INTEGRATED VALUATION: INTEGRATING VALUE DIMENSIONS AND VALUATION METHODS

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SUMMARY

Valuation of nature is attracting more and more attention in modern discussions on environmental protection, and is most often associated with monetary methods that fit into the overarching economic paradigm. Valuation is typically expected to create a platform for communication between environmentalists and decision makers, and eventually to inform decision making. However, environmentalists and decision makers, as well as others who use the environment and protect or manage it, usually perceive the environment differently – through the lens of different value dimensions. Relatively early in the discussion on valuation it was argued that special attention needs to be paid to establish and strengthen linkages between different valuation methods and approaches. More recently, the push for integrating different valuation approaches have intensified, increasingly requiring researchers to go beyond standard techniques of examining problems from a dominant economic perspective. Indeed, the challenge of integrated valuation is currently perceived as a frontier in the study of ecosystem services. Here we analyse the opportunities for integrating different valuation methods which represent three value dimensions: economic, social and ecological. We argue that the highest integration potential stems from whether the methods in question refer to logically commensurable values and whether they are technically compatible. Ultimately, different methods can be co-developed specifically for the purpose of a given integrated valuation exercise. Even when full integration is not possible, different valuation methods can be combined to provide additional information that helps to interpret the results of at least one of the methods which are brought together. Finally, it is also possible to use different valuation methods in parallel, without attempting to integrate or combine them, to obtain different pieces of information on the same object of study. To analyse the potential for integrated valuation of nature, we consider pairs of methods representative for the different value dimensions. Where possible and relevant, we provide examples indicating either what such an integrated valuation exercise might look like or how it has actually been achieved in practice. Among our key conclusions, we note that integrated valuation approaches provide detailed information about very specific situations, which may be generalizable but not necessarily relevant for broader discussions on the value of nature to people. Perhaps surprisingly, instead of broadening the scope of analysis, we are narrowing (but refining) it.

1 INTRODUCTION

Valuation of nature is attracting more and more attention in modern discussions on environmental protection, and is most often associated with monetary methods that fit into the overarching economic paradigm (Kallis et al., 2013). Valuation results are expected to create a platform for communication between environmentalists and the decision makers, who are used to thinking in economic terms (Kumar, 2010). Relatively early in the discussion on valuation it was argued that special attention needs to be paid to "improve linkages between ecological and economic methods and to develop improved protocols for valuation studies" (Bingham et al., 1995, p. 74). More recently, calls emphasizing the need for integrating different valuation approaches have increasingly required researchers to go beyond standard techniques of examining problems from a dominant economic perspective (Dendoncker et al., 2013; Hubacek and Kronenberg, 2013; Martín-López et al., 2014; Norton and Noonan, 2007). Indeed, the challenge of integrated valuation is currently perceived as a frontier in the study of ecosystem services (Gómez-Baggethun et al., 2014; Kronenberg, 2014), with the objective of integrating economic, socio-cultural and ecological value perspectives, as well as monetary and non-monetary valuation techniques.

In response, new integrated valuation approaches have been developed. This has been done especially through multi-criteria evaluations and their extensions (Aznar et al., 2011; Frame and O'Connor, 2011; Martinez-Alier et al., 1998; Munda, 2008; Zoppi, 2007), but also through attempts to integrate different valuation methods and approaches. The overarching objective of these attempts have been to: (i) overcome the limitations of and thus respond to criticism of individual methods, especially the monetary ones; and (ii) provide a more comprehensive picture by capturing more value dimensions at the same time. These different approaches have begun to identify some of the potential for combining different monetary valuation methods, as well as monetary valuation with non-monetary valuation methods, where the latter aim to reveal human preferences in a more comprehensive and accurate manner. One example is the combination of a choice experiment with the travel cost method to estimate the individual opportunity cost of travel time in the travel cost method (Czajkowski et al., 2015). More comprehensively, monetary valuation methods have been complemented with a discourse analysis component (Wilson and Howarth, 2002) as well as deliberative (Lo and Spash, 2013; Spash, 2007) and participatory processes (Fontaine et al., 2014), to depict the broader social and political context of eliciting monetary values. This makes it possible to reveal the broader social and shared values in addition to the individual values which are typically revealed in standard valuation techniques (Kenter et al., 2015). Finally, other authors have performed independent valuation studies using different monetary and non-monetary methods, and then standardised and compared the results of those studies to check if these different approaches provide consistent and/or complementary information (e.g. Martín-López et al., 2014).

In line with the above attempts, we have already undertaken work within the GREEN SURGE project to integrate different valuation methods (the details of which are presented in our Deliverable 4.3). We focused on hedonic pricing, which is one of the valuation methods most frequently used in relation to urban green spaces. Hedonic pricing helps us to understand the monetary impact of green spaces on real estate prices, and we used the hedonic pricing framework to check the monetary impacts of green spaces assessed with the use of other valuation methods. So far, we combined hedonic pricing with:

1. *the non-monetary softGIS survey - to incorporate non-monetary green space evaluations based on the residents' own experience into a hedonic pricing model (Czembrowski et al. 2016a); and*
2. *the biocultural framework - to assess whether biocultural value of a green space influences the monetary value of that green space (Czembrowski et al. 2016b).*

We are currently working on further integration of hedonic pricing with sociotope mapping (a tool for capturing and characterising the social value of green spaces used in Stockholm), and on combining hedonic pricing with a choice experiment. The latter will be a relatively simple example of comparing the results of two valuation methods applied to the same case (using one to verify the results of the other). Meanwhile, all of our other examples indicate opportunities to use different valuation methods and approaches simultaneously – to provide more comprehensive and meaningful results than any of those methods alone. In the following, we call the simpler form of mixed-methods use combination and the more complex one integration, while use of multiple methods is called parallel use.

In this Milestone, we address broader issues regarding the potential integration of different value dimensions, valuation methods and approaches. Our aim is to provide an overview of a series of potential arrangements of pairs of different valuation methods and ponder on the potential to use those pairs for integrated valuation. The principal questions we address are: i) How and to what extent can different value dimensions and valuation methods be integrated? What aspects of value are particularly well/ill suited? ii) What are the benefits and limitations of integration?

The milestone is organised as follows: in the next section, we clarify the most elementary terminology, such as what we mean by values and valuation and by the three levels of integration of different valuation methods/approaches. We then move to an overview of the specific examples of valuation methods/approaches, the different dimensions and potential pairings that we consider. The core of this paper consists of three tables, which present potential arrangements of different valuation methods/approaches, each followed by an overview of how such arrangements could work and under what circumstances they could be possible. Finally, we provide a broader discussion on integrated valuation in the context of these specific tables, and in the context of the work carried out by other authors.

2 TERMINOLOGICAL CLARIFICATIONS

In this section, we clarify several key terms, which we shall use in our methodological considerations below. The most important of these are 'values', 'valuation', 'value dimensions' and the possibilities for linking different methods ('integration', 'combination' and 'parallel use').

