# Chapter 3. The potential of valuation[1, 2]

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[1] This is the final text version of Chapter 3. A laid-out version of the full assessment report will be made available in the coming months.

[2] Authors are listed with, in parentheses, their country or countries of citizenship, separated by a comma when they have more than one; and, following a slash, their country of affiliation, if different from that or those of their citizenship, or their organization if they belong to an international organization. The countries and organizations having nominated the experts are listed on the IPBES website (except for contributing authors who were not nominated).

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# Executive summary

**Valuation of nature** is a process that is intentionally undertaken to generate information about values of nature and of human-nature relations. While all individuals knowingly and unknowingly undertake some form of valuing to inform their everyday decisions, this chapter only addresses valuation that is conducted for purposes beyond those of the individual, usually for collective or societal benefits. In the context of decision-making about nature, valuation makes visible the range of values surrounding a given issue and can facilitate and recognise them and enable their inclusion in decisions. In such contexts, valuation is conducted by knowledgeable individuals (valuators or valuation experts) entrusted to apply established valuation procedures for eliciting and synthesising values.

**The goal of valuations** is to achieve improvements in human well-being, ecological sustainability and justice of decision-making processes and outcomes. More specifically, valuations can: support decisions about alternative projects or policies; inform the course of (collective) action; aid in the design of policy tools and instruments; assess and even strengthen human-human and human-nature relations.

**This chapter assesses the merits of a wide range of discipline-focused and traditional valuation methods and approaches.** We explore valuation methods from the fields of economics and ecology, as well as other procedures and practices that are used to assess the value of nature and human-nature relations, including those undertaken by Indigenous Peoples and Local Communities (IPLC). In doing so, we have adopted a broad definition of 'valuation methods', that recognises a wide range of procedures that are currently accepted (by their communities of practice) as valid ways to undertake valuation. By following established procedures, valuation methods can be taught, learned, and applied by valuation practitioners (valuators) acquainted with them. Since valuation methods have originated from different cultures, disciplinary traditions and schools of thought, different methods embody different ways of thinking about how to identify values, measure them or compare them against one another.

**Questions emerge** whenever people give a mandate to a (group of) valuator(s) to conduct a valuation process to inform a decision. Who is providing this mandate? what is its scope? who is conducting the valuation? how will the valuation results be used? which values are considered? whose values are (not) taken into account? Intertwined with these questions is the choice of appropriate methods. This choice requires assessing what valuation methods are capable of, what their drawbacks are, and which contextual considerations are key to make better valuation choices.

**Assessing valuation (methods and approaches)** requires consideration of the suitability of methods and approaches within a context and political process. Valuation goes beyond technical procedures of method application. The valuation methods assessed in this chapter focus on 'valuation of nature' in the broadest sense, including for instance: a ritual to confirm community relations to nature described in traditional knowledge or anthropological research; biophysical models to evaluate ecosystem services; deliberative social appraisal of the impact of nature on wellbeing; or expression of the values of nature in monetary terms through revealed preference methods. Our evidence covers the entire field of valuation of nature, which has substantially grown and diversified over the past 40 years.

**The primary objective of this chapter** is to identify key considerations for making valuation choices and developing guidance for improving valuation practice. To this end, the chapter synthesises existing knowledge on valuation methods in order to identify the range of valuations that exist, how they have been applied and what their limitations are. The chapter assesses the potential of valuation

methods to elicit and make sense of diverse values. It does not cover the effectiveness and actual uptake of valuation outputs into decision-making processes (which is the subject of *Chapter 4)*.

**The evidence base of *this chapter*** consists of systematic in-depth reviews, topical meta-reviews, and methods reviews of the existing literature from all involved disciplines, content analysis of expert contributions, dialogues with and contributions from Indigenous and local knowledge holders, and thematic expert contributions. The chapter first describes the richness of valuation methods, then derives key considerations for valuation and ends with a stepwise guidance framework to support better valuation choices.

In the following text, 15 key findings summarise main considerations, principles and recommendations to make methodological choices regarding valuation of nature.

## Key findings

**1. Valuation of nature is conducted with the aim of achieving improvements in human well-being and ecological sustainability, and just decision-making processes and outcomes** *(well established)***.** Valuation assesses nature's importance for human well-being using a wide range of indicators from livelihood dependence, use of natural resources, peoples' preferences or spending on safeguarding biodiversity and ecosystem services {*3.2.3*}. Valuation for ecological sustainability has been achieved through assessment of the importance of ecosystem capacity, condition and sustainable use {*3.2.3*}. In addition to intertwined goals of improving human well-being (31% of valuations) and ecological sustainability (65%), justice was considered in 4% of valuations in the systematic review {*3.3.1*}. Valuation is intended to inform decision-making in different ways, from purely providing information (61% of cases in the systematic review), to assisting in selecting between alternative actions (32%) and providing insights for design, management or policy interventions (7% of cases) {*3.2.1.1*}.

**2. A rich pool of methods and approaches exist to value nature and its contributions to good quality of life. Methods from a wide range of disciplines and traditions offer a multitude of ways to elicit and interpret the diverse values of nature for decision-making** *(well established)***.** More than 50 clearly distinct valuation methods are identifiable from the last four decades of valuation research and practice; many more exist depending on how one defines methods considered to be 'nature valuation' {*3.2.1*}. Having been developed from disciplines as diverse as - for example - anthropology, biology, economics, geography, psychology, and sociology, they form a rich resource of valuation procedures that are currently being applied to elicit many value types and to inform on how values vary and change across time, space and social contexts {*3.2.1*}. In the last two decades, valuation applications have extended across the globe (*Figure 3.1*) and in a broad range of ecosystems. Most valuations took place at below-national scales (72%), while national (11%) or above-national scales (6%) are less abundant {*3.2.1*}.

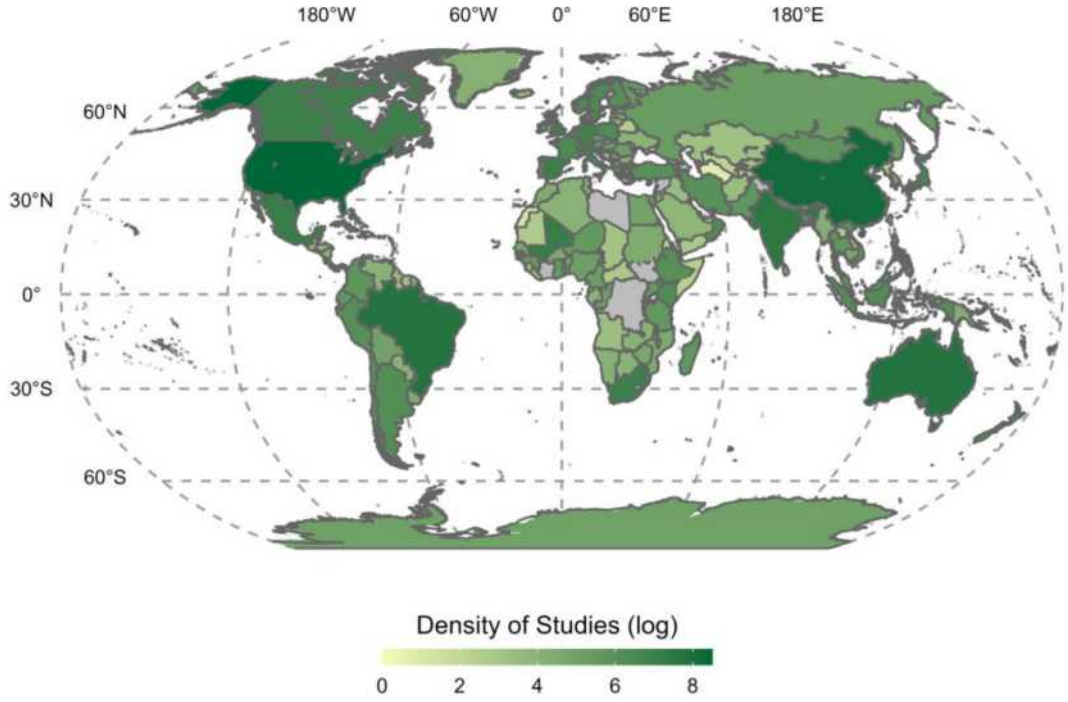


**Figure 3.1.** Global distribution of valuation studies in the period 2010-2020 as reported in academic literature based on key words searches in Web of Science[3].

**3. Existing classifications of valuation methods are based on disciplinary perspectives (e.g., economics, ecology, political science, etc.), making it a challenge to foster interdisciplinary exchange to advance valuation practice** *(established but incomplete).* Ultimately, all valuation methods gather their information from three main sources (components of nature, people's statements and people's behaviours), while others integrate and synthesise values to improve understanding and decision-making. Numerous classification systems exist to group valuation methods. While each existing classification system has its merits within the disciplinary context in which it has been developed, their application across disciplines is limited {*3.1.1*}. Regardless of their disciplinary origins, methods can be organised into four method families that are not based on discipline-informed assumptions about human-nature relationships. Nature-based valuation methods assess the biophysical world in order to measure and characterise nature and components of nature to make nature's contribution to people and the importance of nature-in-itself visible to decision-making {*3.1.1, 3.2.2.1*}. Statement-based methods infer values based on what people express when asked about what they value and why; their responses can be verbal, written or expressed as songs, stories or art {*3.1.1, 3.2.2.2*}. Behaviour-based methods assess the importance of nature to people based on what people do with and in nature, including their purchasing behaviour, use of natural resources and time spent in nature {*3.1.1, 3.2.2.3*}. Methods that combine and synthesise several sources of information (whether from the same methods' family or across families) can be categorised as integration methods {*3.1.1, 3.2.2.4*}. Within method families, when selecting specific methods, practitioners can apply a range of approaches to suit different valuation objectives (*Figure 3.2, Table*

[3] Valuation Atlas (https://doi.org/10.5281/zenodo.6468906).

*3.1*). For example, methods can use quantitative or qualitative approaches, they can be participatory or non-participatory. The four methods families were largely developed based on a review of the academic literature; however, we also recognize that IPLCs have developed their own set of valuation approaches. Applying the methods family framework to understand valuation procedures that are undertaken by IPLC can help to highlight commonalities across valuation traditions and IPLC practices and procedures that resemble non-IPLC methods. However, the method family typology risks presenting IPLC valuation practice out of context and omitting core cultural and spiritual beliefs that underpin IPLC ways of valuation. Valuator familiarity with the underlying assumptions of methods and their potential and limitations is critical in valuation practice to ensure that methods are correctly applied, yet, it is rarely assessed.

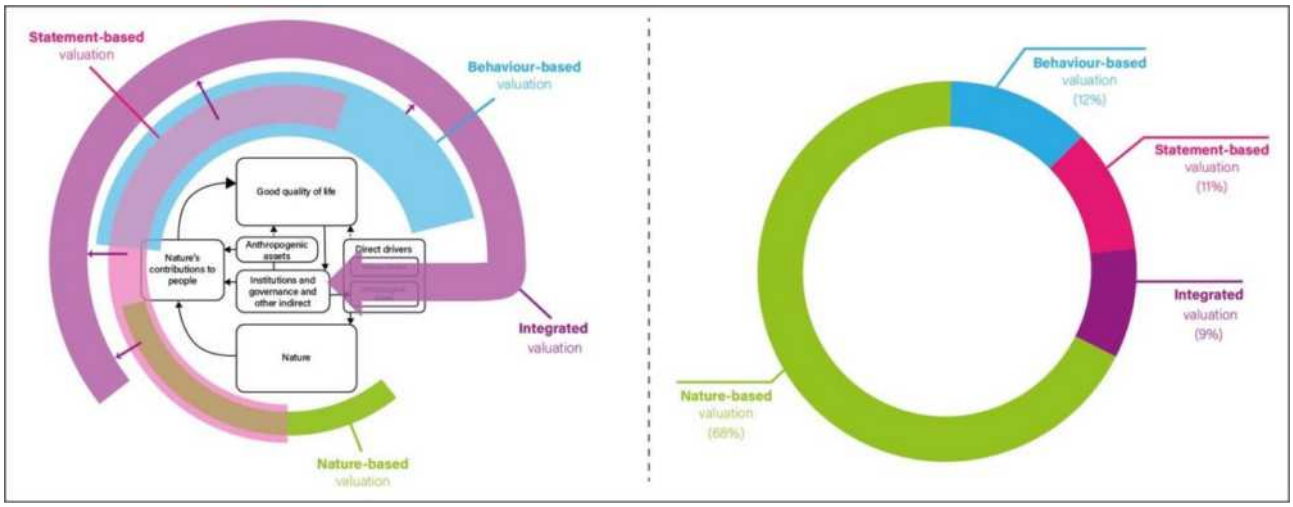


**Figure 3.2.** Discipline-neutral valuation method families and their coverage of the IPBES conceptual framework (Díaz et al., 2015b) and abundance of the method families in the valuation literature[4].

[4] Systematic PCIV (Principles, Criteria, Indicators, Verifiers) review on valuation methods (https://doi.org/10.5281/zenodo.4404678).

**Table 3.1.** Valuation methods can be classified into four method families with distinct characteristics.

| | Valuation method families | | | |
|---|---|---|---|---|
| | Nature-based methods | Statement-based methods | Behaviour-based methods | Integration methods |
| |  |  |  |  |
| **What is assessed?** | Nature, physical or ecological components of nature | What people express when asked about the importance of nature | What people do in nature, for nature, with nature, to, as nature | Different outputs from one or more methods, to support decision-making |
| **How is information about values generated?** | Measuring nature and its functions through several methods such as remote sensing, field observations, consulting experts, etc. | Asking people (interviews, questionnaires), analysing other expressions (e.g., narratives, discussions, art, etc.) | Observing people, assessing records of people's behaviour (e.g., park visits, policy choices, (non-)market exchanges, etc.) | Synthesising, comparing, contrasting, deliberating, consolidating or aggregating diverse values for decision-making or decision support |
| **Which values are elicited** | Mainly intrinsic and instrumental values | Instrumental, intrinsic and relational values | Mostly instrumental values | Instrumental, intrinsic and relational values |
| **Examples of value indicators** | Species richness, CO2 stored, ecological indicators | Preferences for nature's contributions to people, subjective well-being indicators, narratives of human-nature relationships, required compensations | Time spent, share of household income, prevalence of disease, price of land, use of plants | Strength of support or objections to policy options, welfare gains or losses from projects |
| **Examples of methods and approaches** | Biodiversity assessment, ecosystem services mapping, Delphi method | Group discussion, Q-methodology, choice experiments, valuation interviews | Participant observation, travel cost method, cost-based method, livelihood dependence, photo-series analysis | Natural capital accounting cost-benefit analysis multi-criteria decision aid, integrated modelling, deliberative decision methods |
| **Type of stakeholder inclusion** | Most methods do not include stakeholders, though some inclusive approaches exist (e.g., based on local ecological knowledge) | Most methods include stakeholders to some extent (e.g., surveys) and inclusion is often integral to the method (e.g., participative approaches) | Most methods have limited stakeholder inclusion (e.g., analysis of market accounts) but some include diverse stakeholders | Some methods can be non-inclusive (e.g., desktop multicriteria decision analysis MCDA) but often, inclusion is key to the decision support aspect (e.g., participatory scenario building) |
| **Examples of typical valuation "products"** | Biodiversity indices, maps of priority areas for policy/management action, improved understanding of the importance of components of nature | Ranked importance of components of nature or nature's contributions to people, (monetary) value of protection of biodiversity-rich areas, explanations for why people value nature | Ranked importance of components of nature or nature's contributions to people, quantified changes in values nature or nature's contributions to people, explanations for why people value nature | Ranked policy options, evaluation of socio-economic and environmental impacts of policy options, improved understanding of conflicts/shared values of nature |
| **Limitations/ concerns** | Impact on people assumed but not assessed, dependence of nature is not assessed by the people dependent on the resources | Concern about reliability of statements, power disparity can reduce the validity of group-based methods, representativeness in selection of respondents | Requires conceptual and empirical understanding of the relationships between behaviour, nature and its contribution to well-being, challenging to reveal in-depth understanding of motivations behind behaviour | Aggregation of values across groups of people can reduce representation of values, combining multiple value types creates incommensurability concerns |

**4. Nature-based valuation methods gather and analyse information on the biophysical properties of nature making them an essential family of methods for assessing ecological**

**sustainability and quantifying and qualifying nature's contributions to people. When complemented with behaviour and statement-based valuations, they can provide critical information for informing policies and decisions about nature** *(well established)***.** Human societies have a long and established history of assessing nature and natural resources to make decisions for the collective, hence the strength of nature-based methods lies in their long history of trial and error and on their tendency to focus primarily on perceivable dimensions of nature. Nature-based valuation methods comprise the largest group of method families and reports of their application are the most frequently encountered in academic literature {*3.2.2.1*}. The methods employ direct and indirect approaches for measuring components of nature ranging from actual observations in the field (e.g., camera trapping, vegetation surveys, water sampling) to remotely sensed observations (e.g., based on satellite imagery) and expert consultations (e.g., Delphi methods, participatory resource mapping, and interviews). Most methods formulate their estimates based on proxies rather than direct measurements of nature. Direct and indirect assessment of nature is also undertaken in IPLC through their own methods, such as by conducting targeted territory patrols or *ad-hoc* reporting by individuals of observed biophysical indicators (e.g., the recent appearance of new grass in grazing areas) {*3.2.4*}. Nature-based methods share some key constraints and limitations. For instance, biodiversity and ecosystems models are heavily reliant on assumptions about key processes and input data. Also, global imbalances in the availability of high-quality biophysical information have repeatedly been identified as a key constraint for its widespread incorporation into decision-making, particularly in less wealthy nations. This is partially due to their relatively high cost and skills requirements needed to transform data into useful information for decision-making through data processing, analyses and modelling {*3.2.2.1*}. Choosing a method is a value-laden process that has implications for which ecosystem services or species are prioritised. Yet this process is rarely reported, and the issue is rarely discussed for nature-based methods {*3.2.2.1*}.

**5. Behaviour-based valuation applies a range of direct and indirect methods to assess values of nature based on observations of what people do. Values based on observed behaviour are regarded as less influenced by participant and interpreter bias and bring robust information for decision support** *(well established)***.** Behaviour-based valuation can be traced back to the 1940s and includes diverse valuation methodologies varying from expressing how nature underpins productive activities to valuation of non-material psychological experiences from recreational activities {*3.2.2.3*}. The main strengths of most of the methods are that they reveal values from observed behaviour and are therefore less sensitive to participant or interpreter biases than statement-based methods {*3.2.2.3*}. The main limitations for wider application of the behaviour-based methods are their methodological inflexibility and generally high requirements for data availability {*3.2.2.3*}. Furthermore, the methodologies tend to be specialised to a limited range of value targets {*3.2.2.3*}. A key limitation of cost-based methods is that they can be a poor reflection of the benefits that people obtain from nature; however, they are often used because they have low resource requirements {*3.2.2.3*}. IPLC valuation practices that assess values based on what people do in the landscape, what they consume, how community members trade goods and services between each other, or which rules are broken or adhered to by community members shares components of behaviour-based valuation {*3.2.4*}. Behaviour-based valuation has the potential to contribute to Natural Capital Accounting {*3.2.2.3*} (*Box 3.7*) as they capture observed interactions between ecosystems and economic activities which are amenable to accounting principles. Improved access to environmental, social and economic databases across global regions could reduce the barriers for the application of these methods.

**6. Statement-based valuation methods generate information, based on individual or group expressions, about people's relation to and perceptions about nature and quality of life, and their preferences for material, non-material and regulating contributions of nature. Methods in this family can provide deeper understanding of worldviews and motivations underlying peoples' values of nature** *(well established)***.** A wide range of methods have been developed to

understand the values of people and communities by engaging them in activities that encourage value expression through verbal, written or other forms. These methods permit capturing how humans value nature in ways that cannot be deduced from market-based approaches or direct observations of people's behaviour or their practices. Consequently, statement-based methods can complement nature-based and behaviour-based valuation. Methods in this family include interviews and group discussions, contingent valuations, choice experiments, and mental mapping. Some IPLC valuation practices that draw heavily on people's expressions, can be described as containing components of statement-based {*3.2.4*}. By identifying, characterising and assessing values that are directly expressed by people these methods have contributed to theoretical understanding of what is valued (i.e., specific values) and why (i.e., broad values) {*3.2.2.2*}. Because they mostly rely on what people say, statement-based methods can facilitate direct interaction and inclusion of stakeholders in the valuation process {*3.2.2.2*} however, they have been criticised for being over-reliant on what people say and being subject to the valuators' own interpretations of what is said (i.e., they are sensitive to participant or interpreter biases). Solutions to some of the challenges of statement-based valuation have been developed, although they have not completely resolved the fundamental concern regarding reliability of statement-based valuation {*3.2.2.2*}. Mainstreaming this family of methods into policy and other decision-making domains could diversify the range of actors and values that are brought into decision-making processes {*3.2.2.2*}.

**7. Obtaining information about values alone is insufficient for guiding inclusion of values in decision-making. Integration methods attempt to serve this objective by synthesising values towards decision-making. However, depending on the method and how it is applied, value integration can inadvertently conceal social complexities and promote/discriminate values** *(well established)***.** Integrated valuation methods bring together different values of nature and human-nature interrelations {*3.2.2.4*}. The approaches are diverse and include decision support tools for project and policy evaluation; but also modelling and scenario building methods to consolidate information for decision-making through the exploration of the interactions between ecosystem processes and human and environmental drivers. Cost-benefit and multi-criteria decision analyses are common integrated valuation approaches. Another example is participatory mapping of nature's contributions to people, which can integrate information from nature-based and statement-based methods to spatially define and quantify the importance of different facets of nature. Production function approaches can help bring together information on nature's biophysical values (from nature-based valuations) and economic values (from behaviour-based and statement-based methods) to estimate the costs and benefits of projects or policies {*3.2.2.4*}. The United Nations System for Environmental Ecosystem Accounting synthesises physical information on ecosystem extent, condition and services with monetary valuation of ecosystem services and asset/natural capital value {*3.2.2*}.

**8. IPLC undertake valuation in their territories using diverse approaches, procedures, and practices aimed at fulfilling multiple goals** *(established but incomplete),* **but there is incomplete understanding about valuation within IPLC settings** *(well established)***.** As with other societies, IPLC uphold valuation traditions within their own communities and territories to generate pertinent information about their inter-relations with nature for fulfilling specific purposes, such as maintaining reciprocal relations with nature and contributing to ecological sustainability. Through diverse approaches and practices, IPLCs use valuation processes to enhance well-being, transmit and generate ecological and cultural knowledge, and reinforce their cultural identity with land and waters. A more complete description and characterization of IPLC valuation is hindered, however, by a scarcity of studies and limited regional representation of existing works. Available works suggest that valuation by IPLC shares many of the attributes of non-IPLC valuation. For example, IPLC valuation practices that assess values based on what people do in the landscape, what they consume, how community members trade goods and services between each other, or which rules are broken or adhered to by community members shares components of behaviour-based valuation {*3.2.4*}. Although IPLC

valuation is sometimes led by a few community experts, it is often a collective process whereby most - if not all – community members participate as experts to gather information on values and to collectively assess its meaning. Understanding the wealth and depth of IPLC valuation will require expanding stringent disciplinary definitions of "methods" and concepts such as "evidence" {*3.2.4*} (*Figure 3.3*). The field of indigenous methodologies and methodologies from other knowledge systems is growing and offering opportunities to recognize and include IPLC and other knowledge systems to describe and develop valuation methods that adequately elicit and articulate their values. Ethical standards and guidelines for engaging with IPLCs to undertake valuation exist and should be widely applied {*3.3.1*}.

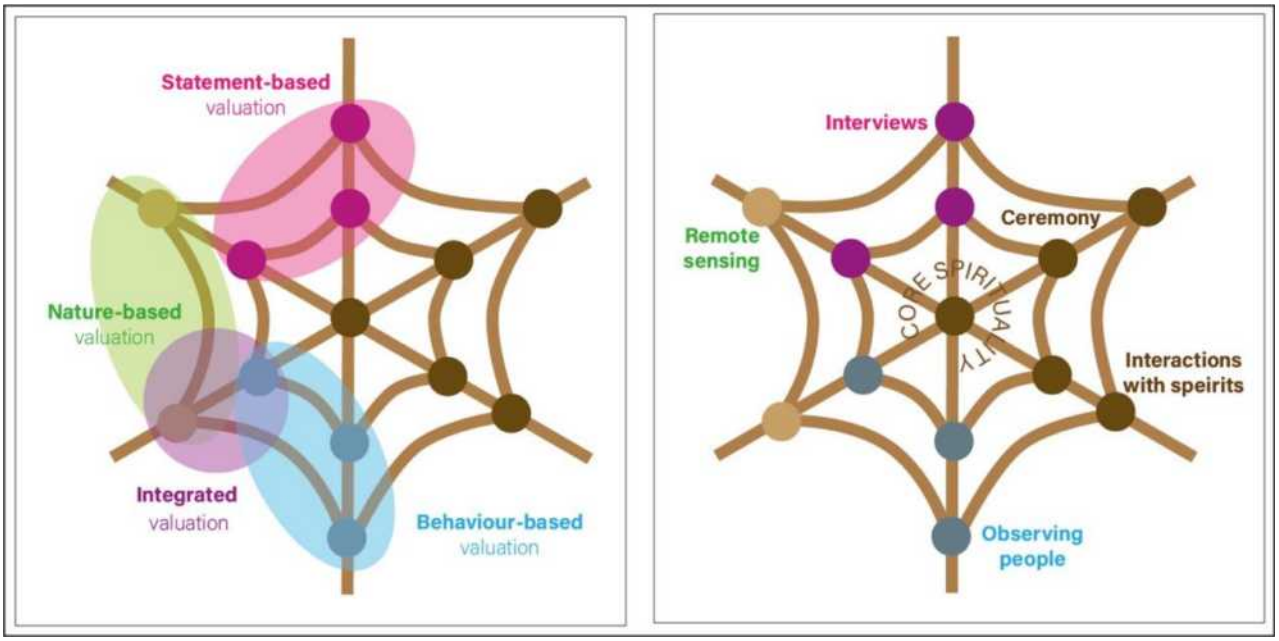


**Figure 3.3.** Visual representation of how the methods families (left) act as selective filters that make only isolated elements of IPLC valuation visible. To the right: Three examples (interviews, remote sensing, and observing people) of how the method families framework accesses elements of IPLC valuation. Two examples of integral elements of IPLC valuation not accessed or represented by methods families (e.g., valuation as ceremony and interactions with spirits).

**9. Valuation studies are capable of representing diverse value dimensions. In practice, most studies assess instrumental values although studies assessing intrinsic and relational values are also abundant** *(well established)***.** The instrumental values of nature for human well-being are the most common focus for valuation (74% of valuations in literature), but the valuation of the intrinsic worth of nature (20%) and relational values (6%) are also established in the literature (well established). 'Living from' is the most common perspective for valuation (41% of valuations in a systematic review), followed by the 'living with' and 'living in' perspectives (34% and 20% respectively). The 'living as' perspective is rare (5% of valuations in a systematic review) {*3.2.3*}.

**10. Valuation needs to be robust if it is to provide valuable information for decision-making. Best practices to achieve robustness are not universally accepted, however, and vary substantially across disciplines and knowledge systems** *(well established)***.** In reference to methods, robustness refers to the ability of a method to provide reliable and consistent representation of values. Research on robustness of valuation processes has focused on different aspects of robustness, reflecting the different intended use of the valuation outputs. The economic valuation literature has emphasised theoretical consistency and accuracy to enable a broader range of values of nature to be

included in economic policy and project appraisals {*3.3.2.2*}. Valuation in the social sciences has focused on robustness in terms of the legitimacy of the process to recognize diverse value systems and enable dialog {*3.3.2.2*}. Robustness testing of methods allows methods to be continuously improved making them more reliable. For example, continuous testing of stated preference valuation results has resulted in more robust methods to ascribe peoples' values of nature using statement-based valuation {*3.3.2.2*}. Adhering to best practice across diverse valuation approaches can greatly improve the robustness of valuation {*3.3.2*}. In practice, while two thirds of valuations consider at least one aspect of reliability, these aspects as well as the way they are addressed vary widely between methods {*3.3.2*}. Given the diverse purposes and contexts within which valuation is conducted, valuation studies need to report more regularly on how they addressed robustness and what uncertainty remains in the results.

**11. Procedural justice has become a key consideration in valuation to ensure that all stakeholders are heard, and that the valuation process is accessible. Consensus on how to achieve procedural justice in valuation and how to evaluate good practice is largely lacking** *(well established)***.** Procedural justice in valuation refers to the fairness in the valuation process. Fairness in valuation processes relates to how representation of different stakeholder groups is ensured, the extent to which participants can get involved in the process and how power disparities between participants can be addressed in the valuation process. A considerable number of valuations represent diverse stakeholders (48%) and have distinguished different social groups based on gender, income, age, education level, indigenous rights, power, type of knowledge held, different stakes and different political roles {*3.3.2.3*}. Most often (30%), two or more of these variables are considered. However, even though it is recognised that power asymmetry can undermine the inclusion of participants {*3.2.2.4*}, few valuation studies document how power asymmetry is accounted for in the valuation process (1% of studies in a systematic review). The contribution of valuation to achieve fairer decision processes relies on transparent and tested methodologies. Validation of procedures to take procedural justice into account is lacking and best practice guidance is needed.

**12. Aggregation of values held by individuals to inform collective decisions is central to valuations** *(well established)***. Yet, aggregation has important implications for fairness and robustness of valuation. No consensus exists on the best practice for aggregation procedures** *(well established)***.** Decisions on nature most often have impacts on multiple stakeholders. Therefore, decision-making involves weighing up the impacts to arrive at an overall evaluation i.e., a societal value. Weightings to account for intergenerational distribution of outcomes of projects or policies through application of discounting procedures is established and contested {*3.3.2*}. Intragenerational weighting procedures to consider distributional justice for practical use in project and policy evaluation are developed but not widely used {*3.3.2*}. Most valuation studies focus on the values of a specific group of people from the current generation. A range of aggregation approaches are used, with the sum of individual's values being most widely adopted. Deliberative approaches can be suitable in some valuation contexts but do not provide a general solution to the aggregation challenge. Therefore, practical options to consider intragenerational distributions are needed for more robust aggregation of valuation results.

**13. Plural valuation is a strategy to include more diverse values, with the aim of increasing legitimacy, justice and robustness of valuations** *(established but incomplete)***. It is achieved by combining complementary methods that elicit multiple value types** *(unresolved)***.** Valuation methods have varying capacity to identify diverse values {*3.3.1.3*}. Valuation methods exist to elicit different components of value, including: use, non-use and option values, various contributions of nature, aspects of biodiversity and quality of life, broad values related to different life frames of nature's values, different specific values (instrumental, intrinsic and relational), and IPLC principles.

Plural valuation allows multiple types of specific values to be captured (e.g., different NCP) and different broad value frames (e.g., life value frames) to be considered.

Most valuations do account for some degree of such specific and broad plurality {*3.3.1.3*}. However, only few valuations have a high specific (1.3%) or broad (0.6%) plurality. Capturing a richer diversity of values can be achieved by combining several complementary methods, but the use of multiple methods requires careful consideration, since their underlying assumption and disciplinary origin can make some methods incompatible with one another. Despite the wide range of methods available, most valuations (77%) only apply one main method. Where combinations of methods have been employed, the methods used have come from the same discipline {*3.3.1.3*}. In cases where diverse values need to be captured, complementary methods from different disciplines are required. In practice, consulting valuators from different disciplinary backgrounds can help select the appropriate method(s) to produce scope-relevant results.

Combining methods however is more demanding regarding skills, resources and time. The level of investment in the valuation process depends on the complexity and stakes of the valuation context: high stakes and high complexity justify investing in a more complex and demanding valuation (*see Chapter 1*). The operating space for valuation is determined by risk and resources (*Figure 3.4*). Underinvestment in valuation risks to misinform decisions and produce adverse effects. Parsimony on the other hand advises against using more resources and time than justified by the benefits or losses at stake {*3.4*} (*Figure 3.4*). Note that for decisions of low complexity and stakes, no valuation might be needed at all. Similarly, for medium complexity and stake, often a simple valuation might suffice (*Figure 3.4*).

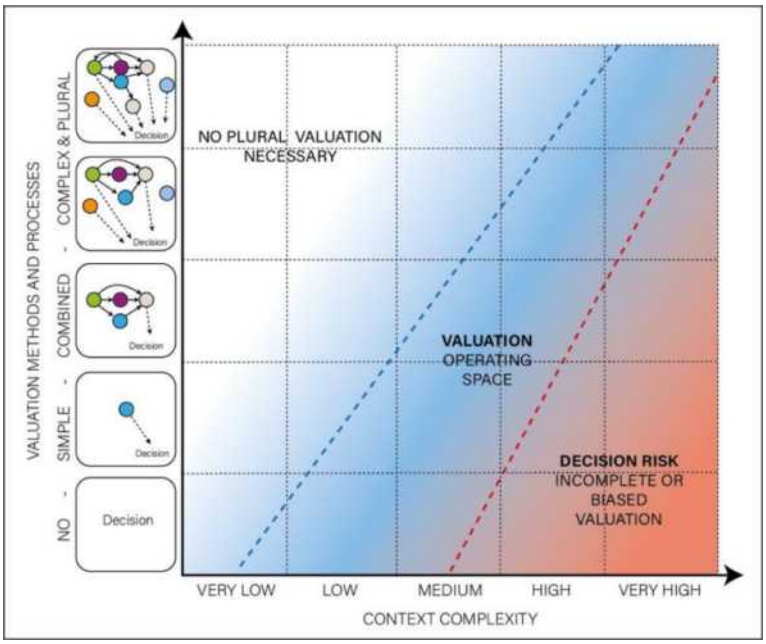


**Figure 3.4.** The valuation operating space: valuation methods and processes from 'none' to 'plural' as a trade-off between decision risk and resources spent on unnecessary valuation.

When multiple methods are applied, often incommensurable results are obtained, adding complexity to the decision-making process. For instance, a decision might need to be based on information on diverse types of values such as economic costs and benefits, socio-cultural importance, ecological value and principles held by the population regarding human-nature relations. These values are not fully separable or fully comparable: any value indicator will reflect partial aspects of different values.

This is inevitable in plural valuation and implies that transferability of value estimates across valuation context poses risk in decision-making. In practice, the majority (56%) of valuations do not attempt to bring different values together, but instead use distinct biophysical, monetary and socio-cultural indicators. A primary objective of valuation is to allow different but compatible values to be comparable e.g., to enable prioritizations in decision-making. About half of the valuation studies that do bring different values together apply methods allowing values to be directly compared {*3.3.1*}; the other half compares bundles of values, or uses relative weights based on participants' or valuation experts' rankings or deliberation {*3.3.1*}. Less than 1% of valuation studies keep values separate (i.e., treat them in parallel in a deliberative process) {*3.3.1*}.

**14. Trade-offs between the relevance, robustness and resources define the operating space for valuation within each decision-making context** *(established but incomplete)***.** Clarifying the purpose and subsequent scoping of a valuation process can help identify the values at stake and ensure the *relevance* of the valuation for decision-making. As the choice of valuation process influences the outcome, relevance entails ensuring that all the values at stake are accounted for; rather than only eliciting those values that can easily be made visible with the readily available tools and skills {*3.3.4, 3.4.1.3*}. *Robust* use of methods refers to the ability to provide reliable and consistent evidence following transparent and legitimate value elicitation processes. Robust valuation methods therefore require both that values elicited are reliable and that they fairly represent the values at stake. Robustness therefore entails adhering to theoretical consistency and accuracy to allow reliable impact evaluation. It also requires a socially legitimate process to recognize and include diverse values and enable dialogue {*3.3.4, 3.4.1.5*}. Testing the robustness of methods is key to making valuation gradually more reliable for decision-making {*3.3.2, 3.3.2.1*}. Standardisation and adhering to best-practices can greatly improve valuation robustness {*3.3.2, 3.3.4, 3.4.1.5*}. Valuation requires employing *resources*, including time, financial, technical, human and political resources. Comprehensive information on resource needs for valuation methods is lacking {*3.3.3*}.

**15. The valuation process can be summarised in five steps. Valuation choices made in each single step define options in the next steps, and finally determine the quality of the valuation. The steps are (1) constructing a legitimate process; (2) defining the objectives of the valuation; (3) scoping the valuation; (4) selecting and applying methods, and (5) facilitating the uptake in decision-making. Following these steps and reporting on the decisions made improves transparency of valuations** *(well established)***.** A five-step approach includes the steps needed to cover key considerations of the valuation process {*3.4.1*}. The five-step model illustrates that the application of valuation methods and approaches is part of a larger process, and it is largely this process which can ensure that valuation methods provide quality input to decision-making. The valuation process includes the following steps (*Figure 3.5*). Step 1 - construction of a legitimate process - requires that the providers of valuation information are explicitly defined, and transparency about how a robust valuation is ensured regarding representativeness or participation {*3.4.1.1*}. Step 2 - defining the purpose of the valuation and the intended use of the outputs {*3.4.1.2*}. This purpose is often clear from the decision context or the given problem, but the valuation process can benefit from fine tuning and (re)defining this purpose with the stakeholders engaged in the first step. Step 3 - scope of the valuation defines what is being valued, whose values are being represented and whose are not. Also, feasibility constraints in terms of financial, human and technical resources need to be evaluated {*3.4.1.3*}. Step 4 - choice and application of valuation methods, combining an appropriate set of nature-based, statement-based, behaviour-based or integration methods {*3.3.4, 3.4.1.4*}. Step 5 - articulation towards decision-making requires transparent communication of the outputs, as well as limitations and omissions in the valuation which might affect (risks in) their application {*3.4.1.5*}.

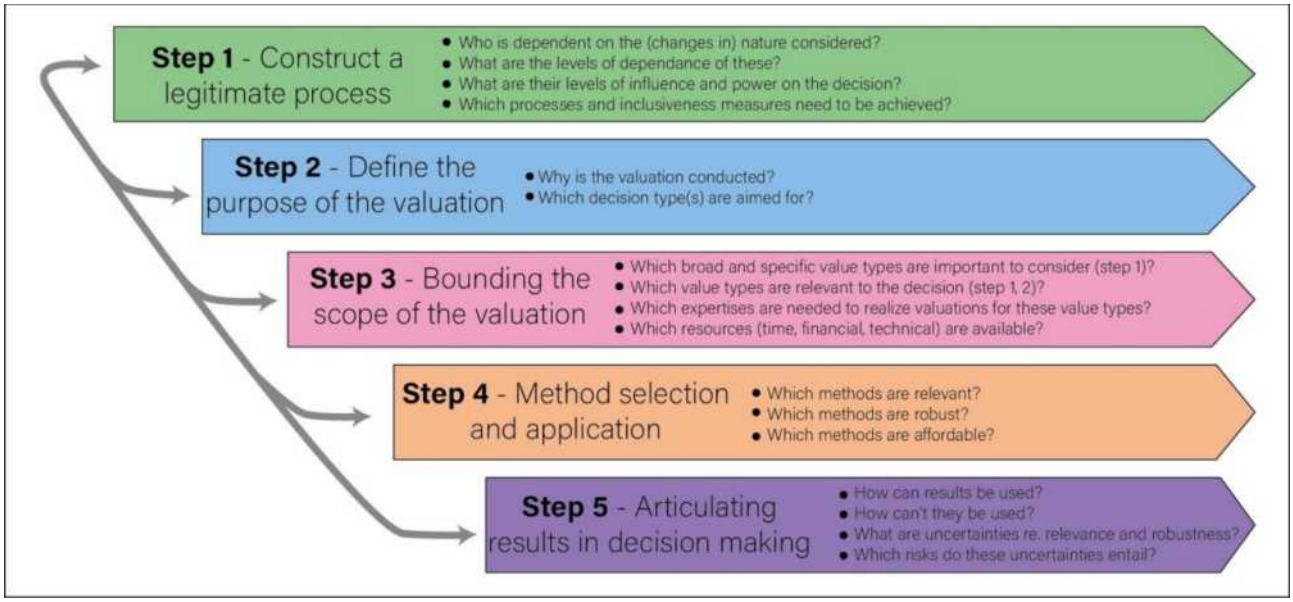


**Figure 3.5.** Valuation process depicted in 5 steps. The choice and application of an appropriate (set of) valuation methods is embedded within this larger process.

# 3.1. An introduction to valuation of nature

## 3.1.1. What is valuation of nature and human-nature relations?

*Chapter 2* provided a comprehensive introduction and assessment of how people and societies value nature in terms of how they relate to nature, the importance that they assign to all or parts of nature, and the different ways that they manifest their relations with and preferences for nature. The act and process of valu*ing* nature is expressed by individuals, groups, and societies in either explicit perceivable forms or implicit and allusive ways. As *Chapter 2* has outlined, some of the ways in which valuing of nature manifests in societies is through:

- How people talk about nature or their relations with nature
- How people spend valued resources such as time and money on nature-related experiences, goods and services
- How people depict nature in art, literature, song and other forms of artistic expression
- How nature is embedded in personal or societal aspirations such as life goals or constitutions
- How people choose between different options for actions related to nature
- How nature is incorporated into lifestyles, career choices, or
- How people regard and subsequently treat nature

*Valuation of nature* is the process of documenting the existence of values, identifying when and where and by whom they are expressed, that in turn allows characterising values. Recognizing which and whose values and their characterization in a given context allows making values visible and increase the probability for their inclusion in decision-making. In the context of nature-related decision-making and policy design, valuation is an important process for ensuring that decisions are informed by existing values and that they ultimately reflect the values of those affected by decisions (*Figure 3.6*). In many cases, a multiplicity of actors (e.g., different stakeholder groups) and value types (i.e. broad and specific values) surround a decision-making context. Understanding which and whose values are at play requires valuation processes that capture value plurality and articulate it for better informed decisions.

While individuals consciously and unconsciously undertake some degree of valu*ing* to interpret and understand nature or to assess their own and others' relations with nature, in this chapter we only address *formal* valuation, conducted for purposes beyond those of the individual, usually for collective or societal benefits. To this end, we focus on valuation that generates information about nature's values that can ultimately be used to, for example:

- Design policy tools and instruments for conservation and sustainable management of nature and natural resources;
- Choose between alternative projects or policies;
- Understand, mitigate or transform socio-environmental conflicts;
- Assess the potential damage to nature of different [policy] decisions;
- Collectively celebrate, honour or acknowledge the importance of nature.

**Valuation methods and approaches**

Regardless of who undertakes valuation, valuation processes are guided by methods and approaches that enable recognition of values of nature and human-nature relationships. A *valuation method* is a procedure for *eliciting and articulating values of nature*. Elicitation methods include a wide range of data collection techniques that are used to gather information about values. Value articulation is the process of generating clarity and coherence of the values elicited. Firstly, it consists of analysing,

interpreting and communicating values; and secondly of organising value expressions to support different decision-making purposes. Methods lay out which procedures and what techniques will be combined at different steps of the valuation process. Ideally, valuation methods are standard and accepted approaches to be applied within their decision-making context.

*Valuation approaches* are defined here as higher-level assumptions, ideas or beliefs that underpin methods. They translate key decisions on how a method is to be applied or how the information generated by methods is to be interpreted. For each approach there are often multiple accepted methods that adhere to the basic assumptions and ideas of the given approach. In the case of valuation, approaches determine whether valuation will be participatory or not, whether it is only academically and institutionally oriented or not, whether values will be expressed in monetary or non-monetary terms, spatially specific or not, place-based or not, whether values will be elicited using direct or indirect techniques, or whether contested values will be deliberated or assessed by other means. Valuation approaches can also manifest as academic "traditions" or widely accepted and expected protocols for undertaking valuation. All valuation traditions are heavily informed and influenced by cultural context, epistemologies and worldviews.

Ideally, a valuation method is informed by an explicit theoretical framework that outlines key assumptions about how and why people value nature (*Figure 3.6*). It informs procedures for data collection (value elicitation), data analysis, data interpretation (values articulation). In some cases, validation procedures might also be spelt out and certain ways of communicating and presenting the results might be encouraged (e.g., as maps or narratives or graphical representations). In real world applications of valuation methods, however, various theories inform a valuation study or mixed procedures are undertaken to elicit and articulate values. Moreover, valuation methods might provide specific guidelines for some aspect of valuation - such as how values are to be elicited - while providing little to no instructions on which data analysis techniques to apply, while other methods/approaches provide the full suite of epistemological backing and procedures from eliciting till communication. The result is that a broad range of existing methods and approaches from a wide array of disciplines are considered as "valuation processes": they outline how values of nature can be identified, interpreted, or assessed. This offers valuators a range of methods to choose from and combine, to fit to the purpose of the valuation for the specific decision-making context. While this is an opportunity to improve the practice of valuation, it represents a challenge for the assessment of methods. Applications of methods to real world decisions are to a large extent unique to a specific event in space and time. Thus, evaluation criteria for valuation quality vary between disciplines and approaches and comparing a sufficient number of studies with the same configuration of methods or in similar contexts is rarely possible.

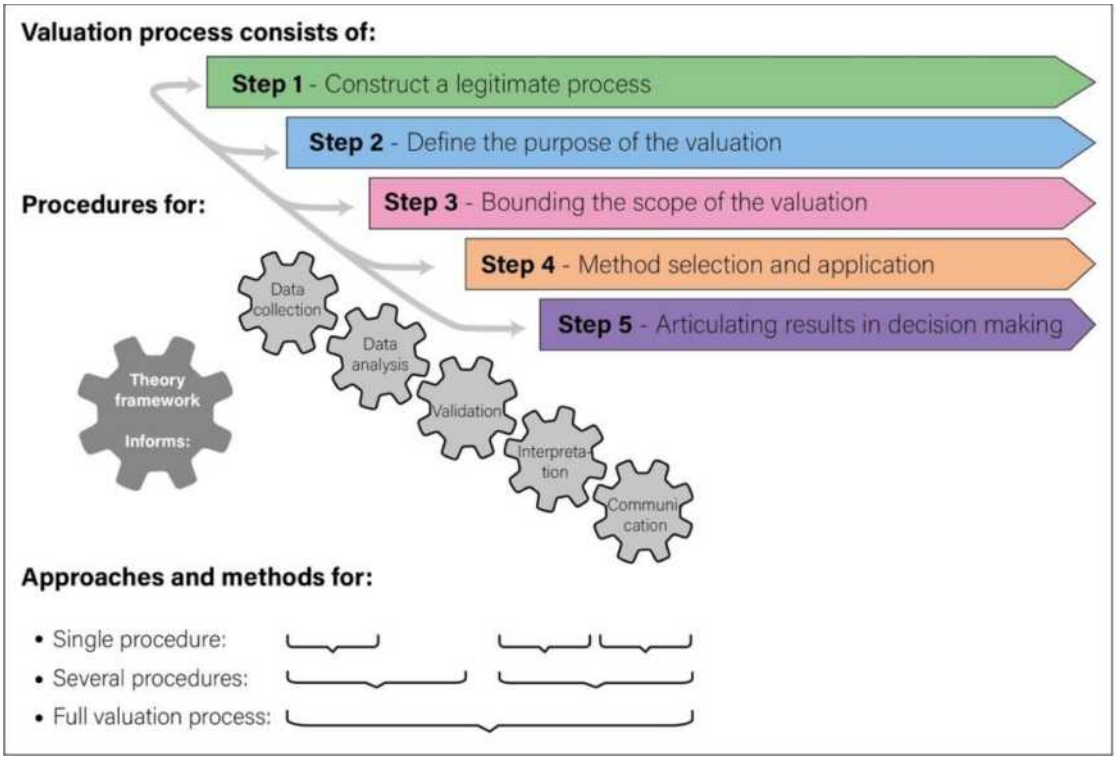


**Figure 3.6.** The five steps in the valuation process (see *3.4*) are realised through interacting procedures, underpinned by theory. Valuation methods can offer a full set of procedures for undertaking all steps of the valuation process or only some procedures. Valuators often must combine complementary methods to ensure that all relevant steps are addressed. Valuators are not always explicit about the theories underpinning their methodological approach. They may also report specific techniques that they used without describing the precise procedures or methods informing their study.

Valuation *sensu* IPBES includes diverse epistemologies, different views on nature-human relations, and recognizes academic traditions in social and environmental sciences that address and study values in seemingly contrasting ways, albeit for similar or complementary goals. This assessment aims to bridge academic and societal boundaries and broaden the set of methods and approaches available to reliably and legitimately generate information on values of nature in order to improve nature-related decision-making. In this vein, *Chapter 3* uses the term "valuation methods" as a shorthand for a *broad and inclusive collection* of "valuation methods and approaches", recognizing a wide range of valuation traditions and practices that are currently accepted as valid ways to undertake valuation. By adhering to established procedures, the key features defining valuation methods is that they are approved by a community of practice, and that they can be taught, learned, and repeatedly applied by valuation practitioners who are acquainted with them. Having originated from different cultures, disciplinary traditions and schools of thought, methods embody different ways of thinking about how to identify values, measure them or compare them to each other. IPLC valuation methods and practices are still in the process of being systematised and this chapter acknowledges its importance for inclusive valuation of nature.

The origin of valuation (elicitation and articulation of values) is ancient; valuation has informed and guided societies in decision-making about nature since early human history. Ancient valuation practices and their modern iterations continue to generate information about values today; they represent a body of valuation tradition that is the core source of information about values for individuals, communities and indigenous people worldwide. In the context of human history, the

valuation methods and approaches that have been developed in academia are fairly recent; while they may have once drawn from ancient practices, they have subsequently diverged and evolved over time, usually along disciplinary lines. The methods and approaches taught today in academia are mostly informed by western worldviews and ways of generating knowledge, however. Understanding the practice of valuation solely from the dominant worldview of western science can obscure and undermine other values and knowledge systems. This chapter acknowledges and recognizes diverse worldviews such as perspectives and knowledge held by indigenous peoples and local communities about valuation of nature. Some indigenous worldviews elicit a holistic view of nature in which humans are part of and not detached from nature; this is a vital starting point for understanding how evidence is conceptualised, acquired and shared within IPLC contexts (LaDuke, 1999; McGregor, 2004). Assessing IPLC valuation practices and procedures solely through the lenses of western science approaches risks devaluing the interest of IPLC as "right holders" in valuation of nature exercises. Comprehension of Indigenous and local worldviews and knowledge systems allows demonstrating the diversity of valuation. This highlights the need to capture the full breadth of IPLC multidimensional interconnections of values or principles which inform valuation practices. This also requires an understanding of evidence within an IPLC context (*Box 3.5*).

## 3.1.2. Why assess valuation methods and approaches?

The choice of valuation methods has a strong bearing on which values and whose values are elicited and how they are articulated. This, in turn, can affect decisions informed by valuations.

The urgency of the global environmental crises and the challenges in making progress towards agreed sustainability goals provide increasing opportunities to apply valuation as part of the governance of nature and human-nature relations. However, the capacity of valuation methods to fulfil their intended goals and to inform decision-making is highly variable and depends on how valuations are conducted. Knowledge on the capacity of methods needs to be advanced, and decision-makers and practitioners need guidance on which methods to apply, the conditions under which they can be applied, their underlying assumptions, what type of information they can generate and their limitations and resource needs.

The chapter provides an overview of available methods, characterises methods based on their shared attributes and assesses their applicability for different purposes and points to key sources for guidance on their application to support decision-making. The chapter evaluates for what purpose methods have been applied. This includes the types of values that have been assessed, the context in which valuation methods have been applied and whose values have been involved in the valuation processes. Building on earlier assessments, we consider valuation methods from a broader suite of scientific disciplines (natural, social and humanities) which are described in scholarly literature, grey literature, as well as indigenous and local knowledge (ILK) sources. The potential and limitations of the wide range of valuation methods are assessed to provide policy relevant guidance on how valuation can be improved to better support decision-making.

## 3.1.2.1. Classifying methods to facilitate their assessment

### Existing typologies of valuation methods

Numerous classification systems exist to organise valuation methods and approaches into groups with shared characteristics or typologies that highlight key distinctions between them. Common classifications group methods based on the way methods articulate values (e.g., monetary/non-monetary), by disciplinary perspective (e.g., biophysical/economic/socio-cultural), based on how

they elicit values (stated/revealed preference methods) or based on features of the elicitation process itself (participatory/non-participatory).

*An early typology* distinguishes direct and indirect methods as one dimension; and observed versus hypothetical behaviour as another key dimension of valuation methods (Freeman III et al., 2014). This classification has influenced many subsequent refinements of economic valuation methods typologies. De Groot et al. (2002) includes group valuation as a distinct valuation method into economic valuation methods classifications.

*The Economics of Ecosystem and Biodiversity (TEEB)* initiative builds on earlier classifications but introduces biophysical valuation methods to assess value based on the intrinsic properties of ecosystems measured in biophysical units (e.g., in time, energy, materials, land surface, etc.) and are referred to as physical *costs* (TEEB, 2010). Deliberative methods are also included alongside stated and revealed preference methods in the TEEB typology.

