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Chapter 3 - The means determine the end – pursuing plural valuation in practice

Lead Authors: Sander Jacobs, Berta Martín-López,

Contributing authors: David N. Barton, Robert Dunford, Paula A. Harrison, Eszter Kelemen, Heli Saarikoski, Mette Termansen, Marina García-Llorente, Erik Gómez-Baggethun, Leena Kopperoinen, Sandra Luque, Ignacio Palomo, Joerg A. Priess, Graciela M. Rusch, Patrizia Tenerelli, Francis Turkelboom, Rolinde Demeyer,Jennifer Hauck, Hans Keune,Ron Smith

Chapter overview

In environmental valuation, although it is well recognised that the choice of method heavily affects the outcome of a valuation, little is known about how existing valuation methods actually elicit the different values. Through the assessment of real-life applications of valuation, this chapter tracks down the suitability of 21 valuation methods for 11 value types and assesses the methodological requirements for their operationalization. We found that different valuation methods have different suitabilities to elicit diverse value-types. Some methods are more specialized than others, but every method has blind spots, which implies risks for biased decision-making. No single valuation method is able to capture the full spectrum of values of nature. Covering the intrinsic, relational and instrumental value dimensions requires careful selection of complementary valuation methods. This chapter also demonstrates that performing such an integrated valuation does not necessarily entail more resources, as for every value dimension, methods with low to medium operational requirements are available. With this chapter, we aim to provide further guidance on selecting a complementary set of valuation methods in order to develop integrated valuation in practice that includes values of all stakeholders into environmental decision-making.

Chapter Keywords

values of nature; integrated valuation; operational requirements; ecosystem services; valuation methods

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"*The end cannot justify the means, for the simple and obvious reason that the means employed determine the nature of the ends produced*" - Aldous Huxley

1. Introduction

The policy relevance of valuation of nature is reflected in international initiatives such as the Millennium Ecosystem Assessment (MA 2005), The Economics of Ecosystem services and Biodiversity (TEEB, 2010), the Strategic Plan for Biodiversity and the first CBD Biodiversity Target which aims at raising awareness on the value of biodiversity (SCBD, 2010). More recently, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) has developed a guide to assess the multiple values of nature and its benefits, in order to acknowledge these in all ongoing regional, global and thematic IPBES assessments (IPBES 2015). In addition, as values are shown to be the main drivers of sustainable behaviour (e.g. Ajzen, 1991; Schultz, 2011; Clayton et al., 2013), the way we value nature will directly impact achievement of the Sustainable Development Goals.

The dependence of our societies on nature has been well known and valued throughout history (Daily, 1997, pp. 5–6), although the field of environmental valuation is relatively young (e.g. Ridker and Henning, 1997). Already since the 1970s, different scholars emphasized the controversies, risks and limitations of environmental valuation relying on one value type only (typically economic value; e.g. Kapp, 1972; Pearce, 1976, Westman, 1977, Martinez-Alier, 1987; see Baveye et al., 2013 for an overview). Since the 1990s, monetary valuation has resurged due to its potential contribution to environmental decision-making (Bateman et al., 2013); although some authors have argued that its impact for influencing decision-making is still deficient (Laurans et al., 2013, Laurans and Merme, 2014). As a consequence, original criticisms have been revived in an equally growing body of literature which argues that monetary valuation fails to capture the importance of nature beyond economic values (e.g. Martinez-Alier et al., 1998; Chan et al., 2012; Dendoncker et al., 2014; Boeraeve et al., 2015; Gómez-Baggethun and Martín-López, 2015). In fact, valuation approaches that target single value-types, be they economic, ecological or socio-cultural values, can only represent part of the society and its worldviews, interests and preferences. As a response, integrated valuation approaches are increasingly put forward (Dendoncker et al., 2014, Martín-López et al., 2014; Jacobs et al., 2016).

Integrated valuation recognises that valuing nature to inform more sustainable decisions requires a broader definition of 'value' and 'valuation', and the inclusion of a plurality of values in decision-making. This realization is reflected in the growing critical mass of scientists from different disciplines engaging in the integrated valuation field (Jacobs et al., 2016). Instead of focusing on differences, critiques and academic opposition of single methods or schools, integrated valuation seeks to combine diverse approaches and methods, understand interdisciplinary differences, acknowledge different knowledge systems and interests of multiple social actors, and provide guidelines to integrate plural values in real-life decisions and problem solving (Gómez-Baggethun et al., 2014; Gómez-Baggethun and Martín-López, 2015). This emerging field of integrated valuation has percolated into various global science-policy interface initiatives such as IPBES (IPBES 2015, Jacobs et al., 2016; Pascual et al., in press).