2.1 Values and valuation

Values are understood differently in different areas of research, and these understandings are not consistent (Brosch and Sander, 2016; Dietz et al., 2005). Additional confusion results from the broad use of the terms 'economic valuation', 'social valuation', 'environmental valuation', 'ecological valuation', often in a different sense. Interestingly, all of these terms tend to be used interchangeably when referring to monetary valuation of the environment with the use of economic methods (c.f. Boyd, 2004).

We attempt to bring all of these different dimensions to a common ground, by deriving the meaning of value from economics, which is also often used in everyday thinking. We associate values with opinions regarding which circumstances or objects or quantities are seen as more desirable by individuals (Dietz et al., 2005) and social groups (Kenter et al., 2015). Note that value in economics does not have to be associated with the monetary dimension. In this way, we assume that even social and ecological approaches can also reveal values. Within each value dimension[1] values are commensurable, because they can be considered from the same perspective of what has a higher and a lower value, or what is more or less desirable (they can be put on an ordinal scale). However, even values representing different dimensions can often be held against each other and thus exhibit commensurability, which is of key importance for our notion of integrated valuation.

The above holds even though some of these values are 'created' through social and political processes, while others are derived from expert opinions and are often considered by those experts as 'objective' (Raymond et al., 2014). An assumption central to most discussions on values is that values influence decisions (Dietz et al., 2005). While the connection between held values and behaviour is far from straightforward (e.g. Leiserowitz et al., 2006), we may expect (or like to think) that the more people value nature or its parts, the more likely they are to protect it or manage it in a sustainable manner (Heberlein, 2012; Ives and Kendal, 2014; Leiserowitz et al., 2006; Thøgersen and Ölander, 2002). However, again, this can be understood differently in different areas of research. From the point of view of psychology and sociology, where values refer to the basic rationales for human behaviour, values can also be associated with people's preferences. In such contexts, values translate into behaviours, behavioural intentions or other measures that express concern for the environment. Hence, values used in this way define people's actions towards the environment, but even such an approach indicates which situations, circumstances, actions or states of the world, and eventually even goods and services that are preferable to other.

Based on the above understanding of values, valuation is the process of establishing the value of a given component of nature, an ecosystem, or an ecosystem good/service. Eventually, valuation

[1] As explained in the following subsection we limit our consideration to three value dimensions: economic, social and ecological, but acknowledge that there may be more value dimensions.

is meant to inform decision making. A caveat here is that values expressed by different stakeholders may be inconsistent or qualitatively different. In the case of all examples of valuation methods or approaches listed in the following section, the value of different aspects of nature is derived from statements made by individual consumers/citizens, and then generalised to broader social groups based on statistical reasoning, or made by experts and again approximated to broader social groups presumably represented by the experts. Depending on who performs valuation and whose values are considered, it is possible to identify trade-offs between values expressed by different constituencies (Ernstson, 2013; Raymond et al., 2014). This includes differences between values expressed by experts and individual users, with standard examples such as thuja hedges and lawns, which are often preferred by individual house owners over more biodiverse gardens despite their lower ecological value. Similar differences between different value dimensions may lead to further trade-offs between different values. Indeed, a higher value is not necessarily desirable as such – for example, something that has a high monetary value does not have to have a high social value (for the society as a whole), and can even be problematic for the society. Examples of such broader considerations include gentrification, environmental justice and privatisation of public goods.

Finally, what is it that we value? In this milestone, we focus on valuing different aspects of nature which may cover whole ecosystems, individual species or habitats or even certain properties of those ecosystems only. The aspect we value depends on the specificity of the different methods. For example, with ecological valuation methods that focus on biodiversity we usually value ecosystems, and not ecosystem goods/services. Clearly, although many recent discussions focus on the values of nature through the lens of ecosystem services (Kumar, 2010), our approach is not limited to ecosystem services. Instead, what is valued depends on the context, the needs of specific methods and their opportunities and limitations. Also, sometimes what people value is not exactly what researchers want them to understand – lay people may not be aware of exact linkages that underlie ecosystem functioning. Here people may relate to indirect connections (e.g. some consequence of biodiversity – in the case of functional performance) rather than direct ones (biodiversity itself). Thus, it is always important to be very specific in survey instructions and interpretation, especially in stated preferences methods and the related social valuation methods, in particular with the deliberative ones.

2.2 Value dimensions

Even in light of our standard definition of value, values and valuation can be understood differently in different dimensions: economic, social and ecological – as explained in the following paragraphs. Eventually, value dimensions translate into the different types of indicators used to measure value.

In economics, values tend to be associated with how much people are willing to pay for a certain aspect of nature, and such values can be elicited even in the case of the so-called non-market goods and services, i.e. those that are not subject to market exchange. It is also possible to estimate the cost of potential losses or the cost that could have been avoided had some aspect of nature been available, as well as the potential flow of benefits related to a certain aspects of nature, and use such cost or benefit estimates as a proxy of those aspects' value. The above monetary value estimates can be linked to both use values and non-use values, including their different subcategories. However, even in economics, values can be expressed in units other than

money, e.g. by comparing two or more different aspects of nature and determining their relative values (hence economic non-monetary valuation).

In social terms, value can be linked to how much a given aspect of nature contributes to satisfying selected personal or social policy objectives. For example, people may value certain aspects of nature for their contribution to people's happiness, quality of life, health, social cohesion, but also aesthetics and recreational use. In fact, health impacts are often considered as yet another value dimension in itself – there are many opportunities to discuss health impacts in the context of the value of selected aspects of nature. Several social valuation methods (which are sometimes presented as social perception rather than valuation) refer to the multifunctional value of nature or the value of multifunctionality of green spaces. For example, sociotope mapping indicates the different uses of green spaces and hence the use values that they represent (Ståhle, 2006). Many similar approaches have evolved around the so-called participatory mapping within which people indicate the different characteristics of specific locations using maps. Nevertheless, again, valuation in social terms may be based on expert judgements and predictions, and not necessarily on directly asking people about their perceived values. For example, expert judgements may be based on the observation of how many people are active in a particular green space, and then translated into conclusions on the social attractiveness of such a green space or eventually on its health impacts.

In ecological terms, valuation may refer to the role that different components play in an ecosystem. For example, keystone species denote special value or importance of certain species. The importance may be considered from the perspective of how many other species depend on them in a trophic chain or for providing habitat. More broadly, value may be considered in biophysical terms, following approaches such as various types of energy–emergy analysis, emphasising the differences in the value of different energy types and sources, and the fact that value can be defined by the amount of energy required to produce a product or a service (Odum and Odum, 2000). In practice, biodiversity is mostly addressed at the ecosystem scale (habitat or land-use types) while diversity at the species community or gene scale is less frequently addressed (Botzat et al., 2016). A frequently used exception to this tendency is the use of threat status or rarity of certain species as a value marker.

