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Item 5 (f) of the provisional agenda*

Work programme of the Platform: revised scoping report for a methodological assessment on diverse conceptualization of multiple values of nature and its benefits

Preliminary guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services (deliverable 3 (d))

Note by the secretariat

1. At its third session, in its decision IPBES-3/1 (sect. V, para. 2) on the work programme for the period 2014–2018, the Plenary of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services approved, until the fourth session of the Plenary, the continuation of the expert group established for the development of the preliminary guide on the conceptualization of values of biodiversity and nature's benefits to people, which, at the discretion of the Chair, following consultations with the Bureau, could be expanded to include a limited number of resource persons and representatives of strategic partners as resources permitted.

2. In the same decision (sect. V, para. 3), the Plenary requested the expert group to revise the preliminary guide (IPBES/3/INF/7) following an open review by Governments and stakeholders.

3. The preliminary guide was open for online review by Governments and stakeholders from 26 February to 31 March 2015, together with the scoping report for the methodological assessment on values (IPBES/4/9). Comments received were discussed by the expert group for this deliverable at its meeting held in Budapest from 8 to 11 June 2015, and the guide was revised accordingly. Thereafter, the preliminary guide was the subject of an internal expert group review before being finalized and submitted to the Plenary at its fourth session (see annex III).

4. Annex I to the present note sets out the list of selected experts who attended the workshop in Budapest and drafted the guide, as well as the list of experts who reviewed it. Annex II sets out the stepwise approach to assessing the diverse conceptualization of multiple values of nature and its benefits, and provides a summary of the preliminary guide, the complete version of which is presented in annex III. The annexes are presented without formal editing.

* IPBES/4/1

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Annex I

List of experts and reviewers

1. Members of the IPBES Multidisciplinary Expert Panel and of the Bureau

Sandra Díaz (Argentina) - Member of the Multidisciplinary Expert Panel and expert group co-chair
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György Pataki (Hungary) – Member of the Multidisciplinary Expert Panel and expert group co-chair
Robert T. Watson (United Kingdom) – Bureau member and expert group co-chair
Marie Stenseke (Sweden) – Member of the Multidisciplinary Expert Panel

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3. Expert reviewers

Edward B. Barbier (University of Wyoming), Michael Burton (University of Western Australia), Joël Houdet (ACTS, Integrated Sustainability Services, Synergiz), Hans Keune (Belgian Biodiversity Platform & Research Institute for Nature and Forest), Shuang Liu (CSIRO Land and Water Flagship), Simone Maynard (Simone Maynard Consulting), Rosimeiry Portela (Conservation International), Marja Spierenburg (VU University Amsterdam)

4. Resource Persons and Contributing Authors

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5. Coordination, Technical Support, and Editing

Aaron Vuola (UNEP), Nalini Sharma (UNEP)

Annex II

Stepwise approach to "assessing diverse conceptualizations of multiple values of nature and its benefits, including biodiversity, ecosystem functions, and services": a summary and directions to the guidance document (Preliminary Guide, Annex III)

This summary provides an introduction to the guidance document and illustrates how it can be used within the context of IPBES work. It contains a stepwise approach to:

1. identify the range of values;
2. find information on values in the literature;
3. categorise and assess values data and methods involved;
4. synthesize and then integrate the values in the wider assessment and;
5. communicate results.

For each step we outline who within the assessment team should be involved, how to go about the step, referring to relevant sections of the full guidance document or other IPBES documents that provide further detail and illustrations and finally what to document and make transparent about how values were assessed.

Step 1: Identifying value dimensions and understanding where values play a role in your assessment

This step concerns the co-chairs, CLAs and value experts of the assessment team.

The word "value" has interrelated but distinct dimensions and is understood and analysed differently in the biophysical sciences, social sciences, economics, and ILK. It is therefore essential that an assessment team tasked to address diverse values be broadly interdisciplinary and come to a shared understanding of terminology. For example, value can refer to:

- a **principle** or core belief
- a **preference** (for something or for a particular state of the world)
- the **importance** (of something for itself or for other things);
- a **measure** (for example the number of species).

In the IPBES conceptual framework these dimensions of value are focused on:

- nature (non-anthropocentric or intrinsic values)
- nature's benefits to people (anthropocentric values: instrumental)
- good quality of life (anthropocentric values: relational)

In IPBES assessments biophysical measures of nature will be used in different ways. They will play a decisive role in analysing e.g. status and trends of species or ecosystem properties and their benefits to people. These topics are not addressed here but in the *methodological assessment on scenarios analysis and modelling of biodiversity and ecosystem services (IPBES deliverable 3 (c)).* This guide focuses on the values that people associate with nature (principles, importance, and preference), and the measures and indicators used to elicit these values. These values can be assessed from sources of ILK, economic analysis, and social sciences analysis (e.g. ethnography, sociology) which reflect different worldviews, but also by using biophysical measures. A broad range of different methods are used that elicit complementary or conflicting results for the documentation of nature's benefits in different formats.

IPBES assessments should address the values attributed to nature, nature's benefits and a good quality of life. The values are individual or shared, context and scale sensitive, influenced by personal experiences, by social and norms the socio-cultural and political environment (collectively called institutions in the IPBES conceptual framework), and by the biophysical environment itself. Many values change through time, influenced for example by environmental changes, social learning and institutional dynamics. Values

influence behaviour at the level of the individual, institutions and whole societies. Values are influenced by institutional settings that shape issues such as distributional justice and equity, power relations and inclusiveness across stakeholders (see Chapter 2 Section 2.6).

Identify where values are relevant to your assessment:

Each IPBES assessment has a defined purpose (including a set of policy relevant questions and issues) and identifying and assessing values plays a key role in this context. Based on your scoping document, analyse where values, nature's benefits and /or good quality of life are referred to or play a role.

Within the scoping document the sections on utility, policy-relevant questions, all the chapters but particularly those on benefits, scenarios or response options will likely contain relevant information and require some assessment of values.

➔Ensure valuation/value experts are included in the relevant chapter teams. Economists and social scientists should be adequately represented in the overall team; if this is not the case make sure you identify relevant contributing authors early in the process (or ask the expert group on diverse values for support).

Addressing the following questions can help to scope the values aspect of your assessment:

A. What worldviews are involved, and what issues are at stake, in the mandate of the assessment? *Chapter 2 is a good starting point for answering this question.*

B. What scale or scales are relevant and how do they interact? (see Chapter 2 Section 2.4)

C. Does the assessment team have the needed expertise to address the worldviews and scale issues involved? *Following the IPBES conceptual framework, the team may be most effective if it integrates contextually relevant expertise from ILK, ecological science, economics, and other social sciences such as sociology, anthropology and human geography.*

D. How are values associated with nature, nature's benefits to people and a good quality of life relevant for the assessment? (See Table 2.1)

E. Considering the diverse conceptualizations of nature, and nature's multiple benefits, what is the possible scope of values that may be relevant in the assessment? *It is useful to first identify all potentially relevant values. Chapter 2 describes specific value types and Table 2.1 is a tool to help identify these in a systematic way. Chapter 5 provides a detailed illustration of how you might use the table.*

Chapter 5 provides an overview and step by step illustrations both generically (in Section 5.1) and identifying diverse values specifically for:

- Land degradation (Section 5.2)
- Invasive alien species (Section 5.3)
- Sustainable use (Section 5.4)
- Regional assessments (Section 5.5).

Step 2: Searching the literature

This step concerns mainly the value experts within the assessment team

Once the team has clarified which chapters of your assessment require addressing values and what value dimensions might be concerned, the next step is to screen the literature to identify relevant studies that report on such values. The task of searching for relevant literature should be broad-minded, comprehensive and inclusive, considering diverse values and worldviews, including those associated with or coming directly from ILK holders, going beyond standard peer-reviewed papers. IPBES experts (those experts in charge of carrying out the assessment at hand) could also utilize workshops to gather relevant information.

Chapter 4 provides detailed information on potential sources, specifically also where you might find published versions of ILK (indigenous and local knowledge).

Table 5.1 guides you through the search process and can also help with the assessment of the results you find (see Step 3), be sure to include the policy-relevant questions of your assessment and identify which values are most appropriate to informing these.

Box 1: Some useful search terms for literature search;

TEK – traditional ecological knowledge, ILK – indigenous and local knowledge, Worldviews on nature, Worldviews on benefits from nature, Sacred ecology, Good quality of life, Ecological knowledge, Traditional knowledge, Multiple values, Plural values, Socio-ecological systems, Coupled human and natural systems (CHANS), Institutions, IPLC – indigenous peoples and local communities, Bio-cultural diversity, Integrated valuation, Bridging worldviews, Transdisciplinary approaches, Interdisciplinary approaches, Multi-stakeholder perspectives, Social engagement, Equity, Cultural values/ services, Socio cultural values, Value mismatches, Resilience, Sustainability, Socio-ecological resilience, Shared values

➔*Document the literature search process and make the arguments for your approach explicit.*

Step 3: Categorizing, sorting and assessing values – which values have been elicited (in the literature) and how?

This step concerns mainly the value experts within the assessment team

In carrying out an IPBES-based assessment to identify impacts on biodiversity, ecosystems and their benefits to people, associated threats to a good quality of life, and effectiveness of responses, an assessment should explore diverse values, worldviews, valuation methods and their findings. In order to achieve this, IPBES experts should examine how diverse values have been elicited and reflected in the literature.

➔Table 5.1 provides a heuristic for this step. The following questions can help to collect relevant information and analyse it:

Collecting information about values included in the information sources

A) What dimensions and types of values related to nature, nature's benefit to people and good quality of life have been captured in the study (e.g. article/thesis/report/indigenous research papers)? (see Chapter 2)

Collecting information about valuation perspectives included in the information sources.

B) What **worldviews** are reflected in the study? (e.g. Western, Indigenous, urban-modern, rural-traditional)

C) How have the **values of different worldviews at different scales** been explicitly discussed?

D) What levels of **social, spatial, temporal, and decision-making** scales have been covered in the study?

E) To what extent were social engagement or participatory processes involved in the identification and documenting of values in the existing data sources, which social groups were included, which ones were left out? What types/**levels** of social engagement are reflected in the study?

F) To what extent is **ILK** represented? Have ILK holders been involved in the research?

Is this representation sufficient? What are the implications?

Collecting information about valuation methods included in the information sources.

G) What types of valuation methods have been used to identify/elicit values? (Chapter 3 Section 3.2)

a) Biophysical and ecological

b) Cultural and social

c) Economic

d) Public health

e) Holistic, Indigenous, and local knowledge-based

Information addressing synthesis or integration of diversity of values and/or value perspectives

H) Have values have been aggregated/up-scaled? If so, how and by whom? Has upscaling created double counting problems? (Note: Double counting of values is an issue only in certain applications such as calculating economic values for national accounting or aggregating 'total economic value'.)

I) Has the study attempted to combine and bridge different types of values, where relevant? (see Chapter 3 Section 3.3)

Gaps in information in individual information sources.

J) What are the gaps in value formation, value elicitation, and value articulation (interpretation and discussion) processes in the study?

K) Is the study (article/reports/thesis) explicit about the limitations of the valuation approach chosen?

L) What are the limitations in the research findings, including uncertainty associated with values, methods used, and probable scenarios (where relevant)?

Gaps in information based on the collected body of knowledge

M) What gaps are there in the existing data on values (dimensions and types of values)? To what extent can the causes of the gaps be identified? What are the implications of these gaps?

Information about interpretation of values in the information sources

N) Is the study relevant to answering policy questions at different scales (e.g. local, landscape, national, regional)?

O) What types of policy implications are derived from the values documented in the existing data? How does the lack of bridging and not-reporting certain value dimensions/types affect the policy implications?

P) Has the study considered implications of findings at a broader social context (i.e. equity, distributive effects etc.)?

Q) Have the studies predicted future scenarios of development trajectories and their implications on different types of values? If values are extrapolated, have confidence limits (or associated uncertainty) been explicitly stated in relevant studies, and if so how?

➔Synthesize and evaluate what you have found in each of the studies.

Try to fill gaps as possible within the time and financial restrictions of an assessment process, for example, consider using Delphi Questionnaires (experts) or ethnographic interviews.

➔**A first result** is to present a summary of your findings, addressing what sorts of values, (worldviews, types, foci, scales, regions, social groups) addressing what sorts of questions have been predominantly studied, and to identify and describe where current gaps lie. Systematically document the missing data on values, e.g. certain types of values for certain ecosystem services in certain biomes (refer to Table 5.1 in Chapter 5) and give an expert estimation of how relevant these missing parts are for the purpose of assessing the plurality of values. Such an overview already is a type of assessment of values and provides helpful and important information to any IPBES assessment.

➔*Make transparent who prepared this assessment and how you approached this step*

Step 4: Synthesis, up-scaling and integration

This step concerns the value experts and CLAs of the assessment team

The type(s) of synthesis, bridging or integration of values needed depend on the purpose(s) of the assessment including the policy-relevant questions as outlined in the IPBES scoping document and clarified in Step 1.

Addressing the following questions would help clarify the purpose and methods for this step:

a) Who is the likely end-user of the synthesis outcomes?

b) Are there specific policy or management contexts wherein the synthesis would be relevant?

c) At what (political, geographical and temporal) scales should the synthesis be reported?

d) What are the synthesis needs at different scales?

e) Is the full range of values available at all scales for synthesis? If not, what are the gaps and what are the implications for synthesis?

f) What confidence can be attached to the synthesis outcomes?

While an assessment does not entail original data collection (e.g. conducting valuation studies), synthesis is an original task of an assessment. Sometimes this can be done based on the literature or on previous assessments. The assessment team may employ methods to characterize values such as those listed below. These methods can help to present diversity in a well-structured manner, making the diverse values accessible to decision-makers, retaining data integrity rather than reducing to a single value.

Step 4 builds on the reflection and compilation completed in Step 3 and the documentation of gaps in the current literature. This should also include an estimation by the experts doing the assessment of how relevant these missing parts are for the purpose of assessing values and what the implications of incomplete information regarding the responses to the policy-relevant questions are.

Approaches an assessment team can use to synthesize information on diverse values and to relate it to other results of the assessment process can include:

- *Narratives* can include story-telling, scenarios, graphs, sketches as forms of synthesis (See Chapter 3 Section 3.3.1 and Chapter 2 of the guidance document on scenarios). Qualitative, based on the evolution of value-drivers, but may include quantitative references. Likely all assessments will include this approach.
- *Integrated modeling* is mostly a numerical approach to quantify the system-wide effects of interacting biophysical and socio-economic realities and values across time and space (Chapter 3 Section 3.3.3), and to assess outcomes of policy or management scenarios.

Depending on the purpose(s) of the valuation assessment, other synthesis methods may be required that involve actors (e.g. stakeholders, organizations, and other people). These include:

- *Multi-criteria analysis* (MCA, Chapter 3 Section 3.3.4) is a method capable of embracing, combining and structuring often incommensurable diversity: diversity of information (such as different types of data, e.g. qualitative and quantitative data, as well as uncertainty), diversity of opinion (also amongst experts), diversity in actor perspectives (e.g. stakeholders), and diversity in assessment/decision-making criteria (see Chapter 3 Section 3.4.3).
- *Deliberative valuation* is a social process with the purpose of discovering, constructing and reflecting values in a dialogue with others (Chapter 3 Section 3.3.2).

Synthesis needs differ with varying scale (an example is given in Chapter 5 Section 5.4 sustainable use). Up-scaling of values in space or time may be desirable, if studies are available only for specific places or periods in time (Chapter 3 Section 3.3.5). However, up-scaling is not always feasible because different scales may require different valuation methods and available data may be deemed too coarse. This has implications for synthesis and integration. Different valuation studies may refer to different scenarios of the future and these might be used for temporal up-scaling. Options will be evaluated according to what is feasible within the constraints of an assessment.

Synthesis may lead to identification of values which co-vary negatively in response to policy choices and management decisions under consideration (refer example in Chapter 5 Section 5.4 sustainable use). Such value trade-offs need to be carefully elicited in the synthesis process for informing decision makers. It can be very informative to policy makers to know how different stakeholder groups interpret and debate the valuation process and diverse values. Stakeholder groups involved in the IPBES framework can be considered for this, but perhaps a broader diversity of stakeholder groups need to be considered too (see Chapter 3 Section 3.3).

Assessment teams may face a trade-off between "getting it right" vs. "getting it relevant". A way to deal with this is to focus on getting it relevant and to report confidence limits in a transparent way; but some serious errors cannot be solved this way. Confidence limits to the assessment and synthesis of values refer to three levels:

1. the level (extent and types) of values available in the literature
2. the level (extent and depth) of synthesis, taking into account the number of studies available
3. the limits of scope with respect to the scoping considerations (worldviews, foci of value, types of value), and scale of values.

Delphi Questionnaires with relevant experts may be used to help address confidence limits.

➔*Make transparent who prepared the synthesis and how you approached this step, make confidence limits explicit.*

Step 5: Deriving and communicating results

This step concerns the co-chairs, CLAs and value experts of the assessment team

The process of communicating assessment results consists of synthesizing and contextualizing diverse results so that they can contribute to "mainstreaming biodiversity management into decision making at all levels". Some results arise directly from the value assessments (particularly Steps 3 and 4) and can be communicated as such, while others will have to be brought together with the results from other components of the assessments and tailored to communication formats that can easily be understood and acted upon by policy makers/decision makers.

Addressing the following questions can effectively guide communication:

- What are the implications of the value assessments to the policy relevant questions your assessment is addressing?
- How do results of the value assessment inform scenarios and scenario analysis?
- What are the implications of having incomplete/biased information on values?
- What are the confidence limits of the results both from the existing body of literature and from the incomplete coverage of diverse values and conceptualizations?

Chapter 5 Section 5.1 and examples in that chapter provide further detail. ➔*Be explicit about how you derive results and where in the assessment more background information can be found.*

(See Chapter 12 in the IPBES Deliverable 2(a): "Guide on production and integration of assessments from and across all scales" for more details of the communication and stakeholder engagement)

Annex III

Preliminary guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services

Chapter 1: Introduction

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The second session of the IPBES Plenary approved "*the initiation of scoping for a methodological assessment on the conceptualization of values of biodiversity and nature's benefit to people and development of a preliminary guide, for consideration by the plenary at its third session*" (IPBES/2/17, Annex V).

This preliminary guide is 'Platform supporting material' categorized as a guidance document (IPBES/2/17, Annex to decision IPBES-2/3, Section 5d) "that assists in the preparation of comprehensive and scientifically, technically and socio-economically sound Platform reports and technical papers". The preparation of guidance material is overseen by the Multidisciplinary Expert Panel and is commissioned by the Plenary.

The IPBES conceptual framework explicitly acknowledges the different paradigms or worldviews that lead to a diversity of human expressions of value. To the extent possible, the conceptual framework aims to bring together different ways of perceiving and defining value, classifying nature, nature's benefits to people and a good quality of life, as well as valuation concepts from the perspective of multiple stakeholders. Culturally rooted diverse and legitimate understandings of terms such as biodiversity, ecosystem services and well-being are highlighted within the IPBES conceptual framework.

The present guide, which in short is referred to as a '*guide on values and valuation*' gives effect to the diverse conceptualization of multiple values regarding the three main foci of the IPBES conceptual framework: (i) nature, (ii) nature's benefits to people, and (iii) a good quality of life. It aims to raise awareness of the diversity and complexity of their associated 'value' types, how to conceptualise them, what methods may be applied to elicit such values, what data and capacity building needs currently exist within the IPBES objectives as well as how the diverse conceptualisation of values and valuation approaches provide inputs for the design and application of policy support tools. In addition, the guide illustrates how it can be used in the context of thematic and regional assessments that are already the focus of implementation in the Platform's work programme 2014-2018, notably objectives 2 and 3. The main purpose of the guide is to ensure consistency in approach across IPBES assessments of biodiversity and ecosystem functions and services undertaken in accordance with the IPBES conceptual framework.

The word 'value' has different meanings. It can refer to a *principle* associated with a given worldview or cultural context, a *preference* someone has for something/a particular state of the world, the *importance* of something for itself or for others, or simply a *measure*. Multiple and plural values may be formed and elicited within different cultural, social and institutional frameworks, and valuation can have several purposes, for example to provide social and economic knowledge informing policy decisions. Underlying worldviews determine which types of value and valuation approaches and methods may be perceived as being more appropriate in any given cultural and historical context.

Figure 1.1 provides a schematic of the chapters of this guide and how the guide connects to the IPBES conceptual framework regarding diverse and multiple values. The guide starts by outlining the diverse conceptualizations of nature's multiple values from diverse worldviews and cultural perspectives (Chapter 2). Then it outlines methodologies and sets out a protocol applicable for conducting both valuation studies and assessments of valuation studies within IPBES (Chapter 3). Chapter 4 identifies the types of data and

knowledge needs and gaps that may be encountered while undertaking assessments on valuation studies, as well as the major available data and knowledge sources. Chapter 5 offers information on how to practically apply the diverse concepts on value and valuation methods outlined in chapters 2 and 3, respectively, to assist experts mandated with conducting IPBES assessment. It illustrates how to get started for thematic assessments (on land degradation, invasive species, and the sustainable use and conservation of biodiversity), as well as for regional assessments. These illustrations could also be easily expanded to potential assessments at the global level. Chapter 6 focuses on capacity building to support and enhance the assessments and articulation of diverse conceptualizations of multiple values to planning and decision making for biodiversity and ecosystem services. Lastly, Chapter 7 outlines how the guide can support the use of policy tools and the design and implementation of policy instruments, and decision making in general.

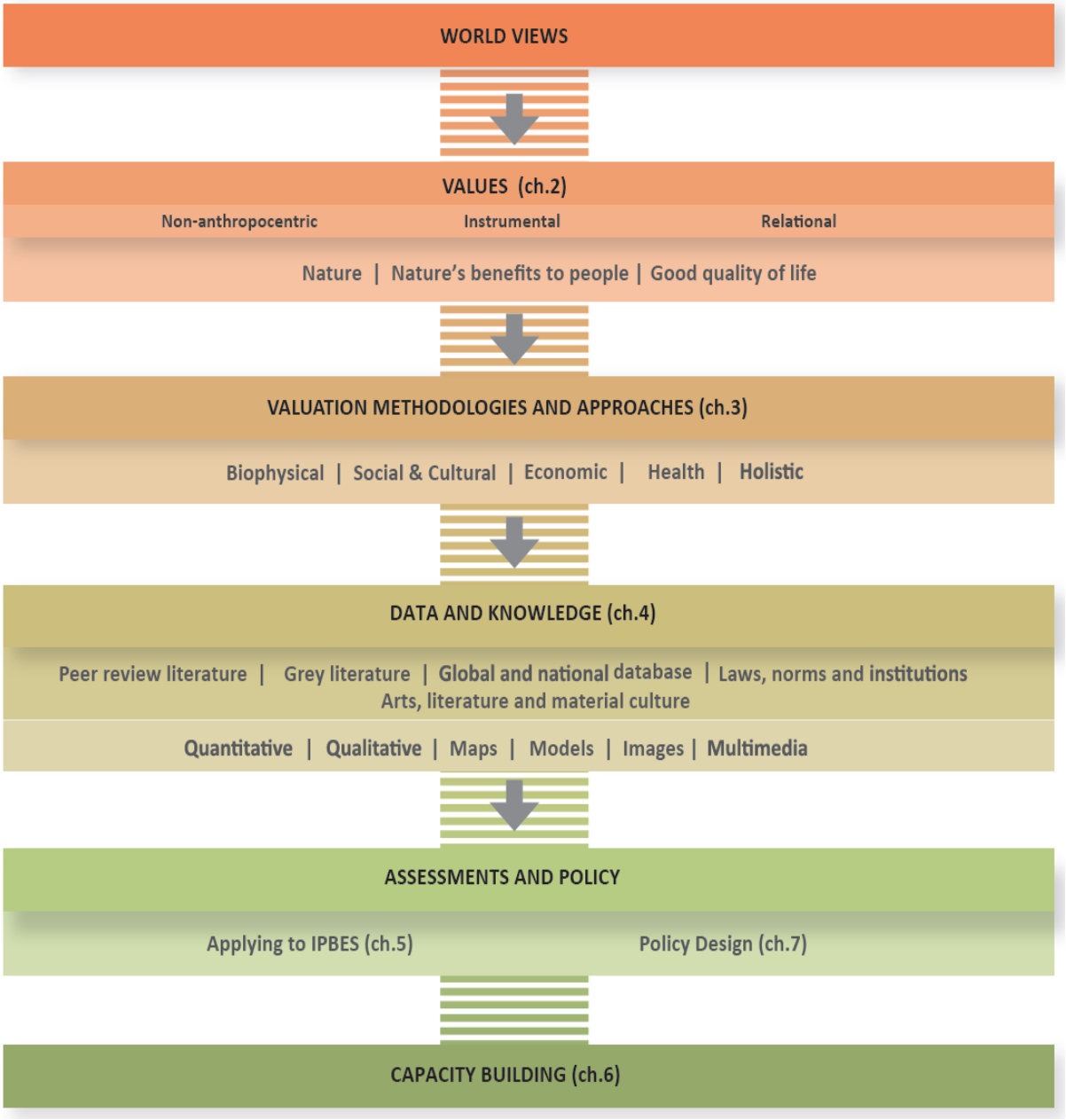

Figure 1.1: *Schematic representation of the chapters of this guide regarding the diverse conceptualization of multiple values of nature and its benefits, including biodiversity as well as ecosystem functions and services. Each step of this guide recognizes the existence of different worldviews which determine the way value and foci of value might be addressed, associated valuation methodologies and approaches, and the data sources and data types that can be used in valuation studies and assessments of such studies. The choice of any particular worldview can be associated with various types of value and relate to all the foci of value.*

The concept of 'values and valuation' permeates every step of the guide and there are connections between the chapters. For example, later chapters focus on capacity building and how it may influence values and valuation through adapting worldviews. While the guide includes different theoretical underpinnings regarding 'major concepts of values' and addresses alternative methodological options to give effect to valuation processes, the guide is limited in scope due to the contextual dynamics and fluidity posed by the complexity of the topic. This is acknowledged throughout the guide. Notwithstanding the inherent limitations of the guide, it is hoped that it will serve to identify ways to assess and explicitly recognise the diversity of values and valuation methods, while identifying their specific uptake into policy design and implementation.

As recognized by the IPBES conceptual framework, nature, nature's benefits to people and good quality of life are interconnected via institutions (formal and informal) and governance models. Values stem from such institutions. That is, institutions are largely determined by the worldviews or cultural contexts which prioritise some of the types of values that are held by decision makers and users of biodiversity and ecosystem services at the expense of other types of values and other stakeholders.

Acknowledging, assessing, and explicitly including the diversity of values while identifying their specific uptake into policy design is challenging because it requires a more integrated vision and toolbox than the fragmented one we currently have or have access to in different parts of the world. A fundamental premise of this guide is that decision-making process would benefit if it addresses values of biodiversity and ecosystem services in as much of a pluralistic and integrative way as possible, finding and supporting means to include values held by the full range of stakeholders with different worldviews on nature, nature's benefits to people and a good quality of life, at different spatial and temporal scales.

A protocol for conducting a valuation process (from scoping the need for valuation to the design of policy support tools) is presented in Chapter 3. The protocol is also further elaborated for values relevant to ongoing IPBES assessments based on existing knowledge in Chapter 5, and generally includes the following steps: (i) identifying the main purpose of the valuation exercise; (ii) scoping the valuation process that shall serve this purpose; (iii) conducting the actual valuation study, or reviewing the available studies according to the scoping criteria; (iv) synthesizing, upscaling and integrating the diverse values; (v) communicating results for policy uptake through well suited policy support tools; and finally (vi) reviewing the entire process. Step (iv) may include transparent, participatory and inclusive multi-criteria decision support tools and integrative valuation methods to allow for synergies and complementarities among alternative valuation approaches, i.e., biophysical, cultural, economic, health-based, and social, as well as the diversity of methods available to each of these approaches. These integrative and bridging tools would ideally be used to help to structure culturally determined information on the values held by a diversity of actors involved in the valuation process. This is seen as a key necessary condition to achieve cross-sectoral policy objectives conducive to intertwined sustainability goals, including the sustainable development goals associated with economic, environmental, social, including health and education objectives, through the use of the appropriate policy support tools and methodologies.

The potential implications of two contrasting approaches to valuation for the design of policies regarding the maintenance of nature and its benefits, including biodiversity and ecosystem services are shown by means of a heuristic example in Figure 1.2. It is an illustration and its elements are simplified exemplars of alternative worldviews, foci of value, policy objectives, valuation approaches, value indicators, as well as policy support tools and instruments. While in reality different worldviews may coexist, the model shown in Figure 1.2. treats them as separate for illustrative purposes only. It helps to illustrate both the importance of the choice of elements, including policy objectives, values, valuation approach, and policy support tools, as well as how these elements are connected to each other. The model suggests that an alternative choice of elements in the valuation process could result in different potential impacts on biodiversity and ecosystem services, as well as on societal well-being. It also suggests that any valuation approach is mediated by an institutional framing which generates feedbacks between policy instruments and policy goals, as noted in the IPBES conceptual framework. The types of feedbacks would differ among the valuation approaches given the range of worldviews considered.

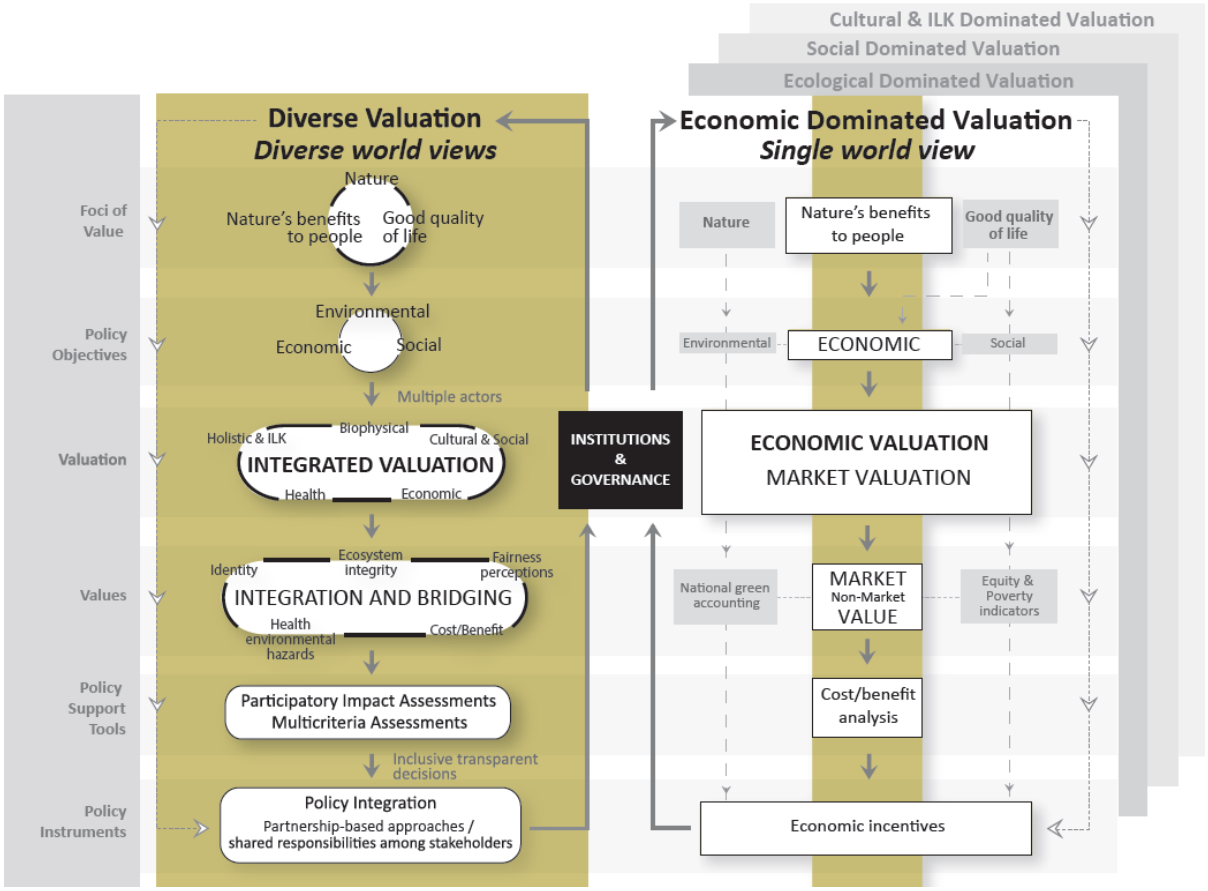

Figure 1.2: *A stylized illustrative framework of contrasting approaches to the process of valuation of nature, nature's benefits to people and good quality of life. The left side panel emphasizes the importance of a pluralistic notion of value, compared with monistic approaches to human-nature relationships represented in the right side panel. Monistic approaches dominated by a single worldview might overemphasize (i) the needs of ILK (Cultural & ILK dominated valuation), (ii) social development and poverty alleviation (Social dominated valuation), (ii) the conservation of biodiversity (Ecological/biophysical dominated valuation), or (iv) economic growth (Economic dominated valuation). The figure uses examples chosen for illustrative purposes to highlight how a given monistic approach, such as that associated with economics alone (on the right hand side) contrasts with pluralistic and integrated notions of value (on the left hand side). It is acknowledged that other worldviews, besides an economic dominated one, and approaches beyond this polarized example exist or may exist in the future.*

Figure 1.2 reflects that there exist monistic worldviews for understanding the value of biodiversity and ecosystem services that emphasize ecological/biophysical, social, cultural or economic approaches to valuation. For example some stakeholders may emphasize an idea of valuation dominated by an economic worldview that focuses on market-based approaches, which would in turn lead to a valuation process where market prices would mostly signal the value of marketed ecosystem goods and services, while dismissing other non-market values of ecosystem services. Ways to incorporate non-market monetary values for biodiversity and ecosystem services are increasingly being fostered through initiatives such as The Economics of Ecosystems and Biodiversity (TEEB) and the accounting of natural capital in national accounts. This is generally recognized as necessary in programmes such as the UK-National Ecosystem Assessment (UKNEA). However, as also recognized by the UKNEA, this economic approach would still fall short of achieving sustainable outcomes if values that are not amenable to economic methods including other worldviews and associated values are not considered, including those associated with individual and shared socio-cultural values, those underpinned by indigenous local knowledge, as well as other biophysical and health-related values. By contrast, an approach to valuation that recognizes such a wide range of worldviews, and that is more inclusive regarding acknowledging the existence of a diversity of values and valuation approaches, would be in a better position to develop the conditions for the design of

more comprehensive and deliberative policy support tools and policy instruments to enhance nature, nature's benefits to people and a good quality of life.