The scientific understanding of the multiple ways by which different societies acknowledge and interpret the importance of nature has resulted in different value definitions, conceptions and categorizations (Kenter et al., 2015; Arias-Arévalo et al., in press, see table 3.1). In this chapter, three categorizations are applied. Within the traditional economic understanding of value, the Total Economic Value (TEV) framework classifies values into use and non-use values (Krutilla, 1967; Turner et al. 2003). Use values include direct use, indirect use, and option values while non-use values refer to satisfaction that individuals derive from the existence of environmental assets per se, or from the pleasure for others or future generations (Plottu and Plottu 2007). In ecological economics literature on ecosystem services (e.g. Farber et al., 2002; de Groot et al., 2010; Dendoncker et al., 2014; Martín-López et al., 2014) and in the TEEB project, values are classified into three value domains: ecological, sociocultural and monetary (Gómez-Baggethun and Martín-López, 2015).

Recently, IPBES adopts an even more inclusive approach for defining and categorizing values, by broadening the concept of value in terms of 'importance, worth or usefulness' , as well as 'principles and moral duties' (Díaz et al., 2015). The IPBES classification of values distinguishes three value dimensions: an intrinsic dimension, an instrumental dimension and a relational dimension (IPBES, 2015; Pascual et al., in press, table 3.1). Whereas the intrinsic dimension covers values of nature itself that are non-anthropocentric (Díaz et al., 2015). The instrumental dimension includes all the aforementioned use value types and are typical related with provisioning and regulating services, whilst the relational dimension refers to desirable relationships among people and between people and nature, being more associated with cultural ecosystem services (Chan et al., 2016).

Table 3.1. *Value classification according to three frameworks. Sources: Krutilla (1967); Farber et al. (2002); Turner et al. (2003); de Groot et al. (2010); Dendoncker et al. (2014); IPBES (2015); Díaz et al. (2015).*

Framework	**Category**	**Short definition**
Total Economic Values (TEV)	Direct use values (e.g. provisioning services)	Value derived from conscious use and enjoyment of nature, both extractive (e.g. wood, food) and non-extractive (e.g. tourism, appreciation of landscapes)
	Indirect use values (e.g. regulation of air pollution)	Value associated with regulating services, such as pollination, water purification or soil fertility, not necessarily entailing consciousness in their use
	Option values (e.g. preservation of forests for future use and other values)	Value associated with the potential to use and enjoy nature in the future
	Bequest values (non-use, e.g. natural heritage and cultural heritage for future generations,...)	Satisfaction that humans derive from the knowledge that future generations will use or enjoy nature

Framework	Category	Short definition
	Existence values (non-use, e.g. existence of diverse species and ecosystems)	Satisfaction derived by humans from the knowledge that nature (in its multiple forms) exists
TEEB values	Ecological values (e.g. resilience, biodiversity or functioning ecosystem,...)	Nature's capacity to provide ecosystem services (de Groot et al., 2002), related to resilience of ecosystems to ensure provision of services over time (Pascual et al., 2010)
	Sociocultural values (e.g. heritage, sense of place or spirituality)	Contributions of nature to cultural identity, sense of belonging, heritage, spirituality or sacredness, good social relationships derived from the use, enjoyment or management of nature (Chan et al., 2012; Martín-López et al., 2014)
	Monetary values (e.g. jobs, profits, costs or investments)	Contributions of nature to individual welfare, conceived as utility and represented through monetary metrics (Martín-López et al., 2014)
IPBES values	Intrinsic value dimension	Inherent value of nature, independently of any human judgement (Callicot, 1987; IPBES, 2015)
	Instrumental value dimension	Benefits of nature, contributions of nature to the achievement of human's quality of life (Díaz et al., 2015; IPBES, 2015)
	Relational value dimension	Good quality of life, desirable relationships among people and between people and nature (IPBES, 2015, Chan et al., 2016)

Because valuation methods have been designed to elicit particular value-types, they provide very specific information and reveal importance of biodiversity and ecosystem services in different ways (Martín-López et al., 2014). This points to the need to consider multiple methods in order to properly acknowledge the diversity of forms by which people value nature (Martín-López et al., 2014; Díaz et al., 2015, Gómez-Baggethun et al., 2016; Jacobs et al., 2016). However, there is only sparse information on the suitability of different methods to capture different values (e.g. Martín-López et al., 2014; Smith et al., 2016) or on their application in real-life practice (e.g. Bagstad et al., 2013).