*IPBES typology of valuation approaches and perspectives*: IPBES's Methodological guidance to values and valuation recognizes five perspectives (economic, biophysical, socio-cultural, ILK/Holistic and Health valuation) (IPBES, 2015). The five perspectives represent the different ways in which the term "value" is understood and subsequently analysed by different disciplines and knowledge systems:

- Economic valuation methods are founded in welfare economics. Economic values are based on individual preferences, reflecting individual needs, wants, perceptions and worldviews, as well as the scarcities imposed by nature and by the social and economic contexts within which people live.
- Cultural and social valuation methods aim to value nature and its contributions to people by discovering the psychological, historical, cultural, social, ecological and political contexts and conditions, as well as the worldviews and social perceptions that shape individually-held or commonly-shared values.
- Biophysical approaches assess value based on the intrinsic properties of objects by measuring underlying physical parameters. They generally aim to examine the ecological importance of attributes, qualities, and quantities characterising nature's condition and functioning.
- ILK/Holistic valuation systems aim to value the relationships and dynamics established among peoples and nature regarding the regeneration or reproduction of the systems of life of Mother Earth. They follow a rights-based approach; considering that living in balance and harmony with Mother Earth is based on the complementarity of the rights of Mother Earth and the rights of peoples to their holistic development and eradication of poverty.
- Health valuation methods aims to value effects on human health. They are used to assess how changes in nature affect the quality of life through health metrics describing physical and mental health at the core of human well-being.

According to IPBES integrative approaches offer opportunities to bridge the different valuation perspectives while also acknowledging '*the existence of different perceptions of what constitutes a "good life" across social groups and cultures* and acknowledging *the role of institutions, including social norms that underpin human-nature relations'* (Pascual et al., 2017).

Further valuation typologies exist in literature, among others Raymond et al. (2014) suggest a typology of valuation approaches which categorises valuation into two main types: instrumental and deliberative approaches. They argue that each approach involves distinct perspectives on rationality, different processes of value elicitation, particular types of representativeness, and various degrees of decision-maker involvement (from Tadaki et al., 2017). The typology proposed by Tadaki et al. (2017) operationalize valuation concepts along the degree of civic participation. The four notions of

value they identify are: value as a magnitude of preference, value as contribution to a goal, values as individual priorities, and values as relations. The authors argue that when valuators conceptualise values as magnitudes of preference or as contributions to a goal, they tend to operationalize these in technical valuation tools, including monetary valuation, which allow experts to tightly structure (and potentially limit) citizen participation in decision-making. On the other hand, when values are conceptualised as priorities, valuation provides a way of describing individuals' priorities and considering how these priorities differ across a wider population usually through structured surveys. Finally, when values are conceptualised as relations, valuation is generally used to foster deliberative forms of civic participation.

While any classification has its potential merits, especially for their specific research or assessment purpose, they would severely limit the assessment of valuation in this chapter: Most typologies are restrictive to economic valuation methods, while Raymond et al. (2017) and Tadaki et al. (2017) distinguish valuation approaches only by the extent of involvement of stakeholders. Lastly, IPBES's typology is divided across disciplinary traditions, thematic focus and knowledge systems and ignores the fact that approaches (e.g., a deliberative approach) and even methods (e.g., participatory mapping) are often shared across these disciplines. Furthermore, pitching "economic" versus "sociocultural" or "IPLC related" versus "biophysical" risks to further polarise disciplinary or epistemic discussions rather than bridge them.

### 3.1.2.2. A discipline-neutral grouping of valuation methods: introduction to the method families

This chapters' broad and inclusive definition of valuation and explicit inclusion of methods and approaches from broad disciplines and academic traditions, that elicit and articulate values to enable decision-making in diverse contexts, are unamenable to existing typologies.

With a view to compare a wide array of valuation methods and approaches emerging from diverse disciplinary fields and traditions, we have grouped methods using a discipline-neutral lens. Here, methods have been classified into four "method families". The first three families are distinguishable from each other by a single criterion: their 'source' of information on values. Values can be derived from the environment or nature, from people's behaviours, and from people's statements. As such, methods can be grouped as nature-based valuation, behaviour-based valuation, or statement-based valuation. A fourth family – integrated valuation - captures methods aimed at characterising and articulating values by bringing together and synthesising different types of value information. We present a brief description of each method family here. A more thorough review of each family is presented in *Section 3.2*.

- *Nature-based valuation*: Quantifies or qualifies aspects of the physical world which are of importance to people. This can be based on -or derived from- physical measurements, but also on expert information and local or specialised knowledge.
- *Behaviour-based valuation:* Quantifies or qualifies the importance of nature for people based on what people do with/in nature. This can be based on observations of rituals and traditions, of time and efforts spent for nature or resources and money spent to experience nature. This information can be derived from direct observations of people or indirectly from databases or descriptions of behaviours.
- *Statement-based valuation:* Quantifies or qualifies the importance of nature for people based on what people state about the importance of nature and human-nature relationships. These statements can be narratives, importance scores or willingness to pay (or receive) money for changes in aspects in nature and human-nature relations. The statements can be obtained from

direct interactions with individuals or groups of individuals. The valuation is mainly based on interviews, surveys or group discussions.

- *Integrated valuation:* Combines several sources of information on the importance of nature for people with the goal to integrate them towards a decision-making process. Integration can happen through integrated modelling, deliberative processes or aggregation procedures to bring together value estimates. While these methods draw on different other valuation methods from the former groups, they do not sit exclusively in either of these and have the specific goal of bringing values together from multiple sources. Several integration methods (e.g., participatory rural appraisal and multi-criteria decision analysis) can be considered decision support tools that explicitly aim to bring information on synthesising values to choose between alternative options.

Essentially, the families cut across existing classifications, and each method family consists of quantitative and qualitative valuation methods that are associated with biophysical, economic as well as socio-cultural approaches (*Figure 3.7*). By sharing the same value sources, methods within families share similar ways of eliciting values and are confronted with many of the same limitations. Consequently, even though families contain methods that have been developed by different disciplines, the innate capacities and limitations imposed by the source of values become shared attributes of the family. This makes the methods families approach highly amenable to assessment of methods at a higher grouping level that is still relevant for understanding their potential and shortcomings for decision-making and – to some extent - independent of academic disciplines.

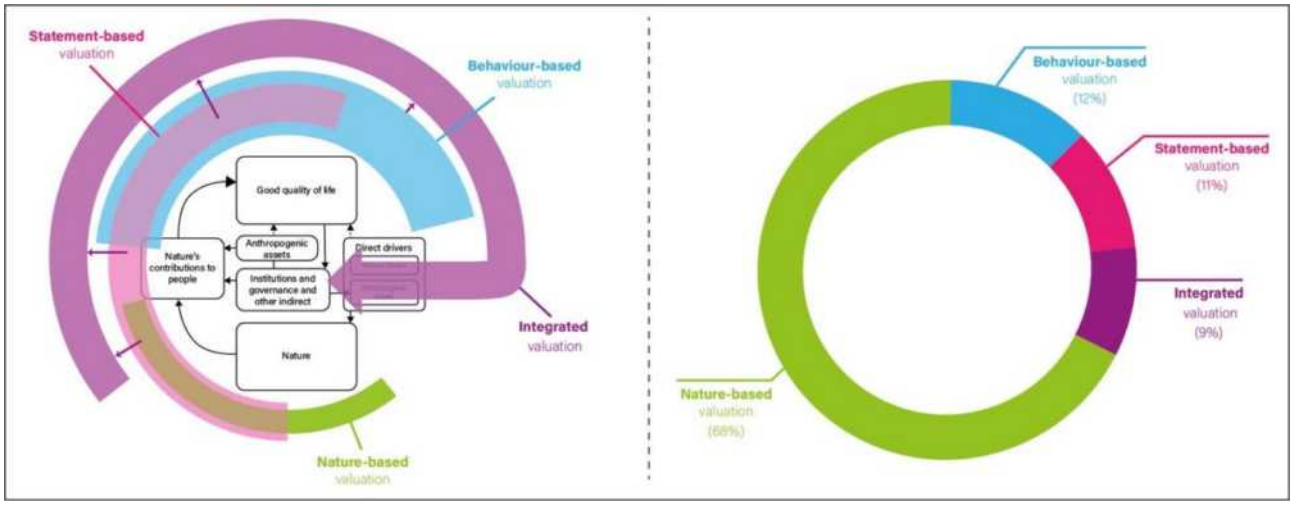


**Figure 3.7.** Chapter 3 discipline-neutral valuation method families and their coverage of the IPBES conceptual framework (Díaz et al., 2015) and abundance of the method families in the valuation literature[5].

While the method families intuitively map onto the IPBES conceptual framework of human-nature relations (*Figure 3.7*), it should be noted that the classification of methods families is not meant to be an intercultural nor a multi-worldview approach. It is a pragmatic approach that has been conceived for this specific assessment process. It is heavily informed by a western science worldview that is founded on the notion that values are sourced from a limited set of *places* (the environment and humans) and that methods can indeed be classified into distinct yet overlapping groups. The method

[5] Systematic PCIV (Principles, Criteria, Indicators, Verifiers) review on valuation methods (https://doi.org/10.5281/zenodo.4404678).

family classification does not account for worldviews that consider additional value sources such as ancestors and other non-human entities, as is the case in many IPLC contexts. In this vein, the method families do not properly include IPLC practices and methods of valuation.

### 3.1.3. Previous assessments and significant reviews of valuation methods

Some notable assessments and major reviews on biodiversity and ecosystem services have been conducted in the past at different spatial scales – national, regional, and global. A brief description and the extent of valuation methods considered in these assessments and reviews are given in *Figure 3.8* and *Annex 3.1*. Among these, The Economics of Ecosystems and Biodiversity (TEEB, 2010), the United Kingdom National Ecosystem Assessments (UK NEA, 2011, 2014) and the United Nation's System of Environmental-Economic Accounting - Ecosystem Accounting (SEEA EA) have assessed some valuation methods.

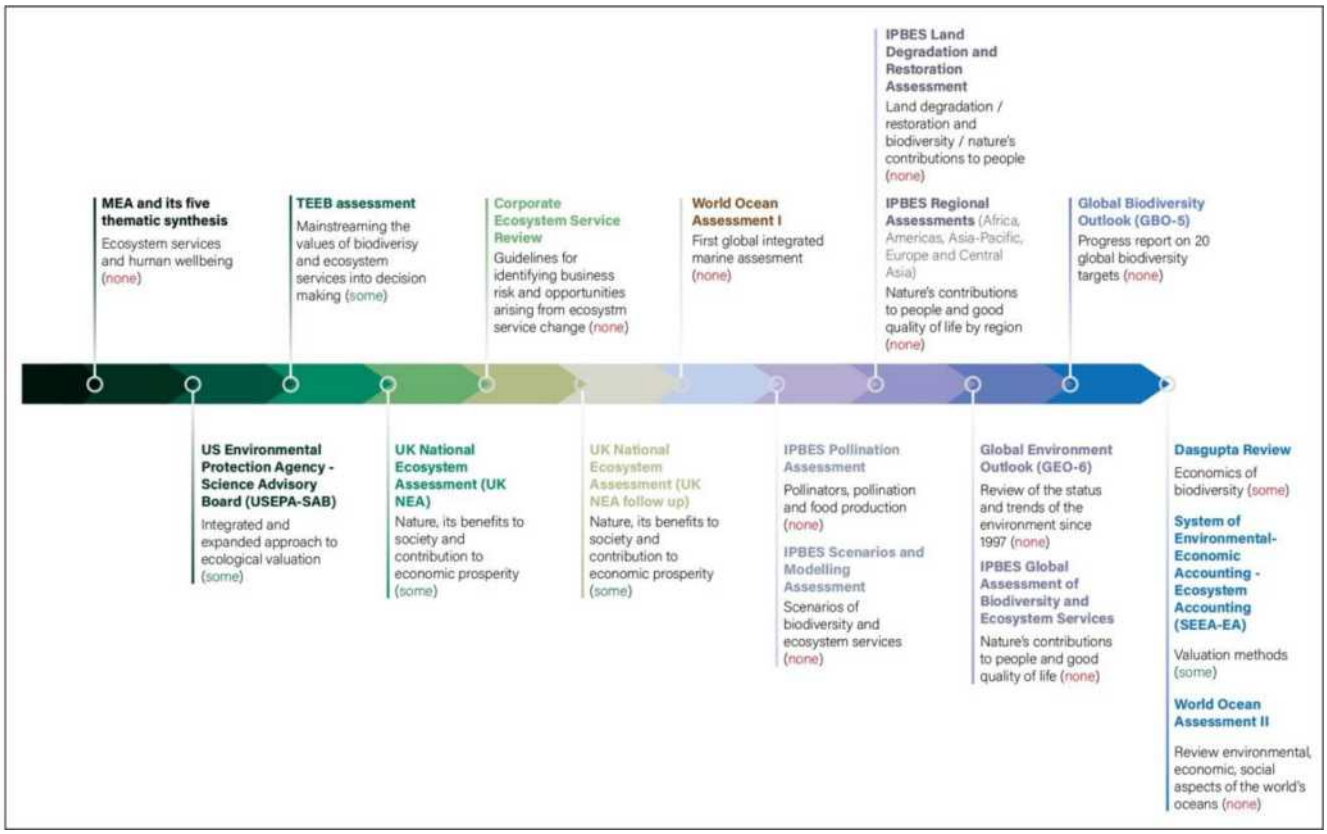


**Figure 3.8**. Timeline of major biodiversity and ecosystem service assessments and major reviews, their main focus and the extent of the review of valuation methods (in parenthesis).

The methodological reviews in the scientific literature are dominated by an economic valuation perspective (e.g. Bartkowski et al., 2015; de Groot et al., 2020; Hanley & Czajkowski, 2019; Schild et al., 2018; Turner et al., 2015; Venkatachalam, 2004)[6]. Methodological reviews of nature valuation solely on non-economic valuation methods, such as socio-cultural valuation or indigenous and local knowledge-based valuation are rare. This may be because application of non-monetary valuation methods of nature are fewer, although this is changing (Chan & Satterfield, 2020). Very few studies

[6] Previous comparative assessments of valuation methods (https://doi.org/10.5281/zenodo.4404320).

exist that value (either in monetary or non-monetary terms) actual biophysical *changes* in ecosystems (Chan & Satterfield, 2020).

A systematic review of the peer-reviewed literature identified 41 review papers on methodological reviews mainly focused on economic valuation methods. Among these review papers, there are some thematic reviews that specifically focus on economic valuation of either biodiversity (Bartkowski et al., 2015) or ecosystem services of a particular type – e.g., cultural (Cheng et al., 2019), or regional (Wangai et al., 2016), ecosystem-specific – e.g., mangroves (Barbier, 2016; Vo et al., 2012), or their changes driven by a particular cause - land degradation and restoration (Turner et al., 2015). In contrast, there are numerous reviews on specific economic valuation methods, e.g., 35 reviews on contingent valuation[7].

Numerous databases on valuation methods and approaches have been developed and serve as a useful resource for researchers, policy-makers, and valuation practitioners for selecting methods for valuation applications and decision-making. See *Annexes 3.2 and 3.3* for a collection of databases on valuation studies and best practice resources, respectively**.**

Valuation assessments have tended to take a disciplinary approach, providing a partial picture of the types of methods available to consider. Assessing all available methods conjointly - irrespective of the disciplines and academic traditions that developed them - can help integration of diverse values by increasing availability of approaches tailored to the requirements of different contexts: a "more plural" valuation (see *Chapter 1* and *Figure 3.7*) (Tress et al., 2005). Moreover, valuation also occurs in non-policy contexts such as in indigenous and local communities, and in the private sector. Comparing methods across disciplines and practices requires an interdisciplinary and inclusive approach.

In light of this, the primary objective of this chapter is to provide an overview of existing academic methods and their application, and guidance to valuation specialists who work with practitioners and decision-makers looking to incorporate valuation into decision-making processes. To achieve this, the chapter analyses the goals, principles, capacities and applications of valuation methods; and provides an assessment of the potential and limitations of existing methods for informing decision-making processes.

## 3.1.4. The scope and evidence base for the chapter

The objective of the chapter is formally detailed in the scoping document for the values assessment. Several statements in the general part of the scoping document are relevant to *Chapter 3,* in addition to the specific scoping text. To achieve this mission and to shed more clarity on the specific objectives of the chapter the scoping statement was framed around six chapter-specific assessment questions. These questions inform the chapter's rationale and reporting structure. A brief description of each question is presented below, providing a short justification for each and pointing to the evidence that was assessed by *Chapter 3* to generate responses for each question

## 3.1.4.1. The six assessment questions in Chapter 3

The six questions guiding valuation methods assessment in *Chapter 3* are:

[7] Previous comparative assessments of valuation methods (https://doi.org/10.5281/zenodo.4404320). (See document B).

- **Assessment question 1:** *Why is valuation undertaken?* (Why are valuation methods applied? What purpose do they seek to address?)
- **Assessment question 2:** *Which methods are applied?* (Which methods and approaches have been applied to undertake valuation? To what extent are methods combined?)
- **Assessment question 3:** *Which values are elicited?* (Which types of values do valuations aim to elicit? How do valuations capture the diverse ways in which humans value nature? Which values are often or rarely elicited?)
- **Assessment question 4:** *When and where are valuations undertaken?* (When, where, and at which spatial and governance scales have valuation methods been applied? In which socio-ecological contexts have they been undertaken?)
- **Assessment question 5:** *Whose values are considered?* (Are valuation methods inclusive and do they allow for meaningful participation of stakeholders (including IPLC)? How do valuations deal with legitimacy, power and justice issues?)
- **Assessment question 6:** *How reliable and feasible is valuation?* (What are the limitations of valuations? How are validity, consistency and transparency considered in current applications? How feasible is it to include valuation methods and approaches in decision-making processes?)

### 3.1.4.2. The evidence generation process

Given the broad definition of nature valuation used in the values assessment and cognizant of the fact that - due to terminology and disciplinary differences - many valuation studies may not self-identify as such, this chapter therefore casts a broad net to capture literature and non-written material that represents the body of available knowledge on nature valuation. As such, the chapter bases its evidence on literature reviews (primarily from scholarly journals, but also from publicly available grey literature including previous IPBES assessments), reviews of methods guides and handbooks, and reviews of reports of IPBES ILK dialogues that were conducted as part of this and previous IPBES assessments. Where evidence was scarce, essays and other contributions were solicited directly from experts. This section describes how the evidence was sourced and the process that was used for consolidating, synthesising and, in some cases, analysing the information to generate the results and findings.

The six assessment questions described in *Section 3.1.4.1* represent the line of questioning that *Chapter 3* has taken in order to provide the most current understanding and critique of contemporary valuation. As depicted in *Section 3.1.1,* the chapter uses a broad working definition of valuation so that it can include the wide diversity of methods and approaches that are undertaken today by different disciplines, traditions, sectors and actors. In the interest of representing that diversity, multiple types and sources of evidence were consulted, aware that the assessment questions cannot be satisfactorily answered by a single approach (*Table 3.2*). This section first describes the types of literature reviews that were conducted and the additional consultations that were undertaken to complement the literature reviews (see *3.2.2*). followed by a detailed description of how the assessment questions were operationalised, specifically for the systematic literature review that was undertaken to assess application of valuation (see *3.2.3*).

- In the case of *assessment question 1 (why is valuation undertaken?)*, information on purposes for valuation is derived from an overview and previous assessments review, thematic reviews of different types of methods, from a systematic review of scientific and grey literature on valuation applications, and from ILK.
- The assessment is tasked with providing an overview of existing types of valuation methods and approaches (*assessment question 2: which valuation methods?*). The main source of evidence for assessing this question are thematic reviews of methods. These are

enriched with material from a systematic review of method applications in the context of nature, nature's contributions to people and human-nature relationships. Quantitative data from a literature search as well as information from an in-depth review were synthesised for individual types of methods.

- Evidence of how valuation methods address diverse values (*assessment question 3*) is an important aspect of the *values assessment*. This question helped identify whether different methods are able to capture a full range of diverse values or are limited to a smaller set of values (including broad and specific values, diverse value targets and life frames) (see *Chapter 2*). The main source of evidence to assess this question is a systematic in-depth review of valuation applications in scientific and grey literature. Especially for broad values, this is enriched with findings from ILK.
- A basic spatio-temporal inventory of applications of valuation (*assessment question 4*) - according to the main method types - is a requirement for understanding gaps in and ways forward for valuation. Also, the context in which a valuation method is applied is a main factor in understanding its applicability to different socio-ecological settings. The main source of evidence is a quantitative output of the literature search, which stretches across all global regions and a historical review of literature.
- The question of *whose values?* (*assessment question 5*) pertains to the perspectives of people holding different worldviews, potential to include diverse sources of knowledge, and consideration of power, gender, age, and distribution within and between generations. The two main sources of evidence are (1) a systematic review of valuation applications evidencing participation, representation and procedural justice aspects of the application of valuation methods, and (2) information obtained from ILK-assessment activities.
- Reliability and feasibility (*assessment question 6*) is an important aspect for the use of valuation methods to inform decision-making and policy processes. The evidence used for addressing this question includes an in-depth systematic review of valuation applications to document how validity and reliability are addressed in valuation applications. This is enriched with findings derived from thematic reviews on individual types of methods (grouped into method families) and other targeted reviews.

Together, these assessment questions provide evidence to the assessment using the "3R framework" to assess valuation methods. ***Relevance*** is assessed by combining the evidence from assessment questions 1-4. ***Robustness*** is evaluated based on assessment questions 5 and 6. ***Resource*** needs are assessed using evidence from answering assessment questions 2 and 6. The multi-pronged approach that is applied in this chapter has provided a rich volume of valuation material to consult and assess, allowing - on the one hand - to confidently draw conclusions on multiple aspects of valuation, and on the other, to identify contested issues, inconclusive evidence, knowledge gaps and future directions in the field of valuation. Chapter authors are fully aware of the bias of the evidence base towards English-language literature and acknowledge that despite explicit targeting of IPLC approaches and principles, most of the sources used are still informed by western knowledge systems and epistemologies (Altbach, 2007; Ammon, 2012; Hakkarainen et al., 2020; Rasmussen & Montgomery, 2018). This bias is a system-wide shortcoming of contemporary knowledge generation that reflects historical imbalances that persist to this date (Carter, 2004; Sutherland et al., 2014; Tengö et al., 2017).

In this regard, it is important to note that the assessment on IPLC aspects for the chapter served as an exploratory mechanism aimed at addressing existing knowledge gaps in the literature about IPLC valuation methods and approaches. It is by no means an exhaustive assessment of the range of IPLC valuation methods and approaches. The results presented in *Section 3.2.4* should not be generalised beyond the IPLC contexts that they describe.

The five types of evidence sourcing applied in this chapter are complementary and include "review of reviews", "topical review of methods families", "systematic review of methods applications", "thematic reviews", "ILK dialogues" and "consultations with ILK experts" (see *Table 3.2*).

**Table 3.2** Summary of evidence sourcing methods applied in Chapter 3 (Source: adapted from table 1 of Grant & Booth (2009)[8,9,10,11,12,13,14].

| Type of approaches | Type of sourcing | Evidence selection | Analysis and output | Assessment question |
|---|---|---|---|---|
| **Review of method families**[7] | State-of-the-art review | Aims for comprehensive searching of current literature about valuation methods and approaches | Current state of knowledge, overview of challenges and debates | 1, 2 and 3 |
| **Review of reviews**[8] | Umbrella review | Qualitative assessment of existing reviews of valuation methods (based on both primary studies and grey literature) | Research gaps (what remains unknown), recommendations to improve the elicitation of values | 2 and 6 |
| **Systematic review of methods applications**[9,10] | Systematic in-depth review | Aims for exhaustive, comprehensive searching of reported valuation experiences | What valuation experience can reveal about methods and how it can inform recommendations for practice | 1 - 6 |
| **Thematic reviews**[11] | State-of-the-art review | Aims for comprehensive searching of current literature on specific themes deemed relevant to valuation | Current state of knowledge of specific themes; trends, caveats and unresolved issues in valuation of nature | 2, 3, 6 |
| **ILK dialogues**[12] | Contributions by ILK-holders in dialogues organised with IPBES ILK liaison group; documented in reports | Aims for complementary evidence on valuation from IPLC perspectives | Findings on IPLC perspectives, adaptations in chapter conceptual and analytical framework, search terms and analysis criteria for other reviews | 1, 2, 3 |
| **Consultations with ILK experts**[13] | Written responses to questions, accompanied by other material, discussion via phone, email and in-person | Aims for complementary evidence on valuation by IPLCs for IPLC purposes | Content analysis and narratives to better describe IPLC valuation | 1, 2, 3 |

In summary, this chapter is based on multiple types of evidence sourcing to derive a comprehensive understanding of various aspects of valuation methods. In the review process, the authors considered qualitative descriptions of methods, derived quantitative data from applications to investigate how methods have been used in different valuation contexts, and engaged with indigenous knowledge holders to broaden the evidence base, the analytical approaches and the conceptual understanding.

[8] Systematic review on Method Families (https://doi.org/10.5281/zenodo.4404436).
[9] Previous comparative assessments of valuation methods (https://doi.org/10.5281/zenodo.4404320).
[10] Systematic PCIV (Principles, Criteria, Indicators, Verifiers) review on valuation methods (https://doi.org/10.5281/zenodo.4404678).
[11] Valuation Atlas (https://doi.org/10.5281/zenodo.6468906)
[12] Systematic review on Method Families (https://doi.org/10.5281/zenodo.4404436).
[13] Reviews on IPLC approaches to valuation (https://doi.org/10.5281/zenodo.4422079).
[14] Analysis of Contributions on Values and Valuation Methods by ILK experts and holders (https://doi.org/10.5281/zenodo.4404612).

# 3.2. The richness of valuation

The objective of this section is to give an account of the richness of nature valuation in terms of the abundance of methodologies that exist to undertake valuation, and the diversity of valuation disciplines and traditions. In addition to describing how valuation has evolved in academia, this section also provides an assessment of how the current practice of valuation of nature has developed to what it is today, including in IPLC contexts. The section demonstrates the characteristics of different valuation methodologies, structured using the methods families, highlighting some of the key developments in valuation methods. This also contextualises the trend of growing inclusiveness in the valuation process, the continued search for ways to integrate more types of values of multiple stakeholders, as well as the growing interest by indigenous scholars in developing valuation methods and metrics that better capture values as they are lived and transmitted in IPLC contexts.

## 3.2.1. Valuation Atlas: the diversity and global distribution of valuation practice

As an academic field, nature valuation is relatively young but involves a wide range of academic disciplines (*Figure 3.9*). Although valuation literature is dominated by work from natural sciences disciplines, it extends across to social sciences and humanities to include disciplines such as economics and anthropology and inter-disciplinary work. For the purposes of this assessment, it should be noted that we only included biophysical and social assessments with a nature valuation purpose[15].

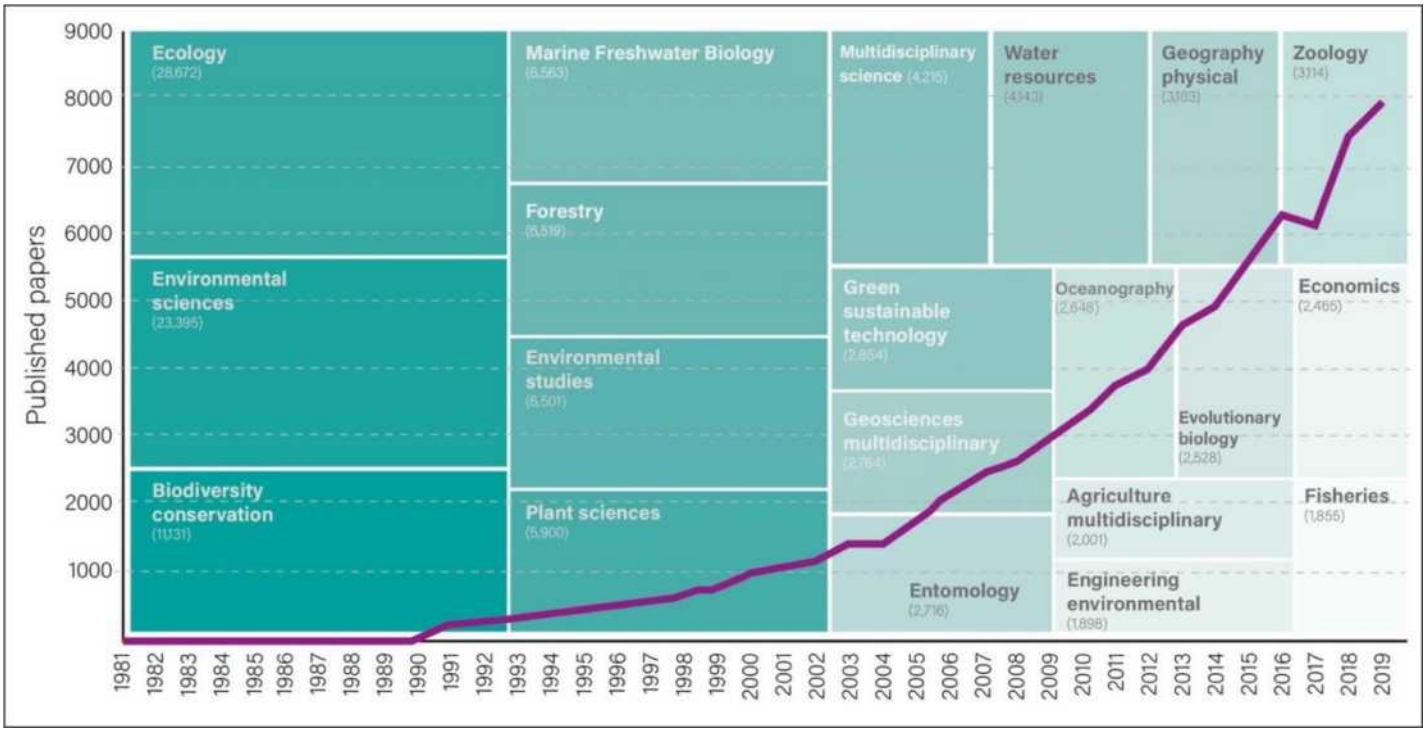


**Figure 3.9.** Trend and disciplinary mix in nature valuation based on Web of Science.

[15] Valuation Atlas (https://doi.org/10.5281/zenodo.6468906).

Although assessing nature, its importance and our interactions with nature have a long history, references to nature valuation as an explicit undertaking that applies specific methods and approaches are relatively recent. In academia, methods to assess the values of nature were mentioned in only a few publications in the 1980s, for example. Between 1990 and 2000, however, reported valuations in literature increased tenfold and increased by another fivefold between 2000 and 2020 (*Figure 3.10*). Valuations are now conducted worldwide and since the 1990s all methods families have been applied across the global region. During the decade of the Millennium Ecosystem Assessment (2001-2005), valuation studies tended to be concentrated in a few countries (namely, United States, Brazil, India, United Kingdom). Between 2008 - 2018, the concentration of valuation studies in those countries increased with only some diversification to European Union countries, African countries, and China[16].

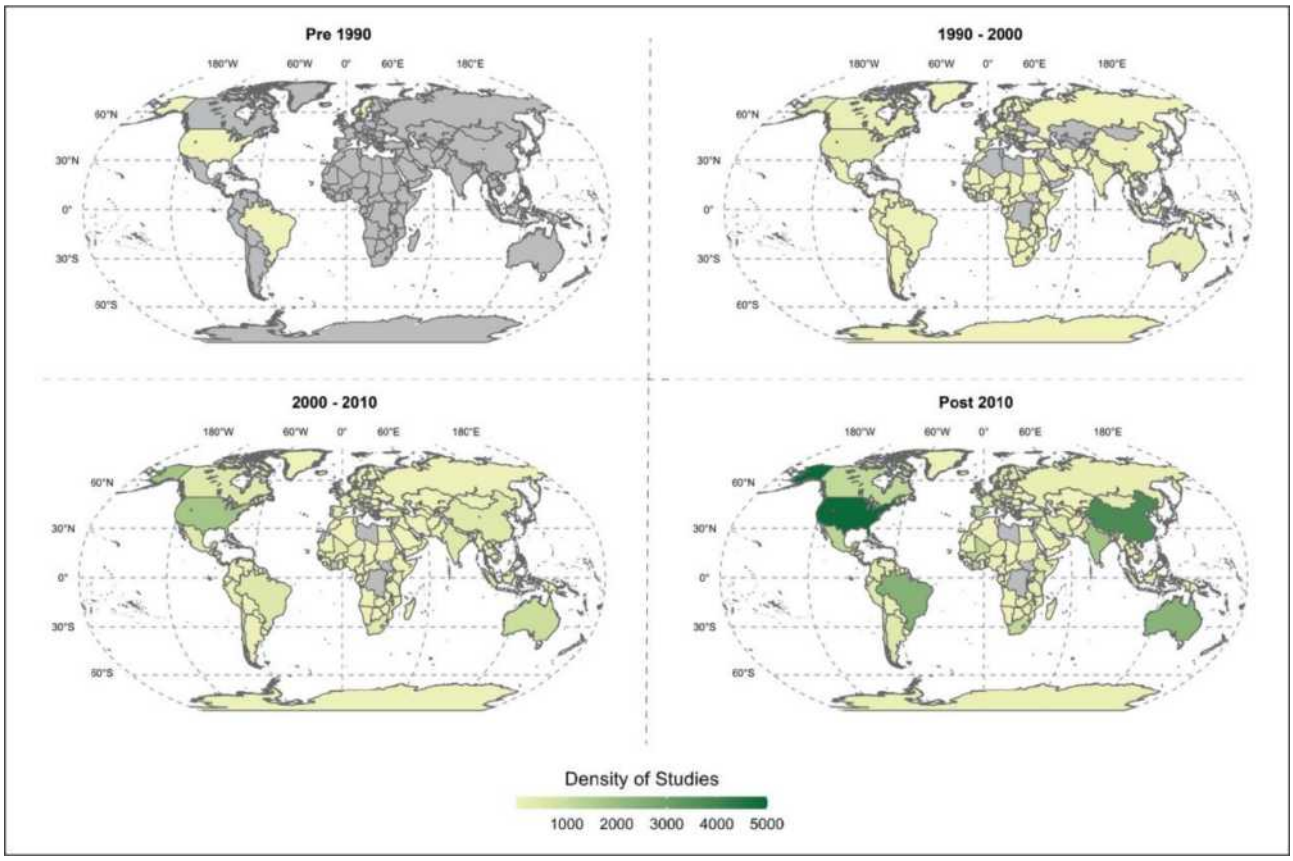


**Figure 3.10.** Decadal country distribution of the corpus of nature valuation studies (n= 48,781)[17]

To understand the relationship between the frequency of valuation studies and the biological and socioeconomic context in which they are conducted, a Pearson correlation analysis was used, to compare the number of valuation studies, the IPBES Core Indicators, and a chosen set of other relevant indicators. The correlations are generally low and the indicators do not provide strong explanations for the global pattern. However, the analysis indicates that over the whole period: fewer studies have been carried out in countries with lower Gross Domestic Product (GDP) and more nature valuation studies where biodiversity and environmental degradation is higher (for example, places with low Biodiversity Intactness Index, or high rates of use of pesticides, or high wood removals).

[16] Valuation Atlas (https://doi.org/10.5281/zenodo.6468906)
[17] (Idem)

Valuation studies have also mostly been conducted where environmental protection is lower (for example, places with poor management effectiveness in National Protected Areas, or with high rates of corruption perception index)[18]. Given the scarcity of literature on IPLC valuation, it is not yet possible to identify a global pattern of how valuation methods and approaches vary across IPLCs (see *3.2.4*).

Valuation has been conducted in all habitat types, but to varying degrees and with only small variations between method types (*Figure 3.11*). Unlike the de Groot et al. (2020) study on ecosystem services specifically, which reported that valuation of water is the most frequently conducted, this review indicates that valuation of forests was the most abundant, followed by cultivated areas and freshwater habitats. Nature-based valuation methods, for example, were mostly applied to forest systems and were less likely to be used in urban environments.

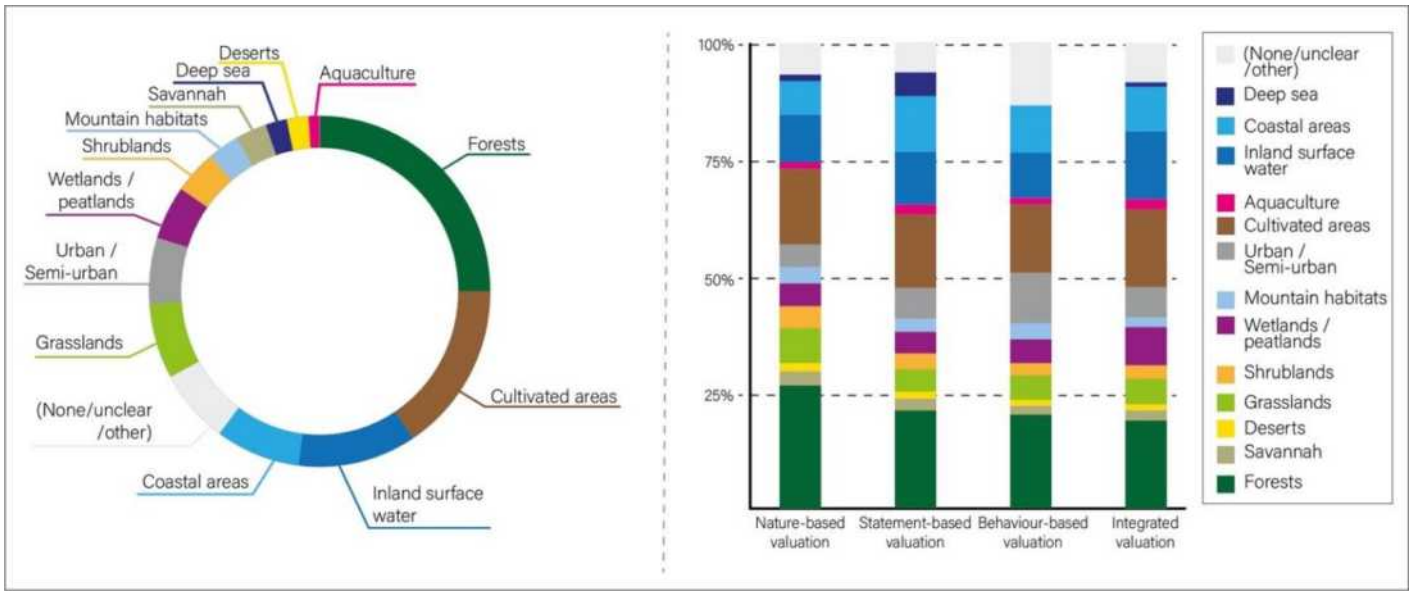


**Figure 3.11.** On the left, percentage abundance of valuations, on the right, distribution per method family (systematic in-depth review n=1163). Valuations per habitat type post 2010, using broad categories from the International Union for the Conservation of Nature Red List of Threatened Species Habitat Classification Scheme (IUCN, 2012).

Valuations have been conducted at multiple spatial scales, although approximately one third of the reviewed studies do not specify the biophysical scale to which the values relate. Valuation studies that assess specific biophysical properties tend to do so at all scales from very local up to regional ecosystem scales (*Figure 3.12 left*). Statement-based valuation studies were the least likely to report on the biophysical scale of the study (*Figure 3.12 right*). This is to be expected given that statement-based methodologies do not necessarily require linking people's values to biophysical locations, flows or stocks (see *3.2.2.2*).

[18] Systematic review on valuation uptake (https://doi.org/10.5281/zenodo.4391335)

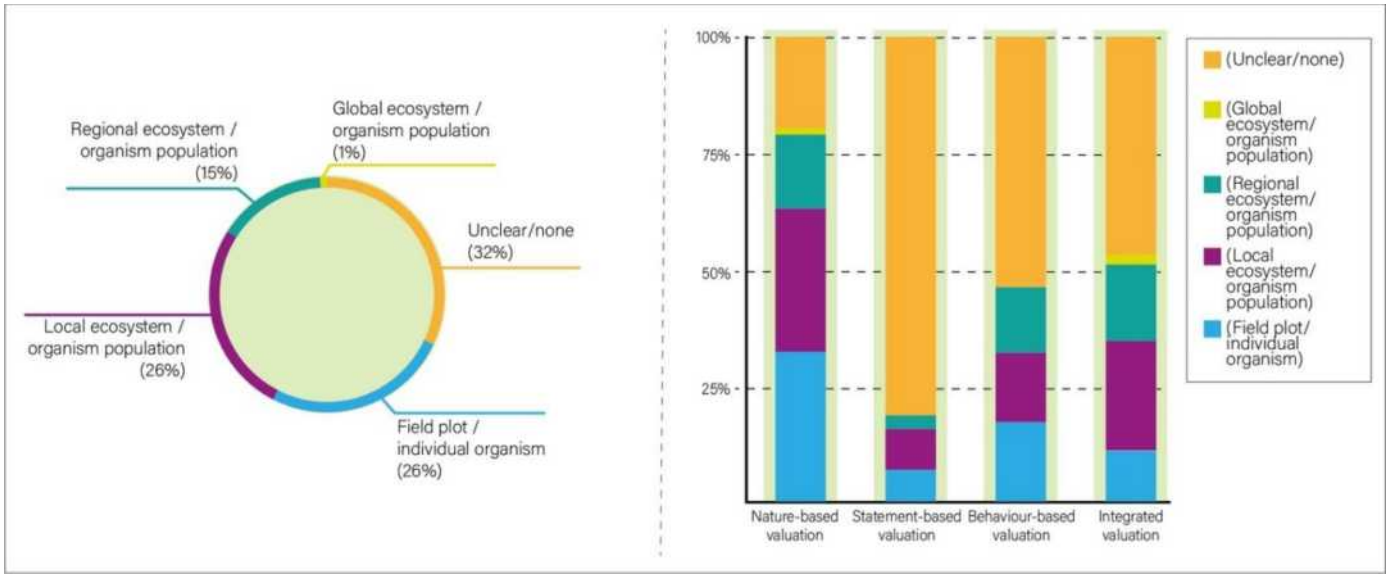


**Figure 3.12.** Biophysical scale at which valuations were performed. On the left, percentage abundance of valuations; on the right, distribution per method family (systematic in-depth review n=1163). Note that valuations often do not focus on a biophysical scale, but for example on the values of a social group or community.

The valuations are however clear on the administrative or policy scale the valuation is relevant for. It is very clear that the practice of valuation and therefore the experiences to draw from in decision-making have been predominantly generated at the sub-national scale (see *Figure 3.13*). The evidence also shows that this is the case across all method families.

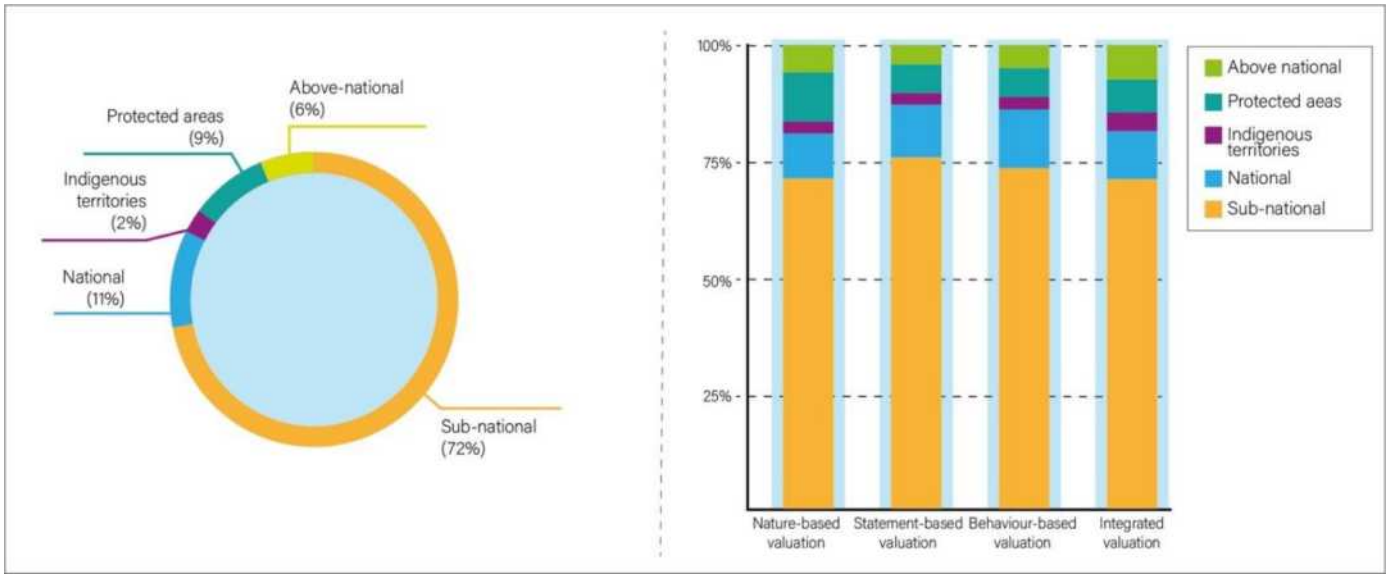


**Figure 3.13.** Valuations per administrative scale. On the left, percentage abundance of valuations, on the right, distribution per method family (systematic in-depth review n=1163). Scale includes overlapping categories in order to capture both spatial biophysical and administrative aspects (including IPLC designations).

### 3.2.1.1. Reasons (purposes) for valuation

It has been suggested in the literature that valuations have fallen short of their often-cited intentions to enable decision-making to account for the values of nature (e.g., Laurans et al., 2013). To evaluate the evidence for this, we applied Laurans et al.'s (2013) classification system of decision-making purposes based on the intended use of the valuation: i) providing information ("informative"); ii) assisting with prioritisations ("decisive"); and iii) designing technical features of policies ("technical") (see *4.6*).

The most frequently reported purpose of valuation is informative (*Figure 3.14*) followed by decisive purposes indicating that valuations are frequently aimed at providing decision-makers with recommendations about the most desirable course of action. Nonetheless, studies rarely report using valuation procedures actively in decision-making processes suggesting that the recommendations they provide may not actually be channelled into real decisions (see *4.6* for further analysis of uptake of valuation). Finally, few studies report on the use of valuation to design policy instruments (*technical purpose*). This somehow contrasts with the academic focus on correction of externalities through economic instruments, which have justified the development of many of the valuation methods over the last few decades (see *3.2.2.2*, *3.2.2.3*). A slightly higher fraction of studies conducted having technical design purposes are from statement- and behaviour-based valuations, however, variations across method families are small.

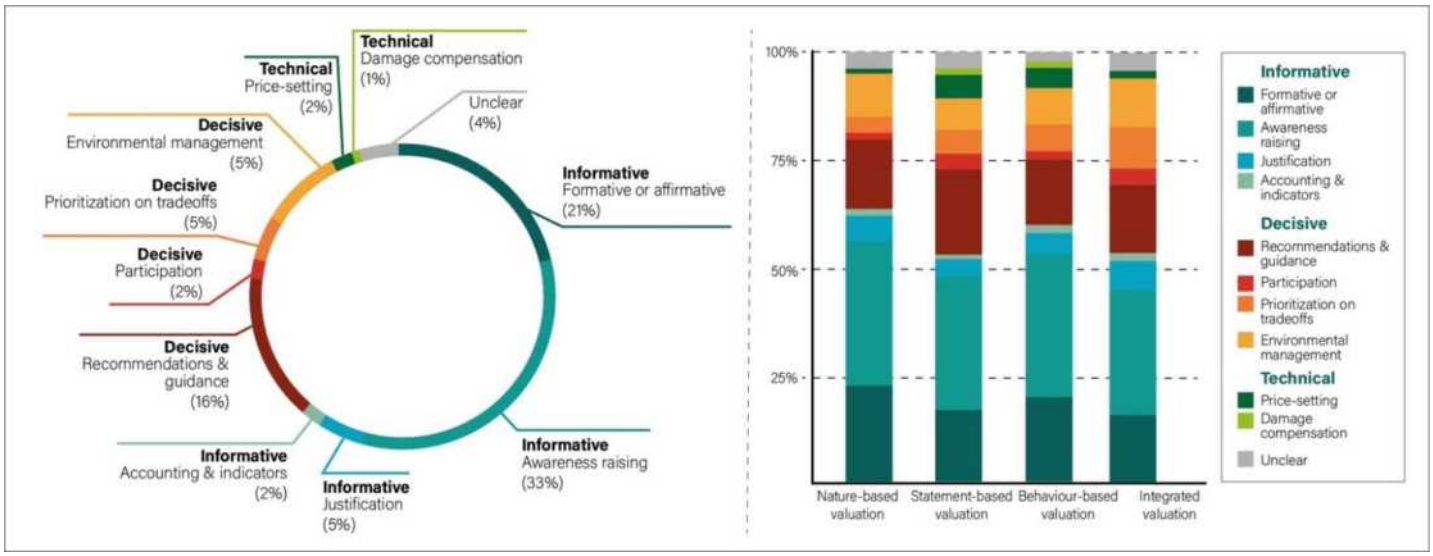


**Figure 3.14.** Stated purposes of valuations. On the left, percentage abundance of valuations, on the right, distribution per method family (systematic in-depth review n=1163). Note that actual uptake or use is largely unreported.

### 3.2.1.2. Which values and whose values are assessed

Nearly half (46%) of the valuation studies assess nature's contributions to people (material and non-material), 33% assess nature itself or the maintenance of options, whereas 28% of the studies we reviewed assessed some aspects of quality of life (*Figure 3.15*).

This review does not assess the concept of disservices or negative nature relations *per se*, although the valuation literature assessed does inherently include value indicators of negative nature relations (such as through costs and damages). Most valuations report on the positive contributions of nature to people and societies. A substantial proportion of valuation studies, however, reported on the undesirable dimensions of nature-human relations. For example, studies among those selected for the

systematic literature review report on human-wildlife conflicts in communities residing inside and around conservation areas, predominantly in sub-Saharan Africa (crop raiding primarily) but also in the United States of America and Latin America (ranchers versus wolves and mountain lions). Several studies highlight the real or perceived danger posed to human lives by residing in close proximity to wildlife and the damage to human property it can cause. There are also some urban ecology studies testing links between urban tree cover and urban wildlife to infrastructure damage, human health impacts (asthma and plant-related volatiles), crime and injustice.

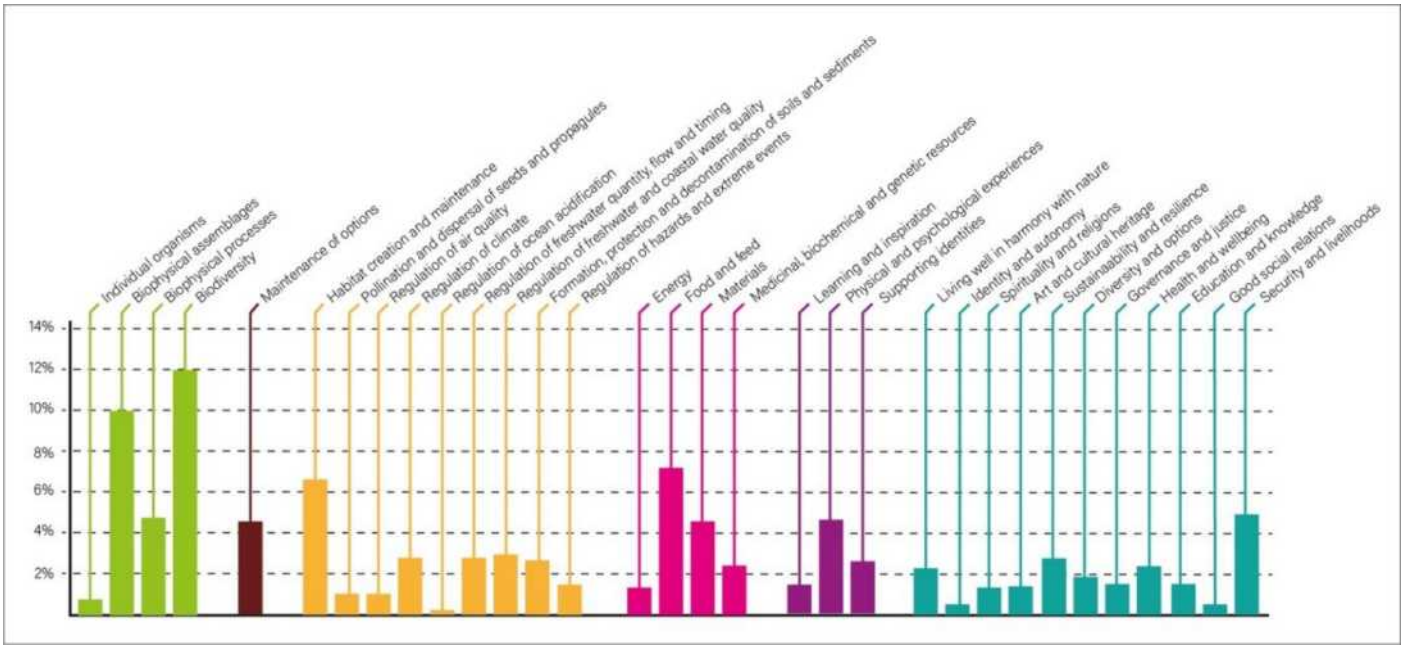


**Figure 3.15.** Relative abundance of various valuation targets (systematic in-depth review n=1163) Classification following as in Europe and Central Asia Assessment (IPBES, 2018), colours according to targets of nature itself, nature's contributions to people (regulating, material, non-material) and good quality of life categories.