The right side panel of Figure 1.2 reflects a worldview dominated by economic ways of considering human-nature relationships. Such a perspective is oriented to utilitarian assumptions that favour individual self-interested behaviour together with a strong belief that market-oriented growth would eventually induce protection and conservation of the environment (i.e. Kuznets curve hypothesis) as well as poverty alleviation (i.e. wealth trickle down). The market-oriented worldview can be moderated through the use of non-market valuation tools that may help to reduce negative impacts of environmental externalities and expand the scope of economic indicators of 'well-being'. Such an approach could contribute to natural capital accounts and other measures to better reflect changes in wealth. However, relying only on economic approaches – market or non-market – limits which kinds of values can be included and therefore limits how environmental and social policy tools can be informed, for example, through economic incentives to change human behaviour.

On the left side of Figure 1.2, an alternative approach highlights that the valuation process needs to account for multiple worldviews in a more integrated and iterative way, both within and among the different valuation steps. This is based on the premise that human (social and economic) activities ultimately depend on ecosystems and that there are strong feedback mechanisms linking nature, nature's benefit to people and a good quality of life. The left panel of Figure 1.2 provides the vision for this values and valuation guide (c.f. Figure 1) consistent with the IPBES conceptual framework, expanding on the different valuation steps involved.

Figure 1.2 illustrates the importance of underlying worldviews in the context of valuation processes. Of course the world is not divided into such contrasted worldviews. Indeed, the socio-cultural and political contexts in each community, country and region determine the institutions that in turn favour the setting of policy goals, emphasis on different types of values and associated policy support tools and instruments. Actual approaches to valuation can range from very narrow to fully pluralistic. In practice, intermediate initiatives are underway such as the UKNEA and TEEB.

The present guide is underpinned by the view that acknowledging and fostering the use of diverse conceptualizations of multiple values of nature and its benefits to people is required for adequately addressing the challenge of global sustainability. Further, it seeks to address the urgent need to transition towards new ways of understanding, demonstrating and capturing the diversity of values of biodiversity and ecosystem services. It includes the conceptual understandings, tools and data and capacity needed towards integrated valuation, making inclusive and transparent decisions and designing integrated policies.

Chapter 2: Major concepts of values

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Key Messages:

Diverse worldviews matter to valuation. The way nature, biodiversity, and ecosystem services are perceived and valued depends on how the world is viewed and analyzed across different cultures, societies and disciplines. In a valuation process, it is critical to assess explicitly and transparently which worldviews are adopted or taken into account.

The word "value" has many different meanings. It can refer to a *principle* or a *social norm*, a *preference* someone has for something/a particular state of the world, the *importance* of something for itself or for others, or a *measure*.

Values relevant to IPBES have varied foci. A pragmatic division that is in concordance with the IPBES conceptual framework distinguishes between: i) values of *Nature* (non-anthropocentric orientation), ii) values of *Nature's benefits to people* (anthropocentric orientation including biophysical and instrumental values), ii) values of a *Good quality of life* (anthropocentric orientation including social and relational values).

Values are context dependent, dynamic, and vary across scales. Values depend on and change with people's cognitive and personal circumstances, their broader socio-cultural and political contexts, and their ecological and environmental contexts. Values can also vary across spatial, temporal and social-organizational scales.

Potential and future values need to be considered today. Bequest, option and insurance values, and those attributed to sustainability and resilience, need to be considered and incorporated into today's decision making.

Values are plural and often incommensurable. Values are plural because they can be considered from diverse perspectives, and need to be assessed in pluralistic ways. These plural values can be incommensurable and thus they cannot easily be reduced into a single metric or be compared and weighed against each other.

Value articulation is often influenced by how values are elicited. Elicitation of diverse and plural values needs to be equitable, by being inclusive of all actors that are affected either via differential costs, benefits or responsibilities. It is important to be mindful of power relations among these actors, and pay particular attention to site-specific as well as indigenous and local knowledge (ILK).

Including diverse values into valuation is challenging but desirable. Contradictions and conflicts between different systems of value and different groups of stakeholders are particularly relevant for decision making. Thus, assessing and taking into account a plurality of values requires a plurality of valuation methods, all of which are value-laden. This means that methodological choices are normative. They are subject to the preferences and priorities of the individuals with the authority or influence to make those choices and should be critically evaluated. Appropriate mainstreaming of valuation outcomes into policy design is thus essential. Transparent decision and policy making processes informed by pluralistic value assessments of biodiversity and ecosystem functions and services have better foundations for being more equitable and participatory.

2.1. The purpose of understanding diverse conceptualizations of values of nature and its benefits

Nature can be conceptualized in different ways (e.g. as the environment, Mother Earth, natural resources, natural capital from which people derive ecosystem services, our biological community). People ascribe different types of values to nature (e.g. intrinsic, instrumental, aesthetic, symbolic). Furthermore, people ascribe multiple values to the same natural entity (e.g. a landscape can simultaneously be seen as a provider of food and medicine, a good site for mineral exploitation, important for water supply, a habitat for wildlife, a beautiful place or a sacred space). Complications can also arise from the fact that both our conceptualizations and our value ascriptions vary across cultures, stakeholders, space and time, and evolve in response to new information or a changing social or ecological context. Values can be held by individuals or shared by communities and societies, and can vary in response to both environmental and organizational conditions such that interactions between different agents can result in outcomes with varying implications for conservation, equity, resilience and sustainability goals.

The existence of diverse conceptualizations of nature and a plurality of possible values means that policy making in this field is challenging and often subject to disagreement and debate. For assessment, management and policy purposes it is therefore important to recognize the multiple values that different stakeholders implicitly or explicitly ascribe to nature and its benefits, and to be transparent in how these are handled and addressed in decision making.

People normally seek to act in ways that are consistent with their values and these values can be correlated positively or negatively, strongly or weakly, with a behavior compatible with environmental sustainability. However, there can be paradoxes and trade-offs in the set of values of the same individual and even more among different stakeholders. Thus, understanding what values are, how they are conceptualized and formed, and how they change across contexts, scales and time is critical to inform decision making and policy design at local, national and global levels.

This chapter outlines the diverse conceptualizations of multiple values associated with nature so as to lay the foundation for subsequent chapters on assessment methods and policy tools.

2.2. Different worldviews and important implications for science and policy

The ways that nature, biodiversity, and ecosystem services are conceived and valued strongly vary across cultures and societies. It is critical to acknowledge and to take into account the great diversity of worldviews. These worldviews can be characterized along two dimensions that are both important for biodiversity and ecosystem services valuation:

- different ontologies: what is reality?
- different epistemologies: what can we know about it and how?

It is important to understand the influence of these dimensions because our worldview, as well as the design of methodological approaches and policy processes to acquire and transmit knowledge, will, to a large exent, determine the findings and conclusions. Therefore it is important to be aware of the diversity of values but also be very explicit and transparent about which worldviews are adopted or taken into account.

2.2.1. Different ontologies

There is a wide range of conceptions of reality, of the connections between human beings and their natural environment, and of the interactions among human beings. Based on the intellectual perspectives and concepts of Western philosophy (and assumptions grounded within the Western worldview), theorists have developed typologies of worldviews in an attempt to characterize how humans of all cultures understand reality. As concepts, these are generalizations for analytical purposes and not how people would characterize themselves.

About reality

Reality is viewed in very different ways and can be known using very different approaches, as those shown here.

- **Materialism**: the world is only constituted of physical matter and all reality is reducible to material entities, process and interactions.
- **Idealism:** the reality as we can know it is mentally constructed.
- **Spiritualism**: the world is not only constituted of physical matter but also infused with a spiritual dimension or metaphysical entities.
- **Reductionism**: Every phenomena is reducible to a basic level of organization (e.g. physico-chemical interactions).
- **Holism**: Some high-level systems present emergent properties that cannot be reduced to lower level interactions (e.g. ecosystems).

About relationships between human beings and nature

People conceive the relationship between humans and nature in many ways, as shown here using an example typology (Descola, 2005).

- **Naturalism**: human beings are conceived as separated from the rest of the natural world. This dichotomist view, inherited from Western Modernity, is strongly entrenched in contemporary Western societies.
- **Totemism**: There is a continuity between human beings and non-human beings, some non-humans and humans sharing a common genealogy and common physical and psychological properties.
- **Animism**: Natural entities, living or not living, are infused by a vital principle, a soul of the same kind than humans are believed to have.
- **Analogism**: Different kinds of beings are analogous but physically and psychically heterogenous, united in the great chain of living beings going from the simplest to the most complex ones. Wholes such as landscapes or the universe itself are thought to be holistic organisms, sharing properties and processes with individual living organisms. Human beings are an organic part of nature belonging to an interconnected system of life (including Mother Earth) and the whole cosmos is conceived as a living being.
- **Relational Worldviews**: Some cultures have at times been classed as animist, but that interpretation has historically wrongly been used to portray (particularly) indigenous cultures as naïve. In many indigenous cultures it is understood that for all living beings relationships are the foundations of personhood, society and culture. Humans, other animals, spirits, and some other aspects of the natural world are understood to have personhood, and engage with each other through intentional, respectful, reciprocal relationships. Maintaining the integrity of these relationships is therefore essential to maintaining the integrity and stability of life in the world. This means that not only do humans depend on the animals and other persons for their subsistence, they recognize that these other persons also have subsistence needs, families and lives of their own, and that together they are part of a "Great Community of Persons" (Scott, 1996, Preston, 1997)

About relationships between individuals and human communities

There are different ways to conceive of human interactions that lead to different approaches for the assessment of their values.

- **Individualism**: individual beings are the basic units of communities, which must be considered as the aggregation of individuals.
- **Communitarianism**: communities are not reducible to the sum of their parts and they are collective entities with their own properties and dynamics. For instance, what is good for a group can significantly differ from the sum of what is good for its members.

2.2.2. Different epistemologies

Different people and communities differ in their representation of what is knowledge and what are the relationships between reality, truth, knowledge and science. This is critical to the way different sources of knowledge will be articulated in the face of policy interpretation within IPBES. Core concepts about the basis for understanding truth have evolved in the tradition of Western science and philosophy, and are summarized here. IPBES also recognizes that different worldviews can result in different 'ways of knowing', or epistemological systems, that vary from the Western scientific tradition. It is estimated that there are over 4000 indigenous cultures, and each culture has its own traditions and knowledge systems. It would be incorrect therefore to assume that one set of definitions will apply to all. The question of how knowledge should be produced and presented, and the question of how the societal meaning of that knowledge should be interpreted, are closely related.

In Western philosophy, knowledge is generally defined as a set of **justified true beliefs**.

Justifications - The justifications can come from different sources: perception, reason, memory, testimony, introspection, authority. Different kinds of knowledge (scientific, traditional, indigenous, etc.) will depend more or less strongly on these different sources of justification, but all of them will define criteria that discriminate between justified beliefs and non-justified beliefs. Ways of knowing are based on empirical observation and lived experience, interpreted through beliefs about the nature of reality (ontology). Assurance of the truth of received information can be associated with the demonstrated credibility of the person from whom it is received, as recognized by their community. This is especially so in the case of oral tradition which typically includes traditional ecological knowledge. TEK and ILK can be the source of extensive ethnoscientific knowledge of the earth, the living beings that share it, and the relationships among them.

Truth - What it is for a belief to be true differs in criteria among cultures, contexts, and for disciplines; we provide here six different examples developed in Western philosophy.

- **Scientific realism**: there exists an external world that is independent of human minds and the aim of science is to better know this world. The best scientific theories enable formulating true (or approximately true or at least not false within the boundaries of the scientific context) descriptions of the world.
- **Positivism:** the only authentic knowledge is scientific knowledge. It must be verifiable and acquired by a scientific methodology which seeks to annul any subjectivity. The ideal of positivism is thus the formulation of universal statements about the objective truth.
- **Falsificationism:** There is no way to ensure that a scientific theory or model is actually true and science mainly consists in the elimination of false statements. Valid scientific knowledge thus consists in not-yet-falsified beliefs rather than properly true beliefs (Popper, 1962).
- **Scientific instrumentalism:** Science and scientific knowledge should not aim to discover the truth about an external, mind-independent reality; for it to be useful it should enable the formulation of good predictions (Dewey, 1938).
- **Social constructivism:** knowledge, including scientific knowledge, are contingent social productions that depend on varied social factors and paradigms as well as on historical and personal conditions that are (more or less partly) independent of any external objective world (Berger and Luckmann, 1966).
- **Scepticism:** we know much less than what we think we know, especially about the external world (sensory perceptions are not reliable) and about ourselves (no one can know for sure that he or she is not "a brain stimulated by a super-computer as in Putnam's thought experiment (Putnam, 1981)).

2.2.3. The importance of explicitness and transparency on ontology and epistemology in IPBES

The different ontologies and epistemologies sketched above may raise intense debates and controversies. It is not the role of the IPBES assessments to resolve these debates or to give priority to one worldview over the others. However, because these issues are highly significant to the way values can be perceived, conceived and assessed, it is crucial for any assessment process to be reflexive about the ontologies at stake and the assessment's underlying epistemological framework.

This means that the scientific basis for policy interpretation of the assessment outcomes is crucial but not a given: defining what is taken into account and how, and what is presented as a basis for policy interpretation is part of a process of decision making. Deciding on which methods to apply for dealing with complexity are crucial for IPBES as the relation between the natural environment and humans is highly complex and still poorly understood. Deciding on the methods is not an objective purely scientific matter. Methodological decision making is part of negotiations between relevant experts and stakeholders involved in the research and interpretation of results in a specific context. As such, the complexity taken into account becomes negotiated complexity (Keune et al., 2013). Some experts believe (Holland, 1998) that new scientific strategies on how to deal with complexity will bring us closer ever more perfect knowledge about and control of complexity. Others (Keune, 2012) believe that complexity by definition will never be fully grasped, necessitating us to focus on parts of complexity and to critically reflect on the normative basis for such simplification of complexity.

2.3. The multiple meanings of the concept of "value"

The word "value" has different meanings and this can lead to confusion. For biodiversity and ecosystem services it is important to distinguish four different kinds of values that are interrelated but not synonymous:

- A value can be a **principle** or core belief underpinning rules and moral judgments. Both a belief in that intergenerational equity is desirable and an ethical imperative to live in harmony with nature represent values in this sense. Values as principles vary from one culture to another and also between individuals and groups. For instance, even in the same socio-cultural context, some people will ascribe to a value/principle of respect for all living things whereas others may not.

- A value can be the **preference** someone has for something or for a particular state of the world. Preference involves the act of making comparisons, either explicitly or implicitly. Preference refers to the importance attributed to one entity relative to another one. Socio-cultural preferences depend on perceptions and knowledge of the entities to be compared, as well as on their relative contribution to objective and subjective well-being. Preferences also inform the logic of economic valuation in which stated preferences and revealed preferences are thought to unravel the importance attached to a thing relative to other things through the choices actually or potentially made. From this perspective, values can be conceived as the *subjective* importance people attribute to an entity, to a relation, to a state of the world, or to the relative contribution of an action to meeting specified goals, objectives or conditions. These preferences are partly shaped and informed by the principles endorsed by people. They also reflect personal aspirations and beliefs and depend greatly on the context in which the preference is expressed. For instance, someone may prefer certain ecosystem services such as not limited to aesthetic properties of a naturally flowing river while others may prefer the benefits provided by an engineered dam. These values influence human thought and emotion, stimulate expression, and motivate behavior and actions.

- A value can be the **importance** of something for itself or for others, now or in the future, close by or at a distance. This importance can be considered in three broad classes. 1. The importance that something has subjectively, and may be based on experience, e.g. the way that a particular aspect of nature informs a person's or community's identity. 2. The importance that something has in meeting objective needs. 3. The intrinsic value of something is the importance that people believe a thing has unto itself regardless of the interests of people or others. Intrinsic value reflects an ethical perspective held by people. Values can, within this meaning, be understood as *objective* and inherent properties of an entity or a state of the world,

independent of any external recognition of this value by people. These can include the importance of a particular site for other species as a refuge, or the importance of the ozone layer for the maintenance of life on earth. They can also include the value of nature in and for itself. In consideration of diverse worldviews, classes 1 and 2 can refer to importance from the perspective of humans and non-human persons in nature (other species).

- A value can be a **measure**. In the biophysical sciences, any quantified measure can be seen as a value, for example, when one measures species richness (e.g. the number of species) and thereby arrives at a particular value for this. Monetary values are also measures in this sense. In different cultures and from different worldviews (and even different knowledge specializations within the same culture) the thing that is measured, how it is measured, and what the measurement means can all be conceptualized in significantly different ways.

These different kinds of values can also be interrelated, e.g., when ethical **principles** lead one to have a **preference** for a specific course of action, which in turn can be **measured** by an appropriate valuation tool. For instance, the subscription to an ethical principle about the right of species to exist can lead one to have a strong preference towards conservation objectives and actions that further the preservation of endangered species such as the Giant Panda. This support can in turn be measured with appropriate methodological devices, for instance by the estimation of willingness-to-pay for conservation or the ranking of a set of policies having impact on Giant Panda conservation.

These different kinds of values are often conflated but may also be totally unrelated. Monetary values, conceived as **measures**, can be based on a direct measurement of **preferences** (as with the use of contingent valuation), and sometimes they are not. For instance, market prices do not directly measure people's preference for something, but rather a relationship between supply and demand, generally mediated by specific institutional arrangements. These exchange values do not directly reflect the potential **importance** of what is priced, nor subjective **preferences** for it, as noted by Adam Smith (Smith, 1776) about the paradox of value: things can be vitally important (e.g. water) but cost almost nothing whereas other things can have a great exchange value (e.g. diamond) while being virtually useless. Values as **principles, preferences and subjective importance** are assigned to things on the basis of people's experiences, beliefs, and understandings, which are in turn influenced by their socio-cultural context. These "socio-cultural values", often identified as values shared by people in groups and/or those that inform shared identity of a particular group cannot be elicited by valuation tools that focus on values only as a measure.

When designing and negotiating policies related to nature and its benefits, particular attention should therefore be paid to the different ways in which the concept of value can be used. Consideration should also be given to how this use may vary across the different disciplines, stakeholders or worldviews involved in a debate or decision-making process and to the potential implications of adopting one meaning over another, both in terms of setting the frame or scope of an assessment and evaluating the appropriateness of different assessment tools and methods.

2.4. The multiplicity and diversity of values

2.4.1. Different foci of value

According to the IPBES conceptual framework (Díaz et al., 2015), the focus of values as they concern biodiversity and ecosystem services issues can be divided into three broad categories: "nature", "nature's benefits to people" and "good quality of life". This division has been chosen for pragmatic reasons so as to capture an array of different interests and to support diverse worldviews. This division is not meant to describe a real, firm or ontological division of the world into three separate realms (see Box 2.1 below).

- **Nature**. This category refers to the value that nature or natural entities have in, of and/or for themselves. It can include their functional value within a broader ecological state. It can also involve attributing them a moral value, e.g. that species should not be driven to extinction regardless of human interests. The target of value may be: individual organisms such as a particular gorilla or oak tree; bio-physical assemblages such as a population of polar bears or a river basin; biophysical processes such as evolution or ecological resilience; or biodiversity on a genetic, organismal, species or holistic basis. The orientation in this category is non-anthropocentric (see Box 2.2 below).

- **Nature's benefits to people**. This category refers to the benefits (in the broadest sense) that people draw from nature or ecosystem functions. These benefits can be realized as physical outputs, such as water or food. They can also include cultural, recreational and/or spiritual interactions that are directly or indirectly influential for human endeavor. One of the conceptualizations of nature's benefits is 'ecosystems services'. The orientation in this category is anthropocentric, and includes both biophysical and instrumental values with a normative goal of human well-being (see Box 2.2).
- **Good quality of life**. This category concerns the contribution of nature and ecosystem processes to a good quality of life, or a fulfilled human life. This refers to the way in which different elements of nature and BES support human well-being. It also includes the principles of living in harmony with nature, and living well in balance with Mother Earth. This can involve the development of desirable communities and societies, for example the way landscape conservation can contribute to a sense of place and community. The orientation in this category is anthropocentric and relational (see Box 2.2).

Box 2.1. What are the foci of values within IPBES

Nature: The concept of "nature", as used in this document, refers to nature at large, encompassing a continuum from nature as an autonomous functioning and evolving system to nature as domesticated plants and animals. Within the context of science, it includes categories such as biodiversity, ecosystems, ecosystem functioning, evolution, the biosphere, humankind's shared evolutionary heritage, and biocultural diversity. Within the context of other knowledge systems, nature includes different categories held by indigenous peoples around the world, such as Mother Earth and systems of life shared by the indigenous people of the South American Andes, and holistic concepts of the land held in the South Pacific islands which include non-human living organisms, living people, ancestors and deities (Díaz et al., 2015). Values attributed to nature also often concern some portions of nature (e.g. agricultural landscapes) or some natural entities (e.g. pet species) that have been influenced by human activities to different degrees. They can also refer to the relationship between human beings and other living beings as part of a global system of life. All of these components of nature are included in the scope of the document. However, some controversial issues can be raised about whether some highly technologically dependent entities (such as GMOs or clones) belong to nature or not. Such inclusion will depend on how people view the nature/culture boundary and define the concept of "nature" itself (see Section 2.2.2). It is, however, outside the scope of this document, and outside of the legitimacy of its authors, to decide in any strict sense what nature is or is not as this will depend on the cultural context defining the term. This plasticity concerning the concept of nature should be kept in mind by anyone engaged in values assessment.

Biodiversity: the formal definition of biodiversity is "The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems". The concept of biodiversity thus formally does not refer to *collections* of natural entities themselves (species, ecological communities, ecosystems, landscapes), but rather to a property of these collections: their *variability*. Biodiversity encompasses variability of traits and genes within populations and species; variability of phenotypes and evolutionary lineages within populations and species; variability of species, assemblages and functions within ecosystems and communities; and so on. When considering biodiversity values, it is the different values of this variability which are at stake, and not the values of the ecological entities that vary. For instance, the value associated to genetic variability of cultivated plant may be related to its capacity to buffer and resist pathogens rather than on the cultivated plant itself. Values can refer to biodiversity in this technical sense. However, given that in common language, the concept "biodiversity" is often used to refer to nature or ecosystems in a broader meaning, the values of the variability of life are sometimes conflated with those of life itself.

Ecosystem services: these are the benefits that people obtain from ecosystems (MA, 2003). Ecosystem services are considered in this document to encompass "ecosystem goods and services" as an organizing principle oriented to human well-being. According to the definition and typology by the *Millennium Ecosystem Assessment* they include provisioning services such as food and water; regulating services such as flood and disease control; and cultural services such as recreation and sense of place. The whole pathway from ecological processes to the delivery of final ecosystem services to society is considered here. The need or demand from society for ecosystem services can also be considered.

Benefits from nature to people: This term is used to encompass a wide variety of benefits to society beyond the ecosystem service definition by the *Millennium Ecosystem Assessment*. This category includes indicators of the dependence of society on ecosystems in terms of the amount of energy consumed, the amount of materials consumed, the footprint of human enterprise, and the indirect contributions of ecosystems to people.

Good quality of life: This refers to the achievement of a fulfilled human life. The criteria for achieving that vary greatly across different societies and groups within societies. It is a context-dependent state of individuals and human groups, comprising aspects such access to food, water, energy and livelihood security, and also health, good social relationships and equity, security, cultural identity, and freedom of choice and action. "Living in harmony with nature", "living-well in balance and harmony with Mother Earth", the need for caring for and attending to places in perpetuating a sustainable life and "human well-being" are examples of different perspectives on good quality of life (Díaz et al., 2015).

The four different meanings of the concept of value (principle, preference, importance, measure) can be used for the three broad foci of values (nature, nature's benefits to people and its contribution to a good quality of life). Examples of these combinations are given in Table 2.1.

Table 2.1: *Examples of how the different meanings of values can be associated to the different foci of valuation*

	Measures	Importance	Preferences	Principles
Nature (e.g. *about a Bonobo reserve*)	*Area in hectares of tropical forest within which Bonobos are found*	*The keystone role of Bonobos for seed dispersal in forest ecosystems*	*Interest in maintaining Bonobos as a charismatic species*	*The right of the Bonobo species to survive*
Nature's benefit (e.g. *about the benefits derived from tropical forests*)	*Amount of carbon stored by tropical forests*	*Contribution of carbon stored in tropical forests to global stocks*	*Interest in maintaining diverse rather than species poor forests*	*The need for climate mitigation for future generations*
Good quality of life (e.g. *about the livelihoods of tropical forest dwellers*)	*Self-reported happiness*	*Identity as forest dweller as key to self determination*	*Interest in maintaining sacred species*	*Living in harmony with nature*

Box 2.2, below, provides definitions for the main types of values referred to in this guide.

Box 2.2. Definitions of the main types of values used in this document

Instrumental Value: An instrumental value is the value attributed to something as a means to achieve a particular end.

Non-Instrumental Value: A non-instrumental value is the value attributed to something as an end in itself, regardless of its utility for other ends.

Anthropogenic: Anthropogenic means 'human-generated' and is a term often used to refer to the way in which value is a concept and construct generated by humans. While it can be argued that all principles and preferences are anthropogenic (human-generated), it is important to note that this does not mean they are all anthropocentric (human-centred).

Anthropocentric: Anthropocentric means 'human-centred' so an anthropocentric value is a value that something has for human beings and human purposes.

N**on-anthropocentric**: A non-anthropocentric value is a value centered on something other than human beings. These values can be non-instrumental (e.g. a value ascribed to the existence of specific species for their own sake) or instrumental to non-human ends (e.g. the instrumental value a habitat has for the existence of a specific species).

Relational value: Values relative to the meaningfulness of relationships, including the relationships between individuals or societies and other animals and aspects of the lifeworld (all of whom may be understood as conscious persons), as well as those among individuals and articulated by formal and informal institutions. Another type of relational values, *eudaimonistic* values are associated with a good

life, which include considerations of principles and virtues, and value the actions and habits that are conducive to a meaningful and satisfying life.

Intrinsic value: This concept can refer to inherent value, i.e. the value something has independent of any human experience or evaluation. Such a value is viewed as an inherent property of the entity (e.g. an organism) and not ascribed or generated by external valuing agents (such as human beings). This is the meaning of intrinsic value that has been adopted in the IPBES Conceptual Framework (Díaz et al., 2015): "*Intrinsic value* [is] *the value inherent to nature, independent of human experience and evaluation and thus beyond the scope of anthropocentric valuation approaches*".

Biophysical values: A biophysical value is a measure of the importance of components of nature (living being or non-living element), of the processes that are derived from the interactions among these components, or those of particular properties of those components and processes.

Economic values: Economists group values in terms of their "use" or "non-use", each of which is associated with a selection of valuation methods. Use values can be both direct and indirect, and relate to the current or future (option) uses. Direct use values may be 'consumptive' (e.g. drinking water) or 'non-consumptive' (e.g. nature-based recreational activities). Indirect use values capture the ways that people benefit from something without necessarily seeking it out (e.g. flood protection). Non-use values are based on the preference for nature's existence without the valuer using it, and are of three types: existence value, altruistic value, and bequest value. Such values can be mediated through market, pseudo-market or non-market mechanisms.

Socio-cultural values: Values shared by people in groups and/or those that inform shared identity of a particular group.

A general and overarching typology of relevant values to IPBES is presented in this chapter, together with some illustrative examples, in Table 2.2. This table is intended to guide the assessment of values within IPBES activities. It presents a range of values (non-exhaustive) that could arise from very different worldviews and is organized around the three broad categories of the IPBES conceptual framework (nature, nature´s benefits to people, good quality of life).

Table 2.2 aims to be as inclusive as possible in order to encompass the different approaches to conceptualizing and ascribing values. However, it also tries to provide a practical framework that may be of use to those conducting IPBES assessments or to practitioners involved in understanding the values at stake in the context of decisions related to nature, its benefits and its contributions to a good quality of life.

Table 2.2: Diverse values related to nature, nature's benefits and a good quality of life. *Examples from diverse worldviews and for different types of values are given as examples of those that are likely relevant for IPBES assessments.*

Category	Type of values		Focus of values	Example targets of valuation
NATURE *Intrinsic value*	**Non-anthropocentric**		Individual organisms	Living beings (biocentrism), sentient beings (animal welfare/rights)...
			Biophysical assemblages	Populations, communities, ecosystems, biomes, the biosphere, Gaia, Pachamama, Mother Earth...
			Biophysical processes	Evolution, ecosystem functions and processes, ecological resilience ...
			Biodiversity	Genetic, functional, taxonomic and phylogenetic diversity, uniqueness, vulnerability...
NATURE'S BENEFITS TO PEOPLE	**Anthropocentric**	*Biophysical*	Biosphere's ability to enable human endeavor	Energy: Embodied Energy, Human Appropriation of Net Primary Production (HANPP)...
				Materials: Total material consumption, life cycles, carbon footprint, water footprint...
				Land: Land cover flows, ecological footprint...

Category	Type of values		Focus of values	Example targets of valuation
		Instrumental	Nature's ability to supply benefits (basis of benefits)	Habitats for fisheries, contribution of soil biodiversity to sustenance of long-term yields, biodiversity for future options...
			Nature's gifts, goods and services	Regulating services: Climate regulation, regulation of water flows, pollination, biological control...
				Provisioning services: Food, medicine, timber, water, bioenergy...
				Cultural services: Ecotourism, education, psychological benefits,...
GOOD QUALITY OF LIFE		*Relational*	Security and Livelihoods	Physical security, political stability, food and water security, energy security, livelihood security...
			Sustainability and Resilience	Social-ecological resilience, social, economic and ecological sustainability...
			Diversity and Options	Biocultural diversity, diversity of current and future options …
			Living Well and in Harmony with Nature and Mother Earth	Stewardship, relationships and interactions between people and nature, conservation activities, contemplation of nature...
			Health and Well-being	Physical, mental, holistic health...
			Education and Knowledge	Inspiration, education, experience, learning space...
			Identity and Autonomy	Sense of place, sense of community, historical values, agency, self-determination...
			Good Social Relations	Community cohesion, social resilience, conviviality...
			Art and Cultural Heritage	Inspiration, artistic creation...
			Spirituality and Religions	Sacred sites, totemic beings, spiritual well-being…
			Governance and Justice	Environmental justice, intra-generational equity, inter-generational equity...

Note: Any entity can be ascribed multiple types of value (non-anthropocentric, biophysical, instrumental, relational). For example, rhinos can be valued intrinsically as sentient beings, they can be valued instrumentally for their contribution to the dynamic and resilience of savanna grasslands, and their appropriate treatment can be judged via relational values.