Finally, there are integrative approaches that address different value dimensions at the same time. These more multidimensional frameworks for discussing the value of nature include resilience, sustainability and biocultural value. These frameworks act as lenses through which one can look at the importance of the different aspects of nature for human life and wellbeing, and they tend to focus on the ecosystem (or a social-ecological system) level. For example, resilience can be considered through a specific notion of insurance value, which does not necessarily involve monetary valuation but emphasises that resilient ecosystems provide insurance to social-ecological systems (Green et al., 2016). In such cases, ecologists highlight features such as ecological connectedness or variation within functional response traits within a species community. Another example of particular interest to GREEN SURGE is the notion of biocultural diversity, i.e. the mutually reinforcing diversity of human cultures and biological structures (Elands et al., 2015). The related concept of biocultural value refers to the different values attributed to different ecosystem components by different cultural groups, which in turn is related to the fields of economic botany and economic zoology, as well as ethnobotany and ethnozoology (e.g. Grace et

al., 2009). Although by their nature inclusive, these multidimensional frameworks can be specified to address one-dimensional, specific values, and it is primarily in this capacity we use them in this report.

2.3 Integration vs. combination vs. parallel use of different valuation methods

Theoretical underpinnings for integrated valuation can be drawn from various suggestions on how to design mixed-method evaluation/research protocols (Brannen, 2005; Greene et al., 1989; Teddlie and Tashakkori, 2009). Most of these emphasise the need for complementarity of the methods to be integrated, or – more specifically – of the underlying data. Interestingly, a complementarity check can be performed after the original studies have been carried out. Thus, in principle, a mixed-method approach does not require that the whole study is planned before all of its parts have been initiated. However, as we suggest below, proper integration requires that this is the case.

Integrated valuation requires integration of different value dimensions (in particular economic, social and ecological) and valuation approaches/methods followed within those dimensions. However, the different dimensions and approaches/methods can be integrated to different extents. Integrating value dimensions is relatively simple and qualitative; it can be simply associated with discussing different value dimensions at the same time, addressing them, acknowledging the fact that there is more to consider than just one dimension. This is a general background for our approach. Meanwhile, integrating valuation methods is much more complex and specific – and this is the core of integrated valuation.

The potential to integrate them depends on whether they refer to commensurable values (dimensions and approaches) and whether they are compatible (approaches and methods). Commensurability refers to whether they can logically provide consistent results, which does not necessarily require that they address the same value dimension. Although in practice different value dimensions are often not commensurable, sometimes it is possible to adjust our reasoning in a way that makes the different sets of information commensurable. Compatibility indicates that the underlying data can be technically joined and used together, i.e. they share some relational aspect like geographical coordinates or the data are structured in a similar way. Often, this is related to whether the different methods are used to assess the value of the same object, location or circumstance, e.g. selected types of urban green spaces. Ultimately, compatibility could be ensured by co-development – i.e. designing the application of both tools together, forming a consistent framework (as opposed to those tools being applied separately to be used independently). Our general integration framework is illustrated in Figure 1. In the following sections, we consider the potential to integrate pairs of valuation methods addressing different value dimensions and valuation approaches.

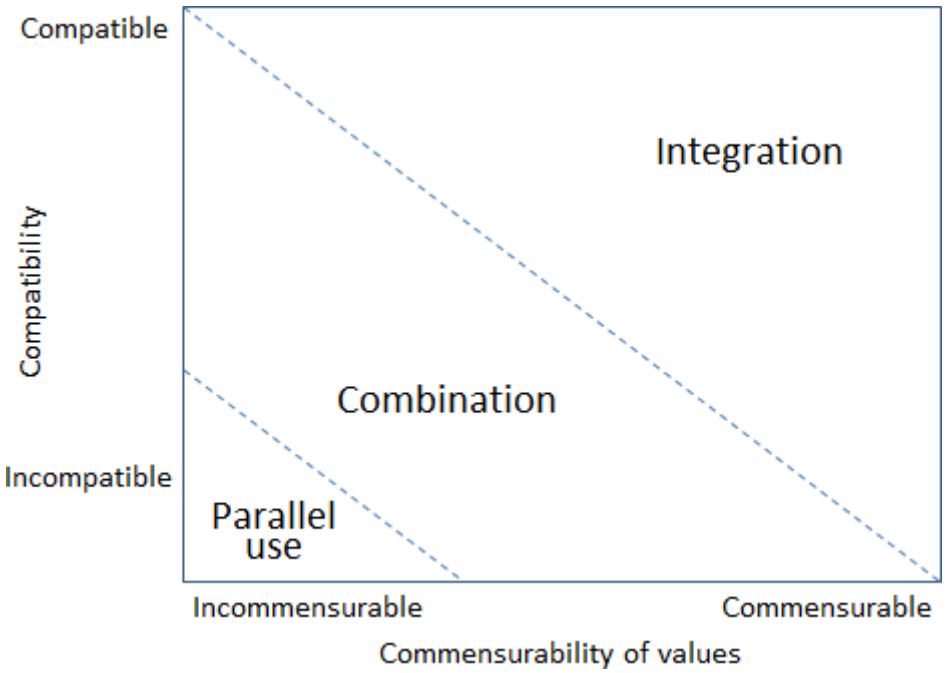

Figure 1: General integration framework. Commensurability refers to whether value dimensions and approaches are logically commensurable, and compatibility refers to whether valuation methods are technically compatible.

Full integration takes place when both methods are tailored to answer a specific question together. From the start both processes need to be designed in a way that they mutually complement each other, or one needs to be adapted to fit the other to make them fit together. This requires that they are commensurable and compatible. In such a case, both methods are adjusted to each other. Thus, this is a hybrid, integrated approach, which provides a consistent stream of information.

Combination allows for a more flexible approach where neither full commensurability of value dimensions or compatibility of methods are required. Two separate valuation studies can be combined – carried out in the same setting – to provide additional information on the evaluated aspect of nature. The key here is that one helps to interpret the other. This approach does not require changes in any of the methods, but it is necessary that they cover the same topic and can be discussed together in a consistent manner (hence require some degree of technical compatibility). In such a case, the use of one method assists the use (and interpretation) of the other. Although other researchers have sometimes referred to what we call 'combination' as 'parallel use' or 'parallel track analysis' (Hattam et al., 2015; Teddlie and Tashakkori, 2009), we prefer to keep 'parallel use' as a designation for even less integrated arrangements – as indicated in the following paragraph.

Parallel use of different valuation methods makes it possible to obtain different pieces of information on the same object of study, without any effort of adjusting one method to fit the other, and without the need to adjust their interpretations. If these different methods do not in any way influence each other but simply measure different things, and it is possible to compare their results (even though they do not necessarily shed new light on each other) this is merely parallel

use of different methods. This does not go beyond the two (or more) separate studies being considered together. For example, one might study a park with the use of different valuation methods and thus collect complex information about this park, but in the case of parallel use such information would not be more comprehensive than just two sets of results of two different studies used together. Still, such a multiple-method approach is likely to provide better understanding than could be gained from the individual approaches alone. What we call 'parallel use' is sometimes – in broader contexts, not necessarily focusing on valuation – referred to as triangulation of research methods (Greene et al., 1989).