Whether implicitly or explicitly, all valuation studies – including nature-based valuations – manifest the values of 'someone' (individuals or specific groups). However, in over half of the studies, authors do not explicitly associate values with people (*Figure 3.16*). Valuations that explicitly assess the values of people mainly elicit values from individuals and households and to a lesser extent the values of groups/communities or societies as a whole.

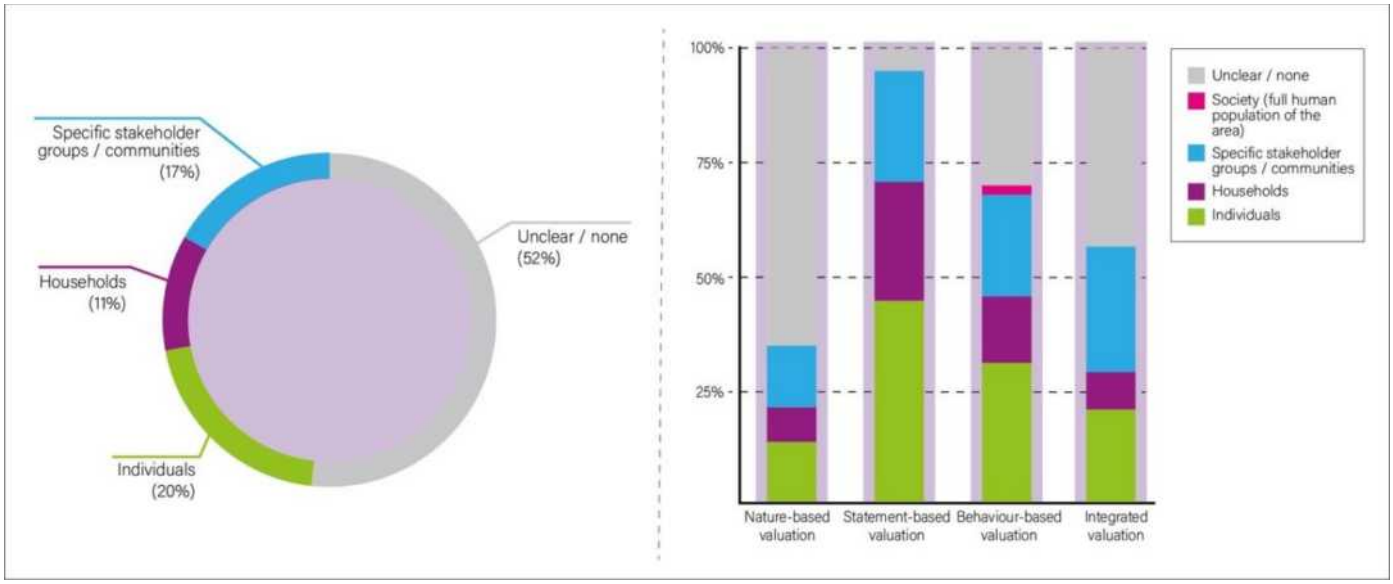


**Figure 3.16.** On the left, percentage abundance of valuations, on the right, distribution per method family (systematic in-depth review n=1163). Social scale at which valuations were performed. Note that valuations often do not focus on a social scale, e.g., when focusing on a habitat or species.

The way in which people are included in valuation has evolved over the last decades in line with the general increased focus on stakeholder participation. Participatory processes are those where actors or stakeholders (i.e., individuals, groups or representatives of organisations) have an active role in decisions that are relevant to them (Reed, 2008). Participatory approaches differ in terms of the level of participation they provide, the role of participants, and the extent to which participants can impact on decisions (Carnoye & Lopes, 2015). Methodologically, this has led to an expansion of the methods used in valuations, including the incorporation of participation in traditional appraisal techniques such as participatory mapping (Brown & Fagerholm, 2015; Brown & Kyttä, 2018), participatory modelling (Fontaine et al., 2014), participatory scenario planning (Oteros-Rozas et al., 2015), participatory choice experiments (Maldonado et al., 2019), and participatory multi-criteria analysis (Garmendia & Gamboa, 2012; Stirling, 2006). Some methods are participatory by design, including deliberative methods such as citizen juries (Brown et al., 1995), participatory (action) research (Sieber et al., 2014), rural appraisal (Chambers, 1994) and focus groups. Other methods do not require the subject to interact with other study participants, but they do allow for individuals to have more say in what and how they share information with valuators, such as with diary keeping and story-telling methods (Chambers, 2009).

Since the second half of the 20$^{th}$ century, participatory practices have increasingly been used in urban planning (Hisschemöller, 2018), natural resource management (Johnson et al., 2016), community-based management (Wiber et al., 2004), climate change (van Aalst et al., 2008), energy futures (Kowalski et al., 2009), technological development (Cuppen, 2012, 2018), Nature-based solutions (Palomo et al., 2021), environmental decision-making (UN, 1993), Global Water Partnership (2000) and others (Chilvers & Kearnes, 2016; van Asselt Marjolein & Rijkens-Klomp, 2002). Participatory approaches have shifted towards allowing more diverse types of co-production and citizen-led processes informed by a diverse set of knowledge systems and disciplines (Fontaine et al., 2014), incorporating issues of democratisation (Habermas, 1999), legitimacy and other good governance criteria; (Barnaud & van Paassen, 2013), inclusion (Elias et al., 2017), complexity (Reed, 2008) and diverse values (Lo & Spash, 2012).

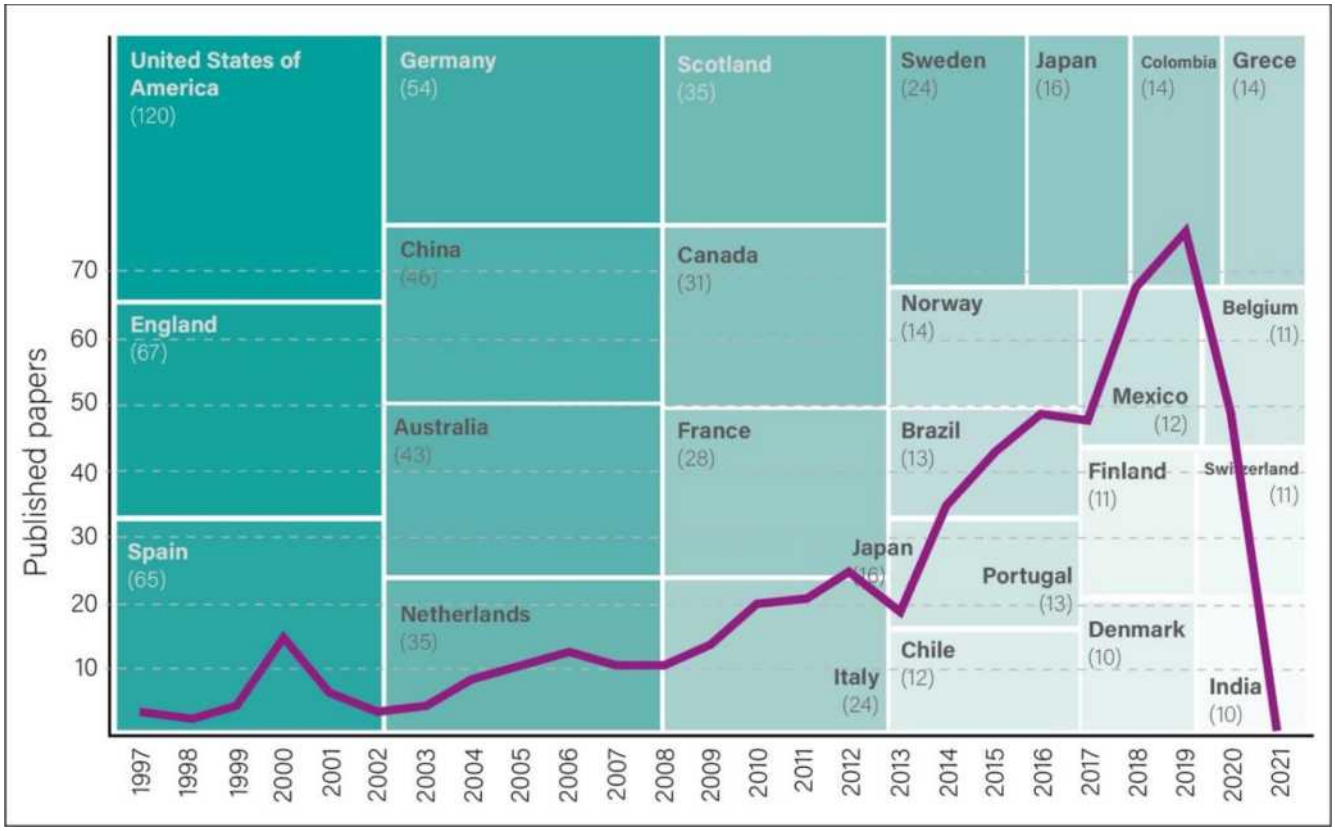


**Figure 3.17.** The number of studies reporting on participatory valuation of nature in the academic literature have increased substantially over the last 25 years, most notably since 2014 (web of science search on participant* AND valuation AND environment*). Most such studies have been conducted in just a few countries. (Only countries with 10 or more studies are reported).

Participatory processes, - especially those where actors engage in dialogue - seek to fulfil different purposes, including increasing awareness and learning (before making decisions), addressing conflict and seeking consensus (Brown & Raymond, 2014) (*Box 3.1*), generating situated understandings (Ungar et al., 2020), or policy design (Kallis et al., 2006; Wesselink et al., 2011). Despite these claims, the uptake of results of participatory and co-production processes by decision-making remains limited (Turnhout et al., 2020; Wesselink et al., 2011).

**Box 3.1. The role of nature valuation in the management, resolution and transformation of socio-environmental conflicts**

Socio-environmental conflicts are the result of disputes between social groups about decisions concerning the natural environment or disagreements on the ownership, access, and distribution of costs and benefits derived from nature's transformation (Herrera et al., 2017; United Nations et al., 2015). Conflict resolution refers to the wide spectrum of strategies that are available to manage and resolve conflicts (Ramsbotham et al., 2011).

Methods for articulating and assessing values can facilitate conflict resolution and transformation processes by characterising how the social groups involved perceive the world and by providing information about values for a constructive dialogue between the parties. It should be noted, however, that the application of valuation methods is only one of several other methods and approaches that are essential in the complex and sometimes long process of conflict resolution and transformation (*Table 3.3*). Among the valuation methods that are suited for use in conflict analysis, worldview assessment, framing analysis, consensus analysis, and ethical analysis are powerful methods that can be used to understand the stakeholders (For

descriptions of these methods, see *3.2.2.2*). Participatory multi-criteria decision-making analysis can be applied with conflictual parties to help make explicit the range of values involved, the dimensions of well-being that are manifested and to begin exploring scenarios for the resolution of discrepancies (*see 3.2.2.4*). Deliberative approaches, with their strong emphasis on reaching consensus through discussion and reflection about individual and collective preferences allow expressed values to be articulated and their inter-relations explored. Conflict analysis can also draw from nature-based valuation methods to quantify and characterise the components of nature that are contributing to the conflict and their distribution across parties, and to ultimately inform the process and outcomes of agreements.

**Table 3.3** Examples of methods that can be used to address conflict across conflict resolution stages.

| Conflict analysis | Stakeholder engagement | Negotiation/ Resolution/ Management/ Transformation | Description | Reference |
|---|---|---|---|---|
| Worldviews assesssment | | | Understanding the worldviews of the disputing parties helps to understand the different positions from which they interpret, enact and co-create reality. The assessment of worldviews has been used to explain pro-environmental behaviour, and there are few applications to the analysis of socio-environmental conflicts. | Hedlund de Witt et al., 2016; Hedlund-de Witt, 2012; Hedlund-de Witt et al., 2014 |
| Framing analysis | | | Understanding frames is important for mediators of conflicts, as this allows them to intervene with a clearer insight on divergences and convergences, to find potential common ground, and to propose alternative accounts of conflicts in ways that disputants can subscribe to. | Brummans et al., 2008; Davis & Lewicki, 2003; Asah et al., 2012 |
| Consensus analysis | | | It can potentially be applied to 'characterize variation in environmental beliefs across various stakeholder groups that will help in facilitating an understanding of common and contrasting conceptions and values' (Emery & Oughton, 2011, p.19). The analysis mainly provides inputs to identify opportunities for the construction of social agreements or public policies (Hung & Yang, 2006). | Carothers et al., 2014; Horowitz 2009; Miller et al, 2004; Stone-Jovicich et al., 2011; Swora 2003; Van Holt et al., 2010; Hung & Yang 2006; Stone-Jovicich et al., 2011; Hung & Yang 2006. |
| Ethical analysis | | | Ethical participatory assessment expands upon pre-existing methods by opening them up to more effective bottom up deliberation through reflecting upon ethical aspects of a public decision. | Gritten et al., 2009; Nylund & Kröger 2012 |
| Multicriteria decision analysis | | | Decision support tool that allows the disputing parties to account for multiple disputing parties to account for multiple dimensions of well-being, create different scenarios and deliberate on the best options. | Davies 2013 |
| Deliberative valuation methods | | | Disputant parties go through a process of discussion and reflection to form preferences beyond self-interest (Dietz et al., 2009), consensus opinions (Murphy et al., 2017; Palomo et al., 2011a), generate trust, and increase social support for policy decisions (Bunse et al., 2015; Parks & Gowdy, 2013). | Rauschmayer 2006 |

Among the 1163 valuation studies that were reviewed in *Chapter 3*, nature-based methods were the least likely to involve stakeholders followed by behaviour-based and integrated methods (*Figure 3.18*). On the contrary, about one third of statement-based valuation involved stakeholders to some extent. Across all method families, the most common form of stakeholder participation was as active and conscious data providers who had given their consent. This form of stakeholder participation is considered low-level participation since stakeholders' agency to affect the valuation process and their contribution to it is limited (Fontaine et al., 2014). Integrated valuations were more likely to provide

agency to stakeholders by engaging them in all steps of the valuation process. Only 2% of studies consult stakeholders on findings and 1% involve them in every step of the valuation process. Across all methods families, a fair number of studies either failed to report on or were unclear about their stakeholder engagement strategies if any.

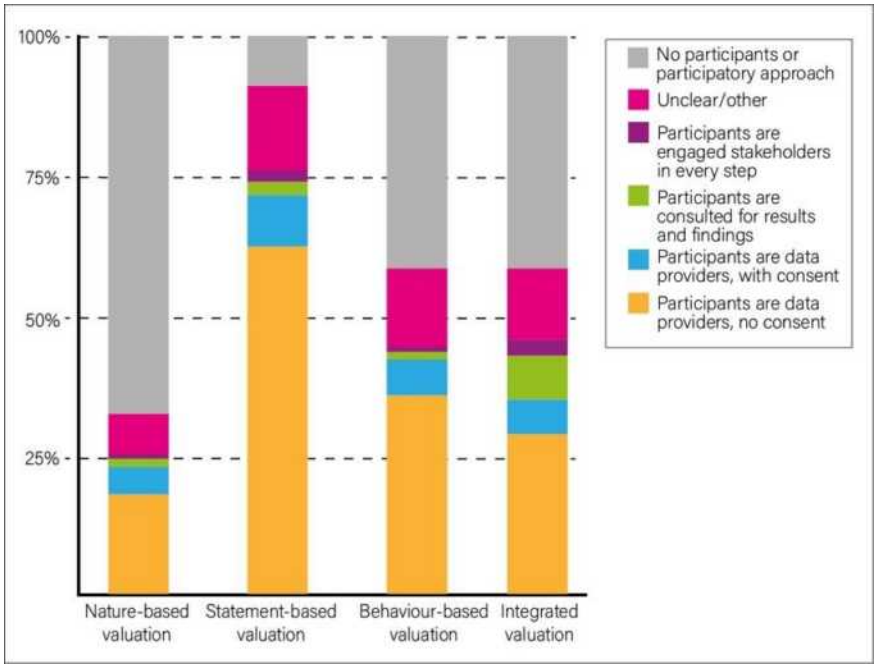


**Figure 3.18.** Levels and types of stakeholder engagement in valuation studies.

## 3.2.2. Assessment of valuation methods

Comprehensive reviews of valuation methods and approaches that are applicable to biodiversity and nature's contributions to people are scarce. Valuation method reviews focused on either one aspect of nature from multiple methodological perspectives or multiple aspects from one methodological perspective. To review the wide range of existing methods covering the scope of chapter, we organise the review and assessment of methods following the methods family typology (see *3.1.2.2*)[19].

### 3.2.2.1. Overview of nature-based valuation methods

Nature-based valuation methods are methods that gather or analyse observations of (changes in) biophysical properties of nature with the aim to inform decision-making on nature. These include observations on species, ecosystem structures and processes, but also landscape, topography, soil, water and air. Nature-based valuations play a central role in making socio-economic analysis more robust (Chan & Satterfield, 2020; Ferng, 2007; Wang et al., 2017).

Nature-based valuations- as that which is today practised in western science academies- have roots that go back to early records of the natural world[20]. Some of the early works can be traced to early philosophers and natural historians (40 AD to 1800s) who are recognized for having had a key role in the development of western scientific inquiry by asking questions about nature, natural phenomena, including technology and humanity. Ultimately, however, all cultures - large and small - have long

[19] Systematic review on method families (https://doi.org/10.5281/zenodo.4404436).
[20] Historical development of nature-based valuation methods (https://doi.org/10.5281/zenodo.4422075).

histories of studying nature and its components and philosophising about human-nature relations. We acknowledge the bias towards western science contributions to nature-based valuation presented in the next paragraphs and subsequent sections.

Natural history, as a field of study in Europe, inspired centuries of scholars to document the natural world by accumulating large collections of exotic specimens and developing systems to categorise them into taxonomic groups (Wulf, 2015). The observations, theories and writing of Alexander von Humboldt of his travels to South America in the early to mid-19th Century laid the foundation for subsequent explorations by renown European natural historians including English naturalists Henry Walter Bates, Charles Darwin, and Alfred Russel Wallace (Helferich, 2011; Morrison, 2016).

Their work gave birth to biology as a theory-informed science and provided the early foundations for western conservation science (Swart et al., 2001). The field introduced many of the concepts used in nature valuation today that make explicit the importance of nature in decision-making (Williams, 2014) such as the concept of "keystone species", defined as species with a pivotal role in structuring ecosystem processes (Paine, 1969); "biodiversity hotspots" as areas for priority conservation planning and "threatened species" as species deserving special conservation attention (Swart et al., 2001). The role and contribution of IPLC to these efforts is increasingly being acknowledged and critiqued, however, given that this extractive mode of working with local communities and knowledge holders persists in modern day valuations of nature (see *3.2.4*).

While nature-based valuation methods have been applied mostly to measure and assess values of nature, such as (fertile) soil, (productive) forest, (pure) water, (rare) minerals, as well as ecosystems, biomes, species, and ecosystem functions and processes, they have a long history in supporting decision-making on management of natural resources. More recently, their application on concepts such as nature's contribution to people and ecosystem services is helping to make the link between nature and people's quality of life more visible and easier to understand (Hammer et al., 2018). The importance of nature to deliver contributions to humans is well-recognized (IPBES, 2019a). Specifically, ecosystem service mapping is an assessment method that has received a lot of attention due to its clear links with spatial planning (Albert et al., 2016) (*Box 3.2*).

Due to the diversity of values of nature, a broad set of tools and methods have been developed to value biophysical phenomena (*Table 3.4*). Some of them can be used for several purposes and in different ways, which makes discrete categorization difficult. Indeed, many projects and experts present different categories of methods depending on the data needed, the process used or even the types of results or final use. *Table 3.4* presents the main characteristics of the major nature-based methods groups identified from the literature review[21]. As mentioned above, the boundaries among these groups are not rigid and many overlaps occur. Among the decision-making processes these methods inform are e.g., conservation prioritisation, planning & management, resource extraction planning (e.g., through stock assessments), agricultural development (genetic material, pollination services, soil fertility), conservation programme development, legal and voluntary compliance (e.g., through water and air quality monitoring), climate change mitigation & adaptation, infrastructure development (e.g., impact assessments).

[21] Systematic review on method families (https://doi.org/10.5281/zenodo.4404436). See nature-based valuation.

**Box 3.2. Ecosystem services valuation**

Ecosystem service valuation, in the sense of this valuation chapter, covers aspects of the different valuation method families discussed in this chapter, and thus represents an essential cross-cutting theme.

Valuation of ecosystem services aims to better understand the importance of ecosystems to human wellbeing. The ecosystem service concept dates from the late fifties and was re-introduced in the 1977 paper of Walter Westman titled "How Much Are Nature's Services Worth" (Baveye et al., 2013). During the 1980's, the field of 'ecological economics' emerged (e.g., Ehrlich & Ehrlich, 1981) and argued for valuation of ecosystems based on biophysical properties, inspired by classical economics theory of value based on costs of production. In the nineties, the concept gained further traction and diverse methodologies to assess ecosystem services were developed, either based on biophysical properties of ecosystems or on people's preferences, perceptions and behaviours (e.g., Costanza et al., 1997; Daily, 1997; Hanley et al., 1998).

The main critiques revolve around the adopted valuation methods and the theoretical inconsistencies with economic value concepts (see e.g., Pearce, 1998). In short, economic valuations are based on changes in economic welfare resulting from marginal changes to ecosystems. Such values are context-dependent and will vary with any (non-marginal) change in the state of the ecosystem or socio-economic system (Turner et al., 2003). Therefore, estimating "total" economic value of the Earth's ecosystems was argued to be unsuitable for public policy advice about relatively modest changes to economic and ecological systems (Bockstael et al., 2000). The calculations did however succeed in raising awareness of the economic significance of ecosystems and stimulated further research in environmental valuation.

In terms of scientific publications, since the millennium ecosystem assessment (2005) and the economics of ecosystem and biodiversity study (2010) the field has grown exponentially in the United States, the United Kingdom and China, while papers from the global south remain virtually absent (McDonough et al., 2017). While environmental sciences and agricultural and biological sciences are the ones that account for the largest number of publications (McDonough et al., 2017), an increasingly large and diverse set of ecosystem service-valuation methodologies emerged from multiple scientific fields (including geography, environmental psychology, economics, human geography, sociology, political science, etc.). At the same time, the policy-oriented vision has stimulated collaboration and integration of different approaches on concrete real-life valuations (Jacobs et al., 2016), which has led to the increasing application of socio-cultural valuation approaches as well as to the higher frequency of mixed-method approaches that integrate biophysical, economic and socio-cultural approaches (Martín-López et al., 2019) and an increasing attention for approaches to value nature used by indigenous peoples and local communities (IPLC).

These advances are reflected in the conceptual framework of IPBES, which rebranded the concept to 'Nature´s Contribution´s to People' (Díaz et al., 2018; Pascual et al., 2017), to better emphasise diverse worldviews, relational values and fluid reporting categories (Kadykalo et al., 2019). Different frameworks are needed for the global policy audience, to enable a stimulating and constructive dialogue among diverse disciplines, from ecology to social sciences, on how nature underpins human quality of life and how this can be valued in decisions (Díaz et al., 2020).

However, several challenges for ecosystem services valuation prevail. One challenge is the prevalence of valuations without appropriate biophysical grounding (Chan & Satterfield, 2020). Also, while integration of ecosystem service data within economic valuation and accounting systems represents clear opportunities (de Groot et al., 2022), the connection of ecosystem services valuation with policy questions and decision-making institutions needs improving (Bouma & van Beukering, 2015; Schaefer et al., 2015; Schröter et al., 2014). Additional challenges are to move beyond national assessments towards the impacts of international flows (Pascual et al., 2017; Schroeter et al., 2018), as well as inclusion of diverse worldviews (Hobern et al., 2019; McElwee et al., 2020).

Nevertheless, the field of "valuation of ecosystem services" is regarded as one of the major advances within sustainability science in the last three decades (Chan & Satterfield, 2020), with a pedagogical aim to demonstrate human´s dependence on ecosystems, and to identify solutions to the current environmental

crisis (Clark & Harley, 2020) for example by regarding future decisions of land use change, to provide better outcomes for humans and nature (Bai et al., 2018; Bateman et al., 2013; Goldstein et al., 2012) and support the systemic change that is needed (Dasgupta, 2021).

**Table 3.4** Examples of tools and methods in nature-based valuation. (See more complete list in *Annex 3.4*).

| Approach | How data are collected or generated | Examples of methods |
|---|---|---|
| **Direct measurements** | • Field observations and measurements (in situ/ex situ)<br>• Inventory /statistics | • Species' lists & inventory<br>• Vegetation surveys<br>• Biophysical data collection<br>• Biodiversity monitoring |
| **Stakeholder consultations** | • Data is collected from resource users or those are knowledgeable about the nature phenomenon | • Resource use surveys<br>• Interviews<br>• Delphi Methods<br>• Expert consultation |
| **Spatial Analysis and Mapping** | • Direct ground-based mapping<br>• From satellites, aircraft, ships, drones, and other remote-sensing and on-site measurements.<br>• Normalized difference vegetation index (NDVI)<br>• Enhanced vegetation index (EVI)<br>• Information provided by consultations with resource users, local stakeholders and experts | • Species distribution & biodiversity hotspot mapping<br>• Gap analysis<br>• Participatory mapping of different attributes of nature and ecosystems<br>• Habitat suitability analysis<br>• Ecological importance<br>• Forest cover estimation and forest structure analysis<br>• Vulnerability, resilience and adaptation assessment<br>• Least cost corridor analysis<br>• Unmanned aerial vehicles for monitoring of biota |
| **Modelling** | • Primary or secondary sources of data<br>• Often uses combinations of data sources collected using the methodologies mentioned above | • State and transition models<br>• Phylogenetic analysis<br>• Modelling and simulation of agricultural systems or productivity<br>• Hydrological/climate modelling |

### Challenges and potentials in nature-based valuation

The choice of what to measure biophysically is informed by cultural principles, contexts and worldviews (see *Chapter 2*). It is simultaneously a proxy of ecological importance that can be further assessed for its socio-cultural or economic importance or directly inform decisions. For instance, the decision to measure the abundance of a red listed species in a certain area can lead to legal protection of the area. Therefore, the choice of what is (not) measured or valued has "normative, value-laden dimensions", even when the valuation itself is an objective measurement (Bresnihan, 2017) (*see Chapter 2*). A review by Crossman et al. (2013) on ecosystem services showed that, out of 113 mapping studies, 32% mapped only one ecosystem service, even though other services existed. Emphasising one aspect without considering the whole system can have, and has had, damaging consequences (Bresnihan, 2017; Everard & McInnes, 2013; MEA, 2005). A growing number of studies explicitly consider multiple aspects of nature, ecosystem services belonging to different categories, bundles of ecosystem services or synergies and trade-offs, which is essential to guide decision-making to avoid biases towards specific ecosystem services, and to include potential linkages and feedbacks between them (Crouzat et al., 2016; Spake et al., 2017). Despite the growing body of literature, synergies and trade-offs remain poorly understood, however (Filyushkina et al., 2016; Haase et al., 2014; Seifert-Dähnn et al., 2015).

Different methods used to measure an aspect of nature often yield different results and have different implications for policy. There is a debate as to whether a diversity of approaches will support advancement (Seppelt et al., 2012), and meet the diverse demands reflected by the heterogeneity of socio-ecological systems and contexts, or whether the discrepancies in the spatial patterns of mapped and modelled ecosystem services yielded by the various methods will create confusion over which method is the most accurate (Andrew et al., 2015), hinder comparability (Bagstad et al., 2013), and hamper evidence-based decision-making. Palomo et al. (2018) confirm that one of the main bottlenecks related to the mapping of ecosystem services is the selection of methods. Tiered mapping approaches, decision trees (e.g., ValuES), and guidelines for standardised mapping and measurements of ecosystem services are potential solutions for map-makers, while platforms for methods documentation and comparison could be developed to help end-users (Palomo et al., 2018).

*Scaling issues* - Scale is defined as the physical dimensions, in either space or time, to which any nature-based valuation or assessment of the biophysical world applies. Scale is often loosely defined to include issues of extent, duration, resolution, grain and hierarchical level. Scale is a key issue in any nature-based valuation, assessment or measurement of nature, nature's contributions to people or ecosystem services. Issues of scale are associated with the fact that nature's contributions to people or ecosystem services are supplied, used, valued and managed at different spatial and temporal scales. For example, the spatial or temporal scale at which the processes of nature operate or function (to produce nature's contributions to people or ecosystem services) generally do not overlap with the scale at which those processes are managed or valued by humans (Willemen, 2020). Such an example of spatio-temporal mismatch has been illustrated in relation to the supply of fresh grass for essential oil production in South-Africa which varies in space and time, while its management occurs uniformly throughout the studied area (del Río-Mena et al., 2020). In general, scale effects are still poorly considered (Lavorel et al., 2017). The scale of any study should be determined by the end user and correspond to the scale of the decision to be made (Lavorel et al., 2017).

Some models and tools are particularly well-suited to specific local contexts and results of their applications in different contexts are not made to be compared. The disadvantage is that they might not fit within common decision frameworks (Bagstad et al., 2013). As Bagstad et al., (2011) mention, this trade-off is partly related to scale: some generalised models may be highly effective at a national level but ineffective at the local level. Malinga et al., (2015) found that a majority of studies are performed at the municipal and provincial levels (i.e., intermediary scale), and two-third of studies used a fine spatial resolution of one hectare or less. An alternative strategy might be to cross-compare policy findings of place-based studies rather than applying fully harmonised generalised concepts and methods and foregoing the local context-specific relevant features (Balvanera et al., 2020).

However, scaling will remain a partly unresolvable challenge. Often, a combination of spatial data available at different spatial resolutions (e.g., from different satellite sensors), in different geographic information systems formats (e.g., raster vs vector), or covering different spatial extents are used for nature-based valuation (e.g., land use data, habitat suitability maps, or species observation data). Depending on the spatial resolution, data from different sensors for example will likely give different ecosystem services or nature's contributions to people estimates for a given area (de Araujo Barbosa et al., 2015).

*Data quality* - Biophysical assessments used in valuation, especially ecosystem service-mapping studies, often derive their results from unvalidated secondary data of variable quality, e.g., land cover used as proxy instead of biophysical observations or measurements (Martínez-Harms & Balvanera, 2012; Seppelt et al., 2011). The values (or indicators) developed in such studies are largely hypotheses of relationships between the biophysical data at hand and the ecosystem services of interest (Andrew et al., 2015) which have rarely been tested (Martínez-Harms & Balvanera, 2012).

There is a clear need for more validated maps and models (Schägner et al., 2013). In addition, few studies explicitly address and communicate uncertainty (Hamel & Bryant, 2017; Lavorel et al., 2017), as well as detailed information on specific methods used to assess ecosystem services (Bagstad, et al., 2013b; Seppelt et al., 2011).

Land cover data is the most common input for ecosystem service mapping and modelling (Andrew et al., 2015). A given indicator is often attributed to each land cover / ecosystem service combination, irrespective of specific location characteristics, using, e.g., expert knowledge. While this has the advantage of being a relatively fast assessment, it may result in a poor fit of ecosystem service estimates (Burkhard & Maes, 2017; Martínez-Harms & Balvanera, 2012). The relationship between land cover and ecosystem service supply still has to be tested in most regions of the world (Martínez-Harms & Balvanera, 2012).

Ecological production functions, on the other hand, are quantitative models of ecosystem services that use measured ecosystem properties. These models make greater attempts to mechanistically estimate the supply and flows of ecosystem services (Andrew et al., 2015) but demand more resources. Also, despite their prominence in ecological studies of ecosystem services, providers of ecosystem services (Kremen, 2005) are rarely used for the mapping of ecosystem services, although they could be useful indicators of ecosystem services supply (Andrew et al., 2015). Statistical models based on field data should also be used more frequently (Martínez-Harms & Balvanera, 2012). In general, how specific indicators are linked to ecosystem services and nature's contributions to people remains an important issue, and an indicator's capacity to describe a specific aspect of ecosystem services and nature's contributions to people varies across space and time (Haase et al., 2012). Statistical models based on field data should also be used more frequently (Martínez-Harms & Balvanera, 2012).

**Costs of conducting nature-based valuation**

Academic literature rarely provides information about the cost of methods either in terms of finance, time or human resources and the implications of different approaches (e.g., participatory vs non-participatory monitoring) on costs of undertaking a study. For some methods (e.g., biodiversity monitoring) costs can be inferred from the type of expertise needed (e.g., low or high technical skills), the costs of the tools used and the time required to undertake the study. However, given that tools are rarely used exclusively for one study and that human resources can be spread across multiple tasks that are not reported in studies, cost estimates based on valuation reports can easily be over or under-estimated.

Additional factors that can affect the costs of undertaking nature valuation: i) difficulty in establishing methodological comparisons because methods are often developed to address specific problems/issues (Hernández-Morcillo et al., 2013; Winthrop, 2014); ii) costs derived from quality control and repeatability of methods (Winthrop, 2014); iii) costs associated to time and financial needs in data collection at the spatial and temporal scale required (Ambrose-Oji & Pagella, 2012; Kumar et al., 2021), and iv) costs and resources needed to develop and maintain the nature valuation tools and training staff (Bagstad et al., 2013).

## 3.2.2.2. Overview of statement-based valuation methods

Statement-based valuation methods directly ask people to express their values either verbally, in writing or through other actions solicited by the valuation process e.g., ranking components of nature or indicating preferences (Carson, 2018; Tinch et al., 2019). As such, the methods in this family generate information *directly from participants* of the diverse ways in which they perceive and value nature. The responses obtained can be used to describe values held and to quantify and qualify

people's interactions with nature, nature's contributions to people and nature-derived wellbeing (Cheng et al., 2019; Díaz et al., 2015; Johnston et al., 2017). Valuation participants can state their values as economic or social-political agents or both (Blamey et al., 1995; Nyborg, 2000).

The earliest form of statement-based valuation was contingent valuation (Davis, 1963), although the use of values elicited from statements in public policy debates remained scant for decades (Kling et al., 2012). After the Exxon Valdez incident in 1989, however, where court cases determined the compensation for oil spill damages of remote wilderness areas in Alaska (for details see Exxon Valdez Oil Spill Trustee Council, 2008) interest in estimating the value of public goods for similar decision-making purposes was spurred. For example, a panel of experts was brought together to assess if results from a contingent valuation could be used as evidence to determine damages to nature (see National Oceanic and Atmospheric Administration (NOAA) documentation (e.g., Arrow et al., 1993)). Over the following decades the methods have been refined and now also include methods using other value indicators (e.g., Hegetschweiler et al., 2017; Nesbitt et al., 2017) and also methods based on group elicitation. This family of methods includes the so-called stated preference methods developed in economics (I. Bateman et al., 2002), some preference-based methods and many "socio-cultural" valuation techniques that are often used to evaluate non-material nature's contributions to people (Hernández-Morcillo et al., 2013; Scholte et al., 2015).

Statement-based valuation can range from highly structured to unstructured approaches. Structured methods collect a fixed set of value information descriptors (e.g., by using structured questionnaires). In unstructured and/or exploratory methods value indicators of interest are not a priori defined (e.g., ethnographic and narrative interviews). These methods generate quantitative and qualitative data, allowing for the application of analytical as well as interpretative methods (Hernández-Morcillo et al., 2013). Moreover, the valuation process can be designed primarily by those whose values are assessed, be co-created, or fully controlled by the valuator.

For the purpose of this overview, the methods and approaches in this group are subdivided into two types: methods that elicit values from individuals and those that elicit values from groups of people (Wolff et al., 2015). This grouping focuses on the elicitation process (i.e., how information is generated) which is also the basis for identifying the limitations of statement-based methods (see *3.3.2.2*)[22].

**Individual-based approaches**

In individual-based methods, a researcher, possibly in collaboration with the *respondent*, collects statements on values, and in qualitative or quantitative format, from individuals, through questionnaires, interviews or other data collection methods and instruments. Individual-based methods can be useful for multiple purposes, for example: when individual rather than group-formed values are of interest, when group-sessions would restrict individuals (for reasons of privacy, sensitivity or otherwise) from expressing their views, where policies are evaluated based on outcomes at individual or household level, or where individuals hold specific knowledge, views or positions requiring in-depth individual engagement. Interviews and questionnaires are the most widely used approach for generating information about values of people for nature's contributions to people/ecosystem services (*see 3.3.3*). Brook & McLachlan (2008) also find that more than 60% of ecological and conservation research and monitoring studies conducted in IPLC contexts, used interviews to document ILK (Brook & McLachlan, 2008).

[22] Systematic review on method families (https://doi.org/10.5281/zenodo.4404436). See statement-based valuation.

Methods using surveys include a range of specific valuation procedures such as contingent valuation (De Boer & Baquete, 1998), (discrete) choice experiments, and contingent behaviour (Christie, 2007). In the context of monetary valuation, these specific methods are known as "stated preferences" methods (Bateman et al., 2002; Johnston et al., 2017). These methods circumvent the absence of markets for certain environmental goods and services. They present respondents with hypothetical markets or hypothetical policy options where they have the opportunity to choose or to *buy* the goods in question and state their preferences (Bateman et al., 2002). Within monetary valuation, stated preference methods have been applied regularly and to many different habitats to value a diverse set of ecosystem services/nature's contributions to people (Hanley & Czajkowski, 2019; Schmidt et al., 2016). Especially in contexts where (cash) income is limited, but time potentially less so, studies have used time - rather than money - as a numeraire, asking people for their willingness to spend time to contribute to environmental improvements or protection (O'Garra, 2009).

While monetary valuation methods assess preferences and assume these relate to utility, other methods use different well-being indicators. A strand of literature has used questionnaires to assess to what extent differences in indicators such as life satisfaction and happiness can be explained by variation in natural landscapes, features or phenomena (Kweon et al., 2010; Olsen et al., 2019). These include both the positive effects attributed, e.g., to green space (Kweon et al., 2010), as well as the negative impacts of disasters such as floods and storms (von Möllendorff & Hirschfeld, 2016).

Non-economic, quantitative preference assessments (not directly linked to well-being indicators) such as ratings and rankings based on visual representation of nature, ask participants to indicate preferences from a series of photographs manipulated to contain marginal changes in (usually) landscape attributes. Such assessments have been used at least since the 1960s (e.g., Shafer, 1969; Shafer & Brush, 1977) and continue to be an effective statement-based method for conducting valuation (e.g., Häfner et al., 2018).

The Q-method (Q-sorting) (Newman & Ramlo, 2010) is another methodology that has been used to investigate individuals' perspectives on human-nature relationships. Rather than being randomly sampled from a target population, in Q-method respondents are selected to represent different perspectives, and their ranking of a series of statements is used to determine how different stakeholder groups assess importance (e.g., Zabala et al., 2018). Q-methodology has been used to assess recreational, spiritual and aesthetic values, and sense of place, with very few examples of its use in assessing educational values, knowledge systems, social relations or inspiration with this methodology exist (Cheng et al., 2019).

Interviews can range from highly structured formal discussions to unstructured interactions akin to informal conversations. The most common setting consists of a one-to-one discussion between researchers and respondents. This is considered suitable for collecting qualitative data through open-ended questions, exploring the respondent's life views and their ways of constructing their lives and social worlds, in the present, past and future (Warren, 2004). For example, structured interviews have been used to assess preferences of ecosystem services in agricultural landscapes (Smith & Sullivan, 2014) and mountainous regions (Schmidt et al., 2016). Expert interviews and other expert-based approaches (e.g., using Delphi techniques) also generate information on values obtained through statements and are apt for data-poor environments (Scholte et al., 2015). They can capture all specific value types (i.e., instrumental, relational, intrinsic), and can be used to assess biophysical values (Edwards et al., 2012; Nahuelhual et al., 2014).

Narrative research uses stories to determine narrators' values, such as their sense of place (Cheng et al., 2019). These narratives can be based on multiple data collection methods including interviews (Klain et al., 2014) and short stories (Bieling, 2014). Interviews involve a conversation between participants/narrators and listeners/researchers who - through this conversation - generate meaning

of the events or experiences of the narrator (Mishler, 1986). Proponents of narrative approaches argue that they allow for linking across multiple disciplines can provide creative solutions to persistent problems (Squire et al., 2014) and can contribute to shifting environmental attitudes (Knackmuhs et al., 2019).

**Group-based approaches**

Group-based approaches elicit values through a process that requires the presence of two or more participants with a facilitator. The main feature of group-based methods is that the responses, which could be individual statements or group statements or a mix of those, are all provided through a process where interaction between the participants is an important part of the process. The group interaction can have many benefits, particularly in situations where participants are asked to provide value judgements on issues that are unfamiliar or when the level of complexity of the decision problem is high (further elaborated below). A group-based interaction can sometimes be classified as a deliberative process (Habermas, 1999; Howarth & Wilson, 2006a). However, a deliberative process will require more time and often repeated interaction, and sets stricter conditions on the quality of communication, than other methods using group discussion/elicitation (Schaafsma et al., 2018) (*see 3.2.2.4*).

Group dynamics can be designed to have minimum interaction and/or deliberation between participants which range from strongly moderated discussions to free-flowing conversations whereby topics are determined by the participants. Group discussions are usually organised around one or more group activities. Focus group discussions is a widely used technique which sociologists and psychologists have applied since the 1940s (e.g., Merton et al., 1956; Merton & Kendall, 1946). Nominal group technique is a structured method for group brainstorming that encourages contributions from all participants and facilitates quick agreement on the relative importance of issues, problems, or solutions. Methods using discussion-based approaches may rely on one or more facilitators who not only moderate the discussion, but whose role is to stimulate interaction and exchange between participants (Epstein & Leshed, 2016). The methods can elicit individual and/or group-level perceptions and values.

Group-based approaches can address some of the shortcomings of individual-based methods. Due to the emphasis on participants' worldviews, narratives, discourses, expressed values and perceptions, it is often claimed that discussion-based approaches allow for broader legitimacy than non-participatory methods that do not engage with stakeholders (Kenter et al., 2016b). In this vein, it is argued that concepts of justice and equity (distributional, procedural and recognitional) are particularly well adapted to this approach (Beauvais & Baechtiger, 2016; Zafra-Calvo et al., 2017). However, inclusion of stakeholders and the representation of different groups (e.g., IPLC) can be a challenge in terms of time and resources needed (Flynn et al., 2018). Trade-offs must usually be accommodated, and new risks can be introduced when amplifying inclusivity, e.g., concerns regarding the actual representativeness of participants (Boeraeve et al., 2018) or power dynamics between participants (Berbés-Blázquez, 2012) (*Table 3.5*).

**Types of values elicited by statement-based methods**

Methods in this family can capture a wide range of specific values and are particularly useful for eliciting values related to non-market benefits and non-use aspects of nature. In value-stating methods, actual behaviour or presence is not necessary: people are (assumed to be) able to state their values for hypothetical/future/past situations (Cheng et al., 2019; Hanley et al., 1998). Techniques in this family are particularly well-suited for assessing the values of current and potential use and demand of nature's contributions to people and nature's contributions to good quality of life (Christie et al., 2012), and broad as well as specific values. These aspects provide a reason for the diverse use

of this family of methods. Many monetary valuation methods collect individual utility-based values (such as choice experiments), based on neoclassical utility maximisation assumptions (Tinch et al., 2019). Other valuation methods, both economic and non-economic, have less or no rigid assumptions regarding preferences and use different ethical (non-utilitarian) stances (Hirons et al., 2016).

Although statement-based methods have mostly focused on eliciting instrumental values (Schmidt et al., 2016), several of the methods included (such as contingent valuation and choice experiments) have been used to assess the intrinsic or existence value of nature (Christie et al., 2012). This group of methods can also capture direct use values, option values, bequest values and existence (non-use) values (Turner et al., 2003). It can provide useful information about the economic significance of the lost passive-use values individuals may suffer from anthropogenic activities damaging natural resources and related biodiversity (see *3.3.2.2*). This method family has been proposed for assessing social, cultural, and other-regarding (altruistic) values (Cooper & Kagel, 2016), values expressed within instrumental and relational, and sometimes intrinsic justifications (see *3.3.2.2*) (see *Box 3.3*).

**Box 3.3. Methods for eliciting and articulating broad values and worldviews**

Broad values and worldviews form key aspects of personality (Nilsson, 2014), social attitudes (van Hiel et al., 2007), and group identity (Irzik & Nola, 2009; Mendoza-Denton & Hansen, 2007) (also see *Chapter 2*) and can therefore be included in the assessment of specific values both using individual based and group-based methods. (e.g., Boyce et al., 2021).

Consensus Analysis consists of analytical techniques and models *"that can be used to estimate cultural beliefs and the degree to which individuals know or report those beliefs*' (Weller, 2007, p. 339). These methods assume '*culture can be defined at least in part as a shared pool of knowledge that is socially distributed according to societal divisions such as class, gender, and the division of labour*' (Swora, 2003, p. 341). The analysis consists of establishing the degree of consensus or dissent among groups that share cultural knowledge around a specific issue, using statistical analysis and qualitative information (Horowitz, 2009; Miller et al., 2004). These methods are used in studies about intra-cultural variation; shared knowledge in traditional societies; fisheries; water and environmental management; climate change perception; local hunting conditions and folk medicine (Carothers et al., 2014; Horowitz, 2009; Hung et al., 2006; Miller et al., 2004; Stone-Jovicich et al., 2011; Swora, 2003; van Holt et al., 2010). See *Chapter 2* for discussion of shared values (see *2.4; Box 2.9*).

Ethical analysis supports systematic reflection upon ethical aspects of a critical public decision. The purpose is to help people understand not only each other's premises but also their own ethical standpoint in a policy setting. According to Feldman (1987), the main contribution of this approach is to devote explicit attention to ethical issues, which are usually neglected in public decision-making whereas they are often implicit to it. In understanding the different stances that stakeholders take and mapping of ethical issues, different tools are used, such as principle based ethics, the ethical matrix, the ethical grid and the ethical participatory assessment (Dubois & Fraser, 2013; Forsberg et al., 2017); which mainly differ in terms of their format, type or extent of deliberation. Principle based ethics looks at the general norms. The ethical matrix examines general principles such as well-being or fairness.

Framing analysis consists of assessing the ways people define what is central, peripheral, meaningful and less meaningful (Davis & Lewicki, 2003). Framing is the process of creating frames and reframing is the change in frames, which might happen as a result of deliberate interventions in conflict mediation (Gray, 2003) or without interventions (Dewulf et al., 2004; Emery et al., 2013). Diverse typologies are used to classify frames (Dewulf et al., 2010; Kaufman et al., 2003; Shmueli et al., 2006; Shmueli, 2008). Generally, methods combine qualitative primary information and qualitative and quantitative analyses of it (Brummans et al., 2008; Dewulf et al., 2004; Lewicki et al., 2003).

**Strengths and potentials of statement-based valuation**

The methods have potential to inform policies in a range of ways; development of policy instruments for conservation, such as the design of payments for ecosystem services schemes (Chan et al., 2017; Engel et al., 2008; Wunder, 2005) including compensation levels to ensure sufficient participation (e.g., Zandersen et al., 2016). A common decision-making context for which the valuation results are used are project appraisals through cost benefit analysis (Atkinson et al., 2018).

Choice experiments or contingent valuation may be suitable when monetary estimates based on representative samples are required in order to design policy instruments for protected areas (e.g., Uyarra et al., 2010), or to gain understanding of the general public's support for or opposition to potential policy programmes (Rolfe & Windle, 2013), to evaluate different preferences among stakeholder groups (Monzón-Acuña, 2004), and whether improvements might be financed (Martin-Ortega, 2012; Meginnis et al., 2020). Due to their ability to capture non-use values, these approaches can be used to identify the premium that the public is willing to pay to avoid biodiversity losses (Nobel et al., 2020).

It is claimed that statement-based valuation has advantages over other families in terms of providing procedural and recognition justice of valuations. For example, both individual and group-based methods can be design to have [statistically or politically] representative samples or target specific groups (e.g., marginalised voices) (Aldred et al., 2017). By including the values of diverse stakeholders in the valuation process these methods can increase the legitimacy of the policy decisions taken based on those values (Kenter et al., 2016a; Pieraccini, 2015).

Statement-based valuation methods can also be used to understand values of less familiar habitats (such as deep oceans), where observation of direct use or societal engagement with the habitat is challenging or does not occur (see *3.3.2.2*). Group-based methods (i.e., stakeholder workshops, focus groups, and others) allow for deliberation and social learning processes before values are stated, so that participants can familiarise themselves with different perspectives as well as the targeted nature's contributions to people for valuation.

Statement-based valuation methods provide an opportunity to address, discuss and evaluate the risks and uncertainty of environmental change and associated values. Risk and uncertainty can stem from gaps in knowledge about ecosystem dynamics (including regime shifts and tipping points/thresholds; Lenton et al., 2019), social dynamics and human preferences (Godfray et al., 2018) and technical issues (Morton, 2015) in the valuation process. Methods have very different approaches to assessing how these risks and uncertainty affect value generating and stating processes, making the selection of the method a key consideration (Botelho et al., 2017). In general, research has found that higher outcome uncertainty reduces utility (Lundhede et al., 2015).

Research has also shown that statement-based valuation methods can elicit values related to quality of life, cultural identity, sense of place or social relations in nature and non-use values (Benjamin et al., 2014; Hausmann et al., 2016; Houkamau & Sibley, 2019; Poe et al., 2016; Tinch et al., 2019). Also, the measurement of good quality of life often requires value stating methods (Benjamin et al., 2014). Other advantages of value stating methods include that they can be applied where there is limited or no existing data, and some of these methods are low in costs (e.g., sample sizes are small and low-cost technologies can be used (Scholte et al., 2015)). However, the required skills and budgets differ considerably across methods.

**Limitations and disadvantages of statement-based valuation**

Most of the statement-based valuation methods are used for ex-ante policy appraisal. Therefore, it is assumed that the stated values of respondent/participant within the setting of the method are transferable to future *real-life* settings. This requires that the participants have a good understanding of the future setting and are willing to convey their real values. Moreover, if participants know or believe that their responses will have a material effect on policy design, and the survey is incentive compatible, then strategic bias (e.g., stating a high value for important issues if there is no actual payment expected) may be avoided. For ex-post evaluation, the value-stating methods assume that participants accurately recall and truthfully report on the values that informed their decisions or behaviour at the time of the environmental (management) change for which values are elicited. Despite the increase in use in academia of valuation based on people's statements, the suitability of the methods for public policy remains disputed (e.g., Carson, 2012; Hausman, 2012; Kling et al., 2012) (see *3.3.2.2*).

Social and cultural contexts play a fundamental role in determining what is valued, how it is valued and why (Arnberger & Eder, 2011a, 2011b; Kaplan & Kaplan, 1989; Ode et al., 2009; Swanwick, 2009). Therefore, the outcomes of valuations conducted with statement-based methods are highly dependent on who is included in the valuation exercise and whether the method matches the context to which it is applied (Berkes, 2004; Kelemen & Gómez-Baggethun, 2008).

Power issues that influence or determine which methods are used to elicit and express values and how the valuation process is designed are highly relevant to this method family. Some of the methods are often fully designed and executed by the researcher and lack participation in all valuation steps, whereas others can be more easily co-designed and led by participants. A key characteristic of this method family is that those conducting the valuation collect this value information using purposefully designed data collection methods. In this sense, the role of the researcher (and moderator) requires reflexivity and positionality, where the research reflects on their role in the valuation process and their influence on the outcomes (Soedirgo & Glas, 2020).

With group-based methods, power-relation effects within the group and other dynamics might affect the assessment outcomes (Schaafsma et al., 2018). For example, in deliberative methods, dominance of individual participants can lead to exclusion of other participants and domination of one perspective in the results (Dietz et al., 2009). Carefully designed processes are therefore essential to reduce the risk of not representing less vocal participants (Barnaud & Van Paassen, 2013; Felt et al., 2016; Turnhout et al., 2020).

Evidence from reviews about the reliability and validity of these methods is more abundant for some methods than for others. For example, regarding reliability and validity multiple reviews are available of monetary stated preference methods (with mixed results; Haab et al., 2013; Hausman, 2012), willingness to pay (Oerlemans et al., 2016), willingness to accept (Whittington et al., 2017), choice experiments (Rakotonarivo et al., 2016), contingent valuation (Venkatachalam, 2004), and studies regarding the reliability in risk assessment (Hertwig et al., 2019; Pasman & Rogers, 2018, 2020; Rogers et al., 2019). However, the literature search provided limited evidence for other methods, especially those whose application in the context of valuation of biodiversity and nature's contributions to people is more recent. For example, one problem with ranking according to the importance of nature's contributions to people (or ecosystem services) is that participants may rate all types as very important. Such rankings do not help to inform trade-off decisions where not all nature's contributions to people can be provided at the same time and in all policy options (Horne et al., 2005).