Given the plurality of worldviews and approaches to valuation (Box 2.3 below), Table 2.2 (above) is necessarily referential, heterogeneous, non-exhaustive and non-prescriptive. The examples given include the four meanings of value (i.e. principles, preferences, importance and measures), and are meant as illustrations of the entities, processes or states of the world that could be relevant in specific situations. There is some overlap and redundancy among the key elements and examples because the different foci of values (i.e. nature, nature's benefits to people, and a good quality of life) may occur concurrently, but the purpose has been to be as inclusive as possible within the specific guidelines provided by IPBES. Examples of the different targets of valuation are intended to help the user identify terms, concepts and entities that may arise as relevant from different backgrounds.

Box 2.3. Divided Perspectives on Environmental Value

Within the IPBES integrative framework, identifying and assessing conceptualizations and values of nature should be as inclusive of diverse worldviews and beliefs as possible and bring together diverse sciences and indigenous and local knowledges. This approach has been deemed critical in order to produce documents, guidance, evaluative tools and assessments that span philosophical divides. This box describes prominent divisions in how nature's value is conceived in Western philosophy. These dualisms do not apply in most eastern cultures or indigenous cultures.

Non-instrumental / Instrumental values

Since its inception, environmental ethics has involved ongoing debates about whether entities in nature possess intrinsic or only instrumental value. There is a disagreement about whether nature only has value for human ends and purposes or whether it has value in and of itself, regardless of what it may offer to human endeavor. For the supporters of nature possessing intrinsic value, there are further divides concerning the basis on which an entity can be said to possess intrinsic value or what characteristics are required to be awarded this status (e.g. level of cognitive capacity, self-awareness, nervous system development, or simply being alive) and on what level of organization it applies (e.g. whether intrinsic value can be ascribed to individual organisms, ecosystems, or all life on earth).

Anthropocentric / Ecocentric ethical frameworks

Another related classic divide in environmental ethics is that between the views that place humans at the centre of all value attributable to nature (anthropocentric views) and those that see humans as just one species within a broader ecological system of value (ecocentric views). The first view is most typically linked to anthropocentric values and the second to non-instrumental values of natural entities, however this correlation is not absolute. For example, people holding ecocentric views still recognize that nature also possesses instrumental value for human beings and some of those holding anthropocentric views may be able to acknowledge that humans may award nature non-instrumental value but this need not have any significance for or impact on policy deliberations and decision making.

Strong / Weak anthropocentrism

Within those holding anthropocentric views, there is a further relevant distinction between strong and weak anthropocentrism. At the strong anthropocentrism end of the spectrum, nature is primarily seen as a provider of goods and services for human activity. This includes attributing a privilege to human beings over nature. At the other end of the spectrum, weak anthropocentrism values nature for the benefits it provides to humanity, but is critical of the exploitation of nature and argues for the importance of caring for and maintaining the resource base of nature for sustainable human use.

Subjective / Objective values

This debate is between those that see values as inherently subjective and an outcome of human intellect, emotion and reasoning and those who believe that values exist in a more objective sense and can be held by objects and entities without humans necessarily recognizing or attributing them.

About these dualistic categorizations

For most indigenous cultures the dichotomies inherent in Western thinking do not exist (Kipuri, 2009): "Dichotomies such as nature vs. culture do not exist in indigenous societies. Indigenous peoples do not see themselves as outside the realm of nature, but as part of nature, and they have their own specific attachment to their land and territory and their own specific modes of production based on a unique knowledge of their environment. Nor do indigenous peoples emphasize a radical duality between the sacred and the mundane as happens in Western culture. In many indigenous cultures, social and political institutions are part of the cosmic order, and it is on the basis of their worldview, beliefs, values and customs that indigenous peoples define their own forms of governance, as well as their customary laws and norms." (p.52)

2.4.2. Values are context-dependent and dynamic

Values can vary significantly depending on the context within which they are formed and expressed. Values are embedded in, and derived from, peoples' worldviews and are influenced and mediated by a range of psychological, cognitive, social, cultural and political processes and contexts. This means that peoples' values are shaped through tangible and intangible relationships with natural, social and cultural environments, and shape these environments in turn (Feld and Basso, 1996). Environmental and cultural changes are of course also tightly interlinked. A growing literature on socio-ecological diversity highlights the interdependencies of biophysical and cultural factors, for instance between loss of habitats, loss of way of life and loss of cultural traditions or identity (Loh and Harmon, 2014). Obvious examples are found in resource-based communities, such as farmers and fishermen, whose sense of place, community structures, and cultural traditions are intimately tied to daily and seasonal practices (Breslow, 2014).

Values are not fixed once and for all. They sometimes may be slow to change (Hamilton, 2011), but can respond to the external environment, changing cultural norms and social learning. Drivers of value evolution include changes in individual circumstances, changes to the environment or community in which one lives, changes in cultural norms, major political and economic trends (e.g. neoliberalism), historical conditions (e.g. colonialism), broad social trends (e.g. globalization and social movements), and acute events (e.g. war, natural disaster, political upheaval). Socio-cultural institutions also play a role in determining which values are activated or expressed in specific situations (Vatn, 2005).

The value commitments of individuals can vary in strength or intensity, for instance increasing when one becomes more aware of the impact of the deterioration of environmental quality on either their own welfare or that of other living beings. People can also experience a qualitative change in their values, for instance, when what was initially considered as an instrumental value (e.g. the value of surrounding farmland as a supplier of agricultural resources) changes through time and becomes perceived as a non-instrumental value (the sense-of-place attached to this specific landscape and the associated cultural identity) (Deci and Ryan, 2010).

One specific way in which values can change and evolve that is of great interest for assessment issues is through deliberation. Deliberation allows people to learn about the implications of alternative courses of action on nature's benefit to society and other people's quality of life as well as for nature itself, and as a consequence reconsider their own initial value positions (Vatn, 2009). When instantiated at a political level as promoted by deliberative democracy, deliberation allows citizens to learn from one another and to develop new understandings that are more widely justifiable (Guttman and Thompson, 1996). Deliberation can thus create awareness of "our more remote and indirect connections with others, the long-range and larger-scale significance of what we want and are doing" (Pitkin, 1981). In this process, people take responsibility for justifying their own standards and values against those of the others, and against social norms and practices, thus remaining engaged in a joint effort of understanding and problem-solving. The whole deliberative process can thus be a way to enhance the individual and collective ability to reconsider and change values.

2.4.3. Values are scale-dependent

Worldviews and values change over time (i.e. over years, decades, millennia), space (i.e. across local areas, regions, biomes) and levels of social-organization (i.e. individuals, local communities, nations, and global entities). As value-related decisions change both across and within these three dimensions, mismatches between these dimensions represent a challenge for incorporating diverse values into BES decision making (Duraiappah et al., 2014). Managing organisms and ecosystems so as to attain "conservation and sustainable use of biodiversity, long-term human well-being and sustainable development", as stated in the IPBES goals, thus requires careful consideration of the issue of scale and at what scales the different values are at stake. Scale, defined as the spatial, temporal, quantitative or analytical dimension used to understand a phenomenon (Cash et al., 2006), is socially and politically constructed (Wyborn and Bixler, 2013). Scale refers here both to the spatial and temporal dimensions of value as well as to the connection between representation and power, and both formal and informal institutions (cultural norms, rules, laws, policies) and its influence on value (Cumming et al., 2006).

- **Time scales.** Perception of time is relevant to values and valuation, whether short versus long timescales or the past versus the future. Things that are not valued today can acquire great value in the future, for instance because of changing environmental conditions, changing knowledge, changing

preferences or changing principles (see Sections 2.3 and 2.5). Some people will prioritize short-term goals and activities while others will place more value on those extending over the long term (e.g. those ascribing to principles of intergenerational equity). Furthermore, in economic decision making, how much future value decreases with respect to current value depends on the time preference for consumption (today or into the future). This sensitivity will be reflected in economic valuation by discounting rates - the larger they are, the more present values are weighted over future values. It has been argued that in some circumstances, a negative discounting rate could be applied in order to favor future values over present ones (Fleurbaey and Zuber, 2012). Perception of time also plays a role in understanding cultural perspectives, where relationships with the past or future may have implications for decision making. Many cultures maintain strong relationships with ancestors and historic events, and envision futures transcending multiple generations. In cultures with such value-based principles and preferences, significant emphasis will naturally be placed on longer timeframes and scales in any assessment process.

- **Spatial scales**. The spatial scale arguably anchors value perceptions (i.e. whether dealing with close proximity or far distance; fine or coarse resolution; square meters to thousands of kilometers). The values of nature, nature's benefits to people and a good quality of life change across space (Costanza, 2008). Something might be considered very valuable locally and less so at larger spatial scales; for instance, a sacred grove may be very important for an indigenous group but not be considered valuable at the national scale, and vice versa. Furthermore, benefits that people obtain from nature are generated at multiple, overlapping scales.

- **Social organization scale**. Values of nature, nature's benefits and a good quality of life also change across levels of societal organization from individuals, to communities, societies, nations and to the globe. Societal configurations express their demands or needs for nature's benefits in diverse ways. However, individual, group-based and large-scale valuations are not necessarily mutually exclusive and may provide complementary information with regard to how values are expressed at different levels of societal organization. While values are rooted in particular worldviews and perceptions, they can also be constructed during the valuation process itself and in dialogue with others. For example, the values we express as consumers making choices based on individual preferences are very different from the values we express as citizens to influence political decisions at an aggregated societal level (Sagoff, 1998). Above the level of individuals, deliberative process and group-based valuations can reveal collective values among a set of people sharing interests and responsibilities toward a specific issue. That could be the case for instance when people are collectively affected by the ecological state of their environment (e.g. such as where there is a dependence on rivers or aquifers) or in contexts of common property (e.g. collective property right). At an even larger scale such as nations, it can be useful to instead look at values embedded in societal norms, conventions and legally sanctioned rules. For example, constitutions permeated by the values of indigenous peoples in societies like Bolivia and Ecuador incorporate some recognition of the rights to nature.

The three interacting dimensions of scale (space, time and social organization) can result in varying values of nature, nature's benefits and what a good life encompasses. For example, at the local, short-term scale, values for individuals and families may center on how to secure their livelihoods. Moving along the time and space scales, the spiritual and cultural values of ethnic groups have developed at subnational spatial scales over decades or centuries. At the highest level, values regarding common assets such as the atmosphere and oceans and the service of climate regulation as well as various non-anthropocentric values can be shared across social contexts.

Assessments of the values of nature, its benefits and contributions to a good quality of life therefore need to be multi-scalar. Decisions on how to manage nature are often taken at the local and individual scales although they are constrained by biophysical and societal drivers that operate at a range of space, time and social organization scales (van den Belt and Blake, 2015). Management decisions and policies aimed at maintaining biodiversity and ecosystem services can be designed at global, national, state and local levels. Scale mis-matches occur involving cross-scale dynamics over time, space and organizational scales.

2.4.4. Potential and future values

In the context of BES decision making, special attention must be addressed to the potential and future values of nature and biodiversity. These future-oriented values are not easily articulated with the different categories of values presented in Table 2.2 (above) since each of the examples shown there are susceptible to having a special significance into the future. Also, some of them are already truly actualized whereas others are only potential. This is especially the case for the values of biodiversity since one of its most noticeable values comes from the fact that the variability of living things can be the source of yet unknown benefits in the future.

- **Bequest values** are attributed by individuals and/or groups to the transmission of present items of value to future generations. This special responsibility has to do with intergenerational justice and can be considered as a principle. Taking this principle into account, any present value can be enhanced by a special interest in its conservation and transmission to the next generations.
- **Insurance values** relate to the importance we attribute to ecosystem resilience. It refers to the role of ecosystems in maintaining their integrity as functioning systems and their capacity to deliver ecosystem services and various associated values. In the present context of global change, things that are not valued now may become highly valuable in the future. The contribution of ecosystems to climate change regulation, specifically to its mitgation, is becoming more valuable. Values associated with this resilience are then not linked to the particular state of nature, the flow of benefits or the quality of life, but rather to their ability to cope with change in ways that are compatible over time (Pascual et al., 2010).
- **Option values.** In the broadest sense (not confined to economic vocabulary), option values are associated with the fact that new values can be discovered in the future. Biodiversity is "a reservoir of yet-to-be discovered uses from known and still unknown species and biological processes, and as a constant source, through evolutionary processes, of novel biological solutions to the challenges of a changing environment" (Díaz et al., 2015).

In concordance with the idea of a "frontier of the future" (Wilson, 1988), biodiversity symbolizes our lack of knowledge about the components of life's variation and their importance to humankind (see Takacs, 1996). The not-yet-actualized values are surely difficult to assess and directly incorporate into decision making, yet any valuation that ignores them inevitably underestimates the real value of biodiversity and ecosystems.

The manner in which nature, its benefits to people and a good quality of life are valued into the future is also linked to the way sustainability is defined (Robert et al., 2005). Emphasis can be placed on sustaining or improving quality of life; it can be placed on the maintenance of the flow of benefits from nature to society; or it can be placed on the protection of biodiversity and the continued functioning of ecosystems. The integration of the diverse conceptualizations of values can contribute to an assessment of the incommensurable dimensions at stake.

Values associated with the resilience of nature are also relevant for future values. Socio-ecological resilience (towards undesirable change) is needed to cope with endogenous and exogenous changes to biophysical and societal conditions (Folke, 2006). Values associated with this resilience are then linked not to the particular state of nature, the flow of benefits or the quality of life, but rather to their ability to cope with change in ways that are compatible over time.

2.5. Values are plural and often incommensurable

The values of nature, nature's benefit to people and good quality of life relevant for decision making are plural. Some refer to the perceived objective importance of ecosystem functioning (e.g. resilience), some refer to subjective preferences (e.g. social demand for recreational spaces), and some refer to cultural and moral principles (e.g. sacred sites or respect for life). They can be considered from diverse dimensions (biophysical, philosophical, cultural, sociological or economic), some of which are quantifiable (e.g. biophysical and monetary measures) and others that are not.

These multiple dimensions will often be incommensurable, which means that they cannot be reduced to one single metric and cannot easily be compared (Martinez-Alier et al., 1998). For instance, a mountain may be regarded as a mineral deposit with high economic potential by one set of actors, and at the same time

valued as the guardian of an ethnic race by other actors. While the former focus of value can be captured using quantitative opportunity cost methods, the latter can be captured only through qualitative socio-cultural methods. This raises issues particularly relevant for economic valuation, which is founded on the aggregation of different values quantified in the same unit, and thus relies on value commensurability. The commensurability assumption implies that different values and goods can be substituted for one another and all decisions can ultimately be reduced to trade-offs. However, many values cannot be traded-off with others or even quantified. Indeed, in practice, it is often the case that people are found to be unwilling to trade-off one value for another, especially where the values represent strong cultural or ethical principles. In the later chapters of this guide, attention is given to different types of integrating tools and methods as a way to handle value incommensurability.

2.6. Power and equity in value articulation

Value articulation can be directly influenced by the framing and the context in which values are elicited (Brondizio et al., 2009). Therefore, any attempt to assess values should consider equity, the distribution of power, and whose values are taken into account during the selection and application of valuation tools and processes.

2.6.1. Equity

In order to avoid bias and injustice, at least two main dimensions of equity should be considered in the context of BES assessment: *distributional equity* (comprising inter- and intra-generational equity) and *procedural equity*, which takes into account differential power relations that may affect a process and whose values are able to be heard (Pascual et al., 2010).

- **Distributional equity** concerns the allocation of costs, benefits, risks and responsibilities as well as of the products of nature. The loss of biodiversity and its benefits particularly impacts the world's poorest people who rely most directly on these benefits to survive and who often cannot substitute them with other products or services (Martinez-Allier, 2002). Their right to the access and use of certain resources, such as land, water or forests, are often not well secured, which makes them even more vulnerable in cases of conflict between different users (Kosoy and Corbera, 2010). Biodiversity conservation itself can also sometimes impact the livelihoods of the world's worst-off, for instance by limiting their access to resources, creating further inequities (Krause and Loft, 2013). A linear aggregation of values can obscure these distributional issues. For instance, converting a forest into a plantation might produce sizeable overall economic benefits, most of which are captured by international timber companies while local people are deprived of the forest from which their culture and livelihood depend. Thus, a disaggregation of values to highlight who benefits and who loses, and to demonstrate the consequences for those affected, is crucial for describing and understanding the potential impacts that may be implied by different options. Distributional equity also refers to the needs and interests of future generations. Since it is impossible to directly assess preferences of unborn people, hypotheses must be made about what could be nature's values for future people and methods must be developed in order to include concerns for future generations in present assessments (see Sections 2.5. and 3.1).
- **Procedural equity** refers to the inclusiveness of decision-making processes and the negotiation of competing values (Haughton, 1999). Procedural equity deals with the issues of power asymmetries that affect whose voice is heard and who has a say regarding access and control of nature (concerning biodiversity use, conservation or destruction). Policy-making processes have sometimes inadequately addressed minority groups or the interests and values of people who are actually or potentially affected, directly or indirectly. Well-managed participatory mechanisms that introduce dialogue and negotiation can be used to reveal different and potentially competing values and knowledge systems, reduce tensions, explore opportunities for compensation, and identify options for more equitable decisions and more equitable implementation of these decisions.

2.6.2. Power

Political, structural and social power asymmetries can also affect the ways in which values and knowledge systems are represented in actual decision-making situations and in participatory platforms. The level of procedural equity depends on whose voice and values are included in the debate and which contextual knowledge can influence decision-making systems. The framing of the valuation process can significantly influence which values are taken into account, which ones are omitted, and which ones may not be compatible with the type of measurement applied.

2.6.3. Inclusion

Site-specific knowledge and indigenous and local knowledge (ILK), local language and local worldviews should arguably carry increased weight in BES assessment and decision making as they are based on extensive experience and long-time good practice. Yet, representation of traditional knowledge systems and spiritual/cultural values can be a challenging task. Explicitly including cultural dimensions, traditional knowledge of local and indigenous communities, as well as gender differences can, however, help to ensure that important dimensions for the assessment of values are included and to strengthen procedural equity. For example, it has been recommended for the case of the Māori (http://www.mfe.govt.nz/publications/rma/maori-values-supplement/) to have particular regard to including "*kaitiakitanga: the exercise of guardianship by the tāngata whenua of an area in accordance with tikanga Māori in relation to natural and physical resources*." Self-representation of indigenous and local groups is critical to the correct inclusion of their values.

2.7. Including diverse values into valuation

Values and value systems are diverse, sometimes incommensurable and sometimes in conflict. Different value systems can be complementary but harmonization may not always be possible, or even desirable. Contradiction and conflict between different systems of value (e.g. between rights-based approaches and human needs-based approaches) and between different groups of stakeholders (e.g. local community and private developers) are particularly relevant to decision making. The methodological choices to assess values should thus be made with care and transparency.

- **The plurality of values requires a plurality of valuation methods**. Values assessments need to be adjusted to specific contexts when considering the values of nature, nature's benefits and a good quality of life. Some approaches will emphasize the quantification of biophysical and ecological attributes of nature, others can focus on the physical, cultural and socio-psychological benefits from nature, while others still can address the moral values that influence what is meant by a "good quality of life". In order to encompass the great range of worldviews and values, there is a need to use a range of approaches to valuation derived from a variety of disciplines and knowledge systems (e.g. indigenous knowledge systems). Depending on the context, a combination of methods and the synergies between them may be more appropriate than one single approach, particularly so as to include a plurality of values and address issues of equity. This necessitates an ability to engage in synthesis and reflective learning, avoiding paralysis in the face of pluralism as well as a genuine interdisciplinary collaboration from across the physical, social, and health sciences.
- **Valuation methods are value-laden.** The approach to valuation depends on the particular way of thinking and the perspectives concerning the way people see and manage their relation and interaction with nature (Brondízio et al., 2010). Indeed, valuation methods do not simply identify preexisting values; they also act as *value articulating institutions* in themselves (Vatn, 2009). For instance, they influence the way in which particular environmental resources are described (e.g. a commodity or a common pool resource) or the relative importance awarded to different types of value (e.g. self-regarding or other-regarding).
- **Methodological choices are political**. Valuation methods choices are not only technical, they also are political (Stirling, 1997), because they are subject to the preferences of people holding the power to influence choice and thus influence the scope and orientation of results. The type of approach taken and the type of questions asked, as well as the methods selected to elicit what is presumably technical knowledge, all influence and often implicitly decide on whose values are included and which values are featured. How to frame what questions are asked, what methods used, what data collected, or what interpretation is given can all involve a political dimension: what and who do we consider important to

take into account, both from a scientific and a societal perspective. Making the reasons for such choices explicit and context specific can help to highlight value dimensions more clearly in decision making. This implies the need to find an appropriate role for technical knowledge to inform rather than replace value-related debates in decision making. This is particularly important for the case of biodiversity-related issues, which are highly contextual, and where information should be drawn from various knowledge systems including practical, local and indigenous knowledge.

- **Appropriate mainstreaming of valuation outcomes is essential**. The varied information collected through valuation processes can be used in different ways and for different purposes, and managers and policy-makers may not be familiar with all of these. For instance, qualitative results are often considered unwieldy and unreliable for decision making, so they tend to be disregarded in favor of quantifiable measures and arguments. However, essential information can be wasted due to inexperience with incorporating qualitative results into the decision making processes. Participatory methods, for instance, create spaces for people to say what matters to them but these submissions can be questioned for their representativeness and are typically not incorporated into the final decision. The final incorporation of diverse values will depend on the creation or refinement of mechanisms that can enable managers and policy-makers to understand and explore in practice how to use the information provided in constructive and informative ways.

2.8. Conclusions

Values of nature, nature's benefit to people and a good quality of life are diverse and plural because:

- there exists diverse forms, understandings and conceptualizations of these values,
- the word "value" has different meanings and interpretations (i.e. principle, preference, importance, measure),
- there are different foci, orientation and types of value: e.g. nature (non-anthropocentric values), nature's benefits to people (anthropocentric, biophysical and instrumental values), a good quality of life.
- different worldviews influence the predominant types of values and the ways in which they are articulated,
- values depend on and change with people's cognitive and personal circumstances, their broader socio-cultural and political contexts, and their ecological and environmental contexts,
- values vary across spatial, temporal and social-organization scales (and complex interactions among values at these scales occur), and
- future and potential values of biodiversity and ecosystems are diverse and relevant for the present.

Explicitly including diverse and plural values into decision making and policy design is challenging because:

- diverse and plural values are incommensurable, and thus cannot be easily reduced to a single metric or compared,
- value articulation needs to be equitable, by a) being inclusive of all actors that bear differential costs/benefits and responsibilities, b) being mindful of power relations among these actors, and c) paying particular attention to site-specific knowledge and indigenous and local knowledge (ILK),
- contradiction and conflict between different systems of value and different groups of stakeholders are particularly relevant, and thus a plurality of values requires a plurality of valuation methods, and
- all valuation methods are value-laden themselves, making methodological choices political, and appropriate mainstreaming of valuation outcomes essential.

Recognizing, understanding, assessing the diversity and complexity of values ascribed to nature, biodiversity and ecosystems is needed to:

- **raise awareness** of nature's multiple values and how worldviews shape the behavior of individuals, communities and societies,

- **make visible** the wide spectrum of values that can be ascribed to nature, nature's benefits to society, and its contribution to a good quality of life, including biodiversity and ecosystem services,
- **permit recognition** of, and respect for, the values of all individuals, communities and social entities, including those who are at risk of being disenfranchised by the outcomes of decision making,
- **design and conduct assessments** that take into account different worldviews, types of values and knowledges, and
- **design management and policy interventions** that are consistent with stakeholder values and thus do not undermine the very functions that those decisions seek to accomplish.

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Chapter 3: Valuation methodologies

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Key Messages:

An IPBES protocol for valuation and assessment processes is proposed. Conducting a valuation or valuation assessment according to the IPBES protocol may facilitate comparability of results, and transparency and accountability in the process and resulting decisions.

Valuation methods are diverse. They include biophysical and ecological, cultural and social, economic, public health, and holistic, indigenous, and local knowledge-based types of methods. Valuation can be applied, for example, in cost-benefit analysis, cost-effectiveness analysis, multi-criteria analysis, participatory modelling, impact assessment, national accounting, business accounting or reporting.

Methods for assessing, integrating and bridging different valuation approaches are diverse. These include narratives, deliberation, integrative modelling, and multicriteria analysis. All aim to reflect the plurality of values expressed by different valuation methods. Integration or bridging of diverse valuation approaches is not always appropriate.

How to do valuation or assessment depends on the purpose of valuation. Valuation can have different purposes, including decision-making support, raising awareness, accounting, litigation or conflict resolution.

Seven major considerations should guide valuation and valuation assessments: (a) Which worldviews are relevant, which are endorsed? (b) Which are the relevant foci of value? (c) What are the relevant types of value? (d) What are the spatial, temporal and social organization scales at which values are expressed? (e) Who is involved, and how, at each stage of the valuation process? (f) How is the broader social context taken into account? (g) Practical considerations including availability and need for resources, knowledge, information and data.

A valuation or assessment process includes communication of results to the public and decision-makers. The level and type of social engagement during the process, as well as the manner in which the results of the valuation and assessment are communicated affects decision making and can even affect the assessed values themselves.

This chapter outlines the key valuation methodologies for IPBES, and how they relate to different conceptualizations of values. The chapter has four sections. Section 3.1 proposes a 6-step protocol for IPBES-related original valuations or literature-based assessments. A major step in this protocol is to scope the entire process. Section 3.2 introduces common types of valuation methods, and Section 3.3 outlines ways to integrate or bridge diverse valuation approaches. These sections describe choices in methods and approaches, and guide IPBES researchers to relevant fields, subfields, journals, books, experts, and other information sources. Section 3.4 presents methods and fields where valuation may be applied.

3.1. Proposed IPBES protocol for valuations and assessments

To ensure consistency among IPBES valuations, we propose a 6-step protocol to guide both original valuation studies and assessments of existing and documented valuation processes, as illustrated in Figure 3.1. The protocol is equally relevant for IPBES assessments, as it guides the assessment of the methodical approaches taken in the already existing valuation studies.

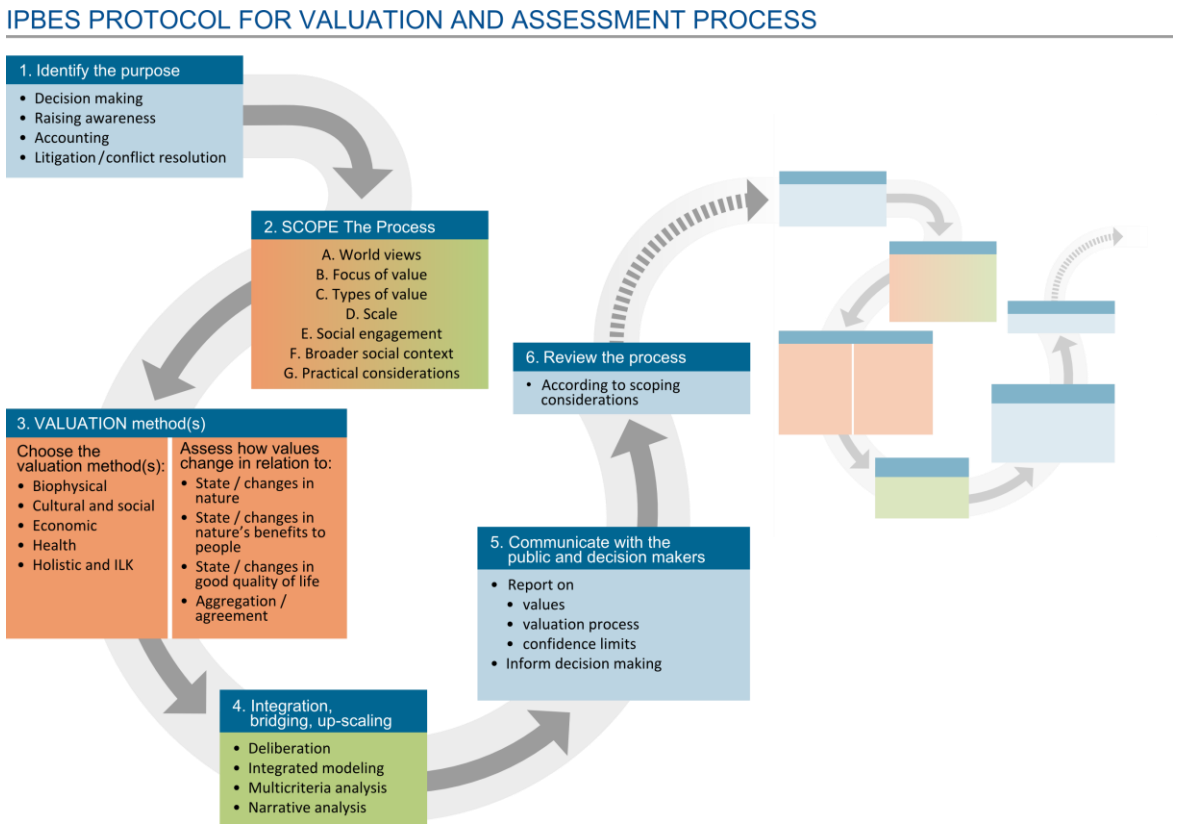

Figure 3.1*: Illustration of the six steps according to the proposed IPBES protocol for valuation and assessment processes. Orange and green colours indicate that the scoping applies to methods for both valuation and integration/bridging.*

3.1.1. Identify the Purpose. Clearly identifying the purpose of the valuation is key for the study or assessment. Purposes include decision making at the public, community, and private levels (e.g. implementation of public policy instruments, project design at any level); raising awareness (e.g. to inform private decision making); accounting (e.g. at national or business levels); litigation for environmental liabilities and conflict resolution (Gómez-Baggethun and Barton, 2013). Also, businesses interested in the environment – beyond the obligation to abide to public management regulations – may wish to conduct a valuation or assessment study for their purposes (see also Section 3.4).

3.1.2. Scope the Process. The choice of valuation method, or, in an assessment, the selection of studies using a particular type of valuation method, is not a neutral decision. The results of a valuation are shaped by the method(s) and how diverse values are synthesised. Even seemingly technical details can significantly affect outcomes. Appraisal methods influence how the environmental resource or quality is characterized (e.g. as a commodity or a common pool resource), which value dimensions are emphasized (e.g. individual values or social values) and how they are elicited (e.g. via willingness-to-pay surveys or group deliberation). Valuation methods comprise rules concerning a) who should participate and in which capacity, b) what is considered as data and which form data should take, and c) rules about how a conclusion is reached (Vatn, 2009). Therefore the following considerations should be addressed before choosing valuation methods, information sources, and integrative approaches.

A. Worldviews shape values (cf. Chapter 2). The scoping process needs to identify which worldviews are relevant to the valuation's purpose and, for the sake of transparency and validity, articulate which worldviews are actually reflected. Valuation methods and approaches differ in their ability to accommodate different worldviews.

B. Focus of value. Values can be focused on nature, nature's benefits to people and/ or on a good quality of life, in line with the IPBES conceptual framework (cf. Box 2.1, Section 2.4).

C. Types of values. The IPBES conceptual framework categorises values, at the broadest level, into anthropocentric (instrumental and relational) and non-anthropocentric values (cf. Box 2.3). As discussed in the following sections, some valuation approaches are mainly applicable to anthropocentric values (e.g. ecosystem services valuation), while others apply to non-anthropocentric values (e.g. ecological

integrity). Methods also differ in how they account for a plurality of values, such as the diverse ways in which people value nature and its benefits to people, illustrated by the different definitions of "good quality of life" in the IPBES conceptual framework. Some methods can account for a wide range of values while others are better suited to exploring one or a few value types in depth. Valuation methods as well as methods of integrating, bridging or assessing diverse valuation approaches further differ in their basic assumptions about the extent to which different values can be expressed in common terms (cf. Chapter 2). Some methods attempt to aggregate all values into a single quantity (measured in terms of money or energy, for example), some strive for partial aggregation by means of consensus-building or mathematical aggregation, and other methods do not aggregate at all (Martinez-Alier, 2009, Pascual et al., 2010).

D. Scale refers to the dimensions of space, time, and social organization (Section 2.4.3). Both human and natural scales matter with respect to space and time. Methods differ in their ability to integrate and cover changes in values across different spatial, temporal and social organizational scales – with respect to both the valuation and assessment process itself and the values that are expressed.

Social engagement. All valuation methods are embedded in a social context; methods are explicit about this to a greater or lesser extent. Valuation methods differ in how actively they deal with participation. Some valuation methods do not require active participation of stakeholders, some methods involve people primarily as knowledge providers, and some methods seek to engage a wide range of social actors, often representing different knowledge systems, in the valuation process. A collaborative valuation process may require the empowerment of underrepresented groups. Involving various knowledge holders (such as citizens, local and indigenous people) in the process may entail a responsibility on the part of the researcher to assure that these communities feel the benefits of their contribution to the valuation process and its results and real life applications. Further considerations include whether collecting, reporting on, and assessing values can harm people in any way (e.g. by revealing private information, and being too invasive with research). The effects of a valuation or assessment process on people can go well beyond the process, as it can influence decision making and the resulting changes in nature and its benefits (cf. Step 6). Such distributional impacts, which may result from decision making based on the valuation results, should be anticipated and taken into account to the extent possible.

