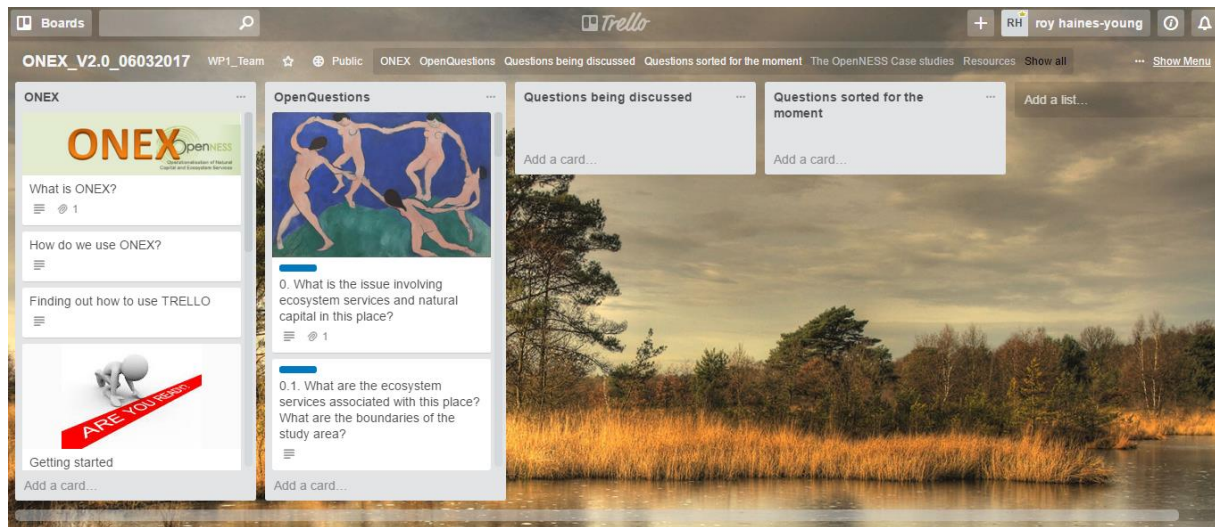
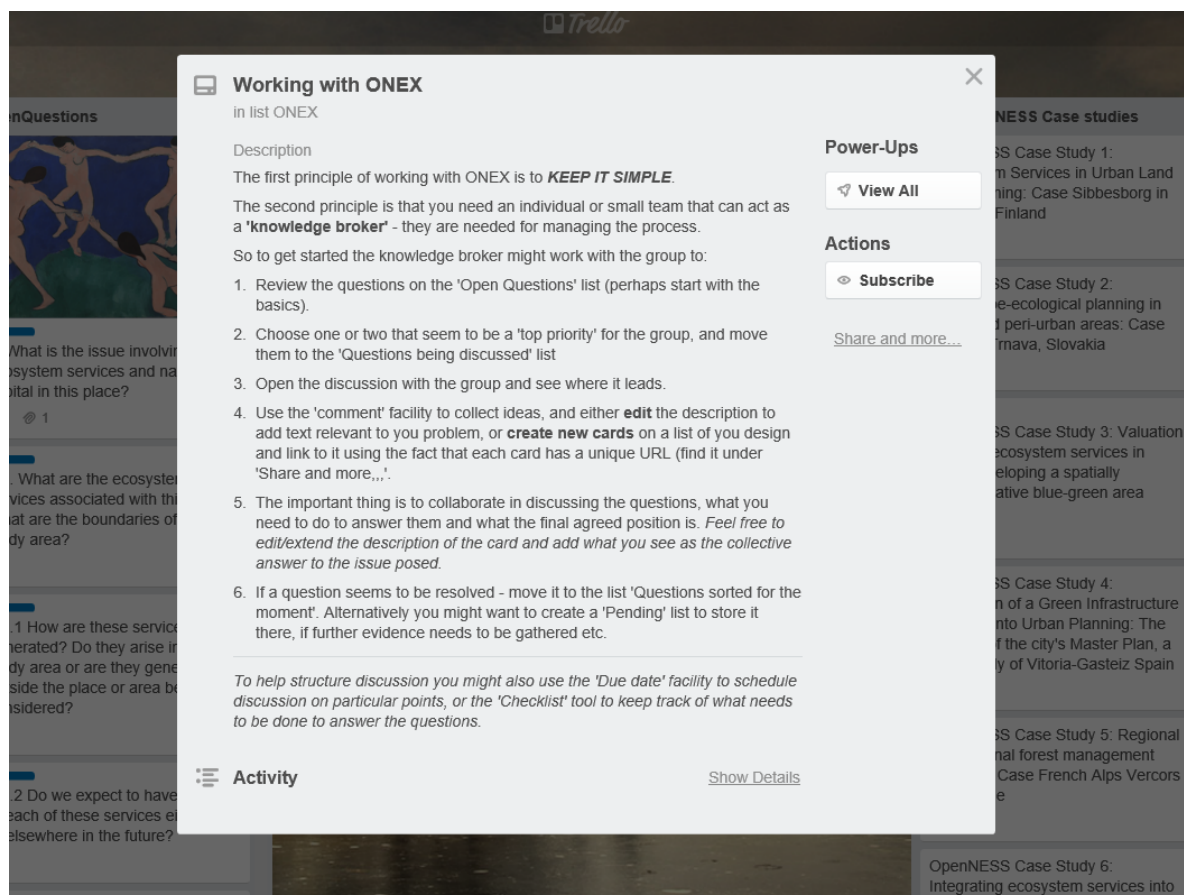


Figure 13: The 'Working with ONEX' card

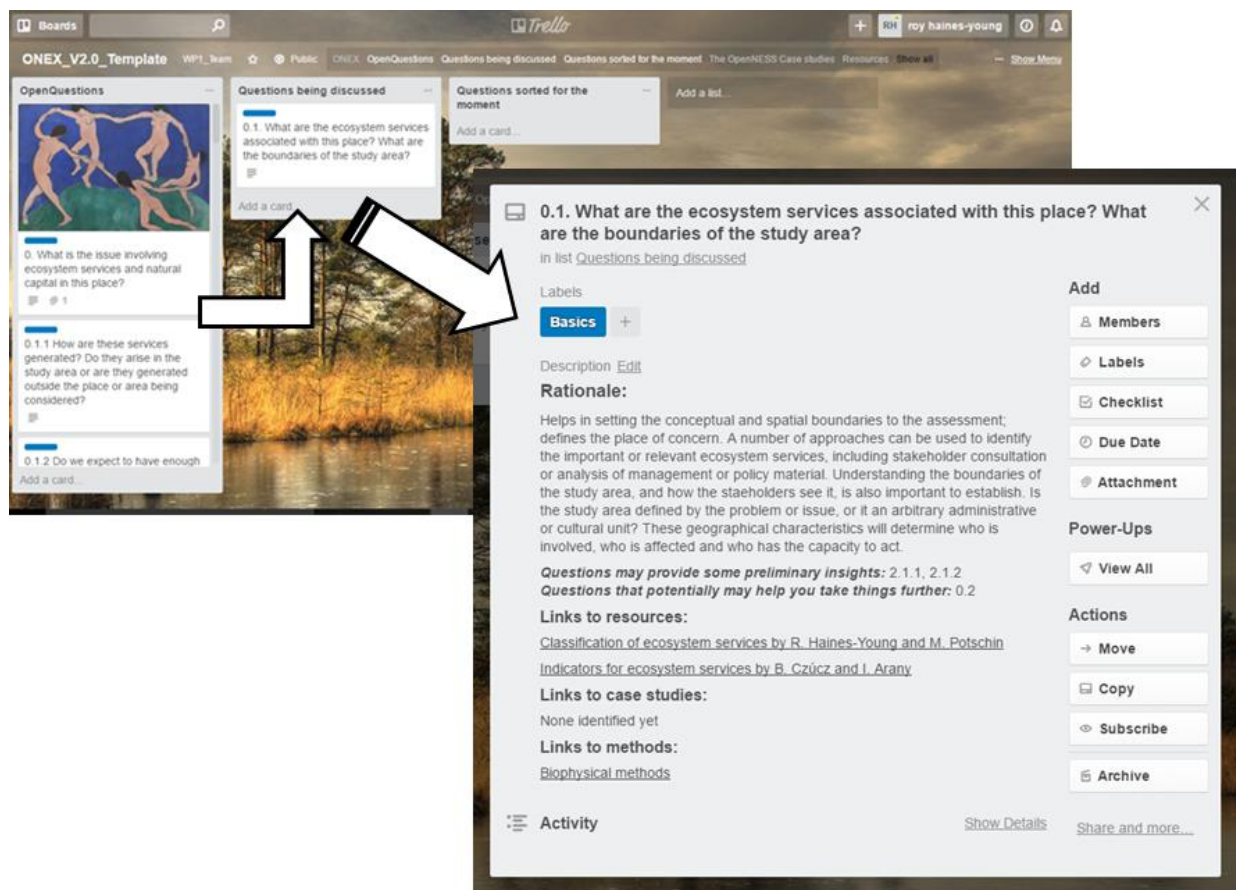


The knowledge broker might then work with the members of a group who are collaborating on resolving an issue by reviewing the questions on the 'Open Questions' list. After discussion they may choose one or two that seem to be a 'top priority' for the group, and then move the relevant cards over to the 'Questions being discussed' list. The knowledge broker should then encourage further focussed discussion of these points and 'see where it leads', by using the 'comment' facility to collect ideas. The knowledge broker can then either edit the description of the card relating to the particular question and add text summarising the view of the group and/or or create new cards on a list on their version of the ONEX Board that is particular to the study. The knowledge broker can link to these new cards, using the fact that each card on a TRELLO Board has a unique URL. If the group members deem that a question is resolved then they can agree to move it to the list called 'Questions sorted for the moment'. Alternatively, the group might want to create a 'Pending' list to store it there, if further evidence needs to be gathered, etc. To help structure the discussion the knowledge broker might use the 'Due date' facility to schedule comments on particular points, or the 'Checklist' tool to keep track of what needs to be done to answer the questions.