This chapter aims to provide guidance for selecting a set of valuation methods which is both appropriate and realistically applicable to elicit the diversity of values associated with nature. Specifically, we (1) assess the suitability of 21 monetary, socio-cultural (also called non-monetary; e.g. Gómez-Baggethun and Martín-López, 2015), biophysical and synthesising methods to uncover the different value-types (sensu IPBES, TEEB and TEV, Table 3.1) and (2) assess the methodological requirements (in terms of resources, data and collaboration) for their application. This is the first comparative study which evaluates suitability of different methods to elicit various value dimensions in practice and assesses requirements for implementing integrated valuation that allows the consideration of multiple value dimensions.

2. Methods

2.1. Data collection

First, a survey template was developed to describe and assess the methodological requirements and appraise the suitability of 21 methods to elicit multiple values (sensu IPBES, TEEB and TEV). This sample of methods is a subset from the tools applied in the OpenNESS project (http://www.openness-project.eu/) and the main selection criterion was pragmatic: availability of eligible and responsive valuation experts with hands-on experience in the method.

In the survey template, one tabulated question evaluated how each method is estimated as suitable to elicit a range of value types (Table 3.1). Other questions asked information about the amount of new quantitative and qualitative data required, the degree of collaborations required with scholars from other fields and with non-academic stakeholders, as well as the demand in time and economic resources. We then synthesized the general level of requirements as the sum of the scores of (1) the need of new data, (2) the need of collaboration with scholars from other disciplines and with non-academic experts and (3) the level of time and economic resources for applying each method.

17 experts[6] who had actively applied various methods in real-life contexts filled in the survey, based on their previous and current application of the method in concrete case study contexts. Because some of the experts have knowledge and experience in multiple methods, they completed the survey for more than one method. For each socio-cultural and synthesising method, two experts completed the survey, while biophysical and monetary valuation methods were filled in by one expert only. After the experts filled in the survey, we validated responses by asking two reviewers per method to revise and complete the information provided by experts. Reviewers independently went through the information provided by experts. When disagreement emerged, a round of discussion was implemented in order to reach consensus. Final data used in this chapter results from various validation rounds between the experts and the reviewers.

For the purpose of this chapter, we grouped valuation methods in 4 groups according to the object of their valuation or the main units used (table 3.2, see also Harrison et al., *in press*). Biophysical valuation methods aim to appraise ecosystem condition and/or capacity of ecosystems to provide ecosystem

[6] Authors of this chapter.

services. Socio-cultural and monetary valuation methods target the social interest or demand for diverse values (Martín-López et al., 2014). Socio-cultural valuation aims to uncover the contribution of nature to human well-being, by eliciting human preferences beyond strictly monetary measurements; whereas monetary valuation methods use monetary units to elicit these preferences. Finally, synthesising methods aim at bringing together different types of information to support decision-making (Table 3.2). Appendix B provides a more elaborated description of methods (see also Harrison et al., *in press*).

Table 3.2. *Overview of the valuation methods considered in this chapter according to the four groups of methods: biophysical, socio-cultural, monetary and synthesising valuation methods. Methods are alphabetically ordered in each of the methodological groups. For a detailed description of methods, see Appendix B, and for a short description of methods see Harrison et al. (in press).*