The reliability and validity of more structured methods in this family rely heavily on well-created study designs, including the accuracy of the description of the environmental/biodiversity issue at stake. Errors in the description discovered after the fact can mostly not be changed. Furthermore, large-sample quantitative studies tend to elicit a small range of quantifiable responses. This may limit the adequate elicitation of different value types (e.g. related to spirituality or cultural heritage) and diverse values, especially those that are not (well) quantifiable (Scholte et al., 2015). Statement-based valuations sometimes assume that people have sufficient information about the ecosystem before stating their values; where this is not the case, some scholars argue that it is risky to base environmental management on such values (Ruiz-Frau et al., 2018).

**Table 3.5** Overview of value stating methods. See also a more elaborate version including potential strengths and limitations in *Annex 3.5.*

| General Approach (source of data) | How data are collected | Examples of methods |
|---|---|---|
| **Individual based Survey-based** | Questionnaires and interviews administered to individuals and/or groups directly (face-to-face), electronically, by mail or by phone | • Contingent valuation<br>• Choice experiments<br>• Ethnographic interviews/ methods<br>• Narrative research<br>• Happiness survey<br>• Life satisfaction approach<br>• Individual-based participatory assessment process<br>• Individual-based Q-methodology<br>• Expert elicitation<br>• Mental mapping |
| **Group-based Discussions-based** | Facilitator-moderated group interaction | • Public good games<br>• Deliberative valuation (including monetary)<br>• Nominal group technique (NGT);<br>• Focus groups<br>• Scenario assessments/ visioning exercises<br>• Photo-voice<br>• Delphi panels |

## 3.2.2.3. Overview of behaviour-based valuation methods

Behaviour-based valuation methods quantify or qualify the value of nature's contributions to people based on observations of people's behaviour using both economic and non-economic indicators. The origin of valuation of nature in economics rests on a behaviour-based methodology. The idea that it is possible to identify the worth of recreational benefits of national parks based on the cost incurred by visitors to travel to the places they visited (attributed to Hotelling (1947), see Pearce, 2002 for an overview of the early developments). Hotelling's suggestions outlined what is called today the travel cost method. At the time, no methods existed to include environmental benefits or costs in evaluations of public policies and the effects were usually ignored and described as intangibles (Pearce, 2002).

More than a decade passed before this insight was further explored in studies by Trice & Wood (1958) and Clawson (1959). Since then, the idea that the value of environmental benefits can be derived from observing how people purchase linked marketed goods and services is known and referred to as "revealed preference methods". The requirement for use of these methods is that the expenditure in the conventional market is a prerequisite for enjoying the environmental benefits or avoiding being exposed to environmental costs.

**Classifying behaviour-based valuation methods**

The economic behaviour-based methods are commonly classified into *direct* methods that estimate values based on the observed behaviour of consumers and producers in markets (market price method); and *indirect* methods that estimate values based on a relationship between nature and individuals' behaviour observed through transactions in a linked market or reflected in some measures of costs (Champ et al., 2003; Farber et al., 2006; Freeman III et al., 2014; Hanley & Barbier, 2009a; MEA, 2005; US EPA, 2009).

The main indirect methods include the travel cost method, which can both be based on observation of visits of a single natural site (e.g., national park, historical site) or observation of the choice between different sites (e.g., choosing one site among multiple competing sites of same nature-beaches, urban parks, recreational fishing areas). The hedonic price method is also an indirect valuation method where the housing market (usually, but not exclusively) is used to reveal the value that people place on natural amenities or absence of dis-amenities (Pandit et al., 2014; Taylor, 2008). The methodology can also be used to value the risk of natural disasters (e.g., Tanaka & Zabel, 2018).

Another indirect method relates human health and nature based on the relationship between health status or risk to human health or even mortality and nature. The approach can be used to assess negative values of nature such as health impacts from diseases transmitted through wild species. The negative values are usually monetised through lost earning and cost of treatments (Clabaugh & Ward, 2008; Ruijs et al., 2017). Knowledge of health impacts in the context of protected areas across the developing world is scarce as human health is rarely included in valuation studies (Naidoo et al., 2019). Health valuation has multiple complex interactions and is further elaborated in section *3.2.2.4.*

The *cost-based* methods that aims to capture the value of supplying nature's contributions to people include replacement cost, avoided damage cost, defensive expenditure and opportunity cost (Champ et al., 2003; Farber et al., 2006). Replacement cost refers to the cost of replacing nature's benefit or service (e.g., the value of cooling service provided by tree shades on homes by replacing the electricity cost of using air conditioner); avoided damage cost refers to the costs of preventing or avoiding damages in the absence of nature's benefit or service (e.g., sediment retention service of forested land as measured in terms of cost of building retaining walls to hold the sediments); defensive expenditure refers to the costs of taking actions to prevent adverse impacts from declining or deteriorating nature's contribution (e.g., economic benefits of biodiversity gains from management of invasive species); and opportunity cost is the cost of forgone alternative (e.g., deforesting land for building structures has the opportunity cost of forgoing nature's benefits or service from the forested land).

Cost-based methods (replacement cost, avoided damage cost and opportunity cost) have been commonly used to value regulating ecosystem services (Balasubramanian, 2019) and wetland values (Browne et al., 2018), and ecosystem service provided by aquaculture (Custódio et al., 2020) but minimally used to value forest ecosystem services (Acharya et al., 2019). Among the methods used to value wetlands, (Browne et al., 2018) found that out of 50 studies reviewed, replacement cost was used in nine studies, avoided damage in four studies, and avoided cost in two studies. Similarly, opportunity cost has been used most studies that value protected areas in German-speaking Europe (Mayer & Job, 2014), whereas replacement cost has been used in some cases to value ecosystem services provided by aquaculture (Custódio et al., 2020), valuing ecosystem services in the Alps (Grêt-Regamey et al., 2008) and dis-amenity value of incineration and landfilling (Eshet et al., 2005). Avoided damage cost has been used in fewer studies including the one that valued mangrove ecosystem service (Vo et al., 2012). Only one review study was found that considered the production function method to value the ecosystem services provided by aquaculture (Custódio et al., 2020).

Behaviour-based valuations that use non-monetary indicators are emerging, i.e., looking at human action and behaviour to identify the importance of human-nature relationships. Examples include fishing activities (Unnikrishnan & Nagendra, 2015), the examination of documents, i.e. looking at texts, images, or other forms of materials (Scholte et al., 2015), number of photos taken by the public in an advert to indicate aesthetic values (Everard et al., 2010); photo series analysis using social media (Czembrowski et al., 2016), and the number of wildlife pictures posted on a photo-sharing website as a proxy to obtain the recreation and ecotourism values (Willemen et al., 2015). Some of the advantages of these methods include on-the-ground observation (structured, unstructured, participant), consideration of the contexts and details of the valuation objects, and in some cases the free availability and easy accessibility of data (e.g., on social media; Willemen et al., 2015). Limitations include that interpretation and analysis of observations are difficult (Jerneck & Olsson, 2013), data availability is limited, and reliability and validity issues for documents exist (Ostwald et al., 2013; Piwowarczyk et al., 2013). These relatively new non-monetary valuation methods nonetheless have the potential to impact valuation practice in coming decades.

A brief description of the behaviour-based methods and their main features and limitations are summarised in *Table 3.6* (more details provided in *Annex 3.6).* Good practice guidelines are presented in *Annex 3.7.*

**Table 3.6** Summary of behaviour-based valuation methods[23]

| Category | Valuation method | Description/main features | Application - Key references |
|---|---|---|---|
| Direct observed behaviour method | **Market methods (Market price)** | The values of ecosystem services or nature's contributions to people directly obtained from what people have paid for the service or good (e.g., timber harvest). Only useful for traded goods and services. | Farber et al., 2006; Aulia et al., 2020 |
| | **Livelihood dependence** | The livelihood dependence on nature of people. Useful in the context where formal markets have limited roles and people rely on nature for subsistence. | Adams et al., 2020; Daw et al., 2011; Yang et al., 2013 |
| Indirect observed behaviour method | **Travel cost method** | Valuations of site-based amenities revealed by the costs people incur to enjoy them. Based on well-established theory. Commonly used to value ecotourism and recreation values. | Bockstael & McConnell, 2007; Champ et al., 2003; Freeman et al., 2014; Perez-Verdin et al., 2016 |
| | **Recreational choice method** | Valuation of access to nature areas and changes in the quality of the areas based on observation of the choice between different nature areas. Based on well-established theory. Assumes full information about alternatives. | Hunt, 2005; Lupi et al., 2020; Raguragavan et al., 2013 |
| | **Time spent analysis** | The value of nature, natural environment or biodiversity partly depends on how much time people spend observing or experiencing such services and how people perceive the value. | Capaldi et al., 2014; Stålhammar & Pedersen, 2017 |
| | **Hedonic pricing method – amenity value** | The value of a service is revealed from what people will be willing to pay for the service through purchases in related or linked markets, such as housing markets for open-space or other amenity and dis-amenity values. Assumes that people have full information about nature values associated with the purchase. | Bishop et al., 2020; Palmquist, 2008; Rosen, 1974; Taylor, 2008; Gibbons et al., 2014; von Graevenitz, 2018; Eshet et al., 2005 |
| | **Hedonic wage method – value of statistical life** | The method estimates the risk changes associated with life-threatening events by valuing individuals' willingness-to-pay to avoid risk or estimate the wage premium/compensating wage differentials required to accept riskier jobs. Assumes full information determines choices. | Evans & Taylor, 2020; Viscusi, 1993 |
| | **Cost of illness method** | The cost of illness links individuals' behaviour and health outcomes including their costs. Relies on dose-response relations. | Clabaugh & Ward, 2008 |
| Cost based methods | **Replacement cost method** | The loss of ecosystem services or nature's contributions to people is evaluated in terms of what would it cost to replace (e.g., tertiary treatment values of wetlands if the cost of replacement is less than the value society places on tertiary treatment). | Heal, 2005 |
| | **Avoided damage cost method** | The biodiversity and ecosystem services or nature's contributions to people is valued on the basis of costs avoided, or of the extent to which it allows the avoidance of costly averting behaviours, including mitigation (e.g., clean water reduces costly incidents of diarrhoea). | Barbier, 2007; Vo et al., 2012a |
| | **Defensive expenditure method** | The incurred expenditures on supply of environmental services are used to infer the implicit value of benefit from consumption of the services. | Freeman et al., 2014; Sinden et al., 2011 |
| | **Opportunity cost method** | Value of foregone benefits/the next best alternative use of resources (e.g., agricultural use of water and land). The method also calculates the cost of preserving biodiversity. | Batie & Mabbs-Zeno, 1985; Ruijs et al., 2017 |
| Other methods | **Participant observation** | This method directly observes human behaviour (participant observation) that reveals peoples' preferences. | Jerneck & Olsson, 2013 |
| | **Document analysis** | This method involves analysis of text documents (texts or images) including historical documents that indicates peoples' preferences or the important they give to nature. | Ostwald et al., 2013 |
| | **Photo series analysis method** | This method involves analysis of social media-based data (photos) to reveal peoples' preferences. Particularly relevant to cultural ecosystem services. | Keeler et al., 2015; Richards & Friess, 2015; Willemen et al., 2015 |
| | **Citizen science method/ Participatory action research** | A tool to understand citizen's understanding. Communities and individuals are involved in designing a research question and perform scientific experiments with minimum involvement of professional scientists. | Kaartinen et al., 2013; Schröter et al., 2017 |

[23] Systematic review on method families (https://doi.org/10.5281/zenodo.4404436). See behaviour-based valuation.

**Challenges and potentials of behaviour-based methods**

The main limitation of behaviour-based valuation is that the methods require explicit assumptions about the relationships between behaviour, characteristics of nature and its contribution to well-being. This needs a well-established conceptual and empirical understanding of the relationships which are often not available. It is often assumed that people act based on full information about nature. A global assessment of disease burden from environmental risks found that the cost-of-illness method to assess prevalence of disease is poorly used in practice (Prüss-Üstün et al., 2016).

The presumption of all cost-based methods that cost is a good measure of societal value is not accurate and adequate (Heal, 2005). For example, for replacement cost to be an adequate measure of economic value of the nature's contributions to people, the replaced object or system has to be a least-cost alternative and like-for-like in quality and quantity (equivalent) to the nature's contributions to people in question (Freeman III et al., 2014).

The main advantage of the behaviour-based valuation methods is that they avoid hypothetical bias (see statement-based methods, *section 3.2.2.2*). Combining statement-based and behaviour-based valuation has been an active area of research (Adamowicz et al., 1994; Cameron, 1992). For example, the travel cost method has been used in conjunction with discrete choice experiments (Czajkowski et al., 2019; Ferrini et al., 2008) and been expanded to understand temporal stability of recreational values (e.g., recreational value of Corong in Australia over a seven-year period (Rolfe & Dyack, 2019)). The potential to improve valuations by combining nature-based methods with behaviour-based methods appear to be a promising area of valuation research. Examples include better specification of hedonic models using spatial biophysical resource mapping, combining degree of naturalness of sites in travel cost methods. Behaviour-based valuation has the potential to contribute to natural capital accounting (*Box 3.7, section 3.3.4.1*) as it captures observed interactions between ecosystems and economic activities which are amenable to accounting principles. Developing standards to align outputs from behaviour-based valuation to accounting standards is also a potential of the methods to inform decision-making going forward (*Box 3.7*) (see *4.6.4.2*). Improved access to environmental, social and economic databases across global regions could reduce the barriers for the application of these valuation methods.

## 3.2.2.4. Overview of integrated valuation methods

Integration involves a process or framework that synthesises different types of information with the overall purpose to generate a more comprehensive understanding of values at stake in a given policy context. While nature-based, behaviour-based, and statement-based valuation can be integrative, some methods are specifically designed to integrate inputs from different methods, or different types of values, often elicited using principles from different method families. As inclusion of diverse forms of values and knowledge for decision-making is a key challenge in valuation, methods used to integrate values are reviewed in this section. Integration can refer to following: diverse and sometimes incommensurable value dimensions (i.e., value pluralism, types of values; Dendoncker et al., 2018), different worldviews (i.e., knowledge systems; Jacobs et al., 2016), the inclusion of the interest of different stakeholders groups, the application and integration of multiple valuation methods and tools, over aspects of the nature-human system (biophysical - economic - well-being) and aggregations of results over spatial and temporal scales (Jacobs et al., 2016). Integration often takes place implicitly (in a decision informed by various types of information) or through a designed process, which might not be fully explained or described. However, some integrative methods used to bring together different types of information and values to support decision-making are well-known and the procedures described and formalised (Jacobs et al., 2018; Pascual et al., 2017a).

Some valuation methods are inherently integrative and therefore do not fit well within the nature-based, behaviour-based, and statement-based methods. These provide formalised ways of bringing together different forms of value and are therefore potentially useful methods for accounting for diverse values of nature.

Integrated valuation methods therefore sit on the edge of "valuation methods" and "decision-making tools", but still have inherent valuation features which determine which and how values are transferred to decisions (Gómez-Baggethun et al., 2014; Jacobs et al., 2016; Pascual et al., 2017). A specific purpose of integration is to support decision-making processes to bring together diverse values and diverse stakeholders and support decision-making between alternative courses of action. Decision-making at a higher social scale than the individual requires consideration of how to define this higher scale, i.e., *society* or the community the valuation is relevant for. Furthermore, the principles that determine how to adjudicate between different possibilities also need to be decided. To help draw out the methodological distinctions and suitability of the individual integration methodologies, we distinguish between methods which are *integrative* in terms of the value information they bring together (Participatory Mapping, Production functions, Integrated Modelling), and methods that are *explicitly designed to inform decisions* directly, i.e., "decision-making tools" (cost-benefit analysis, multi-criteria decision analysis, participatory rural appraisal, deliberative decision making). These categories are indeed overlapping, but the distinction is important in interpreting the main strengths and limitations[24] (*Table 3.7*).

[24] Systematic review on method families (https://doi.org/10.5281/zenodo.4404436). See integrated valuation.

**Table 3.7** Overview of integrated valuation methods, including integrative methods and decision support tools. Detailed references on strengths and limitations can be found in *Annex 3.8.*

| Type | Integrated valuation methods | Description/main features |
|---|---|---|
| Integrative methods | Participatory mapping | Spatial identification of NCP according to stakeholder knowledge (Brown & Fagerholm, 2015) |
| | Production function approaches | Indirect valuation method where nature is valued as an input into the production of a good or reduction in damages (e.g. Barbier, 2000, 2016; Custódio et al., 2020). The production function approach is essentially an example of a combination of nature-based and behaviour-based valuation. |
| | Integrated modelling | Linking different models for a given purpose, without necessarily considering the sharing and reuse of the contained models (Granell et al., 2013). Fundamentally, the purpose of model integration is to expand the complexity of the representation of a system (Haacker et al., 2019). Consequently, an integrated model can be defined as a system consisting of sequentially connected models of natural and/or social systems (Haacker et al., 2019). |
| Decision support tools | Cost-benefit analysis CBA | CBA is an economic framework to account for environmental impacts where the benefits and costs of different alternatives are measured and aggregated in monetary terms and compared to assess the alternatives (Atkinson & Mourato, 2008; Dong et al., 2016). The aim is to account for positive and negative consequences of alternatives by converting them into monetary flow. The analysis includes dentification of relevant impacts over the lifetime of alternatives in monetary units, calculation of net present values by discounting the results to base year, conduct of sensitivity analysis, and recommendation of the best alternative, sensitivity analysis and often distributional effects, and selection of the alternative which maximizes social welfare (Boardman et al., 2018; Choy, 2018; Saarikoski et al., 2016; Choy, 2018; Cimon-Morin et al., 2013; Duke et al., 2013). In particular, cost-benefit analysis formalizes the procedure of how to convert benefits and costs of different impacts that occur at different points in time. |
| | Multi-criteria decision analysis MCDA | MCDA (or multi criteria decision-making MCDM) is a general framework for supporting complex decision-making situations with multiple and often conflicting objectives that stakeholder groups and/or decision-makers value differently (Belton & Stewart, 2002). MCDA is also a set of methods to perform sustainability evaluations as a result of its flexibility and the possibility of facilitating dialogue between stakeholders, analysts, and scientists (Cinelli et al., 2014). In all of these, the basic idea is to evaluate alternatives with the multiple criteria that capture the key decision-making contexts. Stakeholders and decision-makers outline a set of criteria by which to compare alternatives, score the performance of each alternative against each criterion, and weigh the criteria based on their relative importance (Cegan et al., 2017). MCDA techniques can be used to identify either the single most preferred alternative, to short-list alternatives for subsequent analysis, to rank alternatives or to distinguish acceptable from unacceptable possibilities (Achillas et al., 2013). |
| | Participatory rural appraisal PRA | Participatory or rapid rural appraisal with the help of local people uses various tools like maps, seasonal calendars, matrices, rankings, grouping, scoring, transect walks, analysis of trends and changes, institutional diagrams, and analytical diagrams. Participatory or rapid rural appraisal has been widely used in natural resources management (for soil and water conservation, forestry, fisheries, wildlife, community planning, etc.), programs for women and the poor, agriculture, health and food security (Chambers, 1994). |
| | Deliberative decision-making processes | In deliberation, participants undergo a prolonged period of discussion and reflection on their own values and viewpoints and those of other participants. Some deliberative methods aim to identify group-level consensus opinions for decision support, providing an alternative to the simple aggregation of individual preferences (Murphy et al., 2017; Palomo et al., 2011a). Including a deliberative element in the valuation activities can lead to more informed (Lienhoop & MacMillan, 2007) and better decision-making (Kenter et al., 2016). This information provision and preference formation objective underlies many of the deliberative monetary valuation studies (e.g. Alvarez-Farizo & Hanley, 2006; Philip & MacMillan, 2005). |

### Challenges and potential of integrated valuation

In summary, the benefits of applying integrated valuation of nature, identified from the above reviews, can be categorised into its ability to: i) include multiple value dimensions and worldviews, ii) to take account various stakeholders interests into valuation process, iii) to provide comprehensive scientific information to decision–making domains based on information derived from multiple

methods and values, and iv) to deal with issues of social equity, fairness, and representativeness in effective ways.

A great deal of challenges comes together with the promises of integrated valuation. One way to look at the challenges of integration is how to make the benefits of integrated valuation to be realised in practice. This includes for instance, how to identify and integrate/aggregate multiple value dimensions in context; how to make sure various stakeholders groups participate in the process to deal with various forms of equity and fairness; how to design and implement multidisciplinary research to obtain comprehensive and scientifically credible outcomes; and how to effectively deliver research outcomes to decision-makers.

To enhance the inclusion of multiple and diverse values, new ways of combining value stating methods with methods from other families are explored. Each integrative process, however, has limitations, ranging from technical challenges to how well they can deal with uncertainty, power dynamics, representativeness, or ease of communication of the outputs. Moreover, several integration methods require highly skilled facilitators, and the results can be difficult to communicate clearly to decision-makers. Given the importance of value integration methods for complex valuation contexts, efforts are needed to develop integration approaches that strike a balance between comprehensiveness, on the one hand, and ease of application, on the other. The review shows that integrated valuation methods have been developed to elicit a wide range of value types but it remains unclear whether these have been successfully used for decision-making. Health valuation provides an example of a field where experts are developing integrative frameworks to understand linkages between biodiversity and human health and well-being (see *Annex 3.9*). Integrated valuation initiatives are also developing to support decisions in the business sector, as businesses realise their dependence and impact on Nature (*see Box 3.4*).

**Box 3.4. Methods for valuation of nature for businesses**

Businesses have impacts on nature (e.g., pollution, habitat destruction, overexploitation) and are dependent on nature (e.g., water use, pollination, flood protection). These impacts and dependencies are not visualised on a company's profit and loss statement or on their balance sheet. They remain "externalities", or issues without internal consequence. The lack of standardisation across corporate environmental assessment methods, including natural capital accounting standards and practices, has always been an obstacle for mainstreaming of environmentally sustainable activities and assets across the economy as well as correct corporate identification of and management of environmental risks. Fortunately, the situation is rapidly changing. Businesses that understand the true value of nature can benefit from improved risk management, new business opportunities, improved communication with investors, enhanced stakeholder engagement and anticipation of future legislation. Therefore, businesses are increasingly looking for ways to measure and value their impacts and dependencies on ecosystems.

There are several frameworks and methods for valuing nature in a business context. The Natural Capital Protocol (Natural Capital Coalition, 2016) has been instrumental in advancing the way of thinking. It is a standardised framework to identify, measure, and value direct and indirect business impacts (positive and negative) and/or dependencies on natural capital. The Protocol aims to support better decisions by including how we interact with nature, or more specifically natural capital, in decision-making and provides guidance on all types of valuation, whether qualitative, quantitative, or monetary. The Protocol describes the main valuation techniques and helps businesses to select the most appropriate one(s) for their assessment. This framework approach is now being translated into more specific and prescriptive standards on measuring and valuing natural capital, such as the European Union funded Transparent and Align projects. The project is led by the (Value Balancing Alliance, 2021), an alliance of multinational companies coming together with a common goal: to create a way of measuring and comparing the value of contributions made by businesses to society, the economy, and the environment – by means of a uniform, internationally recognized valuation method for calculating reliable sustainability metrics, metrics which previously are not reflected in a

company's balance sheet. The Alliance translates environmental and social impacts into comparable financial data. Traditional environmental and social reporting stops at the quantification of impacts (e.g., tonnes of greenhouse gas emissions). The assignment of a monetary value to these impacts allows for an understanding of the scale of the consequences of more traditional measurement and reporting.

A promising development is the establishment of a business focused subgroup under the United Nations Committee of Experts on Environmental-Economic Accounting (UNCEEA), which will continue the work of the workstream on business accounting (SEEA Business accounting, United Nations, 2019) under the "Natural Capital Accounting and Valuation of Ecosystem Services" (NCAVES) funded by the European Union. This workstream aims to improve the dialogue between national statistics offices, businesses and the System of Environmental Economic Accounting (SEEA EA, United Nations, 2021a). Both the overall concept of ecosystem accounting, as applied by the System of Environmental Economic Accounting (United Nations, 2019) and specific elements of it might be instructive for businesses that are interested in applying natural capital accounting (Lammerant, 2019, 2021a, 2021b).

Companies that already apply tools for measuring biodiversity at site level and with a regular periodicity can easily integrate this data into extent and condition accounts. Adding monetary ecosystem services accounts will increase insights into the links between ecosystem condition and ecosystem services value. This will improve the business case for investments in ecosystem restoration.

In terms of natural capital data, a business consultation in 2019 confirmed that data collection is an expensive activity for companies. It's often hard for sustainability professionals within the industry to justify return of investment. Therefore, data sharing and open-source databases are very important for companies. Companies that start exploring the System of Environmental Economic Accounting will discover that governments have plenty of natural capital information, often at subnational level (e.g., watershed level, specific protected areas) which can help companies put their ecosystem performance in the right context. If national statistics offices invest in making these natural capital data more accessible to businesses and tailoring them to the business needs, this would be a major step towards strengthening corporate natural capital accounting and improving internal decision-making and external disclosure.

Finally, there are many initiatives in the field of external disclosure. One of them is the Task Force on Nature Related Financial Disclosures (TNFD, 2021). The goal of this initiative is to provide a framework for organisations to report and act on evolving nature-related risks, in order to support a shift in global financial flows away from nature-negative outcomes and toward nature-positive outcomes. The Task Force is developing guidance on how to measure and value nature-related risks and opportunities. A key development is the transformation of the European Union Non-Financial Reporting Directive into the European Union Corporate Sustainability Reporting Directive (CSRD) (European Commission, 2021) which will become operational in 2023 and introduces more detailed reporting requirements. Also, during CoP26 in Glasgow, the International Financial Reporting Standards Foundation has announced the creation of its new International Sustainability Standards Board (ISSB) that will develop a comprehensive global baseline of high-quality sustainability disclosure standards to meet investors' information needs. All these developments are expected to generate a tremendous shift in the business and financial community mindset in terms of valuation of natural capital, a shift from shareholder to stakeholder capitalism (Bakker, 2020; WBCSD, 2021).

## 3.2.3. Valuation and diverse value types

The IPBES value dimensions (IPBES, 2018) (see *Chapter 2*) occur in all method families, with a dominance of instrumental values throughout, and relational values being the least represented. Nature-based valuations are more often considering intrinsic values than any of the other three method families (*Figure 3.19 right*). This illustrates that valuation experts take a different perspective on what value types the method they are using can assess. Nature-based valuation assesses intrinsic values of nature by assessing e.g., how biodiversity underpin ecosystem functioning, irrespective of the importance to people. In contrast, statement-based valuation assesses intrinsic values by assessing

why people consider nature to be intrinsically valuable. So while both methodologies provide important information on intrinsic values, they provide very different information for decision-making. Despite the potential lack of consistency in terminology used across the valuation field as a whole, the review provides clear evidence that the assessment of instrumental values has been the main focus in the literature. The *Living from*, *with*, *in* and *as nature* value frames are prevailing in all four method families. *Living as nature* is the least abundant, while *living with* and *from nature* are roughly equally represented (*Figure 3.19 left*).

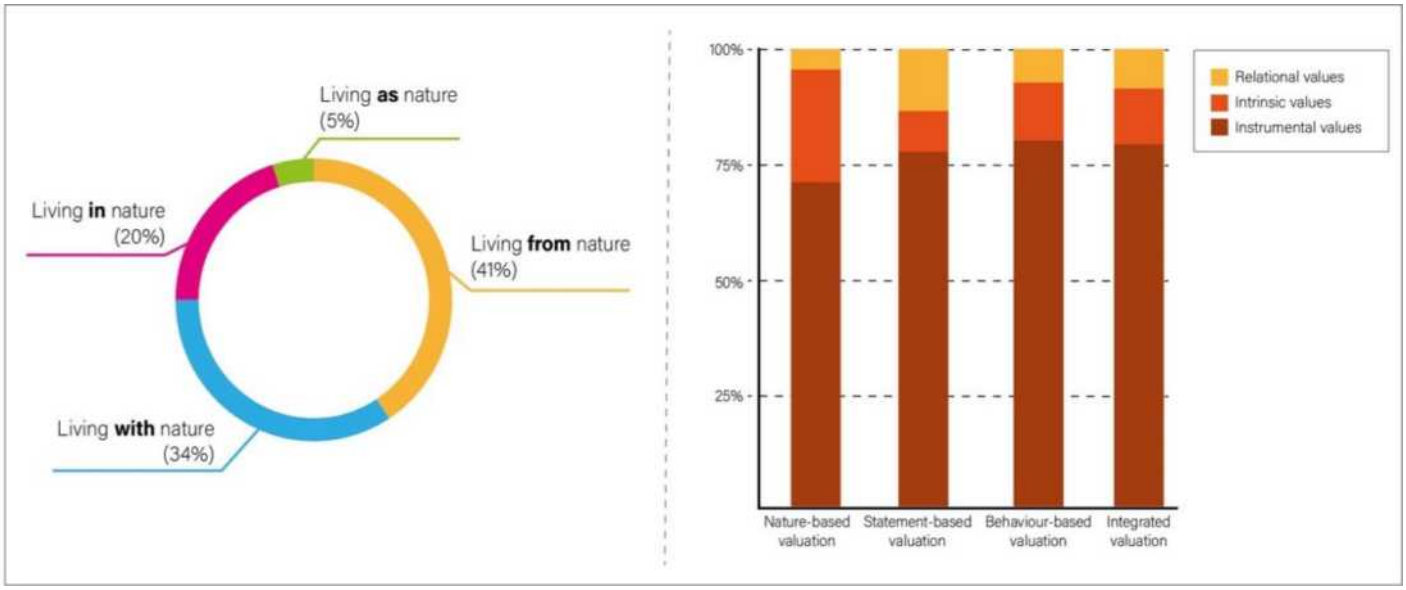


**Figure 3.19.** On the left, percentage abundance of valuations, on the right, distribution per method family (systematic in-depth review n=1163). Value justifications or dimensions (IPBES 2018c) relative per method family (left). Mentioning's of broad values related to the four life value frames (right). Note that justifications as well as aspects of life value frames often co-occur in valuations (systematic in-depth review n=1163).

Valuations have considered the full range of *specific value types sensu* total economic value classification. While *use values* (including indirect use) are the dominant target of valuations, *existence values* are targeted in 20% of the valuations, and more often by nature-based valuations. *Option*, *bequest* and *altruistic values* occur less often (7% in total) but still prevail throughout the four method families (*Figure 3.20*).

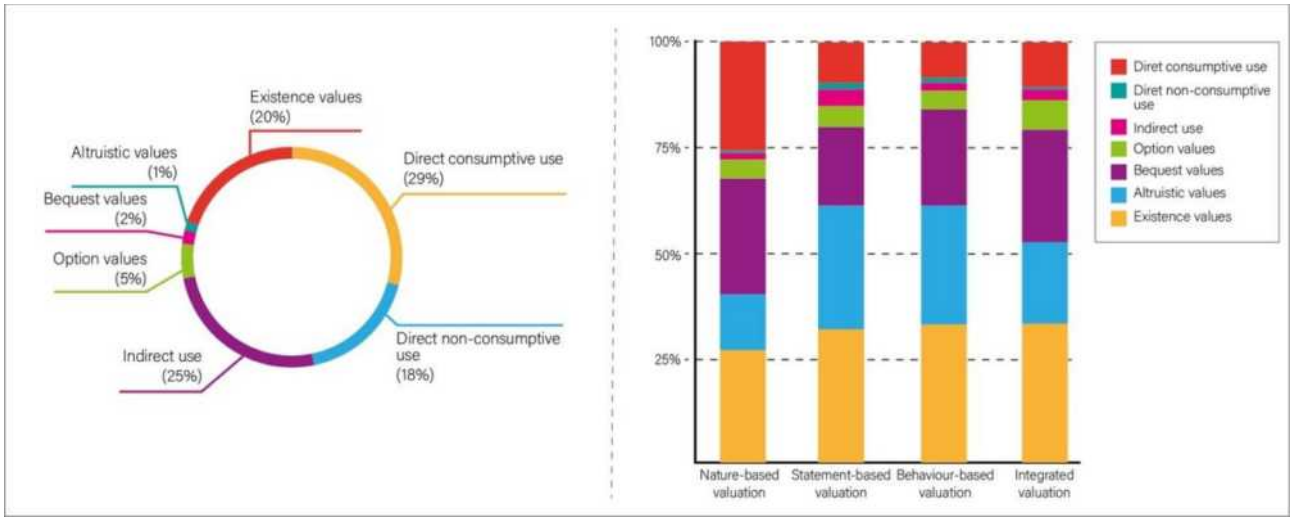


**Figure 3.20.** On the left, percentage abundance of valuations, on the right, distribution per method family (systematic in-depth review n=1163). Value types sensu "total economic value" framework in valuations.

Regarding IPBES *value targets*, valuations have also considered the full range (*Figure 3.21*, *Figure 3.15*). Just under half of the valuations target *nature's contributions to people*, while *nature itself* and *good quality of life* are targeted in roughly a quarter of valuations each (*Figure 3.21*). Distribution among subcategories of IPBES value targets (IPBES, 2018) further demonstrates the diversity of valuations (*Figure 3.21*).

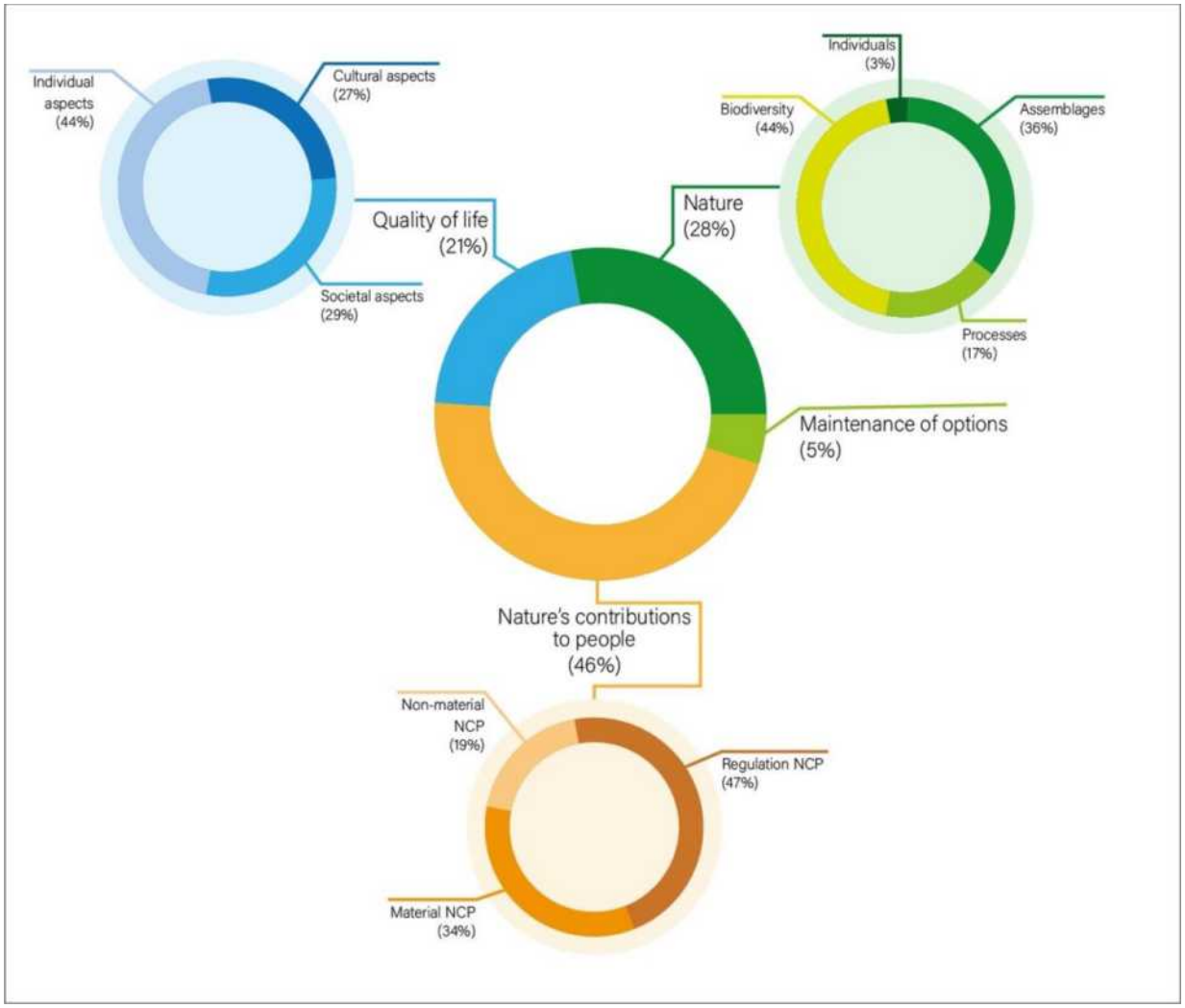


**Figure 3.21**. Percentual abundance of various valuation targets (systematic in-depth review n=1163).

Valuations have applied a broad range of *value indicators* to articulate the diverse values of nature. The most commonly used indicators are biophysical, due to the dominance of biophysical valuations. While the use of certain indicators is skewed to a certain method family or discipline (e.g., nature-based methods more often use biophysical indicators, economic methods more often use monetary indicators), this is by far not a discrete and exclusive relationship. Monetary, Biophysical and Socio-cultural indicators are found in valuation studies from every method family and disciplinary group (*Figure 3.22*).

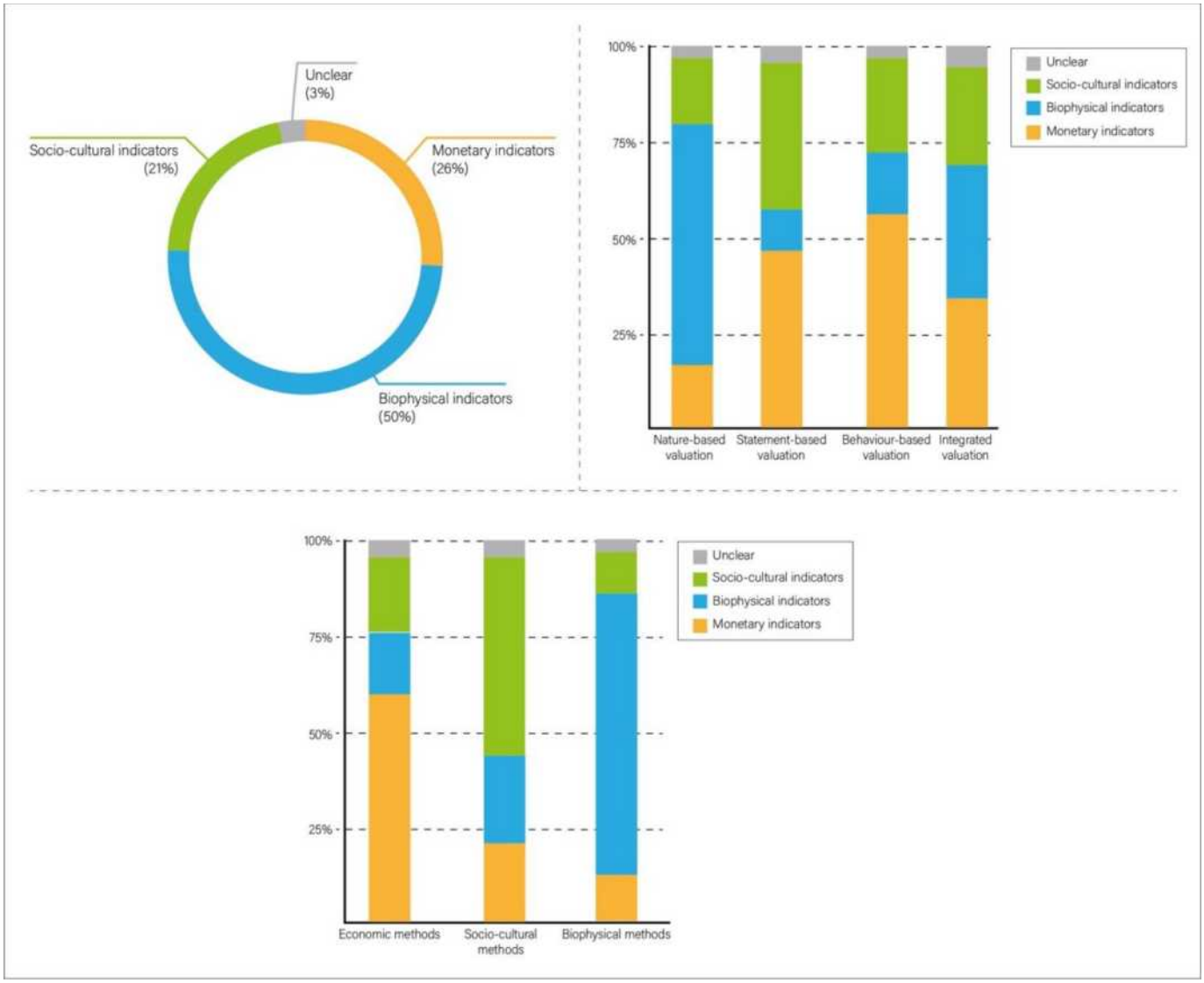


**Figure 3.22.** Abundance of various value indicators over all valuations (upper left), relative per method family (upper right) and per discipline (lower panel) (systematic in-depth review n=1163).

**Valuation methods and approaches: diverse as a whole, but specific in their application**

While the reach of valuation methods and approaches in their totality is clear from the above, it is important to note that individual valuation methods are often highly specific. Most valuations apply a single main method, but quite often methods are combined and auxiliary methods are used to complement the valuation. A biophysical valuation can for instance be complemented with a benefit transfer to articulate value in monetary units, or a statement-based method applies outputs from a biophysical mapping to reveal preferences. While these are not necessarily full method combinations, they still broaden the range of values included and indicators used in valuations.

In summary, there are many methods and approaches available to achieve valuation of nature and its contributions to people, and to articulate these values to the decision-making process. Nature-based, statement-based, behaviour-based and integrated methods each have their own features, strengths and limitations for application (see *Table 3.8*).

**Table 3.8.** Valuation methods can be classified into four method families with distinct characteristics.

| | Valuation method families | | | |
|---|---|---|---|---|
| | Nature-based methods | Statement-based methods | Behaviour-based methods | Integration methods |
| |  |  |  |  |
| **What is assessed?** | Nature, physical or ecological components of nature | What people express when asked about the importance of nature | What people do in nature, for nature, with nature, to, as nature | Different outputs from one or more methods, to support decision-making |
| **How is information about values generated?** | Measuring nature and its functions through several methods such as remote sensing, field observations, consulting experts, etc. | Asking people (interviews, questionnaires), analysing other expressions (e.g., narratives, discussions, art, etc.) | Observing people, assessing records of people's behaviour (e.g., park visits, policy choices, (non-)market exchanges, etc.) | Synthesising, comparing, contrasting, deliberating, consolidating or aggregating diverse values for decision-making or decision support |
| **Which values are elicited** | Mainly intrinsic and instrumental values | Instrumental, intrinsic and relational values | Mostly instrumental values | Instrumental, intrinsic and relational values |
| **Examples of value indicators** | Species richness, CO2 stored, ecological indicators | Preferences for nature's contributions to people, subjective well-being indicators, narratives of human-nature relationships, required compensations | Time spent, share of household income, prevalence of disease, price of land, use of plants | Strength of support or objections to policy options, welfare gains or losses from projects |
| **Examples of methods and approaches** | Biodiversity assessment, ecosystem services mapping, Delphi method | Group discussion, Q-methodology, choice experiments, valuation interviews | Participant observation, travel cost method, cost-based method, livelihood dependence, photo-series analysis | Natural capital accounting cost-benefit analysis multi-criteria decision aid, integrated modelling, deliberative decision methods |
| **Type of stakeholder inclusion** | Most methods do not include stakeholders, though some inclusive approaches exist (e.g., based on local ecological knowledge) | Most methods include stakeholders to some extent (e.g., surveys) and inclusion is often integral to the method (e.g., participative approaches) | Most methods have limited stakeholder inclusion (e.g., analysis of market accounts) but some include diverse stakeholders | Some methods can be non-inclusive (e.g., desktop multicriteria decision analysis MCDA) but often, inclusion is key to the decision support aspect (e.g., participatory scenario building) |
| **Examples of typical valuation "products"** | Biodiversity indices, maps of priority areas for policy/management action, improved understanding of the importance of components of nature | Ranked importance of components of nature or nature's contributions to people, (monetary) value of protection of biodiversity-rich areas, explanations for why people value nature | Ranked importance of components of nature or nature's contributions to people, quantified changes in values nature or nature's contributions to people, explanations for why people value nature | Ranked policy options, evaluation of socio-economic and environmental impacts of policy options, improved understanding of conflicts/shared values of nature |
| **Limitations/ concerns** | Impact on people assumed but not assessed, dependence of nature is not assessed by the people dependent on the resources | Concern about reliability of statements, power disparity can reduce the validity of group-based methods, representativeness in selection of respondents | Requires conceptual and empirical understanding of the relationships between behaviour, nature and its contribution to well-being, challenging to reveal in-depth understanding of motivations behind behaviour | Aggregation of values across groups of people can reduce representation of values, combining multiple value types creates incommensurability concerns |

The diversity of methods and approaches, and the specific limitations and strengths, call for combining different complementary methods. Limitations can as such be alleviated and strengths combined, and a more diverse set of values can be elicited and articulated. In practice, consulting valuators from different disciplinary backgrounds can help select the appropriate method(s). Mixed-method approaches however can be more demanding regarding skills, resources and time. The investment in the valuation process depends on the complexity and stakes of the valuation context: high stakes and high complexity justify investing in a more complex and demanding valuation (*see Chapter 1*).

Several limitations and concerns do not stem from one specific method, approach or method family, but apply to valuation as a whole. *Section 3* will deepen the assessment of some of these main issues and concerns and offer guidance to improve the practice of valuation.

## 3.2.4. Valuation practice in IPLC contexts

The fields of ethnography, anthropology, conservation sciences and development studies have generated a rich knowledgebase for understanding the nature-specific values of IPLCs, how these values are manifested (i.e., the "valuing" process), and in some cases their value systems and worldviews. This body of literature imparts very little knowledge and understanding, however, about IPLC valuation. For example, how those values are elicited and assessed in order to generate meaningful insights into the phenomena of valuing for different purposes (see *3.1* for definition of valuation).

Past reviews and assessment of valuation methods (*Annex 3.1*) do not discuss or describe how valuation methods have been applied within indigenous peoples and local communities (IPLC); nor do they compile and synthesise valuation methods that are used by IPLC. The terms 'indigenous' and 'Indigenous and Local Knowledge (ILK)' are absent from the economics of ecosystems and biodiversity's 2010 synthesis report, for example, and mentioned only twice in the 2018 report. A review of published IPBES assessments including a total of nine ILK Dialogues (three of which were conducted for the values assessment) that took place across these assessments between 2015 and 2021 as well as the recently released Local Biodiversity Outlook 2 (Forest Peoples Programme, 2020), a complement to the fifth Global Biodiversity Outlook (Secretariat of the Convention on Biological Diversity, 2020) emphasises the critical contribution that IPLC worldwide make to the achievement of the Aichi Targets. However, none of them discusses or reviews any valuation methods and approaches, including IPLC valuation.

Historically, the study of IPLC processes through western science lenses has led to gross misrepresentations of IPLC, their traditions as well as their knowledge systems (Battiste & Henderson, 2000; Smith, 2003; Smith, 2012). Valuation studies undertaken in IPLC contexts and conducted by researchers who use western science approaches to interpret people's expressions, behaviours and decisions, often falls short in their ability to adequately capture IPLC's holistic and multi-layered understanding of and relations with nature (*Box 3.5*).

In this section, we demonstrate the value and limitations of integrating knowledge systems and particularly ILK and western science approaches. We first apply the methods families classification system to describe and understand IPLC valuation from a western science perspective. Doing so facilitates the detection of numerous coincidences and similarities between IPLC and non-IPLC valuation processes; the existence of shared characteristics and processes for valuation between knowledge systems points to the potential that exists for dialogue, knowledge sharing and knowledge integration. Indeed, indications of integration already exist in the few examples we were able to find of intercultural valuation methods (i.e., methods that draw from both western science and ILK) (*Box 3.5*).

Understanding IPLC valuation using a western science perspective can make explicit the limitations of rigid application of the "methods families" approach, beyond western-science informed approaches, particularly in terms of their inability to adequately describe the full diversity of valuation practice that is undertaken by IPLC. On the one hand, it is an indication of the need to assess the logic of the Methods Families classification (e.g., what type of information is considered relevant for valuation?) and reflect on how families could be restructured or expanded so that they are more inclusive of other worldviews (e.g., could statement-based valuation include expressions by non-human species and ancestor?). On the other hand, it highlights the larger issue of limitations of knowledge integration: not all knowledge is compatible and thus feasible to integrate, in some cases integration can only be partial, and that there is great value in allowing multiple parallel approaches to co-exist without the need for integration or cross-validation between knowledge systems (Chilisa, 2020; Johnson et al., 2016b; L. T. Smith, 2012a). In this vein, the same set of data was assessed through an IPLC lens, applying one of many indigenous science approaches. The results are an opportunity to understand IPLC valuation without the requirement of fitting it into a classification system that was not developed with IPLC approaches in mind.

**Box 3.5. Understanding "evidence" from IPLC epistemologies**

Respecting IPLC valuation requires comprehension of indigenous worldview that elicits a holistic view of nature in which humans are part of it and not detached from it, and which is vital to understand how evidence is conceptualised, acquired and shared within IPLC contexts (LaDuke, 1999; McGregor, 2004). In western disciplines, ILK is validated into an academic discipline through a validation process or co-production of knowledge wherein participants from diverse knowledge systems concur to research processes. Still, research questions and methodologies are defined outside indigenous worldviews (Smith, 1999). Other approaches centre on validity being assumed independently within each knowledge system creation and acceptance of findings are decided within different institutional settings (Smith, 1999; Tengö et al., 2014).

Indigenous researchers who mostly write from their *living* realities, are constantly under pressure to *validate* or provide *evidence* of knowledge production within a western academic standard. This is because there is a lack of understanding of indigenous ways of knowing (epistemology), ways of being (ontology) and ways of doing research (axiology). However, "relationality" is a vital component of an indigenous worldview, highlighting the holistic view that human and non-human entities are interconnected to the streams of life, and therefore a relationality balance is required to maintain an equilibrium between all entities (Huambachano, 2018). For example, storytelling is a method of gathering, preserving, and interpreting the oral accounts and voices (knowledge) of the ancestors within a specific geographic area, and passed down from one generation to the other. Therefore, the *knowledge* emerging from storytelling is valid and reliable because storytelling is created and shared through relationships and stands as valid, and reliable only in the relationship (Wilson, 2008).

Relationality is what distinguishes indigenous storytelling from qualitative research methodologies that use storytelling as a method for capturing single life stories (Batty, 2009; Portelli, 1997). Storytelling is not captured in journal papers but in videos, reports, web pages, and similar material produced mainly by IPLC and their organisations. Indigenous researchers continue to struggle with questions regarding the *validity* of their knowledge production, for example, when they are asked about the difference between talking circles and focus groups. The answer lies in the nuances of their worldviews that are, for instance, placed-based and ritualistic. Therefore, talking circles are different to focus groups because talking circles distinguish the rituals and protocols underpinning indigenous' ceremonial performance (Huambachano, 2018).

It is important to find ways to adequately consider indigenous peoples' worldviews, agency, systems of knowledge systems, and evidence (McGregor, 2004; Smith, 1999). Indigenous scholars are heralding novel research models to reclaim indigenous voices within research that support their well-being and sovereignty aspirations (Estrada, 2005; Huambachano, 2018; Pihama et al., 2002; Wilson, 2008).

## 3.2.4.1. From valuing Indigenous and Local Knowledge (ILK) to valuation by Indigenous Peoples and Local Communities (IPLC): A historical context

### IPLCs as providers of local knowledge for valuation: Valuation in IPLC contexts

Indigenous people and local communities have contributed important sources of data, knowledge and information for valuation studies conducted by outsiders often without their knowledge or consent. Their contributions to nature-based valuation have been recognized and is increasingly critiqued, particularly their unconsented role in assisting researchers to understand and monitor species population, population dynamics, long-term life cycles of plants or animals, and the rich biodiversity inhabiting their territories (Antunes et al., 2018; Berkes, 2008).