Other tools that can be used to support discussion include:

- the facility to use e-mail to create a new card; each board has a unique e-mail address, and new cards generated by users can be made to appear in a designate place; and
- a notification system that informs users that either a card or board they subscribe to has had a comment made about it or been changed in specified ways.

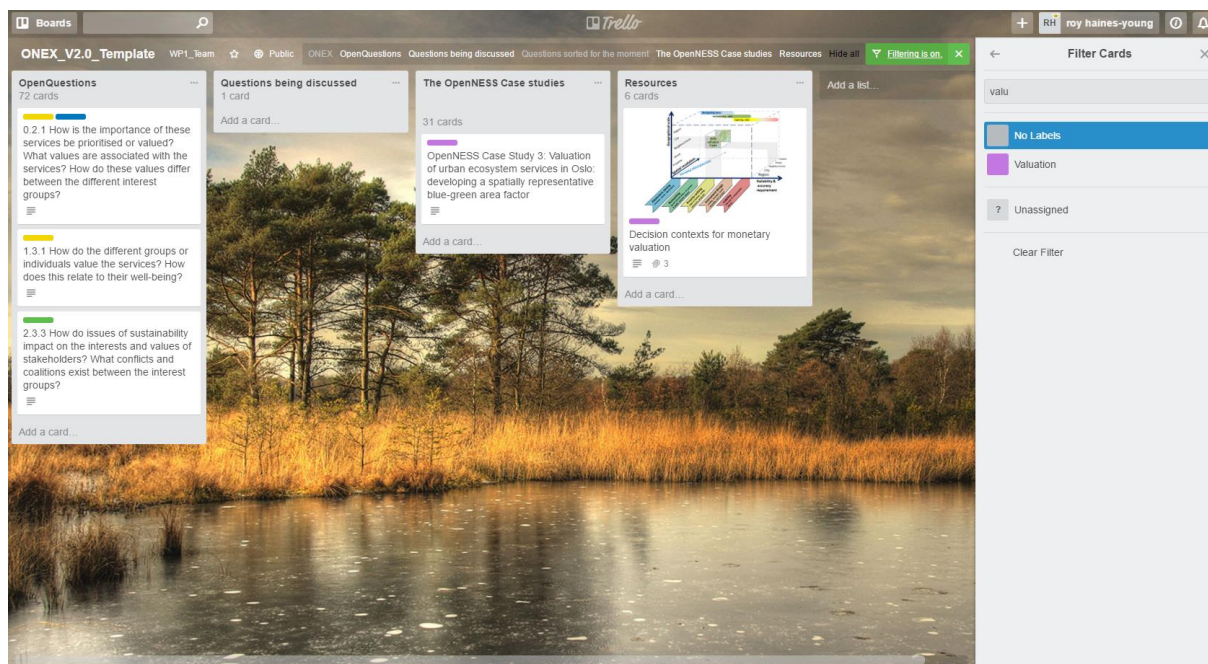
Figure 14: Example of moving a card between ONEX lists and the 'reverse' side of an ONEX card



An example of how the board might be used is shown in Figure 14. Here, question ‘0.1 What are the ecosystem services associated with this place? What are the boundaries of the study area?’ has been moved to the ‘Questions being discussed list’. The card has also been activated to show the reverse side. As illustrated in Figure 14 this reverse side sets out the rationale for the question. In addition, it provides suggestions for which questions may have already provided some preliminary insights, if they had been addressed, and which questions might be considered as a follow-up. Clearly, users can address questions in any order they think fit. However, these links are offered as suggestions based on our analysis of how the key concepts surrounding ecosystem services are related to each other. Finally, the card shown in Figure 14 illustrates how links to background resources, relevant case studies and potentially relevant methods identified by OpenNESS can be provided. The resources currently referenced include all the OpenNESS Synthesis Papers and Briefing Notes, relevant OpenNESS Deliverables, and some selected papers from the scientific literature. These links can be changed or added to in the version of ONEX created by the users so that the group can build up its own body of material that is relevant to their needs.

The example card shown in Figure 14 also illustrates how cards can be ‘indexed’ so that they can be quickly filtered by the users to find questions that might be relevant to their concerns. For example, the card has been labelled as belonging to the ‘Basic’ set, and the blue label can be used in the filter tool provided by TRELLO to select only cards in this group. Alternatively, users can type words into the filter tool and TRELLO will find all those cards that contain reference to this ‘key word’. The result of this kind of operation is shown in Figure 15. Here, the user has entered the text ‘valu’ in order to find cards containing the work ‘value’ or ‘valuation’, and TRELLO has identified three relevant questions, one case study and one resources card.

Figure 15: Illustration of the filter tool in TRELLO, selecting all ONEX cards that contain the word ‘value’ or ‘valuation’

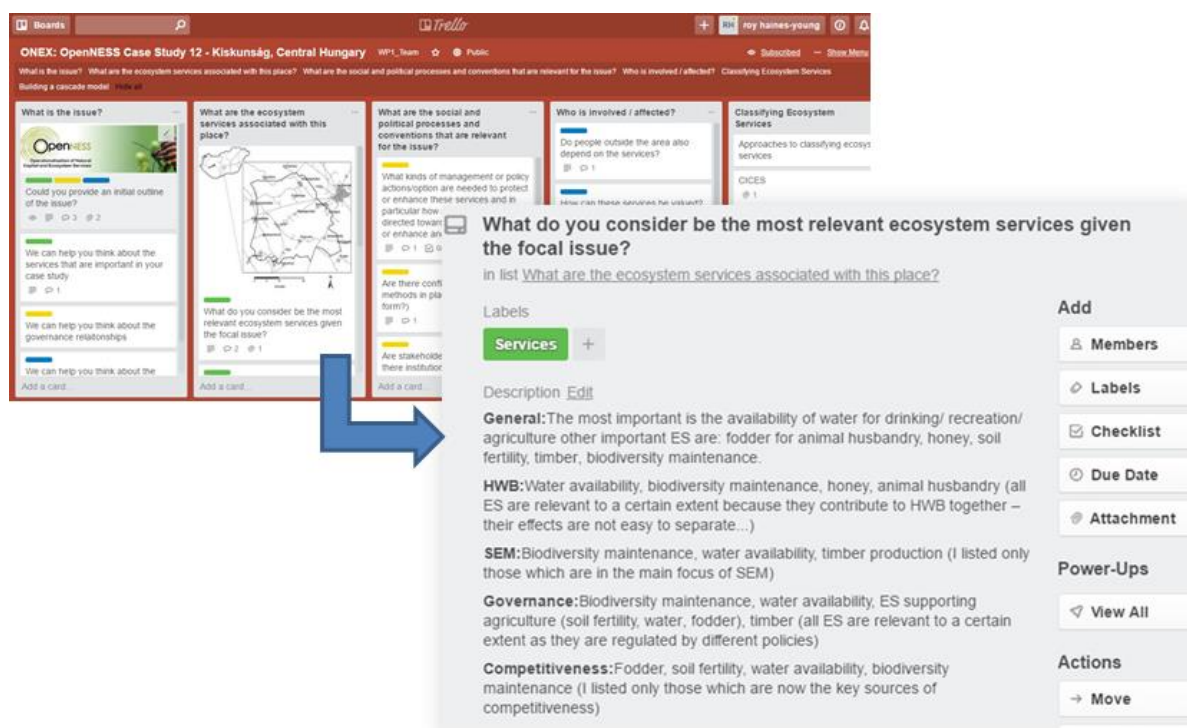


The case study and resources cards shown in Figure 15 are drawn from to final lists that are provided by the ONEX Template. The former contains a listing of all the ONEX case studies; each card has a link to the relevant material on the OpenNESS Website. The latter is a set of resources generated by the WP1 team and its partners, which includes the conceptual maps that underpin ONEX (see Part 4), plus links to documents and other resources relating to the work on ‘Valuation’, ‘Stakeholders’, the ‘Cascade Model’ and ‘CICES’ that has been done in OpenNESS. The intention is that other resources can be added by users if they are identified as relevant for the problem or issue at hand.

Developing ONEX Applications

In order to develop ONEX in ways that are useful operationally the WP1 team has worked closely with the case study from Kiskunság, Central Hungary. The case study leader used an early version of ONEX to think through the implications of questions relating to the four challenges, as well as an initial version of the general set. Although the responses were initially collected using a spreadsheet (Appendix 1), the material was transferred to an early version of ONEX as an example of what a ‘real-world’ application would look like (Figure 16). This case study is available via the ONEX LAB. Time and resource limitations have meant that we have been unable to develop other case study applications during OpenNESS. However, we hope that through systems such as OPPLA, people will be encouraged to use the current version of the conceptual nexus and document their work via the ONEX Lab.

Figure 16: The application of a prototype version of the conceptual nexus in the Kiskunság case study, Central Hungary



Part 6: Summary and Conclusions

The aim of this Deliverable is to provide a set of conceptual guidelines for those seeking to use the idea of 'ecosystem services' to help them solve problems that confront society. Although the definition of ecosystem services as 'the contributions that ecosystem make to human well-being' seem to be a relatively simple and straightforward one, its application is complex. When the idea of ecosystem services is used operationally, it often involves groups of people coming together to resolve an issue. This type of problem solving can be complex because:

- it will almost certainly involve people sharing and criticizing ideas;
- it will involve making judgments on the basis of uncertain or incomplete evidence; and,
- the positions of those involved may change over time as they learn more about the problem at hand.