Method	**Examples of applications in ecosystem service assessments**
Biophysical valuation methods	
MapNat App	An ecosystem service mapping application for Android smartphones (Priess et al., 2014)
Spreadsheet-type methods (a.k.a. matrix method)	Burkhard et al. (2012, 2014), Jacobs et al. (2014), Kopperoinen et al. (2014, 2016)
State and transition models	Bestelmeyer et al. (2010); Kachergis et al. (2011)
Socio-cultural valuation methods	
Cards game method	A method that combines photo-elicitation with a rating exercise (Demeyer, 2014)
Narrative method	de Oliveira and Berkes (2014); Klain et al. (2014)
Participatory mapping method, a.k.a. participatory GIS (PGIS) and Public Participation GIS (PPGIS)	Fagerholm et al. (2012); Palomo et al. (2013); Plieninger et al. (2013a); García-Nieto et al. (2014); Kopperoinen et al. (2016)
Photo-elicitation survey	García-Llorente et al. (2012a); López-Santiago et al. (2014)
Photo-series analysis (a.k.a. geotagged photo-analysis)	Casalegno et al. (2013); Martínez-Pastur et al. (2016); Tenerelli et al. (2016)
Preference assessment survey	Martín-López et al. (2012); Iniesta-Arandia et al. (2014); Oteros-Rozas et al. (2014)
Time use method	Higuera et al. (2013); García-Llorente et al. (2016)

Method	Examples of applications in ecosystem service assessments
Monetary valuation methods	
Benefit transfer	Johnston et al. (2015); Navrud and Ready (2007)
Cost-based methods	BBOP (2009); Saarikoski et al. (2016)
Hedonic pricing method	Garrod and Willis (1992); Barton et al. (2015)
Production function method	Losey and Vaughan (2006)
Shadow pricing method	Bekele et al. (2013); Polaski et al. (2011); Schröter et al. (2014)
Stated preferences method, which includes contingent valuation and choice modelling	Barkmann et al. (2008); García-Llorente et al. (2012a,b); Hanley et al. (1998); Lindhjem (2007)
Travel-cost method	Clawson and Knetsch (1968); Lankia et al. (2015); Martín-López et al. (2009); Termansen et al. (2013)
Synthesising valuation methods	
Bayesian belief networks	Barton et al. (2012); Gonzalez-Redin et al. (2016); Landuyt et al. (2013)
Deliberative valuation method	Kaartinen et al. (2013); Kelemen et al. (2013); Kenter et al. (2011); Raymond et al. (2014)
Multicriteria decision analysis	Kiker et al. (2005); Mendoza and Martins (2006); Saarikoski et al. (2016)
Scenario planning method	Oteros-Rozas et al. (2013), Palomo et al. (2011); Plieninger et al. (2013b); Ravera et al. (2011)

2.2. Data analysis

The method suitability responses were explored by principal component analysis (PCA, Dray and Dufour 2007). To this end, the response categories were coded numerically. The analysis explored patterns in (estimated) value-capturing suitability between all methods. The data was organized into a 21 methods x 11 value types matrix. The explanatory power of this analysis is reflected in the percentage of variance explained by the components (axes), whilst the correlation between value types can be read from the alignment of their vectors. R package ade4 (Dray and Dufour 2007) was used to conduct the PCA. We then synthesised the suitabilities for all methods per group (i.e. biophysical, socio-cultural, monetary and synthesising methods) to elicit suitability for IPBES value dimensions specifically (vectors a, b and c in Figure 3.1A).

3. Results

3.1. Diverse value types and dimensions

The PCA firstly provides some insight regarding the level of similarity between suitabilities to elicit value types (Figure 3.1A), and how they relate to IPBES value dimensions. Second, the pattern elicits which (groups of) methods are more or less suitable to cover the entire value spectrum (Figure 3.1B). The alignment of value types and dimensions is presented along the PCA-axes (Figure 3.1A). The X-axis (which explained 40% of variance) shows that intrinsic and relational values (*'a' and 'c'* in Figure 3.1A.) correlate with socio-cultural, existence, option, bequest and ecological value types. In fact, the X-axis depicts a suitability gradient from right to left, eliciting multiple value-types, except for the bundle of values associated with the instrumental value dimension, i.e. instrumental ('*b'*)*,* direct use (*'g'*)*,* indirect use (*'h'*) and monetary values ('*f'*) (Figure 3.1A). This bundle representing the instrumental value dimension is thus determined by the Y-axis (20% of variability).