Indigenous and local knowledge continues to enrich scientific and other pursuits today. Brook & McLachlan (2008) examined 40,900 articles published in 360 journals and assessed 12 prominent ecological and conservation journals to characterise how local and ecological knowledge has been used in the ecological and conservation literature over the last 25 years (1983 – 2008). Their work is highly informative of the incorporation of ILK into conservation sciences (e.g., interview methods were the most common methods used to solicit ILK). Despite a growing use of ILK and specifically Local Ecological Knowledge (LEK) in conservation research, they reported that studies "generally failed to actively include community members in the research process" (Brook & McLachlan, 2008, p. 3501). Indeed, although indigenous empirical knowledge of nature is highly regarded by external researchers, spiritual dimensions of knowledge production or interactions with the unseen world as a source of knowledge production are usually disqualified in disciplinary discourses (Gaudry, 2011; McGregor, 2004; Simpson, 2011; Wilson, 1995). It has often been the case that information and observations obtained from IPLC that do not fit classic academic standards of "reliable" data have been omitted or misinterpreted by the non-indigenous scientific community (Agrawal, 2002; Johnson et al., 2016; Turner et al., 2008). ILK and indigenous science and worldviews are generally underrepresented knowledge generation institutions and are often subjected to validation procedures developed by western informed epistemologies (Johnson et al., 2016; Louis, 2007; Tuck & Yang, 2012). In the policy context, policymakers have often dismissed community information when not aligned with their objectives (Agrawal, 2002; IPBES, 2019c).

### IPLCs as the subject of valuation studies by outsiders

Indigenous and local people are often the subject of ethnographic and anthropological studies undertaken to describe, characterise and explore their broad and specific values, their cosmovision and worldviews, and their socio-political and economic contexts. The study of the importance of nature to IPLC worldwide is perhaps the most studied dimension of the interlinks and dependencies between IPLC and their natural environment and it is the subject of tens of thousands of publications on rural livelihoods.

In the mid-1950s and early 1960 the application of economic and non-economic valuation in IPLC territories emerged from an anthropological perspective. The initial objective of this perspective was to "understand local lore" with the purpose of documenting and evaluating what IPLC value about nature, and the practices and approaches they have developed to conserve biodiversity (see Conklin, 1957; Frake, 1962; Goodenough, 1957). Applying the principles of cognitive/linguistic and ethnoscience systematised data collection and analysis, indigenous and local knowledge and technologies were vigorously documented particularly in the 1970s and 1980s (Atran, 1985; Berlin, 2014; Berlin et al., 1974; Ellen, 1993; Ford, 1994; Hunn, 1977, 1982; Posey, 1985). This paved the way in academia and development arenas for the inclusion of local perspectives in setting priorities for sustainable development (Rhoades & Bebbington, 1995; Rhoades & Booth, 1982; Warren et al.,

1989). As a result, IPLC practices have been widely promoted and ILK has become '*information currency in the international agricultural research centers and the World Bank*' (Nazarea, 2006).

The recognition of indigenous peoples as legitimate right holders primarily determined their participation in the valuation of nature and active inclusion of their principles or life values. Human rights and international environmental instruments, such as the International Labour Organization Convention 169 in 1989, the CBD in 1992, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) in 2020, cemented the path for indigenous recognition. These instruments provided legal tools such as the duty to consult and seek free, prior and informed consent with the potential to empower indigenous participation in environmental assessment and decision-making scenarios worldwide (Cariño & Colchester, 2010; Orduz Salinas, 2014). Moreover, the creation of the United Nations Permanent Forum on Indigenous Issues (UNPFII) established a legitimate space for voicing indigenous peoples' concerns against development projects and other multifaceted threats to their ways of life, internationally acknowledged as compatible with sustainable use and conservation of biodiversity (Stankovitch, 2008). Institutional policies and guidelines of international financial agencies about the observation of the United Nations Permanent Forum on Indigenous Issues (UNPFII) peoples' rights confirmed the trend towards recognizing indigenous peoples (Corntassel, 2003; Davis, 1993; World Bank, 2016). Additionally, changes in the global legal framework have boosted indigenous peoples' international, national, and local initiatives for inclusion of sensitive cultural, social, and economic information on indigenous peoples' well-being aimed to secure incidence on policy, programs, research, and decision-making processes (Cariño, 2008).

During 2006 and 2007, the United Nations Permanent Forum on Indigenous Issues (UNPFII) and the International Indigenous Forum on Biodiversity (IIFB) led proposals for designing a global index on indigenous peoples' well-being, relevant life conditions, and concerns of indigenous peoples to influence the Millennium Development Goals (MDGs) and the CBD work. In 2015, the new Sustainable Development Goals (SDGs) and the CBD Aichi Targets adopted a framework more inclusive of indigenous peoples' concerns, but indigenous influence was still limited (IPBES, 2019b). Similar proposals about inclusive indicators were put forward, for example, in Canada the holistic health model advanced by the Assembly of First Nations (AFN), 2006 and in Aotearoa New Zealand the Mauri Ora framework (Durie, 2001) and towards a Mâori Statistics Framework (Statistics New Zealand, 2008). Indigenous peoples have also designed culturally sensitive indicators at a regional scale, "Living conditions in the Arctic" (Andersen & Poppel, 2008) and at the local level, for example, the Tuawhenua tribal group in New Zealand (Lyver et al., 2017). These have led to the recent development of indigenous ecosystem services valuation frameworks such as those emerging today in Canada, Australia and New Zealand. A small but growing movement is currently underway, in which IPLC scholars worldwide are calling for indigenous thinking to be recognised in developing indigenous and hybrid methodologies, all in the context of indigenous science and research and decolonizing methodologies (Chilisa, 2017; Pihama, 2010). *Section 3.3.1.2* lists examples of indigenous and other approaches that are emerging to counteract dominant perspectives of knowledge creation of the last centuries. They represent an exciting space for improving current understanding of IPLC valuation and developing practices, protocols and methods for undertaking valuation in IPLC contexts.

**Valuation for advocacy and securing of IPLC rights**

With the backing and support of environmentalists, anthropologists and cultural ecologists, IPLC have utilised the power of valuation to lay claims on competing interests over their territories, to advocate for sovereignty over their lands, and to demonstrate the value of their practices and knowledge for biodiversity conservation (Orlove & Brush, 1996). Indigenous mobilisation and resistance have been deployed by indigenous peoples to make visible their worldview and

understanding about their relationships with Mother Earth or territory (Ellis, 2005; Nazarea, 2006; Orlove & Brush, 1996). Indigenous peoples today mobilise and resist to safeguard aboriginal and environmental rights threatened by exclusionary extractive natural resource projects. Forest concessions, mineral extraction, dam construction, oil exploration, infrastructure development, violation of social and human rights have motivated massive demonstrations, occupancy of highways or towns, blockades, and other manifestations of civil disobedience (Borrows, 2016; Lackenbauer & Belanger, 2014). Athayde (2014) shows how indigenous resistance of Amazonian peoples as the Kayapo and Munduruku actively contributed and inspired social mobilisation against damming rivers for hydropower in the Amazon.

In recognition of these efforts and of the importance of bringing the IPLC perspective on valuation to light, this chapter attempts to explicitly include IPLC principles in the criteria for collection of evidence, in its analytical framework and assessment criteria, and in the designated assessment activities and evidence sources.

## 3.2.4.2. The evidence-base for IPLC valuation

Insights into IPLC valuation and IPLC valuation methods and approaches comes from a small body of literature that was obtained from three separate efforts by authors of the values assessment to collate literature on ILK relevant for the assessment. Thirteen publications were obtained from *Chapter 3's* systematic literature review of valuation practice between 1980 and 2020. In a wider call for contributions on ILK[25] that was made by the IPBES ILK task force, 8 out of a total of 420 contributions provided frameworks and approaches that were relevant for IPLC valuation. Finally, only 2 publications describing methods, approaches and frameworks were identified from a set of 265 academic publications that were part of a systematic literature review on global Philosophies of good living[26]. In-depth review of the 23 publications revealed that only 14 provide relevant information on IPLC valuation, mostly in the form of indigenous research frameworks proposing general approaches (i.e., not specifically about valuation of nature). for generating knowledge and understanding through indigenous worldviews.

Due to the paucity of published literature on IPLC valuation in English, a targeted call for contributions from contributing authors was conducted by approaching 76 IPLC scholars and ILK experts to request information specific to valuation methods and approaches. The contributions consisted of written essays (i.e., unpublished works) backed by evidence, 1000 to 1500 words in length. The essays responded to specific questions obliging experts to explore and describe the process of valuing and valuation of the communities that they belong to or work in. Out of the 76 solicitations that were made, 26 individuals returned essays. Descriptions and characterization of IPLC valuation described in the following subsections are informed by these essays. Although these 26 contributions covered a wide range of IPLC groups from all five IPBES regions and across different livelihood types, they represent a very small proportion of IPLC worldwide (*Figure 3.23*) and should not be generalised to all IPLCs.

[25] Call for contributions on indigenous and local knowledge (https://doi.org/10.5281/zenodo.4390417).
[26] Philosophies of good living ILK cross-assessment case study (cross-chapter/ILK) (https://doi.org/10.5281/zenodo.4399544)

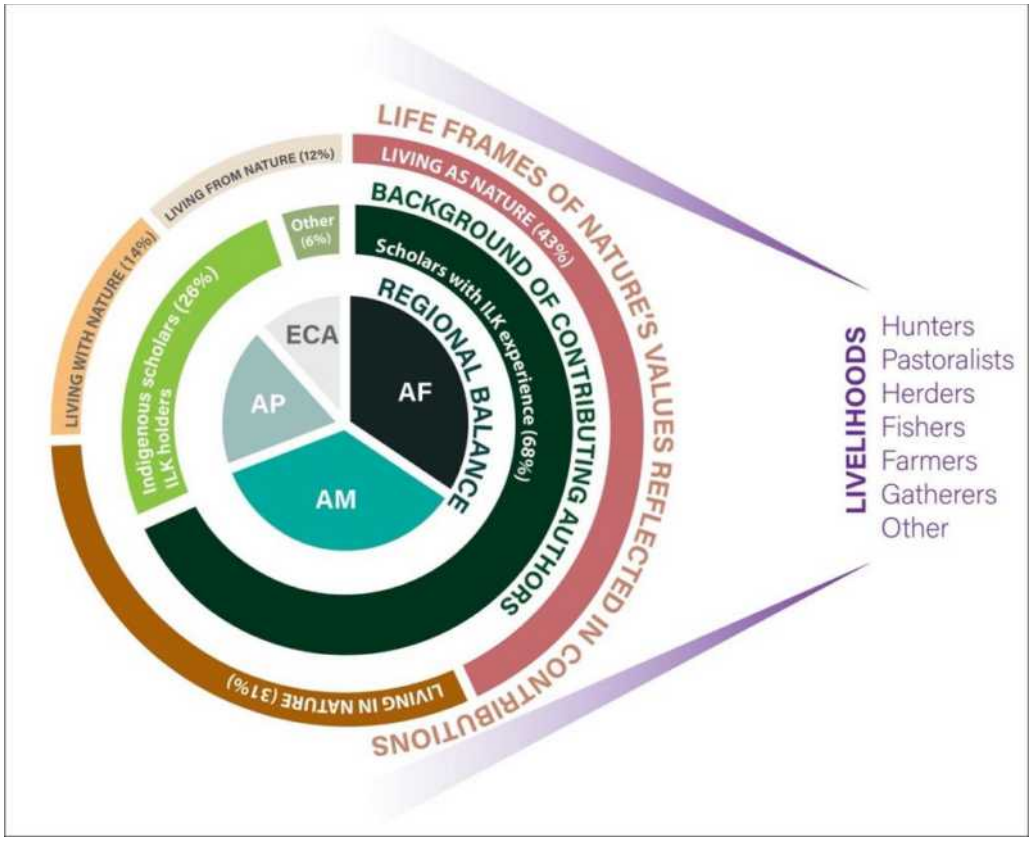


**Figure 3.23**. Concentric circles describing the content of the contributions: Regional balance of the contributions across the four IPBES regions; Background of contributing authors; Life frames of nature's values and their relation to the communities livelihood strategies. AF = Africa, AM = Americas, AP = Asia Pacific, ECA = Europe and Central Asia

## 3.2.4.3. General description of valuing processes in IPLC contexts

**What is valued?**

A total of 142 excerpts contributed to identifying and subsequently characterising the components of life and nature that become the subject of valuation exercises (i.e., the valuing processes) in IPLC contexts. After coding these excerpts we identified that out of the total of excerpts the following focus of valuation were mentioned, noting that one excerpt could express more than one focus of valuation: a) elements of nature itself including elements that might are not strictly considered as nature in western science contexts, such as the Moon and Sun, rain, rocks and the metaphysical (39%); b) material contributions of nature (35%) and to a lesser extent, non-material contributions of nature such as relationships with nature, physical & psychological experiences, aesthetics, spirituality, and identity (5%); c) natural processes including the regulating functions of nature such as water regulation, climate regulation, soil erosion control & soil fertility, regulation of hazards (13%); d) holistic elements of nature such as, spirituality, ancestry and beliefs which were a challenge to situate in the IPBES conceptual framework (8%); and d) good quality of life (0%) although many excerpts refer to good quality of life as the purpose of valuation (*Figure 3.24*). They were characterised as holistic because – on the one hand – they associate elements of nature with nature's contributions to people and good quality of life; on the other, they integrate other aspects of life and the experience of living that are not time and space bound and not limited to the physical and tangible aspects of nature.

Holistic valuing is predominant among IPLC whose principal worldviews were living as nature and living with nature (see *Chapter 2*).

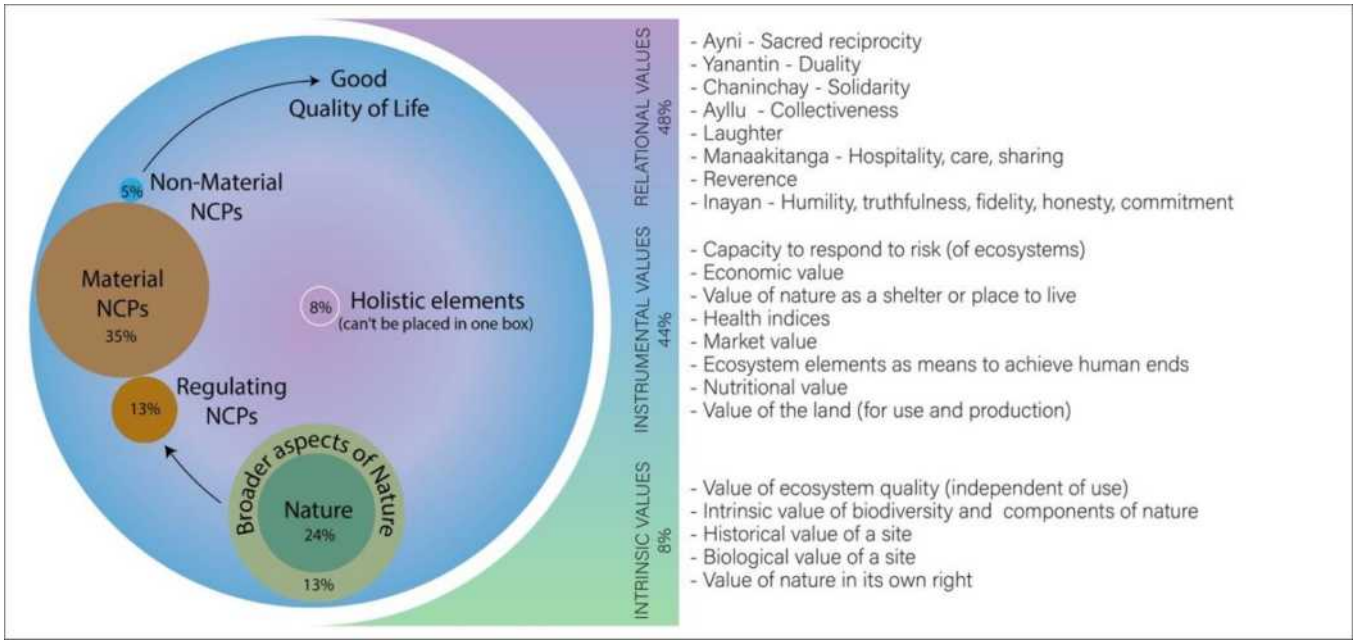


**Figure 3.24.** Projection of the focus of valuation (what is valued?) by IPLCs and the types of values that IPLC valuation captures onto the IPBES conceptual framework. Note that the nature component includes broader aspects of nature that would not usually be considered as nature in non-IPLC contexts, such as the Sun and Moon. Also, that holistic elements at the centre cover in fact the full context. The size of the circles indicates the number of excerpts supporting the component from a total of 142 excerpts. On the right, types of values are indicated along with a list of examples that were extracted from the essays.

*Figure 3.24* combines the results from the question "what is valued?" with value types and lists the full set of values that were identified in the excerpts. Note that a direct one-to-one relationship does not exist between the elements that are valued (the circles) and the types of values that emerge. One might be tempted to associate relational values, for example, with non-material nature's contributions to people. Or instrumental values to material nature's contributions to people. This is not necessarily the case, however. Also, one might assume that intrinsic values are only directed towards nature. However, as *Figure 3.24* shows, they represent only 8% of the value types identified while nature (as a value target) was mentioned in 24% of the excerpts related to *what is valued*. This example demonstrates the deep-rooted and holistic connection that IPLC have with nature, which is a key distinction between indigenous and western approaches of valuation.

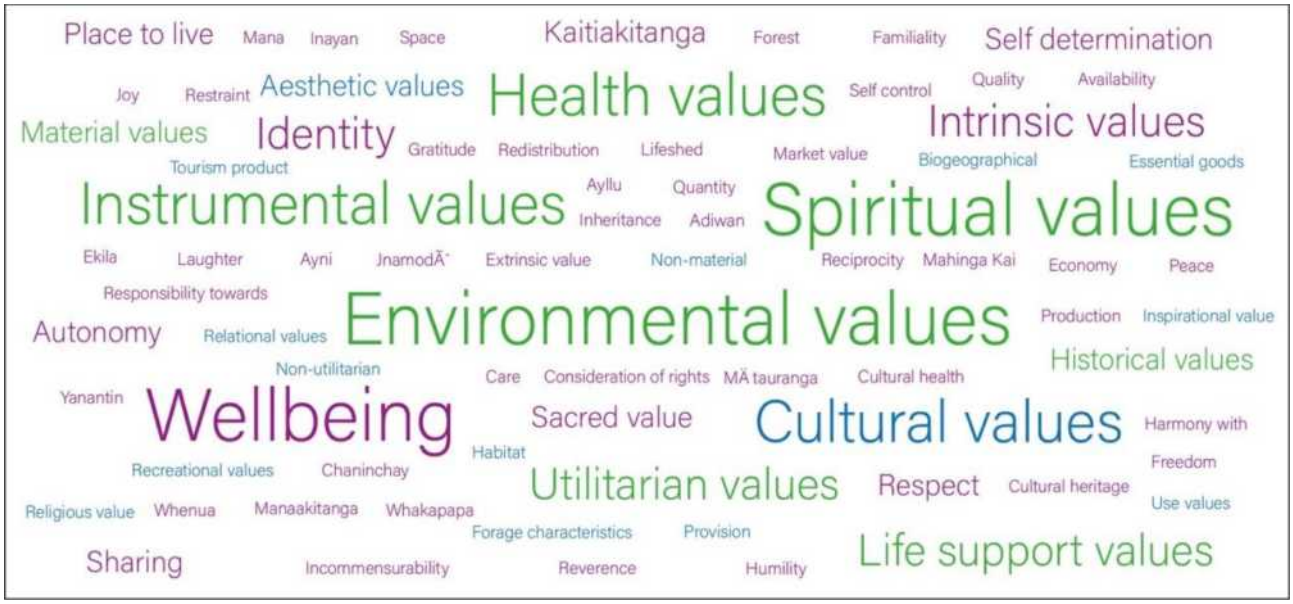


**Figure 3.25.** Values reported by the contributing authors. In purple: values from communities with Human- Nature Worldviews; in blue values from communities with Non-Human- Nature Worldviews; in green values shared by both types of worldviews.

A broad diversity of values and value categories were highlighted explicitly within the revised contributions. These contributions were classified between those that reflect worldviews that address human-nature and non-human-nature relationships, values emerging from both types of worldviews and those that were shared among them were identified (Figure 3.25). The contributions present a wide diversity of values made visible through indigenous methodologies and approaches that have implications for decisions regarding nature.

Some examples of the excerpts mentioning values are presented below[27]:

- Spiritual values: For Shona communities in South Africa '*In traditional Shona cosmology large trees are believed to be the dwelling place of ancestral spirits* (O´Flaherty, 1997). *Some animal species are also protected due to their spiritual value, for example the pangolin (Manis temmickii)* (Virtanen, 2005). *Most of such species-related controls are based on traditional religion, and they include both totem-related taboos and species that are connected to ancestral worship of witchcraft* (Mussanhane et al., 2000).' (Contribution 3).
- Environmental and health values: For Canadian First Nations '*This explains that while the natural environment is recognized as existing to serve the needs of the residents, the economic imperative is not the only consideration. Nature is considered to be valuable in its own right and environmental health is seen as symbiotically connected to human health and well-being. It is also important to emphasize that human health and well-being is conceptualized in a holistic way. Mental and emotional health is considered to be just as important as physical health.*' (Contribution 24).

[27] Analysis of contributions on values and valuation methods by ILK experts and holders (https://doi.org/10.5281/zenodo.4404612).

- Sharing: For BaYaka communities '*Sharing is fundamental to these groups' sociality. BaYaka share even when there would seem to be no need to share, for instance, when huge amounts of fish are captured by everyone in the dry season; and they still share even if this means the producer remains with almost nothing. BaYaka explain that if they didn't share, their ekila would be ruined and they would no longer catch fish or find food*.' (Contribution 12).
- Cultural values: For the Ogiek communities '*Cultural and spiritual values shaped by the lands and territories*' (Contribution 21).

**How values are manifested**

A total of 213 excerpts from the essays conveyed information relevant for assessing how the process of valuing – or of enacting one's values – is manifested in IPLC contexts. Seven ways for expressing values were identified. Values can be expressed as appreciation of the world and components of nature; as daily decisions, actions and practices; as the exchange of goods and services in traditional markets; as how and which knowledge about nature is generated, shared and secured; as specific norms and regulations; as ethical principles, and; as belief systems. A brief description of each is provided in *Annex 3.10* with some examples and their implication for valuation.

Although values are enacted in a number of different ways in all regions, most values are expressed as everyday decisions, actions and practices, and as beliefs (*Figure 3.26)*.

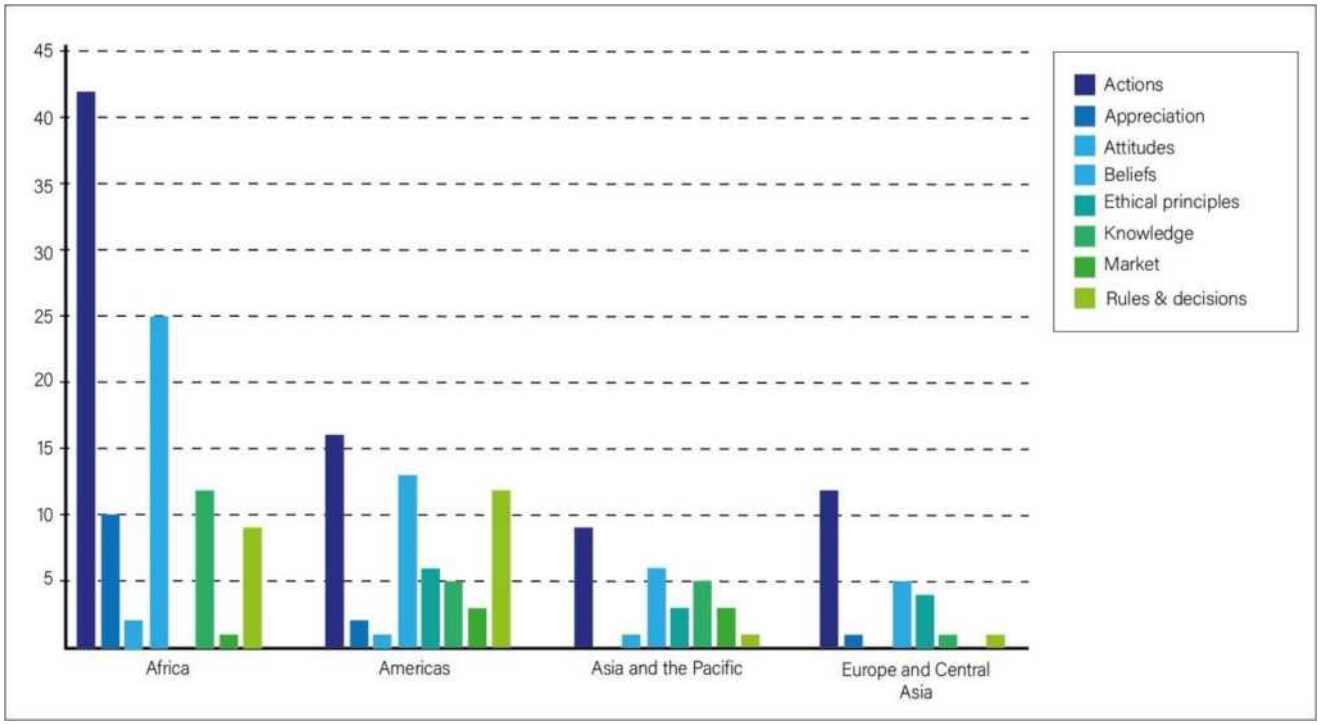


**Figure 3.26.** How values are expressed and manifested in IPLC contexts. IPLC valuation methods assess these manifestations to make multiple conclusions about nature and human-nature relations in their communities. Values represent the number of excerpts from the 26 essays that conveyed these ways of value expression.

Contributions also highlight values as principles that feature prominently and regulate their day-to-day activities. Many of these principles share key components and are usually connected to values such as *respect, reciprocity, sharing, caring, connection with nature and moral values*. For example, the BaYaka communities of Tanzania identify joy, food and "multi-species companionship" as the

most highly valued virtues around which key cultural institutions and activities revolve (Contribution 12). In a similar vein, Quechua communities in South America identify sacred reciprocity, solidarity and duality with nature and with each other as the pillars of their existence and relations with one another (Contribution 13). *Annex 3.11* provides additional examples from all the IPBES regions.

## 3.2.4.4. Description of valuation practice in IPLC contexts

The descriptions of valuation provided by ILK experts suggest that - in IPLC valuation - the boundaries between value expression, value elicitation and decision-making are more permeable and these processes are not necessarily linear. This makes it challenging to describe valuation as if it were a distinct and separate process from that of valuing and acting on those values; valuation is usually undertaken alongside other cultural processes. Additionally, IPLC valuation is oftentimes a collective process in which most - if not all - members participate and the values are elicited and assessed by all. Also, interpretations can be collectively discussed, and consensus is reached before the information generated can inform decisions. Some valuation is commissioned by leaders or community members for very specific purposes. However, other valuation is conducted with much less "formality" because it is part of the day-to-day activities of the "valuators" or valuation experts. Consequently, a wide range of individuals in the community are considered legitimate valuation experts who specialise in continuously assessing nature, human-nature and human-human relations and reporting this to individuals, leaders, or the whole community. Seers, interpreters, healers, Shamans, the community patrol teams, women returning from the farms, report their results to the community whenever it is needed and decisions about nature are made based on their assessments.

**The purpose of valuation in IPLC valuation**

Reasons for undertaking valuation in IPLC are numerous and can be grouped into 10 principal purposes (*Figure 3.27*) with the most frequently mentioned purpose was to generate, transmit and share knowledge about what is valued communally. Importantly, valuation is motivated by reasons that transcend the standard categories of reasons such as fulfilling human wellbeing, ecological sustainability, and justice objectives. Decisions and actions are usually part of a continuous interaction with the deities and non-human entities. When communities are not disentangled from their lands, then the environmental indicators, mandates from spiritual beings, and guidelines emerging within IPLC's settings are the ones that aid in decision-making to preserve nature. In other words, the information required for making decisions is not necessarily accessed through purposed observation, surveying, or measuring biophysical components of the environment, although these actions could be part of the process. Rather, valuation is often undertaken as part of a ceremony, to fulfil traditions and for educational purposes unrelated to decision-making *per se*. Valuations are conducted to celebrate life and share with human and non-human entities (which might be considered a dimension of human wellbeing), to fulfil individual and communal obligations towards nature as part of relational links, and to generate, transmit and share knowledge between community members and across groups.


**Figure 3.27. T**he main purpose of valuation in IPLC contexts as described by ILK experts based on the number of essays that mentioned these purposes.

Community members are the principal actors and influencers (see *6.1*) triggering, leading and moderating the valuation process in their communities. Other key stakeholders are other local communities, civil society, religious stakeholders, national and subnational governors, non-governmental organisations, and researchers. When valuation is an IPLC-led process, valuation experts consist of people who are trusted in the community and who have the knowledge and skills to provide reliable information about values of nature. As such, the responsibility of generating information on values can be given to specific individuals or groups depending on their role in the community (e.g., leaders, chiefs), their age (e.g., youth, elders, cohorts), gender, skills or livelihood source (e.g., farmers, hunters, healers). In collective valuation processes, all community members participate as experts to provide and collectively assess information about values.

## 3.2.4.5. Methods and approaches in IPLC valuation

### Applying the *methods families*: a western sciences perspective

The practices and approaches described by ILK experts in their essays were allocated to method families based on whether the process assesses values based on attributes of nature (nature-based valuation); or evaluates specific or broad values and worldviews based on statements and expressions (statement-based valuation) or based on direct and indirect observations of people (behaviour-based valuation). Valuation processes that combined information from more than one method family were grouped into the integrated valuation family. In many cases, it was not possible to identify a concrete method *per se*. However, descriptions of the conditions around the practice were used to identify the source of information used for the valuation and to assign a method family. *Table 3.9* summarises how descriptions provided by ILK experts were used to identify a method or approach and assign them to methods families. While this might facilitate western science understanding of IPLC valuation and make IPLC practices more conceptually available to readers, it grossly over-simplifies, omits, and most likely misrepresents the meaning and significance of the practices described.

**Table 3.9** Applying the methods families framework to the practice of valuation in IPLC contexts.

| Valuation method Family | What is assessed? | The information used to detect, characterize or assign value (value indicators) | The general approach used to obtain and assess information (valuation approach) | The specific way that values are gathered and processed (valuation methods) | Additional practices or processes that may accompany valuation process |
|---|---|---|---|---|---|
| **Nature-based valuation** | • Ecosystem health<br>• Land use change & its impacts<br>• Ecosystem capacity to provide natures contributions to people<br>• Weather (present and future)<br>• Quality and amount of resource<br>• Preparedness of nature for specific activities (planting, harvesting, migrating)<br>• Threats and risks to Nature | • Species presence and absence data<br>• Behaviours of plants and animals<br>• Location and movements of species, people<br>• Amount or quality or resource<br>• Hunting success or failure<br>• Changes over time and space<br>• Inter- and intra-species interaction<br>• Location of sacred spaces and features | • Territory Patrols<br>• Forest walks<br>• Ecosystem monitoring<br>• Ad hoc reporting by community members of nature-related information<br>• Can be collectively led, expert-led (specialized members) or cohort-led (e.g. by women, youth, elders) | • Direct observations of nature<br>• Counts of components of nature<br>• Discussions among experts (indirect information about nature)<br>• Reading the skies & land<br>• Tasting, touching, listening to nature<br>• Mapping (including mental maps) | • Ceremonies<br>• Occurring simultaneously with planning<br>• Everyday practices such as fishing, hunting, farming, talking, fetching water, building<br>• Protection of territory and resources<br>• Affirming rights and autonomy |
| **Statement-based valuation** | • Strength or weakness of relations with nature<br>• Sustainability of human-nature relations (harmony between humans-nature)<br>• Attitudes towards nature and others<br>• Nature's relations with people<br>• Threats and risks to harmony with nature<br>• Existence as a People | • Feelings that people express through statements, song, poems, stories or dance<br>• Natural phenomena<br>• Other Signs from Nature in including dreams that people describe | • Group discussions<br>• Community assemblies<br>• Interviews<br>• Rituals to gauge people's connection with nature<br>• Prayers to gauge nature's connection to people | • Dialogues<br>• Deliberation<br>• Interviews<br>• Mapping<br>• Interpretation of nature's signs (what Nature has stated)<br>• Interpretation of stories, dance and song (what people have stated)<br>• Interpretation of dreams (what nature has stated to people) | • Ceremonies<br>• Rituals<br>• Planning<br>• Decision-making<br>• Conflict resolution<br>• Teaching<br>• Community strengthening processess |
| **Behaviour-based valuation** | • Strength or weakness of relations with nature<br>• Sustainability of human-nature relations (harmony between humans-nature)<br>• Attitudes towards nature and others<br>• Nature's relations with people<br>• Threats and risks to harmony with nature | • What is consumed or appreciated about nature<br>• Whether rules and principles are adhered to<br>• How goods and services are traded<br>• Hunting or crop failure or success (nature's behaviour)<br>• What people do in the landscape<br>• Changes in traditions and practices | • Expert-led assessments by specialized individuals<br>• Communal assemblies to collectively interpret behaviours | • Observation of people and their behaviours in everyday practices and special occasions<br>• Interpretation of intentions based on what people do (or do not do)<br>• Characterization of human-nature relations based on individual or group behaviours | • Communal assessments of community harmony with nature<br>• Conflict resolution processes<br>• Evaluation and modification of Life Plans<br>• Land use planning<br>• Ceremony and convivial celebration<br>• Communal cohesion building processes |

| Valuation method Family | What is assessed? | The information used to detect, characterize or assign value (value indicators) | The general approach used to obtain and assess information (valuation approach) | The specific way that values are gathered and processed (valuation methods) | Additional practices or processes that may accompany valuation process |
|---|---|---|---|---|---|
| Integrated valuation | • Knowledge and knowledge transmission<br>• Existence as a People<br>• The meaning and reason for Life<br>• Threats to the existence of the collective<br>• Opportunities for extending existence of the collective | • Specificities in the stories<br>• Community behaviours and actions<br>• Impacts on nature and the collective | • Collective process to discuss and deliberate<br>• Ceremonies to develop and transmit knowledge<br>• Rituals to affirm identity and sense of place | • Construction and sharing of worldviews<br>• Interpretation of stories of creation<br>• Retelling of stories of origin<br>• A combination of processes embedded within one or several ceremonial procedures | • Empowerment processes<br>• Protection of Territory<br>• Enactment of Rights to self-termination and autonomy<br>• Conflict resolution |

**Valuation as tradition, ceremony and practice: an IPLC perspective**

IPLC's ways of life and their multiple human-nature and spiritual interactions with land and sea does not lend itself to delineated methods that are separate from daily and ceremonial life. Observed practices or procedures that might resemble methods associated with nature-based, statement-based or behaviour-based valuation can be an integral part of IPLC's ways of life intricately linked to their biocultural context. In this sense, these practices and approaches do not operate with a single purpose such as to collect information to support decision-making processes. Even when these practices are conducive towards decision-making settings, valuation and the decision process are not separated events; rather they are interrelated. Many practices and approaches are part of renewing relations with nature through the performing of, for example, seasonal water and food rituals and honouring landforms, plants, and animals. Some of the practices entail interpreting specific indicators emerging from nature to secure food and water for their own sustenance and the broader community; healing practices focused on the collective, family or community well-being; or consulting with deities to interpret their ancestral laws and elicit teachings to guide collective actions.

The fundamental limitation of applying the methods family approach to IPLC valuation is that it cannot fully capture and risks misrepresenting the interconnectedness of indigenous worldviews and their valuation practices. To illustrate, western scientific epistemology tends to place nature as an external object of assessment rather than as a living being that people renovate relations of respect and reciprocity with. As an external object, *methods are applied to nature* with the specific purpose to value and assess natural resources and ecosystems services to humans. In contrast, many IPLC worldviews place humanity as an inseparable part of nature and subsequently, deploy a multidimensional and intimate relationship with nature that involves cultural identity and a sense of belonging, and collective well-being (Huambachano, 2018a; Nemogá, 2019). Methods, as such, become impossible to extract from the practices, traditions and rituals that are carried out daily as part of the integral connections to the land and seascapes in IPLC's ways of life. Insisting that these practices are additional processes accompanying valuation is misleading.

For example, classifying IPLC procedures for determining physical or ecological characteristics of natural components such as soil quality or plant abundance as nature-based valuation methods, or interpreting processes of people expressing views about nature in collective gatherings and people singing or interacting through ancestral narratives as statement-based methods omits that in IPLC contexts, to speak, to listen, and/or to act upon Mother Earth would require to do so in accordance with ancestral law, values, and protocols that are localised and are not perceptible to non-community

members. Applying a strictly western science approaches to understand IPLC valuation can omit that human-nature communication is often codified in signals or actions known by the community that might be imperceptible to an outsider (IPBES, 2019c). Moreover, in many IPLC contexts direct comparisons between IPLC and non-IPLC methods (such as equating talking circles to group discussions) can be inappropriate. For example, the place selected to discuss might be suitable for the intervention of deities who transmit messages or mandates, which may lack importance in non-IPLC contexts. The inclusion and specific role of other non-humans and non-material entities is key in IPLC valuation; but this easily escapes (and can be considered unacceptable) to those who are alien to an IPLC worldview and epistemology.

**Limitations of applying the Methods Families to IPLC valuation practice**

IPLC practices and approaches can be characterised as holistic, bringing together diverse values, including those contributed by non-human and non-material agents. Not recognizing this integrity and holistic feature of IPLC approaches and practices limits the much-needed participation of IPLC in exercises of valuation of nature. Although the methods family approach is instrumental in identifying IPLC practices and procedures that resemble non-IPLC methods it presents IPLC valuation practice out of contexts; core cultural and spiritual beliefs and practices of IPLC run the risk of being excluded from valuation of nature exercises (*Figure 3.28*). Bringing together non-indigenous valuation methods and indigenous practices and approaches requires acknowledging diverse worldviews on equal footing. If IPLC are going to engage in valuation of nature exercises, co-valuation will be a respectful way to go. Co-valuation of nature, rather than integration, promotes a suitable space for bringing together multiple value dimensions and worldviews if grounded on meaningful and respectful complementarity (Šunde et al., 2018).

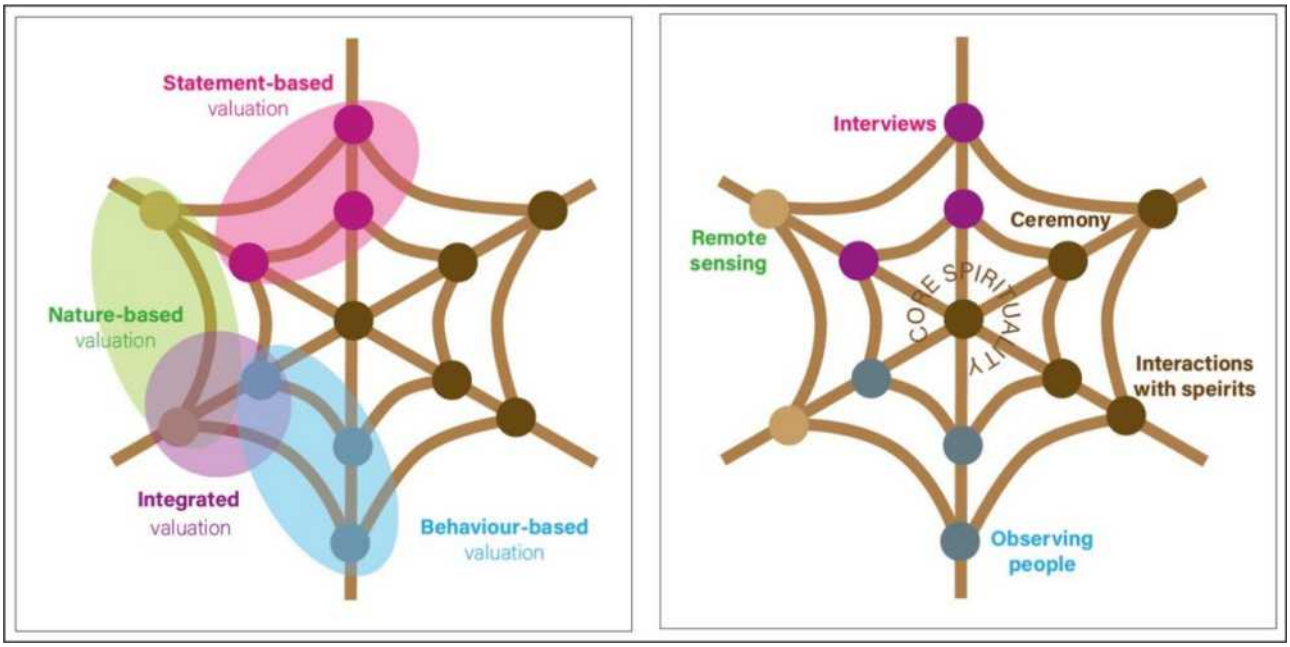


**Figure 3.28.** On the left: Visual representation of how the methods families (statement-based, nature-based, behaviour-based, and integrated) act as a selective lens to make only isolated elements of IPLC valuation visible to the IPBES audience. The structure of the web itself and each node (circle) together represent a simplified example of an IPLC worldview in which valuation takes place as a multi-faceted and on-going process. On the right: Three examples (interviews, remote sensing, and observing people) of how the method families accesses or represents elements of IPLC valuation. Two examples of integral elements of IPLC valuation not accessed or

represented by method families are ceremony and interactions with spirits. The spirituality core of the IPLC worldview is central in the figure and cannot be removed without dismantling the integrity of the rest of the web. Figure adapted from Casimirri, 2003.

The methods families are limited in their ability to acknowledge and characterise IPLC practices and procedures and how they operate within their everyday life or ceremonial relations to the land. *Figure 3.28* shows that simply filtering IPLC procedures and practices through the method family's framework does not reflect IPLC perceptions and their relationships to nature. Consequently, only the components of IPLC valuation methods that fit through the methods family filter, such as elements of nature-based, statement-based, behaviour-based, and integrated methods that are recognizable by the western perspective, will come through and be represented. Similar to what Casimirri (2003) stated regarding the integration of Traditional Ecological Knowledge (TEK) in resource management: if practices and procedures of IPLC are used only to provide data to enrich a western valuation method, even if it is interdisciplinary, it will not represent the values, neither it will serve the needs of the providers of that information.

# 3.3. Key considerations in valuation

This section outlines key considerations in the choice between alternative valuation processes to support decision-making. We outline three considerations that together can guide valuation choices: 1) relevance, 2) robustness and 3) resources. The relevance criterion seeks to draw out key considerations related to how application of valuation methods and approaches can make different types of values visible for decision-making in diverse contexts. The relevant methods and approaches are those that provide information on the values that matters for a given decision-making situation. The robustness criterion includes how methods can generate reliable information and fairly represent values of a broad range of stakeholders. The resource criterion relates to the resource needs involved in the application of valuation methods and approaches in terms time, financial resources, data availability, human resources, and technical capacities.

## 3.3.1. Relevance of the valuation

The section has three components, the first considers how different goals for valuation also render different types of valuation relevant. The second aims to bring evidence together on how valuation has included different forms of knowledge systems and worldviews and in particular indigenous peoples and local communities' principles in valuation. The final section provides the evidence on how plural valuations aim to bring the different types of values together into a common framework or support for decision-making.

### 3.3.1.1. Counting what counts: societal goals of valuation

Valuation seeks to support decision-making by addressing overarching societal goals. We group societal goals into four main goals to evaluate the extent to which valuation applications provide evidence to inform decisions about the consequences of interventions to human well-being, ecological sustainability and justice, as well as a more holistic integrated goal, based on IPLC worldviews. Enabling decision-making to improve human well-being is a key intended goal that valuation seeks to achieve (e.g., Guerry et al., 2015; Keeler et al., 2012; Kenter, 2016; Rendón et al., 2019). Different valuation approaches use different concepts to measure human well-being, including quantitative and qualitative indicators (Bernues et al., 2014; Busch et al., 2012; Walz et al., 2016).

The concept of *human well-being* is used as an equivalent to a "good quality of life" at individual, household or community level in line with the IPBES conceptual framework (Díaz et al., 2015). Empirical studies may use several measures of well-being (Dawson & Martin, 2015). Applications often assess one or more of the diverse *items* that are considered important for a good quality of life, e.g., health (mental and physical), food, education, living standards (such as housing conditions, ownership of assets, access to drinking water and electricity, etc.). Sometimes these are combined into composite indicators of well-being (McGillivray & Noorbakhsh, 2007). Other valuation applications assess subjective well-being defined as *'fulfilling one's virtuous potentials and living as one was inherently intended to live*' (life satisfaction, happiness, optimism about one's future etc.) (Diener et al., 2002). Economic valuation methods tend to be based on the theory of utilitarianism and assess changes in utility as a result of a change in nature or biodiversity (Tinch et al., 2019). Other studies do not measure well-being directly, but use livelihoods as a measure and assess the dependence on land and natural resources as an indicator of how human well-being depends on nature (Gobster, 1999).

Valuation also seeks to inform decision-making about the impact of changes in nature by measuring *preferences or importance assigned to (changes in) nature and biodiversity* protection or utilisation. Valuations use different well-being indicators in this type of valuation such as willingness to give up

access to land or other resources to protect nature (Lliso et al., 2020) or willingness to pay to protect nature or improve ecosystem services (Meyerhoff et al., 2009), while others are rankings of relative importance of aspects of nature and biodiversity (Martín-López et al., 2012) or qualitative indicators of importance linked to nature, biodiversity and well-being (Durie, 2001; Harmsworth et al., 2011; Huambachano, 2018). Finally, *costs* associated with protecting nature and biodiversity or maintaining nature's contributions to people, of either past or future projects are used as (second-best) approximations of how important and valuable nature and biodiversity are to people (e.g., Marre & Billé, 2019; Schleiniger, 1999; Schröter et al., 2014) (*see 3.2.2.3*).

Providing information to achieve a higher level of *ecological quality* is also an important focus of valuation (*see 3.2.2.1*). Valuation can be aimed at assessing whether the use or management of nature and nature's contributions to people is done sustainably regarding the carrying capacity of the ecosystem considered (Gobster, 1994). Ecological sustainability here refers to the capacity of an ecosystem to support the ecological processes required to deliver nature's contributions to people for present and future generations (Costanza, 1999; Opdam et al., 2006). Three sub-criteria were selected to give insight on how valuation applications provide information about ecological sustainability:

- ***Ecosystem condition*** refers to (aspects of) the ecosystem of the natural world *regardless of their use, services for or contributions to* humans. Although this includes conservation-related biodiversity values or ecosystem regulation studies from biocentric or ecocentric perspectives, which *relate* to humans, such applications are still about *how the ecosystem itself is doing.* Related concepts include ecosystem health, healthy functioning of ecological processes, resilience of ecosystems, response to perturbation, naturalness, biodiversity (not related to human use), threatened species, extinction risk, degradation, impacts of drivers on the ecosystem, etc. Measuring ecosystem condition is considered an essential component of any assessment of the ecological impact of use or management.
- ***Ecosystem capacity*** refers to the *potential or actual delivery of ecosystem services/ contributions to people* (Opdam et al., 2006). It also includes biodiversity studies which refer to human utility, e.g., biodiversity assessment of rainforest patches for pharmaceutical exploration, or biodiversity of grassland species related to nutritious value for cattle. It does *not* include studies of just the benefits to people without assessing the ecosystem. Related concepts include ecosystem service potential, stocks, ecosystem service supply, flow, delivery, use, nature's contributions to people, viable populations of "useful" species (habitat suitability), biodiversity (related to a human use, functional biodiversity), quantity or quality of natural resources (related to a human use), etc.
- ***Sustainable use and management of ecosystems*** both require combining aspects of ecosystem condition with aspects of ecosystem capacity, including an aspect of impact of management or use on this condition. These concepts however differ. *Sustainable use* implies meeting human needs without compromising the health of ecosystems (Callicott & Mumford, 1998; United Nations, 1987); whereas *sustainable ecosystem management* is about restoration and maintenance of the ecological structure and function of ecosystems and preservation and enhancement of the health and diversity of species and ecological communities (Gobster, 1994; Harmsworth et al., 2011). Related concepts include ecological thresholds, boundaries, tipping points, maximum sustainable yield or harvest, carrying capacity for human use, restoration, conservation effectiveness, etc.

**Justice** as an objective in environmental policy can be considered in valuation either in terms of fair distribution of benefits or burdens of policies (distributional justice). It is in this meaning that we consider justice in this section. Just valuation is also important in terms of how to achieve more fair valuation processes (procedural justice). How valuation considers recognition of different value systems (recognitional justice) is the topic of *Section 3.3.1.2.*

**Distributive justice** concerns the fair distribution of costs or losses and benefits or gains, i.e. the outcomes of policies (McDermott et al., 2013). The evaluation assessed whether applications provided evidence of **intragenerational** justice, i.e., the distribution of ecosystem services/ nature's contributions to people wealth and resources (gains and losses) *within one generation*, and **intergenerational** justice, i.e., the distribution of ecosystem services/nature's contributions to people wealth and resources (gains and losses) *across generations*. In the review of applications, information was collected about how distributive justice was assessed, for example through disaggregation (across generations or stakeholder groups), inequality indices, or perceptions of distributive justice and needs of future generations.

From the systematic review it is clear the ecological quality in terms of its importance both in itself and to contribute to people is by far the most prominent goal that valuation seeks to inform (*Figure 3.29*). Assessing human well-being more directly is the primary goal of approximately one third of valuations, whereas evidence on the assessment of distributional justice is relatively scarce (*Figure 3.30*).

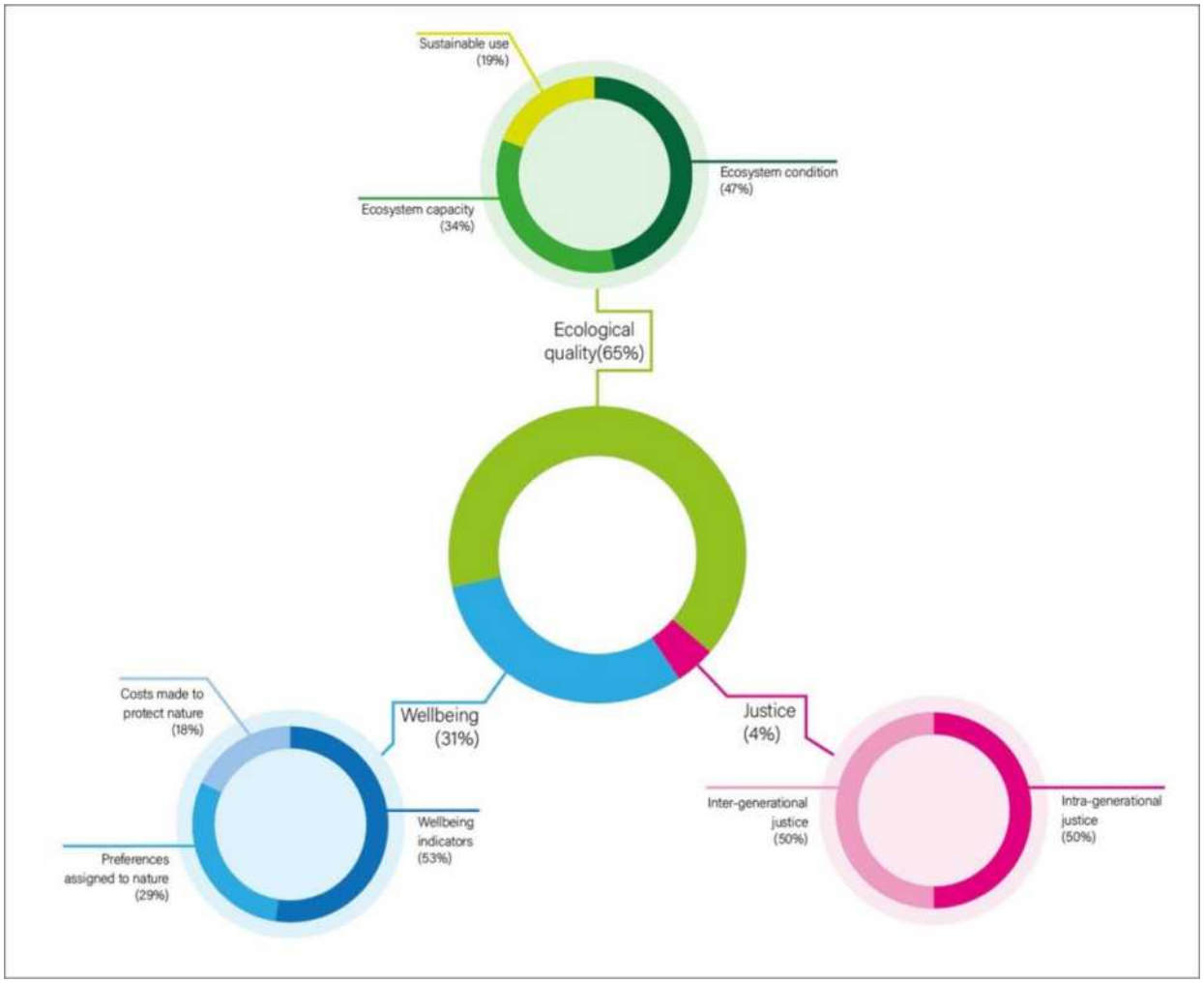


**Figure 3.29.** The stated goals of valuation and the approaches to target these (systematic in-depth review n=1163). Note that goals often overlap, and that this abundance is based on the valuator's interpretation on what is assessed.