ONEX has therefore been designed as a 'working environment' to help groups manage these difficulties, especially when that collaboration takes place over an extended period of time. It is an environment in which 'structured decision making' can occur. The intention has not been to offer 'solutions' but to help people 'map out' the key concepts in the field so that they can arrive at a potentially better understanding of their issues. ONEX does this by helping people to navigate between concepts and to build a collective understanding of them. As a result, they are better placed to identify what methods and evidence might be appropriate for answering their questions.

The need for people to collaborate has been met by setting up ONEX as a social media tool on the Trello Platform. We have chosen Trello because it is widely used for project management and problem solving. It is also freely available and there is an active user community whose experience can be helpful to those using it for applications. As a result, ONEX can be used by people to better identify their problem and the place of ecosystem services within it, and to make an assessment of the ecosystem services that are relevant to their work. The operational prototype is customisable, and so groups can adapt and extend it in ways that are appropriate for their work. We anticipate that such groups will be led by a knowledge broker who can help shape and summarise discussions, and manage ONEX in ways that are appropriate for tackling the problem or issue at hand.

To help users navigate the conceptual nexus we have indicated how the questions are linked to each other. Although we have also index the questions a priori by theme, the analysis of the network structure indicates that there is a core set of questions that might well be an efficient 'entry point' for users. These are the questions that have the largest number of follow-up links. The six most linked questions are listed in Table 13 and their position in the nexus is indicated in Figure 17. The questions concern the identification of the ecosystem services in the study area, the people or groups most affected by the issue and the governance processes. To assist users, we have indexed this subset of core questions as 'setting the scene' in TRELLO.

The analysis of the network structure also indicates which questions appear to be most dependent on other preliminary issues being settled. These are also listed in Table 13. Significantly they appear to cover some of the most difficult application issues that often arise in work with ecosystem services, such as the way stakeholders prioritise or value the importance of ecosystem services, management and policy issues, and conflicts between interest groups. We anticipate that by working through the nexus users will build up a robust, shared understanding of the situation that enables such 'endpoints' to be addressed.

Figure 17: The question structure in the ONEX conceptual nexus (blue circles refer to core questions in Table 13)

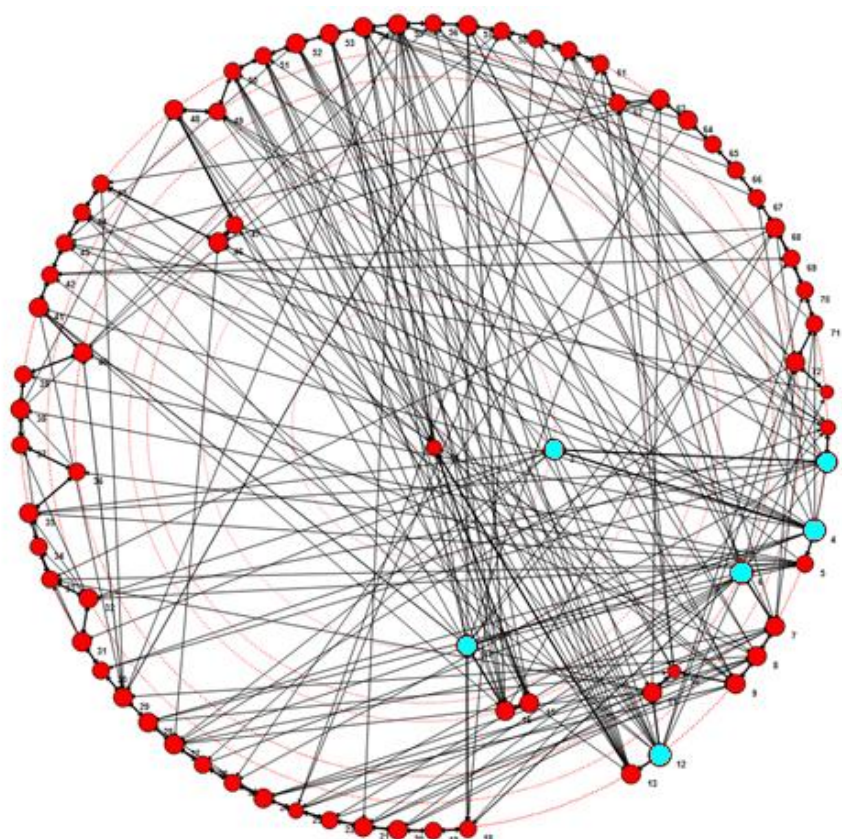


Table 13: Core questions in the OpenNESS Conceptual Nexus

Key to Fig 16	Questions that open up most follow-on issues
2	0.1 What are the ecosystem services associated with this place? What are the boundaries of the study area?
3	0.1.1 How are these services generated? Do they arise in the study area or are they generated outside the place or area being considered?
4	0.1.2 Do we expect to have enough of each of these services either here or elsewhere in the future?
6	0.2 Who is involved or affected by changes in the services associated with the area?
12	0.3 What are the social and political processes and conventions that are relevant to the issue?
17	0.3.5 What seems to be the most appropriate pool of policy options/actions to achieve positive outcomes?
Questions that need most preliminary issues to be resolved	
7	0.2.1 How is the importance of these services be prioritised or valued? What values are associated with the services? How do these values differ between the different interest groups?
16	0.3.4 What alternative policy or management actions can be identified?
17	0.3.5 What seems to be the most appropriate pool of policy options/actions to achieve positive outcomes?
27	1.3.2 How do the dimensions of human well-being relate to the prioritisation of ecosystem services?
33	2.1.1 If you are dealing with a managed system, or a cultural landscape, how do traditional land management practices influence service output?
37	3.2.2 What conflicts can be identified in terms of regulatory frameworks?
38	3.2.3 Who is affected by these conflicts and how - what roles do formal/informal institutions and governance mechanisms conflict management?

As part of the OpenNESS Project, ONEX also provides a gateway to key issues related to human well-being, sustainable ecosystem management, governance and competitiveness. These were chosen as a way of showing how the ecosystem service concept can contribute to a range of societal problems. While these four challenges have provided an initial focus for ONEX there are clearly many other areas of societal concern where ecosystem service thinking can provide a 'nature-based solution'. For example, further questions linked to issues around ecological restoration, green infrastructure or resilience could also be added to the questions set. We hope that a people explore the idea of using a 'conceptual nexus' in an operational context, these other problem foci will be added to what we have provided here.

The successful application of the ecosystem service concept depends on effective social learning. This needs to occur both within groups as they work together on a common issue, and between people in the wider community so that experience can be shared and evaluated. Although the main focus of our work has been to support social learning at the individual project level, the design of ONEX is such that project outcomes can be documented and made available to others. The ONEX Lab has been created as a place where case studies can be made available and the experience gained in using ONEX pooled.

In the introduction to this deliverable we identified a number of criteria by which the effectiveness of social learning tools and processes might be judged (see Table 1). In creating ONEX and making it operational via a social media platform we have sought to create a working environment that can 'make a difference' in terms of peoples understanding. The feedback we have gained from case studies suggests that the question set can indeed open up new perspectives. The structure of ONEX means that the rationale for the question set can be provided, and in working with a knowledge broker responses and agreed positions can be documented in an open and transparent way. ONEX can be customised and it is therefore able to be tailored to meet the circumstances of a given problem situation, and the emphasis that we have placed on supporting deliberative processes means that different views can be taken into account in a way that does justice to those involved. The self-documenting nature of ONEX on the TELLO platform means that participants are kept informed over the kind of extended period that is often needed to solve the wicked problems that surround ecosystem services.

The final criteria for the evaluation of the effectiveness of deliberative public engagement concerns the need to evaluate and learn from the process. In creating and designing a conceptual nexus as a we acknowledge that we are at an early stage in the development of such social media tools and that a more solid body of applications needs to be gathered before one can say that they do help us apply the ecosystem service concept operationally. ONEX must therefore be regarded very much as a 'work in progress', and as people try to use it we will learn more not just about their problems, but also the ways groups come together to find a collective solution to the issue that confront them.

Conceptual thinking is the basis of any attempt to solve a problem or resolve an issue, because it is about the way we look at and understand the world around us. However, concepts are not just a matter of definitions, and it is often the case that we cannot truly understand them until we have attempted to apply them. Our work in OpenNESS is based on the proposition that problem solving is a highly creative undertaking, and in creating ONEX, we have sought to show how conceptual thinking can be supported in ways that might inspire new perspectives and deeper understandings of the ways in which people and nature are linked.

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Appendix 1: Testing the initial version of the OpenNESS Conceptual Nexus

(by Eszter Kelemen)

A1.1 Introduction

The Kiskunság case study was used to test the preliminary version of the OpenNESS Conceptual Nexus (ONEX)⁴. The goal was to examine how the heuristic could help in understanding the context, defining the major problems and choosing appropriate concepts and tools to solve them in a 'real life' situation. The approach was 'informal' in the sense that it involved just one 'key informant' from the case study and the knowledge and perspectives that she had about the area. However, the WP1 team felt that an application of ONEX at this early stage could throw up a number of critical insights on which future work could build. It should be emphasised that our key informant had both a deep understanding of the issues in the case study area itself and a thorough knowledge of the work being undertaken across the entire OpenNESS consortium. Thus, the feedback provided was invaluable in terms of judging the success of ONEX as a synthesising tool.