While in the case of integration both methods are consistent enough to be used in one model, in the case of combination and parallel use methods remain separate. In the latter two cases, both methods can still consistently indicate that the value of a studied object is high or low. Also, further arrangements are possible to improve the results of different valuation studies, for example by adding further valuation studies to those that have already been carried out – to complement them with further information on the studied object (which is similar to parallel use, even though the different methods are used sequentially). However, in such cases, new methods would have to be either integrated with the already used ones, or combined with them, or used in parallel. Ultimately, we assume that if integration of a given pair of valuation methods is possible, then of course also combination and parallel use of those methods are possible.

3 METHODOLOGICAL OPTIONS

In this section, we first present 21 examples of different valuation methods used to depict economic, social and ecological value dimensions (seven per dimension) and then consider potential linkages between them.

3.1 Examples of valuation methods used in the context of valuing nature

Tables 1, 2 and 3 present 21 examples of valuation methods and approaches used to depict economic, social and ecological values of nature. The selection of these examples is meant to demonstrate a broad range of methods and approaches currently in use and it is by no means an exhaustive overview. Readers interested in specific information on these and other methods should refer to Champ et al. (2003) in the case of monetary valuation methods, to Christie et al. (2012) and Kelemen et al. (2014) in the case of non-monetary valuation methods, and to, for example, Carignan and Villard (2002), Noss (1990), and Petchey and Gaston (2002) in the case of ecological valuation methods.

The boundaries between these methods are based on the units or value dimensions that they use to describe values, rather than on how they elicit those values. In particular, when preparing our list of social/non-monetary methods, we took into consideration that some of the so-called non-monetary valuation methods could also be used for monetary valuation, depending on what questions we ask to respondents (e.g. surveys, interviews, focus groups, citizen juries, transect walks, Delphi panels, and even participatory or rapid rural appraisal etc.), although of course they are most often used in a non-monetary context. Furthermore, as explained by Kelemen et al. (2014, p. 2): 'Due to the large heterogeneity of non-monetary techniques, it is difficult (and probably not desirable) to arrive at the same level of methodological consistency as in the case of monetary valuation based on neoclassical economics'. As a consequence, some of the social and ecological methods can be considered approaches rather than methods. They illustrate a broader philosophy of eliciting values and can also be used for other purposes. In particular, ecological methods are not used for valuation per se, but rather to capture and quantify different kinds of ecological patterns that can be linked to how useful these patterns are seen to be in view of certain desired ecosystem features. In general, higher biodiversity translates into higher ecological value.

Table 1: Examples of economic (monetary) valuation methods and approaches.

Broader approach	Method	Brief description
Revealed preferences – existing markets	Market price	Value estimates are based on prices available in the market (available only when a given aspect of nature is subject to market exchange).
	Avoided or replacement or substitute cost	Value estimates are based on how much damage can be avoided thanks to a given aspect of nature, or how much one would have to pay to replace it.
Revealed preferences – surrogate markets	Hedonic pricing	Value estimates are based on how much a given aspect of nature contributes to the value of a market good, most commonly in the case of the real estate market.
	Travel cost method	Value estimates are based on how much people pay to reach a certain destination which is attractive for environmental reasons.
	Productivity method	Value estimates are based on how much a given aspect of nature contributes to the production of commercially marketed goods/services.
Stated preferences	Contingent valuation	Value estimates are based on how much people declare they would be willing to pay for a given aspect of nature in the context of hypothetical scenarios (or how much they would be willing to accept as compensation for the loss of this aspect).
	Choice experiment	Similar to contingent valuation, but value estimates are derived from choices that people make in hypothetical market situations (trade-offs which they make between the different attributes), rather than upon a direct request to state their willingness to pay.

Table 2: Examples of social valuation methods and approaches.

Method	Brief description
Rankings, including Q sort and conjoint analysis	Values are derived from comparisons that people make between different aspects of nature or statements regarding environmental management.
Observation, including participant observation, time use, roleplaying	Values are derived from people's behaviour – the observation of how people behave, how they spend their time, what roles they adopt in certain circumstances, in certain situations that involve their interaction with the environment.
Storytelling, photo elicitation	Values are derived from how people represent reality in their stories or through their pictures and photos. Such studies may involve asking respondents additional questions regarding why certain things are of importance.
Content/document analysis	Values are derived from the analysis of different documents, including official documents, legal texts, newspaper articles etc., based on the different representations of nature and nature protection in those documents.
Non-monetary deliberative and participatory approaches	Deliberative and participatory processes where participants reveal their values and contrast them with those of other participants. As a result of such interaction, they arrive at a joint value statement. Specific methods include citizen juries, focus groups, Delphi surveys, participatory mapping, participatory rural appraisal (PRA), participatory action research (PAR).

Psychometric methods	Values can be revealed based on the study of people's emotions and physiological responses to different stimuli (e.g. with the use of eye movement or brain scans), often referred to as experiential values.
Health-based methods	Values can be derived based on the influence of nature on people's health. The more positive are such health impacts, the higher is the value of the associated aspects of nature. Specific methods include clinical measurements and census data.

Table 3: Examples of ecological valuation methods and approaches.

Method	Brief description
Number of species surveys and models	The most basic form of 'ecological/biological valorisation' within which the perceived value increases with the number of species that use a given ecosystem.
Phylogenetic analysis	The ecological value of an ecosystem depends on the taxonomic diversity and thus different evolutionary pathways of species (more distant taxa translate into higher diversity/value as it reflects higher evolutionary processes). Such an analysis is usually based on genetic information.
Functional diversity analysis (assigning and quantifying traits)	Ecological value depends on the diversity of niches, which in turn reflects the different traits of species or their life history characteristics. Again, the higher diversity, the higher value.
Functional performance analysis	Measurements of performance (speed, magnitude, efficiency) of specific processes and functions, such as pollination, decomposition, nutrient cycling, soil stabilisation. In principle, the better performance, the higher value.
Spatial heterogeneity analysis	Ecological value depends on variation among species assemblages (based on species lists or subpopulations, genetic information etc., analysed at different levels of biodiversity: alfa, beta, gamma diversity). The higher the diversity of an ecosystem compared to selected geographical reference points (for example, a similar but larger ecosystem with a larger pool of species), the higher is its value.
Conservation status surveys and models	Ecological value is sometimes assessed based on population sizes and trends, and the more threatened a given aspect of nature is, the higher is its value.
Focal species identification (expert assessment)	Ecological value is sometimes perceived through the lens of the role that a species plays in an ecosystem (such as keystone, umbrella, indicator species). One of the reasons for this might be that the protection of such species often translates into the protection of the whole habitat. The more important a species is for an ecosystem, the higher is its value.

3.2 Integration vs. combination vs. parallel use of different valuation methods

To analyse the potential for integrated valuation of nature, we consider cross dimensional pairs of the above methods. Below, we present and discuss three tables capturing the most relevant arrangements of methods: economic (monetary)/social; economic (monetary)/ecological; and social/ecological. Where possible and relevant, we provide examples indicating either what such an integrated valuation exercise might look like or how it was actually achieved in practice.