3.2. Method suitability to elicit values

The grouping of different methods demonstrates that the studied biophysical valuation methods are least suitable to capture multiple values, although some might be more suitable to capture the intrinsic value dimension, e.g. MapNat ('*g'*) (Figure 3.1B). Here, it is also important to point out that despite the original classification of photo-series analysis ('*j*') as a socio-cultural valuation method because its capacity to represent social preferences of cultural ecosystem services (e.g. Casalegno et al., (2013); Martínez-Pastur et al., (2016)), its capacity to relate cultural ecosystem services with ecological properties (e.g. Martínez-Pastur et al., (2016); Tenerelli et al., (2016)) supports the idea that it can also be grouped as biophysical valuation method. In fact, it seems that the suitability of photo-series analysis to elicit values is more related to other biophysical valuation methods, rather than socio-cultural.

Monetary valuation methods seem mainly suitable to elicit values in the instrumental dimension, although some were considered suitable to elicit values in the intrinsic value dimension, e.g. stated preference methods ('*q*') (Figure 3.1B). Socio-cultural valuation methods were considered highly suitable to elicit most of the assumed 'intangible' values in the relational value dimension. Synthesising valuation methods, being dependent on input from other methods, seem to be suitable to elicit value types in both the instrumental and relational value dimensions, as well as in the intrinsic value dimension.