The review shows that the goal of the valuations relying on nature-based valuation methods is largely to assess ecosystem capacity and condition as well as sustainable use but that they also often report on wellbeing indicators as part of the study (*Figure 3.30*). Valuations using statement-based and

behaviour-based methods as the main approach to elicit values predominantly aim to assess wellbeing through wellbeing indicators, preferences and costs to articulate values of nature. However, these methods also often have an explicit goal to improve biophysical properties of nature (*Figure 3.30*) Integrated valuation to a larger extent has a mix of expressed intended goals of the valuation.

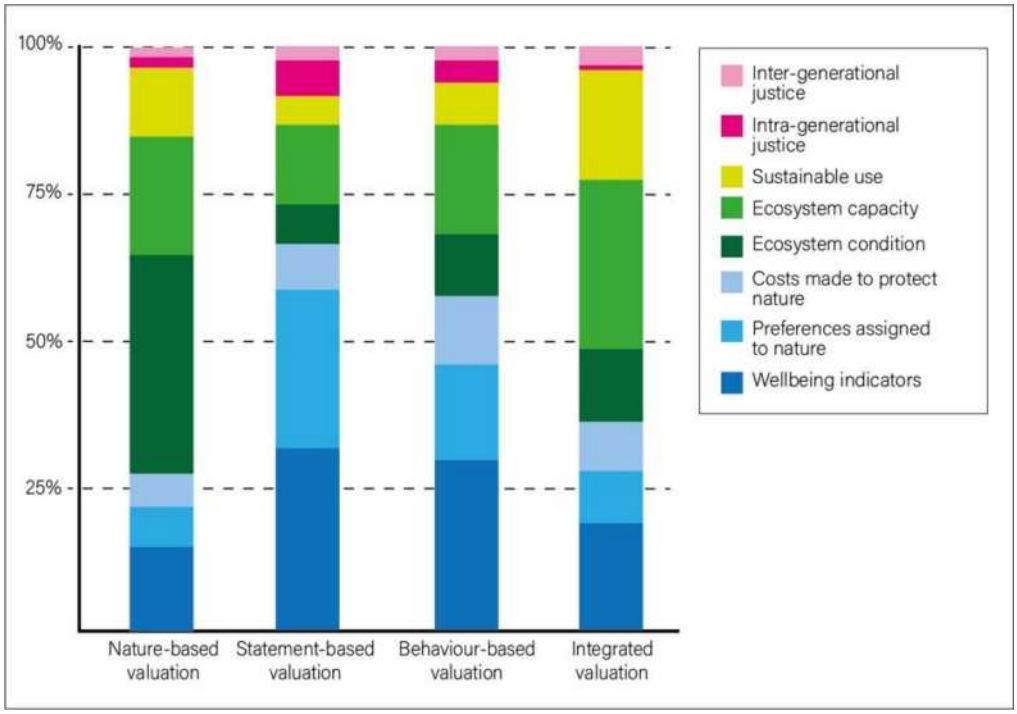


**Figure 3.30.** The stated goals of valuation and the approaches to target these (systematic in-depth review n=1163) associated to methods families. Note that goals often overlap, and that this abundance is based on the valuator's interpretation on what is assessed.

Valuations explicitly assessing distributional justice are less abundant in the literature than valuations assessing other societal goals (see above). However, the evidence of the importance that people place on fairness as a broad value underpinning specific values of nature is important for assessment of the capacity of methods reviewed in *Section 3.2*. It is well evidenced that lower distributional fairness is associated with, for example, lower social welfare and negative health effects (Wilkinson & Pickett, 2009). Additionally, it has also been well demonstrated that people have preferences for more equitable outcomes and do regard the welfare of others in their preferences and behaviour (Gsottbauer & van den Bergh, 2011; Johansson-Stenman & Konow, 2010; Konow, 2010; Nyborg, 2000). There are different methodologies available in valuation to assess how people value fairness, in terms of the distribution of benefits, resources, opportunities, or rights. This holds for both intergenerational and intra-generational distribution.

Ex-ante studies aim to understand such social preferences, including altruism and distributional preferences. It is well established that participants in statement-based methods, including choice experiments and contingent valuation studies, are willing to pay to protect biodiversity and conserve nature for future generations (such values are sometimes labelled 'bequest values') and for current generations living in other locations to enjoy even if they cannot enjoy these themselves (altruistic non-use values) (Nobel et al., 2020; Oleson et al., 2015; Subroy et al., 2019).

In other valuations using statement-based methods (focus groups, questionnaires, choice experiments), stakeholders are directly asked about their preferred distributional rules, such as who

should get the highest payments in payment for ecosystem services schemes (Martin et al., 2014); whether to ask higher payments from richer citizens to support poorer citizens (Rodríguez & León, 2004); how to allocate agricultural subsidies across farmers (Rocamora-Montiel et al., 2014); or how to distribute climate change mitigation efforts (Carlsson et al., 2011, 2013) or payments for air quality improvement and carbon taxing (Dietz & Atkinson, 2021) across different countries. This approach is also used to assess how people would prefer to distribute environmental benefits over time out of intergenerational equity concerns (Spyce et al., 2012). Another approach is to ask respondents in questionnaires how likely they are to contribute to fairer allocations, for instance by buying organic products with different profit distributions in the value chain (Chang & Lusk, 2009). These valuations regularly find that people opt for some level of fairness in distribution, but according to different principles: sometimes by allocating across a larger group, sometimes by allocating funds to those who need it most, to those who are least responsible for the environmental problem at hand or contribute most to better outcomes. However, the number of studies that focus on environmental valuations is small and many valuations fail to consider distributive justice (Garmendia & Pascual, 2013). An important knowledge gap for sustainability-aligned policies is the lack of empirical studies that assess how different users/stakeholders value different gains and losses in seeking a fair allocation in progress towards their multiple and sometimes conflicting objectives (Forsyth & Sikor, 2013).

Another set of experimental studies using games, where participants are asked to share resources with others, has extensively shown that moral norms and fairness concerns affect people's distributive behaviour (Andreoni & Bernheim, 2009; Cappelen et al., 2007; Dreber et al., 2013; List, 2007), and that people are averse to inequity (Fehr & Schmidt, 1999). However, while these preferences are well evidenced in lab and field settings, such evidence in the context of valuations of ecosystem services/ nature-based solutions is sparse.

Furthermore, ex-post studies assess the distribution of gains and losses across stakeholders by disaggregating findings across these groups, such as the gains of protected areas for tourists against the losses of local communities in access to resources and spiritual places (van Beukering et al., 2003). Other studies focus on the gains and losses along the value chain (Ribot, 1998). Again, while it is widely acknowledged that such disaggregation is important for sustainable solutions, the evidence base of studies that do so is small.

### 3.3.1.2. Recognition of diverse knowledges and worldviews

In socio-environmental justice, recognition consists of: 1) acknowledging the existence of other ways of life, different ways of knowing, and different ways of generating knowledge, and 2) respecting those differences (Schlosberg, 2007). For this assessment, valuation practices were assessed for the extent to which they acknowledge and respect different ways of knowing and valuing nature and recognizing the different worldviews that underpin variations in knowledge systems. Recognition was used to assess whether valuations reproduce the societal structures that contribute to social injustices in the form of lack of respect, discrimination, and domination across social fault-lines such as gender, sexuality, and ethnicity (Martin et al., 2015).

**Consideration of diverse knowledge systems in valuation**

Most valuations that are published in scholarly outlets are conducted by academics or researchers including students, hence most of the knowledge that informs valuation originates from academia, albeit from different disciplines (*see 3.2.1*). Almost 30% of valuations rely, incorporate, or - at the very least - acknowledge knowledge other than that from academia such as, lay and experiential knowledge, indigenous and local knowledge, technical knowledge (excluding academic) and policy knowledge (i.e., knowledge that generated and maintained in the policy domain) (*Figure 3.31*).

Valuations that interact directly with knowledge holders from extra-academic domains invariably recognise other knowledge systems, at least implicitly if not explicitly. Specifically, participatory valuation approaches depart from the notion that the knowledge and experiences of others is valuable to the valuation exercise. Nonetheless, knowledge systems that inform valuation are not explicitly acknowledged in reports or given equal importance. The low explicit recognition of other knowledge systems risks perpetuating existing dominance of academic knowledge.

Approximately 41% of reported valuations were explicit about the types of knowledge that informed their studies. In the case of indigenous and local knowledge and the knowledge of other marginalised groups, 8.9% of the studies referred to ILK, and this is even though only 2% of the studies had been conducted in the territories of indigenous peoples and local communities. Lastly, 8.1% of the studies referred to lay and experiential knowledge, such as that which is generated and held by consumers, citizens, or more broadly, the "general public" (*Figure 3.31*).

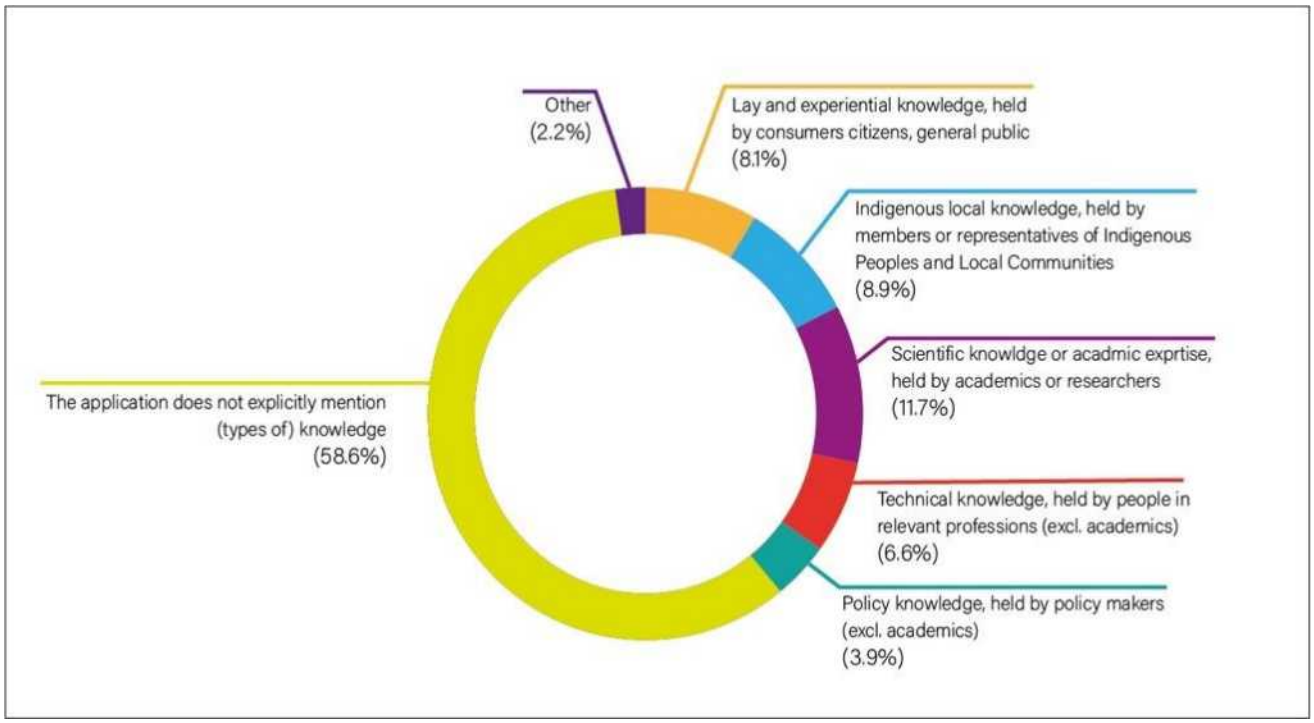


**Figure 3.31.** Proportion of valuation studies that mention reply of different types of knowledge (n = 1163).

**Consideration of indigenous people and local communities' principles in valuations**

Reciprocity, generosity, altruism, kinship, self-determination, and self-governance are key guiding principles in many Indigenous Peoples' way of life. Valuation studies were assessed to determine the extent to which all or some of these principles are acknowledged in the work that is reported. Only

13% of the studies mentioned at least one of the principles; principles associated with respect towards nature, care for the land, and self-determination and ancestral law were the most common (*Figure 3.32*). Not all studies where the principles occurred were necessarily conducted in the IPLC territory or communities, suggesting that some of the principles (particularly care for the land and respect towards nature) guide other non-IPLC societies. The principles of stewardship, altruism, and guardianship have been used to explain caring behaviours towards nature in non-IPLC societies such as recycling, volunteerism and giving to donations (*Figure 3.33*).

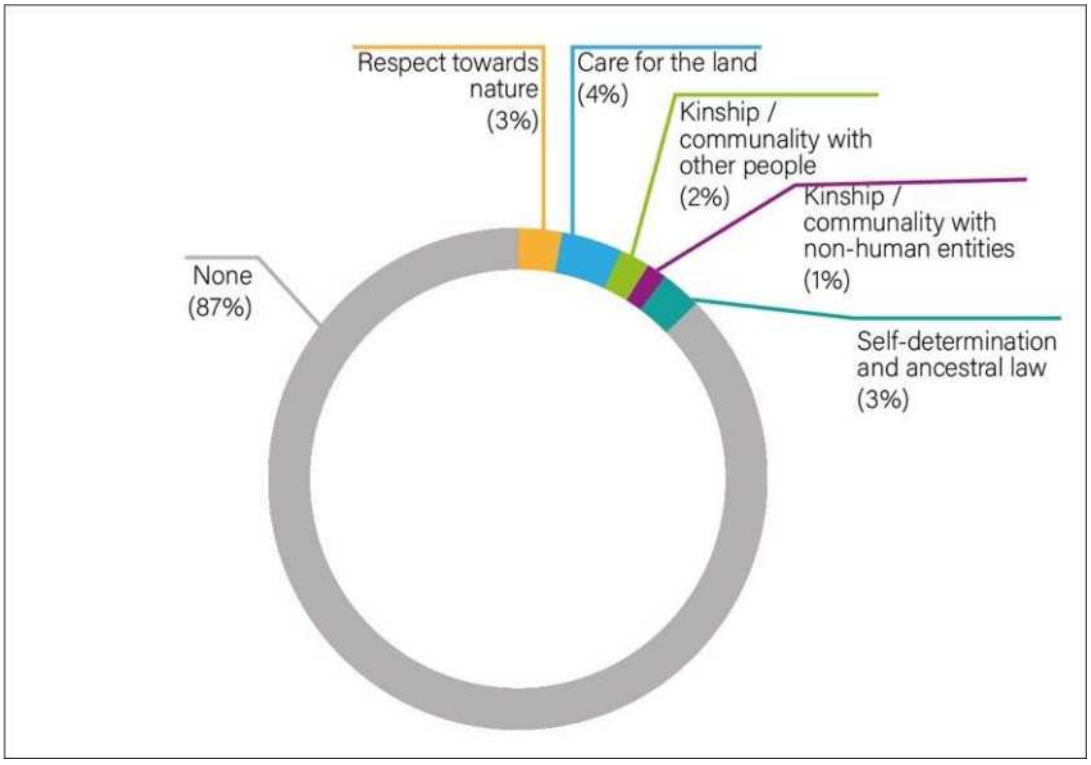


**Figure 3.32.** Proportion of valuation studies that mention key IPLC principles guiding their relations with each other and with nature (n=1163).

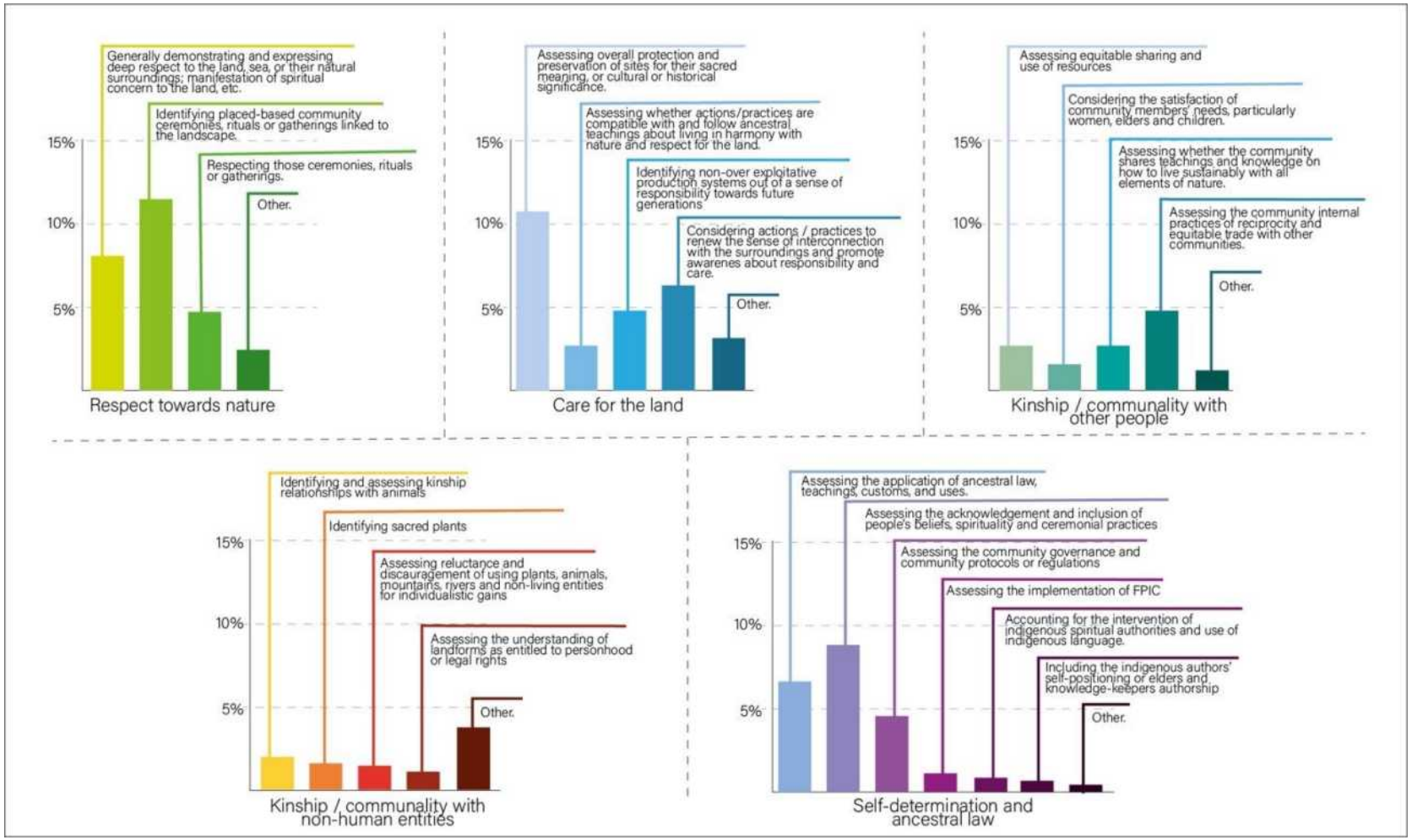


**Figure 3.33.** Recognition of broad principles across all valuations (n=1163) The levels indicate the proportion of valuations that assessed or identified elements of five principles that guide IPLC's relations to nature. Note that these also include the valuations not related to IPLC territories or communities.

**Emerging methodologies to address low recognition of other knowledge systems**

Indigenous scholars and scholars from other marginalised groups are developing new and hybrid research methodologies that build on their philosophies and knowledge systems and follow their own processes of validation. This growing field offers opportunities for indigenous and other scholars to develop valuation methods that are better suited for IPLC contexts and which respect and promote their culture, traditions and values. There is a small but growing body of indigenous scholarship that is raising awareness to the broader scientific community in understanding indigenous cosmovision/worldview (see examples in *Annex 3.12*).

## 3.3.1.3. Plurality in valuation

**Plural valuations elicit and integrate diverse values**

Many valuation applications aim to make *diverse values* explicit in a joint valuation process. Value diversity is fully embodied within the IPBES conceptual framework (Díaz et al., 2015a) where three main value dimensions are considered: (1) values directly linked to nature itself (including biodiversity and ecosystem structure and functioning); (2) values derived from nature's contributions to people (including ecosystem services) (Pascual et al., 2017) ;and (3) values more directly linked to good quality of life (see *3.3.1.1*). In the values assessment, the value typology is further broadened, detailed and developed (see *Chapter 2*). An important distinction is made between broad and specific values. *Broad values* refer to the underlying perspectives, worldviews and life value frames which underpin a potential valuation. A valuation which considers several of these broad values (e.g., considering economic considerations and IPLC perspectives in the study), is a plural valuation in the broad sense (*Figure 3.34*). *Specific values* are for instance as components of biodiversity, types of nature's contributions to people and indicators of quality of life (see IPBES, 2018). A valuation which considers several specific values has a high specific plurality (*Figure 3.35*). Most valuations account for some degree of plurality, but only a minority of valuation can be considered highly plural, either in a broad or specific sense. 75% of the 1163 in-depth reviewed valuation studies focus on more than one type of value related to different aspects of nature, its contributions to people and a good quality of life yet, only 10% address more than one life frame of nature's values (i.e., living from, with, in and as nature). Figures below depict the abundance of valuations over aggregated levels of plurality for specific (Figure 3.34) and broad (Figure 3.35) aspects.

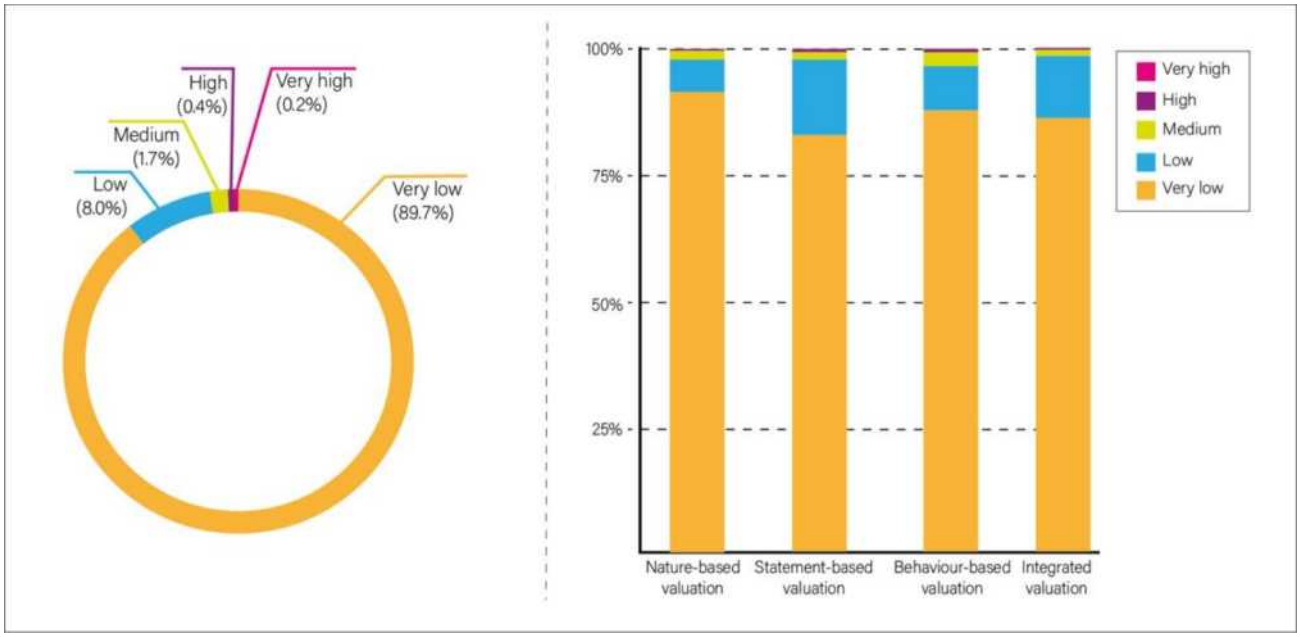


**Figure 3.34.** Level of broad plurality of valuations (n=1163, right: relative per method family). The levels indicate the number of life value frames, Total Economic Value main categories and IPBES value dimensions. Very low: valuation considered from the perspective of a single life value frame, Total Economic Value category and value dimension. Very high: three or more value frames, Total Economic Value main categories and IPBES dimensions are considered.

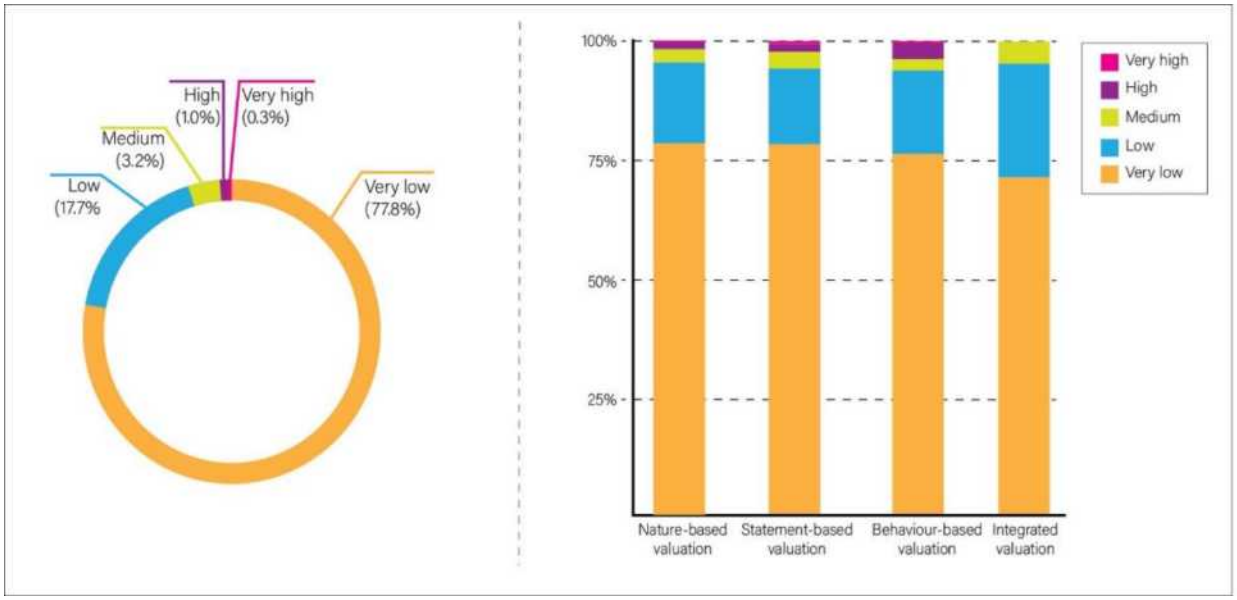


**Figure 3.35.** Level of specific plurality of valuations (n=1163, right: relative per method family). The levels indicate the number of value targets considered in the valuation. Very low: valuation targets less than 5 components of biodiversity, nature's contributions to people types and aspects of quality of life. Very high: valuation targets at least 25 components of biodiversity, nature's contributions to people types and aspects of quality of life.

Our review recorded if and how applications bring diverse values together. In practice, 56% of valuations do not bring different values together. 17.4% of plural valuations consider diverse values

as comparable and sum them in a single summed unit. 7% applies some weighting between value types assumed to be compatible, and 12% keeps value types separate or in bundles to inform decision-making (*Figure 3.36*).

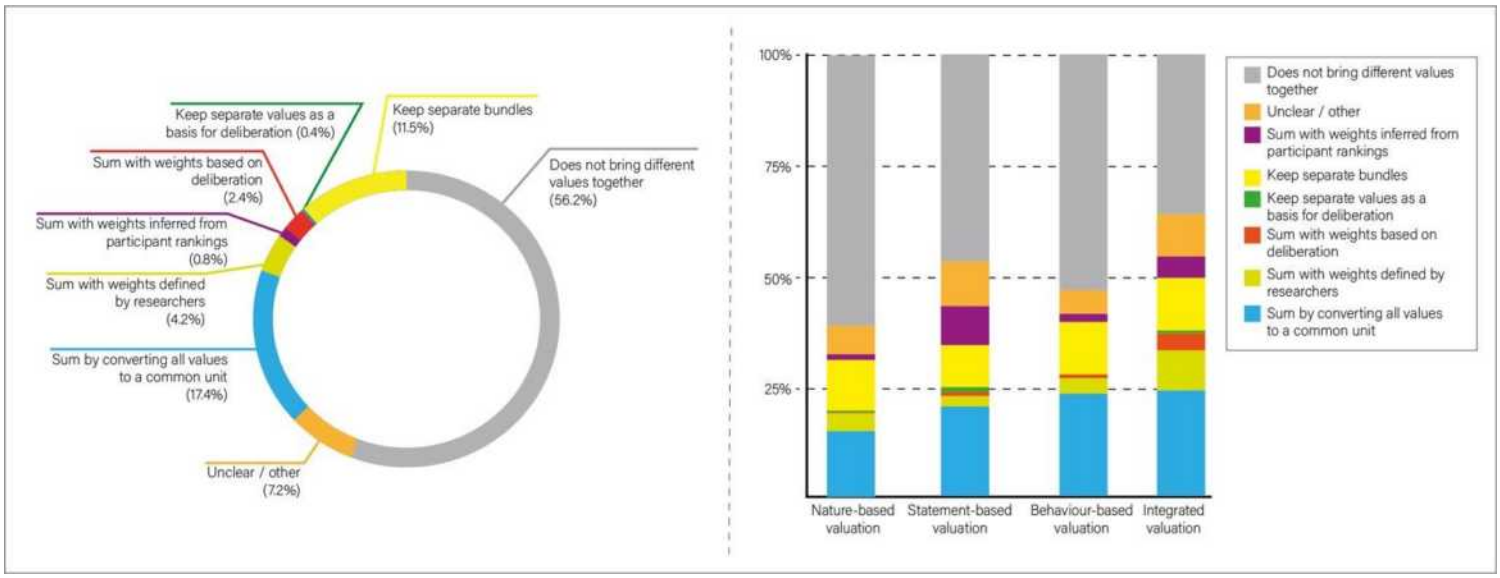


**Figure 3.36.** Ways in which valuations have combined different value types (n=1163, right: relative per method family).

Deliberation has also been suggested as a useful process in valuation where decisions involve multiple value types: it is seen as a legitimate approach to bringing diverse values together in a joint decision process to arrive at a consensual decision (Raymond et al., 2014; Vatn et al., 2011). Incommensurability debates have also had implications for the technical tools proposed to evaluate policy proposals. In particular, multi-criteria-based valuation methodologies have been advocated to enable some relaxation of the assumption that value commensurability underpins conventional valuation approaches (Munda, 2004; Spash, 2008). Furthermore, multi-criteria methods have been more applicable in a wide range of situations where economic estimates have not been available and infeasible/impossible to estimate for many of the relevant impacts.

**Plural valuation in practice**

Some single valuation methods can identify diverse values to some degree, yet specific methods exist to elicit use, non-use and option values, various contributions of nature, aspects of biodiversity and quality of life; but also, broad values related to life frames of nature's values, dimensions such as instrumental, intrinsic and relational, and IPLC principles.

Capturing a richer diversity of values in valuation can thus be achieved by combining several complementary methods. The use of multiple methods requires careful consideration, since their underlying assumption and disciplinary origin can make some methods incompatible with one another. Despite the wide range of methods available, most valuations only apply one main method, and combinations mostly have methods from the same discipline. 77% of the valuation studies use one main method or a combination of approaches within the same method family. On the other hand, many ‘additional methods’ are applied to broaden the scope of a main method. While these are not standalone methods and often embedded in the protocols of the main method, they complement the main method to achieve a certain degree of plurality. Examples are the use of a biological diversity map alongside observations of recreation patterns, or the deliberative process applied to design a

population-wide survey. In practice, consulting experts from different disciplinary backgrounds can help select the appropriate method mix to produce results which are relevant to the decision at stake.

Mixed method approaches however are demanding regarding skills, resources and time. The choice to increase investment in the valuation process depends on the complexity and stakes of the valuation context: high stakes and high complexity justify investing in a more complex and demanding valuation. The operating space for valuation is determined by risk and parsimony (*Figure 3.37*). Underinvestment in valuation risks to misinform decisions and produce adverse effects. Parsimony on the other hand advises against using more resources and time than justified by the benefits or losses at stake. Note that for choices of low complexity and stakes, no explicit valuation might be needed at all, and for medium complexity and stake, often a simple valuation might suffice.

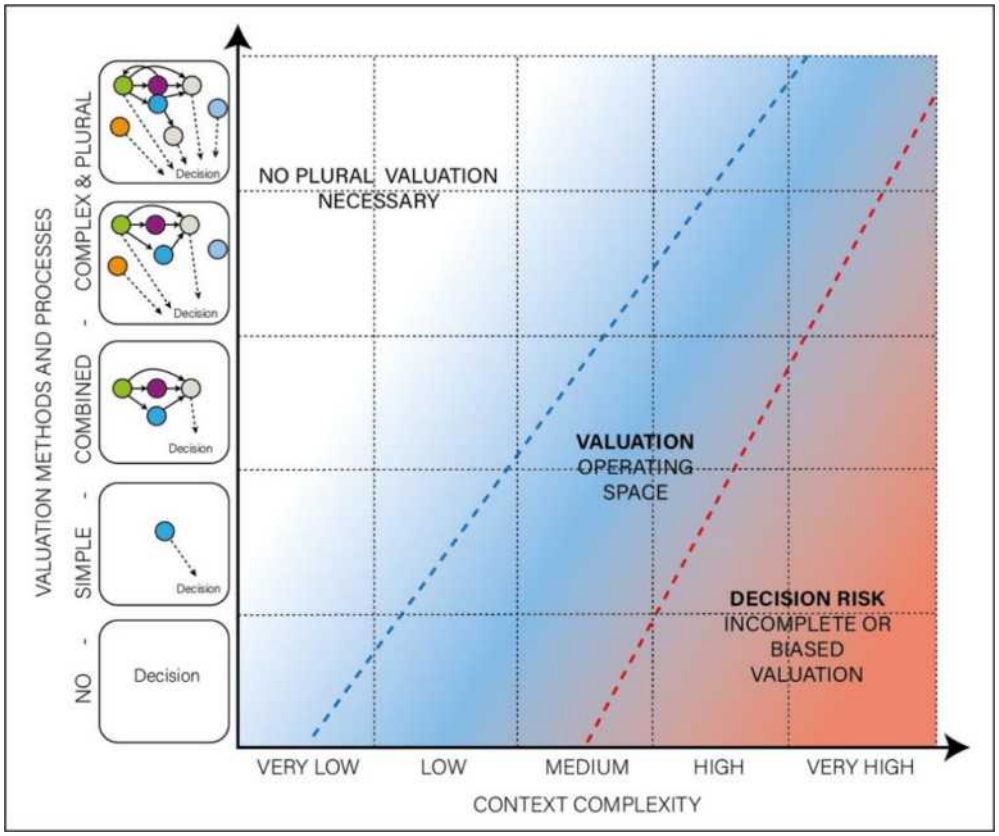


**Figure 3.37.** The valuation operating space: valuation methods and processes from 'none' to 'plural' as a trade-off between decision risk and resources spent on unnecessary valuation.

## 3.3.2. Robustness of valuation

In valuation, robustness is a multi-dimensional criterion that includes how methods can generate *reliable information* and *fairly represent values* of a broad range of stakeholders. The reviews on valuation methods undertaken in this chapter highlight that valuation experts have different perspectives on how to improve the robustness of valuation outcomes. The different perspectives offer insight to the development of valuation going forward but disagreements about what reliable information is may also hinder the use of valuation in decision-making.

In particular, the evolution of statement-based valuation has focused on improving methods to generate more reliable valuation outcomes mainly by improving elicitation procedures (see *3.3.2.2, 3.2.2.2*). This has resulted in widely available best practice guidelines for use in decision-making

procedures. Other methodological developments have focused on improving robustness in terms of inclusion of stakeholders and procedural justice which has contributed to the development of more participatory and deliberative methods (see *3.3.2.2*). Given that both insufficient reliability of information and poorly described procedures for stakeholder involvement can hinder use of valuation in decision-making, efforts are needed to develop methods and best practices for improving both dimensions of robustness simultaneously.

### 3.3.2.1. Reliability in valuation

It is relevant to know how reliable and valid the evidence produced by different valuation methods/approaches is. The stronger the evidence, the more useful it may be for informing decision-making. The evaluation here recognised that different reliability and validity criteria exist for different types of methods and approaches and that they differ across disciplines.

This topic has three criteria in the assessment: reliability and internal and external validity (Bishop & Boyle, 2017; Drost, 2011; Golafshani, 2003). Given the limited available testing in valuation applications of reliability and validity (Lautenbach et al., 2015; Rakotonarivo et al., 2016), the evaluation asks whether applications assessed different forms/tests of reliability and validity, but not whether the results are deemed reliable or valid.

- **Reliability** (sometimes called dependability in qualitative studies) refers to the quality of valuation measurements (Franklin et al., 2010; Rakotonarivo et al., 2016; Schwandt et al., 2007). This is often evaluated by the consistency of measures and degree to which a valuation method/instrument provides similar outcomes each time it is used under the same conditions with the same respondents/participants. Three forms of reliability were included in the evaluation: replicability, consistency and precision. *Replicability* or repeatability of results can be established through test-retest studies, and inter-rater or inter-observer reliability. replicability was reported in 11% of the reviewed valuations. *Consistency* is about showing that the valuation findings are maintaining an accepted standard over time, space, or groups. Consistency was reported in 7% of the reviewed valuations. *Precision* is a measure of variation among observations. Examples of indicators of precision include how scatter are results, heterogeneity, spread, variance, and standard deviations/errors (accuracy is considered a different concept than precision). Precision was reported in 46% of the reviewed valuations.

    - **Validity** is about the extent to which a valuation method accurately measures what it is supposed to measure and performs as it is designed to perform (Rakotonarivo et al., 2016). This can be split into internal and external validity. **Internal validity** refers to the validity of causal implications of a valuation study. Sub-criteria used for internal validity include credibility, construct validity, content validity, criterion validity, and community validity. *Credibility* (as a validity test for qualitative studies) is about the confidence in the "'truth" of the findings and can be established in different ways such as by triangulation, prolonged engagement, or member checks (test whether results are discussed with the study participants). *Construct validity* (also called theoretical validity) refers to the degree to which a valuation method/approach assesses/measures what it intends to measure according to (theoretical) constructs or concepts on which those methods are based. For example, willingness-to-pay measures are theoretically expected to vary with income. *Content validity* refers to the degree to which the method is designed to measure what it is supposed to measure when it performs well. For example, do respondents understand the questions that the researcher wants to ask so that they can provide meaningful answers? *Criterion validity* (for quantitative

studies) is the comparison of measurements or observations against a *true* measure. For example, how do stated preferences from hypothetical markets compare to preferences in real markets (hypothetical bias), or how do the results of a hydrological model compare to measurements done on the ground (for example of water flows volume). Accuracy is a validity indicator and is about measuring what the method is aiming to measure (the *true value*), and some studies do an accuracy assessment. Finally, *community validity* (which is especially relevant in IPLC contexts) is used when the outcomes of a valuation approach are regarded as acceptable evidence if the findings are adequately shared and approved by the subjects of the valuation exercise. Information on internal validity was reported in 48% of the reviewed valuations.

- **External validity** refers to the ability to generalise the results of the valuation application to other settings. This is assessed according to two sub-criteria: transferability and generalisability. *Transferability*, here defined in a way applicable to qualitative studies, is assessed when an application shows that the findings have applicability in other contexts or settings, i.e., other times, settings, situations, and people. *Generalisability*, more used in quantitative studies, refers to the extent to which the results can be generalised from a sample to a population. Information on external validity was reported in 19% of the reviewed valuations.

**Reliability in IPLC valuation**

The "belief system" or worldview of the evaluator determines what they consider as robust methods and robust results and this varies across valuation purposes. For example, the robustness of ILK and IPLC methods and practices is often questioned and undervalued outside the IPLC contexts, unless the results match those of scholarly or academic valuation methods (Casimirri, 2003; Chilisa, 2020; Smith, 2012). Concepts of *what is evidence* (or what counts as truth) vary across disciplines, across actors, across cultures and belief systems (*Box 3.5*). In the review, the criteria for reliability in IPLC contexts, has complemented the reliability criteria outlined above. These include whether valuation experts have the skills (training) and experience (age and practice) to undertake valuation correctly to produce reliable information, whether they are familiar with the teachings and traditions of the community, and whether they are trustworthy individuals (character and reputation).

For valuation to be useful and trustworthy to those who rely on the information that it generates and the conclusions that it draws, IPLC subject the valuators and the valuation process to different reliability criteria. These criteria safeguard the robustness, relevance and reliability of valuation. A total of 169 excerpts contributed to characterising the validation process and standards of valuation[28]. From these, the following could be discerned:

- Only information that comes from a validated and trusted source is useful.
- Heritage is an important determinant of legitimacy to undertake valuation.
- Time spent in the community and years of experience (age) are key factors that are considered.
- Inheritance and background can endow some members specific sets of abilities that allow them to access or retrieve certain types of knowledge, such as that of seers and healers who can serve as intermediaries between humans and non-humans

[28] Analysis of contributions on values and valuation methods by ILK experts and holders (https://doi.org/10.5281/zenodo.4404612).

- Information coming from leaders is also trusted. Legitimate leaders usually fulfil many of the other criteria of trust: heritage, inheritance, skills, and age; and
- The character and reputation of those entrusted with validation is also a key factor.

Importantly, the evidence acquired from valuation is usually subjected to discussions and deliberations with the collective or among different members of the community before it is used to inform decisions (e.g., '*Valuation of nature is undertaken based on observation of resources followed by a decision agreed by chief and his people. The valuation exercise involved the chiefs, community leaders and land-owning groups*' (Contribution 20)).

### 3.3.2.2. Reliability controversy in statement-based valuation

The reliability of results from stated preference valuation have been under scrutiny and many of the lessons learned from the debate related to this also provide valuable information on how to improve other statement-based valuation methods (e.g., Rakotonarivo et al., 2016). The debate has mainly been related to the elicitation of non-use values (also often referred to as passive use values). These values refer to the values that people may assign to nature without any current or future planned use directly or indirectly. Simply knowing that e.g., some particular species exists may be of value to people. Such values have been termed existence value and their importance have been acknowledged for more than half a century (Krutilla, 1967; Weisbrod, 1964). Another non-use value component is motivated by the desire to preserve biodiversity for the sake of other people, either in current or future generations (Loomis, 1988).

It is broadly acknowledged that non-use values are likely to constitute a significant proportion of the values related to biodiversity conservation and protection of nature's contributions to people, e.g., (Hanley & Czajkowski, 2019; Johansson, 1992; Johnston et al., 2003; Richardson & Loomis, 2009; Turner et al., 2003). Hence, omitting non-use values from valuations to support policy decisions affecting nature and biodiversity underestimate the importance that people attribute to conservation action.

The use of stated preference methods has increased over the past 30 years, and they are now the most commonly used economics-informed environmental valuation methods (Hanley & Czajkowski, 2019). However, the methods have been subject to a lot of controversy, most of which revolves around the hypothetical nature of value elicitation. For instance, it has been shown that people often exaggerate their willingness to pay in hypothetical situations compared to what they are actually willing to pay in real situations (Harrison & Rutström, 2008; List & Gallet, 2001; Murphy et al., 2005). This is referred to as "hypothetical bias". In the context of stated preference surveys, as well as in any other methodology relying on people's statements, people may deliberately overstate or understate their actual values, aiming to influence the decision-making process in their desired direction (Bennett & Blamey, 2001; Hanley & Barbier, 2009).

Another criticism of stated preferences methods, usually by economists, has been that the decision behaviour of individuals participating in statement preference studies is often found to diverge from the standard neoclassical economic theories underpinning consumer choice theory and welfare measurement. However, more recent developments in behavioural and experimental economics have highlighted that models of economic decision-making can be improved to include a broader range of dispositional, social and cognitive factors (e.g., Dessart et al., 2019). Particularly in relation to biodiversity, individuals may state high values due to moral or ethical beliefs, for instance, because it makes them feel good to signal a high value, or because they find it ethically unacceptable to trade-off biodiversity for money (e.g., Blamey et al., 1999; Johansson-Stenman & Svedsäter, 2012; Kahneman & Knetsch, 1992; Nunes & Schokkaert, 2003). While the former would reflect strategic

answers (since they do not actually expect to pay), the latter can be considered as a form of protest towards ascribing economic values to biodiversity. Also, it is often found that participants in stated preference surveys are apparently willing to pay some specific amount for nature protection initiatives, regardless of how much additional nature protection they are actually evaluating (e.g., Diamond & Hausman, 1994; Kahneman & Knetsch, 1992; Ojea & Loureiro, 2011). While these different types of "anomalous decision behaviour" are often highlighted in the criticism of the stated preference methods, and some economists argue that the values estimated are consequently unsuited for economic analysis (e.g., Hausman, 2012; McFadden & Train, 2017), it is worth noting that such behaviour actually also sometimes occurs in real life situations (e.g., Czajkowski et al., 2017; Poe, 2016; Smith & Moore, 2010). Hence, it is not a behavioural phenomenon pertaining only to hypothetical valuation processes. Furthermore, some types of personal moral sentiments, for instance, relating to self-image and social conformity, may actually be consistent with economic theory and thus valid drivers of non-use values elicited through stated preference methods (Kotchen & Reiling, 2000; OECD, 2018).

As a result of the controversy, a large research effort has focused on developing and testing valuation measures and procedures to minimise hypothetical bias and other behavioural anomalies, aiming to increase the validity of the value estimates obtained, and make them suited for economic prioritisation (Hanley & Czajkowski, 2019; Kling et al., 2012). Based on inputs from a wide range of experts in the field, current best practice guidance and advice for conducting stated preference studies is widely and freely available. Of key importance is careful survey construction with a particular focus on ensuring that value eliciting survey questions as far as possible are incentive compatible to survey respondents. This entails that respondents have incentives to answer questions in line with their actual values. Specifically, stated preference surveys should fulfil three aspects: 1) the described changes are realistic, 2) their answers will influence the decision-making process, and 3) they will have to contribute the amount they have stated (or approved) if the policy is implemented. Stated preference surveys that as far as possible meet these state-of-the-art standards have been shown to significantly reduce the risk of hypothetical bias, strategic behaviour and other types of seemingly anomalous decision behaviour, and, thus, provide value estimates that are more reliable for policy support (Carson et al., 2001; Carson & Groves, 2007; Hanley & Czajkowski, 2019; Johnston et al., 2017; Vossler et al., 2012).

Despite advances made for the stated preference methods, there is still disagreement in the scientific community concerning the usefulness of these methods for measuring environmental non-use values (and also use values). Many critics maintain that hypothetical bias and seemingly anomalous respondent behaviour inherently make biodiversity value estimates obtained with stated preference methods invalid and useless (e.g., Hausman, 2012; McFadden & Train, 2017) even if the methods are considered valid in other policy fields. On the other side, proponents of the methods argue that the methodological developments have addressed the most severe points of criticism. Proponents thus argue that non-use value estimates obtained through careful implementation of stated preference surveys in line with current best practice guidance will in most cases provide valid inputs on the welfare economic impacts of relevance for policy guidance and natural resource damage assessments (e.g., Carson, 2012; Hanley & Czajkowski, 2019; Kling et al., 2012). Since no other methods can assess welfare economic non-use values, the proponents generally consider that it is better to use the stated preference methods and accept that there is some uncertainty associated with the obtained value estimates. The alternative is to risk that non-use values from nature and biodiversity are left out of the economic analyses routinely conducted in multiple policy contexts and consequently potentially neglected in decision-making processes.

Overall, the literature suggests that in decision contexts where non-use values are clearly non-negligible and important for policymaking, and where economic analysis will in any case be used to

support decision-makers, carefully conducted stated preference studies can provide useful additional information about non-use values of nature and biodiversity.

The review finds that other statement-based methods have not been tested systematically to the same extent. Evidence from reviews about the reliability and validity of these methods is more abundant for some methods than for others. For example, regarding reliability and validity multiple reviews are available of monetary stated preference methods such as willingness to pay (Oerlemans et al., 2016), willingness to accept (Whittington et al., 2017), choice experiments (Rakotonarivo et al., 2016), contingent valuation (Venkatachalam, 2004), and studies regarding the reliability in risk assessment (Hertwig et al., 2019; Pasman & Rogers, 2018, 2020; Rogers et al., 2019). However, our literature search provided limited evidence for other methods, especially those whose application in the context of valuation of biodiversity and nature's contributions to people is more recent. For example, one problem with ranking according to the importance of nature's contributions to people is that participants may rate all nature's contributions to people as very important. Such rankings do not help to inform trade-offs for decisions where not all nature's contributions to people can be provided at the same time and in all policy options (Horne et al., 2005). The use of rankings is therefore not robust for decisive decision-making purposes. In general, the degree of reliability needed (and its associated trade-offs with the research cost and effort), is dependent on the decision context (Olander et al., 2017). Thus, soundly grounding the ecosystem services/nature's contributions to people science into former research from ecological and environmental economics, together with an assessment of the degree of reliability needed by decision-makers, could help mitigating these challenges. Overall, the reliability and validity of more structured methods rely heavily on well-created study designs, including the accuracy of the description of the issue at stake and on individuals being sufficiently informed to provide robust answers (Ruiz-Frau et al., 2018).

## 3.3.2.3. Fair representation

Fair representation relates both to whose values are included in a valuation process but also how the impact on different people or groups counts when a project or policy is evaluated. The first relates to how representation of values are ensured, the second which principles are used to judge whether a policy decision is favourable or not. While the two considerations are overlapping in practice, we present the findings of the assessment in two parts to help distinguish the different methodological aspects of ensuring fair representation in valuation.

### *3.3.2.3.1. Representation*

*Representation* is relevant to understand whose values are being assessed. Representation was evaluated using two elements in the systematic review: the degree of representation (i.e., whether the different stakeholder groups that were identified and targeted as study respondents/participants were represented in the sample), and the characteristics by which stakeholder groups were identified and distinguished (who is included in the valuation process?) (Fish et al., 2011). This latter point, which concerns the sampling strategy, included for example gender, political roles, rights, power and interests/stakes. 43% of the reviewed valuation studies represent a diversity of stakeholder perspectives based on aspects such as age, gender, stakes and power relations (see also *Figure 3.38*).

For *inclusiveness*, it was evaluated *how* the application's process enabled participants to get involved (to ensure "participatory parity"). For example, providing extra time or adjusting language can help to overcome different barriers to participation and enable all participants to get involved as equals (*Figures 3.38 and 3.39*). For instance, 6% of the valuations report they engaged with participants in their local languages, or communicated through diverse media (e.g., verbal and written forms) (3%), or managed group composition and size (1%). For participatory approaches with group processes, the

analysis of *power dynamics* in applications was registered in the systematic review following Bryson et al. (2013). To evaluate the quality and consequentiality of participation, the *level of participation* was evaluated by asking whether participants could influence the design, process and outcomes of the valuation and participate meaningfully (or whether the study only engaged respondents as data providers) (Udofia et al., 2017). Finally, to evaluate the *transparency* of the process, it was assessed whether applications provide sufficient information about the valuation process and outcomes to different audiences, for example through sharing details about the methods, meetings, etc. (Bryson et al., 2013) (*Figure 3.40*).

The final aspect of fair representation evaluated was the *community of justice:* who/what is (implicitly) considered relevant and valuable in the application (Sikor et al., 2014). For example, different groups, ranging from (part of) the current human population, to future or past generations, animals, and more-than-human or non-human beings, mother earth, etc may be considered relevant for the valuation.

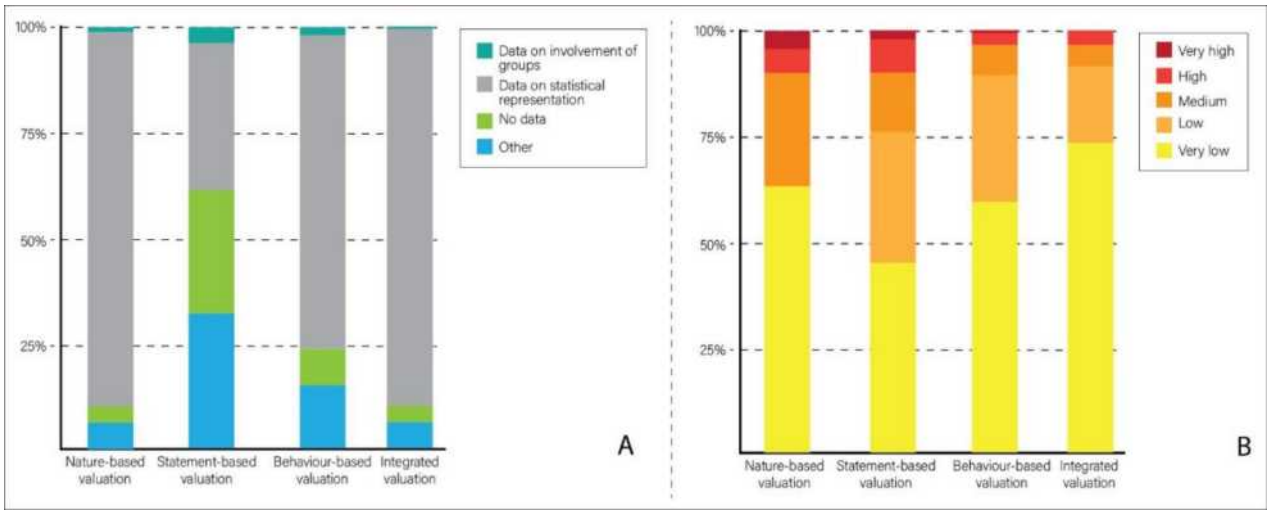


**Figure 3.38.** Consideration of the representation in valuation: (a) Studies including information on different types of stakeholders/groups in society the valuation divided according to method families; (b) the extent to which people are distinguished, for the studies that do include information on participants. The distinctions include political, socio economic and cultural indicators (very low (one of fewer indicators) to very high (more than 8 indicators)). (n=1163).