Since the details of the case study may be unfamiliar to the more general reader, before the results of the test are reviewed it may be useful for them to read the general summary of the case study in the next section, before proceeding to section A1.3. In the final section of this Appendix we record the feedback received from this test case.

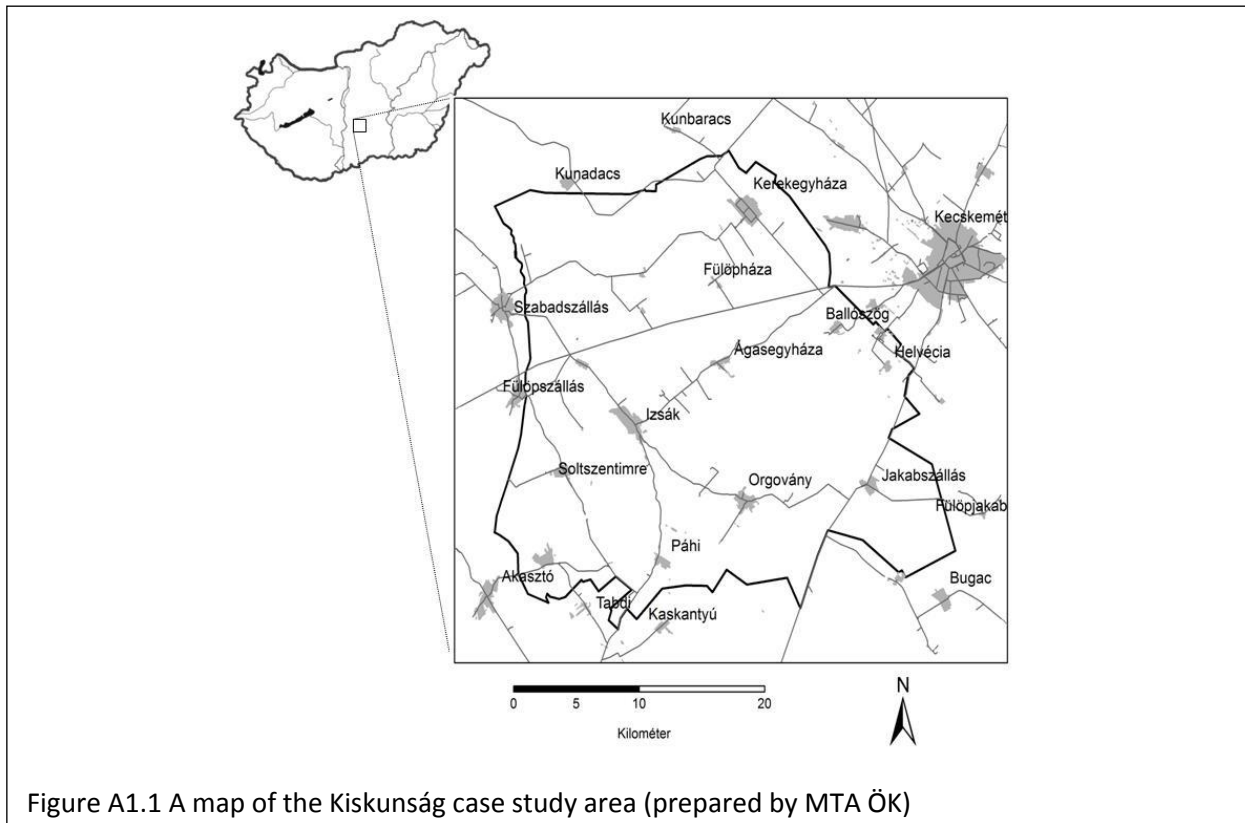
A1.2 Background to the Kiskunság case study

Kiskunság Sand Ridge is an 8300 km² semi-arid lowland region with large extents of inland sand dunes and shallow alkali lakes in Central Hungary (Figure A1.1). Traditional land-uses include grazing, as well as small-scale arable fields, vineyards, and orchards. In the last 50 years, drainage, intensive farming and timber plantations have profoundly transformed the landscape, leading to shifting patterns of abandonment and cultivation, as well as depopulation of the rural areas. Since 1947 the Directorate of Kiskunság National Park has been operating in the area to protecting the unique habitats and the rare and endangered (often endemic) species of the region. Beyond being protected by the Hungarian Law (national park), several parts of the research area belong to the EU's Natura 2000 network and the Ramsar Convention.

During the last 40-50 years the area experienced a significant drop of the groundwater table level. The majority of saline lakes, swamps and meadows are drying or already dried out (almost all of the small lakes disappeared and become pastures), wetland vegetation is suffering and continuously shifting towards less specialized, drought-resistant species. Water scarcity has also impacted small-scale farming through decreasing yields, and has led to land abandonment and land use change (i.e. turning previous pastures into arable land, grazing more sheep than cattle). Despite several research projects aimed at understanding the causes of aridification, there is no agreement on which factors contributed to the water table drop to what extent. There is no doubt today, however, that beyond

⁴ ONEX was tested on the Kiskunság case by Eszter Kelemen (ESSRG), but the knowledge and data used to run the test is the joint result of the Hungarian case study team. We are grateful to Ildikó Arany (MTA ÖK), Réka Aszalós (MTA ÖK), Bálint Balázs (ESSRG), Györgyi Bela (ESSRG), Bálint Czúcz (MTA ÖK), Ágnes Kalóczkai (ESSRG & MTA ÖK), Miklós Kertész (MTA ÖK), Orsolya Lazányi (ESSRG), Boldizsár Megyesi (ESSRG) and György Pataki (ESSRG) for their contribution to the case study analysis.

local human interventions (i.e. drainage, increasing proportion of forest plantations, illegal wells for irrigation, oil and gas test-drills) climate change has also contributed to the present situation.



As one of the key problems of the Kiskunság region is groundwater table drop, water resupply is seen as a necessary action to prevent the loss of ecosystem services. A water resupply project initiated by the Ministry of Agriculture (former Ministry of Rural Development) and implemented by the General Directorate of Water Management has been planned in the northwest border of the study area. This project, also supported by the Kiskunság National Park Directorate (KNPD), aims to reconstruct the habitats (burying several drainage channels and constructing the infrastructure necessary for water resupply and retention) in order to restore alkali lakes and meadows. Due to this project, an improved status of biodiversity, better water availability, and increasing drought resistance of the region are expected. However, conflicts may emerge between farmers, forestry managers, water authorities, and the KNPD due to the trade-offs between locally important provisioning (e.g. animal keeping) and regionally important regulating (water regulation) services. The main goal of our OpenNESS case study is therefore to identify the potentially emerging conflicts, analyse them in terms of ecosystem services flows, associated costs and benefits, and resolve the problems in a participatory way as much as possible.

Our case study builds on several previous research projects (e.g. Kertész et al., 2011; Kelemen, 2014; Kelemen et al., 2014) and applies an inter- and transdisciplinary approach. The core research area within the whole Kiskunság sand ridge has been delineated according to the borders of the planned water replacement project (see Figure A1.1). Key methods and approaches that have been applied during the OpenNESS project include: (1) stakeholder analysis including document analysis and semi-structured interviews, (2) institutional analysis of land property rights and the formal and informal institutions regulating the use of the groundwater, (3) preference assessment of key ecosystem

services, (4) indicator development and quantification of the major ecosystem functions and services (targeting the first three levels of the cascade) by the help of QuickScan, ESTIMAP, BiomBGC, statistical models and GIS data analysis, (5) a three-stage participatory scenario planning process including the selection of key drivers, the development of alternative future scenarios, and the informed decision regarding the most favourable scenario.

A1.3 Results of testing ONEX in the Kiskunság case study

The results of the test are reported in Table 3.1, which sets both the questions and the responses from the key informant, who worked through them in her own time. The ‘test’ involved the key informant going through all the questions suggested by the preliminary ONEX, step-by-step. She was asked to play the role of a ‘knowledge broker’ who was seeking both to develop a deeper understanding of the issues that relate to the case study area, and who might want to organise that knowledge in ways that can be accessed and developed by others. She was asked to try to provide an answer to the overarching questions, and then develop more specific responses in relation to the four OpenNESS Challenges. In order to reduce the demand on the key informant she was asked only to answer the questions in ONEX using information that they had to hand. Crucially, she was asked to consider issues related to the framing of the questions, such as overlap, ambiguity or obscurity, or any gaps in the coverage of concepts that may have led to important issues being overlooked in the case study. Remarks from the key informant are also recorded in Table 3.1.