3.2.1 Economic vs. social

Table 4 presents opportunities to link economic and social valuation methods. In fact, many of these methods are relatively close to each other and they often use similar tools, such as questionnaires and surveys, which is linked to their technical compatibility. Similarly, because eco-

nomics and sociology/psychology represent social sciences, logical commensurability can be expected in most cases. Many attempts have already been made to integrate them, in particular with regard to linking stated preference methods with deliberative processes.

Table 4: Opportunities to link economic and social valuation methods (I – integration, C – combination, P – parallel use).

	Market price	Cost methods	Hedonic	TCM	Productivity	CV	CE
Rankings	C	I	I	I	P	I	I
Observation	C	I	I	I	P	I	I
Storytelling	C	I	I	I	P	I	I
Content analysis	C	I	I	I	P	I	I
Deliberative	C	I	I	I	P	I	I
Psychometric	I	P	I	I	P	I	I
Health-based	I	I	C	I	P	I	I

Market prices are the easiest but also a highly inaccurate method for valuing nature, this because few aspects of nature are subject to market exchange. Integrating market prices with social valuation methods would be difficult because people are likely to rank values differently than what would be indicated by prices. For example, people do not necessarily buy the most expensive products, which the market would indicate to be the best; nor do they necessarily buy the cheapest. Only in the case of psychometric and health-based methods might integration be possible, and in both pairings are used relatively often. For example:

1. *Corporate marketing departments integrate market pricing with psychometric methods when they decide on where to locate products on store shelves. A similar approach might be to study with mobile equipment what people feel and how they react to visiting a park depending on how much it costs to enter such a park. Obviously, there are further complications, such as that people react differently to price signals - some will enjoy something more if they pay more for it, others just the opposite.*
2. *With regard to health-based approaches, their integration with market prices is less likely but still possible. For example, one could study how people respond in terms of their health or stress to the introduction of different levels of a fee to enter a park (in an experiment testing people's willingness to pay for entering a park).*

In all other cases, market prices can at best be combined with social valuation methods. Within such combinations, researchers could study discrepancies between market prices and what people think about the value of certain aspects of nature, and how those discrepancies could be reduced. Such combinations might help us to understand whether people's behaviour is consistent with what we would expect based on typical market reasoning (and market prices).

In the case of cost methods, integration with social valuation methods is possible in most cases, except for psychometric ones which might only allow for parallel use because of limited commensurability of values. Social valuation methods could provide additional input into cost calculations, primarily by revealing whether a given aspect of nature is a good substitute or replacement for a given good or services available in the market. This could be done by asking groups of people or individuals (story telling), and observing what people actually do (what they choose as

substitutes) or by looking for already available information, e.g. in historical documents. Such an approach is the most commonly used in practice in the case of health-based methods. For example, health-based avoided cost methods could reveal costs related to environmental degradation and benefits related to environmental improvement (e.g. Kan and Chen, 2004).

Hedonic pricing makes it possible to demonstrate the value of the different aspects of nature. Integrating hedonic pricing with other valuation methods has been the focus of our work on integrated valuation carried out within GREEN SURGE. First, we followed a standard procedure of differentiating the different sizes of green spaces and their different categories (Czembrowski and Kronenberg, 2016), then we integrated hedonic pricing with softGIS (i.e. one of the participatory mapping methods) that captured the diversity of values that people attribute to urban green spaces (Czembrowski et al. 2016a). A similar approach was followed by Daams et al. (2016) who successfully combined hedonic pricing with value mapping survey data. In another study, we integrated hedonic pricing with the concept of biocultural diversity, differentiating different green space types based on their biocultural value, i.e. the extent to which the current biodiversity resulted from cultural practices from the past (Czembrowski et al. 2016b). We continue working on integrating hedonic pricing with still other valuation approaches, including the sociotope, which is another kind of participatory mapping developed in Stockholm (Ståhle, 2006), and with another monetary valuation method – choice experiment. Integration of hedonic pricing with most social valuation methods seems feasible, except for health-based methods, which are more likely to be successfully combined – rather than integrated – with hedonic pricing.

In the case of the travel cost method, integration seems feasible with all social valuation methods, as the latter can be used to assess the recreational potential of the locations to which we want to assign value. The value revealed through the travel cost method clearly depends on the recreational potential, but in a standard procedure this recreational potential is arbitrarily assessed by experts or it is derived from the special status of a given location, e.g. the fact that it is protected as a national park or an urban park. All of the social valuation methods can provide more specific information on the places of interest, and the travel cost method can then be used to compare the monetary value of locations characterized by the different values captured with social valuation methods.

Similarly, in the case of the stated preferences methods (contingent valuation and choice experiment), integration is feasible with all social valuation methods. This is also something that is already practiced, and that has been advocated for a relatively long time – especially in the case of deliberative approaches (Howarth and Wilson, 2006; Kenter, 2014; Lo and Spash, 2013; Spash, 2007; Zografos and Howarth, 2008). In such cases, an economic valuation study can be carried out before and after a deliberative process to find out whether individual values are consistent with group values, or – in other words – how group deliberation affects individual values. A similar approach might be used to intermit economic valuation with other social valuation methods. This may be possible even in the case of psychometric methods. For example, the Humanities Lab in Lund performs psychometric measurements of subjects exposed to views of nature to find out to which stimuli people react in what way (Donaldson-Selby et al., 2012; Sang et al., 2014). Then, further studies could be conducted to check for consistency of different valua-

tion (or – more broadly – assessment) perspectives. It could also be integrated with one of the stated preferences methods.

The productivity method is the only economic valuation method where integration with social valuation methods seems less relevant. The productivity method is based on the analysis of production functions of different commercial processes, thus the assessment of various aspects of nature by people through the lens of social valuation methods does not have much to do with the contribution of those aspects to the value of final goods/services available in the market (very limited commensurability). Still, it may still make sense to analyse the results of productivity method in parallel with the results of social valuation methods. They may still shed a new perspective on the differences and similarities between these different dimensions.

3.2.2 Economic vs. ecological

Table 5 presents opportunities to link economic and ecological valuation methods. Such arrangements are more challenging than economic/social methods because monetary (economic) and ecological values are less commensurable. Nevertheless, it is still possible to adjust our reasoning in a way that makes the different types of information commensurable in the sense that they can mutually complement each other and provide a more comprehensive and thus specific picture of the analysed aspects of nature. In particular, ecological valuation methods provide useful ecosystem characteristics which can be then evaluated with the use of economic valuation methods (hence ensuring compatibility). This is feasible as long as ecological characteristics can be understood by those who are expressing or calculating values.

Table 5: Opportunities to link economic and ecological valuation methods (I – integration, C – combination, P – parallel use).