E. Broader social context. Relational values are important elements in the valuation of nature and its benefits. Thus, the scoping process must consider how methods take into account the nature of relationships between people across scales, including power relationships, the distribution of incomes, wealth and resources, as well as gains and losses, externalities, and reciprocal relationships (see Box 2.2). These considerations include persons not actively taking part in the valuation, especially future generations. Consideration of the broader social context includes how methods account for the effects of anthropogenic assets, institutions, governance, and other drivers on the values of nature and its benefits.

F. Practical considerations include the availability and need for resources and the information costs (e.g. time, personnel, funding, or equipment), knowledge, information and data (see Chapters 4 and 6). Different types of methods require different technical skills and tools, time and professional expertise.

3.1.3. Choose and apply valuation method(s). For an assessment, this means to choose studies from the literature that apply these methods. This choice is a critical part of the valuation or assessment process, as it is an important determinant of its outcome. The conscious choice of valuation methods is based on the scoping considerations (Step 2, cf. figure 3.1), but also includes reflecting on who is making the choice, and explicitly setting out the assumptions embodied in the method (Section 3.2).

The selected valuation method(s) are then applied following the rules used in the relevant scientific literature. An appraisal of anthropocentric values typically considers how they are related to the current state and potential changes in nature, nature's benefits to people, and good quality of life. This emphasizes that valuation of biodiversity and ecosystem services requires a consideration of the state and/or change in nature. For the intrinsic values of nature (non- anthropocentric values), the state and changes in nature's benefits to people and good quality of life may be irrelevant.

3.1.4. Choose and apply method(s) for assessing, integrating and bridging different valuation approaches, if appropriate. Value assessments based on literature studies, but also original valuation studies that involve multiple methods, often require a further step of integrating different assessments of values. Some integration approaches aim to aggregate valuation results into a unique outcome, while others do not. It may be difficult to integrate assessments following different worldviews (e.g. approaches of biophysical valuation and approaches that believe that Mother Earth is a living being). If integration is not possible or

desirable, value types may still be bridged and aspects such as conflicts, synergies, and trade-offs between values examined. Approaches and methods of integration or bridging are reviewed in Section 3.3.

3.1.5. Communicate with the public and decision makers. Valuation results can be communicated in various ways, including media releases, public hearings, expert workshops or publication in scientific journals. The representation of values can include quantitative, narrative, visual, performative, and other forms. It is equally important at this stage to state confidence limits on the different types of values obtained from studies, taking into account (i) the degree of confidence associated with value estimates obtained from individual studies (i.e., quality of valuation approaches associated with values information) and (ii) the number of studies with available valuation data on specific value types (breath of studies). Confidence limits should also reflect limits of scope in valuation, according to the scoping considerations A-F. The setting of confidence limits ought to be a transparent process to allow reporting about the strengths and weaknesses associated with reported values in assessment exercises, as well as identifying gaps of knowledge on values. In the latter case also, the best available expert judgement would need to be used to acknowledge the implications of missing values.

A report on the valuation process should specify who was involved in identifying the purpose of the valuation (Step 1), scoping it (Step2), and in choosing and applying the methods (Steps 3 and 4). The feedback into society includes informing private and public decision makers, stakeholders, and practitioners, for example in direct consultation. Feedback to the public can also be indirect, as the persons taking part in the valuation process communicate with other persons in society. This way, the valuation process will affect decision making as well as the values themselves.

3.1.6. Review valuation or assessment process, to analyse its strengths and weaknesses. The overall process may be considered iterative, starting again with the scoping step (Step 2) in order to help with adaptive decision making, where the use of policy support tools and methodologies, decision making and their implementation are revised and adapted. Such iterative process allows refining the elicited values and associated methods, and allows for further learning about demonstrating and capturing values in decision making. This process should allow for acknowledging changed purposes of valuation and thus a new valuation process can start.

3.2. Types of valuation methods

Depending on the purpose of valuation (Step 1 of the valuation process), a full assessment of values regarding conservation and sustainable use of biodiversity, long-term human well-being and sustainable development may require a multi-method approach. Most of the methods described in the following sections are inherently multidimensional, and draw from multiple data sources to provide comprehensive assessments of values and contextual explanations for how and why values develop and change. Method types are presented in alphabetic order. Section 3.2.1 deals with biophysical and ecological methods, section 3.2.2 with cultural and social methods, Section 3.2.3 with economic methods, Section 3.2.4 with health assessment methods, and Section 3.2.5 with holistic, indigenous, and local knowledge-based methods.

3.2.1. Biophysical and Ecological methods

The scientific literature has used the notions of “ecological values” and “ecological valuation” with different meanings and in different contexts, ranging from references to intrinsic values of species, to conservation values, and values associated with ecosystem integrity, resilience, stability, and productivity. Despite this variation, the literature on ecological values generally aims to examine the *ecological importance* of attributes, qualities, and quantities characterizing nature’s condition and functioning.

In ecology and conservation science, valuation has traditionally endorsed a biocentric perspective, covering various measures of the *integrity* of the biotic and abiotic components of ecosystems irrespective of their instrumental value for humans, including populations, communities, functional groups, functional traits, and habitat types. Thus, ecological values may be attached to particular sites, species (e.g. populations, characteristics), species composition, genetic composition, or to ecosystem processes, function, structure, and ecosystem characteristics such as complexity, diversity, rarity, and stability that contribute to the potential supply of ecosystem services (Groot et al., 2002). Measurements of biocultural diversity have been developed and applied by, among others, Harmon and Loh (2010) and Gorenflo et al. (2012).

In the ecosystem services literature, ecological values relate to the ecosystem functions, processes and components on which delivery of ecosystem services and benefits to humans ultimately depends (Groot et al., 2002; Elmqvist et al., 2003; García-Llorente et al., 2011; Kontogianni et al., 2012; Bateman et al., 2013). They measure the *ecological health and integrity* of an ecosystem and its capacity to perform regulation and habitat functions as measured by ecosystem parameters, such as complexity, diversity, productivity and stability (Groot et al., 2003).

The notion of ecological values has been often used in relation to measures of ecosystem services in biophysical units, often using modelling platforms (InVEST, ARIES, MIMES, etc). Measures may include the amount of ecosystem services that can potentially be supplied (e.g. amount of biomass available for fodder, or area that is suitable for nature-based tourism), the amount of services that are actually delivered to users (e.g. total production of crops or water conditions in relation to standards for different water users at or above withdrawal point) (Tallis et al., 2012) and positive and negative interactions among ecosystem services (supply, delivery, demand), and bundles thereof (i.e. sets of services that appear together repeatedly at certain intervals through space of time) can be assessed (Rodríguez et al., 2006; Raudsepp-Hearne et al., 2010).

The *insurance value* (Armsworth and Roughgarden, 2003; Pascual et al., 2010; Gómez-Baggethun and Barton, 2013; Baumgartner and Strunz, 2014) relates to the importance we attribute to ecosystem resilience. It refers to the role of biodiversity and ecological infrastructure in securing ecosystem capacity to deliver sustained flows of ecosystem services in the face of disturbance and change. Securing such capacity involves maintaining critical amounts of ecological infrastructure for 'healthy' functioning, sometimes referred to as 'critical natural capital'. In everyday practice, the status of critical ecological infrastructure and related insurance value may be recognized by applying the precautionary principle and setting safe minimum standards or boundaries. The idea of insurance as connected to biodiversity and ecological structures stems from both empirical work and modelling exercises indicating that biodiversity compensates for fluctuations in individual species populations and the functions they perform within their systems (Ehrlich and Ehrlich, 1981; Walker, 1992; Loreau et al., 2001), in particular due to portfolio effects (Schindler et al., 2010; Hoekstra, 2012). Ecosystem resilience to disturbance has been associated with higher levels of functional diversity and redundancy of species performing specific ecosystem functions (functional redundancy), which in turn increase response diversity (Elmqvist et al., 2003; Mori et al., 2013). Regime shift analysis and assessment of ecological thresholds are important tools to address level of threat on insurance values. Insurance values can also be elicited using economic methods (see Section 3.2.3).

Ecologists often use the word *value* to mean a numerical amount denoted by a magnitude, quantity, or number and many ecological economists link the notion of ecological valuation with allegedly objective biophysical measurements of ecological impacts from human activity (Martinez-Alier, 1987; Naredo and Manuel, 2000). Biophysical valuation methods have been used to calculate physical 'costs' (e.g. in time, energy, materials, land surface, etc.) and levels of pressure of human activity on ecosystems (Martinez-Alier, 1987; Martinez-Alier, 2009). Biophysical approaches assess value based on the intrinsic properties of objects by measuring underlying physical parameters. Examples of biophysical valuation include embodied energy analysis (Costanza, 1980), emergy analysis (Odum, 1996), exergy analysis (Naredo and Manuel, 2000), ecological footprint (Wackernagel and Rees, 1997), material flow analysis (Daniels and Moore, 2001), Life Cycle Analysis (Daniels and Moore, 2001), Human Appropriation of Net Primary Production (Vitousek et al., 1986) and Multi-Scale Integrated Analysis of Societal and Ecosystem metabolism (MuSIASEM) (Giampietro et al., 2009) (reviewed in Kumar, 2010; Gómez-Baggethun and Groot, 2014)). Economists have criticised that ecological measures of value would have a weak conceptual basis and rely on strong implicit assumptions (van den Bergh and Verbruggen, 1999; van den Bergh and Graze, 2010).

3.2.2. Cultural and Social methods

Cultural and social valuation methods have diverse theoretical assumptions, disciplinary backgrounds and original fields of application. They are used in many disciplinary fields, including sociology, ethnography, and political ecology. Here we group all methods that apply a hermeneutic approach to the process of valuation, which means that they are based on interpreting various ways of communication. A common assumption of cultural and social valuation methods is that values of nature, its benefits and quality of life, which all can be considered as *the foci of cultural and social valuation*, are rooted in individuals and at the same time are shaped by the social and cultural context in which individuals are embedded (Turnley et al.,

2007). Thus, cultural and social valuation methods aim to valuate nature, its benefits and quality of life in a contextualized way by discovering the psychological, historical, cultural, social, ecological and political contexts and conditions (*the broader social context*), as well as the *worldviews* and social perceptions that shape individually held or commonly shared values (Chan et al., 2012). They are thus able to accommodate more than one *worldview* in the process of valuation and some of them (e.g. ethnographic and narrative methods) can help make connections between conflicting worldviews, as explained below (cf. scoping consideration A, B and F).

Cultural and social valuation methods are able to reveal a wide range of *value types* including intrinsic, instrumental, non-instrumental and relational values (Chan et al., 2012), and also help understand how specific contexts give rise to certain value types (cf. scoping consideration C). A typical investigation in cultural and social valuation processes is at the local geographical *scale* and a time *scale* of human generations. Approaches are heterogeneous in terms of the *scale* of social organization. For instance, ethnographic studies usually refer to the community level, preference assessment focuses more on individuals, while narrative methods can apply to various scales of social organization (cf. scoping consideration D). Methods rooted in the field of political ecology examine how environmental problems are linked to multi-scalar political, economic, cultural, historical, and power dynamics, with particular attention to the experience of local and marginalized resource users (Blaikie and Brookfield, 1987; Neumann, 1992; Peet and Watts, 1996; Sivaramakrishnan, 1999). This orientation makes cultural and social valuation methods capable of bringing conflicts over nature and its benefits to the surface, and allows for better understanding of the implications for resource- and place-based communities (Peluso, 1993; Breslow, 2014; Kovács et al., 2015).

Cultural and social valuation methods are particularly encouraged to engage a transdisciplinary approach which bridges multiple disciplines and includes non-scientist participants as partners. Due to the intensive fieldwork inherent in many of these methods, special attention should be paid to assure that the communities involved receive benefits from participation and that any harm caused by the research to participants is avoided (cf. scoping consideration E on *social engagement*). A case specific 'code of research ethics' discussed with and accepted by the involved communities can avoid or mitigate these risks. Among the *practical considerations* of cultural and social valuation methods we should note that they require strong social scientific skills and the commitment of those doing the valuation to be open, reflexive and responsible for the communities involved. Methods differ in their resource intensity (information costs), some require long lasting field work (e.g. ethnographic methods), and some require strong computational skills and technology (e.g. geographic methods) (cf. scoping consideration G). Nevertheless, these difficulties are counterbalanced by the fact that cultural and social valuation methods engage people in the valuation process and thus lead to results which are more understandable and acceptable to them by reflecting the complexity of human perceptions (Oliveira and Berkes, 2014).

In the following we give a quick overview of diverse cultural and social methods which can be used to value nature and its benefits and contributions to quality of life. This non-exhaustive list of methods is presented in alphabetical order.

Ethnography is a process of observing and working towards understanding the world from the perspective of the people under consideration (Emerson et al., 2011). Ethnography as a method is defined by long-term living within a community, participant observation, daily note-taking, and the writing of a descriptive monograph. It is especially suited to grasping subjective values and meanings expressed through daily language, behaviour (including silence and absence), material culture, the arts and performance, the built environment, and cultural landscapes, among other forms. It is also well-suited to grasping differences in worldviews and how these lead to contradictions in values and conflicts among diverse social groups (Medin et al., 2006). Ethnography uses participation in the daily lives of people while observing and recording language, behaviours and settings, a process termed participant observation. Ethnography includes informal and formal interviews and surveys. Central to ethnography is the need to build rapport with one's research subjects; to extend trust toward them so that they will honestly share their experiences and perspectives with you (Bernard, 2000; Emerson et al., 2011).

Ethnoecological methods focus on understanding how people conceptualize, value, and use their local natural environments. Subfields include ethnobiology, ethnobotany, ethnoentomology and ethnozoology, among others. The focus of ethnoecology is typically "traditional ecological knowledge" (TEK), in which knowledge is defined broadly to mean the interdependency of worldview, knowledge, values, practices,

and institutions related to a particular social group's relationships with its local environments (Agrawal, 1995; Basso, 1996). Related subjects are "indigenous knowledge," "experiential knowledge," and "place-based knowledge," among others (Berkes, 1999; Nazarea, 1999). Methods used in ethnoecological research include participant observation as well as interviewing, cultural consensus analysis, cultural domain analysis, and social network analysis; methods drawn from cognitive anthropology such as freelisting, paired comparisons, rankings, pile sorting, and triad tests. Ethnoecological methods also include methods from ecology such as biological collections, landscape valuation, plots, transects and diversity indices, and other methods such as rapid rural appraisal, oral history, visual stimuli, participatory mapping, market surveys, and statistical analysis. Ethnoecological information is often private, political, sensitive, and vulnerable.

Geographic methods, in particular methods of cultural geography, identify and map values that are place-based, spatial or spatializable. Methods such as participatory geographical information systems (PGIS) and human ecology mapping engage local communities in the research process, and can capture locally variable, subjective, cultural and intangible values related to nature and its benefits. Surveys, interviews, focus groups, and participatory methods are used to elicit values. Mapping tools such as GIS, GPS, and remotely sensed imagery allow geographers to spatially overlay different types of information to better understand spatial relationships between values of nature and nature benefits and other socioeconomic, ecological, and biogeographic information. Results can be used in landscape and marine spatial planning, and in other valuation assessments, such as integrated modelling (cf. Section 3.3.2). In addition, geographers study the politics and cultural values inherent in the social production of space, place, scale, and maps (Lefebvre, 1992; Tsing, 2001), including counter-mapping: the creation of alternative maps to deliberately challenge conventionally mapped notions and claims that threaten local values (Peluso, 1993).

Historical methods reveal how and why values of nature and its benefits have formed and changed over time. In particular, the field of environmental history reveals dynamic interrelationships among cultural values, social circumstances, and ecological conditions (Cronon, 1990; White, 1990; Worster, 1990). The methods of environmental history include those of history in general, such as archival work, oral history, and the analysis of existing economic and social data, in addition to the methods of environmental science that enable insight into historical ecosystems. Environmental history can provide explanatory context for the results of the valuations and assessments of nature and its benefits.

Narrative valuation refers to descriptive methods which capture the importance of nature and its benefits to people, expressed via stories, influence diagrams and other visual and verbal summaries. Narrative methods can be used in parallel with quantitative methods. For instance, it is possible to use constructed scales in order to measure non-tangible aspects such as cultural heritage, and narrative descriptions can be incorporated as part of the analysis (Chan et al., 2012). Narrative valuation methods can draw on ethnographic methods to elicit the value information in different socio-cultural contexts (see above).

Preference assessment is a direct consultative method for analysing perceptions, knowledge and values associated with nature's benefits. It can be used either in individual settings to understand personal perceptions, or in group settings to elicit collectively shared values (Castro et al., 2013). In individual settings (i.e. interviews or surveys) respondents are asked to rank or rate (Martín-López et al., 2012) the benefits of nature according to their perceived importance, an approach closely related to economic stated preference methods (cf. Section 3.2.3). These exercises usually involve a qualitative phase which aims to understand the motivations behind individual choices, and are often supported by a visual aid or a context dependent example to ease the value elicitation phase. Individual values are aggregated by mathematical-statistical methods. If preference assessment is carried out in group setting, participants are invited to debate the collectively shared values of nature's benefits in small groups representing their community. Qualitative and quantitative information on the vulnerability and trends of nature's benefits as well as on the driving forces can be used as expert input to the discussions. Results of group discussions reflect collective choices instead of individual ones (hence no aggregation needed).

3.2.3. Economic methods

Economic valuation is founded in the theory of welfare economics. A defining principle is that the economic value is based on individual preferences, reflecting their individual needs, perceptions and *worldviews* (cf. scoping consideration A), as well as on the scarcities imposed by nature. The *focus of value* (cf. scoping consideration B) is typically on nature's benefits to people or how nature contributes to a good

quality of life. An exclusive use of standard economic approaches is incompatible with some worldviews of foci of value. For example, Living-Well balance and harmony with Mother Earth sees Mother Earth as a sacred and a living being that cannot be commodified.

Economic valuation is restricted to anthropocentric *types of values* (cf. scoping consideration C). The Total Economic Value (TEV) Framework conceptualizes economic values as either "use values" or "non-use values". In that framework, use values consist of direct consumptive (e.g. food), direct non-consumptive (e.g. recreation), and indirect (e.g. pollination) uses. Non-use values consist of bequest (for future generations), altruist (for other people), and existence (satisfaction of knowing something exists) values (Pascual et al., 2010). Bequest values reflect concerns for intergenerational distribution and sustainability (Pearce, 1990, 1993; Baumgärtner and Quaas, 2010). Uncertainty and biodiversity's resiliency role give rise to insurance values (Armsworth and Roughgarden, 2003; Quaas and Baumgärtner, 2008; Di Falco and Chavas, 2009; Baumgartner and Strunz, 2014). In a situation of uncertainty, an option value arises when some decisions have irreversible consequences: this is the value of postponing the irreversible decision to be able to take the new information into account (Dixit and Pindyck, 1994). Often, but not necessarily, economic values are expressed using monetary units of measurement.

Economic methods span a wide range of *scales* (cf. scoping consideration D) in space and social organization, both with respect to the valuation itself and the values that are expressed. Non-market-based valuation starts at the individual or household level. Market-based valuation in open economies goes up to the global scale, as prices are determined on world markets. With respect to temporal scales, economic valuation often focuses on the planning horizon of the individuals included in the valuation study. These planning horizons differ with the particular value considered, but most often they span a few years up to a few decades. Depending on data availability, market-based valuation techniques may additionally make use of historical information going back up to centuries in the past.

The degree of active participation of stakeholders differs widely across economic methods (cf. scoping consideration E, *social engagement*). Most economic methods derive aggregate, social values from individual preferences. This aggregation reflects the *broader social context* (cf. scoping consideration F) and deserves particular attention, as it determines the outcome of economic valuation to a large extent. In particular the aggregate outcome of monetary valuation depends on the distribution of incomes and wealth both within and across generations. More generally, aggregation reflects assumptions concerning distributive justice, which is a relational value, and there is no unique consistent way for such an aggregation (Arrow, 1951; Roemer, 1996). Aggregation faces issues of (in)commensurability of values that arises because of different individual interests and because of complexity that entails a plurality of legitimate perspectives and values.

Established empirical economic valuation techniques are well-documented in Environmental Economics textbooks (Pearce, 1993; Perman et al., 1996; Freeman, 2003). They are appropriate for the valuation of small projects that are not expected to have a wider effect on the economic and institutional context, or for accounting purposes. Generally, these methods can be divided into two main categories: market-oriented and non-market-oriented valuation techniques.

Market-oriented valuation techniques rely on market prices that capture values at the point of exchange and are useful for quantifying factor incomes, damage costs and replacement costs. They are dependent on the current distribution of income. Prices can also be used in a production function approach to assess an indirect value of nature for producing goods and services that have market value.

Non-market-oriented valuation techniques can be applied to value ecosystem services that are not traded on markets. They can be classified into revealed preference or stated preference methods. Revealed preference methods are based on observed consumer behaviour and identify the ways in which a non-marketed good influences the actual market for some other good. Preferences and values are 'revealed' by actual behaviour in related markets. Revealed preference methods include hedonic pricing and travel cost methods. Stated preference methods make use of surveys, in particular using contingent valuation or choice experiments, to ask people to state their preferences for hypothetical changes in the provision of environmental goods or services. This information is then used to statistically estimate the values that people attach to the environmental goods and services in question. *Participatory Economic Valuation* techniques basically reflect people's/stakeholders perceptions about resources and are used when markets for resources are either thin, weak, distorted or completely absent.

From an instrumental viewpoint, the value of an ecosystem should also account for the system's capacity to maintain ecosystem service values in the face of variability and disturbance. This is the so-called *insurance value* and it is closely related to the ecosystem's resilience and self-organizing capacity (Pascual et al., 2010; see also Section 3.2.1). In this case, the distance to a given ecological threshold affects the insurance value (Walker et al., 2010). While valuation exercises cannot be carried out reliably without accounting for this distance, if the system is close to a threshold, valuation may be impossible because of the non-linear consequences of a regime shift effect. In this case economic valuations under such circumstances are often unreliable (Pascual et al., 2010). As ecosystems are about to reach thresholds the underlying marginalist assumption that underlies most economic valuation methods no longer holds. In this case it may be possible to develop early warning indicators to anticipate proximity to tipping points.

Extending the temporal frame in which values are considered allows for the possibility of valuing the option of the future use of a given ecosystem. This is often referred to as option value (Fisher and Krutilla, 1975). In economic terms, option value can also be understood as a way of framing the total economic value of the flow of services under conditions of uncertainty, that is, as the value of waiting for the resolution of uncertainty (Traeger, 2014). An example to illustrate uncertainties surrounding the potential future uses and related option value of ecosystems is given by bioprospecting activities to discover potential medicinal uses of plants (Pascual et al., 2010; Simpson et al., 1996).

Valuing natural capital and dynamic modelling is the dominant approach in climate economics, and employed in particular in the integrated assessment models of climate and the economy (Nordhaus, 1993; Stern, 2006; Llavador et al., 2011), but to an increasing extent also for valuing natural capital (Baum, 1995; Quaas et al., 2012; Fenichel and Abbott, 2014). This approach relies on three fundamentals: (i) an objective function capturing how the use of economic and natural goods and services contributes to individual welfare, and how welfare should be aggregated across individuals, time and uncertainty; (ii) a model of the natural and economic dynamics; and (iii) the resource allocation mechanism (Arrow et al., 2003). Theoretically, this approach allows deriving shadow prices for all ecosystem goods and services included in the analysis, whether they are of direct or only of indirect benefit for humans. Double counting of values cannot occur, as the 'total economic value' is derived (rather than postulated) in this approach. In particular, dynamic models take the interests of future generations explicitly into account, and stochastic models are capable of deriving option and insurance values.

Discounting is the economics approach to make values arising at different points in times comparable. In general, if there are n goods or services valued in the analysis, at two different points in time, there are n^2 discount rates. Some of these discount rates can be positive, some negative in which case "discounting" indicates that future benefits are more valuable than present ones (Gollier, 2010).

3.2.4. Health Assessment Methods

Health assessment comprises methods valuing the effects of ecosystem services on human health. Different domains of health and of biodiversity–human health linkages to be considered in this regard comprise nutrition, infectious disease, non-communicable disease and mental health (World Health Organization and Secretariat of the Convention on Biological Diversity, 2015; Wittmer et al., 2012; Myers et al., 2013). Depending on what type of health domain is relevant for the purpose of valuation, a suite of tools and methods from diverse disciplinary backgrounds can be utilized.

Health valuation methods are particularly suitable to assess how changes in nature affect nature's benefits to peoples' quality of life (cf. scoping consideration B, *focus of value*). These health metrics are at the core of human well-being and are generally considered to be a universal human right. Nearly all health values are *anthropocentric* by nature. Although there have been efforts to translate health research and practice into systems usable and understandable by indigenous people (Durie, 2004), much of health valuation centres on a Western approach and *worldview*. Roughly we can distinguish expert-centred and person-centred approaches to quality of life (Parmesan et al., 2009). One example of an expert-centred approach is the disability-adjusted life year approach (DALY) in which experts assess health impacts. Nevertheless quite some quality of life and health aspects are subjective and in demand of a person-centred approach. An example is the World Health Organization Quality of Life assessment (World Health Organization, 2004), a questionnaire in which a diversity of quality of life aspects is addressed. Participatory approaches and social engagement are nearly always integrated into health methods because this field was designed to serve the public interest. And, broader social contexts and issues of scale are nearly always included, specifically relevant to methodological approaches developed by social epidemiologists.

Many health assessments incorporate epidemiological methods which focus on patterns and determinants of disease. Epidemiological methods typically use one or more of the following five study designs, which are listed in order of increasing rigor (Rothman et al., 2008): (i) Ecologic studies measure the exposure and outcome at the *group* level (Morgenstern, 1995). (ii) Cross-sectional studies measure the exposure and outcome at *one time* point at the *individual* level (Zocchetti et al., 1997; Rothman et al., 2008). Such studies yield measures of prevalence of disease. (iii) Case-control studies identify individuals with a given health or disease state (cases) and analyse select (risk) factors contributing to that state through comparison with "control" populations, as similar as possible to the cases except for the select factors of interest (Greenland, 2004). Such studies yield measures of the odds of the disease/health state of interest given exposure or not to - or possession of - the select factors. (iv) Cohort studies identify individuals who are exposed or not exposed to select factors/interventions and follow them over time. Follow-up post-exposure can be done prospectively or retrospectively. Such studies measure the incidence of disease/health to better understand factors that drive illness or maintenance of health. (v) A *randomized control trial* (RCT) is an *intervention* trial where the exposure is *randomly* assigned (Rothman et al., 2008). RCTs are sometimes thought of as the only way to determine true causal inference.

Epidemiology comprises branches that focus on different aspects of the health/disease spectrum. For example, social epidemiology focuses on the social distribution and determinants of health and explores how social issues/structures in society influence the distribution of health and disease. Social epidemiology may be a particularly useful lens for those interested in the effects of gender, social organization, economics, politics etc. on health (Berkman and Kawachi, 2000). Nutritional epidemiology, as another example, is the study of the ways in which dietary intake and nutrition predispose individuals and populations to a given disease or health state (Willett, 2013).

Environmental health - a discipline within health - provides a framework for understanding the relationship between the environment, including ecosystem services, and human health (Moeller, 2011). Risk assessments and dose-response relationships relating environmental change to human health outcomes are standard methods applied in the field of environmental health. However, ethnographic and other social science methods (cf. Section 3.2.2) can both also produce measures of environmental health outcomes and add insights to help interpret quantitative results (Baum, 1995; Moeller, 2011; Alcaraz-Segura et al., 2013). Integrated environmental health impact assessment offers yet an even more encompassing methodological framework in which also stakeholder involvement has an important role (Briggs, 2008).

Psychological measurement methods can be used to assess the effects of ecosystem services, and change in those services, on people's psychological or "mental" health (Cohen et al., 1996). With the burgeoning interest in biophilia (Wilson, 1984), and nature deficit disorder (Louv, 2008), psychological measurement methods are likely to become increasingly important.

The most useful tool for reporting on values and informing the decision-making process would be a Health Impact Assessment (HIA) of a particular environmental policy or change. These tools are still in need for better connection to Environmental Impact Assessments and can provide a relevant structure to understand how quality of life changes as a result of environmental decision making. HIA is not necessarily only an expert-centred or scientific approach, but can encompass procedures including elicitation of experts from diverse backgrounds and disciplines as well as stakeholders (Quigley et al., 2006).

3.2.5 Holistic, Indigenous, and Local Knowledge-Based methods

Holistic, indigenous, and local knowledge-based methods aim to capture holistic values about peoples and nature whilst internalizing principles and ethical values about Mother Earth and 'Living-well' of indigenous and local knowledge systems. Holistic, indigenous, and local knowledge methods can be applied with indigenous ancestral territories and local communities, and in broader governance scenarios (national and subnational) where rights of indigenous peoples and local communities and the principles or rights of Mother Earth are fully recognized in legal frameworks.

Indigenous and local knowledge approaches to valuation are more likely to characterize and evaluate ecosystem benefits as gifts of Mother Earth subject to cultural norms and beliefs and inter-generational responsibilities, particularly for communities living within their ancestral territories. These approaches assume there are unique characteristics of indigenous and local communities' interactions with nature that require specific understanding attuned to their worldviews and realities. The non-separation between nature and culture that is often but not exclusively true for indigenous peoples makes valuation for indigenous peoples a unique process, in which economic, social, cultural, spiritual, historical, and ecological aspects

are interdependent parts of holistic systems of life (Illescas, 2006; Medina, 2014). Indigenous perspectives on values are affected by profound linkages between people and between people and nature and intrinsically linked with cultural beliefs, customary and traditional obligations to family and country (Baker et al., 2001; Ens et al., 2012), with different challenges on finding appropriate engagement processes and recognizing cultural and traditional knowledge and governance systems (Liddle and Young, 2001; Hankins and J. Ross, 2008; Simonds and Christopher, 2013). Valuation in this context is place-based and may not be suitable to generalize to other scales in space or social organisation. Local and indigenous language terms can be used to design the relevant local and indigenous knowledge concepts that valuations should follow (such as reciprocity, cultural aspirations, positive benefit to communities, fostering enduring relationships) as well as to measure how spiritual and cultural connections are expressed at individual and collective levels.

In this context, the use of indigenous approaches in research has to consider indigenous peoples' self-determined research development and delivery of valuation (Geia et al., 2013), enabling indigenous people to give voice to their understandings using their own styles and formats, such as yarning (Nursey-Bray et al., 2009; Fredericks et al., 2011; Geia et al., 2013). Also, the approach of valuing practice and ethics allow for better understanding of holistic value systems integrating ecosystem functions and symbolic and spiritual values (Naredo and Manuel, 2000; Jackson and Palmer, 2015).

Examples of indigenous valuation models include the Cultural Health Index (CHI), Māori Wetland Indicators and the Mauri Assessment model from New Zealand, the "Indicators for Living Well" in Bolivia, the "Plans of Life" model from the Amazon region and the Coast Salish Indigenous Health Indicators from the US and Canada.

Holistic valuation of systems of life of Mother Earth aims to value the relationships and dynamics, either positive or negative, established among peoples and nature regarding the regeneration or reproduction of the systems of life of Mother Earth for Living-well. Holistic valuation follows a rights-based approach, taking into account that Living-well in balance and harmony with Mother Earth (relational and cosmocentric values) is based on the complementarity of the rights of Mother Earth (intrinsic values) and the rights of peoples to their holistic development and eradication of poverty (instrumental values) (Bolivia, 2010, 2012; Pacheco, 2014b). This method will be more accurately applied when rights of indigenous peoples and local communities and principles or rights of Mother Earth have been included in the national legislation or public policy frameworks. In this regard, the holistic valuation of systems of life can be developed at different levels (national, subnational, and local) assessing to what extent there is in a given jurisdiction a positive relationship and interactions between the conservation of environmental functions, development of sustainable production systems, and peoples' access to basic needs and services for poverty eradication, inherently entwined as systems of life in Mother Earth. This approach is developed using participatory planning and intercultural dialogue techniques, among others, in the context of deliberative multi-actor processes that help to evaluate the extent to which there are systems of life settled in practice in a given jurisdictional territory.