Table A1 Testing ONEX in using the Kiskunság case study

	General	HWB	SEM	Governance	Competitiveness	Remarks
1. What are the ecosystem services associated with this place?	The most important is the availability of water for drinking/ recreation/ agriculture other important ES are: fodder for animal husbandry, honey, soil fertility, timber, biodiversity maintenance	Water availability, biodiversity maintenance, honey, animal husbandry (all ES are relevant to a certain extent because they contribute to HWB together – their effects are not easy to separate...)	Biodiversity maintenance, water availability, timber production (I listed only those which are in the main focus of SEM)	Biodiversity maintenance, water availability, ES supporting agriculture (soil fertility, water, fodder), timber (all ES are relevant to a certain extent as they are regulated by different policies)	Fodder, soil fertility, water availability, biodiversity maintenance (I listed only those which are now the key sources of competitiveness)	General: easy to answer, no special expertise is needed beyond knowing the ES framework. Case specific: in case 12 it was uneasy to separate the key ecosystem services along the four challenges, almost each ES is relevant for each Challenge Links to other material: SPs on bundles, cascade, classification, link between biodiversity & ES
1.1. How are these services generated? Do they arise locally or are they generated outside the place or area being considered?	They arise locally, but external drivers influence the human interventions which either support or destroy the services	HWB only partly depends on locally generated services, it is possible to substitute some ES from national/global scale if the local ecosystem is not able to provide them (e.g. food, herbal plants) – but this substitution may result in lower	Past & current SEM practices influence the provisioning of ES – i.e. intensive production decreased soil fertility, canalization decreased water availability, but on the other hand ecotourism increased because local people/ organizations	Policy changes are one of the key factors influencing the generation of ES (e.g. financial support for timber plantation favours timber but harms biodiversity maintenance	The local origin of certain ES (especially traditional food products) and their relationship to nature protection (i.e. they are environmentally friendly products) highly contributes to competitiveness	General: easy to understand the question, relatively easy to answer if ecological knowledge is available Case specific: different Challenges can relate to ES generation in different logical ways: HWB and competitiveness are the “results” of ES generation, while SEM and policy are influencing ES generation Links to other material:

	General	HWB	SEM	Governance	Competitiveness	Remarks
		HWB	started to provide facilities and attractions			SPs on bundles, classification, link between biodiversity & ES, biophysical methods (WP3)
1.2. Do we expect to have enough of each of these services either here or elsewhere in the future?	<p>Already problematic: water (generally not enough but at some parts of the area there is too much inland water)</p> <p>Decreasing quality: soil fertility, biodiversity maintenance</p> <p>Seemingly enough: timber, honey, fodder (although different stakeholders have different ideas on what is “enough”)</p>	<p>Although nowadays in general almost each of these services are enough in quantity, they are not equally accessible by different groups, and hence some stakeholders might have lower HWB than others.</p> <p>If current trends continues and some ES will be highly destroyed (e.g. water availability) people may have to leave the area or shift to other land uses.</p>	By changing SEM practices (e.g. planting drought resistant plants or shifting to animal husbandry) the area’s ES could be more efficiently and more sustainably used → this would contribute also to higher HWB and competitiveness	See case specific remarks	Since at present the area’s competitiveness (though being relatively low) largely depends on ES, the further decrease in the quantity/quality of ESs will negatively influence competitiveness. If current trends continue, other resources (e.g. human capital, knowledge etc.) should be in the focus of the local economy	<p>General: easy to understand the question, but to answer it in details one needs to have ecological knowledge and future estimations (i.e. scenario work)</p> <p>Case specific: this question can be linked to stakeholders (through having different perceptions) and conflicts (through HWB effects). In our case answering the question from the Governance Challenge was difficult. On the one hand I feel that governance do not have a direct link to the actual quality/ quantity of ES, on the other hand I think that governance structures and policies influences this issue in such a complex (and indirect) way that it is</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
						impossible to give a few notes on it here. Links to other material: SPs on scenarios and tipping points, scenario planning methods from WP2
<p>1.3. What, if anything, could replace or substitute for each of the benefits obtained from these services, either here or elsewhere?</p> <p>Comment: I focused here on water since this looks to be the most problematic ES – see explanation at general remarks</p>	<p>Partly explained above:</p> <p>water cannot be substituted but it is technically feasible to replace it (e.g. from the Danube or by using cleaned sewage water)</p> <p>biodiversity is not really possible to substitute (especially because there are lot of rare endemic species here)</p>	<p>Replacement/ substitution is possible for many ES but this can still negatively affect HWB (i.e. people can go to a zoo to see traditional breeds but it will not have the same feeling as seeing them in the local landscape).</p> <p>Material well-being might stay at the same level but well-being aspects at higher levels (e.g. identity, belongingness etc. contributing to freedom and self-esteem) might</p>	<p>Looking for substituting goods and services is already an issue in SEM (water replacement plan)</p> <p>In Kiskunság there is no agreement on how to solve the deployment of ESs: should they retain the water? Should they replace it? Should they adapt to water scarcity with a cultivation shift? Or instead should they leave the area on the long run? These seem to be competing scenarios.</p>	<p>Governance styles influence local level decisions on SEM (i.e. if top-down decision making is typical, that can support larger scale, technology intensive solutions to substitution, but if local governance is strong and decisions are made bottom-up, smaller scale adaptive solutions might be favoured).</p> <p>On the long run policy can also support the idea of moving out of the area (e.g. by</p>	<p>See above: for competitiveness substitution would mean that other capitals have to be mobilized (e.g. social capital, human capital)</p>	<p>General: the question is understandable, although answering it is difficult if there are several services (bundles) being important in the CS area. In these cases focusing on the most crucial ES (or at maximum 2-3 crucial ES) is necessary.</p> <p>Case specific: In our case the real question is how current processes of ES can be managed to have a better outcome. Alternatives can be substitution (or replacement) / adaptation with changing SEM practices / possibly leaving the given area. To choose the best solution answering this question is a key.</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
		<p>decrease.</p> <p>In the longer run it might happen that moving out from the area has a better HWB effect than staying (even if substitution is possible)</p>		supporting outmigration, providing land or housing somewhere else).		<p>Links to other material: a good knowledge of the benefits people realize from local ES is inevitable to answer this question, which links to WP4 socio-cultural methods and/or social assessment. There is a strong linkage between this question and Q3.2.</p>
<p><i>1.3.1. potential for change</i></p> <p><i>Consider further clarification of this question (see my comments at the general remarks and the links to other material sections)</i></p>	<p>In case of water it is unexpected that current negative trends will turn back naturally, even it will be technically difficult to replace the water, the same stands for biodiversity.</p> <p>Soil fertility can be enhanced in the long run (but the trend is the opposite). Honey, timber and fodder are less vulnerable services, they can potentially improve (both in</p>	<p>In a business-as-usual scenario a negative change of HWB is envisaged, increasing HWB depends on the success of local adaptation processes, which furthermore depends on governance (bottom-up decision making) and strong local community (social capital).</p>	<p>SEM highly influences if and how the potential for change is realized, although SEM practices partly depend on Governance processes (what is allowed, what is supported and what is not). In the scenario workshop we found that SEM would most likely focus on the effective use of existing ES and maybe on the regeneration of decreasing ones,</p>	<p>Governance processes can indirectly influence the direction of change of ES through favouring specific SEM practices.</p> <p>The potential change of governance includes the development of an authoritarian system, but can go to the other direction as well if civil society is strengthened and bottom-up processes are</p>	<p>In a BAU case competitiveness is expected to change negatively, although it can change both positively and negatively depending on how SEM react to the changes of ES.</p> <p>If adaptation / substitution is successful, competitiveness can increase. It could also increase if highly intensive, technology oriented economic sectors would</p>	<p>General: the focus of this question is not completely clear: it is the potential for change in ES or the potential for change in the four challenges? To answer this question many background information is needed both on the ecological status and trends, and on the socio-economic environment and adaptive capacity.</p> <p>Case specific: I had to check the results of our participatory scenario workshops as well as the ecological models MTA ÖK built to prepare forecasts, which had been prepared during a several month</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
	quantity and quality).		but it is not expected that certain activities would pursued solely in order to maintain natural processes (e.g. biodiversity maintenance).	supported. This is closely related to exiting social capital as well. In our workshops, although stakeholders did not want to have an authoritarian system, they still wanted to see a strong state (instead of more decentralized structures) – this also suggests that the potential for having a more bottom-up governance system is maybe lower than the other direction.	appear (e.g. GMO production), although this might decrease HWB and is recently restricted by national/ regional regulations (i.e. nature protection).	<p>long research process. Potential for change is also very much stakeholder driven, so in our case we organized participatory workshops to discuss this topic and find alternative solutions.</p> <p>Links to other material: SPs on scenarios, stakeholder involvement, NBS. Methods and approaches from WP2 (scenarios and institutional analysis) and WP3-4 (integrated methods such as BBN or MCDA). The governance column has a strong linkage (somewhat redundant?) to Q3.</p>
<p><i>1.3.2. quantity and quality of change</i></p> <p><i>Consider further clarification of this question clarification (see</i></p>						<p>General: the wording of this question is a bit unclear (does it refer to actual, ongoing changes or potential changes – i.e. link back to the previous question). Very difficult to answer, detailed ecological</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
<i>my general comments).</i>						<p>knowledge and scientific expertise is needed to estimate the quantity of changes, while quality of changes can be also estimated together with stakeholders</p> <p>Case specific: I cannot give precise answer to this question, stronger expertise in ecological modelling is necessary, and perhaps more time</p> <p>Links to other material: SPs on bundles, tipping points, uncertainty, modelling tools and techniques from WP3</p>
2. Who is involved / affected?	<p>Main stakeholders (SHs): farmers, national park directorate (NPD), water authority (WA), local governments, regional planning authorities;</p> <p>SHs affected but directly not involved: local</p>	<p>From the HWB aspect the most important groups are the local residents which is a quite heterogeneous group (including many farmers but also vulnerable groups). Even though these</p>	<p>Farmers, NPD, WA are key stakeholders who actually do SEM (or who can change SEM practices by adapting to water scarcity).</p>	<p>Local governments and planning authorities, but the NPD and the WA are also governance stakeholders, as their decisions affects other stakeholders' HWB and the potentially applicable SEM</p>	<p>From the competitiveness aspect key stakeholders are local farmers and other small-scale businesses, to a lesser extent local governments and nature conservationists.</p>	<p>General: this is a very important question, although some clarification might be useful (involved in what? affected by what?). Along the four challenges a case specific stakeholder grouping can be prepared: HWB – those stakeholders who are personally affected by ES change; SEM – those who</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
	residents incl. vulnerable groups (unemployed, youngsters, elderly and NGOs representing them), businesses other than agriculture (e.g. forestry, tourism)	stakeholders have less voice in decision making and fewer options for SEM than others, they are the most affected ones because of living there.		practices. These local-regional level stakeholders are interlinked with the national policy making field.		can directly influence ES change; Governance – those who can indirectly (through legislation) influence ES change by affecting SEM practices; Competitiveness – those who realize (or loose) direct benefits from ESs Case specific: nothing special Links to other material: SP on stakeholder involvement, manual for stakeholder analysis
2.1. Do people outside the area also depend on the services? Comment: Consider adding sub-questions – see my general comments	Not so typical. Non-residents who enjoy the ES of this area are tourists, buyers of local food, maybe researchers – and they can find substitutes relatively easily. What is important however is the natural environment (i.e. local species and	Not typical – although we can group here future generations (see my point in the previous cell) and society as a whole which is “benefiting” from the conservation of a rare species (ie. from a moral point of view).	The water authority and the national park directorate practice SEM themselves, but most of their colleagues live outside of the area (they have a relatively close link to the area but still they are not so vulnerable to unfavourable ES	There are relevant governance stakeholders who are “outsiders” but they are not depending on the ES. And this is exactly one of the key issues: people who do not have to cope with the effects of ES change have a strong voice in changing SEM	Perhaps buyers of local products – further analysis is needed to understand the link between competitiveness and external stakeholders.	General: the question is easily understandable, but to answer it one has to be aware of regional interdependencies. To understand stakeholder dynamics (and how this influences the state and trends of ES) it would be useful to also look at people outside of the area who can influence key ESs (but might not be dependent on them). Case specific: in our case