	Market price	Cost methods	Hedonic	TCM	Productivity	CV	CE
Number of species	I	I	P	I	I	I	I
Phylogenetic diversity	C	C	P	P	P	P	P
Functional diversity	C	I	I	C	I	I	I
Functional performance	I	I	I	C	I	I	I
Spatial heterogeneity	C	I	I	I	P	I	I
Conservation status	I	I	P	I	P	I	I
Focal species	I	I	I	I	P	I	I

The use of market prices for valuing nature requires that the properties of the selected aspects of nature are understood by the general public. This limits the potential integration opportunities for market prices to the number of species, the conservation status or presence of focal species, and to some extent functional performance (which can all be relatively easily understood by regular users of nature). All of these measurements can be connected to a sense of naturalness, which in many countries has been the root reason for nature conservation. For example, people are likely to pay more for entering a reserve with more species, and they are likely to pay more for more biodiverse meals (wild food, slow food, local products based on local varieties, breeds of cultivars and biodiversity/species conservation practices). In fact, various environmental branding/labelling schemes are based on species lists or on focal conservation species – e.g. in the case of wines, vineyards (Nunes and Riyanto, 2005). However, other measures of ecological

value (phylogenetic diversity, functional diversity and spatial heterogeneity) are more academic and consumers who pay for entering protected areas or for other aspects of nature are mostly not aware of such academic concepts or considerations. If at all, such valuation methods could rather be combined with market prices in an academic exercise – checking whether the monetary/market and ecological values converge. However, they would probably only do so very rarely.

For the same reasons, cost methods are easier to integrate with ecological valuation because both involve expert judgements. The only exception here might be phylogenetic diversity, which is the most academic of all our examples of ecological valuation methods. It is still possible to combine monetary valuation with phylogenetic diversity when one looks at them simultaneously and tries to explain what phylogenetic diversity means in terms of increasing/decreasing avoided costs or replacement costs of certain ecosystem/land management schemes. And this could be even more relevant in the case of functional performance – for example in the case of pollination or shade, and the need to replace these benefits with human made capital. Number of species, conservation status and focal species can be integrated with various compensation schemes and replacement cost valuation. It might be possible to estimate how much one would have to pay to re-establish the list of species previously present in a given area, or to bring a species back to a less threatened conservation status, or to ensure that a given focal species is present in an area. Furthermore, functional diversity and performance, as well as spatial heterogeneity have bearing on resilience, and this may also translate into avoided costs, especially at the general level of human dependence on ecosystems (as captured by the insurance value of resilience (Green et al., 2016)).

Like market prices, hedonic pricing requires that those who pay for certain aspects of nature understand the selected characteristics of the associated environmental amenities. For example, one can assume that real estate buyers could recognize the difference between proximity to green spaces of higher or lower spatial heterogeneity or functional performance, but not down to the number of species, conservation status or phylogenetic diversity. Spatial heterogeneity might be the most relevant in this case because the diversity of landscapes and habitats may ultimately translate into the diversity of uses, which is what most people appreciate. A related approach was taken by Xu et al. (2016) who used four 'landscape ecological metrics' in their hedonic pricing study of green spaces in Beijing – richness, accessibility, distribution, and shape configuration – all of which are related to spatial heterogeneity. The potential for integrating functional diversity and focal species (especially certain conservation flagship species) with hedonic pricing is much lower, and restricted to certain circumstances and conditions. Notably, higher ecological value may translate into restrictions on use, which may negatively affect the perceived use value of such ecosystems. People may want to live close to a park, but not necessarily to a protected area, although evidence is not unequivocal (Lutzenhiser and Netusil, 2001; Melichar and Kaprová, 2013). Similarly, functional diversity or the presence of focal species may appeal only to very narrow groups of people and thus would only work in the case of very specific, broadly recognised ecosystem components – e.g. assemblages of trees. Usually, to be meaningful to ordinary consumers, such ecosystem components would have to have a particularly high cultural significance (which links to social valuation methods), and in such circumstances their value could be connected to the concept of biocultural diversity (hence such integration might work in certain biocultural contexts, but not everywhere). Otherwise, the signal would be too weak to be cap-

tured by a hedonic pricing model. Similarly, if to a lesser extent, functional traits of ecological features (translating into functional diversity) could be used as attributes of an ecosystem (e.g. a park or a reserve) where people would have to pay a fee to enter. Both of these examples of method integration are fairly unlikely, though. In the cases of phylogenetic diversity, number of species, and even conservation status, hedonic pricing is too blunt to reflect any differences – in the sense that most buyers of market goods, including real estate, would not be able to distinguish between the different levels of ecological value measured with these methods (hence only allowing for parallel use).

The travel cost method is comparatively easier to integrate with ecological valuation methods, relative to hedonic pricing; people who visit natural sites do so because of its recreational value. The recreational value of an ecosystem often depends on this ecosystem's ecological value, especially as measured by the number of species, spatial heterogeneity, conservation status and the presence of focal species. All of such ecological aspects of value contribute to recreational attractiveness (value) of an ecosystem. Functional diversity and performance are far less obvious indicators of recreational value; hence it might be more meaningful to combine them with the travel cost method rather than to integrate them. Again, phylogenetic diversity is too abstract for regular ecosystem visitors, hence it could at best be used in parallel with the travel cost method.

The productivity method can capture the value of those aspects of nature that contribute to the value of final commercially produced goods and services. This needs to be considered on a case by case basis. For example, some ecosystems can be more productive thanks to a longer list of species (as shown by examples of shade-grown coffee and constructed wetlands), but a longer list of species might be contrary to industrial agriculture. Similarly, in the case of functional diversity and performance, one could think of specific products/production processes that would benefit from higher ecological value of ecosystems (pollination serves as a prominent example). Nevertheless, it seems that most aspects of ecological value are not relevant from this perspective (limited or no commensurability), hence only allowing for parallel use.

Both stated preferences methods are equally easy to combine with ecological valuation methods as they offer opportunities to ask people very specific questions, and provide respondents with additional information on the characteristics of valued ecosystems. In fact, these methods require that the considered aspects of nature are defined by criteria that allow for evaluation – and the different levels of these criteria are then associated with the different levels of their monetary value. Hence, these methods are relatively often integrated with ecological valuation methods in the sense that they are used to study human preferences regarding different ecosystem characteristics, and they require that the studied characteristics have different specified levels (i.e. that the different levels of their value can be compared through the lens of monetary units). The best known examples include the monetary valuation of the number of species (c.f. Farnsworth et al., 2015), conservation status (Tisdell et al., 2007), and focal species – or, more broadly, of a label under which a given aspect of nature is sold (Czajkowski and Hanley, 2009). Spatial heterogeneity as well as functional diversity and performance may be more easily understood by some people than by others, but – with proper introduction – they can also be used in valuation studies (c.f. Czajkowski et al., 2009; Farnsworth et al., 2015). Indeed, some ecosystem functions may be better known than others, currently perhaps especially those related to pollination – as opposed to mycorrhiza, symbiosis, nutrient functioning etc. Again, phylogenetic diversity may

not be integrated nor combined with stated preferences methods. At best, it can be used in parallel with those methods. For example, one can discuss the results of ecological and stated preferences studies together and try to draw some conclusions jointly informed by both, but – in most circumstances – these ecological measures are rather difficult to understand by ordinary people and thus have little impact on what people think they would be willing to pay for.