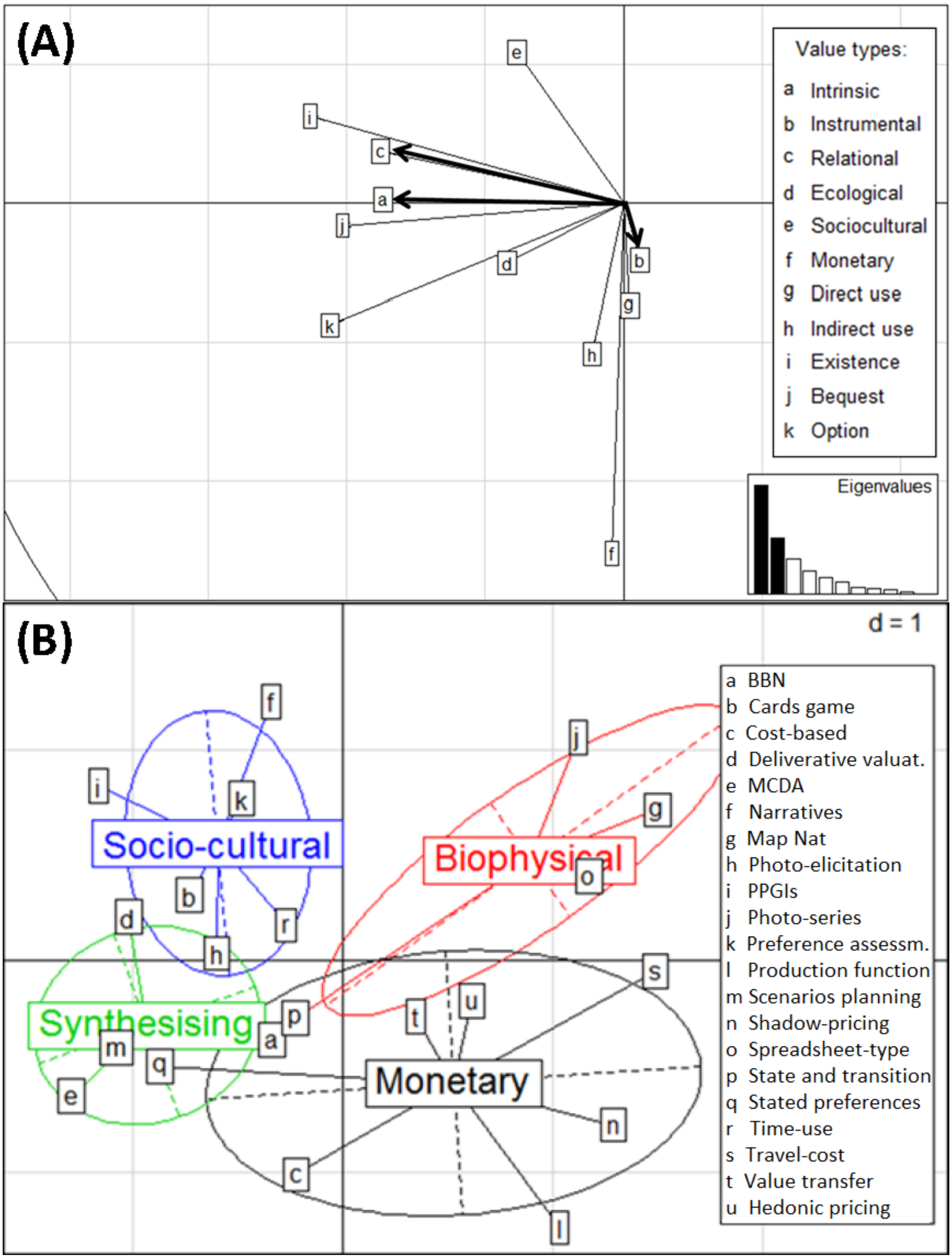

Figure 3.1. *PCA analysis of the suitability of 21 valuation methods to capture 11 value types. A: correlation circle of PCA using all surveyed value types (see Table 3.1). B: Methods' positioning on the PCA, grouped in biophysical,socio-cultural, monetary and synthesising methods. Explained variance X-axis 40%, Y-axis 20%. (BBN = bayesian belief networks; MCDA = multicriteria decision analysis; PPGIS = Participatory mapping). Photo-series analysis (j) as a crosslinking socio-cultural /biophysical valuation method has been considered biophysical in this analysis.*

Total coverage of IPBES value dimensions by all the methods is summarized in Figure 3.2. This representation clearly demonstrates that to cover all three value dimensions with a set of methods, ideally methods from all groups should be selected, especially since methods from the synthesising category depend on input from other methods.

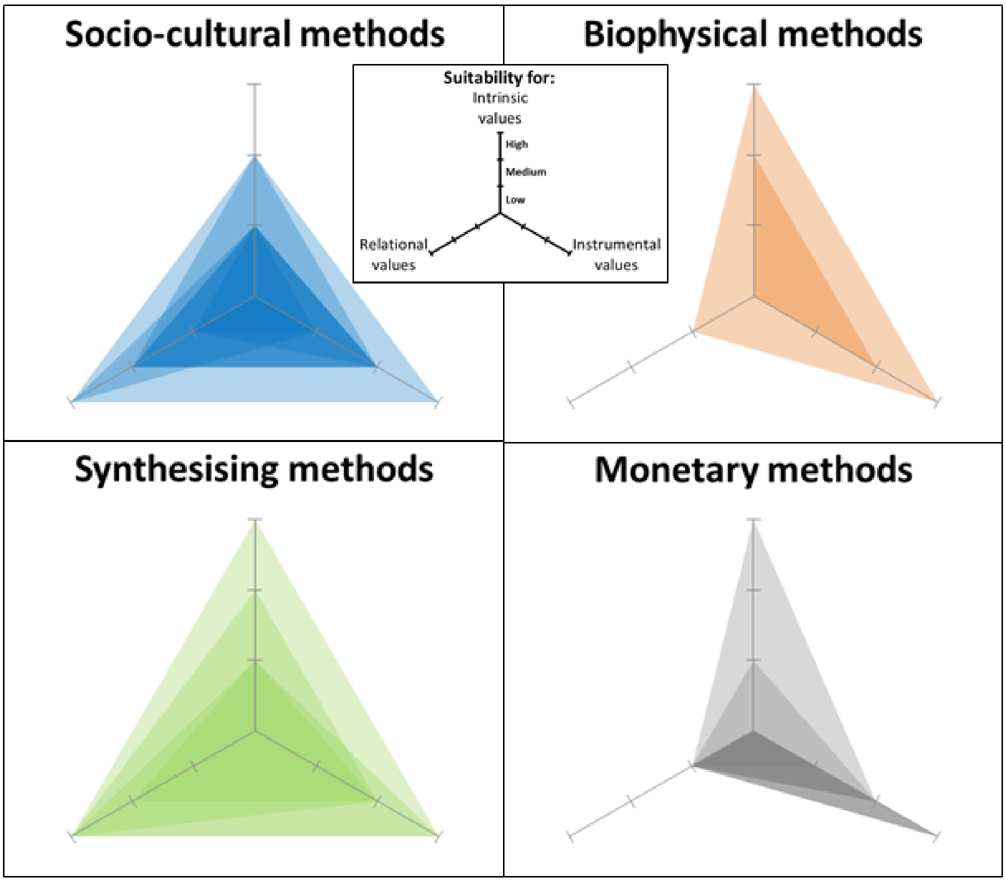

***Figure 3.2**. Suitability of studied groups of valuation methods to elicit the three main IPBES value dimensions: i.e. intrinsic, relational and instrumental values. Color grading represents increasing number of methods (darker means more methods).*

3.3. Requirements for method application

Overall, the group of socio-cultural valuation methods was assessed as the one with the highest level of methodological requirements, particularly in terms of more data (Figure 3.3). In fact, the most important requirement of socio-cultural valuation methods relies on the need for new quantitative or qualitative data. Synthesising valuation methods were assessed as the most demanding for the requirements of collaboration with scientists of other disciplines and non-academic stakeholders (Figure 3.3). Finally, the most demanding methods in terms of economic and time resources were monetary valuation tools (Figure 3.3).