	General	HWB	SEM	Governance	Competitiveness	Remarks
	habitats) and future local generations who are depending on the healthy functioning of the ecosystem but are not taken into account in most decisions.		changes than local residents).	practices...		<p>this is not a crucial issue, more important is to shed light on stakeholders at various scales who are usually invisible in SEM decisions (e.g. vulnerable groups, future generations).</p> <p>Links to other material: SP on stakeholder involvement, manual for stakeholder analysis</p>
2.1.1. Which values and interests are evident?	See detailed answers at the Challenges.	Local residents are interested in constant or increasing HWB, but some aspects of local residents' HWB might be in conflict with others' interests (e.g. farmers might be interested in increasing production, but intensifying agriculture might decrease HWB by eliminating open natural landscapes or by substituting	Farmers, foresters and local businesses are interested in having a stable / increasing yield and earning profit from their fields, but on the long run they are also interested in not destroying regulating ES which is the basis of their business. Hence there is a joint interest (in the long run) between residents,	<p>Very many different interests exist! For local governments (mayors) and national policy makers the main interest is to maximize votes on the next elections.</p> <p>For regulatory authorities (NPD, WA) the main interest is maybe to follow their mission and support the sustainability of</p>	<p>Most probably all stakeholders are interested in increasing the competitiveness of the area, but what competitiveness mean to them, and what tools are acceptable to them to increase it can be different from stakeholder to stakeholder...</p> <p>I think that the most vulnerable groups are hardly ever see the</p>	<p>General: This is a very complex question, can be analysed from each stakeholder's point of view (but not so easy to group them along the four challenges). Lots of background information on socio-economic context and stakeholder preferences is needed to answer properly.</p> <p>Case specific: semi-structured interviews, previously organized focus groups and a preference assessment survey helped to answer this question.</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
		traditional breeds that contribute to local identity).	local businesses (and even with policy stakeholders), although in the short run their interests seem to be conflicting.	the area, but also they have institutional interests which can be conflicting with local interests.	positive consequences of increasing competitiveness	Links to other material: SPs on non-monetary valuation integrated valuation, HWB. Answering this question pinpoints to existing/potential conflicts and social justice issues (cf. Q2.4, Q2.5.1)
2.2. How can these services be valued?	The exact choice of valuation methods depends on the characteristics of the service and the specificities of the socio-ecological context.	Non-monetary (socio-cultural) methods	Biophysical methods	BBN, multi-criteria and deliberative methods	Monetary methods (but also multi-criteria and DV)	General: Case specific: For each Challenge integrated valuation fits better than individual methods. Links to other material: entry point to WP3-WP4 joint decision tree which guides researchers to choose the most suitable method for a certain valuation situation.
2.3. How can the services be prioritised? Consider clarifying/ rewording/ replacing/ deleting this question	<p>It is not clear to me what the difference is between prioritizing and valuing ES (Q2.2. and Q2.3). By valuation we already prioritize (and vice versa). It is necessary to better distinguish these two questions.</p> <p>I am unsure if this and the previous question belong under Q2 or rather under Q1... Choice of valuation methodology surely depends on who are affected but also depends on what ES are at stake. So these questions seem to me as a joint outcome of answering other questions of Q1 and Q2. A first order question into this direction could rather be: what are the priority ESs (from the different angles of stakeholders and the four challenges)</p>					

	General	HWB	SEM	Governance	Competitiveness	Remarks
<p>2.4. Where do conflicts arise?</p> <p>Consider clarifying this question.</p>		<p>Locals contra outsiders.</p> <p>Vulnerable local groups contra powerful local actors.</p>	<p>Farmers contra NPD contra WA, but</p> <p>there are also tensions between farmers at lower and higher parts of the area because of unequal availability of water.</p>	<p>NPD contra WA.</p> <p>NPD and WA contra national policy makers.</p>	<p>External user groups contra local residents.</p>	<p>General: what does 'where' means in this question: between which stakeholders; between which regulations; or the geographical location (and scale) of the conflict?</p> <p>Case specific: it is also very important to know what types of conflicts are there (only interest conflicts, or conflicts based on structural problems or diverging values)</p> <p>Links to other material: SPs on trade-offs, HWB, social justice; methods of stakeholder analysis, preference assessment, ES demand mapping, JRA on conflict management</p>
<p>2.5. Who are the winners and the losers?</p> <p>Consider clarifying this question (see my general remarks).</p>	<p>The present situation (no organized action to water shortage) is suboptimal to all stakeholders, water replacement could favour some of them but it may</p>	<p>I could not say any specific stakeholder groups who are winners in the present situation from a HWB aspect, external stakeholders are</p>	<p>Losers: who lose their land (e.g. land use contract with NPD ended) or whose land becomes uncultivable due to droughts (or continuous inland</p>	<p>Hard to justify – in the present situation I feel there is no winner (i.e. centralization of decision making does not empower local actors and does not support</p>	<p>I could not interpret this question for the competitiveness Challenge in the Kiskunság case.</p>	<p>General: the question could be more precise if it clarifies whether the focus is (1) on actual or potential winners and losers and (2) on general or ES-specific winners and losers.</p> <p>Case specific: I found it difficult to answer this</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
	happen that while a stakeholder is winner from the viewpoint of one Challenge, he is loser from another point of view.	neutral, local stakeholders are rather losers	water due to water retention) winner: maybe NPD	bottom-up processes) and the water replacement plan fits well into this centralization process, taking this into account maybe the central state is the winner(?)		question because it is very subjective. I also felt that my answers here are sometimes in contradiction with my previous ones. Links to other material: SPs on trade-offs and bundles. Since it is a very subjective topic, answering it might be easier from a transdisciplinary perspective (link to SP on transdisciplinarity and stakeholder involvement)
2.5.1. Social justice <i>Comment: this is not a question in this form, rewording would be useful.</i>	Social justice is relevant to all four challenges to some extent, if we focus on both allocation and procedural aspects.	Who will have to cope with the negative effects of changing ES? (allocation aspect): the poorest, the youngsters, the unemployed, the small-scale traditional farmers, and women	Who can change actual SEM practices? (procedural and allocation aspect): farmers and vulnerable groups can also change their practices (even against legislation) through informal institutions	Who have a voice in decision making that affects the availability of ES (through rules of use, access to ES and redistribution of benefit) (procedural aspect): external and institutional stakeholders have a much stronger voice	Who can enjoy the growing competitiveness of the area and who are excluded from the merits of competitiveness? (allocation aspect): see as in the HWB box	General: this question can be specified further along the four challenges. Answering it properly needs social engagement throughout the research process. Case specific: social justice issues are inherent part of our CS, although resolving these requires a different attitude than pure scientific (i.e. participatory action research or community development).