3.2.3 Social vs. ecological

Table 6 presents opportunities to link social and ecological valuation methods. This table has the largest share of arrangements allowing for parallel use only (or at best combination). Again, commensurability of values needs to be understood broadly here, as an opportunity for those methods to mutually complement each other (hence requiring some degree of comparability on the same scale) and provide a more comprehensive picture of the analysed aspects of nature. Similar to the case of linking economic and ecological methods, ecological valuation methods provide useful ecosystem characteristics, which can be then assessed with the use of social valuation methods (ensuring compatibility). But again, this works only when ecological characteristics can be understood by those who are expressing values.

Table 6: Opportunities to link social and ecological valuation methods (I – integration, C – combination, P – parallel use).

	Rankings	Observation	Storytelling	Content analysis	Deliberative	Psychometric	Health-based
Number of species	I	C	I	I	I	P	P
Phylogenetic diversity	I	C	I	I	I	P	P
Functional diversity	I	C	I	I	I	P	P
Functional performance	I	I	I	I	I	I	I
Spatial heterogeneity	I	C	I	I	I	I	P
Conservation status	P	I	I	I	I	P	P
Focal species	P	I	I	I	I	P	P

Rankings are relatively easy to integrate with ecological valuation methods (Botzat et al., 2016); most of the ecological value concepts contain certain attributes that can be ranked by people when they are provided with additional information. For example, social preferences for functional diversity of plants can be studied in different neighbourhoods and countries, but this requires working with traits that are presumably meaningful to people and not necessarily any traits that biologists might address (Goodness et al., 2016). Obviously, rankings can also be based on expert opinion, which makes it possible to use them even in the case of the most complicated concepts, such as phylogenetic diversity. Rankings may not be the sharpest of tools, but they can be further combined with other valuation methods and tools. The only cases where integration with rankings would not be meaningful are conservation status and focal species. It would hardly make sense to rank species by how threatened they are and link this to their value. And it would be equally difficult to make sense out of a ranking of focal species. Such rankings would be skewed because people tend to rank highly what is very rare or what is very abundant, overlooking what is in the middle – and the same in the case of what is considered a focal species. Parallel use would be more relevant for these two methods.

Observation of people's behaviour (e.g. protesting or other articulations of concern) can be used to indicate which phenomena and what aspects of nature are valued. However, for such observation results to be meaningful, we have to assume that people show a behavioural response to information (which needs to be meaningful to them). Therefore, integrating observation with ecological valuation methods only makes sense in the case of the relatively easy to understand selected aspects of functional performance (such as those resulting in shade or other most basic and tangible ecosystem functions), conservation status and focal species. In other cases, at best, ecological valuation methods can be combined with the observation of people's behaviour in response to new information or new developments.

Similarly, storytelling can pick up on any issue, provided that the person who tells the story can construct a narrative that captures the issue or – at least – that the researcher can make sense of what the respondent is telling. Therefore, integration is relatively easy in the case of selected aspects of functional performance, conservation status and focal species, but it is more challenging for other ecological valuation methods. The relatively vague biodiversity indexes, such as species lists, or at least the presence of selected focal species have been part of conservation narratives for a long time. They reflected how conservation has been articulated. Also, species lists and spatial heterogeneity are relatively easy for people to link to historical situations. Conversely, phylogenetic diversity and functional diversity can only be expected to be addressed by regular people in very specific circumstances. One example might be the current upswing for landrace or heirloom varieties, a trend where people are concerned with the often culturally meaningful variation within a well-known species, reflecting concerns regarding monocultures, homogenisation and loss of cultural heritage (Veteto and Skarbø, 2009).

Content analysis can potentially be integrated with any ecological valuation method. This is so because one can look for information in any sphere, any group of documents (legal documents, newspaper articles etc.), whatever is relevant from the point of view of one's study. These documents can reflect opinions of different groups of stakeholders and can reveal the different values these groups attribute to nature.

Similarly, deliberative methods can potentially be integrated with any ecological valuation method. In the case of deliberative methods, the different respondents (or even representatives of different stakeholders) are brought together to discuss a given problem. The exchange of knowledge and perspectives influences how the individual thinks, and potentially also the values she or he holds. New information, or even value statements expressed by others, can change how respondents value something. This may be related to new information on complex concepts of ecological diversity (such as phylogenetic diversity and spatial heterogeneity).

Psychometric and health-based studies are difficult to integrate with ecological valuation methods. Indeed, they seem irrelevant in most circumstances of potential arrangements of different value dimensions – because of limited commensurability they can only be used in parallel with most ecological valuation methods. Nevertheless, both psychometric and health-based methods can be connected to functional performance. For example, both can be used to study how people feel (or how they respond with stress etc.) in different green spaces depending on their microclimate or shade, which may be considered as transparent and broadly understood categories of

functional performance. Also, psychometric methods could potentially be integrated with spatial heterogeneity, especially as far as variation in the landscape is concerned.

4 DISCUSSION AND CONCLUSIONS

The above overview indicates that there is considerable potential for integrating valuation methods. Integration seems feasible in the case of most (about two thirds) of possible arrangements of two different valuation methods or approaches considered above, and several other arrangements reveal potential for combination or at least parallel use of the different methods. The potential for integrated valuation is larger than it is usually thought to be. This is reflected in an increasing number of studies that integrate two or more valuation methods/approaches (e.g. Castro et al., 2014; Kenter, 2014) or that at least combine different valuation methods/approaches (e.g. Hattam et al., 2015; Iniesta-Arandia et al., 2014; Langemeyer et al., 2015; Martín-López et al., 2014; Vollmer et al., 2015).

Most importantly, many examples indicate how integrated valuation can be done in practice, especially in the case of economic valuation methods. Ecosystem goods/services have been described in terms of attributes that can be ordered along certain scales which are then used to estimate different monetary values. For example, this has been the case when hedonic pricing has been integrated with softGIS (Czembrowski et al. 2016a), value mapping survey data (Daams et al., 2016), biocultural diversity (Czembrowski et al. 2016b) and various 'landscape ecological metrics' (Xu et al., 2016). Similarly, stated preference methods can also be used to assess the value of the different aspects of nature already characterized by the different ecological values (e.g. Czajkowski et al., 2009; García-Llorente et al., 2011). Also, integration is common in the case of deliberative methods, which are often connected to other valuation methods to check how individual and group values differ (Christie et al., 2012; Kenter, 2014; Kenter et al., 2015).

We have shown that there are more opportunities, including pairings across dimensions that have probably not been considered as integrable so far. Still, integration of different valuation methods is not necessarily a new thing – it is often just an expansion or refinement of one of the methods. The main benefit of integrated valuation is that it provides a more detailed and nuanced picture of what people think about the different aspects of nature. People do not think unidimensionally and value clusters may better reflect how people actually view the world, and they can be more relevant in complex policy judgment contexts (Satterfield et al., 2000). Integrated valuation can reveal trade-offs between the different value dimensions, or between the different needs of the different constituencies. It allows us to broaden the traditionally 'flat', unidimensional and hence morally restrictive character of normative conclusions based solely on 'utility information', and especially to enliven the traditionally 'cold' monetary valuation (Beckerman and Pasek, 1997; Satterfield and Slovic, 2004). However, this is the case primarily when one connects monetary and social valuation, or when one subjects monetary values to social valuation. This is rather unlikely to happen in the case of linking monetary or social with ecological valuation. The latter is best treated as a characterisation of environmental attributes. As such, ecological value is more objective compared to the subjective economic and social value estimates.