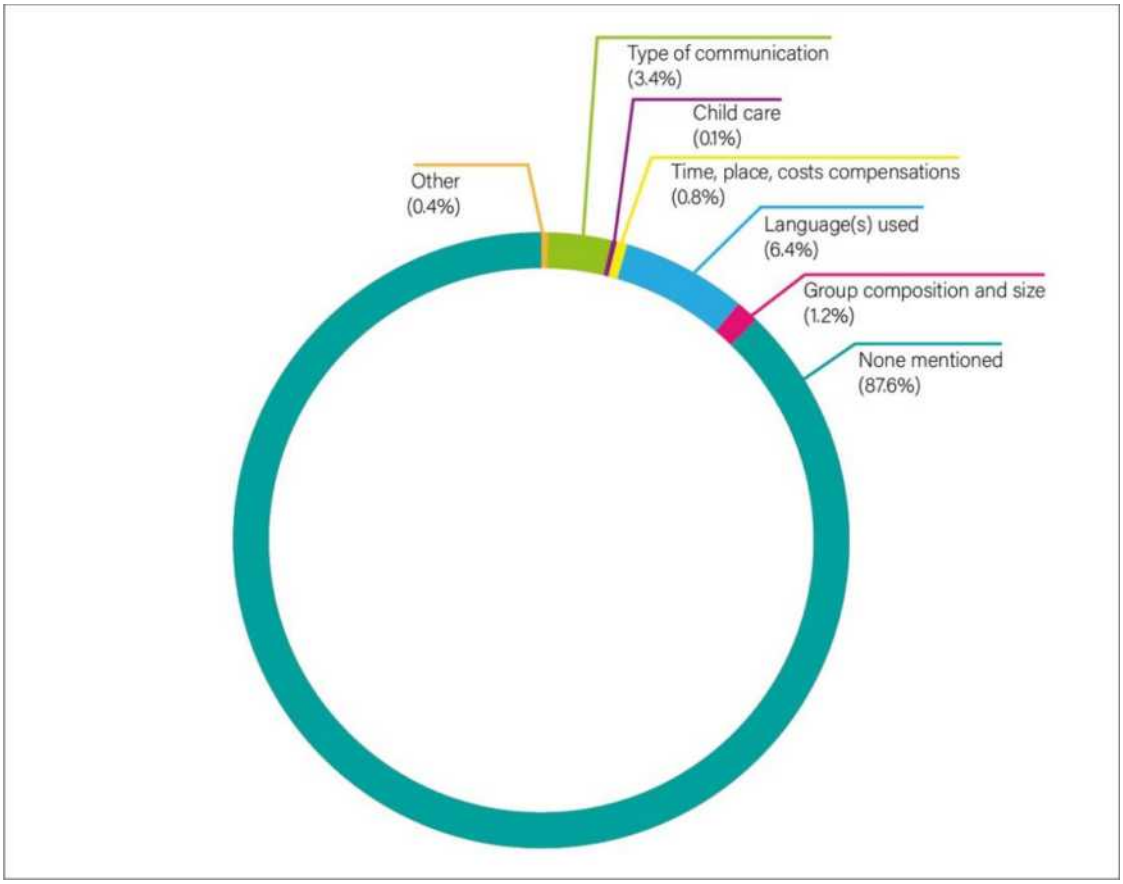


**Figure 3.39:** Approaches for improving inclusion in valuation. Most valuation studies do not report on whether efforts were made to expand inclusion. The most common approach to include more stakeholders is to conduct valuation processes in local languages and to communicate information about the valuation process in ways that can ensure that it is correctly delivered to relevant stakeholders (e.g., accompanying invitation letters with verbal communication, using local media and communication channels).

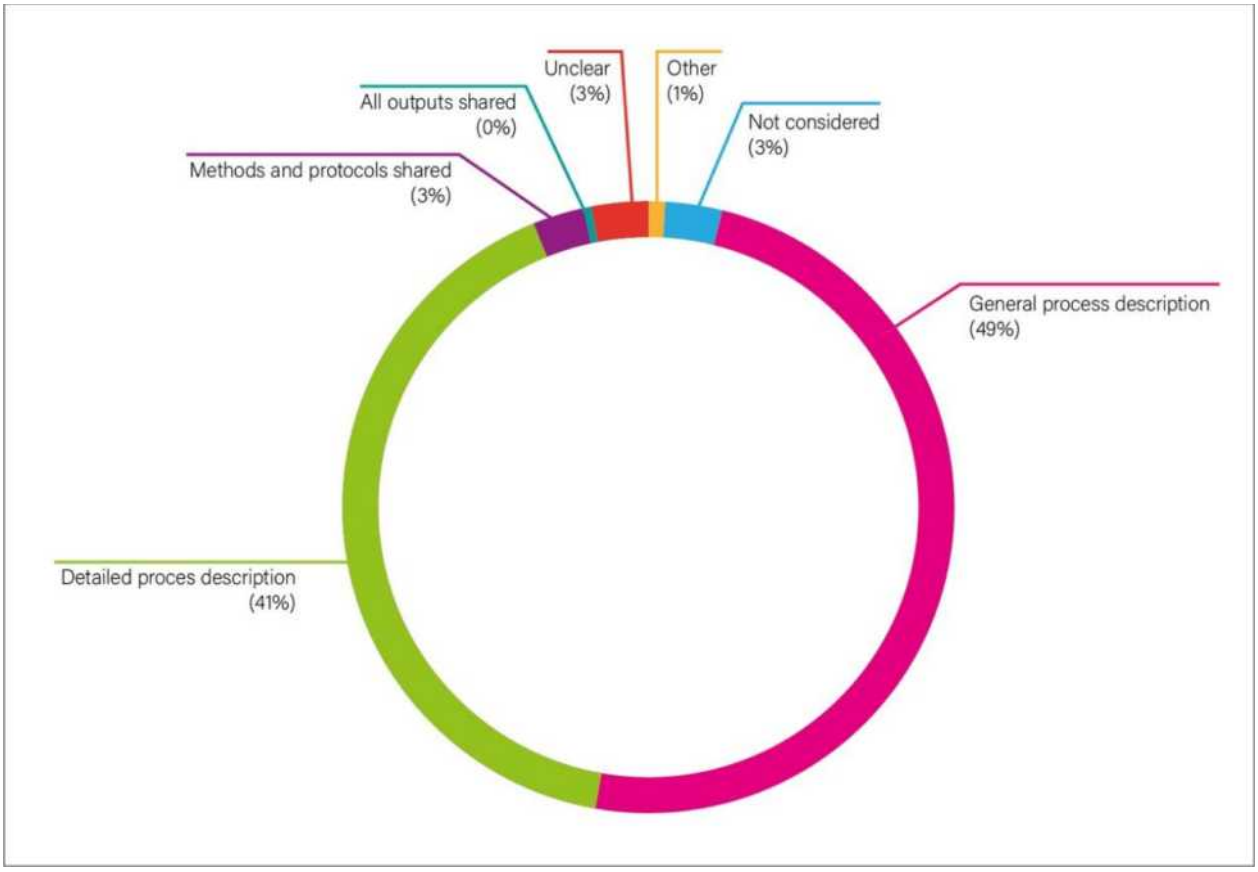


**Figure 3.40:** Consideration of transparency in valuation. Most valuation studies - provide a process description, while a minority shares detailed methods or outputs.

Almost all studies have at least basic transparency, but only a minority fully shares methods and protocols (*Figure 3.40*). The systematic literature review found that valuation studies have largely been focused on generating information about values at local to regional level (see *3.2*) (*Figure 3.10*) and that almost half of the valuations are unclear about whose values are being represented in the study (*Figure 3.41)*. Among those studies that do make explicit whose values are considered, the values of specific groups within current generations (i.e., people living on the planet at the time of the study) prevail (24%) followed by the values of all people occupying the Earth at the time of the study. Studies have rarely considered the values of future generations (those not yet born; 4%) and there is almost complete absence of works that considered the values of past generations (those who no longer occupy the Earth today except as memories, spirits and ancestors). A small proportion of studies considered the values of Mother Earth as a living and contemporary entity (6%) in line with worldviews that do not separate nature from humans. These differences across valuations of whose values are considered reflects other aspects of the valuation process, such as who is involved in the valuation processes (see *3.2.1.2* and *3.2.4.4*) and who is considered a legitimate stakeholder in claims for justice in the community of justice (see *3.3*) and. Less than one percent (0.6%) of studies mention power issues within the valuation process itself.

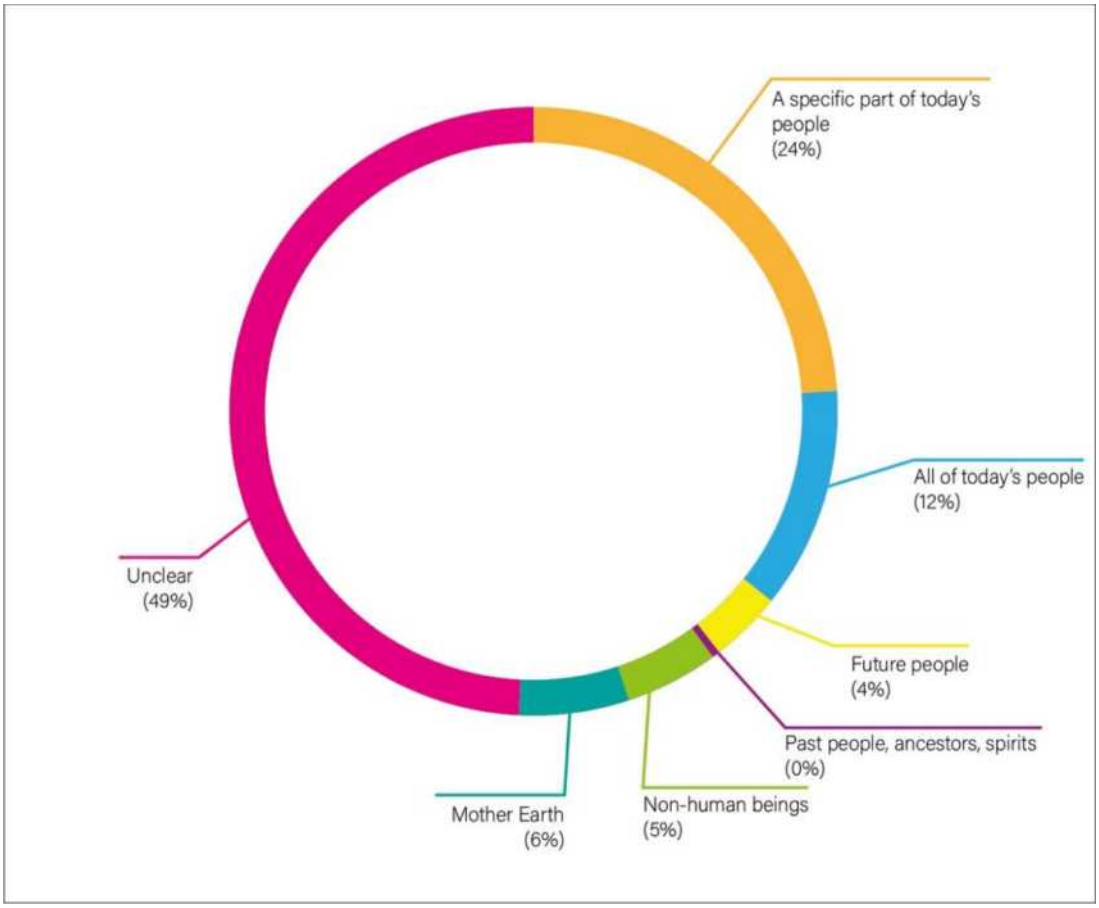


**Figure 3.41.** Community of justice in valuation based on systematic review (n=1163).

### *3.3.2.3.2. What is a good outcome for a community or society?*

Nature valuation draws from different disciplinary traditions to gather methodologies that support the evaluation of community or society improvements as a result from the implementation of a project or a policy. The methodological challenges involved in robustly supporting judgements at a higher social scale than the individual has been debated at length in valuation (see *3.2.2.4*).

An important methodological challenge relates to how (if possible) to compare the values and impacts on individual people. A fundamental challenge is that values and/or well-being are unobservable by the valuator and it is therefore impossible, in practice, to compare the impact on one specific person to the impact on another (*Box 3.6*).

**Box 3.6. Inter-personal comparisons**

There is a long history of debate on making social choices, particularly on *inter*-personal comparisons of utility (Fleurbaey & Abi-Rafeh, 2016; Harsanyi, 1987; Sen, 1970). To illustrate the essential argument, consider measures of subjective well-being, where individuals express on a scale between 1 – 10 how satisfied they are with their lives. Suppose Ana reveals a score of 4 and Laila a score of 5. Does this mean that Ana is less satisfied than Laila? Suppose a year later Ana has a score of 5 and Laila has a score of 6. Does this mean that their satisfaction has increased by the same amount: 1 unit? It seems intuitive to say that satisfaction has increased for both parties (an intra-personal comparison), but societal value aggregation approaches also require inter-personal comparability to aggregate well-being and make comparisons between different options.

If the numbers above represented utility (rather than subjective well-being, which is technically different (OECD, 2018)), and we were using a social welfare function approach, this would mean that the answer to each question would be yes. Ana's well-being is lower than Laila's but increased by the same amount over time. While this is clearly an important underlying assumption, intuitively, we *are* often able to make interpersonal comparisons of well-being when we say that one person's well-being is clearly less than another's on the basis of differences in health or opportunities (Fleurbaey & Abi-Rafeh, 2016; Harsanyi, 1987; Sen, 1970).

Cost benefit analysis (see *3.2.2.4*) takes a different approach to measuring changes in well-being, and valuation in general. First, individual changes in well-being are measured in monetary terms. Compensating or equivalent variations, reflecting Willingness to Pay (WTP) or Willingness to Accept (WTA), are calculated in principle at the individual level, reflecting the individual strength of preferences and the importance attached to changes in circumstances: e.g., ecological quality or nature's contributions to people. Once converted into monetary units, aggregation and comparisons are then possible in this common metric. No assumptions are made about the inter-personal comparability of utility, and the aggregation of impacts is then straightforward if substitutability between values of nature and monetary gains or losses are substitutable (OECD, 2018, Chapters 1-4). See *Chapter 2* for further review of this assumption.

In practice, there are challenges both with the assumption of inter-personal comparability of utility or other well-being indicators and with the monetarization approach used in cost benefit analysis. The downside of not relying on the assumption of inter-personal comparability of utility in cost-benefit analysis is that once well-being is measured in monetary terms (willingness to pay or willingness to accept) the property of diminishing marginal utility of income disappears, and all dollar values are treated the same no matter to whom they accrue (Adler, 2016) (see *Chapter 1*). This is potentially problematic since it ignores distributional issues in the summing up monetary values. The issue can be exacerbated by the fact that willingness to pay often increases with income (although this is not always true since marginal willingness to pay is typically measured), skewing what is seen as valuable by cost benefit analysis towards richer parties. Using a social welfare function (SWF) makes societal attitudes towards inequality explicit in the aggregating function. Evaluation using the social welfare function leads to interventions with a fairer distribution of policy impacts being preferred to alternatives with the same *overall impact distributed more unequally. This approach solves the omission of distributional preferences* but relies on the *arguably* problematic assumption of inter-personal comparability of *utilities:* all utilities are measured on the same cardinal (temperature-like) scale (Adler, 2016; Sen, 1970).

One solution to this issue in cost-benefit analysis is to deploy equity (distributional) weights when aggregating monetary values, and cost-benefit analysis guidelines in many countries recommend the practice. In practice, distributional weights adjust monetary values for diminishing marginal utility of income/money, thereby placing a higher weight on poorer households compared to richer. The United Kingdom Government Green Book Guidelines on cost-benefit analysis discusses these principles (HM Treasury, 2020), as do many other guidelines and textbooks on cost-benefit analysis (OECD, 2018). Despite this, such weights are rarely deployed in practice, for several reasons.

Practically speaking, using distributional weights in cost benefit analysis can change the appraisal and ranking of different interventions (Adler, 2016; Meya, 2020; Meya et al., 2021) (see *Chapter 1*). When larger interventions are evaluated, such as the impact of climate change, the use of equity weights or social welfare functions that accommodate inequality aversion raise considerably the welfare valuation of damages from climate change (the Social Cost of Carbon), in part because climate effects are larger in poor countries and regions (e.g., Anthoff & Emmerling, 2019; Anthoff & Tol, 2010; Kornek et al., 2021). The outcomes for appraisal when using distributional weights in cost-benefit analysis will vary from case to case, and in some cases can lead to worse outcomes for the poor (Boardman et al., 2020).

Nevertheless, there are clearly defined approaches to dealing with distributional issues in cost-benefit analysis using distributional weights. Cost-benefit analysis with distributional weights is sometimes equivalent to defining a social welfare function (SWF). Such approaches can be used to account for distributional concerns for environmental (rather than monetary) outcomes too (Venmans & Groom, 2021). Alternative, pragmatic approaches to distributional issues that are more frequently deployed in public policy appraisal include making clear who are the winners and who are the losers in the constituency and making a value judgement on whether the distribution of benefits and costs is acceptable given the aggregate gains. Other alternatives include looking at the impact on essential items that determine well-being, and this has been offered as an alternative in World Bank guidance on cost-benefit analysis in developing countries (Harberger, 1984).

Finally, Arrow's impossibility theorem (Arrow, 1950) is an important result in the debate on how to define appropriate decision rules at higher social scales than the individual. It states that if individuals have different rankings of, say, environmental policies, there is no social welfare function that can represent these preferences which also satisfies transitivity (if a is preferred to b, and b preferred to c, then a is preferred to c) and a series of other desirable social choice axioms, such as non-dictatorship: social choice being determined by the ranking of one individual (Sen, 1998). Typically, relaxing axioms like Universal Domain (UD: that all policies can be ranked) or the Independence or Irrelevant Alternatives (IIA: that adding new policies cannot change the rank of other possibilities) are seen as a reasonable practical way forward. Cost-benefit analysis fails the Independence or Irrelevant Alternatives axiom for instance (Adler, 2016).

Aggregation of well-being over time is also a central issue in welfare economics. While remaining welfarist and consequential in general, inter-temporal social welfare functions can reflect principles of fairness and sustainability, in a similar way to intra-temporal social welfare functions. In an inter-temporal context, the specific social welfare function implies a particular social discount rate (SDR). A typical utilitarian inter-temporal social welfare function will sum up utilities for a *representative agent*: a single agent that is in some sense representative of the average household and reflects aggregate well-being, over time. Their utility will reflect diminishing marginal utility, and so an additional unit of consumption will be worth less to a rich person than a poor person and vice versa. If there is growth (decline) in incomes over time, agents in the future will be richer (poorer) and hence an additional unit of consumption in the future will be *discounted* positively (negatively) compared to the poorer (richer) present agents (Drupp et al., 2018). Discounting the future stems in part from the aversion to inequality and growth. The way in which the future is discounted from this welfare perspective will depend on the nature of the social welfare function. Emmerling et al. (2017) introduce intra-generation inequality, Dietz & Asheim (2012) introduce sustainability constraints, Gollier (2013) introduces uncertainty in future prospects, Sterner & Persson (2008) introduce environmental scarcity and Drupp (2018) introduces limited substitutability and strong sustainability. Each social welfare function affects the valuation placed on the future by the society, often raising the valuation compared to historical economic analysis. Since 2003, the United Kingdom government has used a declining discount rate due to uncertainty about the long-run future. France, Norway and Denmark do the same (Groom & Hepburn, 2017). The United States of America cost-benefit analysis guidelines recommend a lower rate for very long-run for similar reasons of uncertainty.

The value of the future environment today is a key area of research. Many studies have illustrated the implications for rising scarcity of environmental assets and the lower social discount rate that this can imply: Baumgärtner et al. (2015) for ecosystem services, Drupp & Hänsel (2020) and Sterner & Persson (2008) for climate change, and Venmans and Groom (2021) for forests and air quality. The valuation of the future environment will depend on preferences for the environment, substitutability of the environment for other consumption goods, and the uncertainties about future environmental quality.

Deliberative decision-making takes a very different approach to the question of how to make judgements at higher social scales than the individual level. A judgement should be based on a dialogue between equals and a judgement is rational if it is the result of a free exchange of arguments for or against a course of action (Habermas, 1996; O'Hara, 1996). This makes participation of stakeholders in the deliberative process essential for the legitimacy of the decision (Schaafsma et al. 2018) (see *3.3.2.2*). Furthermore, participation as equals becomes a fundamental requirement for the suitability of this approach (see *3.3.2.3*). In nature valuation, deliberative decision-making, as a process to generate collective decision-making has developed in response to perceived shortcoming of individual aggregation approaches. The critique has both been based on a critique of conceptualising society as a sum of individuals and a critique of monetization. The proponents have advocated for the need for democratic procedures to reach judgement on socially desirable actions rather than technical procedures involved in aggregation (Bartkowski & Lienhoop, 2019; Howarth & Wilson, 2006b; Sagoff, 1988) (see *Chapter 2* ).

The practice of valuation also reflects the theoretical debates on aggregation. The valuation result at the higher social scale can be achieved by aggregation of different stakeholders' values or aggregation of individually expressed values. Aggregation by simple sums, sometimes extrapolated to higher social scales, occurs most often. Sometimes, weights are applied to reflect the social judgement that the consequences for some people or areas are considered more important than others. *Figure 3.42* shows the findings from the systematic review. Group based development of values for a higher social scale in particular (see *3.2.2.2*) places emphasis on equal opportunities to participate in the valuation and acknowledges that power asymmetry needs to be addressed. However, the systematic review found that less than one percent (0.6%) of studies mention power issues within the valuation process itself, and that only a small 5% applies social weights in aggregation.

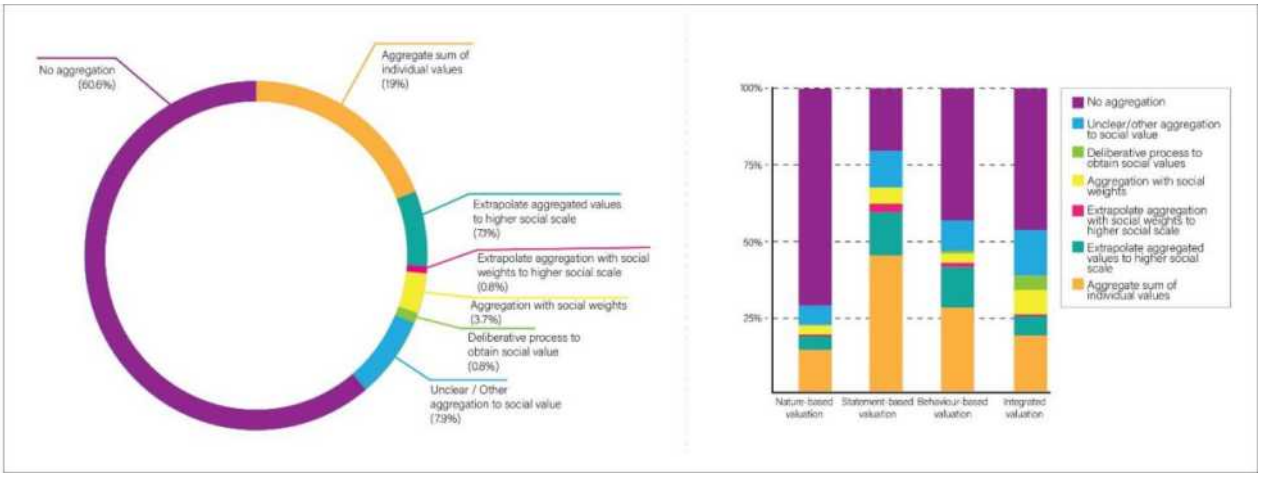


**Figure 3.42:** Approaches to aggregate individually held values for the collective or a higher social scale to support decision-making (n=1163).

The evidence shows that over half of valuation studies do not present the results of the valuation at higher social scales. Of the studies that do bring the values together to form a judgement, simple aggregation of values is the most common approach, followed by using weights. A minority of valuation develops social values using deliberation.

In conclusion, research on robustness of valuation processes has focused on different aspects of robustness, reflecting the intended use of the valuation outputs and the disciplinary perspectives of the valuator. The criteria for how to judge robustness are contested; some sources of evidence emphasise legitimacy and other sources emphasise theoretical consistency and accuracy. Robustness has mainly been formally evaluated using reliability criteria by synthesising evidence from multiple

studies. As true values cannot be observed, and valuation informs decisions in different ways, reliability and validity guidance must be adapted to the valuation needs and the valuation methods chosen. In practical applications of valuation methods, limited attention has been given to formally assess robustness, both reliability and fair representation. Good practice guidelines exist for some approaches but are not generally available for a wide range of methods. Development of a wider range of practical guidelines sensitive to the valuation purpose has the potential to improve the robustness of valuation and decrease the risk of (mis)informing decisions and in turn produce perverse outcomes.

## 3.3.3. Resources for valuation

Methods and tools also vary in their feasibility for widespread use, resource (e.g., time and expertise) requirements, or degree of stakeholder involvement. Different types of resources are needed in terms of data, expertise required, time and budget to conduct valuation. These four aspects vary significantly within each group method and bear strong interdependencies, since choosing a method depends on the existing expertise and the available budget and time. In many contexts, it is only possible to rely on existing valuation outputs and use the outputs to attend the policy problem at hand. We therefore divide this section into two subsections; the first section outlining the evidence on resource needs for use of valuation methods; the second section giving a review of existing approaches to make use of existing valuation outputs in a new policy section.

## 3.3.3.1. Resource needs for methods applications

Different valuation methods vary with respect to the type of data used to generate value information and the resource barriers can therefore be characterised using the method family classification. For all families we divide resource needs in terms of technical skills, existing data sources, network and stakeholder trust, time and financial resources. Overall, the assessment found limited comprehensive sources to assess resource needs for valuation. The section is based on the evidence generated from the review of methods (see *3.2.2*).

**Nature-based valuation**

*Data resources* for nature-based valuation could be classified as biotic or abiotic. Biotic data would entail all information related to species, ecosystems and ecological processes (Tashie & Ringold, 2019). Abiotic data would refer to all data on geophysical processes that influence biota (e.g., hydrodynamics), but also abiotic parameters like, e.g., wave energy or geomorphology. Such data can be obtained through different sources ranging from collected field data, to data collected through Earth observation (e.g., remote sensing, unmanned aerial vehicles; Tashie & Ringold, 2019), data inferred through modelling processes, and data extracted from large global databases.

The *expertise* required to collect data, quantify and map or model biodiversity and ecosystem services with nature-based methods, spans across a multitude of disciplines. Within the ecosystem services body of literature, Droste et al. (2018) identified that upon the beginning of the concept, assessments were mono-disciplinary. Yet as the concept evolved and the topics became more complex, the assessments required inter- and multi-disciplinary expertise. Expertise required for nature-based valuation ranges from: i) topic expertise required for field data collection; ii) modelling expertise; iii) geo-informatics expertise for mapping and modelling; to iv) social science expertise for participatory approaches used to engage with resource users. Palomo et al. (2018) identified the lack of relevant expertise as one of the major bottlenecks in ecosystem services mapping.

*Time and cost* of the different methods also vary significantly with the method. While time and cost are generally correlated (i.e., the longer it takes to undertake a study, the more it costs), it is not always

the case. Direct measurements and participatory approaches are more suitable for assessments of smaller extent, but require time to cover larger areas (Brown & Kyttä, 2018), yet the cost is relatively low. Mapping and modelling are rapid methods for areas of larger extent but require time for learning the method and the software. According to Bagstad et al. (2013), decision-makers feel that running quantitative models takes too much time and costs too much in comparison to the depth and quality of information added to the decision-making process. Depending on the topic under investigation, the cost could range from low (when the assessment uses open data), to very high (mainly when dealing with very high resolution (VHR) Earth observation products).

**Statement-based valuation**

As the valuation is usually based on questionnaires, interviews or group discussions, statement-based valuation often has limited requirements for existing *data sources.* It is also this characteristic that makes the methods highly adaptable to new contexts where valuation has not been conducted previously. The main costs relate to the development of the elicitation format and the implementation of the data collection. When participatory approaches are conducted, projects often need to pay the opportunity costs borne by local stakeholders (Evans, 2018). This can be a significant cost when valuations seek to engage with many participants.

The *expertise* varies from statistical data collection design skills to facilitation skills, and often both sets of skills are needed to conduct a full valuation process (see *3.2.2*).

*Time and costs* required for data collection often face additional constraints related to participants availability. The valuator needs to adapt data collection to suit the participants, and for group-based processes the organizational challenges to bring together the relevant stakeholders requires careful planning over a longer timeframe (see *3.2.2.2*).

**Behaviour-Based valuation**

Availability of *data sources* to conduct behaviour-based valuation is often a barrier to apply methods in this family. Both data to characterise aspects of nature, such as the spatial distribution of available resources, and data on people's activities can be very costly to obtain. In recent years more applications have utilised remotely sourced data, e.g., using Global Positioning System (see *3.2.2*) but where such options are not available or not suitable for the valuation, low-cost options collecting data from resource users through questionnaires and interviews, continue to be a useful approach (see *3.2.2*). Behaviour-based approaches therefore vary in their requirement for existing data sources. Cost-based methods are generally seen as a low-cost option for behaviour- based valuation (see *3.2.2.3*).

The *expertise* varies between highly technical expertise required to conduct e.g., hedonic pricing methods (see *3.2.2.3*) to qualitative data collection approaches using participant observations (see *3.2.2.3*).

*Time and costs* generally result from the amount of prior investment in existing data collection infrastructure and modelling expertise. Given the high quality of core data sets on biophysical resources and socio demographic characteristics, behaviour-based valuation can be relatively inexpensive, however developing the infrastructure is often a large investment (Lupi et al., 2020).

**Integrated valuation**

As integrated valuation brings together diverse approaches to synthesise diverse valuation information, the resources requirements also reflect this diversity. Some approaches are highly

technical (such as integrated modelling, see *3.2.2.4*) and thus the resource requirements resample some of the valuation approaches in nature-based valuation or behaviour-based valuation relying on existing data and model infrastructure. Other methods (such as deliberative decision-making approaches, see *3.2.2.4*) have resource requirements that resemble statement-based approaches.

See further information on resource requirements on selected methods for which sufficient information exists to evaluate limitations for use in resource limited contexts in *Section 3.4*.

### 3.3.3.2. Using pre-existing valuation outputs: benefit transfer.

Benefit transfer is the use of pre-existing empirical estimates from one or more sites or contexts where research has been conducted previously to predict measures of economic value for other, typically unstudied sites or contexts. Transfers can occur over different locations, times, populations, policies, or other dimensions. The primary feature that distinguishes benefit transfer from other types of economic valuation is that values are quantified through the use of "existing data or information in settings other than for what it was originally collected" (Rosenberger & Loomis, 2003, p. 445). Virtually any type of economic value information can be transferred. Common examples involve transfers of welfare estimates from recreation demand models, hedonic property value models, stated preference studies (choice experiments and contingent valuation) and other types of non-market valuation, representing values for changes in many different types of environmental goods and services (Johnston et al., 2018).

Benefit transfer is only one of many procedures that extrapolate existing biophysical or socio-economic information to predict outcomes in new situations. However, environmental benefit transfer has been described as one of the most difficult types of information transfer, due to factors such as the provision of environmental goods and services outside of organised markets, common lack of consistency in the biophysical measures used to quantify these non-market goods and services in original valuation studies, and the fact that economic welfare measures cannot be observed directly (Boyd et al., 2016; Boyle et al., 2010). As a result, environmental benefit transfer has faced greater scrutiny than other types of information transfer, with an extensive literature devoted to topics such as validity and reliability (Boyle et al., 2010; Rosenberger, 2015).

Reviews of benefit transfer theory, methods and practice are provided by Boyle et al. (2010), Johnston and Rosenberger (2010) and Johnston et al. (2018), among others. As discussed by this literature, the accuracy of benefit transfer depends on the underlying accuracy of the original study or studies that provide the information to be transferred, along with the generalisation error caused by the extrapolation of that information to new settings (Boyle et al., 2010; Rosenberger & Stanley, 2006). Accordingly, benefit transfer accuracy depends on the capacity of transfer procedures to calibrate transferred value information to new setting(s). Corresponding to this expectation, past reviews find that benefit-function transfers tend to be more accurate than simpler unit-value transfers on average, although there are exceptions to this general finding (Johnston et al., 2018; Rosenberger, 2015). The use of data-synthesis approaches such as meta-analysis may also improve accuracy (Kaul et al., 2013). Yet although there is increasing consensus over best practices that are expected to enhance the validity and reliability of benefit transfers on average, it is still difficult to predict how individual methods will perform within specific applications (Johnston et al., 2018, p. 222).

Discussions on the need for, and role of benefit transfer within decision-making are provided by sources such as Boyle et al. (2010), Brouwer and Navrud (2015), Griffiths et al. (2012), Griffiths and Wheeler (2005), Iovanna and Griffiths (2006), Johnston et al. (2015, 2018); Johnston and Rosenberger (2010), Loomis (2015), Rolfe et al. (2015) and Wheeler (2015). In principle, decisions on whether to use original valuation studies or benefit transfers to inform decisions should depend on the value of information (VOI) provided by these alternative value-estimation approaches compared

to the associated cost of information. Value of information is determined by the expected increase in the net social value of policy or program decisions made possible by the provided value information, as influenced by factors such as the magnitude of benefits and costs that depend on the decisions to be made, the relative accuracy of each prospective study type, and the potential influence of value information on the decisions (Newbold & Johnston, 2020). Limited research in this area suggests that the cost of original valuation studies is usually justified for major environmental decisions (eg., Allen & Loomis, 2008; Barton, 2007; Navrud & Pruckner, 1997; Newbold & Johnston, 2020).

In practice, however, benefit transfer is often indispensable, because practical constraints preclude the use of original studies to provide the information required for policy or program analysis (Newbold et al., 2018). Within the context of United States federal policy analysis, for example, Newbold et al. (2018, p. 469) argues that, *'it is impossible to conduct a prospective [benefit–cost analysis] without the use of at least some form of benefit (and cost) transfers'*. This tension is discussed by Johnston et al. (2018, p. 179), who acknowledge that benefit transfer *'is rarely a preferred valuation method but is arguably the most common valuation method within large-scale benefit–cost analysis'*.

The uptake of benefit transfer to inform policy and program decisions is well documented in developed-country contexts, including the United States, European Union and Canada. A historical perspective on United States uptake is provided by Loomis (2015, p. 61), who notes that *'U.S. federal and state agencies have used benefit transfers, in one form or another, for decades'*. The use of benefit transfer as part of United States Environmental Protection Agency (US EPA) regulatory impact analyses is well documented (Griffiths et al., 2012; Griffiths & Wheeler, 2005; Iovanna & Griffiths, 2006; Newbold et al., 2018; Wheeler, 2015), and benefit transfer has been recognized within the agency's guidelines for economic analysis for over two decades (US EPA, 2000, 2010). Methods used for these applications have evolved from simple unit-value transfers in the 1980s and 1990s to more recent applications of more sophisticated benefit-function and meta-analytic transfers (Wheeler, 2015). Other United States examples include applications to policy, program and planning analyses within the United States Department of Agriculture (e.g., USDA NRCS, 2010), United States Department of Commerce (e.g., Samonte et al., 2017), United States Forest Service (e.g., Rosenberger & Loomis, 2001), and others (Loomis, 2015). Benefit transfers have also been used to support liability payments for court cases (Boyle et al., 2010; Loomis, 2015). As in the United States, official guidance for cost-benefit analysis in Canada recognizes benefit transfer as an allowable practice (Treasury Board of Canada Secretariat, 2007), and reports utilising benefit transfer have been used to inform government actions (Dupont & Renzetti, 2008).

Brouwer and Navrud (2015) review applications of benefit-transfer in Europe, with multiple examples of cases in which benefit transfer has been used to inform environmental policies and programs. These include the External Costs of Energy (ExternE) project supported by the European Commission (European Commission Directorate, 2005). The European Water Framework Directive (WFD) (approved in 2000) requires river basin management plans to consider measures of benefits and costs and has thereby promoted applications of benefit transfers to quantify these measures (Rosenberger & Loomis, 2003). Brouwer and Navrud (2015) describe a set of benefit transfers linked to the WFD. An example at the national level is United Kingdom National Ecosystem Assessment (UK NEA, 2011), which applied multiple benefit transfer approaches to estimate ecosystem service values (Bateman et al., 2011; Brouwer & Navrud, 2015).

Compared to the United States and Europe, reviews of benefit-transfer applications report fewer examples of uptake related to policy and program decisions in other regions of the world. A summary of benefit transfer applications in Australia and New Zealand is provided by Rolfe et al. (2015). In principle, valuations of economic benefits or costs via benefit transfer can occur in these countries

under multiple types of governmental policy and program analyses, including Regulatory Impact Statements and Environmental Impact Assessments. However, the use of benefit transfer (or more generally non-market valuation) within these analyses is uncommon (Rolfe et al., 2015).

Within developing countries, benefit transfers have been implemented by and for intergovernmental organisations, and are documented in a diversity of technical reports, project appraisals and other publications. For example, an OECD report calculates Value of Statistical Life (VSL) estimates for countries such as China and India using benefit transfer (Brouwer & Navrud, 2015; OECD, 2014). Dixon (2012) reports on the use of benefit transfers to estimate the benefits of waste-water treatment in Guyana, Trinidad and Tobago, Paraguay and Uruguay, as part of a discussion paper for the Inter-American Development Bank. A technical report prepared for the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD) applies benefit transfer to illustrate values linked to reducing emissions from deforestation and forest degradation in Panama (Narloch, 2014). Similar transfers have been conducted by international non-governmental organisations (e.g., Bello et al., 2014 in Colombia).

Developing-country transfers are frequently conducted to raise awareness of economic values or to provide general background information for policy development. There are also examples of benefit transfer within formal policy and program evaluations. Silva and Pagiola (2003), for example, review the valuation conducted for World Bank project evaluations and report multiple applications of benefit transfer. Individual World Bank project appraisal documents also apply to benefit transfer methods (eg., World Bank, 2009, 2017). An illustration of ex-post program assessment is provided by Maradan's (2017) report to the United Nations Development Programme – United Nations Environmental Programme (UNDP-UNEP) Poverty-Environment Initiative in Rwanda, which applies benefit transfer techniques to evaluate benefits from a green village demonstration. In contrast to some developed countries (and particularly the United States), it is difficult to find documentation of cases in which benefit transfer has been applied by individual government agencies within developing countries. Either such applications do not exist, or they have been conducted in ways that are not documented for external searches.

Benefit transfer techniques have also been adopted within worldwide, intergovernmental valuation and accounting initiatives. For example, benefit transfer techniques are recognized in the draft ecosystem accounting framework of the System of Environmental-Economic Accounting (SEEA), prepared under the auspices of the United Nations Committee of Experts on Environmental Accounting (UN, 2020). Within this context, benefit transfer methods provide a way to generalise values to a national accounting area adjusting for spatial variation in ecosystem services and recording reliability. Another example is found in the Economics of Ecosystems and Biodiversity (TEEB) Valuation Database Manual (McVittie & Hussain, 2013), which contains over two hundred examples of values estimated using benefit transfer. The Economics of Ecosystems and Biodiversity (TEEB) training package for national implementers and practitioners further recognizes benefit transfer as an applicable valuation tool.

As observed within prior reviews of research and practice, there is a common divergence between the flexible and sophisticated procedures commonly recommended in the academic literature and those applied by practitioners. This gap appears to be larger and more common for developing-country applications. As illustrated by many of the sources discussed above, applications in the United States and Europe are increasingly moving towards meta-analysis and other more sophisticated procedures. However, developing-country applications often rely on unit-value and other simpler approaches that tend to be less accurate. Addressing this divergence between research and practice has long been recognized as a challenge (Johnston et al., 2018; Johnston & Rosenberger, 2010).

### 3.3.4. Trade-offs between relevance, robustness and resources in method choice

*Sections 3.3.1-3.3.3* have outlined key considerations for valuation choices on *relevance* (see *3.3.1*), *robustness* (see *3.3.2*) and *resources* (see *3.3.3*). It is rarely possible to conduct valuation to support decision-making processes that simultaneously i) provides all relevant information from all relevant stakeholders, ii) brings forward robust information on all important aspects of the alternative options, while iii) doing so using very few resources. Any choice of valuation process and methods therefore entails trade-offs. In the following, we refer to the three dimensions of valuation (*relevance*, *robustness* and *resources*) as the 3Rs for simplicity. We synthesise the relative strength of individual methods, reviewed in *Section 3.2.2*, with respect to the 3Rs. This entails assessing their capacity to provide information on different types of values in a wide range of socio-ecological contexts, the robustness of the value information for different decision-making purposes, and the need for existing data sources and time and financial resources to obtain the valuation results. For the assessment, we select well established valuation methods across the four method families, for which sufficient information has been obtained from the reviews. Each of the 3R dimensions needs to be assessed given the policy purpose. This is perhaps self-evident, but still worth emphasising as this dependence makes it challenging to provide overall principles for a choice of valuation methods. Which values are relevant to assess depends on what the valuation will be used for, and how robust the valuation needs to be, both with respect to reliability and fair representation is also determined by the purpose of the valuation. Finally, the resources that should be spent on valuation is not just based on availability but also on whether the information is worth it in relation to the prospects of the decision alternatives (see *3.3.1.3*). The decision-making purpose is therefore a condition for evaluating the suitability of a method with respect to each of the 3Rs. For each method, we outline what characterises the performance of the methods on each of the three criteria and how performance can be improved. For example, relevance has two performance measures –the capacity to elicit diverse values in diverse socio-ecological contexts, which are separately assessed in terms of the strength of evidence for each method. For each method, we illustrate the three dimensions for a specific policy purpose as an example. Further material on the choice of methods within a valuation process is presented in *Section 3.4*.

The assessment of selected methods is summarised in *Table 3.10* based on the reviews and *Section 3.2.2* and the systematic review of valuation (the methodology for evaluating the criteria is outlined in *Annex 3.13*). For more information about the individual methods please refer to *Sections 3.2.2.1, 3.2.2.2, 3.2.2.3 and 3.2.2.4.*

**Table 3.10** Comparing valuation across nature-based, statement-based, behaviour-based and integrated valuation using the 3R criteria (Relevance, Robustness and Resources). Methods perform well on key valuation principles (large bubble); methods perform adequately for many decision-making purposes (medium bubble); methods compromise key valuation principles without mitigating actions (small bubble). Strength of evidence is assessed to one of the following categories: Well-established (large bubble); Established but incomplete (small bubble). Methods with less available evidence have not been included in the assessment.

| | **Relevance** Diverse values and socio-ecological contexts | | **Robustness** Reliability and fair representation | | **Resources** Initial capacity and costs and time for valuation | |
|---|---|---|---|---|---|---|
| | Values | Contexts | Reliability | Fair representation | Capacity | Conducting valuation |
| **Nature-based valuation** | | | | | | |
| **Ecosystem service mapping** | • Linking nature to nature's contributions to peoples<br>• Instrumental Values<br>• Applicable to all nature's contributions to peoples & applied across ecosystems & global contexts at different scales | | • Reliability testing in terms of accuracy of the tools are emerging<br>• Generally low representation of multiple stakeholders | | • High initial resource requirements (geoinformatics and geospatial data)<br>• Modest valuation costs when initial data and skills are available | |
| How to improve the 3Rs | • Improved understanding of who is impacted by changes in ecosystem services<br>• Apply to alternative policy scenarios | | • Improve availability of data globally<br>• Validate using local data<br>• Higher spatial resolution | | • Capacity building and developing collaboration among data holders and modelers and ultimate users | |
| Strenght of the evidence |  |  |  |  |  |  |
| **Biodiversity priority mapping** | • Ecological integrity<br>• Intrinsic values<br>• Multiple biomes and scales | | • Reliability in terms of accuracy of the tools are emerging<br>• Sensitive to the selected experts involved | | • High initial resource requirements (geoinformatics and geospatial data)<br>• High data needs | |
| How to improve the 3Rs | • Being more specific about the purpose would increase policy relevance | | • Robustness can be improved through harmonization and model-based integration of multiple types of biodiversity and environmental data from heterogeneous sources | | • Capacity building and developing collaboration among data holders and modelers and ultimate users | |
| Strenght of the evidence |  |  |  |  |  |  |
| **Statement-based Valuation** | | | | | | |
| **Stated preference** | • Instrumental values<br>• Amenable to a wide range of economic values and understanding of social drivers of economic decisions<br>• Highly versatile and adaptable to a large range of socio-ecological contexts | | • Allow consistent comparisons of diverse values<br>• Reliable for informative, decisive, and technical purposes given adherence to best practice<br>• Can provide information on distributional effects | | • Requires expert knowledge in designing the survey instrument<br>• Practical guidance widely available<br>• Valuation can be scaled in size to available budget | |
| How to improve the 3Rs | • Design of the valuation in dialogue with stakeholders and policy/scientific experts can greatly improve the relevance. | | • Adhere to best practice guidelines on design process in collaboration with stakeholders and users of the information | | • Adhere to best practice guidelines for the design and data collection<br>• Training required for reliable use | |
| Strenght of the evidence |  |  |  |  |  |  |

| | **Relevance**<br>Diverse values and socio-ecological contexts | | **Robustness**<br>Reliability and fair representation | | **Resources**<br>Initial capacity and costs and time for valuation | |
|---|---|---|---|---|---|---|
| | Values | Contexts | Reliability | Fair representation | Capacity | Conducting valuation |
| **Q sorting** | • Understanding diverse perspective on a policy question, but mainly for informative purposes<br>• Can provide information on incompatible perspectives<br>• Applicable to broad and specific values<br>• Applied to a wide range of policy areas and socio-ecological contexts | | • The samples are non-random implying limited generalizability of the findings and representativeness of key stakeholders | | • Adapted to small group size, but requires considerable planning time and preparation time<br>• Freely available software & does not rely on existing data | |
| How to improve the 3Rs | • Relatively new technique in valuation. Incorporating the method in the valuation design could improve the relevance | | • More testing in valuation contexts would improve the robustness of the approach | | • Development of best practice guidelines for use in valuation | |
| Strenght of the evidence |  |  |  |  |  |  |
| **Behaviour-based valuation** | | | | | | |
| **Revealed preference** | • Economic use values<br>• Applicable to few types of values<br>• Instrumental values | | • Allow consistent inclusion of non-market values<br>• Reliable when adhering to best practice guidelines<br>• Representation often only partial for the community or society in general | | • High initial data requirements<br>• High level of statistical skills<br>• Modest implementation costs | |
| How to improve the 3Rs | • Open access to a wider range of socio-demographic, economic and environmental data | | • Clarity about the restricted range of values and the partial representation of potential stakeholders | | • Capacity building and developing collaboration among data holders and modelers and ultimate users. | |
| Strenght of the evidence |  |  |  |  |  |  |
| **Livelihood assessment** | • Relevant to a broad range of socio-economic contexts where people's livelihood is directly dependent on nature<br>• Instrumental values | | • Reliable for assessing households and communities' dependence on nature<br>• Allow representative assessments of different social groups<br>• Good practice guidelines available to conduct valuation | | • Low requirements for initial data and technical infrastructure<br>• Time demanding and reliance on investment in engaging stakeholders | |
| How to improve the 3Rs | • Designing assessments based on context specific understanding from local stakeholders about livelihood-nature dependency | | • Involvement of local stakeholders in the design of the assessment | | • Adherence of good practice guide and livelihood assessment tools would help to optimize the time and resource requirements | |
| Strenght of the evidence |  |  |  |  |  |  |
| **Integrated valuation** | | | | | | |
| ***Integrative method:* Integrated modelling** | • Linking nature and natural processes to well-being indicators<br>• Often few very specific value indicators<br>• Instrumental, intrinsic values | | • Reliability usually depicted through accuracy and precision in replications<br>• Limited focus on representation of stakeholders | | • High initial resource requirements to develop the approach<br>• High data needs | |
| How to improve the 3Rs | • Design of the valuation in dialogue with policy and scientific experts can greatly improve the relevance | | • Testing model concepts in different settings<br>• Transparency and documentation | | • Capacity building and developing collaboration among data holders and modelers and ultimate users | |
| Strenght of the evidence |  |  |  |  |  |  |

| | **Relevance** Diverse values and socio-ecological contexts | | **Robustness** Reliability and fair representation | | **Resources** Initial capacity and costs and time for valuation | |
|---|---|---|---|---|---|---|
| | Values | Contexts | Reliability | Fair representation | Capacity | Conducting valuation |
| ***Integrative method:*** **Participatory mapping** | • Participatory valuation technique to elicit place-based values of nature<br>• Versatile and adaptable to a large number of socio-ecological contexts<br>• Applicable to broad and specific values<br>• Instrumental, intrinsic and relational values | | • Reliability in replicating the same results is generally low.<br>• Stakeholders' representation in the process is generally at high level | | • Modest to low initial data and infrastructure<br>• Time consuming in planning the valuation activity<br>• Require engagement with the relevant social groups | |
| How to improve the 3Rs | • Increasing public participation<br>• Improving spatial data quality | | • Considerations on fairness and equity in the process and stakeholder representation<br>• Finding scalable mapping techniques to suit spatial decision contexts | | • Good facilitation skills<br>• Allowing time for qualitative data collection and interpretation | |
| Strenght of the evidence |  |  |  |  |  |  |
| ***Integration method:*** **Cost-Benefit Analysis (CBA)** | • Applicable to combine instrumental values measured in monetary terms (market and non-market)<br>• Versatile and applicable to different socio-ecological contexts<br>• Allow ranking of alternative options that vary in monetary costs, monetary benefits, and time period | | • High reliability in replicating the results when adhering to good practice guide<br>• Sensitive to the consistency of the value concepts used and the aggregation rules used<br>• Sensitive to choice of discount rate<br>• Stakeholders' engagement in the process is generally low but all stakeholders are in principle included in the evaluation | | • Moderately data intensive, hence, rely on existing socio-economic and environmental data<br>• Moderate time and costs to conduct evaluation<br>• Requires moderate to high level of skills or knowledge about economic analysis | |
| How to improve the 3Rs | • Sensitivity analysis<br>• Inclusion of uncertainty | | • Considerations of equity and justice aspects in the analysis<br>• Increasing stakeholders in the definition of the scope of the valuation | | • Following good practice guide<br>• Careful planning | |
| Strenght of the evidence |  |  |  |  |  |  |
| ***Integration method:*** **Multi-Criteria Decision Analysis (MCDA)** | • Allow ranking of alternative options that vary with respect to multiple criteria<br>• Accommodate different value dimensions<br>• Versatile (many different types of Multi Criteria Decision Analysis) and widely applicable to varying socio-ecological and decision-making contexts | | • Often high reliability on outcomes but the outcomes are the result of trade-offs across different decision criteria and sensitive to weights.<br>• Often high level of representation of different stakeholder perspectives in the decision-making process | | • Moderate in time and resource requirements<br>• Can be adjusted to available resources | |
| How to improve the 3Rs | • Relevance can be improved by having good practice guide on inclusion of stakeholders, quantifying uncertainty, and overcoming negotiation difficulties when large number of stakeholders (groups) are involved in decision-making | | • Improving transparency of the process, in particular how weighting of criteria is implemented<br>• Incorporate uncertainty | | • Choose the Multi Criteria Decision Analysis tool which match resources available | |
| Strenght of the evidence |  |  |  |  |  |  |

| | **Relevance** Diverse values and socio-ecological contexts | | **Robustness** Reliability and fair representation | | **Resources** Initial capacity and costs and time for valuation | |
|---|---|---|---|---|---|---|
| | Values | Contexts | Reliability | Fair representation | Capacity | Conducting valuation |
| ***Integration method:*** **Deliberative decision process** | • Process to form a value judgement in an open dialogue<br>• Accommodate broad and specific values<br>• Instrumental, intrinsic and relational | | • Designed to ensure fair representation of arguments<br>• Conducted with few individuals and can suffer from small-sample bias and thus less reliable<br>• Sensitive to who is participating | | • Low initial investment costs<br>• Moderate time costs for the valuator to prepare the activity<br>• High time commitment from participants and potentially compensation for participation | |
| How to improve the 3Rs | • Design process in dialogue with policy and scientific informants<br>• Relevance can be improved with more testing in different nature valuation context | | • Transparency about representation<br>• Careful facilitation<br>• Management of power dynamics | | • Careful planning and coordination<br>• Testing of guidelines | |
| Strenght of the evidence |  |  |  |  |  |  |
| ***No valuation:*** **Benefit Transfer (BT)** | • Increasing application in policy and practice<br>• Specific to monetary - use and non-use values<br>• Applicable to specific values | | • Reliability is contingent on availability of suitable value estimates and capacity of transfer procedures to calibrate transferred value information (adjustments) – not always high, often moderate<br>• Limited or no representation of stakeholders or other social considerations (equity and fairness) in the transfer process | | • Quick, efficient and cost effective<br>• No need for additional resources for new valuation studies<br>• Requires moderate to high statistical/analytical knowledge and skills to adhere to best practice | |
| How to improve the 3Rs | • Increasing primary studies for value estimates<br>• Covering broad range of nature's contributions to peoples, species, and socio-ecological contexts<br>• Better characterization of valuation and application contexts (matching the sites) | | • Improving benefit transfer procedures or value moderation processes<br>• Increasing stakeholder consultations in use of transfers<br>• Bridging the gap between research and practice | | • Adhering to good practice guidelines | |
| Strenght of the evidence |  |  |  |  |  |  |

The valuation methods are suitable for different decision-making contexts. Below we exemplify common contexts where the methods can provide useful insight.