	General	HWB	SEM	Governance	Competitiveness	Remarks
						<p>Responsibility of the researcher is high.</p> <p>Links to other material: SPs on HWB, social justice and gender. OpenNESS does not offer tools to researchers to work on social (in)justices.</p>
<p>2.6. Who or what individuals/organizations can influence these services?</p> <p>Consider moving this question upwards (after 2.1).</p>	Main ones are: farmers, other land users (e.g. forestry, tourism), NPD, WA	The same as those listed in the SEM column, plus people living within and outside the area serving as a reference point to perceive and explain individual well-being changes (this latter group does not influence the services per se, but the perception of HWB).	Farmers, NPD, WA are key stakeholders who actually do SEM (or who can change SEM practices by adapting to water scarcity)	Local governments and planning authorities, but the NPD and the WA are also governance stakeholders, their decisions affects other stakeholders' HWB	Local farmers and other small-scale businesses	<p>General: This is as important aspect of Q2 as Q2.1 asking about the dependent groups. Case specific: If there is a mismatch between the dependent and the influential groups that often contributes to conflicts and makes room for stakeholder engagement and participatory processes</p> <p>Links to other material: SP on stakeholder involvement, manual for stakeholder analysis</p>
<p>2.6.1. Property rights</p> <p>Comment:</p>	Two dominant property right systems exists in the area:	Private property is dominant, but some HWB aspects can only be realized if	State versus private property, contributing to conflicts (e.g. land use contracts	State property, but contributes to conflicts due to changing regulations (e.g.	Private property is dominant	<p>General: does this question belong to Q2 or Q3? Is not there overlap between this and Q3</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
<i>Consider replacing this question to under Q3</i>	private property (farming land and residents own land parcels) and state property (the majority of protected land and larger ditches)	protected areas (state property) are maintained	between farmers and NPD)	protected land owned by the state, regulated and monitored by NPD but managed by a profit oriented centralized Land Fund)		<p>questions?</p> <p>Case specific: To give a proper answer a detailed institutional analysis is needed. We used previous interviews and historical and document analysis to answer this question.</p> <p>Links to other material: SP on institutional analysis, methods and approaches from WP2 (institutions and governance)</p>
<p><i>2.6.2. Regulatory frameworks</i></p> <p><i>Consider clarifying the question and adding subquestions to it.</i></p> <p><i>Comment:</i> <i>Consider replacing this question to under Q3</i></p>	Most relevant EU policies are Natura 2000, WFD, CAP (especially the 2 nd pillar) and the development funds	No idea.	Natura 2000, WFD	From the point of view of governance all EU policies look to be relevant	CAP, development funds	<p>General: does this question belong to Q2 or Q3? Is not there overlap between this and Q3 questions? Does this question take into account multi-level institutions and the possible conflicts between them – maybe additional questions are needed to understand this issue in more detail.</p> <p>Case specific: we focused our analysis only to the most relevant regulatory frameworks (Natura2000,</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
						WFD) Links to other material: SPs on institutional analysis and good governance
2.6.3. <i>Formal/informal institutions and their interplay</i> <i>Comment:</i> <i>Consider replacing this question under Q3 and adding a new question</i>	Formal institutions often work ineffectively. Informal institutions might help stakeholders (1) to flexibly apply formal regulations or (2) to escape from the regulations.	In one village within the area there was a community tradition than in each spring the community had a nice party among the sand dunes. After the area become protected the community was forbidden to enter the sand dunes so they lost this tradition, and this way experienced as the loss of local identity.	Example 1: nitrate directive is too strict taking into consideration the low quality soils within the region – rangers of the NPD used to discuss and agree with farmers to occasionally fertilize the soil (they set up informal limits which are not harmful for the environment but helps the farmer) Example 2: regulation on water extraction for agricultural use prescribes huge amount of money paid by farmers, which is not affordable to many of them, so there is an informal norm that almost each orchard owner has illegal wells but none of them talks about it and the WA do not have the means to control all the farmers	I have no good example	General: does this question belong to Q2 or Q3? Is not there overlap between this and Q3 questions? This seems to be a broader question than Q2.6.1 and Q2.6.2 (referring to both formal and informal institutions not only the former). I would consider including a specific question on informal institutions (after the two previous questions on formal ones) and then asking about the interplay of formal and informal institutions. Case specific: answering 2.6.3 (especially the interplay) is very important to better understand the conflicts (Q2.4) and to find possible solutions to these conflicts (Q3.1)!	

	General	HWB	SEM	Governance	Competitiveness	Remarks
						Links to other material: SP on institutional analysis – methodological advice would be probably useful to case studies!
<p>3. What are the social and political processes and conventions that are relevant for the issue?</p> <p>Consider rephrasing this question</p>						<p>General: This question could be split up into three different ones (social processes – political processes – conventions). It is not completely clear what is meant by conventions (informal institutions as defined by classical institutionalists or international conventions that are part of our multilevel governance system). Some previous questions already addressed some aspects of this overarching topic (i.e. Q2, Q2.5, Q2.6).</p> <p>Case specific: This is such a broad question that I could not meaningfully answer it as it stands now – see my previous and next answers to sub-questions under Q2 and Q3 which explain the relevant social and political</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
						processes.
3.1. Are there conflict resolution methods in place? (Who, how, form?)	See my specific answers at the Challenges.	No, because the conflict are still hidden (our research pinpointed it)	Partly (between farmers and NPD) (our research aimed at enlightening these)	Not transparent (at national level policy making, based on institutional power relations)	No	<p>General: this question can be directly linked to Q2.4</p> <p>Case specific: in-depth knowledge of the social context (including contacts with vulnerable groups) is necessary to be able to answer this question.</p> <p>Links to other material: SP on good governance, social justice, JRA on conflict management, some participatory valuation methods from WP3 and WP4 (e.g. BBN, MDCA, deliberative valuation), although OpenNESS does not provide methodological advice on conflict resolution.</p>
3.2. What kinds of management or policy actions/options are needed to protect or enhance these services and in particular how might actions	<p>General remarks: Please reword Q3.2 because now it contains two different questions. I feel that the first question can be answered only at the end of a whole integrated assessment process (or at the end of ONEX) and it is the group of stakeholders who should decide upon this question.</p> <p>The second question is, however, relevant to choose the needed management actions. I suggest here to form three questions instead of 3.2 as follows:</p> <p>3.2. What alternative management or policy actions / options exists which can protect or enhance these services?</p> <p>3.3. How might these alternative actions directed towards one service impact or enhance another (but to answer this it would be useful</p>					

	General	HWB	SEM	Governance	Competitiveness	Remarks
<p>directed towards one service impact or enhance another?</p> <p>Consider splitting up and rewording the question.</p>	<p>to have a question under Q1 about ES bundles and trade-offs within the CS area)</p> <p>3.4. Which seems to be the most appropriate pool of management or policy actions based on the above analysis – this question needs to be answered by the stakeholders themselves!</p> <p>Case specific remarks: until the question is not clarified I can answer it only at a very superficial and general level. In our case it would be necessary to include local stakeholders in deciding on the proper ways of solving the water shortage. Different stakeholders support different solutions (i.e. water replacement or adaptation) because the two major options have very different ecological and socio-economic (well-being and competitiveness) effect.</p> <p>Links to other material: this question sums up almost all the previous ones (explicit or implicit links to other questions). Links to SPs on good governance, stakeholder involvement, trade-offs and bundles, and SEM.</p>					
<p>3.2.2. Empowered or institutional restrictions?</p> <p>Consider rephrasing, splitting and clarifying the question.</p>	Both phenomena can be found and sometimes act contradictory.	Local residents and especially vulnerable groups are not empowered (the latter ones are rather marginalized)	Institutional restrictions, some groups (i.e. larger farmers, hunters) are empowered to act in their own or in cooperation.	Institutional restrictions.	Local stakeholders running local businesses are more or less empowered	<p>General: The focus of this question is not completely clear: are stakeholders empowered or are there institutional restrictions? These are not restrictive questions – so maybe it would provide more detailed information if it would be split up into two questions.</p> <p>Case specific: I understood this question as a quick feasibility check for the management options listed above – if different stakeholder groups are empowered to carry out SEM decisions or not.</p> <p>Links to other material: I</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
						do not know where to link this question – support would be helpful
3.2.3. Which policy level should be involved (local, national, EU)?	From local to EU	Mainly local	Local and regional	Local to national to EU	Local to national	<p>General: this is a very useful question, which could be used also for stakeholders. Some more specification would be useful however (i.e. which policy level should be involved in what?)</p> <p>Case specific: nothing special</p> <p>Links to other material: SPs on good governance and institutional analysis.</p>
3.2.4. Are we looking at individual, collective or institutional interests? <i>Comment: consider directly linking it to Q2.1.1</i>	All	Individual and collective (some aspects of HWB are realized as being part of a community)	Individual and collective (incl. the natural environment)	Hard to justify – rather institutional (and partly individual)	Individual (and to a smaller extent collective)	<p>General: this question echoes Q2.1.1 but in a more structured way – these two questions could be directly linked to each other.</p> <p>Case specific: nothing special</p> <p>Links to other material: results from different valuation methods (link to WP3 and WP4), conceptual support on how to</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
						differentiate between individual and collective interests would be useful
3.2.5. Liabilities		No special liabilities for HWB except basic human rights and health and social standards	N2000 WFD	N2000 WFD No special liabilities known beyond general democratic processes	I have no information.	<p>General: please phrase this topic in a question format. Answering this question needs detailed knowledge of the regulatory frameworks.</p> <p>Case specific: in our case we focussed only on the most relevant regulatory frameworks (N2000 and WFD)</p> <p>Links to other material: SP on institutional analysis and good governance</p>
3.3. Property rights	see at Q2.6.1					<p>Duplicated questions! Please consider replacing these questions to avoid overlap.</p>
3.4. Regulatory frameworks	see at Q2.6.2.					
3.4.1. Governance level as source of conflict (local/national/EU)		Conflicts between local requirements and state level policy plans for development (e.g. school reform, communal work	Conflicts between N2000 regulations and regional characteristics	Conflicts between state and EU level regulations and interpretation of democratic principles	I cannot justify (have no information)	<p>General: this question can be related to Q2.6.2, Q2.6.3 and Q3.2.3., answering it requires an in-depth knowledge of the governance structure</p>

	General	HWB	SEM	Governance	Competitiveness	Remarks
		reform etc.)				Case specific: nothing special Links to other material: SP on good governance – additional support (either conceptual or methodological) would be useful to better address this question in case studies.
3.4.2. <i>Monitoring and responding</i> Please elaborate this question further.						General: what does this question actually means? Case specific: I cannot answer because I do not fully understand Links to other material: ?