Despite the high methodological requirements for the application of specific methods, at least one method in each of the four groups of methods –i.e. biophysical, socio-cultural, monetary and synthesising - was assessed to have low or medium level of general application requirements (Figure 3.3).

	DATA	COLLABORATION			RESOURCES		
	Amount of data	Researchers own field	Researchers other field	Non-academic stakeh.	Time	Economic	General level of requirement
Biophysical valuation methods							
MapNat App	◕	●	●	●	◔	◔	2/4
Spreadsheet-type method (basic)	◑	●	●	●	◔	◔	1/4
Spreadsheet-type method (advanced)	●	●	●	●	◑	◑	4/4
State and transition models	◑	●	○	●	◔	◑	1/4
Socio-cultural valuation methods							
Cards game method	◕	○	●	●	◔	◔	2/4
Narrative method	●	○	○	●	◑	◑	4/4
Photo-elicitation survey	●	●	●	○	◑	◑	4/4
Photo-series analysis	◕	●	●	○	◔	◔	1/4
Participatory mapping method	●	○	●	●	◑	◑	4/4
Preference assessment survey	●	●	●	○	◑	◑	4/4
Time use methods	●	●	○	●	◑	◑	4/4
Monetary valuation methods							
Benefit transfer	◑	●	○	○	◔	◔	0/4
Cost-based methods	◑	●	○	○	◔	◔	0/4
Hedonic pricing method	●	○	●	○	◑	◑	4/4
Production function method	●	○	●	○	◑	●	4/4
Shadow-pricing method	◑	○	●	○	◔	◔	0/4
Stated preferences methods	●	●	●	○	◑	●	4/4
Travel-cost method	●	●	○	○	◑	◑	3/4
Synthesising valuation methods							
Bayesian beliefs networks	◕	○	●	●	◔	◑	3/4
Deliberative valuation methods	◕	○	●	●	◑	◑	4/4
Multicriteria decision analysis	◕	●	●	●	◔	◑	3/4
Scenario planning method	●	●	●	●	◔	◑	4/4

Figure 3.3. *Methodological requirements for valuation methods, classified in the four groups: biophysical, socio-cultural, monetary and synthesising methods. Methods are alphabetically ordered in each of the methodological groups. Methods were assessed according to the level of requirements in terms of data, time and economic resources (= high, ◕ = medium-high, ◑ = medium-low, ◔ = low and ○ = no particular requirement). Collaboration was assessed as (● = collaboration required; ○ = collaboration not necessarily required). General level of requirements is indicated by the 'wifi signal' bars. We distinguished between two different applications of the spreadsheet-type method: basic spreadsheet approach based on land-use data and advanced spreadsheet approach based on multiple datasets (e.g. GreenFrame); for more details, see Harrison et al. (in press).*

4. Discussion

This chapter uses real life application expertise to verify whether valuation methods differ in suitability to elicit values of nature and how they differ in practical application requirements. Valuation of nature requires an integrated approach (Jacobs et al., 2016), but resources (time, budget, data or collaborations with other scholars and stakeholders) can be restricted in practice. Our study aims to provide some insights for the selection of valuation methods in order to represent multiple value dimensions in an effective but efficient manner, which is one of the main principles to achieve integrated valuation (Gómez-Baggethun et al., 2014; Gómez-Baggethun and Martín-López, 2015) .

This chapter demonstrates the fact that different valuation methods are more or less suitable to elicit specific value types and dimensions (Figure 3.1). In fact, this chapter reconfirms that valuation methods can act as value-articulating institutions (Vatn and Bromley, 1994, Vatn, 2005; Chapter 4 and Barton et al., *in press*), *creating* a value rather than *eliciting* a pre-existing value. In other words, '*the means employed determine the nature of the ends produced*' (A. Huxley). This realisation supports former studies that argue that -as a practical implication- the selection of the valuation method might be as relevant as the valuation result itself (Gómez-Baggethun and Ruiz-Pérez, 2011; Martín-López et al., 2014).