3.3. Methods of integrating, bridging and upscaling valuation results

For assessments drawing on multiple valuation studies, but also original valuation studies using different types of methods, some element of synthesis for the different value types may be desirable. No matter what approach of synthesis, integration, or bridging is chosen, it will always include some element of valuation itself, either by an implicit weighting of valuation studies, or explicitly by applying a particular method. In this section we present and discuss different methodical approaches: Narratives in Section 3.3.1; Deliberation in Section 3.3.2; Integrated Modelling in Section 3.3.3; and Multicriteria Analysis in Section 3.3.4. Moreover, assessments in most cases face the difficulty that no valuation studies exist for some types of foci of value, or at some relevant scales. In such cases, methods of up-scaling are needed, which we also review in Section 3.5.

3.3.1 Narratives

Narratives are one of the practically most important ways of synthesizing different and incommensurable values. Narratives always contain qualitative elements, but they may include quantitative references both in verbal or graphical presentations, as well as visual and artistic illustrations. Narrative approaches to bridging and integrating valuation results allow for representing diverse *worldviews* and *value types*, and can be applied to various *foci of valuation* (Satterfield, 2001). They are suitable to bring together valuation

results from different geographical and social organization *scales*, although 'upscaling' is often based on logical argumentation instead of calculation. Different time scales can also be represented by narrative approaches, especially by scenario storylines that describe and compare plausible future alternatives (cf. the IPBES assessment on scenarios and modelling).

Narratives often prove to be powerful communication tools that integrate scientific and expert knowledge as well as ILK and tacit knowledge forms in sometimes novel ways (see e.g. artistic representations below). This makes the results of the assessment more accessible for decision makers, experts and the general public (including marginalized social groups), and help them consider and apply relevant value information in complex policy decisions (Gregory et al., 2000). There is substantial methodological diversity within the field of narrative approaches. Basic textual, descriptive narratives can be developed further by broadening the social engagement throughout the assessment process to at least three main directions: (1) narratives to account for changing time scales (scenario storylines), (2) narratives to support the creative (re)organization of available data and knowledge (concept maps), and (3) narratives to communicate through the universal language of arts.

Scenario storylines are "internally consistent narratives deliberately crafted to describe multiple plausible futures" (Johnson et al., 2012). Scenarios can be developed by the help of expert input or wider public participation, and can take various shapes ranging from qualitative narratives to quantitative modelling exercises. Scenarios are suitable to take into account uncertainty and complexity inherent to many decision situations, especially if a larger time horizon is involved in the decision (Peterson et al., 2003).

Concept mapping and mental mapping are visual tools to support creative thinking and organization of available data and knowledge. They can be used to assess past and current research and to identify knowledge and information gaps with the help of experts or stakeholders. Concept maps (and mental maps) are usually developed in a qualitative way, but they can also be combined with modelling (e.g. Fuzzy Cognitive Mapping; Kontogianni et al., 2012). Since these tools were originally developed for educational purposes (Novak, 1990), they are suitable to foster knowledge sharing, learning and communication to different audiences. Potential domains of application range from original valuation studies (Soini, 2001; Kelemen et al., 2013) to assessments (Yee et al., 2011 present two examples from the US). Trade-offs between different types of quantitative values may be presented by graphs showing *efficiency frontiers* (Lester et al., 2013; Cavender-Bares et al., 2015).

Artistic representations, such as forum theatres (Guhrs et al., 2006) or the photo-voice method (Berbés-Blázquez, 2012), are communication tools that help integrate ILK and scientific knowledge and interpret the results in an open and accessible way. Their strength lies in their participatory approach, namely that they involve various audiences (including the general public and marginalized social groups) in the interpretation and the rethinking of research findings. They represent a possible way of triangulating scientific findings from non-scientific points of view (Bennett and Dearden, 2013). Furthermore, by giving voice to usually unheard social groups, these approaches contribute to the democratization of knowledge and are able to catalyse community self-organization. Thus, from a theoretical point of view, these methods are strongly linked to deliberative valuation.

3.3.2. Deliberation

Deliberative valuation is based on the assumption that valuation is a social process in which values are discovered, constructed and reflected in a dialogue with others. Therefore, deliberative valuation invites stakeholders and citizens (the general public) to form their preferences for ecosystem services together through an open dialogue, which allows consideration of ethical beliefs, moral commitments and social norms beyond individual and collective utility. Deliberation is considered to be an integrating and bridging approach to valuation for two reasons: (i) A deliberative approach can be applied to various valuation methods ranging from monetary techniques through cultural and social methods to health assessment. Deliberation as a process can enhance the application of single valuation methods by broadening the worldviews and the types of values included, and explicitly targeting social engagement and empowerment. (ii) Various deliberative techniques have been explored and are used to make publicly accepted and legitimate decisions that influence human-nature relationships. These techniques such as citizens juries and consensus conferences (Smith, 2003) create forums for open discussion and debate on different worldviews, values and interests to reach conclusions, which reflect the heterogeneity of standpoints.

Deliberative valuation can accommodate diverse ***worldviews*** and offers a possible solution to increase understanding between them (cf. scoping consideration A). Deliberative valuation is particularly suited for

understanding the meanings that people attribute to nature and nature's benefits to people, such as holistic concepts of the land, and it can accommodate diverse forms of information such as narratives and story-telling. Therefore, deliberative valuation is found helpful both in indigenous (e.g. Kenter et al., 2011; Chan et al., 2012) as well as non-indigenous societies contexts (e.g. Kelemen et al., 2013).

In a deliberative process, choosing the *focus of values* can be a subject of discussion. Therefore, values can also be investigated in a holistic way by focusing on the complex interrelations between people and nature (O'Hara, 1996), instead of separating the values of nature, nature's benefits to people and good quality of life. The aim of deliberative valuation is to help people clarify and articulate the diversity of *value types* including both anthropocentric and non-anthropocentric values (Wilson and Howarth, 2002; Spash, 2007) as well as values which are expressions of personal utility or motivated by moral and ethical considerations (Wegner and Pascual, 2011). Deliberative valuation accepts that values are plural and often incommensurable. The result of valuation is either consensus if values converge during the discussions (Wilson and Howarth, 2002) or the clear and equal representation of conflicting values reflecting their incommensurability (Goodman et al., 1999) (cf. scoping considerations B and C).

Deliberative approaches are usually applied to local level questions (Soma and Vatn, 2010), but they can also be used to address policy level problems (Stagl, 2006). From a temporal perspective, deliberative valuation can capture the interests of future generations in addition to the interests of present generations. From the aspect of social organization, deliberation invites participants to express principled views of the public interest or purpose as citizens, or members of the society, not private preferences about their own consumption opportunities as consumers (Sagoff, 1988) (cf. scoping consideration D on *scales*).

In deliberative valuation, participants are actively engaged in framing the valuation processes, carrying it out and communicating the results to wider audiences (cf. scoping consideration E on *social engagement*). A close interaction between the participants such as local community members and/or stakeholder representatives as well as scientists and local knowledge holders can lead to greater awareness of the consequences of human actions for the environment (Kenter et al., 2011). The ownership of the process can foster participants' commitment to the outcomes which reflect their own problem framings. However, participatory and deliberative processes can also be used strategically to legitimate decisions (see e.g. Smith, 2003). Deliberative processes, which are based on small-group interaction, cannot capture the views of a general audience and hence may need to be supplemented by survey or interview methods (see e.g. Hanley, 2001). Open discourse, generated by deliberative techniques, is able to expose relational values and reflect upon the *broader social context* of valuation. This can only be achieved if the process is inclusive, transparent, and gives equal voice to participants, which may require their empowerment as a preceding step (cf. scoping consideration F).

Deliberation is time and resource intensive, because social actors have to be engaged and involved at each step of the process often in large numbers, and transparency has to be provided through continuous dialogue along the science-society-policy interface. It is essential to have professional expertise in organizing and facilitating group processes (cf. scoping consideration G on *practical considerations*). Failures of deliberation are often caused by lack of time, weak preparatory phase (e.g. lack of empowerment of the marginalized ones), weak commitment of policy/decision makers and problems of representation (insufficient, illegitimate or unequal representation) (Spash, 2007; Vatn, 2009).

3.3.3. Integrated modelling

Integrated modelling reflects a scientific *worldview* (A). State-of-the-art integrated models are set up in multidisciplinary or interdisciplinary efforts (Baumgartner et al., 2008; Schlüter et al., 2012; Pandit et al., 2014; Perino et al., 2014; Sen et al., 2014; Thébaud et al., 2014). Accordingly, the *focus of value* (B) differs across modelling approaches. Integrated modelling studies for valuing biodiversity and ecosystem services simulate changes in biophysical aspects of ecosystems, followed by the application of one or more of the valuation techniques described above (e.g., biophysical or economic). Integrated modelling as an overall approach thus can deal with different *types of value* (C). A challenge for integrated analyses of socioeconomic systems is keeping coherence in their multidimensional representation (Giampietro and Mayumi, 2000).

A major advantage of integrated models is that they can cope with different *scales* (D). The ecosystem services oriented integrated modelling approaches range from non-spatial to spatially explicit and from static to dynamic incarnations. Models can take spatial heterogeneity in both biophysical (e.g. the relative

position of forests in a watershed) and socioeconomic (the spatial distribution of groups of stakeholders) variables into account (Hein et al., 2006; Voss et al., 2014b; Voss et al., 2014a).

The purpose is most often decision support, with different degrees of *social engagement* (E). Some models are built *for* stakeholders, while others are co-developed *with* stakeholders (see also Section 3.4.4). Integrated models make use of historic data or looser forms of knowledge embodied in stakeholder representation. Values, valuation and changes thereof can be represented through simulation of scenarios. This makes integrated modelling capable of exploring the relevance of changes in the *broader social context* (F) in all dimensions explained in Section 3.1.

Examples of integrated models include InVEST (Natural Capital Project, www.naturalcapitalproject.org), Marxan (www.uq.edu.au/marxan/), ARIES (Artificial Intelligence for Ecosystem Services, http://www.ariesonline.org/), and MIMES (Multi-scale Integrated Modeling for Ecosystem Services, www.ebmtools.org). Large scale projects that have applied them include TEEB (2010) and UK NEA (UK National Ecosystem Assessment, 2011; Bateman et al., 2013).

3.3.4. Multi-criteria Analysis

Multicriteria analysis (MCA), sometimes called multi-criteria decision analysis (MCDA), is a general framework for supporting complex decision-making situations with multiple and often conflicting objectives that stakeholders groups and/or decision-makers value differently (Belton and Stewart, 2002). The basic idea of MCA is to evaluate the performance of alternative courses of action (e.g. management or policy options) with respect to criteria that capture the key dimensions of the decision-making problem, and elicit stakeholder and/or decision-maker preferences for option performance under each criterion. MCA is a decision support tool (see Section 3.4) but it can also be used as a value elicitation method to cover a broad range of values, including ecological and economic values as well as cultural and heritage values. Therefore several authors have seen it as a promising alternative to economic valuation in a CBA framework (Vatn, 2009; Wegner and Pascual, 2011; Chan et al., 2012).

MCDA is typically used in participatory processes to facilitate dialogue between experts, stakeholders and/or decision-makers and therefore it can be combined with deliberative valuation to articulate shared, or citizen values, having the form "We ought to" as opposed to individual, or consumer, values ("I want") (Sagoff, 1998). MCA methods are also suited for illustrating distributional impacts but not all of them can address incommensurable criteria such as rights and duties (Wenstøp, 2005). However, some approaches such as social MCA can better accommodate incommensurable criteria that are difficult to trade-off against each other (Munda, 2004, 2008).

MCA methods facilitate value integration by combining and structuring diverse information, including multiple criteria, different types of data, and diversity of actor perspectives and value judgements (Vatn, 2009). Biophysical and ecological valuation methods can feed into MCA by providing information about ecological impacts of alternative courses of action. MCA can also accommodate economic value information such as cost and economic impacts of alternative courses of action as well as socio-cultural value information. Finally, it can incorporate local and indigenous knowledge and narrative information by allowing both for quantitative and qualitative information (scales can be used to translate qualitative information into quantitative scores).

MCDA methods differ in the extent to which they need detailed and extensive data, how they mathematically deal with diversity of information and the extent to which they accommodate or, are flexible for, fitting a specific decision-making context. MCDA does not produce final, 'optimal' clear cut outcomes, but rather is a decision-support and sounding board tool. It should be understood as a package of several capacities which are of value to IPBES valuation: elicitation of information relevant for decision making (such as a diversity of values), support of a combination of analytical and deliberative activities in the whole process, and integration and structuring of all information in a decision supportive procedure.

The main output of MCA process is a preference ordering of alternatives according to different value positions and worldviews. A pluralistic approach to MCA is not to aggregate the results but to group them according to a similar set of values (Spangenberg, 2001; Saarikoski et al., 2013) to facilitate transparent decision making and open societal deliberation about the different viewpoints pertaining to the problem situation (Stirling, 2006; Keune and Dendoncker, 2014).

3.3.5. Upscaling values

A core issue for assessments is the upscaling of values to larger scales in space, time, and social organisation. The value of ecosystem services over an entire region or biome cannot be found simply by adding up estimated values from smaller ecosystem sites as this would also require taking account of the non-constancy of marginal values. One technique for upscaling economic values is benefit transfer (BT). More specifically, BT is the procedure of estimating the economic value of an ecosystem service by transferring an existing valuation estimate from a similar ecosystem. The ecosystem to which values are transferred is termed the "policy site" and the ecosystem from which the value estimate is borrowed is termed the "study site". BT methods can be divided into four categories: i) unit BT, ii) adjusted unit BT, iii) value function transfer, and iv) meta-analytic function transfer.

Unit BT involves estimating the value of an ecosystem service at a policy site by multiplying a mean unit value estimated at a study site by the quantity of that ecosystem service at the policy site. Unit values are typically expressed as values per individual or as values per unit of area. In the former case, aggregation of values is over the relevant population that hold values for the ecosystem in question. In the latter case, aggregation of values is over the area of the ecosystem. Adjusted unit transfer involves making simple adjustments to the transferred unit values to reflect differences in site characteristics such as differences in income between study and policy sites and for differences in price levels over time or between sites. Demand function transfer methods use functions estimated through other demand-based economic valuation applications (travel cost, hedonic pricing, contingent valuation, or choice modelling) for a study site together with information on parameter values for the policy site to transfer values. Parameter values of the policy site are plugged into the value function to calculate a transferred value that better reflects the characteristics of the policy site. Lastly, meta-analytic function transfer uses a value function estimated from multiple study results together with information on parameter values for the policy site to estimate values. This allows the value function to include greater variation in both site characteristics (e.g. socio-economic and physical attributes) and study characteristics (e.g. valuation method). The complexity of the BT method does not necessarily imply lower transfer errors.

There are also methods to upscale values using approaches outside economics. For example, ethnographic approaches when undertaken in a robust way may provide understanding at a community and culture scale. As well, social survey methods using statistically representative sampling can enable upscaling results from a sample to a population, even for data on social values, preferences, and priorities in narrative terms provided that a sample is sufficiently large and results are of good quality.

In the context of multiple types of value, if we are applying upscaling to larger geographical scales, this is often interrelated with values expressed at different scales of social organization (scales of social organization and spatial scales interfere with each other).

3.4. Examples of applications

In this section, we briefly present eight examples of applications for valuation, namely: cost-benefit analysis (Section 3.4.1), cost-effectiveness analysis (Section 3.4.2), multi-criteria analysis (Section 3.4.3), participatory modelling (3.4.4), impact assessment (3.4.5), national accounting (3.4.6) business accounting (3.4.7) and reporting (3.4.8).

3.4.1. Cost-benefit analysis

Cost Benefit Analysis (CBA) is used to establish an economic ranking of ‘projects’ from the point of view of society or a specific stakeholder (a comprehensive guide to CBA may be found in Hanley and Barbier, 2009). A CBA firstly describes the physical changes of implementing the considered project over space and time. Secondly, changes in both market and non-market values are quantified for all effects of the project, including those on ecosystems. According to standard cost-benefit analysis a project should be undertaken if the expected present value of aggregate benefits exceeds the expected present value of aggregate cost, and if no other feasible project exists which has larger expected net (= benefits net of costs) present value. When aggregating over time, discounting of benefits and costs may be a crucial element (see Section 3.2.3). In a situation where the project leads to irreversible consequences, considerations of option values may significantly change the ranking of projects (Dixit and Pindyck, 1994). If the net benefits of a project passing the cost-benefit criterion cannot be distributed among the affected individuals, the consequences to the interpersonal distribution of income due to the project implementation need to be quantified as an indicator of the social impact of the project. The question of who wins and who loses may play a crucial

role if distributional impacts matter for policy making. While the number of studies applying CBA for the conservation of biodiversity is limited, there is a vast literature in natural resource economics using this framework to determine the optimal use of natural resources (Wilen, 2000). In business, CBA is used in many contexts to assess the best options for reducing environmental, health and social impacts while ensuring a minimum (or maximum) return on investment (Houdet et al., 2012). Business-focused guidelines include the Corporate Ecosystem Valuation (WBCSD 2012) and the Natural Capital Protocol (Natural Capital Coalition 2014).

3.4.2. Cost-effectiveness analysis

In situations where the benefits of a project cannot be expressed in monetary terms, and thus not be weighed against its cost, cost-effectiveness analysis is a means of ranking projects. It can also be useful when comparing cost scenarios to implement policies or reaching specific compliance targets or legal requirements. The "cost-effective" among alternative projects is the one that achieves a given social, environmental or conservation objective at the least cost. If different projects lead to different degrees of achievement of the conservation or policy objective, the cost-effectiveness ratio (effect per unit of cost) may be used to rank the projects. Cost-effectiveness approaches are prominent in the literature on conservation economics (e.g. Drechsler et al., 2007; Kronbak and Vestergaard, 2013; Finseth and Conrad, 2014). A central limitation to cost-effectiveness analysis is that it can be used in a rigorous way only if the ecological effect of different projects can be determined by a one-dimensional measure. If the effect changes over time, or if it is uncertain, measures of the effect inherently need to deal with the problem of how to capture social risk and time preferences.

3.4.3. Multi-criteria analysis

Besides being a method for integrating different types of value (see Section 3.3.4), MCA can be used as a policy support tool to structure complex decision-making challenges. It is an umbrella term to "describe a collection of formal approaches which seek to take explicit account of multiple criteria in helping individuals or groups explore decisions that matter" (Belton and Stewart, 2002, p. 2). MCA methods can combine ecological, economic and social information, objectives, or value domains, in a shared framework and thereby illustrate the trade-offs between competing goals. MCA does not seek to provide decision-makers with a single optimal or efficient solution; instead, it aims at facilitating open societal debate about the consequences of alternative courses of action (Stirling, 2006), including actions affecting biodiversity and ecosystem services, and the ways in which decision-makers, stakeholders and/or citizens prioritize ecological, economic and social goals in each particular decision-making situation. MCA methods are applied widely to environmental management, mostly at local or regional scale, sometimes also on national policy-making scale (Stagl, 2006).

3.4.4. Participatory modelling

Participatory models are deliberation-, interpretation- and synthesis aids in policy support. Modelling can be done with or for stakeholders. Modelling assists in detecting, discussing and learning about facets of complexity across the social, economic and ecological domains. Scientific data and non-scientific knowledge can be combined in an iterative deliberation process. Examples of applications include flood risk in Tisa River Basin, Ukraine (Haase, 2013), climate change and water resource planning in Okanagan Basin, Canada (Langsdale et al., 2013), river management in Upper Mississippi, USA (Metcalf et al., 2010), integrated catchment management and coastal zone management (van den Belt, 2004).

Participatory modelling and participatory scenarios can be vital to bringing ILK into IPBES assessments, as they may facilitate knowledge co-production (Maclean and Cullen, 2009; Robinson et al., 2015; Wyborn, 2015).

3.4.5. Impact assessment

A diversity of relatively well established impact assessment methods can be considered helpful for incorporating and combining diverse values and value perspectives related to biodiversity and ecosystem services. These methods offer the potential of bridging value-relevant fields of expertise and practice from an integrated assessment perspective: they have integrating capacities. A recent example is the connection of the concept of ecosystem services to environmental impact assessment (EIA) and strategic environmental assessment (SEA) (Slootweg, 2010; Geneletti 2013; Landsberg et al., 2013). EIA encompasses a "process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments

made" (IAIA 1999). Currently health is only limitedly taken into account in SEA (e.g. in Scotland, Douglas et al., 2011), but some efforts are being made to develop an Integrated Environmental Health Impact Assessment (IEHIA) (Briggs, 2008; http://www.integrated-assessment.eu/).

3.4.6. National accounting

The System of National Accounts (SNA) is the internationally agreed standard set of recommendations on how to compile measures of economic activity of a country. Well-known weaknesses of the SNA include that it does not include many dimensions of natural capital and ecosystem services, only human made capital. For instance, it excludes the wild fish stocks and forests that supply a stream of benefits (provisioning services) to the formal economy. In addition, the costs of pollution and quality deterioration of ecosystems (including regulating and many cultural services) are also not included, while clean-up costs and other defensive measures are included as income and production in the accounts. As a response, various initiatives to address the situation are being undertaken. The UN System of Environmental-Economic Accounting (SEEA) provides a systematic conceptual framework to collect information on the state of natural capital. Its Central Framework (SEEA-CF) sets out an approach for environmental resource accounts to measure the stock and flows of abiotic resources and some biotic resources. The experimental ecosystem account handbook (SEEA-EEA) provides methodological guidance for the measurement of ecosystem assets and services. Other global initiatives also provide methodological guidance and support pilot projects in the area of national natural capital accounting and valuation of ecosystem services: e.g. European Environment Agency's Land and Ecosystem Accounting (LEAC), the World Bank's 'Wealth Accounting and the Valuation of Ecosystem Services' (WAVES) project, and the Convention on Biological Diversity's 'Quick Start Package' on 'Ecosystem Natural Capital Accounts' (ENCA).

3.4.7. Business accounting and reporting

Biodiversity and ecosystem services values can potentially be used in different business accounting applications, using a combination of qualitative, biophysical, economic and / or financial values. The choice of value(s) depends mainly on whether the company needs to satisfy internal (e.g. shareholders, management) or external (e.g. NGOs, regulators, debtors) stakeholder needs. On the one hand, internal purposes include budgeting and cost-control activities in which businesses are interested mainly to maximise revenues and minimise costs. In that context, environmental management accounting (EMA) is the primary tool used by companies. EMA involves the identification, collection, analysis, use and coupling of two types of information (Jasch, 2001; Schaltegger, 2010; UNDSD, 2001), namely (i) monetary information on environmental-related internal / external costs and benefits; and (ii) biophysical information on the use, flows and destinies of energy, water, materials and (potentially) ecosystem services (see Houdet et al., 2009). On the other hand, biodiversity and ecosystem services values may be used in various business accounting approaches targeting external stakeholders (Houdet et al., 2014), namely financial, sustainability (e.g. GRI G4, 2014; Gilbert et al., 2011) and integrated reporting. While financial reporting deals mainly with financial performance (e.g. compensation expenses or liabilities for damages to ecosystem stocks and services), sustainability and integrated reporting may include information on how companies use and impact biodiversity and ecosystem services (e.g. volumes or quantities of ecosystem services used, impact on habitats and species). The disclosure of environmental and social externalities is also gaining ground in that context (e.g. Danish Environmental Protection Agency 2014; Huizing and Dekker, 1992; Kering 2015).

3.4.8. Systems of life

A practical example of a holistic-based valuation using the "Systems of Life" approach is developed in Bolivia. The System of Life of Mother Earth can be used to assess holistically the positive or negative relationships that exist between social, economic, and environmental aspects in specific territorial jurisdictions ranging from national to regional and local. A system of life is achieved when an optimum balance occurs between: (i) the development of sustainable production systems, (ii) the protection of environmental functions, and (iii) the eradication of poverty. This approach is an instrument not only to assess holistic values in the context of territorial management but also for helping decision making in order to restore equilibriums in situations where such balances have been destroyed. In order to do this the approach encompasses three successive steps, as follows: first, the characterization of the system of life in a given territorial jurisdiction; second, the establishment of Complementary Agreements with Mother Earth, setting out the goals and objectives to be enforced in order to build up systems of life or a positive

relationship between peoples and nature; and third, the harmonization of the systems of life of Mother Earth, as the necessary actions to be enforced to restore the balance (Pacheco, 2014a, 2014b).

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Chapter 4: Data and knowledge needs, sources and gaps

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Key messages

Data and knowledge needs for a valuation study can vary substantially. Differing spatial, temporal and social organization scales of a given valuation study or an assessment of valuation studies will affect the data and knowledge needs. Following the valuation methodology - scoping results will determine the appropriate choice of the method(s) to be applied, and this will determine data and knowledge requirements. Where possible, multiple data, knowledge sources including indigenous and traditional local knowledge systems, and information systems should be consulted and utilised.

Not all data and knowledge are readily available or accessible. Holistic and integrated valuation exercises require an extensive amount of data and knowledge. However this varies across scales of analysis as does the accessibility of this data and knowledge. Existing data, knowledge and information sources on nature, nature's benefits to people and good quality of life including biodiversity and ecosystem services are available to a limited extent at local, regional and global levels, but remain inadequate to capture the multiple values defined in Chapter 2 and the different knowledge systems and peoples' worldviews impacted.

Data and knowledge generation requires multi-disciplinary approaches. As data and knowledge related to socio-cultural aspects are often collective, oral and un-written, different sources must be considered (e.g. narratives, images, folk art forms and other oral and visual traditions etc.). Multi-disciplinary teams that include ILK holders and practitioners are required to carry out valuations and assessments but it is preferred that ILK holders must express their views about values by themselves.

Given the broad range, complexity and plurality of the values pertaining to biodiversity and ecosystem services (BES) described in Chapter 2, and the equally wide range of valuation methodologies outlined in Chapter 3, data and knowledge needs also vary considerably. As laid out in the valuation protocol (see Section 3.1), the different spatial, temporal and social organization scales in a given value analysis may require different data and knowledge. In addition, valuation-related data and knowledge gaps are evident even for widely recognised systems and methodologies, such as the non-use values of boreal ecosystems. This chapter highlights the main types of data and knowledge needs that may be encountered while undertaking a valuation study, the major available data and knowledge sources on global, regional and local scales, and the main data and knowledge gaps.

This chapter uses the definitions and typology of data, information and knowledge developed by the IPBES Data and Knowledge Working Group (IPBES/3/4[1]). It should be stressed that the scope of the data and knowledge analysis (needs, sources and gaps) is confined to valuation approaches that have been laid out in Chapter 3 and in particular to the three elements of the IPBES conceptual framework referring to valuation, namely, Nature, Nature's benefits to people and Good quality of life.

4.1. Data and knowledge needs

Depending on the scoping results emerging from the valuation protocol, appropriate choices of the method(s) will need to be made (see Chapter 3). The application of valuation method(s) requires multiple data sources, knowledge and information systems. For example, the adoption of landscape unit and classification systems for the valuation of ecosystem services will be necessary: the abundance of ecosystem services is directly linked to an ecosystem's extent (Costanza et al., 1997; MEA, 2005). But the span of services provided by an ecosystem and the level of its resilience depend on its inherent quality (Kremen, 2005; Pisupati, 2007) and on the values and behaviours of the people benefitting from, or "co-producing" those services.

[1] The generic types of data, information or knowledge defined by the Task Force are: Data (raw information from monitoring, research and observations), Information (analysed data), Knowledge and Knowledge Products, Indicators and metrics, Links and references.

Indigenous peoples' and local communities' knowledge and continued survival are essential to conserving, maintaining and enhancing biodiversity and ecosystem services in many parts of the world (IPBES International Expert Workshop, 2014). Therefore, it is important to include a wide range of local case studies (particularly those based on ILK systems) into valuation approaches. In order to reflect the holistic and multiple values pertaining to BES in different valuation studies and assessments, consultative dialogue and discussions are important cornerstones of the IPBES deliberative process.

Chapter 2 addressed how the value of nature and its benefits and what a good life encompasses change across time, space and social organization scales. So, for example, data and knowledge needs at regional levels will differ from those at national levels. Generally, data needs are greater for local scale analyses than for regional or global analyses. Possible formats for assessing the data needs at different scale combinations are given below in Table 4.1.

Table 4.1: *Possible format for assessing data needs at different scale combinations*

	Local, appropriate level of social organization	**National, appropriate level of social organization**	**Global, appropriate level of social organization**
Supply of Ecosystem Services	Need = high resolution data and ability to interlink data for short term decision support. Available = Mixed data and multiple tools; sufficient for scoping purposes in developed countries but insufficient for management. Insufficient for scoping or management in developing countries.	Need = mixed resolution data and ability to interlink data for short and long term decision support. Available = Multiple data bases often organized per country and multiple tools.	Need = low resolution data and high ability to interlink and disseminate data for long term decision support. Available = Sufficient data for scoping, insufficient ability to interlink.
Demand for Ecosystem Services	Need= high ability to recognise market and non-market sectors in managing trade-offs. Available = ?	Need= ability to recognise market and support non-market sectors in managing trade-offs in short and long term. Available = market based information and some socio-cultural information depending on country.	Need= ability to support all sectors with understanding of global ecosystem services and humanity's long term, collective needs. Available = market based information and some socio-cultural information.
Gap	Thousands of examples for specific ecosystem services.	Examples of ecosystem services supply; demand side lagging. Interconnections among ecosystem services and between local and global scale elusive.	Shortage for some global ecosystem services. Interlinkages among global ecosystem services elusive.

4.2. Data and knowledge sources

Existing data, knowledge and information sources on IPBES-relevant topics include: national, regional and global thematic datasets (i.e.: socio-economic, ecological, cultural); sectoral specific datasets (i.e. forestry, agriculture, aquaculture, health, etc.); and products/processes/practices supported by both scientific assessments and Indigenous Peoples and Local Knowledge Systems. Table 4.2.1 includes each relevant focus of valuation (nature, nature's benefits to people and good quality of life) pointing to possible sources of data, information and knowledge (these should be seen as illustrative as opposed to exhaustive lists).

Data and knowledge sources for the "Nature" component of the conceptual framework are diverse. In support of the Convention on Biological Diversity (CBD), data sources are available on the global, regional and sub-regional levels and national levels for biodiversity and ecosystems. There are a number of global biodiversity databanks for genetic diversity, species diversity and ecosystem diversity. As for data sources at the national level, most datasets may be available in local languages. Collection and integration of such

data sources are critical to regional and sub-regional database development. The availability of regional data sources is not balanced among different continents; more datasets are available in Europe and North America.

Table 4.2.1: *Examples of available sources of data and knowledge regarding the "Nature" component of the IPBES Conceptual Framework*

Subject	Global	Regional	National/Local
Biophysical & ecological	IUCN[2], FAO STAT[3], CITES[4], Ramsar, WCMC[5], GBIF[6], CoL[7], OBIS[8], Tree of Life, WOA[9], GEOSS[10], GEO BON[11], GCP[12], USGS[13], DataONE[14], EOL[15], WCPA[16], WDPA[17], NWW[18], WWF Ecoregions, GenBank, NCBI[19], UNCDD[20], BIP[21]	ACB[22], ABCDNet[23], EIONET[24], BISE[25], EMODnet[26] CSIRO [32] ECLAC [33]	Gapminder, NOAA[27], NEON[28], NSII[29], CONABIO[30], Noah's Ark[31], National Agencies (e.g. forest, park authorities)
Socio-cultural, Holistic & indigenous	UND, MDG, GBO, CBD, MEA, WB, UNESCO		National environmental policies, statements of protection goals, anthropological and historical studies, cultural sources (music, poetry, literature...), social norms and laws

[2]International Union for the Conservation of Nature – Red List of Threatened Species and Ecosystems
[3]Food and Agricultural Organization Statistics
[4]Convention on International Trade in Endangered Species of Wild Fauna and Flora
[5]World Conservation and Monitoring Center
[6]Global Biodiversity Information Facility
[7]Catalogue of Life
[8]Ocean Biodiversity Information System
[9]World Ocean Assessment
[10]Global Earth Observation System of Systems
[11]Group on Earth Observations - Biodiversity Observation Network
[12]Global Carbon Project
[13]United States Geological Service
[14]Data Observation Network for Earth
[15]Encyclopedia of Life
[16]World Commission on Protected Areas
[17]World Database of Protected Areas
[18]Nature World Wide
[19]National Center for Biotechnology Information
[20]United Nations Convention to Combat Desertification
[21]Biodiversity Indicators Partnership
[22]ASEAN Center for Biodiversity
[23]Asia Biodiversity Conservation and Database Network
[24]European Environment Information and Observation Network
[25]Biodiversity Information System for Europe
[26]The European Marine Observation and Data Network
[27]National Oceanic and Atmospheric Administration (USA)
[28]National Ecological Observation Network (USA)
[29] National Specimen Information Infrastructure (China)
[30] National Commission for the Knowledge and Use of Biodiversity (Mexico)
[31] Noah's Ark National Biodiversity Database (Turkey)
[32] CSIRO & UNEP Asia-Pacific Material Flows online database
[33] Economic Commission for Latin America and the Caribbean United Nations

In the "Nature's benefits to people" element of the conceptual framework, it is worth considering existing data sources in terms of the ecosystem service categories outlined in the framework. For provisioning services, multiple national and finer scale measures and data in relation to agriculture, fisheries, forestry, water supply and demand are available. For regulating services, there are fewer clearly linked data sets available. Nevertheless, estimated data of costs associated with damage relating to extreme natural events (like flooding, and sea storm coastal impacts), and restoration activities can be drawn from various sources. For cultural services, sacred site and cultural values mapping, access use rights, culturally important species' lists are available for some places; tourism data sets at different scales are available.