**Ecosystem service mapping.** This method can help to link biophysical characteristics with ecosystem services to assess nature's contributions to people. They are mainly suitable for informative and decisive use related to spatial planning (*Box 3.2*). Multiple mapping tools are available, but most are data, time and capacity (skills/knowledge) intensive. There is a trade-off between user friendliness and accuracy of the results based on data quality and tools used. Illustrative examples of the applications to support decision-making includes Naidoo et al. (2008), Vorstius & Spray (2015); Maes et al. (2012).

**Biodiversity priority mapping.** The methods in this category can help to estimate species population, distribution or abundance using multiple data. They are useful for informational or decisive purposes (i.e., biodiversity prioritisation); but do not elicit species values as such. Their application requires modelling infrastructure (data and software) and implementation costs if applied for biodiversity assessment and monitoring purposes. Illustrative examples of the applications to support decision-making include Jetz et al. (2019); Meller et al., (2014); SANBI & UNEP-WCMC (2016).

**Stated preferences.** These methods have mainly been used for informative policy purposes, but applications for decisive and technical purposes are also reported. An example of the use for as a technical purpose is the use of a choice experiment conducted with farmers for the design of an agro-environmental scheme in Germany (Breustedt et al., 2013). The choice experiment was used to define the compensation requirements for the programme. Another example is the contingent valuation study conducted to estimate damages to nature caused by the British Petroleum oil spill in the Mexican Gulf in 2010 (Bishop et al., 2017). One advantage of the methods is that it allows for estimation of non-use values (see *3.3.2.2*).

**Q-sorts.** The methods can help understand conflicts and different positions about virtually any topic (both broad and specific value perspectives) but does not elicit values as such. The methodology is mainly suitable for informative use and scoping of valuation processes. The methodology is not suitable for generalisation to higher social scales as it is sensitive to small sample bias. It does not require large infrastructure but is still time consuming to develop for a specific policy question. Illustrative examples of the applications to understand value perspectives include Rust (2017); Mazur & Asah (2013); and Zabala et al. (2018).

**Revealed preferences.** The methods can be used to estimate specific values; they implicitly elicit the instrumental values of nature. Can be used for informational, decisive purposes and technical purposes. The methods are data intensive both in terms of socio-economic data and data on the aspects of nature that the valuation seeks to assess. Low on-going costs are needed to conduct new valuations on the same policy question. Illustrative examples of the applications to support decision-making include Pandit et al. (2014); Johnston et al. (2017); Heagney et al. (2019).

**Livelihood assessments.** The methods can help to understand (rural) households' access and use natural resources. Useful to characterise specific values that are primarily instrumental through a resource dependency linkage. Can be used for informative and decisive purposes in decision-making. Requires time to engage with stakeholders, can be performed with low infrastructure (capacity) needs. Illustrative examples of the applications to support decision-making include Barnes et al. (2017) and Adams (2020).

**Integrated modelling.** This approach has been developed for decision support in different fields. As an example, hydro-economic modelling approaches have been developed to inform the implementation of the Water Framework Directive in Europe, identifying cost-effective programmes of measures as required by the Directive (e.g., Brouwer et al., 2007). Brouwer's model development is built on a rich hydrological and economic data set based on a Dutch integrated hydro-economic accounting system. Hjerppe and Vaisanen (2015) developed an integrated model system for cost-effective river basin management of phosphorus. There is limited information on whether the increasing number of studies in this domain have been merely of informative use or whether they have been used for aiding decisions more directly.

**Participatory mapping.** The methods allow stakeholders to map out importance or values of natural resources. There are a range of methods requiring localised information in order to use geographic information tools. Applicable for specific or broad values; commonly used for instrumental and relational type of values based on mapping and stakeholders' consultations. Resource needs in terms of time and costs can be adjusted and can be applied to many socio-environmental and socio-cultural contexts. Illustrative examples of the applications to support decision-making include Palomo et al. (2011), Wolf et al. (2015), Brown & Kyttä (2018) and Fagerholm et al. (2021).

**Cost Benefit Analysis.** This method aggregate benefits and costs of alternatives; use money metric to provide relevant information for decision-makers to choose between investment or policy options. Sensitive to the choice of discount rates, and availability of benefits and costs information. Can't

accommodate non-monetary values. Moderate requirements in terms of existing data. Illustrative examples of the applications to support decision-making include Song et al. (2018) and Markanday et al. (2019).

**Multi-criteria Decision Aid.** The method can be used to integrate value estimates based on multiple criteria or weightings. Applicable to specific or broad values that are instrumental, intrinsic and relational in nature. Do not elicit values per se on its own but can help value integration. Can capture multiple stakeholder views. Result is contingent on weightings applied for different criteria. Not much initial investment required for application for many versions of Multi Criteria Decision Analysis. Illustrative examples of the applications to support decision-making include Kurth et al. (2017) and Adem Esmail & Geneletti (2018).

**Deliberative Integration methods.** This method can be used for decisive policy purposes in a wide range of contexts where a judgement on a course of action impacting multiple stakeholders (often in diverse ways) needs to be made. The method is not widely used (see *3.2.2.4*) but can potentially allow for representation of multiple types of values among diverse social groups in relatively resource efficient ways. An illustrative example of the use of the methods is in the context of placement of wind turbines in landscape (Mehltretter Drury et al., 2021).

**Benefit Transfer.** The method allows transferring specific values that are mostly instrumental from studied site to a policy site with relevant adjustments. Prone to discrepancies on values based on (match or mis-match) of sites, transfer methods applied, species or services under considerations. Can be used for informational and decisive purposes. No investment and implementation costs needed if suitable value databases exist but generating values for a particular policy purpose requires time. Illustrative examples of the applications to support decision-making include Johnston et al. (2015); Subroy et al. (2019); Plummer (2009).

The analysis in this section has highlighted that there are trade-offs in method choice and that no method performs highly on all criteria. It is therefore important to clearly define what the objective of a valuation is and which types of risks that are most important to avoid. The analysis also illustrates that a combination of methods may be needed to fully answer to a given policy question (see *3.3.1.3*). Further material on choices in valuation processes can be found in *Section 3.4*.

## 3.3.4.1. Trade-offs and complementarities in economic valuation initiatives

In this section we use the 3Rs framework to highlight trade-offs and complementarities between three main high level economic nature valuation initiatives, The Economics of Ecosystem Services and Biodiversity initiative (TEEB, 2010), the United Nations System of Environmental and Economic Accounts – Ecosystem Accounts (UNSEEA EA) and Comprehensive Wealth approach (similar to the inclusive wealth approach) recently advocated in the Dasgupta Review (Dasgupta, 2021) (see 2.2 and 6.2). The Economics of Ecosystem Services and Biodiversity initiative promotes that using a wide range of valuation methods, which are suited and can be adapted for valuation of different projects and policies, can enable inclusion of nature's values in decision making (see reviews of the economic valuation methods in section 3.2.2). More material on the United Nations System of Environmental-Economic Accounting can be found in *Chapter 4* and in *Box 3.7*. In this section we briefly give an overview of the Comprehensive Wealth approach as a methodology to account for nature's values.

**Box 3.7. Natural capital accounting: the system of environmental economic accounting (SEEA)**

Natural capital accounting applies economic and accounting principles to the description and management of the environment with the aim of aiding environmental and economic decision-making. This requires measuring biophysical aspects (quantities and qualities) as well as socio-economic values, assigning them to aspects of the natural world and recognising the connections to (groups of) individuals and businesses. The System of Environmental-Economic Accounting (SEEA) is the statistical framework endorsed by the United Nations Statistical Commission as the way in which natural capital accounting can be supported by official statistics (United Nations et al., 2014a; 2014b).

This summary gives an overview of the System of Environmental-Economic Accounting and its role in integrating data to inform discussion of the connections between people and the environment, pointing to some main opportunities and challenges.

The System of Environmental-Economic Accounting develops internationally agreed concepts and definitions pertaining to the measurement of environmental flows (e.g., water, energy, waste and emissions); environmental transactions (e.g., environmental taxes and expenditure); natural resources (e.g., minerals, timber, fish) and ecosystems and the services they provide. Work on the System of Environmental-Economic Accounting was initiated in the 1970s) gaining momentum from the Earth Summit in Rio de Janeiro in 1992 and through ongoing testing and development by statistical agencies. More recent work has shown the connection to monitoring progress towards the Sustainable Development Goals and the targets of the Convention on Biological Diversity (see *4.6.4.2, Chapter 4*).

Its origins lie in adopting and extending the accounting principles, classifications and definitions of the System of National Accounts that are used to underpin economic statistics, including gross domestic product. While originally focused on adjusting measures of gross domestic product for the effects of depletion and degradation, the focus of the System of Environmental-Economic Accounting has broadened to cover the general integration of physical and monetary environmental and economic data. As a statistical standard, the System of Environmental-Economic Accounting pursues the consistent comparison and exchange of data and aims to underpin a range of applications, including the derivation of coherent and consistent indicators that reflect the impacts and dependencies of the economy on the environment.

The broadening of the measurement and valuation context using accounting principles builds on a range of literature (Banzhaf & Boyd, 2012; Dasgupta, 2009; Haines-Young & Potschin, 2010; Keith et al., 2013; Obst et al., 2016; Vanoli, 1995) and consists of several advances:

First, the System of Environmental-Economic Accounting *extends the definition of assets* to incorporate all biophysical components irrespective of their degree of economic ownership or flows of benefits in monetary terms. This broadening in biophysical terms provides the basis for recording a more complete range of interactions between the environment and the economy and provides physical measures to complement monetary valuations. More recently, this scope has expanded to capture ecosystem extent (area) and condition (ecological integrity) across the terrestrial, freshwater, subterranean and marine realms.

Second, in accounting for ecosystems, the System of Environmental-Economic Accounting *incorporates a wider scope of* benefits than conventional measures of income and production by including a range of ecosystem services. These services include air filtration, climate regulation, flood mitigation and amenity-related services that are commonly non-market services and hence not explicitly identified or valued in the national accounts. The extended accounting framing builds on recognition of the exchange value of these services, as well as the flows in physical terms, and hence could support reporting on measures of ecosystem degradation and enhancement in response to human uses of the environment, aspects which are missing from the current national accounts.

Third, progress in the implementation of the System of Environmental-Economic Accounting, especially concerning ecosystem accounting, has highlighted *the importance of spatial data and local context*. The

organisation of data at detailed spatial scales supports recognition of a larger diversity of contexts in the supply and use of ecosystem services and can improve understanding of environmental and social outcomes.

However, several on-going challenges exist in advancing implementation of the System of Environmental-Economic Accounting:

First, there is the need to *move beyond the compilation of accounts* to the use of accounting data in applications and decision-making processes. This will require ongoing engagement with a variety of users to realize and demonstrate the added value of the System of Environmental-Economic Accounting.

Second, there is a need for the System of Environmental-Economic Accounting to build links to the *discussion of diverse value perspectives*. While the System of Environmental-Economic Accounting does have a specific approach to monetary valuation based on exchange values, that supports integration with the national accounts (and excludes consumer surplus), it does not have an aim to provide a "single value of nature". At the same time, the System of Environmental-Economic Accounting organisation of data on ecosystem extent, ecosystem condition and the physical flows of water and energy allow moving beyond a narrow market exchange view of accounting.

Third, there is a need for further research on several *aspects of measurement and valuation*. Through the revision process of the System of Environmental-Economic Accounting Experimental Ecosystem Accounting manual (2018-2021), significant progress has been made in harmonising definitions of ecosystem units, types and qualities, in providing comparable definitions for ecosystem services, and in discussing monetary valuation techniques for integration with the national accounts. Work will be needed to refine and test these areas, as well as advancing the measurement of concepts such as ecosystem capacity, and the use of detailed spatial data to support both local, national and global decision-making processes.

From a valuation perspective, the System of Environmental-Economic Accounting aims to broaden traditional accounting by adding part of natures' values to an instrument currently inconsiderate of these values. Beyond the use of the System of Environmental-Economic Accounting's biophysical data to assess non-monetary values, the future development of pilot and experimental accounts might provide complementary data reflecting additional monetary value perspectives currently not reflected in an accounting context, such as consumer surplus and welfare values, non-use and relational values

The System of Environmental-Economic Accounting is a major program with a very high potential impact. The step from 'market values of economic assets' to 'market and non-market values of economic and natural assets' may seem small from the perspective of value plurality. However, this approach to accounting might further challenge the standard application of economic theory, could lead to transforming standards for environmental measurement and may pave the way to a more plural accounting of nature-human relations.

The concept of Comprehensive Wealth (CW) is a reflection of how values measured in terms of well-being and prosperity of a country depend not just on the returns from physical and human capital, as reflected in typical national accounts, but also on environmental and social capital. The reason Comprehensive Wealth is proposed is that using this concept in valuation, well-being at any given time is determined by the returns to national wealth. Comprehensive Wealth is therefore intrinsically related to sustainable economic development (SED) (Hamilton & Hepburn, 2017). Current measures of economic performance, such as Gross Domestic Product (GDP), do not reflect sustainability, as it is a measure of economic flows (see *2.2*). It is possible that gross domestic product grows over time solely as a result of running down the national wealth. The Dasgupta Review on the Economics of Biodiversity argues that global growth is being maintained by erosion of regenerative natural capital and biodiversity (Dasgupta, 2021). Since the 1970s, economists have shown that sustainable economic development is strongly related to comprehensive wealth. They conclude, that if comprehensive wealth goes up, future well-beings will not decline, and if comprehensive wealth declines, future well-beings are certain to decline (Arrow et al., 2012; Hamilton & Clemens, 1999). Using a comprehensive wealth approach to valuation of nature therefore has direct policy

implications: i) Governments should change measures of performance to include measures of comprehensive wealth; ii) natural capital should be valued and monitored over time; and, iii) rents from non-renewable resources (which value the decline in this form of capital) should be reinvested in other forms of capital to maintain Comprehensive Wealth (e.g., Barbier, 2019; Dasgupta, 2021).

The valuation of natural capital is therefore essential for these policy recommendations to work and needs input from both natural scientists and economists. However, there are severe data limitations, particularly for the measurement of biodiversity.

In practice, several studies have aimed to operationalize the comprehensive wealth approach. Among the empirical studies that demonstrate the theoretical principles, early work by Hamilton and Clemens (1999) placed monetary values on natural resource depletion in developing countries, albeit limited to non-renewable resources, deforestation and $CO_2$ emissions. Their review showed a mixed picture for the period 1970-1993 in which 'Genuine Savings' (aggregate savings minus natural resource depletion) was negative for many countries; and Comprehensive Wealth declined and growth in incomes was therefore unsustainable. Particularly in Sub-Saharan Africa and the Middle Eastern states, reinvestment of resource rents was insufficient to maintain overall wealth, and natural resource depletion was excessive. In a counterfactual analysis, Atkinson and Hamilton (2016) show a similar scenario in the UK with respect to North Sea Oil. They show that had the United Kingdom invested its resource rents during the 1970s and 1980s rather than consumed rents to finance tax breaks, its national wealth would now be much higher than it is today. Similar evidence can be found in Hamilton and de Ruta (2006) who analyse a selection of countries to illustrate how simple aggregate savings rules, including investing resource rents (the Hartwick Rule (Hartwick, 1977)) would have left many countries with larger comprehensive wealth. The Comprehensive Wealth literature illustrates the importance of long-term thinking and how important it is for long-term well-being to value natural resource depletion and then invest equivalent amounts to sustain wealth. Helm (2015) makes the case that natural capital should also be the recipient of investment for this purpose.

The World Bank's (2010) comprehensive wealth accounts were estimated across the world including natural resource wealth: agricultural land, urban land, pasture land, energy and mineral resources, forest resources and protected areas. Natural resource wealth was found to make up 25% of national wealth in poor countries. A broader theory and set of results can be found in Arrow et al. (2012) in which Comprehensive Wealth measures, which include a broader array of categories, are calculated for the United States, China, Brazil, India and Venezuela using publicly available data. The headline results show that typical gross domestic product growth is woefully inaccurate as a measure of long-run well-being, and that growth in comprehensive wealth while largely positive, is composed of negative growth in natural wealth coupled with positive growth in human, health and occasionally manufactured capital (Arrow et al., 2012). The Dasgupta Review made measurement and reporting of Comprehensive Wealth a central policy recommendation for living within the limits of environmental constraints (Dasgupta, 2021).

The terms Inclusive Wealth and Comprehensive Wealth have the same theoretical underpinnings: that non-declining wealth means non-declining inter-temporal well-being over time, but historically the need for different terminology reflects different means of measuring and valuing national wealth. Comprehensive Wealth is the term used by the World Bank and measures wealth across manufactured, human, natural and other capitals by calculating the present value of future consumption that will not reduce national wealth: i.e., sustainable consumption (see e.g., Hamilton & Hartwick, 2005; World Bank, 2006). The Inclusive Wealth measure proposed by Arrow et al. (2012) and used by the United Nations in its wealth accounting (UNU-IHDP & UNEP, 2014), values national wealth and its capital stocks directly by estimating physical units of capital and multiplying them by a social price. In essence, Comprehensive Wealth uses the present value of a flow of benefits

to estimate national wealth, the latter directly estimates the stock of national wealth. The different approaches to measurement have different practical implications concerning data requirements and the treatment of Intangible Capital like Human Capital. Yet as attempts to measure sustainability they are similar policy proposals.

Polasky & Dampha (2021) provided a review of the Inclusive Wealth approach as an indicator for sustainable development. They concluded that estimating a full value of inclusive wealth in practice would be near infeasible due to data demands and that '*no current measure of inclusive wealth is in fact fully inclusive'*. They propose that combining a semi-inclusive wealth indicator with indicators of changes in critical natural capital could provide a set of signals to decision-makers of whether society is following a sustainable development trajectory.

In conclusion, the theoretical concepts underpinning the Comprehensive Wealth/Inclusive Wealth approach are well established. The empirical examples are connected to biodiversity through the land and forest resources that are included in the operationalization of the concepts. However, the approach does not directly evaluate the impact on biodiversity and ecosystem services of declining natural capital stocks nor value these changes (Polasky & Dampha, 2021). The overall wealth accounting initiatives are important steps in accounting for the composition of economic development and understanding its sustainability in terms of well-being and the natural environment. Inclusive Wealth accounting goes beyond gross domestic product to look at stocks rather than flows and provides a more comprehensive and longer-term perspective of the consequences of economic activities.

In *Table 3.11* we compare the relative strength of the three initiatives. The primary objective is to highlight how complementary approaches can support diverse needs. The initiatives can also provide data sources that jointly be used for multiple purposes and therefore reduce the overall resource needs for valuation (*Annex 3.14*).

**Table 3.11** Comparison of the relative merits of The Economics of Ecosystems and Biodiversity, United Nations System of Environmental Economic Accounting (UN SEEA EA) and the Inclusive Wealth approach using the 3R criteria (Relevance, Robustness and Resources).

| | **Relevance** Capturing diverse values in multiple socio-ecological contexts | | **Robustness** Ensuring reliable (accurate and valid) and fair representation of stakeholders | | **Resources** Resource requirements for capacity building and resources for conducting valuation | |
|---|---|---|---|---|---|---|
| | Values | Contexts | Reliability | Fair representation | Capacity | Conducting valuation |
| **Integrating economic initiatives** | | | | | | |
| **System of Environmental Economic Accounting (UN SEEA EA)** | • Instrumental values<br>• Physical and monetary exchange values<br>• Applied to ecosystem extent, condition, ecosystem services<br>• Applied to thematic accounts for carbon, biodiversity, oceans and urban areas | | • Standardized methodologies are reliable for the purpose of national accounting<br>• Representative at national sectoral level, but not representative of all local values at local level, despite high biophysical resolution (lower spatial granularity for monetary methods) | | • High initial resource requirements (geoinformatics and geospatial data, location specific economic data)<br>• High implementation costs (annual compilation at national level) | |
| How to improve the 3Rs | • Complementary accounts bridge to welfare values, inclusive wealth, corporate natural capital accounting | | • Improve availability of data at national level<br>• Validate using local data<br>• Higher spatial resolution of monetary valuation methods<br>• Uncertainty analysis for aggregates | | • Capacity building and developing collaboration among national data holders, researchers, statistical agency compilers and modelers and ultimate users.<br>• Standardization and automation of workflows | |
| Strenght of the evidence |  |  |  |  |  |  |
| **The Economics of Ecosystems and Biodiversity** | • Instrumental values but allow assessment of multiple types<br>• Allow accounting for social, cultural and political context of decision-making<br>• Design valuation to answer specifically to policy needs | | • Allow prioritization of stakeholder needs through participatory design of the valuation<br>• Design valuation to assess the impact on different groups<br>• Some inconsistencies in value indicators, as different methods, different value concepts | | • Can be designed to resource availability to some extent<br>• Each valuation process is adapted to the policy question but optimization of resource use can come from training of valuators, building of core data sets for a region/country and use of best practice guidelines | |
| How to improve the 3Rs | • Use of complementary methods<br>• Using pilots routinely to ensure relevance to stakeholders<br>• Following reporting standards to allow others to use learn from the experiences | | • Engagement with local stakeholder in design of valuation<br>• Engagement with policy and scientific experts in design of valuation<br>• Adherence to best practice guidelines and updating of practices | | • Open access to environmental and socio-economic data, training of valuators, and widely accessible best practice guidelines | |
| Strenght of the evidence |  |  |  |  |  |  |
| **Comprehensive/ Inclusive Wealth** | • Instrumental values<br>• Includes social capital (education, health)<br>• Mainly applied to renewable and non-renewable natural resources (stocks and flows)<br>• Country scale | | • Theoretically consistent welfare indicators<br>• Includes dynamics of both the economy and the natural resources<br>• Represents all sectors and demographic groups included in national counts | | • High initial resource requirements to acquire data on natural resource stocks but can build on UN System of Environmental Economic Accounting (UN SEEA EA) efforts<br>• Rely on data that exists in many countries | |
| How to improve the 3Rs | • Operationalizing the approach | | • Improve data sources and represent a wider range of natural resources and biodiversity considerations | | • Build on UN System of Environmental Economic Accounting data sources and infrastructure | |
| Strenght of the evidence |  |  |  |  |  |  |

The analysis shows that the initiatives are complementary. The economics of ecosystems and biodiversity (TEEB), as a flexible policy evaluation tool, is more adaptable to emerging decision-making needs. United Nations system of environmental economic accounting (UN SEEA EA) provides an opportunity to link biophysical ecosystem accounts to national economic accounts and improving the information for decision-makers to do nature valuation. Inclusive wealth has its strength in the theoretical consistency for measuring sustainable economic development. However, data shortages are still hindering full implementation in practice.

# 3.4. Guidance for valuation practice

Previous sections have demonstrated that there are no perfect methods; that - for a comprehensive valuation - several complementary methods will usually need to be combined; and that a careful play of balancing trade-offs between relevance, robustness and resources is inevitable. Moreover, since the purpose of the valuation drives many of the method choices that must be made, and context-specific conditions influence what works or cannot work in a given situation, it would be imprudent to suggest that clear-cut recipes exist that match methods to purpose and contexts.

Hence, this section combines the lessons learned from the assessment of methods conducted in this chapter to provide general, yet practical guidelines aimed at avoiding irreversible or expensive social, financial or environmental errors. The aim of the guidelines is to ensure that - for different contexts and purposes - the valuation process is designed to adequately inform decision-making and policy design for nature while also accounting for the 3Rs. The guidelines for valuation synthesise theoretical principles of valuation identified in this chapter into clear and useful valuation questions to guide valuation experts or commissioners of valuation studies in a stepwise manner. The valuation process is therefore presented in five steps.

## 3.4.1. Valuation is a step-wise process

The valuation process can be summarised into five steps. Valuation is often seen as a merely technical process of choosing and applying a method fit-for-purpose, but the assessment clearly shows that the relevance, robustness, and resource-efficiency of a valuation depends heavily on the normative and political context of the valuation and positionality of the valuator. In that sense, a 'valuation' is the entire 5-step process. Choices made in each step affect the next step and go on to affect the final quality of the valuation. The steps are also interacting rather than fully discrete steps through time. Following these steps explicitly, and transparently reporting on the choices made, improves the quality of the information and processes that valuation generates, and covers key considerations of the valuation process. The steps are:

- **Step 1 - Construct a legitimate process**. This requires that the providers of valuation information are explicitly defined, and that there is transparency about how a robust valuation is ensured particularly in regard to representativeness or participation. Whenever relevant, they should be informed or engaged in the upcoming valuation study.
- **Step 2 - Define the purpose and intended use of the valuation outputs**. While the purpose is often clear from the decision context or it is defined by the socio-environmental problem that is triggering the valuation, the valuation process can often benefit from fine tuning and (re)defining this purpose once stakeholders have been engaged in the first step.
- **Step 3 - Establish the scope of the valuation.** This requires defining thematic and geographic boundaries of the valuation and ultimately, determining who can be considered as a legitimate and relevant stakeholder of the valuation process. This step helps clarify whose values are being represented and helps identify which stakeholders (and thus, whose values) might have been omitted in the first and second steps. Feasibility constraints - in terms of financial, human and technical resources - are evaluated at this stage. This step interacts with step 1 and 2.
- **Step 4 - Choose and apply the valuation methods.** With the purpose of the valuation clear and having identified the diversity of interests and stakeholders at play and being aware of the resource limitations impinging on whatever process or outcomes are decided upon, the appropriate methods can be selected. In most cases, a combination of nature-based, statement-based, and behaviour-based are needed and their findings can be brought together with integration methods. This step requires acute awareness of the limitations of

certain methods and approaches, of the processes that have been developed to counter some of the limitations and designing around those.

- **Step 5 - Articulate results in decision-making.** The findings of valuation results need to be presented in a way that makes them easy to understand and to uptake into decision-making. This requires effective and transparent communication of the outputs and honest reflection of the limitations and omissions of the valuation process. Importantly, any factors that pose risks to the uptake of valuation results should be explicitly reported.

For each step, a set of valuation questions are provided to guide the valuator along with a short description of the valuation principles that apply. References are provided to the section in the chapter where more detailed information is available (*Figure 3.43*).

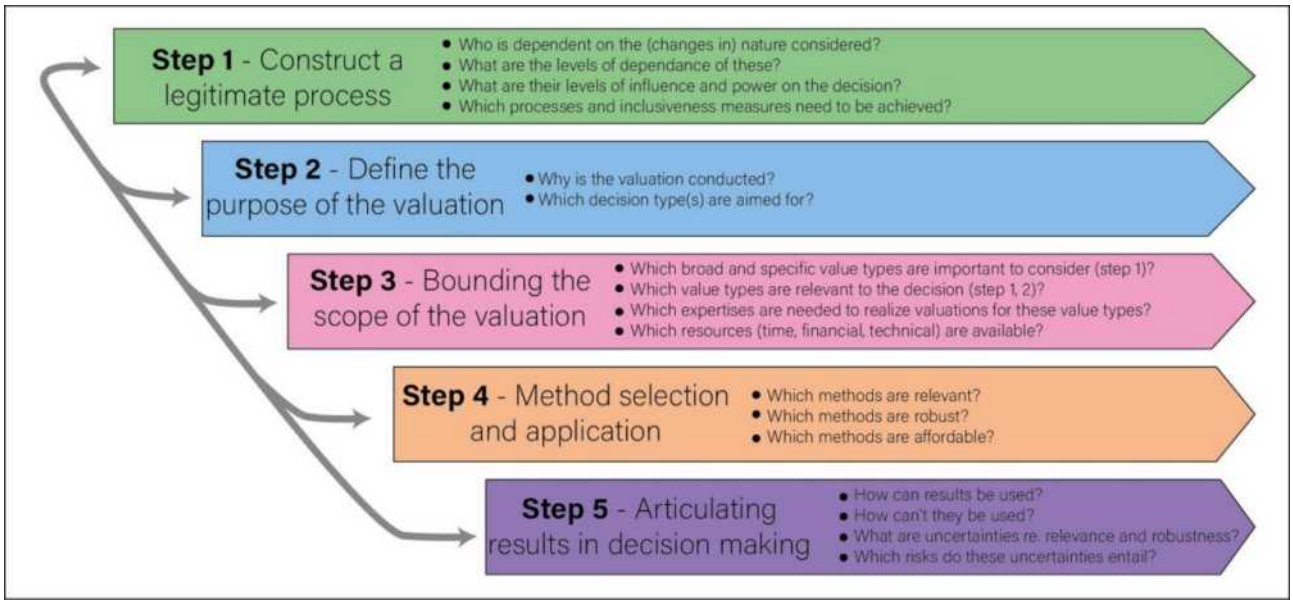


**Figure 3.43.** Valuation process depicted in 5 steps. The choice and application of an appropriate (set of) valuation methods (step 4) is embedded within this larger process.

## 3.4.1.1. Step 1- constructing a legitimate process

Valuation of (changes in) nature departs from the fundamental notion that people and communities depend on nature (albeit to different extents) and these dependencies must be secured. While it is important to consider all groups and communities and their diverse values, dependencies on nature are usually disproportionate across groups in any given society. Access to the valuation process needs to account for existing and historical differences. Moreover, the power to influence decisions on what counts, and thus which values and whose are prioritised, also varies strongly between social groups. Lastly, some groups (such as past and future generations) and entities (such as animals, mother nature and other non-human beings) do not have a direct way to communicate their values, hence their representatives might be needed (e.g., the elderly, historians, religious and spiritual leaders, the youth).

**Step 1 - Valuation Questions - constructing a legitimate process**

Step 1 relates mainly to relevance and robustness consideration. What is considered to be the community of justice, how is fair representation ensured (see *3.3.2.3*) and which forms of knowledge need to be included (see *3.3.1.2*). Furthermore, step 1 designs the procedures for transparent reporting. Assessment questions to consider in step 1 are:

1. Who is dependent on the (changes in) nature considered (people, social groups, communities)?
2. What are the levels of dependence of these people/communities on nature?
3. What are their levels of influence and power on the decision regarding nature?
4. Which groups of people (and non-human beings) need to be distinguished?
5. Whose values need to be represented?
6. Which people/groups/communities need to participate in the valuation process?
7. Which processes and inclusiveness measures need to be achieved?

Participation level is based on the depth of stakeholder engagement and the presence of actions to remove barriers for inclusion. The lowest level captures data and information coming from stakeholders, while at the highest level, stakeholders are actively involved in reviewing and validating outputs or processes. The representation level (*Figure 3.38*) depicts how diverse groups of stakeholders are targeted and recognized in the process as well as how the presentation of values is disaggregated for these groups.

In cases where valuation will be conducted in indigenous peoples and local community territories (land and sea), numerous guidelines exist on how to conduct ethically responsible research that takes into account the IPLC context where one is working (*Annex 3.12*). Some of these guidelines are locally specific and provided by specific indigenous peoples or local communities (for example, The Framework for Research Engagement with First Nation (University of Manitoba, 2014), Metis, and Inuit Peoples, or the San Code of Research Ethics (Chennels & Schroeder, 2017)), others are regional and include some communities and indigenous groups while others are much broader and represent many of them. A non-exhaustive list of existing guidelines for conducting research in indigenous and local communities is provided in *Annex 3.15*. It is generally recommended that one follows the most local guidelines available and if those are missing, to apply the next level of locally pertinent guidelines. In the absence of local, group-based or national guidelines, the General principles for ethical conduct in human research (NHMRC & Australian Research Council and Universities Australia, 2007) should be applied.

### 3.4.1.2. Step 2- defining the purpose of valuation

Valuations are initiated with a certain goal and purpose. In our chapter, goals are defined as broad societal 'missions' such as improving wellbeing, justice or nature itself, while purposes are the 'way how' valuations target a certain decision-making process. If goal and purpose are not explicitly stated when commencing with a valuation, it is impossible to assess which valuation is relevant. Based on decisions in step 1, the goals and purpose of the valuation can be stated, communicated towards or deliberated together with the relevant people, groups or communities. Transparency in this step mitigates the risk for valuations to be conducted or commissioned in ways that will result in outputs not being used, or even reproduce or aggravate injustices that the valuation aimed to reduce. Some important questions to define the purpose of valuation are the following:

1. Why is the valuation conducted?
2. Which decision type(s) does the valuation aim to inform?
3. How will valuation results target these decisions?
4. Who will be involved in decisions regarding these questions (adapt step 1 if necessary)?

The chapter has structured the evidence on why valuation is conducted, i.e., why is it relevant, by synthesising valuation goals into whether they seek to improve human well-being, ecological quality or justice or broader IPLC principles (see *3.2*). Often a valuation has several goals and identifying these are helpful for targeting the activity. Furthermore, deciding how the valuation is intended to enable decision-making is also essential for better design of valuation. Is the valuation intended only

to serve as informative, or is the valuation intended to support a decision-making itself, serving as a decisive support tool. Finally, the goal of the valuation may also be to support the development of policy instruments. For further information on the purposes of valuation (see *3.2.1.1* and *4.6*). Defining the purpose of valuation is a prerequisite for deciding who should be involved (see *3.3.1.2, 3.3.2*).

### 3.4.1.3. Step 3- scoping the valuation

Once the process and purpose are clear, a decision is needed on which values to cover with the valuation. Together with the involved stakeholders (or taking into account the groups that need to be represented) a wide inventory of relevant values can be made. Value typologies such as the one from this assessment (see *Chapter 2*) can be used to cover the diversity of values and check if no relevant values are overlooked. In this stage, it is possible -based on the broad and specific value types inventoried- that the purpose needs to be reformulated, either to broaden it to include values, or to focus it to better reflect the scope. This inventory then is confronted with the available resources and expertise. Additional valuation expertise might be needed, and resources might need to be spread across experts in order to cover the required value diversity. Resource availability might require concessions to be made, either on relevance (e.g., excluding certain relevant value types) or robustness (e.g., choosing a quick screening method rather than a resource-intensive one) (see step 4 below). Important guiding questions to define the scope of the valuation are the following:

5. Which broad and specific value types are important to the people considered (step 1)?
6. Which value types are not relevant (enough) to the people considered (step 1)?
7. Which value types are relevant to the purpose of the valuation (step 2)?
8. What kinds of expertise are needed to realize valuations for these value types?
9. Which resources (time, financial, technical) are available?

### 3.4.1.4. Step 4- selecting and applying valuation methods

It is only once the process, purpose and scope are clear, that it becomes relevant to select adequate (sets of) methods for valuation and to apply them. This step is intertwined with the trade-off considerations regarding available resources in step 3, but also needs to take into account some inherent features of existing methods. This step critically requires involving open-minded experts from different disciplines to avoid disciplinary bias. Especially when judging on pros and cons of potential methods, it is essential to recognize diversity of valuation methods and approaches from different disciplines and traditions and recognize diverse types of evidence and ways to assess quality of valuations. The informed choice made in this step has immediate and large implications on the valuation results, and builds on the process, purpose and scoping steps. It is risky to skip these steps or leave them implicit, as the choice of method is then left to the person or group which happens to have the authority to decide this, but - because of inevitable social or disciplinary bias - does not necessarily realise, recognize or represent the full extent of value diversity entailed by the purpose.

In this section, the choice of methods that are appropriate for different contexts and purposes is illustrated by five hypothetical examples that typify the sets of considerations and contexts that valuations must navigate (*Table 3.12*). These cases demonstrate how diverse contexts lead to different consolations of conditions that ultimately limit the consolation of appropriate and adequate methods. Although the cases themselves are hypothetical, they build on the diversity of valuation cases (n = 1163) that were reviewed for this chapter.

**Table 3.12** Illustrative example cases to illustrate valuation choices and method selection. The case descriptions are inspired by the in-depth systematic literature review (n=1163); any resemblance with real life cases is coincidental.

| Goal and purpose of the illustrative case | Specific contexts and conditions of the case | | | |
|---|---|---|---|---|
| | Risk of conflicts | Socio-political complexity | Socio-economic impact | Resources for valuation |
| **Case A - "Humboldt Park"** Urban planning - Local authorities commission development of vision plan for multifunctional green space in middle-class neighborhood | Low | Low | Low | High |
| **Case B- "Rain River"** Litigation - Court demands expertise for village court case against gravel extraction company for downstream river bank erosion. | High | Low | Medium | Medium |
| **Case C- "Beaver Dam"** Natural Resource Use case - National Law requires socio-environmental impact assessment for drinking water dam in uninhabited valley | Medium | Medium | High | Medium |
| **Case D - "Breton Airport"** Infrastructure development - valuation for NGO and grassroot organisation which contest airport development in rural area | High | High | High | Low |
| **Case E - "Fancy Farm"** Payment for Ecosystem Services design - Government commissioned design of compensation scheme for farmers' efforts to mitigate landscape degradation in rural region | Medium | Medium | Medium | High |
| **Case F- "Wollah Hunting"** Access to indigenous peoples' territories - for necessary culling of top predator populations, rangers or hunters need regulated access | Low | High | Low | Low |

The illustrative cases - even if only concisely described - allow to distinguish different ways to answer the valuation questions in step 1, 2 and 3. While in reality, these answers can be elaborated and co-created with the relevant stakeholders as inherent part of the valuation process, differences in participation level, type of information and decision, and plurality level are clearly illustrated (see *Table 3.13*).

**Table 3.13** Potential responses for the valuation questions guiding Steps 1, 2 and 3 of the valuation process, for each of the illustrative cases

| | A "Humboldt Park" | B "Rain River" | C "Beaver Dam" | D "Breton Airport" | E "Fancy Farm" | F "Wollah Hunting" |
|---|---|---|---|---|---|---|
| **Step 1 - valuation process** => participation level | **Medium:** Experts and inhabitants | **Low:** Based on authoritative experts | **Medium:** Experts, actors from water and nature sector | **Medium:** Authoritative experts and local experts | **High:** Experts on ecology, farming economy and law, and local farmers. | **High:** Experts on ecology, indigenous representatives |
| **Step 2 - valuation purpose** => which info, for what | Accepted & legitimate; for design | Robust and focussed; for court ruling | Broad and reliable; for assessment | Broad and accepted; for campaigning | Robust and broad; for effective and fair design | Broad and accepted; for respectful agreements |
| **Step 3- valuation scope** => Plurality level | **Medium:** Specific local ecological & wellbeing values | **Low:** Specific damages, biophysical processes | **Medium:** Diverse ecological, wellbeing values | **High:** Ecological values, broad wellbeing values | **Medium:** Wellbeing, broad values, ecological values | **High:** Broad values, principles, ecological values |

Based on the answers in Steps 1 to 3, the potential methods can be selected and applied. This is illustrated with the example table from *Section 3.3.4* and the illustrated cases and their level of available resources. *Table 3.14* demonstrates that adequate sets of methods differ strongly between valuation contexts. In reality, more nuanced purpose definitions and resource descriptions applied over a larger set of available methods brought by different disciplines, through a more or less participatory process to take this key decision for valuation.

**Table 3.14** Examples from the four method families, their main characteristics (see *Table 3.10*) and their selection for the six illustrative cases. Capital "M": main method; small caps "a": potential additional method. Note that this illustration only includes the example methods from Section 3.3.4: scores for the 3Rs are derived and summarised from *Table 3.12*. The illustrative method choice is based on general context descriptions from the cases: in reality, the range of potential methods is much larger, and contextual requirements more detailed.

| Method examples | Relevance (see 3.3.1) | | Robustness (see 3.3.2) | | Resources (affordability see 3.3.3) | | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| See 3.3.4 | Suitable to a wide range of values | Suitable to a wide range of contexts | Suitable when accurate estimates are required | Suitable when fair | Low data, skills and software is required | Low time and costs for the valuation is required | | | | | | |
| ES mapping | Medium | High | Medium | Low | Low | High | a | | | | a | |
| Biodiversity mapping | Low | Medium | Medium | Low | Low | Medium | | | a | | a | |
| Stated preferences | Medium | High | Medium | Medium | Medium | Medium | | a | | a | M | a |
| Q sorts | Medium | Medium | Low | Low | Low | Medium | M | | | | | |
| Revealed preference | Low | Medium | High | Medium | Low | High | | a | a | | | |
| Livelihood assessment | Medium | Medium | Medium | Medium | High | Medium | | | | | a | a |
| Integrated modelling | Low | Low | Medium | Low | Low | Medium | | M | a | | | |
| Participatory mapping | High | High | Low | Low | High | Medium | a | | | M | | |
| MCDA | High | High | Medium | Medium | Medium | Medium | | | M | | | |
| DIM | High | Medium | Low | High | Medium | Medium | | | | | | M |
| Benefit transfer | Low | Medium | Low | Low | High | High | | | | a | | |

Step 4 operationalizes the trade-off between the 3Rs (see *3.3.4*), but entails also a highly context-dependent component. Deciding methods to fit the purpose, decision types, involved values and actors, as well as process requirements, entails knowledge on methods' inherent features (see *3.2.2* on the review of different methods). However, methods' *inherent* features are hard to distinguish from context-specific application patterns, as methods can be combined or even recompiled into a mixed approach which combines several procedures (and disciplines) to fit the context. As such, *inherent* shortcomings of certain methods can be relieved (as well as strengths lost) depending on the way they are implemented in practice.

### 3.4.1.5. Step 5 - articulating the values for decision-making

For a valuation to be successful, its results need to inform and improve the decision that was originally envisaged. This *uptake* is dealt with in *Chapter 4* of this assessment, but it is an important step in the valuation process. The defined purpose (step 2), based on a legitimate and relevant process (step 1)

and defining the scope of the valuation (step 3), provides relevant, robust and resource-efficient results (step 4).

Each of these choices, however, has a flip side: which actors are not included, which aspects are not representative or participatory, which values are not targeted, and what are shortcomings of the methods chosen. This has immediate repercussions on how the results can be applied for their purpose. More importantly, applying values beyond their purpose entails risks. Based on the illustration cases above, in particular the one referring to the Wollah indigenous territory, using the values of nature elicited for the beaver dam would risk creating a conflict. Also, applying the values of nature elicited in the Humboldt Park visioning to the Breton Airport conflict case risks to generate irrelevant information. Different decision-making stages and the role of valuation in supporting these stages can be characterised in several ways (see *3.2.1.1 and 4.6*).

Effective and responsible uptake of value information in decisions is a shared responsibility between the actors commissioning the valuation, the valuators and the diverse actors involved in it. This goes beyond transparent communication of values and assumptions, and requires engagement with the decision processes and actors in an early stage. See *Chapter 4* for further reading on uptake of values in decision-making.

# 3.5. Conclusions, knowledge gaps and recommendations

The assessment of valuation methods conducted in this chapter has provided answers to the six assessment questions outlined in *Section 3.1*. The six questions encapsulate the scope of *Chapter 3* in terms of what it was supposed to assess (valuation methods) and the numerous considerations of valuation that it was supposed to address (the ability of methods to fulfil numerous societal goals). Here, we provide a concise description of how the questions were answered and the responses for each based on the findings of the chapter. We also identify knowledge gaps that were detected and make some recommendations for how to address them.

Assessment question 1: **"Why is valuation undertaken?"** was answered by assessing the goals of applying valuation methods, as well as the various purposes in decision-making they aim to serve. We found that valuation is undertaken for a multitude of reasons, but primarily for informative followed by decisive purposes, indicating that valuations frequently aim to provide decision-makers with recommendations about the most desirable course of action (*Figure 3.14*). However, published valuations are rarely linked to active decision-making processes suggesting that the aim to inform is merely hypothetical and that the information they generate is not channelled into decision-making. Valuation studies do not sufficiently address this uptake gap, however, through reflective evaluation and recommendations of ways to connect studies to actual decisions. With the help of contributions from ILK experts, we have been able to only scratch the surface on the nature of valuation in indigenous peoples and local communities. Further valuation work would benefit from linking directly to decision-making processes that require valuation. This would also help identify the nature of barriers to uptake, particularly whether limitations to uptake are method-related or context-related. For this to happen, better collaborations between academia (the biggest producers of valuation studies) and stakeholders associated with socio-environmental issues is needed. Valuation practice would also benefit from improved understanding of IPLC valuation through stronger collaborations with IPLC scholars and communities to learn how their ways of valuation could inform current valuation practice in non-IPLC contexts.

Assessment question 2: **"Which methods are applied?"** was addressed by inventorying the methods and approaches that were applied in 1163 valuation studies between 1980 and 2020, stratified and randomly sampled from a corpus of more than 79,000 valuation studies. To facilitate methods assessment, a cross-disciplinary classification system was developed (the *methods family*) that allowed grouping of a highly diverse list of methods based on some of their most basic characteristics (what they assess and their information source). We found that, while there is no scarcity of methods (more than 50 distinct methods exist) available to conduct valuation, most valuation studies only apply one and because methods are highly specific in terms of which values they are able to elicit, studies mostly fail to report on the full range of values at play. Given the diversity of methods and approaches, and the specific limitations and strengths presented by each of them, combining different complementary methods can ensure that valuations address diverse values and do so robustly. Method combinations require interdisciplinary valuations teams, capacity building in methods to ensure proper applications and sensitivity to the appropriateness of methods in different cultural and socio-economic contexts.

Assessment question 3: **"Which values are elicited?"** was implemented by applying the values typology introduced in *Chapters 1* and *2* on methods, i.e., we assessed the extent to which methods were used to elicit broad values, specific values and which value indicators were used. Additionally, we assessed whether methods could generate information about live value frames and if they made reference to IPLC related principles or if they used or acknowledged knowledge systems from sources other than academia. We found that valuation studies have mostly focused on assessing instrumental values, followed by intrinsic and relational values.

On the contrary, valuation in IPLC contexts is mostly focused on relational and intrinsic values, in line with most IPLC worldviews. Outside IPLC contexts, most methods tend to be highly specific about the values that they can elicit or articulate, highlighting the importance of mixing methods to capture the full range of values at play in any given situation. In many cases, however, despite the versatility of methods to capture a wide range of values, their users only apply them to elicit one type of value. Knowledge gaps relate to both practical and theoretical challenges such as how to deal with representation aspects when aggregating individually held values to the collective, deliberating towards shared values, how to take the values of future generations into account, and how to sum, compare, or separate incommensurable value types. Ways to address some of these challenges have been developed for some methods, while other challenges contribute to some of the limitations of methods. Valuators need to be well versed in both the potential and shortcoming of methods to ensure that they harness the potential and are fully aware of the limitations of their findings.

Assessment question 4: **"When and where are valuations undertaken?"** was answered by assessing the global distribution of valuation studies based on when, where, and at which spatial and governance scales they were applied. This included an assessment of which administrative, social and biophysical scales valuations have been done, and the habitats they were conducted in. The valuation atlas represents the first exhaustive global literature review on the distribution of valuations across a broad range of natural and social science disciplines, informed by a broad and interdisciplinary definition of valuation. Our findings show that, since the early 2000s, the practice of valuation has been gradually expanding globally. To date, one quarter of valuation studies have been about understanding values associated with forest ecosystems followed by cultivated areas and freshwater habitats. More than half of the studies are highly localised generating information about a specific location or species and only 1% have a global outlook. In IPLC valuations, place and location of valuations is highly relevant and the selection of where to undertake valuation processes is usually assessed and prepared. Knowledge gaps associated with the spatial and administrative scales of valuations relate to the need for better understanding the discrepancies and relations between who commissions or undertakes valuations and who is affected by the decisions that the valuation is commissioned for. Current practice in valuation suggests that valuation is usually conducted by the powerful with little to no meaningful participation of local stakeholders, risking that valuations might not adequately reflect the full range of values and perspectives at play in a given decision-making context (see *Chapter 4)*.

Assessment question 5: **Whose values are considered?** This question was addressed by examining the inclusiveness of valuation methods in terms of whether and how valuations considered and/or engaged relevant stakeholders (including IPLCs) and how valuations dealt with representation, power and justice issues. In more than half of the studies, authors were not explicit about whose values are represented in the study. Even though valuations have become more participatory over time, the engagement of stakeholders is still mostly basic and extractive, with most studies that include stakeholders limit their engagement to data and information providers. This trend is particularly acute in valuation of IPLCs, risking that valuations perpetuate historical injustices. In an effort to counteract the trend, the chapter committed to reporting on IPLC valuation, only to find that it is a research topic that has barely gathered traction in the field of valuation. Integrated and statement-based valuation methods hold promise for engaging with stakeholders more meaningfully and ensuring they contribute to all steps of valuation design, implementation and interpretation. A large proportion of studies do not provide information on whether the stakeholders they worked with are representative of all actors with stakes, and even fewer reveal how they addressed issues of power and justice. The robustness of existing valuations is hugely undermined by an absence to report or adequately address these issues. Future valuation needs to train valuation experts to not only report on these issues, but also to incorporate adequate strategies to improve representativeness in studies. Knowledge gaps

relate to inadequate understanding of IPLC valuation and lack of reporting and standards regarding representation aspects of valuation.

Assessment question 6: "**How reliable and feasible is valuation?**" was approached by highlighting the different ways that robustness is understood based on perspectives and disciplinary framing and assessing the data requirements, skills needed, finance and time costs. Consequently, we assessed the limitations of valuations and the extent to which applications consider issues of validity, consistency and transparency. Judging robustness is contested, however: while some sources of evidence emphasise legitimacy others emphasise theoretical consistency and accuracy. Both aspects are important for use and hence the impact of valuation. Practical guidance that is sensitive to the purpose of valuation could improve the robustness of valuation. Robustness requirements vary between informative, decisive and technical purposes and guidelines for robust use should reflect this. This would increase the potential of valuation to reach the intended goals and decrease the risk of (mis)informing decisions and producing perverse outcomes. With respect to resource requirements to judge the feasibility of valuation, such information is rarely reported and must thus be deduced from the complexity of the methods used, the context of studies, and the time taken to undertake valuations. As a result, a very important knowledge gap is the lack of information on feasibility and resources needed to perform valuations for different purposes. This is very likely to represent an important barrier to the inclusion of valuations in decision-making processes.

The chapter has gathered evidence from four global reviews, tapping into various strands of academic literature, and two global processes mobilising indigenous and local knowledge. While this provided a robust and in many instances exhaustive body of evidence, some obvious **gaps and blindspots** in our work must be noted. Firstly, by focusing almost exclusively on academic literature, we have not captured the large body of knowledge on valuation and valuation methods and approaches that has been generated outside of academia. Some valuation practice (e.g., conducted by the business sector, to assess health, or to address conflict resolution) is partially addressed in the chapter. However, a myriad more groups and actors conduct valuation and report it in non-academic literature. Additionally, because we focused on English-language literature, and that which is contained in journals indexed by Scopus and Web of Science, we have limited from our assessment valuation knowledge and experiences reported in languages other than English, or that have been reported in unindexed journals or journals from other indices. Given that IBPES assessments cannot undertake new research, the extent to which we could include knowledge about IPLC valuation has been sorely limited; we acknowledge that the 26 essays on IPLC valuation informing this chapter and the ILK Dialogues that were conducted during the *values assessment* cannot be generalised beyond the communities that were consulted in the Dialogues or those who are described in the essays. We also acknowledge that the inclination to compare what is observed or described in IPLC valuations to what is seen elsewhere can seem like an attempt to validate indigenous and local knowledge by imposing western science worldviews and frameworks. This was by no means our intention. On the contrary, we hope that the coincidences observed across cultures and worldviews help demonstrate the commonalities of valuation shared across humanity and that this invites desire for collaboration and intercultural dialogue.

Finally, while assessment findings and patterns assessed are situated at a global and general level, the chapter has also provided **guidance for valuation**, which - despite inevitably situated on a general level - provides clear principles and concerns to be taken into account by various actors active in valuation, from valuation professionals, to local-to-global decision-makers commissioning valuation studies, to experts evaluating and reviewing valuation studies or policymakers using valuation results to underpin or justify decisions.

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