Monetary valuation can inform other discussions and value dimensions, but it need not be prioritized, especially when it is integrated with social valuation, and when social valuation plays a dominant role in such an exercise. One of the main reasons for not privileging monetary valuation is that it is based on the largest number of simplifying assumptions, which make it rather far removed from reality (Spangenberg and Settele, 2010; Wegner and Pascual, 2011). However, we

conclude that many integrated valuation studies rely on the use of economic (monetary) valuation methods as their core. This is contrary to the expectation that integrated valuation offers an alternative, non-monetary approach to capture the diversity of value perspectives/dimensions. Many of the approaches we have discussed other dimensions of value are subordinate to the dominant economic framework – for example, a hedonic pricing study remains a hedonic pricing study that expresses the value of urban green spaces in monetary units, even when the attributes of those green spaces result from complex social or ecological assessments (Czembrowski et al. 2016a). Obviously, one could have reversed the order, and ask the non-monetary question first, but in practice this is done far less frequently.

When integrating valuation methods, one has to remember that a synthesis inherits the flaws of the components, unless they complement each other and negate each other's limitations (Czembrowski et al. 2016a). Most arrangements presented as potentially integrable would provide new information and thus complement each other. For many of these arrangements the inclusion of new information would actually make the dominant valuation method more specific and meaningful (Czembrowski et al., 2016a, 2016b; Daams et al., 2016; Kenter, 2014; Langemeyer et al., 2015; Vollmer et al., 2015). Also, integrated valuation requires more time and data than do a traditional, unidimensional valuation, which may translated into higher costs.

Furthermore, even though integrated valuation provides a more comprehensive picture compared to single-dimensional valuation studies, such arrangements still fail to consider many issues or value dimensions not captured by what we have discussed in our tables above. We have based our tables on what is more or less readily available for inclusion. Some phenomena are hardly ever captured, for example non-linearity and thresholds. People may not see the value – or implications – of such ecosystem properties now, but it does not mean that they do not value them. Put simply, in normal circumstances, people may find it very difficult to express their preferences towards certain aspects of nature until they seen as threatened (or threatening). Until we find indicators that reflect aspects such as resilience or broader sustainability, we still offer partial and incomplete decision support for planning.

Examples of integrated valuation indicate that one method tends to dominate and other methods are subjected to the needs of the former (Czembrowski et al., 2016a). In practice, the other methods are used as inputs – as refined data – that are meant to fit into the dominant model (approach). Still, integrated valuation reveals a richer, more nuanced picture of human–nature interactions, compared to unidimensional valuation. Combination of different methods/approaches, on the other hand, allows for more flexibility, and it produces less specific results (which in many circumstances may actually be an advantage). In the case of combinations, their results are even more multi-dimensional because the different results remain separate (i.e. they are still expressed in their own specific units) and are only brought together for the purposes of better interpretation of the outcomes of each of the combined methods.

In our tables above, we assessed integration potential generously, trying to find as many opportunities as possible. However, one needs to keep in mind that some of those potential integration examples may refer to very specific situations only and require specific assumptions. Limited commensurability of different value dimensions (Aldred, 2006; Funtowicz and Ravetz, 1994) constitutes the main challenge. Again, our definition of commensurability is less restrictive than

the standard one. Integration requires that one adopts not only many assumptions specific to each individual method, but also further assumptions pertaining to the joint use of different valuation methods. Again, this is yet another argument indicating how much narrower the information provided by integrated valuation has to become, which may also translate into challenges in interpreting results.

Finally, it is important to note that the different valuation methods reveal values of the different stakeholders. This is yet another area where commensurability needs to be considered and which requires the consideration of the so-called value articulating institutions (Stagl, 2012; Vatn, 2005). The latter refer to the circumstances and settings within which values are revealed, and which may influence those values. As illustrated in the previous section, values can be revealed by experts as well as ordinary consumers/citizens. Values revealed by experts can only approximate values present within a society to a certain extent as these experts are often meant to represent 'the wisdom' of that society. Interestingly, many issues related to the value of nature to people are beyond most people's knowledge (and independent of it), for example resilience. Also, different groups of ordinary consumers/citizens value nature differently and their ability to benefit from the environment varies. This links to distributional and equity issues related to environmental justice, which are important to consider in any valuation exercise. Stated societal ambitions and values may sometimes be more reflexive than personal values, especially when the latter are elicited in a way that allows the respondents limited time for reflection. Also, the different values may not necessarily be commensurable, given the different reasons and rationales people have for stating a specific value (e.g., two persons may value something equally high but for completely different reasons). There are a number of such philosophical question surrounding our integrated valuation approaches, and they need to dealt with on a case by case basis.

Future research in the area of integrated valuation should strive to involve more dimensions – and methods – not just two, as discussed in this paper. Within GREEN SURGE we continue to develop new approaches in this field and some of our work can be found in Deliverable 4.3 (Report on the potential for integrating monetary and non-monetary valuation of urban ecosystem services). In addition to the work we have done so far (Czembrowski and Kronenberg 2016; Czembrowski et al. 2016a, 2016b; Engström, 2015), we plan to test further integrations of different valuation methods presented in this overview. In particular, we plan to test combinations between ecological and economic valuation methods in one of the GREEN SURGE urban learning labs for which we will have data on spatial heterogeneity/functional diversity (or at least UGI diversity) and ecosystem services generated within WP3 Deliverable 3.4. Eventually, we also plan to include the issue of integrated valuation in our forthcoming GREEN SURGE game on urban ecosystem services governance.

In conclusion: despite our attempts at integrated valuation, no valuation exercise will ever be comprehensive enough to capture all aspects of nature and all human preferences. Any attempt to value a specific aspect of nature will undervalue or otherwise reduce the perceived importance of other values/aspects of nature. Therefore, valuation results have to be interpreted with due care and seen as partial information only (Kallis et al., 2013). Eventually, integrated valuation approaches can be used to study increasingly detailed and specific issues – they help us to understand specific situations, but this knowledge is not necessarily relevant for broader

discussions on the value of nature to people. Again, perhaps surprisingly, instead of broadening the scope of analysis, we are narrowing (but refining) it. Still other value perspectives and approaches need to be identified and pursued to promote a broader view of human dependence on nature, for example political priorities and relational values (Chan et al., 2016; Kronenberg, 2014). These may elude the traditional approach of instrumental values (protecting nature for humans' sake) or intrinsic values (protecting nature for nature's sake), which are typically captured within the value dimensions and by the valuation methods addressed in this overview. They are, however, more closely aligned with multidimensional aspects of value of nature, such as resilience, sustainability and biocultural value.

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