Table 4.2.2: *Examples of available sources of data and knowledge regarding the "Nature's Benefits to People" component of the IPBES Conceptual Framework*

Subject	Global	Regional	National/Local
Economic	MEA[32], TEEB[33] reports, WOA[34], FAO STAT, WB, WDCGC[35], IPCC, GDW[36], UN-SEEA[37]	European System of National and Regional Accounts, ADB[38], EU, EBRD[39]	NEAD[40] EVRI[41], Governmental Databases (eg. Fisheries, Agriculture, Forestry, Tourism Ministries, disaster monitoring centers)
Socio-cultural, Holistic & indigenous	UNESCO-World Heritage, WEP-GRIN[42]		Academic literature (eg. Anthropological, geographic studies), art (paintings, sculptures etc), cultural sources (music, poetry, literature...), heritage sites and their justification, sacred site mapping, cultural values mapping, lists of culturally important species, CINE
Public health	WHO[43], WHO-CBD[44], GBDD[45], DHS[46], FAO, MICS[47]	WHO, GBDD, DHS, FAO	DHS, Ministries of Health, CINE[48], MICS
Biophysical & ecological	TEEB, MEA, IUCN, FAO, CITES, WCMC[49], GBIF[50], WOA, GEOSS[51], GCP[52], USGS[53], DataONE[54], NWW[55], GLORIA[56], GMBA[57],RAM Legacy, Sea around Us Project	SGA[58], ACB, APBON, ABCDNet, EIONET, BISE, EMODNET, EU	NEON[59], NSII[60], CONABIO[61], National Agencies (e.g. forest, park authorities)

[32] Millennium Ecosystem Assessment
[33] The Economics of Ecosystem Services and Biodiversity
[34] World Ocean Association
[35] World Data Centre for Greenhouse Gases
[36] Global Disaster Watch
[37] United Nations - System of Environmental-Economic Accounting
[38] Asian Development Bank
[39] European Bank on Reconstruction and Development
[40] National Environmental Accounting Database, University of Florida
[41] Environmental Valuation Reference Inventory
[42] World Economic Plants – Germplasm Resource Information Network
[43] World Health Organization
[44]World Health Organisation – Convention on Biodiversity
[45]Global Burden of Disease Database
[46] Demographic Health Survey
[47] Multiple Indicator Cluster Surveys (UNICEF)
[48] Centre for Indigenous People's Nutrition and Environment
[49] World Conservation and Monitoring Center
[50] Global Biodiversity Information Facility
[51] Group on Earth Observations
[52] Global Carbon Project
[53] United States Geological Service
[54] Data Observation Network for Earth
[55] Nature World Wide
[56] Global Observation Research Initiative in Alpine Environments
[57] Global Mountain Biodiversity Assessment

There is an expanding literature accounting for different types of indicators of the "Good Quality of Life" element of the conceptual framework, coming from a range of backgrounds including country socio-economic performance and happiness indicators among other indicators of the different components of well-being, as well as poverty and poverty reduction literature. These are illustrated in Table 4.2.3.

Table 4.2.3: *Examples of available sources of data and knowledge regarding the "Good Quality of Life" component of the IPBES Conceptual Framework*

Subject	Global	Regional	National/Local
Economic	WDI[62], UNSD, MDG tables[63]		National census data
Public health	WHO, GBDD, DHS	WHO, GBDD, DHS	DHS, Ministries of Health
Biophysical & ecological	MEA, IPCC reports		UK-NEA
Socio-cultural, holistic & indigenous	MDG reports, World Database of Happiness	Knowledge products	UK-NEA

4.3. Data and knowledge gaps

- Regional & local datasets (not as visible as global datasets)
- Regulating services are usually modelled, actual data sets are lacking and the Regulating ES are usually specific to each locality
- More comprehensive awareness and understanding of cultural and social values are needed
- Public health value understanding is lacking
- Availability of spatial data at finer resolution for valuation is lacking
- Even where data exist at local levels, consistent updates of all data types (economic, biophysical, social etc.) are lacking
- Knowledge gap - techniques of linking bio-physical and socio-economic components
- Traditional, Indigenous and Local Knowledge sources (including the need to improve their registration and inventory development)
- Further ethnographic and historical knowledge sources are needed and there is a need to increase awareness of their importance

The above-mentioned gaps should be seen as clear messages to respective IPBES member states about prioritization and funding challenges to address them. In addition to these data and knowledge gaps, it is important to highlight the challenges involved integrating different types of data within a valuation study, not just due to incommensurability but more often due to disciplinary and worldview rigidities. Using information captured in traditional knowledge systems such as songs, rituals, and dances, for environmental management and decision making might be helpful, but remains underexplored.

4.4. Data and Knowledge Accessibility

How easy it is to access data for the purposes of conducting valuation studies or assessments can vary substantially for a given task. Some data are public while others have property rights or are licensed. For example, most Elsevier publications are only available through paid subscription. Open source journals such as Public Library of Science (PLoS) and Global Biodiversity Information Facility (GBIF) are

[58] Sub Global Assessments (MEA)
[59] National Ecological Observation Network (USA)
[60] National Specimen Information Infrastructure (China)
[61] National Commission for the Knowledge and Use of Biodiversity (Mexico)
[62] World Development Indicators
[63] Millenium Development Goals Tables

accessible with internet use. Even if publically available, there may be limitations to access, infrastructural and human capacity to access data (online and other forms). At national levels, there are issues concerning governmental databases, specifically related to uncertainties, biases and restricted access.

Different data sources contain results from different types of valuation methods. Peer reviewed journals are a good source for biophysical and economic valuation methods and can be easily accessed through online searches of publication outlets (e.g. Springer, Elsevier etc.). Books are especially important sources of academic information for socio-cultural and holistic methods; however, they may not be widely available or translated. Grey literature can contribute information on any of the valuation methods but locating each type of grey document can be time consuming as they can vary widely across countries and types of valuation methods. Global and national databases (e.g. FAO, NOAA, WB, NEON) can provide information for a range of valuation methods. Because data and knowledge related to socio-cultural aspects are mostly collective, oral and un-written, different sources must be considered (e.g. narratives, images, folk art forms and other oral and visual traditions).

Awareness and sensitivity are needed when approaching ILK systems for capturing knowledge and information. In accordance with the recommendations of IPBES ILK working group, synergizing ILK and science in the context of a given IPBES task requires the development of robust relationships and trust across the diverse group of knowledge holders and following appropriate protocols for mutual exchange, compilation and analysis of information to ensure reciprocity, transparency, shared benefits and understanding of potential risks (IPBES, 2014). IPBES should follow best practices and ethical standards for the use of published material and ensure free prior informed consent (FPIC) for access to undisclosed knowledge (ibid). In the context of many assessments, aggregated information and information on importance are sufficient rather than on exact location or other sensitive information; this can help to ensure the privacy of ILK, and inclusion of ILK even under tight timelines.

4.5. Collaboration means

Documenting the wide range of BES values requires a sustained effort to collaborate with a network of partners and stakeholders. Consistent with the objectives of Knowledge and Data Strategy and Knowledge and Data Management Plan, close collaboration is required with the custodians of data and knowledge pertaining to BES values and valuation.

It is foreseen that successful data accessing can be attained both within and outside IPBES:

→ Collaboration within IPBES

- ILKTask Force
- Knowledge & Data Task Force
- Member states

→ Collaboration outside IPBES

- IPCC
- Regional networks & regional professional organizations
- NGOs (IUCN, WWF, WCS, etc)
- Other international initiatives on data banking and management (WCMC,UNEP etc)
- Academic institutions to build on research base
- Observation networks (ie. GEO-BON, İLTER, citizen science groups)
- ILK social organizations and ILK communities

Furthermore there is a need for collaboration with local partners in a range of countries to guide access to grey literature and relevant data sources that are not openly accessible. For instance, regarding regional and local scale studies, there might be various data and information sources available in local publications rather than in international publications. Thus, there is a need to try to include some local experts who can provide local data, understand the local languages and evaluate the quality of the datasets which would enhance the impacts of the assessment. Guidance is often needed to access open databases that are not easily found, to identify which types of grey literature or documents would be most useful and where to find them.

Chapter 4 APPENDIX

Table 4A.1: An example of data and knowledge sources pertaining to **'Nature's benefit to people'** component of IPBES conceptual framework

Examples of valuation methods	Examples of data sources	Examples of knowledge sources
Economic	World Bank (World Development Indicators) http://data.worldbank.org/topic EVRI https://www.evri.ca/Global/HomeAnonymous.aspx ECLAC http://www.cepal.org/es	Scopus Web of Science Wiley Online Library EconLit
Ecological/biophysical	FAO http://faostat3.fao.org/faostat-gateway/go/to/home/E IUCN http://www.iucnredlist.org/ CSIRO http://www.cse.csiro.au/forms/form-mf-start.aspx ECLAC http://www.cepal.org/es	Scopus Web of Science Wiley Online Library SpringerLINK BIOSIS
Social	UN http://unstats.un.org/unsd/default.htm UN DESA http://undesadspd.org/	Scopus Web of Science ScoINDEX Academic Search Premier
Cultural	UNESCO http://portal.unesco.org/culture/en/ev.php-URL_ID=35166&URL_DO=DO_TOPIC&URL_SECTION=201.html	Scopus Web of Science Wiley Online Library EBSCO eHRAF world cultures
Health–related	UNICEF http://www.unicef.org/statistics/index_countrystats.html WHO http://apps.who.int/gho/data/?theme=main	PubMed CAB Abstracts & Global Health MEDLINE ScienceDirect
Holistic and ILK	UNESCO http://www.uis.unesco.org/Pages/default.aspx	eHRAF world cultures Ethnographic video online

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Chapter 5: Integrating diverse conceptualization of holistic and multiple values of biodiversity and ecosystem services into IPBES activities and suggestions for the development of assessments under deliverables 2b, 2c, 3bi, 3bii and 3biii.

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Key messages

Application of the tools and methodologies to IPBES activities requires special attention to the context of the assessment. This chapter helps to identify relevant types of values and how to apply concepts and methods of valuation in the context of IPBES assessments.

Assessment processes need to consider all possible types of values and acknowledge the diversity of worldviews. When biodiversity is concerned different values/a broad set of diverse values are at stake. In order for an assessment to identify relevant value categories, as well as knowledge and information on these it is important to consider all possible types of values.

It is important to reflect on the gaps in the current literature and in the existing assessments and to communicate these explicitly. Assessments commonly include market values and increasingly address other economic values where adequate information and methods are readily available. However cultural and health values as well as values held by IPLC (indigenous people and local communities) are often not adequately covered. It is neither necessary nor usually feasible to include all types of values in depth, many may not be applicable/relevant for each assessment; others may have to be left out due to scarce resources. Being transparent about which values were included and for what reasons others were left out increases the usefulness of the assessment.

Assessments need to pay attention to scalar dynamics when assessing valuation results and particularly when attempting to aggregate or integrate values.

Studies on values address different purposes and scales (temporal, spatial and level of social organization) and values change across these scales. For example, indigenous peoples are often minorities in their countries, and their often quite specific relationships to biodiversity involving several value dimensions would be averaged out in a simple aggregation process.

This chapter guides experts on how to practically apply the concepts outlined in Chapter 2 and the valuation approach developed in Chapter 3 in IPBES assessments and provides additional practical guidance on the step-by-step approach referred to in the summary (Section 5.1). It also provides initial thoughts for the assessments currently planned in the first work plan. Section 5.2 illustrates the stepwise approach with the example of a thematic assessment on land degradation, 5.3 for invasive species, 5.4 for sustainable use and conservation of biodiversity, and 5.5 provides some ideas for regional assessments. These subsections are presented to illustrate procedure and provide initial ideas. These examples are intended to assist teams mandated with conducting the assessments. The tables and text presented here are intended to trigger discussion and do not provide exhaustive answers for each of the assessments. The utility of this chapter lies in suggesting examples that can inspire authors of the corresponding assessments.

5.1. How to apply this guideline in the context of assessments?

The valuation protocol developed in Chapter 3 Section 3.1 can be applied to both IPBES regional and thematic assessments. In the summary to this document five steps have been outlined on how to go about assessing values in an assessment context.

Steps for assessing multiple values from different worldview within IPBES assessments:

Step 1: Identifying value dimensions & understanding where values play a role in the assessment

Step 2: Searching the literature
Step 3: Categorizing, sorting and assessing values - which values have been elicited (in the literature) and how?
Step 4: Synthesis, up-scaling and integration
Step 5: Deriving and communicating results

Below we provide additional practical guidance on how to go about these steps. Assessments use existing studies and knowledge to compile an understanding of the current situation and derive overall conclusions and directions typically under very tight timelines. Under such conditions it becomes particularly challenging to adequately represent different worldviews and conceptualizations of values and there is no silver bullet for doing so. The assessment of values includes identifying types of relevant values, compiling what is available on them and then describing where there is evidence, where there are some indications of the importance of values but nothing conclusive and possibly most importantly, where there are gaps in our current understanding. Highlighting that decisions are currently taken without even indicative information on certain values at stake can be an important result regarding values in an IPBES assessment. Beyond presenting such a stocktaking and evaluation of what is documented or accessible knowledge, information on values should be used to inform other parts of the overall assessment efforts including the construction of scenarios, response options, and implications of findings.

Table 5.1 (below) is an expanded version of Table 2.2 to help work through the steps for assessing values: first to specify 'elements of value' and then, for each of these, specify 'key stakeholders & knowledge sources', 'potential policy-relevant questions', 'methods/approaches' and 'sources of data and information'. 'Methods/approaches' in an assessment context refers to the methods/approaches chosen by the studies available and will help to characterise the information available (compare Step 3). The table has been tentatively filled (only for demonstration purposes) for each of the upcoming assessment topics.

How to use Table 5.1 in the step-by-step approach?

When scoping what values are at stake we recommend first considering all types of values listed. Not all of these will necessarily need to be included or will be applicable/relevant for each assessment. The values are related to a specific paradigm and worldview, but for most IPBES assessments more than one worldview will be relevant.

Note: the table is not a balance sheet breaking down values into distinct categories that could be added up to some sort of a 'total value'. (Double counting of values is an issue only in certain applications such as calculating economic values for national accounting or aggregating 'total economic value', for this other approaches should be used e.g. CICES.) In Table 5.1 there is overlap between the different categories and their significance will vary according to context, worldview and purpose of valuation. Different time scales need different types of valuation. Similarly assumptions e.g. discount rates (often differing for private and social costs) also need to be carefully chosen according to the purpose. It is also important to note that some paradigms and worldviews do not include calculating economic values and accounting of nature and its environmental functions. The table can help to structure the search and analysis: It lays out the entire value space (Step 1) and can help to search for relevant studies (Step 2), to categorize and better understand what values are reflected in the literature found and used for an assessment as well as identify the gaps (Step 3). Similarly it helps to document the entire process of assessing values explicitly and thus facilitate making it transparent.

Table 5.1: Key elements for assessing values and valuation							
Category	**Type of values**	**Focus of values**	**Example targets of valuation**	**Examples of policy-relevant questions**	**Key stakeholders knowledge sources, expertise**	**Methods/ approaches**	**Data & Information sources**
NATURE *Intrinsic value*	**Non-anthropocentric**	Individual organisms	Living beings (biocentrism), sentient beings (animal welfare/rights)...	*to be specified for each assessment*	*to be added for each 'element identified*	*to be added…*	*to be added…*
		Biophysical assemblages	Populations, communities, ecosystems, biomes, the biosphere, Gaia, Pachamama, Mother Earth...	…	…	…	
		Bio-physical processes	*to be specified …*	…	…		
		Biodiversity	…				

Table continues with the same rows as table 2.2…

Concerning Step 1 "Identifying value dimensions & understanding where values play a role in the assessment"

A first important step in any assessment is to identify which values might be at stake and thus relevant for a given topic of assessment. For this, it is also important to consider the different paradigms, worldviews and knowledge systems about a "Good Quality of Life" according the IPBES Conceptual Framework (e.g. well-being and living-well) and what types of values are at stake from these different perspectives. In addition, this implies considering all 'key targets of valuation' for each worldview regarding Good Quality of Life and 'type of value' and then specifying and selecting which are applicable. For most cases, not all of them will be applicable so some rows might remain empty or be considered of minor relevance and thus not further pursued. Most assessments will take "nature's gifts" into account but the importance for good quality of life might easily be left aside or summarized very briefly. The table can help to uncover implications of losing specific aspects of biodiversity or ecosystem services for good quality of life. Assessing values in IPBES assessments is both an endeavour in its own right and needed to illustrate the implications of changes in biodiversity and ecosystem services. As outlined in Chapters 2 and 3 assessing values involves many different perspectives and methodological approaches. In order to ensure relevant expertise is available during the assessment it is useful to identify where values are already explicitly contained in the respective scoping document as well as where expressing changes in terms of values affected would be useful, (typically chapters on responses or scenarios). Involving stakeholders in identifying relevant values should also be considered, online consultations, or sessions at other relevant events could be viable even within the tight timelines and limited resources available for IPBES assessments.

It is important to clarify whether the **assessment team has the needed expertise** to address the worldviews and scale issues involved? Following the IPBES conceptual framework, the team may be most effective if it integrates contextually relevant expertise from ILK, ecological science, economics, and other social sciences such as anthropology and human geography. If the selected experts do not cover all relevant aspects, assessment teams can tap into relevant networks of expertise, acquire contributing authors to fill the gap, or approach the IPBES expert group on valuation for support in identifying adequate expertise, (ideally very early on in the process).

Concerning Step 2 "Searching the literature"

As an important part of Steps 2 (and 3) we suggest using Table 5.1. For each row potentially relevant 'elements of value' or value dimensions at stake should be specified. The column for policy-relevant questions can be used in two different ways: (1) the questions to be addressed by and already specified within the assessment can be associated with relevant rows, (2) other potentially relevant questions can be identified when you search the literature. Policy-relevant questions will differ at different spatial/social/institutional scales, there is an illustrative example in Section 5.4 on sustainable use below. Identifying affected stakeholders and potential knowledge holders can help both to search the literature and to identify whether all relevant stakeholders have been considered in the studies you find, if not it helps to describe the gaps identified. Similarly, by making explicit which methods or at least indicators would be adequate for analysing a particular element of value, can help to find further relevant studies. The task in Step 2 consists of finding relevant studies and "sorting" them into the respective boxes of the table. Even without further detailed analysis of the studies this will show, where and how many studies on each type of value are available and where no results have been found. Special care should be taken to ensure access to ILK. Chapter 4, particularly Section 4.4 elaborated on this, and IPBES (2014) provides an overview on indigenous valuation compared to other valuation of biodiversity and ecosystem services.

Concerning Step 3 "Categorizing, sorting and assessing values - which values have been elicited (in the literature) and how?"

In Step 3, for each of the cells of the table with available study results, these studies should be characterized in terms of values covered and at what scales these were captured (time, space and level of social organization) the list of questions in the summary helps to categorize and analyse the available information. These results should also be explicitly included in the assessment. The description of Step 3 in the summary contains a list of questions to help characterise the studies found. Besides these characteristics it is also important to consider the level of social engagement incurred by the original valuation studies. All valuation methods are embedded in a social and cultural context; methods and studies applying them are explicit about this to a greater or lesser extent. Some approaches seek to engage a wide range of social

actors, who often represent different knowledge systems, in the valuation process, including in the stages of defining the problem, and choosing alternatives and evaluation criteria (question E in the summary). Within an assessment the task consists of identifying how the studies have elicited different types of values, the following : *Original data or secondary data e.g. via benefit transfer? Inclusive or not, and to what extent? Which social groups were included? Where all relevant groups covered, including underrepresented ones? Have the results been validated with relevant stakeholders? To what question did the valuation respond? Individual, (collective, social values)? Level of aggregation at which results are presented?* Even though most studies do not provide information on all of these aspects a careful characterisation of what exactly was valued can help tremendously to provide a good assessment of the values available as well as a good understanding of the gaps.

Following such an approach will (a) help to broaden the search for relevant information on values, and (b) help to structure the presentation of available information, even if complete coverage will rarely be possible, and (c) allow the assessment team to identify what sorts of values have been predominantly studied and to identify where current gaps lie. Even in cases where no additional analysis is possible, providing an overview of available studies and gaps is already a type of assessment of values and provides helpful and important information in any IPBES assessment.

Concerning steps 4&5 "Synthesis, up-scaling and integration" and "Deriving and communicating results"

In the last two steps the results from assessing values will be combined with other elements of the assessment, e.g. it will be assessed what certain changes in biodiversity will imply in terms of values. Again it is important to explicitly deal with the gaps: e.g. what are the implications of having only partial information on values available? Just like with primary valuation (compare Chapter 3), assessing values has ethical implications as well: collecting, reporting on, and assessing values can harm people (e.g. by revealing private information, omitting or undercounting the values of marginalized people, or transgressing sovereignty and self-representation). The effects of a valuation or assessment process on people can go well beyond the process of assessing, as it can influence decision making and the resulting changes in nature and its benefits. Assessing values thus has a distributional impact, in that some may win and others lose if decisions are made on the basis of its results; any biases that are not made explicit have a higher risk of causing ethical issues.

5.2. Illustrating the step-by-step approach for assessing values within the assessment on 'Land degradation and restoration'

Here we apply the five steps at the beginning of the document to the assessment of land degradation and restoration, and assume it is to be conducted separately in different regional assessments as the global level seems too aggregated for collecting and assessing information. In the following we used the example of Africa.

Short description of issues involved and related values:

Degradation can encompass issues related to changes in forest cover, or land use, but also soil characteristics (physical, chemical and biological), species composition and diversity, and change in water dynamics (flow, infiltration, evapotranspiration, filtration and purification). Restoration can be attempted for a variety of reasons. For example, it may be focused on restoring composition, ecosystem functioning or particular ecosystem services. It can include major changes such as rewetting a dried peatland, or comparatively minor changes in certain management practices. Multiple stakeholders are impacted by land degradation in diverse ways. For certain cultures, this impact can be existential highlighting the importance of the focus on 'good quality of life' and all the values identified there. Similarly stakeholders have very different visions of what to restore and why depending on their worldviews, their dependence on the services to be restored, and the contributions of these services to their quality of life. Incommensurable trade-offs occur among the actors that operate at very different spatial scales and that do or do not promote restoration for a variety of reasons.

Step 1: Identify value dimensions and understand where values play a role in the land degradation assessment

Purpose of the IPBES assessment on land degradation: understanding land degradation status and trends; ecological, social, economic, cultural implications of land degradation; devise policy tools to deal with challenges; actions and outcomes of land degradation; keep people informed on all of the above.

Purpose of assessing values in this context: generate understanding of values affected/at stake, create awareness for costs of loss, inform the development of policy options, understand distributional impact of land degradation and implications for good quality of life.

Values are explicitly mentioned in **Chapter 5. Land degradation and restoration associated with changes in ecosystem services and functions and human well-being and good quality of life**. This chapter will focus on the impacts of land degradation and restoration on changes to the delivery of nature's benefits to people and the resultant impacts on quality of life. The chapter will assess land degradation associated with the loss of benefits to people including provisioning services, such as food production, quality and quantity of water resources, and availability of raw materials, as well as regulating, cultural services and other aspects of nature, recognizing a diverse conceptualization of the values of nature. The chapter will analyse changes in benefits to people in terms of the relative contribution of biodiversity and ecosystem structure and functioning and that of anthropogenic assets (e.g., technologies, knowledge) applied by people in the co-production of benefits. Impacts on the diverse dimensions of a good quality of life will include impacts on health, poverty, income-generating opportunities, meaningful livelihoods, the equitable distribution of natural resources and rights and values considered important in different cultures. The chapter will consider the diverse costs of land degradation and benefits of restoration for people, including the overall economic and non-economic costs and benefits, encompassing those that are associated with the area of degraded or restored land itself, as well as costs or benefits borne by people in other areas who are affected by degraded or restored sites. For both land degradation and restoration the chapter will examine the type, extent and severity of these changes in different social-ecological systems in different land cover and land management systems, including their implications for social and ecological stability and resilience and cultural integrity.

Clarify the following *before* assessing values at stake, searching for information sources, and agreeing on approaches to synthesising, up-scaling or integrating different values and formats of results encountered:

What worldviews, foci and types of values are relevant within the scope of the assessment and which ones are currently reflected in the available expertise? *Identifying which worldviews are relevant should be achieved by the assessment team*[64]. The worldview helps framing the assessment of values according to a particular knowledge system. All worldviews represented in Africa and affected by land degradation should be identified and considered. Similarly, land degradation affects all three foci of value – *nature, nature's benefits to people and a good quality of life*. It is useful to first identify all potentially relevant types of values (Table 5.1 is a useful tool for such a brainstorming).

What scale or scales are relevant and how do they interact? *There are at least two ways scale can be considered in the valuation process: the overall scope of the valuation or assessment*: Regional, e.g. Africa *and the scale at which values are expressed:* the latter needs to be made explicit for all study results that will be used in the assessment. *Spatial scale*: Africa, subdivision for different biomes might make sense; *temporal scales:* will probably be specified in the IPBES scoping document e.g. last 50 years, the mandate might include some sort of scenario work for the future as well. *Social organization*: it is important to distinguish how values in available studies have been elicited, which may include individual, household, and community approaches (relevant for Step 3). Scales of social organization are not to be confused with political scales. *In addition the scale of the audiences of the assessment, what policy or decision makers the assessment is supposed to inform, should be explicitly discussed (see Step 4 & 5 below on synthesising and reporting results).* The IPBES assessment on land degradation is probably addressing the global level (e.g. CBD, Convention on Desertification), as well as national governments in affected countries and donors providing development aid, the private sector at an aggregate level, e.g. the World Business Council on Sustainable Development, possibly also investors in land. Yet a continental, assessment would have to differentiate between different sub regions, as it makes very little sense just to try and aggregate across all

[64] Text in italics summarizes the scoping step from Chapter 3 Section 3.1, normal text gives indications how this might be specified in the example of an Assessment of land degradation in Africa.

of Africa. *It is important to keep in mind that both human and natural scales matter with respect to space and time.* For land degradation this has implications. For example, restoring land after desertification requires long time scales and may also significantly affect adjoining landscapes, so values of preventing degradation, or losses due to degradation should not be calculated on very short time or spatial scales. Also, land degradation or restoration in one location could significantly affect ecosystem services or nature's benefit to people in another location, such as up- and down -stream and transboundary contexts. Before using a study in an assessment, it is important to understand what that study referred to and if it dealt with scales adequately.

Next it is important to clarify whether the **assessment team has the needed expertise** to address the worldviews and scale issues involved? Can the drivers and implications of land degradation (including those from the socio-economic and cultural realms) be adequately covered? Is/are there ILK holder(s) on the team and is this person able to tap into relevant networks and identify sources? If the selected experts do not cover all relevant aspects, the team should act now to acquire missing expertise (see Step 1 above).

What broader social context needs to be considered? *Relational values are important elements in the valuation of nature and its benefits. Thus a scoping process must consider how methods take into account the nature of relationships between people across scales, including power relationships, material and spiritual relationships and interactions about people and nature, the distribution of incomes and resources as well as gains and losses, externalities, and reciprocal relationships. These considerations include persons not actively taking part in the valuation, especially future generations. Consideration of the broader social context includes how methods account for the effects of anthropogenic assets, institutions, governance, and other drivers on the values of nature and its benefits. (These interlinkages should be thought through for the specific context both in Step 1 when identifying potentially relevant issues and analysed for the different studies found in Step 3).*

For example: Access to land and property right regimes, including the distribution of management and use rights, often decisively influence the value formation concerning both degradation and restoration of land. In Africa competing legal systems, e.g. formal and traditional law, de facto open access, and privatization of formerly communal fragile lands are important drivers of land degradation. At the same time, formal systems and privatization of lands limit community's access to lands and have direct implications for what communities can and cannot do to prevent degradation or start restoration. This can affect values people might attribute to different aspects of land use and the contributions to human well-being.

Step 2: Searching the literature (for an assumed regional assessment in Africa)

We have indicatively filled the table (Table 5.1a.) to illustrate how this might be applied to land degradation. In some places implications of land degradation already include significant migration, sometimes loss of entire cultures that can no longer survive on their traditional livelihood strategies that are deeply entwined with managing fragile ecosystems with significant parts of their culture and social systems directly depending on these practices. Effects of degradation are also often felt in areas quite remote from the degraded area itself, both downstream effects and sand storms are examples.

In an assessment context, this means first scanning the literature for all the issues specified in the table (including gray literature and all potential sources outlined in Chapter 4) to identify which values have been uncovered and where there are knowledge gaps (Step 3). For Africa there is a rich body of anthropological literature, but special attention should be paid to ILK and its holders and to directly involving them in the assessment wherever possible.

After the literature search the material encountered could be sorted according to the rows in the table indicating how many studies where found for each type of value (different elements mentioned in each row). A first overview can now be given, where there are many, some or no studies.

Step 3: Categorizing, sorting and assessing values - which values have been elicited (in the literature) and how?

The description of Step 3 in the summary contains a list of questions to help characterise the studies found. This categorization and characterisation should be done for each group of studies found (e.g. on a particular element or value dimension) and on the entire set of studies found. Besides the characteristics mentioned in Step 1 concerning worldviews, foci and types of values, as well as scales, it is important to consider the

level of social engagement incurred by the original valuation studies. The main question is if all relevant social groups have been involved and who played what role at each stage of the valuation and assessment process and who decides about the issues of participation.

The studies used in the assessments will have addressed these issues to different extents, try to make explicit what has been taken into account and what not. It is important to cover values of all relevant groups for an assessment. Therefore a helpful starting point is to analyse what social groups are affected by land degradation and restoration and how these processes affect their livelihood strategies, for example. In the multi-cultural settings of Africa where different ethnic groups depend on land and are affected by its degradation in diverse and distinct ways it is particularly important to be aware of and make explicit whose perspective has been included and whose has not both in each study and in the entire body of literature. The column on key stakeholders in table 5.1 can help to start identifying relevant groups to consider.

If there are important gaps in the studies, state this and possibly suggest ways to fill-in such gaps. Examples to fill gaps could include the use of Expert Delphi technique and/or engaging ILK holders. Be transparent about your sources. Describing a gap as clearly as possible helps both to make explicit what has not been considered and what the implications of omitting certain values or perspectives are and to guide future research to be more comprehensive in uncovering different values from different perspectives.

The expert group can then prioritize certain values for further analysis. Every assessment should provide a general overview of values at stake (including the paradigms and worldviews under which they have been carried out), where gaps of current accessible knowledge are and explicitly indicate which ones have been prioritized and why.

Step 4: Synthesis, up-scaling and integration

Often ‘describing what is there and how important some values are in some contexts’ will be an important first step. Beyond this, the policy context and how useful the results are for addressing the policy-relevant questions at the scales targeted will determine the level of synthesis and integration of the findings that can usefully be done. For example, values of the same ES found using different disciplinary methods may need to be reconciled, or at least the differences explained, for policy purposes. Even with the use of the same valuation method, values found at the scale of a study area need to be integrated or bridged for application at higher levels. Where incommensurable values are being considered, the assessment needs, at least, to recognise that complexity, and if possible, indicate any practical ways of dealing with it. It is important to be aware that values under different paradigms and worldviews usually cannot be integrated, for example, monetary valuation under the Living-well in balance and harmony with Mother Earth. Different formats of MCA, can be used to provide an overview even without prioritising different alternatives or perspectives. Illustrating divergence e.g. of different groups on particular issues and of trade-offs between values or social groups can be useful results for policy. Discussing such overview results with stakeholders can help validate these results and to identify useful next steps from their perspective.

Beyond the values themselves, at this stage the assessment team will probably discuss scenarios or policy options and indications of their possible impacts on different types of values will be requested. Again it is crucial to be explicit about which value dimensions were included in any further analysis and which ones could not be included and what the implications of this selective information basis is. Being explicit about this and the uncertainties associated with results can help to limit bias.