As the choice of the valuation method can strongly determine the value-dimension that will be elicited ('creating'), valuation practice should consider different, complementary and diverse methods in order to adequately cover the distinct ways by which people value nature and its contributions to human well-being. More precisely, in order to represent the diversity of nature's values held by different social actors in decision-making, integrated valuation should entail *as much diversity* of methods *as value plurality* exists in the system (Martín-López et al., 2014). In consequence, integrated valuation cannot be done by a single method (even if it is a synthesising one) or by methods from the same group of methods.

Our study suggest that selection of a set of methods from each of the four method groups allows elicitation of all value dimensions. The study also demonstrates that for each group of valuation methods, there is at least one method that can be reasonably applied with few resources and methodological requirements (Figure 3.3). In other words, it is possible to elicit multiple dimensions of value without spending excessive resources in a research or assessment project.

Dealing with complexity in environmental valuation may involve higher initial information costs than valuations that narrowly focus on single value types (Chapter 4 and Barton et al., *in press*). In addition, Martinez-Alier and Muradian (2015) argue that integrated valuation involves higher complexity of communication and methodological development. However, it is important to note that, although a single-method valuation can seem more cost-efficient, its reduced capacity to provide information about multiple values and the risks this involves for decision-making in real human-nature contexts entails that such valuations are *de facto* inefficient and ineffective. Indeed, Ockham's razor or the parsimony principle states that the best out of two good solutions is the simpler one. Therefore, the application of integrated valuation application should strike the balance: the number of values and elicitation methods should be enough to elicit the main value dimensions that exist in a system in a fair and just process, but at the same time be kept at the minimum level required to meaningfully understand the problem at stake.

Some caution should be taken when selecting methods from the different groups with the purpose to provide input for develop an integrated valuation. First, covering all the value dimensions might require methods that are ontologically and epistemologically very different and represent conflicting valuation languages (Arias-Arévalo et al., 2017). In this sense, integrated valuation in its true sense should acknowledge the incommensurability of values: some values can be neither comparable to each other, nor to an ultimate single-value indicator (Martínez-Alier et al., 1998; O'Neill et al., 2008). For the sake of comparability, narrow interpretations of 'integrated' valuation, 'integrate' values into a single (numeric) unit. This holds the risk of reducing the distinct ways of expressing values (e.g., qualitative or quantitative) and the inherent value pluralism. Integrated valuation rather accepts (and emphasizes) these diverse values and languages, in order to truly consider them in decision-making.

A second point of caution concerns the claim that valuation of nature promotes inclusion of the different voices and interests of multiple social actors in decision-making (Menzel and Teng 2010; Martín-López and Montes, 2015). Indeed, the use of single-method approaches might invoke that other valuation dimensions are overlooked and that the people who embrace these values are also neglected in decision-making (Brondizio et al. 2010; Jax et al. 2013). This directly links to procedural justice, i.e. the fairness in decision-making that involves recognition, inclusion, representation and participation of the stakeholders (McDermott et al., 2013, Aragão et al., 2016). Therefore, selection of valuation methods should not solely be the researchers' decision.

5. Conclusion

We argue that integrated valuation should aim at representing all three value-dimensions (i.e. intrinsic, relational and instrumental), in order to represent the multiple stakeholders who depend on or have any interest in the issue at stake. Further, integrated valuation allows elicitation of opposing values, which are often at the basis of trade-offs and conflicts that might appear in a particular human-nature setting (e.g. Iniesta-Arandia et al., 2014; Turkelboom et al., *in press*). Integrated valuation therefore should be embedded in a process of stakeholder identification, characterization, involvement and engagement (see Reed et al., 2009; Mauser et al., 2013) in order to deal with trade-offs and to contribute to procedural justice.

6. Epilogue

Chapter 3 was peer reviewed for publication in Ecosystem Services and several improvements were made. Reviewers found the distinction between value types and dimensions unclear, and asked for more explicit description of method blind spots. In the final paper we clarified the distinction made between types and dimensions, and also discussed blind spots of the methods explicitely.

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