A1.4 Feedback on ONEX from the test case

Our key informant reported that:

- 1) Working through ONEX, and answering the questions step-by-step, enabled a 'comprehensive picture' of the case study to be built up. The experience was found to 'shed light on non-trivial relationships' between different aspects of the problems and issues that were the focus of the case study, that were previously not so well articulated. The experience was exemplified by reference to the insights gained on how conflicts and social justice issues are related to policy and governance aspects, as well as to ecological characteristics and processes within the case study area.
- 2) Some of the questions can be answered if the user has some basic knowledge about ecosystem services and natural capital, and has a good general overview of the social and ecological contexts of the case study area. However, the key informant also recognised that many questions required quite detailed scientific knowledge to answer and that considerable time might be needed to gather all the information required. This therefore implied that ONEX would have to be used iteratively, perhaps over an extended period. The questions found to be more demanding in terms of skills and data resources have been indicated in the responses of the key informant, who highlighted the fact that they are nevertheless valuable because they are 'able to drive the users of ONEX to new research directions by shedding light on the different aspects of the issue at hand'.
- 3) Despite the specific characteristics and concerns of the Kiskunság case study, the key informant found that it was possible to answer all the questions and none were identified as 'irrelevant', though in terms of the specifics of the case study some were more important or central to the study's concerns. The key informant suggested that potentially the user might be encouraged to identify the questions that were of primary concern to them, and perhaps tackle those first. Emphasising that the 'test run' highlighted that one of the strengths of ONEX was that it was able to expand the horizon of the researcher and brings new viewpoints into the discussion, the key informant suggested that it would be helpful if the questions of ONEX could be tackled in a way that allowed questions that seemed secondary to the case study be answered at a later stage; when more fundamental aspects of the issue are already covered and the importance of these questions could be appreciated. To represent this flexible approach for ONEX, the key informant suggested that it might be visualised in terms of a 'circular structure' with concentric rings used to organise the main questions, sub-questions, third-order questions and supporting material. The latter might include reference to the OpenNESS Synthesis Papers, for example, or the various tools and techniques that have been developed and described in WP2, WP3 and WP4. Figure A1.2 was prepared to illustrate this thinking.
- 4) The key informant emphasised that in the test run the questions were answered based on 'existing knowledge'. In an 'ongoing real-life situation' she felt that questions of ONEX could be used either as a platform to initiate discussion among the stakeholders aiming at joint problem definition, and/or as a roadmap to structure the process of problem solving. The latter would include the selection of key concepts, methods and tools. The implication here is that an iterative use of ONEX would potentially stimulate co-learning within the stakeholder group. The key informant suggested that to better understand how ONEX might work in real life transdisciplinary settings, it would be necessary to use it in case studies which are at an earlier

stage of the project cycle. She suggested that the ‘best way’ would be to apply ONEX in case studies from the very beginning when the stakeholders and researchers meet first to discuss the problem(s) at hand.

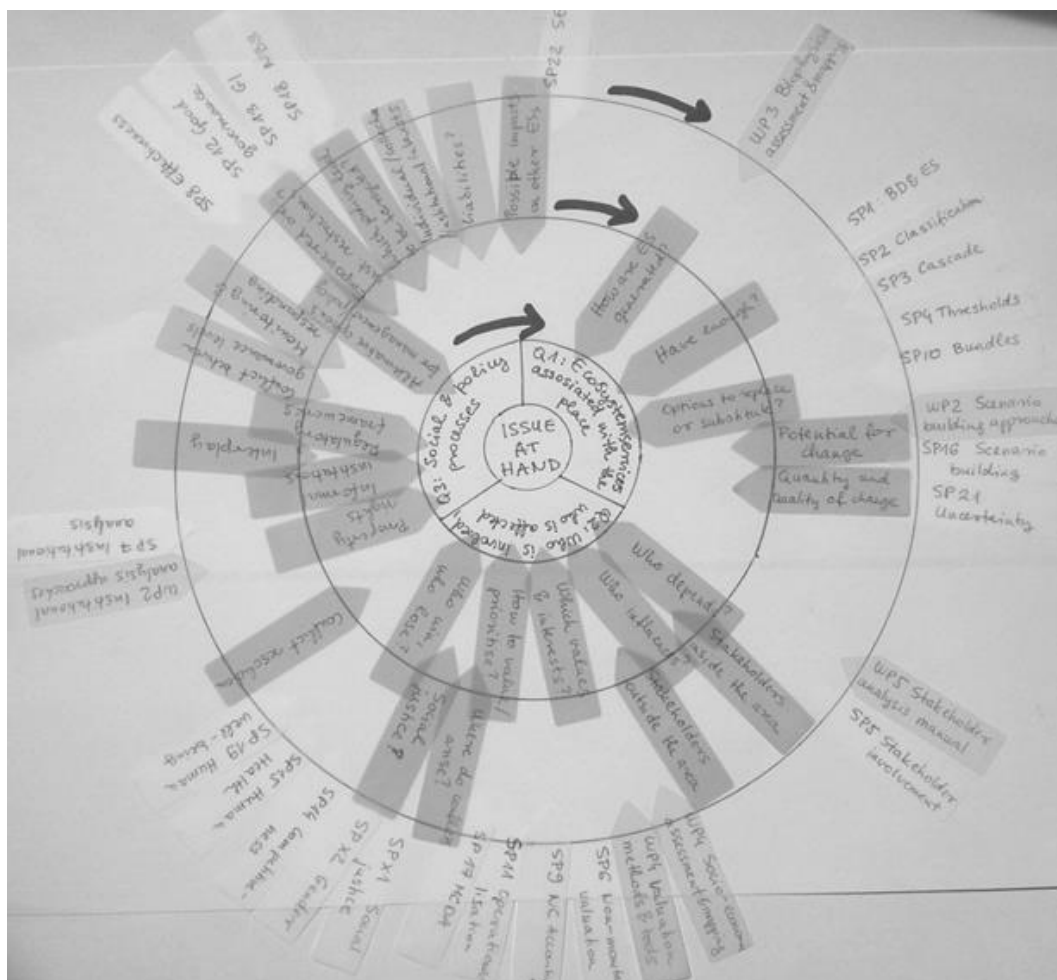


Figure A1.2: Circular structure suggested for ONEX – including main questions, sub-questions, third-order questions and supporting material in concentric circles. The concentric circles can be ‘moved around’ the centre (the ‘issue at hand’) in a flexible way, which suggests that the users of this heuristic can arrive at a specific sub-question or third-order question when looking for answers to different main questions. The same is true for the supporting material. Synthesis papers, and methods and tools provided by other the OpenNESS WPs can be organised under or linked to specific sub-questions and third-order questions according to relevance, but most of the concepts, tools and methods can be used to answer other questions as well (e.g. scenarios are not only useful to discover the potential for change in ES delivery, but to understand possible future effects of alternative policy options; thus the user could be directed to the outputs of WP2 & 3). *Design by Eszter Kelemen.*

Appendix 2: ONEX Fact Sheet

(for OPPLA and AST)

ONEX

Introduction

When the idea of ecosystem services is used operationally it usually involves groups of people coming together to resolve an issue, or at least to identify strategies for doing so. This type of problem solving can be complex because:

- it will almost certainly involve people sharing and criticizing ideas;
- it will involve making judgments on the basis of uncertain or incomplete evidence; and,
- the positions of those involved may change over time as they learn more about the problem at hand.

ONEX has been created to help groups of people manage these difficulties, especially when they work together over an extended period of time.

Keywords

Structured decision making, social learning, deliberative methods, collaborative problem solving

Why would I choose this approach?

ONEX is not a single approach but is best seen as a **‘working environment’** intended for groups of people needing to collaborate on an ecosystem service issue. It is called a ‘conceptual nexus’, because it is basically a network of some of the key ideas used by the ecosystem service community. ONEX helps people to see how these ideas are linked to each other. By exploring these conceptual relationships groups can develop a richer picture of the issue that has brought them together. ONEX therefore helps people to navigate between concepts and to build a collective understanding of them. As a result they are better placed to identify what methods and evidence might be appropriate for solving their problem. We anticipate that such groups will be led by a knowledge broker who can help shape and summarise discussions, and manage ONEX in ways that are appropriate for tackling the problem or issue at hand.

What are the main advantages of the approach?

ONEX is a social media tool that uses the Trello Platform. We have chosen Trello because it is widely used for project management and problem solving. It is also freely available and there is an active user community whose experience can be helpful to those using it for applications. ONEX can be used to help people to better identify their problem and the place of ecosystem services within it, and to make an assessment of the ecosystem services that are relevant to their work. The

conceptual nexus also provides a gateway to key issues related to human well-being, sustainable ecosystem management, governance and competitiveness; other topics can be added as experience develops within the user community.

What are the constraints/limitations of the approach?

The need to manage the deliberative process that surrounds any attempt to resolve a problem or issue within a group of people. An individual or small team needs to act as a knowledge broker.

What types of value can the approach help me understand?

All types of value

How does the approach address uncertainty?

By deliberation.

How do I apply the approach?

In the context of a group of people collaborating on a problem usually at local scales. ONEX is fully customisable. You can download the template from, the [ONEX Lab](#) and change it in ways that makes sense for your application. You need to register with Trello first. The ONEX Template from the ONEX Lab will be updated from time to time, and you will also find example case studies and a news section there. There is also a facility to provide feedback.

Requirements

Access to internet; a knowledge broker to manage the deliberative process.

Where do I go for more information?

The [ONEX Lab](#)

Haines-Young, R., Potschin, M., Jax, K., Görg, C., Heink, U., Kelemen, E., Schleyer, C. (2017): OpenNESS Conceptual Network (ONEX). European Commission Seventh Framework Programme Grant Agreement No. 308428. (trello.com/b/aWbq9p7u/onex-v2-0-template)