Step 5: Deriving and communicating results

As indicated above, the first result of an assessment of values will be to provide an overview of potentially relevant values and a description of the knowledge available about them. The challenge is to make statements that are useful for policy even where little information is available. Case studies can be used to illustrate the significance of certain values in specific contexts. For example, in the case of land degradation, studies that illustrate causal chains of degradation, outmigration, break down of cultural traditions, importance of communal access and management rights and institutions etc. can be used to show what is potentially at stake, or has been lost, or could be recovered by timely restoration efforts, even if it is impossible to calculate exact values for all issues involved, let alone achieve complete coverage in spatial terms. When reporting results, care should be taken to contextualize what is known, to point to important gaps and highlight potential implications rather than only pointing to inconclusive evidence and the need for further studies. Creating awareness of the diversity of values at stake, which paradigms and worldviews are considered and which are not, the potential implications of a decline of nature's ability to provide these values for the quality of life and relational values within societies can be much more important than exact figures.

Results should also address different levels and contexts of decision making. Local rural managers are an example of one level. Relevant issues for them are how they perceive degradation and how they are directly affected, recommendations on how to safeguard some of the values that are of interest to them, and how they can integrate them in the management of their resources. However, many issues cannot be addressed at the local level and land degradation in many countries has become an important (sub)national issue when it has clear impacts on food production or leads to erosion and changes in sediment retention patterns, affecting reservoirs and coastal water quality or triggers significant outmigration. At the international level, the role of degradation and restoration is debated in the context of carbon stocks and uptake. Land degradation is becoming a global issue e.g. in the context of the reduction of emissions from deforestation and forest degradation (REDD+) and the ability of forests to store and uptake carbon and how these do not compensate for efforts focused on land use change, but also through sand storms transporting dust to neighbouring continents. In each of these contexts the values at stake and recommendations how they might better be addressed differ significantly.

Step1	Table 5.1a Land Degradation and restoration (issues identified before to help search the literature)						
Category	**Type of values**	**Focus of values**	**Example targets of valuation for land degradation and restoration**	**Examples of policy relevant questions**	**Key stakeholders, knowledge sources, expertise**	**Methods/ approaches**	**Data & Information sources**
NATURE *Intrinsic value*	**Non-anthropo-centric**	Individual organisms	suffering or local extinction of animal species	policies on extinction prevention Impact of degradation on key species, e.g. habitat change…	local communities* affected, specialised researchers and conservation specialists	qualitative, species loss can be quantified, biodiversity indexes and indicators (red list)	peer-reviewed literature
		Biophysical assemblages	Wilderness, ecosystem integrity, species right to exist, biodiversity at stake; Gaia, Pachamama, Mother Earth integrity may be lost	Impact of land degradation on species composition? Effects on food web or food chain in the terrestrial ecosystems?	societies or peoples affected*, indigenous and local leaders	qualitative, interviews, group discussions, deliberative processes, holistic and indigenous valuation	peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Biophysical processes	biogeochemical cycles, evolution, ecological resilience all are at stake	What would be the responses to maintain biogeochemical cycles? How to increase ecosystem's resilience?	Government, local communities, researchers and research institutions*	Both qualitative/ quantitative	peer-reviewed literature
		Biodiversity	Reduced biodiversity (at least at species and functional levels		government, civil society, business people, local communities affected by degradation, specialised researchers	Both qualitative/ quantitative, ecological assessments and indicators, ecological valuation	peer-reviewed literature

Step1	Table 5.1a Land Degradation and restoration (issues identified before to help search the literature)						
NATURE'S BENEFITS TO PEOPLE	*Biophysical*	Biosphere's ability to enable human endeavour (energy, materials, land)	Energy: Embodied Energy, Human Appropriation of Net Primary Production (HANPP)...	the more is appropriated by humans the more degradation is to be expected		biophysical & geochemical science	peer-reviewed literature results from modelling
			Materials: Total material consumption, life cycles, carbon footprint, water footprint...	does not seem helpful for assessing value loss due to land degradation, unless mining is causing land degradation.		biophysical & geochemical science	peer-reviewed literature, results from modelling
	Instrumental		Land: Land cover flows, ecological footprint...	Might be useful to better identify implications such as deforestation which can trigger loss of other values.		biophysical & geochemical science	peer-reviewed literature, results from modelling
	Anthropocentric	Nature's ability to supply benefits (basis of benefits)	Resilience of the supply of nature's benefits to people will decline with loss of soil stability and fertility and water quality and quantity	Carrying capacity of land?	communities affected, specialised researchers, ILK holders	Indigenous and local people valuation	Networks and participatory approaches to support ILK knowledge and practice
	Relational	Nature's gifts, goods and services (actual services enjoyed, including regulating, provisioning & cultural services)	Erosion and fertility decline, Sedimentation increases, climate regulations, water quality and quantity decline	Direct and indirect impact of land use change on water quantity and quality? on food production (potential) Different dimensions of impacts? Natural systems, who is affected and in what way? Are impacts vital for livelihoods?	local communities affected* including downstream etc., governments of relevant regions and levels, soil and water scientists	Indigenous and local people valuation	Networks and participatory approaches to support ILK knowledge and practice
			Decline in food production, loss of		local communities affected*,	Market prices for pro-duction	peer-reviewed literature

Step1		Table 5.1a Land Degradation and restoration (issues identified before to help search the literature)					
			forest and forest products, decline in water availability		governments* of relevant regions and levels	decline, even if for subsistence, production functions for water decline, time required for water or fuel collection	official statistics
			Loss of ecotourism opportunities, recreational options will decline (option/bequest values lost), specific knowledge of managing certain ecosystems can be at stake, loss of places that are spiritually important	What are options to minimise the impact of land degradation on economic opportunities of local people?	local communities affected*, governments of relevant regions and levels, national economy, ILK knowledge holders	Indigenous and local people valuation	peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
GOOD QUALITY OF LIFE		Security and Livelihoods	Food security, water security, livelihood security are at stake	What is the level of dependency of different communities on critical resources?	communities affected	Livelihoods' assessments Indigenous and local people valuation	Peer review literature Networks and participatory approaches to support ILK knowledge and practice
		Sustainability and Resilience	social-ecological sustainability decline, in extreme cases outmigration can put more pressure on resources and infra-structure in the places people migrate to; Social resilience declines	How is land degradation affecting availability of labour force in rural areas? Does it affect social fabric – harmony/conflicts?	communities affected, ILK knowledge holders, specialists for integration, or coupled system understanding	Quantitative Deliberative processes Holistic and indigenous and local peoples valuation	Peer review literature Networks and participatory approaches to support ILK knowledge and practice

Step1		Table 5.1a Land Degradation and restoration (issues identified before to help search the literature)					
		Diversity and Options	loss of cultural diversity, diversity of options, may also lead to new ways of life, and how to manage the land		local communities affected, humanity, anthropologists and social scientists	Deliberative processes Holistic and indigenous and local peoples' valuation	peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Living well in harmony with nature and Mother Earth	Management of systems of life to restore harmony with nature	Is land degradation a source of conflict? How to avoid conflicts originated as a result of land degradation (on site, up-stream/down-stream, across political boundaries within and between nations?	societies or peoples affected*, indigenous leaders, local communities and indigenous peoples	deliberative processes, holistic and indigenous valuation	networks and participatory approaches to support ILK knowledge and practice
		Health and Well-being	loss of medicinal plants, malnutrition, water quality can lead to health issues, incidence of several diseases increases, destitution in extreme cases	What are the direct impacts of land degradation on public health at different scales?	local communities affected, other communities might be affected* e.g. as a consequence of immigration, ILK knowledge holders	Ethnobotanical studies,	peer-reviewed literature networks and participatory approaches to support ILK knowledge and practice
		Education and Knowledge	Traditional knowledge on managing fragile lands/ecosystems,		local communities affected,	Ethnographic studies, Anthropological studies	
		Identity and Autonomy	Cultural identity of nomadic people may be at stake, way of life might change entirely, loss of sense of place, social cohesion, social capital	How does land degradation affect the social identity e.g. of indigenous groups? and what are likely coping strategies and impacts?	local communities affected, ILK knowledge holders, anthropologists, social scientists	Qualitative Holistic and indigenous valuation	peer-reviewed literature

Step1		Table 5.1a Land Degradation and restoration (issues identified before to help search the literature)					
		Good social relations	Social resilience can be reduced by land degradation		local/affected communities		Participatory mechanism for ILK
		Art and cultural heritage	Heritage values and future options are lost, e.g. loss of totemic species associated with cultural rites, but also specific skills.	How land degradation affects local culture? What are potential ways to minimize cultural impacts?	local communities affected, future generations (who represents them?), ILK knowledge holders, social scientists, heritage organizations*, e.g. museums,	Ethnographic, qualitative, some option values might be quantified	peer-reviewed literature
		Spirituality and Religions	totemic beings, species important to spiritual or religious practices, sacred sites		religious leaders,	Ethnographic, qualitative	peer-reviewed literature
		Governance and Justice	Groups depending directly on the land become more vulnerable in extreme cases lose most of their assets and options, injustice/inequity increases	Who are the winners and losers of land degradation? What policies would be beneficial for losers (at least to minimize the loss)?	communities affected*, ILK knowledge holders,	qualitative and quantitative, needs to be disaggregated for different groups	peer-reviewed literature
					* ideally communities and peoples would be specified to help the search		

5.3. Invasive alien species and their control

5.3.1 Short description of issues involved:

The focus of the assessment might be on the threat that invasive alien species pose to biodiversity, ecosystem services and livelihoods, and the global status and trends in impacts of invasive alien species by region and sub-region. Even though biological introductions are as old as human migrations, they became a real concern in the mid-1980s, following the growth and intensification of economic, social and ecological damage related to invasions (Sagoff, 2004). Today, the study of and the fight against biological invasions are one of the most prominent issues in conservation biology. A whole discipline is developing, invasion biology, with a scientific society, several journals and whole research departments. Biological invasion management encompass broader values and representations: a sense of identity, a way to consider a good and a bad biodiversity (Peretti, 1998). For instance some vernacular names given to invaders might reflect a society's xenophobic opinions. It is thus crucial to pay a specific attention to values when dealing with biological invasion issues (whether for policy making or for managing purposes). Biological invasions management situations are almost always the scene of a great diversity of heterogeneous and competing values and interests. Integration of public values in the assessment and the collection of heterogeneous information are essential for policy making and management purposes. Any manager or policy maker who wants to tackle invasion issues could benefit from an accurate overview of the values concerned.

5.3.2. Illustrating the step-by-step approach for assessing values in the invasive species assessment

Here we apply the valuation process outlined in figure 3.1 to the assessment of invasive alien species and their control, and assume it is to be conducted separately in different regional assessments as the global level seems too aggregated for collecting and assessing information. In the following we operationalize different steps by giving examples from several well-known case studies.

Step 1: Identify value dimensions and understand where values play a role in the assessment

Purpose of the IPBES assessment is to understand the threat that invasive alien species pose to biodiversity, ecosystem services and livelihoods the global status of and trends in impacts of invasive alien species by region and sub-region

Purpose of assessing values in the alien invasive species assessment is:

- To generate understanding of values affected/at stake.
- To raise awareness of the conflicting ethical frameworks of different stakeholders (for instance between conservationists, private sector and animal right advocates).
- To acknowledge the economic and social costs of invasions
- To predict possible future costs of invasion.
- To evaluate respective costs of different policy actions (prevention, eradication, restoration and long term management)

Clarify the following *before* assessing values at stake, searching for information sources, and agreeing on approaches to aggregating, integrating or bridging different values and formats of results encountered:

What worldviews, foci and types of values are relevant within the scope of the assessment and which ones are currently reflected in the available expertise? *Agreement on worldviews according to the IPBES Conceptual Framework to be considered should be achieved by assessment team*[65]. The worldview helps framing the assessment of values accordingly to a particular knowledge system. If necessary, review all relevant worldviews in the literature and reflect on their differences. For instance, some scientific worldview on biological nativeness and ecosystem integrity could strongly differ from other worldviews that sees nature as changing.

Values can be focused on nature, nature's benefits to people and a good quality of life, (IPBES conceptual framework). It is important to cover values of all relevant groups for an assessment. Therefore a helpful starting point would be to analyse what social groups are affected by invasive species or the policies that are being implemented to control invasive alien species. When assessing different studies care should be

[65] Text in italics summarizes the scoping step from Chapter 3 Section 3.1, normal text gives indications how this might be specified in the example of an Assessment of land degradation in Africa.

taken to identify which social groups were included in any study used and which were not. Invasive alien species affects all of these foci, in a given assessment. Biological invasions management situations are almost always the scene of a great diversity of heterogeneous and competing values and interests. Any manager or policy maker who wants to tackle invasion issues could benefit from an as accurate as possible overview of the values concerned.

What scale or scales are relevant and how do they interact? *There are at least two ways scale can be considered in the valuation process: the overall scope of the valuation or assessment*: Regional, e.g. Europe *and the scale at which values are expressed:* the latter needs to be made explicit for all study results that will be used in the assessment. It is important to distinguish how values in available studies have been elicited, which may include individual, household, and community approaches. *In addition the scale of the audiences of the assessment, what policy or decision makers the assessment is supposed to inform, should be explicitly discussed (see Step 5 below on reporting results).* The IPBES assessment on invasive species is probably addressing the regional level (e.g. policies at the European commission level), as well as the national level that are affected by policies or by invaders. For instance, in the case of regional control, confinement and eradication of the invader, one can expect changes in laws and regulations at the national level. In relation to valuation, scale can play out in several ways. For instance, in the case of grey squirrel eradication in Europe, one can value the interest of the animal targeted by an eradication plan as well as the integrity of the invaded ecosystem and local biodiversity. In the context of good quality of life, it is essential to understand cross-scalar interactions as measures on invasive alien species can have impacts on health (ex. Case of Fire Ants East-South USA) as well as in community structure and identity (ex. Nile Perch in Lake Victoria)

What broader social context needs to be considered? *Relational values are important elements in the valuation of nature and its benefits. Thus a scoping process must consider how methods take into account the nature of relationships between people across scales, including power relationships, material and spiritual relationships and interactions about people and nature, the distribution of incomes and resources as well as gains and losses, externalities, and reciprocal relationships. These considerations include persons not actively taking part in the valuation, especially future generations. Consideration of the broader social context includes how methods account for the effects of anthropogenic assets, institutions, governance, and other drivers on the values of nature and its benefits.* As mentioned before, biological invasions management situations are almost always the scene of a great diversity of heterogeneous and competing values and interests. Any manager or policy maker who wants to tackle invasion issues need to pay attention to this diversity and provide a platform that allows different worldviews and interests. Intergenerational aspects need to be considered in the case of irreversibility of invasions. In the case of loss of local livelihoods, policy schemes are essential to explore as they could suggest several options from compensation to incentive-schemes that suggest changing local activities. Such policy options have implications on social justice if unequal relations of power in the community are not taken into account. Furthermore, one could also evaluate if invasive species change landscapes to an extent that they threaten and change spiritual and religious practices or community identity (see table 5.3.1 for policy relevant questions)

Step 2: Searching the literature

In an assessment context, this means first scanning the literature (including gray literature and all potential sources outlined in Chapter 4) and identifying knowledge gaps. The expert group can then prioritize certain values for further analysis. Every assessment should provide a general overview of values at stake (including the paradigms and worldviews under which they have been carried out), where gaps of current accessible knowledge are and explicitly indicating which ones have been prioritized and why. In this context, more expertise on qualitative approach that can unfold local perceptions, ethical issues, and eco-ethnological impacts is suggested for the assessment on invasive alien species and their control.

Step 3: Categorizing, sorting and assessing values - which values have been elicited (in the literature) and how?

Literature on biological invasions management issues is dominated by few disciplines such as ecology and economics. In this respect, a specific challenge for value assessments in the context of biological invasions is that it may be that some values at stake are either unconscious or willingly hidden and dissimulated under "so-called" objective statements about ecological or economic issues. Review should encompass a broad range of disciplinary approaches including history, social science and anthropology. Epistemic community can share a strong normative bias regarding the issue at stake for instance it has been reproached to invasion biologists to overemphasize the damage of biological invasions (Larson, 2005) and reciprocally it has been reproached by social scientists to disregard ecological evidence (Simberloff et al., 2013) The scientific vocabulary itself is more than often normative (Larson, 2005; Larson, 2007). Indeed, literature on biological invasions is highly value laden. In the context of invasive alien species and their control, one could find more studies done in the fields of economy and ecology. However, there is growing number of qualitative studies that cover ethical and local implications of invasive species. If there are important gaps in the studies, state those gaps and possibly suggest ways to fill-in such gaps. Examples to fill the gaps could include the use of Expert Delphi technique and/or engaging ILK holders. This at least helps future research to be more comprehensive in uncovering different values from different perspectives. There is a huge amount of literature on the ecological and economical valuation linked to biological invasion, for specific cases as well as at more global levels. A great diversity of qualitative studies on local perceptions, ethical issues, eco-ethnological impacts are also available and multiplying.

Step 4: Synthesis, up-scaling and integration

What might make sense to aggregate, integrate or bridge will depend on the specific focus of the assessment and on the availability of relevant study results, as opportunities for additional valuation studies will be extremely limited if at all.

It should be noticed that most evaluations will have to assess a variety of the values presented in the table and thus will need mixed methodologies and multi-criteria analysis.

Invasive species strongly affect nature itself this part needs to be understood in order to better understand values at stake regarding nature's benefits and quality of life. Often 'describing what is there and how important some values are in some contexts' will be an important first step. Beyond this, the policy context and how applicable the results are will determine the level of integration or bridging of the findings that can usefully be done. For example, values of the same ES found using different disciplinary methods may need to be reconciled, or at least the differences explained, for policy purposes. Even with the use of the same valuation method, values found at the scale of a study area need to be integrated or bridged for application. Where incommensurable values are being considered, the assessment needs, at least, to recognise that complexity, and if possible, indicate any practical ways of dealing with it. It is important to be aware that values under different paradigms and worldviews usually cannot be integrated, for example, monetary valuation under the Living-well in balance and harmony with Mother Earth.

Step 5: Deriving and communicating results

As indicated above, the first result of an assessment of values will be to provide an overview of potentially relevant values and a description of the knowledge available about them. The challenge is to make statements that are useful for policy even where little information is available. Case studies can be used to illustrate the significance of certain values in specific contexts. Creating awareness of the diversity of values at stake, which paradigms and worldviews are considered and which are not, the potential implications of a decline of nature's ability to provide these values for the quality of life and relational values within societies can be much more important than exact figures.

Results should also address and be communicated at different levels and contexts of decision making. For example, in the case of exotic plant invasion, there are decision makers at several levels. At the local level, management of natural reserve are influential in identifying the drivers of the plant invasion. However, they have to work together with the government officials at the state level for raising public awareness (for linkages between spread of domestic gardens and exotic plant invasion) and for implementing long term monitoring of plant communities (Pauly, 1996). At the international level, the role of European

Commission is also essential as they could suggest measures on international trade of exotic ornamental plants.

This kind of assessment will share all the challenges and difficulties mentioned in the general context. Special attention should be paid to the integration of public values in the assessment and the integration of very heterogeneous information.

5.1b. Invasive species and their control							
Category	**Type of values**	**Focus of values**	**Example targets of valuation for invasive species**	**Examples of policy relevant questions**	**Key stakeholders, knowledge sources, expertise**	**Methods/ approaches.**	**Data & Information sources**
NATURE *Intrinsic value*	**Non-anthropocentric**	Individual organisms	The species existence (for instance when an endemic species is threatened by an exotic competing population). Some charismatic plants can be at stake in some exotic invasion issues and raise social concern for the individual plant themselves (example :Exotic trees in gardens or native trees threatened by an exotic	What are the threats and implications of invasive species to indigenous species and natural ecosystems?		Minimum viable population analysis Preference assessment	Peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Biophysical assemblages	Populations, communities, Evolutionary potential of the community			Minimum viable population analysis	
		Biophysical processes	The value of diversity for itself, Ecosystem integrity			Ecological assessment of the situation (demographic trend of the targeted species, ecological impact of the invasion…) Qualitative inquiries about the social perception of the issue at stake. Economic and technical assessment of the impacts of diverse available control techniques (displacement, sterilization, killing…)	Peer-reviewed literature
		Biodiversity	Indigenous biodiversity - Endemism Global biodiversity Possible threat to local sterns			Global biodiversity mapping Global range of distribution mapping Mapping of global transportation means for exotic species (people, boats, seeds…)	peer-reviewed literature

NATURE'S BENEFITS TO PEOPLE	*Biophysical*	Biosphere's ability to enable human endeavour (energy, materials, land)				biophysical and geochemical studies	
	Instrumental	Nature's ability to supply benefits (basis of benefits)	Resilience of the supply of nature's benefits to people, nutrient cycling	What are the impacts of invasive species on ecosystem services in place and what are the cost of clearing and restoration programmes ??			Peer reviewed literature
	Anthropocentric	Nature's gifts, goods and services (actual services enjoyed, including regulating, provisioning, cultural services)	Regulating : Invaders often play an ecological role (positive or negative)				peer-reviewed literature
			Provisioning: A lot of exotic species are initially introduced because of their provision value Competition for aquaculture			Diverse ecological measures Biophysical modeling approaches	peer-reviewed literature
			Cultural services: Recreational/Educational virtue of some management programs that include civil society. Scientific value of "open field experiment" (Brown & Sachs 2004) Recreational value of easy birdwatching			Biophysical valuations Market-oriented valuations Sociological inquiries	peer-reviewed literature
GOOD QUALITY OF LIFE	*Relational*	Security and Livelihoods	The resilience of the ecosystem is affected by invasion Negatively (Kudzu, Nile Perch, etc.) Positively (e.g. when an exotic pollinator replaces an extinct native one)	How are the livelihoods change as a result of an introduced species? What type of policy options are there to compensate local livelihoods ?			peer-reviewed literature Anthropological accounts Socio-economic assessment reports

		Sustainability and Resilience	Bequest value of pollination, Ecological, social, economic, social-ecological sustainability Long delay between the invasion and its full effects Increasing costs with time Possible irreversibility of some invasions	What are the public values at stake of future generations in the case of irreversibility of invasions ?	Current and future generations	Sustainability frameworks such as transition theory, systems- analysis, DPSIR	peer-reviewed literature
		Diversity and Options	Cultural diversity and biodiversity				
		Living well in harmony with nature and Mother Earth	The understanding of the balance between different ecosystems and cultural background challenged by invasion, and options for restoring the balance between peoples		Communities	Indigenous and local knowledge systems valuation	peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Health and Well-being	The Fire Ants (Solenopsis invicta), in the South-East of US Emergent diseases (West Nile Virus)	What are the economic and social cost of disease control as a result of problems related with invasive species ?	Governments Health institutions Academics Community Donor institutions	Monetary valuations Participative economic valuations Deliberative valuations Public health valuation	Peer-reviewed literature WHO reports
		Education and Knowledge					
		Identity and Autonomy	Biological invasions can crystallise some identity and nationalism feelings and discourses			Deliberative valuation Holistic and indigenous methods	Peer-reviewed literature
		Good social relations	Community cohesion, social resilience, conviviality.			Sociology and anthropology. Use of focus groups	holistic and indigenous and local knowledge systems
		Art and Cultural heritage	Inspiration, artistic creation: invasions can be quite inspiring or increase aesthetic values				Peer-reviewed literature
		Spirituality and Religions	Sacred sites, totemic beings, spiritual well-being	Are invasive species changing landscapes to an			Peer-reviewed literature

				extent that they threaten and change spiritual and religious practices ?			
		Governance and Justice	Environmental justice, intra-generational equity, inter-generational equity...	Have equitable approaches taken in prioritising areas for restoration and control of invasive species?	Communities Current and future generations	Political ecology Deliberative valuation Holistic and indigenous methods	Peer-reviewed literature

5.4. Sustainable use and conservation of biodiversity and strengthening capacity and tools

The concept of sustainable use of resources is deeply ingrained in societies that continue to hold the worldview that humans should live in harmony with nature and Mother Earth. Such societies have evolved strong institutions (sets of beliefs, norms, taboos, laws and regulations) that deter their members from exploiting ecosystems and resources therein beyond limits that will affect their functioning and population or quality. Furthermore, - through a long and continuous interaction with nature and Mother Earth, such societies have a deep knowledge of the resources available, ecological cycles, appropriate harvesting or hunting period and utilization of the resource for various needs, including the spiritual relationship between peoples and nature. Stewardship towards nature or certain species is an important value in many societies and religions. With changes to environmental governance patterns and dominance of a prominent worldview focused on rational, positivist thinking, and a shift away from sustenance-based economies, the concept of sustainable use has entered the lexicon, meaning a rational use of the natural resources without undermining the capabilities of regeneration of natural resources. However, sustainable management of ecosystems, including use and conservation of biodiversity, appears to be a crucial aspect in different knowledge systems and not only in rational utility economy. Sustainable use and conservation of biodiversity is one of the challenges for all societies to interact with nature and Mother Earth thinking in future generations. Therefore, sustainable use and conservation of biodiversity can be analysed from different worldviews: i) traditional and local knowledge systems, where the traditions and local efforts for managing ecosystems and nature sustainably for current and future generations are emphasized, ii) biocentric scientific perspectives on the natural dynamics and the effects of management on these resources, iii) management perspectives on how to achieve and sustain maximum harvest, iv) economic assessments of costs and benefits of maintenance of the resources, v) practical guidance to support sustainable management and awareness of the threats into the future. This focuses on utilization of resources within sustainable limits and by implication also relates to the rights and responsibilities of various actors who have a stake in a resource or ecosystem function and service. It also relates to the rights of different actors to their various needs such as livelihoods, traditional territories, sense of place, and access to production sites, sites of habitation, and various other ecosystem functions and services. Sometimes, the values held by different actors towards resources, functions, ecosystems and production systems vary and could result in conflicts. Some examples include the interaction of traditional values with new values imposed by public policies (eg. mixed cropping with monocropping; retention of farmland vs creating more urban areas); through the in-migration of people who do not attribute similar values to the biodiversity and ecosystems where they move into; or the demands on production patterns dictated by consumers from distant cities.

In the context of sustainable use and conservation of biodiversity, the values attributed to nature should emphasize the diversity of values depending on different worldviews and knowledge systems and should include anthropocentric and non-anthropocentric 'types of value', such as genetic, populations, species, community, type of ecosystem, species identity, species' functional characteristics, species' requirements. Among nature's benefits, all kinds of uses of biodiversity can be included, such as food, medicine, construction, decoration, and spiritual services. It is also important to emphasize the role of populations and communities and their impacts on these services. These resources are tightly linked to worldviews themselves and relational values, to livelihoods, and to cultural values associated with heritage or identity or traditional knowledge. For good quality of life, impacts of biodiversity and its sustainable use are linked to supplying resources to satisfy basic needs, income, security in terms of providing equity as well as a range of options, health in terms of medicinal plants, sustainable livelihoods, sustainable production and consumption patterns and sustaining the capabilities of regeneration of systems of life of nature. Several methodologies can be used depending on the target research areas. Biophysical approaches are needed to assess diversity of resources, population sizes and how they can be managed sustainably. Economic approaches are needed to assess opportunity costs, costs of management, net benefits and links to market prices. Public health methods assess the diverse human health effects from various domains (nutrition, infectious disease, non-communicable disease and mental health). Socio-cultural analysis provides various ways of understanding sustainability, resource use and conservation by analysing tensions, society's preferences, historical meanings as well as institutional challenges and opportunities. Holistic approaches, including indigenous and local knowledge systems, are needed to understand the role of this biodiversity in different worldviews and livelihoods from an integrated perspective, including the development of

socio-economic and ecological systems. A mixed method, which combines these approaches, is suitable for IPBES assessments, or where available, studies and results from the different approaches mentioned should be considered in the assessments.

5.1c Sustainable use and conservation of biodiversity and strengthening capacity and tools.						
Category	**Type of values**	**Focus of values**	**Example targets of valuation for sustainable use and conservation of biodiversity**	**Key stakeholders, knowledge sources, expertise**	**Methods/ approaches.**	**Data & Information sources**
NATURE *Intrinsic value*	**Non-anthropocentric**	Individual organisms	Sacred being (cannot be killed) reverence for large trees Issues related with hunting and harvesting Animal welfare reverences to the soul of hunted animals after Life	Hunters, harvesters Rural populations Urban populations Citizens Culture in general	Ethnographic, Ethnoecology History ILK systems	Books Book chapters Peer review literature Material art Networks and participatory approaches to support ILK knowledge and practice
		Biophysical assemblages	Sacred ecosystems, Pachamama, Mother Earth. Religious views			
		Biophysical processes	Evolution and ecological resilience			
		Biodiversity	Endemism, genetic diversity, functional diversity, species diversity, Biodiversity of insects, bats and bees and flowering plants			
NATURE'S BENEFITS TO PEOPLE	*Biophysical*	Biosphere's ability to enable human endeavour (energy, materials, land)	Energy extracted from the ecosystem Proportion of energetic needs provided by ecosystems	Urban populations Rural populations	Biophysical (e.g. energy analysis, ecological footprint, material flow analysis Economic (market and non-market assessments	Global and regional databases Peer review literature Grey literature
			Total material consumption, life cycles, carbon footprint, water footprint...			
			Land cover flows, ecological footprint...			
	Instrumental	Nature's ability to supply benefits (basis of benefits)	Resilience of the supply of nature's benefits to people	Local to global level managers and policy makers	Quantitative and qualitative information Biophysical: indicators of ecological resilience	Peer-reviewed literature

	Anthropocentric				Indigenous and local knowledge systems	
	Relational	Nature's gifts, goods and services (actual services enjoyed, including regulating, provisioning, and cultural services)	Wild food sources, medicinal plants and animals, resources for ritual events, for arts and crafts	Hunters, Harvesters, Managers Policy designers Ecotourists	Quantitative and qualitative information Biophysical (amount of resources available Maximum sustainable use, Negative aspects of harvesting or sightseeing) Geographic (where are resources located) Deliberative (which species are preferred) Ethnoecological (which species are used and how) Economic (non-market assessments Indigenous and local knowledge systems Holistic valuation	Books Peer-reviewed literature Grey literature Global and regional databases
GOOD QUALITY OF LIFE		Security and Livelihoods	Food security and livelihoods security. Food sovereignty Institutional diversity Social cohesion TEK adaptive co-management	Hunters, Harvesters, Managers Policy designers	Biophysical (insurance value, demand vs. supply) Political ecology (who has access) Economic Indigenous and local knowledge systems	peer-reviewed literature, Norms, laws and agreements

		Sustainability and Resilience	Resources availability for today and into the future Social-ecological resilience of harvesting or hunting Precautionary principle Buffers against shocks	Current and future generations	Sustainability frameworks such as transition theory, systems- analysis, DPSIR Holistic valuation	Peer-reviewed literature
		Diversity and Options	Cultural diversity and biodiversity Biocultural diversity Local traditional knowledge Bequest value	Hunters, Harvesters, Managers	Biophysical (diversity of options) Ethnoecological (diversity of uses) Political ecology (diversity in access) Holistic and indigenous knowledge systems	Peer reviewed literature Grey literature Material culture
		Living well in harmony with nature and Mother Earth	Relationships and interactions between people and nature inherently entwined as systems of life in Mother Earth; Stewardship of nature and resources …	Communities and indigenous peoples	Quantitative and qualitative information Deliberative processes Indigenous and local knowledge systems Ethnography Sociology History	Networks and participatory approaches to support ILK knowledge and practice Peer review literature Grey literature Material culture
		Health and Well-being	Impact of sustainable use on Physical, mental, holistic health, keeping genetic pool resources Zoonotic diseases	Rural populations Urban populations	Nutrition Epidemiology Psychological health	Peer-reviewed literature Grey literature Global and regional databases
		Education and Knowledge				
		Identity and Autonomy	Cultural identity, religious and spiritual identity, sense of place.	Community and individuals	Qualitative approaches, anthropology, tools such as narrative analysis, interviews	

		Good social relations	Community bonding Community rituals		Sociology and anthropology. Use of focus groups	Peer-reviewed literature
		Art and cultural heritage	Sacred sites Artistic creation Inspiration		Anthropology	
		Spirituality and Religions	Sacred sites, totemic beings, spiritual well-being…		Anthropology, religious texts and studies	
		Governance and Justice	Distributional justice future access to resources) intra-generational equity (equal access across gender socio-economic status, religion, ethnicity) Water grabbing, Land grabbing Virtual water	Current and future generations	Qualitative approaches such as political ecology, ethnography… Discount rate Ecological debt	

5.4.1 An application of assessment steps to wetlands

An application of assessment steps to wetlands is described in Table 5.2. Wetlands are ecosystems located at the interface of land and water systems. The wise use approach, adopted by 168 Contracting Parties to the Convention on Wetlands, recognizes human sustainable use of wetlands, on the basis of their value ascription, as compatible with conservation (Finlayson et al, 2011). It also encourages engagement with stakeholders and transparency in negotiating value trade-offs and determining equitable outcomes for conservation. Wise use is defined in the Convention text as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development". Ecological character is "the combination of ecosystem components, processes and benefits / services that characterize the wetland at a given point in time". Ecosystems approaches call for considering the complex relationship between various ecosystem elements and promote integrated management of land, water and living resources; that is, the integration of values emphasizing sustainable development, the call for wise usage of resources and resource use patterns that can ensure that human dependence on wetlands can be maintained not only in the present, but also in the future. Contracting Parties to the Convention are committed to wise use of wetlands in their territory.

Achieving wise use entails actions at multiple levels, by a diversity of actors with different values ascribed to wetlands. These include, *inter alia* managing sites based on integrated management plans which address all drivers of degradation, basin and coastal zone level management plans taking into account the full range of values, and at national scale, mainstreaming the values that people ascribe to wetlands into sectoral development plans and programmes which directly or indirectly influence wetland features. The table below elucidates the application of this guides assessment steps (outlined in Chapter 5) for the multiple values that people ascribe to wetlands (outlined in Chapter 2) at three different policy scales, namely site management, river basin/ coastal zone management within which wetland is located and the overarching national wetland programme which stimulates action at the two scales, as well as global cooperation for wetland wise use.

Table 5.2: *Applying the assessment steps for values of wetlands at different decision-making scales*

Assessment Steps		**Decision-making Scale**		
		Wetland site manager / Wetland management authority	River basin / Coastal zone management	National Wetland Focal Point / National Wetland Committee
Step 1: Identifying value dimensions and where values play a role in assessment	Issues at stake in the mandate of assessment	Unsustainable wetland use	Land and water use in the river basin / coastal zone lead to adverse change in wetland ecological character	Sectoral policies and programmes do not recognize the full range of values that different stakeholders ascribe to wetlands
	Relevant scale	Wetland site	River Basin / Coastal Zone	National
	Stakeholders	Site managers; on-site, upstream and downstream wetland users; community organizations; NGOs; knowledge centres	River basin / coastal zone managers; government departments entrusted with sectoral planning; land holders; private investors; knowledge centres; NGOs	National ministries; planning organizations; knowledge centres; national NGOs; inter-governmental organizations
	Expected policy outcome	Integrated site management to achieve maintenance of site's ecological character	Integration of wetland values in land and water use planning in river basin / coastal zone management	Mainstreaming wetlands values in national sectoral developmental programming
	Valuation purpose	Assessing value trade-offs resulting from various direct and	Assessing value trade-offs resulting from impact of different land	Assessing value trade-offs resulting from impact of (national /

			indirect uses of the wetland (including upstream and downstream uses)	and water use practices on wetland values	provincial) sectoral policies on wetland values
			Identifying site management practices that help maintain full range of values (by preventing any adverse change in ecological character)	Identifying ways and extent to which wetland wise use helps in delivering land and water management objectives for the river basin / coastal zone (e.g. extent to which maintaining functional wetlands can reduce floods)	Identifying ways and extent to which wetland wise use helps in achieving sectoral development goals (e.g. food security, poverty reduction)
	Scope of values		Wetland biodiversity and ecosystem services values associated with livelihood systems of direct and indirect users	Wetlands biodiversity and ecosystem services values associated with basin / coastal zone level conservation and development objectives	Wetland biodiversity and ecosystem services values associated with national sectoral development programming objectives
Step 2: Searching the literature	Data sources		Site management plans; published and unpublished research	River Basin / Coastal Zone plans; wetland inventories; published research on ecological character elements	National wetland plans; wetland inventories; published research on ecological character elements
Step 3: Categorizing, sorting and assessing values	Valuation targets and examples	**Non-anthropocentric**			
		Individual organisms	In a relational worldview, the living beings (e.g. animals, plants, insects) that live in the wetland, and their quality of life	Values associated with 'species at risk'	Values associated with 'species at risk'
		Biophysical assemblages	Populations and communities of wetland life; wetland physical settings; relational importance of ecosystem as home for all of these beings	Influence of river basin / coastal zone processes on wetland geomorphic, physical, soil and water regime settings and habitats	Influence of sectoral developmental programming on wetland physical, geomorphic, soil and water regime settings and habitats
		Biophysical processes	Ecosystem processes (physical processes, energy-nutrient dynamics, processes that maintain plant and animal populations, species interaction) that underpin delivery of wetland ecosystem services	Ecosystem processes (e.g. physical processes and processes which help maintain plant and animal species populations) which underpin delivery of ecosystem services within river basin / coastal zone in relationship with river basin / coastal zone management	Ecosystem processes in relation with sectoral developmental programming (e.g. altered wetland species migration due to regulation of river flows and inundation regimes)
		Biodiversity	Wetland biota; endemism; site's relevance in regional biodiversity e.g. flyways of migratory waterbirds	Contribution of wetland biodiversity to biodiversity objectives of river basin / coastal zone management (e.g.	Contribution of wetland biodiversity values to national biodiversity targets; international MEA commitments

		maintenance of habitat connectivity)	
Anthropocentric			
Biosphere's ability to enable human endeavor	Emergy; Primary Production	Interlinkages of river basin / coastal zone management with site's emergy and primary production	Interlinkages of sectoral programming with site's emergy, primary production etc.
Nature's ability to supply benefits	Wetland ecosystem resilience	Interlinkages of river basin / coastal zone level land and water resource management with wetland ecosystem resilience	Interlinkages of sectoral programming on ecosystem resilience
Nature's gifts (goods and services)	Wetland ecosystem services of provisioning food, medicines, and other materials benefiting local communities	Wetland ecosystem services delivered at river basin / coastal zone scale (water provision, food production, nutrient retention, moderation of hydrological regimes, buffering of extreme events etc.)	Contribution of wetland ecosystem services to national development policy objectives of food, water and climate security
Security and livelihoods	Wetland values in the context of food, water and livelihood security of wetland dependent communities	Wetland values in the context of basin / coastal zone level food, water and livelihood security	Wetland contributions to national scale food, water, livelihood and climate security values
Sustainability and resilience	Sustainability of resource harvest and land and water uses associated with wetlands	River basin and coastal zone management practices that support and enhance ecosystem components and processes	Sectoral management practices that support and enhance ecosystem components and processes
Diversity and options	Wetlands as settings for diverse livelihood functions	Interlinkages of river basin and coastal zone management with wetland dependent livelihood systems	Interlinkages of sectoral programming with wetland dependent livelihood systems
Living well in harmony with nature and mother earth	Degree of concordance between livelihood value functions and wetland ecosystem functioning	Degree of concordance between river basin / coastal zone management and wetland ecosystem functioning	Degree of concordance between sectoral development programming and wetland ecosystem functioning
Health and well-being	Wetland ecosystem services and biodiversity contributing to health of communities living in and around wetland	Wetland ecosystem services contributing to basin wide health and well-being objective	Contribution of wetland ecosystem services to national health objectives (i.e. food and nutritional security, insurance value etc.)

	Education and knowledge	Wetlands as settings for multiple epistemologies and knowledge systems supporting wise use	Epistemologies and knowledge systems to link wetland management with river basin / coastal zone management	Epistemologies and knowledge systems to link wetland management with national sectoral developmental programming
	Identity and autonomy	Wetlands informing cultural, religious, and spiritual identity; Sense of place	Wetlands contributing to identity of river basin / coastal zone management	Wetlands contributing to identity of sectoral policy planners and decision makers
	Good social relations	Wetlands as settings for social cohesion and collective action	Consideration of wetland issues within stakeholder engagement processes in river basin / coastal zone management	Consideration of wetland issues within stakeholder engagement processes in national sectoral policy making
	Art and cultural heritage	Art and cultural values associated with the wetland	Value of wetlands as a part of basin / coastal zone wide art and cultural heritage	Value of wetlands as part of national art and cultural heritage
	Spirituality and religion	Spiritual and religious values associated with wetland	Wetlands within the network of sites within river basin / coastal zone with significant spiritual and religious values	Wetlands within the national network of sites with significant spiritual and religious values
	Governance and Justice	Cross-sectoral institutional architecture for representation of sectoral interests in site management	Representation of wetland ecosystem services and biodiversity values in basin / coastal zone scale institutional architecture	Institutional mechanisms for inter-sectoral coordination for wetland wise use at national scale
		Social equity in access and benefit sharing from wetland ecosystem services and biodiversity values		
Step 4: Synthesis, upscaling and integration		Status and trends in values included in site inventory, monitoring systems and management plan	Wetland values included in basin / coastal zone level status and trends	National scenarios on status and trends in wetland values
		Values as an input to assessing outcomes of alternate wetland management	Values as an input to assessing outcomes of alternate river basin / coastal zone management	
		Values outputs derived such that they can be aggregated at basin / coastal zone level status and trends	Values outputs derived such that they can be aggregated into national scenarios	Values outputs derived in relationship with national policies, MEA committments
Step 5: Deriving and Communicating Results		Values reported as part of site management plan effectiveness; stakeholder level outreach	Values reported as part of basin/coastal zone level management plan effectiveness; basin/coastal zone level outreach	Scenarios report for communication to national ministries, planning agencies, MEAs

5.5. Guide to regional assessments:

Four different regional assessments are being conducted; here a hypothetical example is used to illustrate the application of the step-by-step approach to assessing values in the context of a regional assessment exercise: the status of and changes to food security, biodiversity loss and biofuel crops in Southeast Asia.

Purpose of the Assessment: The Assessment should help to make decisions on conservation and sustainable use of biodiversity for the region as well as enhancing knowledge about key drivers of biodiversity loss and their implications for a 'Good quality of life'. It also aims to enhance understanding of values of biodiversity and ecosystem functions and services, land use options for this region including the consideration of systems of life of nature and Mother Earth.

Specifically, it addresses the following policy relevant questions:

- How might achieving food security and the development of biofuel crops affect conservation and sustainable use of biodiversity?
- How to balance the trade-offs of food security, biodiversity loss and biofuels?
- How to manage the health (food security, air pollution, etc.) and economic trade-offs that arise from ecosystem transformation driven by biofuel agriculture?

Step 1: Identifying value dimensions and understanding where values play a role in your assessment

Types of values to be considered/captured: see table 5.1d considering different paradigms and worldviews in the context of the IPBES Conceptual Framework. In this example, only a few values are considered for demonstration. It is to be noted that the assessment team needs to be as inclusive as possible. These values were chosen as they address the goals and aspirations of different stakeholders including conservation interests, national policy interests, livelihood and cultural interests of local communities, developmental, health and well-being goals to be addressed.

Values chosen to address specific policy relevant questions in this example include:

- Biodiversity
- Provisioning of food and energy
- Security and livelihoods
- Governance and justice
- Spirituality and religion
- Health and well-being

Stakeholders/ Interest groups to be engaged

- Local communities & Representatives (farmers, indigenous peoples)
- NGOs working on conservation and equity issues
- Researchers/ Scientists
- National, regional and local governments, Business community
- Relevant Government officers (from Forest Department, Agriculture, Education, Tourism, Meteorology, Water resources, Environment, Energy, Health, Land)

Step 2 & 3: Collecting, categorizing, sorting and assessing values – This requires a mix of expert knowledge from formal and non-formal sources and literature review (please see table 5.1d), including Indigenous and Local Knowledge Systems (ILK) and practices (assessment team could look at documented records of land use; organize workshops).

a) Data sets that can be targeted

- FAOSTAT
- Landsat RS maps

- Socio-economic data from ADB, national data
- SEEA,
- IUCN data
- Asean Center for Biodiversity
- Literature surveys
- Sociological data surveys
- Participatory surveys and workshops, if required

b) Selection of methods that might have been used to generate certain types of information:

- Economic methods (Cost-Benefit): for income, alternate land use, opportunity, livelihoods, food security
- Ethnographic/ Socio-cultural methods/ Holistic/ Indigenous methods: for systems of life and livelihoods, food security, self-determination, rights to resources, territorial mapping, local priorities
- Biophysical methods: for agrobiodiversity, broader biodiversity, ecosystem functions and related (e.g. Remote sensing methods, species listing, ecosystem red listing)
- Public health methods: food security, health indices,

Step 4: Synthesis, up-scaling and integration of results

The following methods might be used to synthesize the diverse results found.

- Perhaps Multicriteria analysis
- Deliberative methods are useful especially to identify trade-offs and solutions between values that are difficult to measure, e.g. many of the 'Good quality of life' values, and values that are more easily quantified (this is especially true when only a limited number of values are considered for the assessment, requiring extrapolation of inferences from narratives and other qualitative methods through deliberative methods)
- For the regional assessment, a higher degree of aggregation of data will be required and broader range of ecosystem services have to be considered. Assumptions of transboundary co-operation need to be taken for site selection.

Step 5: Deriving and communicating results

- Several outputs can be designed to target different purposes- from policy intervention to local level implementation. These could range from developing various scenarios and highlight likely outcomes; developing targeted policy briefs on issues pertaining to national and regional interests; highlighting gaps in information and knowledge and identifying potential future research and action, etc.

5.1d Regional Assessment of status and changes to food security, biodiversity loss and biofuel crops in Southeast Asia (hypothetical example)							
Category	**Type of values**	**Focus of values**	**Example targets of valuation for regional assessments**	**Examples of policy relevant questions**	**Key stakeholders, knowledge sources, expertise**	**Methods/ approaches**	**Data & Information sources**
NATURE *Intrinsic value*	**Non-anthropo-centric**	Individual organisms	Species diversity (plants and animals) Issues related with hunting and harvesting Charismatic species (e.g., orang-utans)	What biodiversity richness do people perceive in the area?	Hunters, harvesters, indigenous peoples, Rural populations, citizens	Ethnographic, Ethnoecology Historical records	Books & book chapters Peer review literature Material art, remote sensing maps, Participatory interviews or meetings, Networks and participatory approaches to support ILK knowledge and practice
		Biophysical assemblages	Mosaic landscapes, Communities and systems of life				
		Biophysical processes	Evolution and ecological resilience			Hydrological methods, soil science, population studies	Data Records, Maps, Networks and participatory approaches to support ILK knowledge and practice.
		Biodiversity	Endemism, genetic diversity, functional diversity, species diversity, Diversity of plants, animals and ecological complexes			Biophysical indicators	Remote sensing maps, Records, networks and participatory approaches to support ILK knowledge and practice
NATURE'S BENEFITS TO PEOPLE	*Biophysical*	Biosphere's ability to enable human endeavour	Energy extracted from the ecosystem Proportion of energy needs provided by		Urban populations Rural populations	Biophysical (e.g. energy analysis, ecological	Global and regional databases Peer review literature

	Instrumental **Anthropocentric** *Relational*	(energy, materials, land)	ecosystems		Importers	footprint, material flow analysis Economic (market and non-market assessments	Other literature
			Total material consumption, life cycles, carbon footprint, water footprint...				
			Land cover flows, ecological footprint...				
		Nature's ability to supply benefits (basis of benefits)	Resilience of the supply of nature's benefits to people		Local to global level managers and policy makers	Biophysical: indicators of ecological resilience	Peer-reviewed literature
		Nature's gifts, goods and services (actual services enjoyed, regulating, provisioning, cultural)	Wild food sources, medicinal plants and animals, resources for ritual events, for arts and crafts	What is the dependence of the national and international population on the biodiversity and ecosystems from this region to meet food security? What is the dependence of the national and international population to meet green energy needs?	Hunters, Harvesters, Managers Policy designers Ecotourists	Biophysical (amount of resources available, Maximum sustainable use Impacts of overharvesting, land use change, monocropping) Geographic (where are resources located) Deliberative (which species are preferred) Ethnoecological (which species are used and how) Economic (market and non-market assessments Indigenous and local knowledge	Books Peer-reviewed literature Other literature Global and regional databases Networks and participatory approaches to support ILK knowledge and practice

GOOD QUALITY OF LIFE		Security and Livelihoods	Food security and livelihoods security. Food sovereignty Health security Income Institutional diversity Social cohesion TEK adaptive co-management	What are the economic benefits of biofuel production at various levels?	Hunters, Harvesters, Managers Policy designers	Biophysical (insurance value, demand vs. supply) Political ecology (who has access) Economic (market and non-market) ILK	Peer-review literature Norms, laws and agreements Networks and participatory approaches to support ILK knowledge and practice
		Sustainability and Resilience	Resources availability for today and into the future Social-ecological resilience of harvesting or hunting Precautionary principle Buffers against shocks		Current and future generations	Sustainability frameworks such as transition theory, systems-analysis, DPSIR	Peer-reviewed literature
		Diversity and Options	Cultural diversity and biodiversity Biocultural diversity Local traditional knowledge Bequest value		Hunters, Harvesters, Managers	Biophysical (diversity of options) Ethnoecological (diversity of uses) Political ecology (diversity in access)	Peer-reviewed literature Grey literature
		Living well in harmony with nature and Mother Earth	Relationships and interactions between people and nature inherently entwined as systems of life in Mother Earth; Stewardship of nature and resources		Indigenous peoples, local communities	Quantitative and qualitative information Deliberative processes indigenous and local knowledge	Peer-review literature Grey literature Networks and participatory approaches to support ILK knowledge and practice
		Health and Well-being	Impact of sustainable use on Physical, mental, holistic health, availability and sustenance genetic pool resources	What are the health values provided by the forests? To what extent does conversion of forests for biofuel affect air and water quality and the	Rural populations Urban populations	Nutrition Epidemiology Psychological health	Peer-reviewed literature Grey literature Global and regional databases

			Zoonotic diseases	prevalence of non-communicable diseases? What are the opportunity costs of prioritizing biofuel expansion over agricultural production in achieving food security? What are the opportunity costs to health/nutritional security from reducing forest biodiversity due to habitat conversion for biofuels?			
		Education and Knowledge	Persistence of knowledge on use of resources, sustainable harvesting, sites for study, inspiration		Community, Individuals, researchers, Local Government,		
		Identity and Autonomy	Cultural identity, religious and spiritual identity, sense of place.		Community and individuals	Qualitative approaches, anthropology, tools such as narrative analysis, interviews	Peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Good social relations	Community bonding Community rituals			Sociology, anthropology. Use of focus groups	Peer-review literature Networks & participa-tory approaches to support ILK knowledge and practice
		Art and cultural heritage	Sacred species Sacred sites Artistic creation Inspiration			Ethnographic studies, Anthropology	Images, Ceremonies, Art

		Spirituality and Religions	Sacred sites, totemic beings, spiritual well-being…	How does the expansion of biofuel production affect customary practices of indigenous and local people? (or) How do customary practices of IPLCs affect the development of biofuel plantations?		IPLC, Ethnographic studies, Anthropology, ILK	
		Governance and Justice	Distributional justice (future access to resources) intra-generational equity (equal access across gender socioeconomic status religion ethnicity) Equitable access to various resources	How does the expansion of biofuel production affects access to land and land use?	Current and future generations	Qualitative approaches such as political ecology, ethnography Discount rate Ecological debt	Peer-reviewed literature

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Chapter 6: Capacity building

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Capacity building is a key component of IPBES' work programme for 2014-2018. Two deliverables aim directly to promote and support capacity building: priority capacity building needs to implement the Platform's work programme matched with resources through catalyzing financial and in kind support (deliverable 1a) and capacities needed to implement the Platform's work programme developed (deliverable 1b). Beyond these, however, all other activities critically depend on matching identified needs and gaps with available resources, and mobilizing new resources.

In the context of Deliverable 3(d), capacity building is intended to support and enhance the assessment and articulation of diverse conceptualization of multiple values of nature and its benefits, ultimately aiming to improve the integration of these values in planning and decision making for biodiversity and ecosystem services. We have considered below three priority areas for capacity building, together with examples of crosscutting activities to address them.

6.1. Identifying and prioritizing capacity building needs

The three priority areas identified in this session refer to (a) the capacity for generating data and information, (b) the capacity to carry out valuations / assessments, and (c) the capacity to influence policy and decision making/planning. For each of them, several lines of actions have been proposed in the following table.

Capacity building needs	Target audience	Lines of actions for capacity building
A. Capacity for generating data and information	Multi-disciplinary experts, municipal and local government, NGOs, private sector, university and research centers	● Increase access to / visibility of existing knowledge, including 'grey literature' and indigenous and local knowledge (ILK) where appropriate, e.g. by identifying existing sources of information, engaging with different types of expertise, and facilitating interlinkages between existing data repositories and networks of practitioners. ● Mapping of existing sources of information and development of an electronic portal that facilitates access to this information network ● Ensure better use of electronic / web-based tools for data sharing and collaboration. ● Conduct a strategic review of existing information base on capacity building needs available within biodiversity related Conventions and MEAs (e.g. CBD, Ramsar Convention), national strategies (for example NBSAPs) and other sources. ● Define procedures for the identification and meaningful involvement of relevant stakeholders, particularly holders of local and indigenous knowledge and under-represented categories (young people, practitioners from developing countries, disenfranchised groups).
B. Capacity to carry out valuations / assessments	Multi-disciplinary experts, municipal and local government, NGOs, private sector, university and research centers	● Increase capacity to carry out and use national and regional assessments, notably through early involvement of policy makers in scoping, coordinating, reviewing and uptake of assessments. ● Increase training capacities for interdisciplinary and transdisciplinary competences (major obstacle for the integration of existing or new knowledge of different types and from different sources). ● Include capacity building assessments within regional and thematic assessments processes to be conducted under IPBES framework. ● Clearer guidance on integrating ILK into scientific analysis and policy making (also taking into account experiences from other initiatives such as td-net (Network for Transdisciplinary Research in Switzerland).
C. Capacity to influence policy & decision making /planning	Government, Experts, Universities, civil society, resource managers	● Better connection of scientific and policy actors, exchange of knowledge on needs and existing expertise on both sides. ● Tailored information/training on how to interpret and use assessment results. ● Improve the capacity to locate and mobilize financial and technical resources through effective communication, training and the creation of a network of information and fund-raising volunteers.

6.2. Examples of crosscutting activities to address capacity building needs

6.2.1. Identifying and mobilizing additional financial support

Financial support, including technological support, is a key precondition for addressing the capacity needs identified above, taking into consideration the financial constraints in many of the developing countries. Mobilization of the resources should consider the following actions:

- Identifying regional, national and local priorities and constraints in mobilizing capacity building support, including technological support.
- Ensuring that the match-making tool is flexible enough to facilitate match-making for different needs and types of stakeholders (different user-specific modules, advanced search facility etc.).
- Strengthening the operational capacity of the secretariat, including creating an advisory capability on capacity building for articulation of multiple values of nature.
- Facilitate the match between actors who have a capacity building need related to the agreed IPBES work programme with those able to help meet that need, while avoiding duplication of efforts.
- Mobilizing professional support from advertising agencies, fund raisers and other stakeholders with relevant expertise.
- Increase capacity for stakeholder involvement, among others through clear and impartial procedures on equal and fair access, and address possible power imbalances and vested interests.

6.2.2. Fellowship, exchange and training programmes

Knowledge exchange and training programmes have a significant multiplier effect for diffusing research results and building capacities in various sustainable development areas including biodiversity and ecosystems. Actions to be taken in this dimension include:

- Clarifying the eligibility criteria, application procedure and available resources for each type of action (fellowships, exchange programs, secondments, training programs, mentoring schemes).
- Prioritize inter-regional mobility, and facilitate exchange and flow of expertise, taking into account differences in capacities and infrastructure between regions.
- Provide opportunities for the training of trainers for capacity building assessment.
- Develop thematic or user-specific e-learning materials to support education and training activities.
- Consider the potential of ICT-based training, including MOOCs, to support or complement face-to-face training and mentoring activities.
- Develop a communication strategy adapted to the needs of different user groups (e.g. young professionals, researchers, trainers).

6.2.3. Facilitating science-policy networks, platforms and centres of excellence

Capacity for communication and networking could be developed for the science-policy aspects of biodiversity and ecosystem services evaluation. Efforts in this area should be made to:

- Develop an inventory of existing networks and areas of possible collaboration (north-south and south-south), including specific strengths and areas of expertise of different actors (e.g. training, communication, fund raising, networking).
- Facilitate communication within the IPBES community (including member states experts, national focal points): exchange of information and good practices through regular meetings, online forums, match-making facility etc.
- Identify and make use of formal and informal (or semi-formal) science-policy mechanisms and communities of practice established at subnational, national, regional or interregional level.
- Increase efficiency of knowledge sharing and use through better networking with other initiatives / avoiding replication of tasks and efforts.

- Connect with other existing mechanisms (especially CBD, UNCCC) for exchange of expertise and mutual support on capacity building.
- Make use of existing platforms, resources and tools (Sub-Global Assessment Network, IPBES' catalogue of assessments, UNCCD market place and CBD LifeWeb etc.).

Facilitate the involvement of national and regional centres of excellence and science-policy platforms, inter alia through clearer identification/selection procedures and better communication on existing needs and priorities.

Chapter 7: Policy Support Tools, Methodologies and Instruments for the Diverse Conceptualization and Assessment of the Multiple Values of Nature and its Benefits

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7.1. Introduction

A near-term IPBES deliverable is a guidance document on how to implement the mandate of the IPBES with regard to the policy support function and the development of a catalogue of policy support tools and methodologies, including those relevant for "the diverse conceptualization and assessment of the multiple values of nature and its benefits, including biodiversity and ecosystem services". In this regard, policy support tools hinge on the worldviews that different people in different cultures have, especially according to their particular view of nature, nature's benefits and the meaning they give to a "Good quality of Life" including that of "Living-well in balance and harmony with Mother Earth". Therefore, any assessment of the multiple values of biodiversity and ecosystem services should use the guidance document and catalogue when assessing policy tools and methodologies.

The objective of the guidance document and catalogue is to identify a wide range of policy-relevant tools and methodologies, to enable decision makers to gain easy access to tailored information, and to allow a range of users to provide input to the catalogue and assess the availability, effectiveness, practicability and applicability of tools and methodologies, recognizing they are needed for different purposes at different stages of the policy cycle. The catalogue is developed as a dynamic online platform designed to meet the end-users' needs, including for experts conducting IPBES assessments.

Policy support tools and methodologies "are approaches and techniques based on science and other knowledge systems (including indigenous and local knowledge) that can inform, assist and enhance relevant decisions, policymaking and implementation at local, national, regional and international levels to protect nature, so promoting nature's benefits to people and a good quality of life" (IPBES Del. 4c) (figure 7.1).

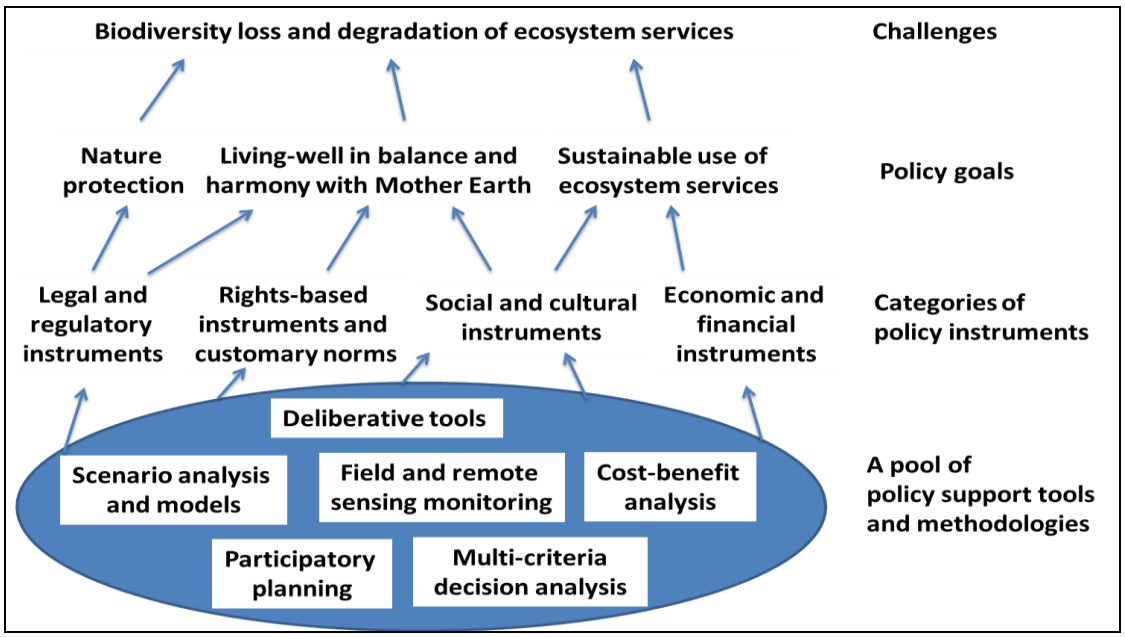

***Figure 7.1**: Schematic representation of the interrelation of policy formulation, policy instruments and policy support tools and methodologies (IPBES Del. 4c)*

The guidance document and catalogue of policy support tools and methodologies addresses each of the boxes and arrows of the IPBES Conceptual Framework, including those boxes and arrows relevant to the multiple values of nature and its benefits to people, i.e., boxes on "Nature's Benefits to People" and "Good

Quality of Life", and associated arrows between the boxes. Tools for mapping and valuing biodiversity and ecosystem services can be used to understand Nature's benefit to people, the distribution and ability to capture those benefits across beneficiaries from biodiversity and ecosystem services. For example, multi-criteria decision analysis tools and methodologies can contribute to assess how biodiversity elements and ecosystems services promote a good quality of life of people holding alternative value systems. Policy support tools and methodologies can be used to identify and assess distinct aspects of governance systems such as power relationships, equity and inclusion, poverty and access to nature's benefits which relate to the formation and modification of values. For example, the use of equity assessments in regional and sub-regional assessments can help in identifying various options for integrating biodiversity and ecosystem services into poverty reduction strategies and assessing who would gain or bear the respective costs, benefits and the risks and opportunities that may arise (see IPBES3-5 and Deliverable 2 (b) IPBES/3/6/Add.1). Policy support tools, methodologies and instruments need to be understood in the context of policy cycles and socio-ecological challenges at different spatial scales.

7.2. The policy process and elements of the policy cycle

Any comprehensive guide to policy support tools and methodologies needs to articulate a view of the policy development process. A practical characterization of the policy process includes three distinct but overlapping elements: agenda setting and review; policy design and decisions; and policy implementation, as shown in figure 7.2 (see IPBES Del. 4c). This deliberately merges 'post policy' evaluation and 'pre-policy' problem framing, as problem framing occurs in the context of settings and circumstances that have been influenced by past policies. Presenting the three elements as overlapping further recognizes that in practice the boundary line between elements is often blurred, and that the evolution of policy does not always follow a strict sequence of events (as implied by more distinct multi-stage categorizations of the policy cycle, e.g. UNEP, 2009). The overlap between elements suggests that specific tools and methodologies can be used to support multiple elements or stages of the policy cycle, and in some instances it may be difficult or inappropriate to classify a specific policy support tool or methodology as only being associated with or relevant to one element or stage.

The dynamics and operation of the policy cycle may vary depending on the restrictions and opportunities determined by the wider context. In other words, the specific conditions found at a given geographical setting and scale may restrict or ease the suite of policies that may be carried out, according to, for instance institutional capacity, culture, ways of thinking and value systems, historical experience, cultural history.

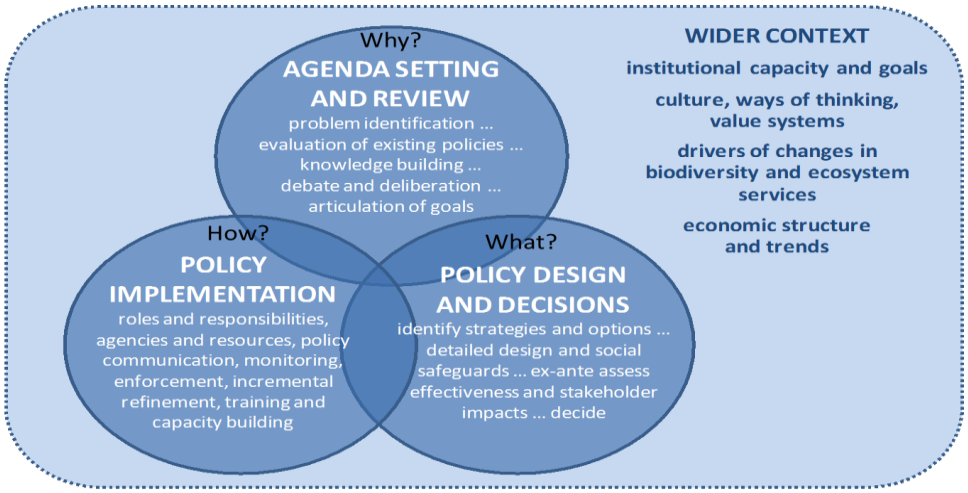

***Figure 7.2**: Three key elements of the policy cycle, and illustrative activities associated with these elements, in their wider context (IPBES Del. 4c).*

Policy and decision making are seen as a process to address perceived societal challenges and are rarely confined to a single scale. The flow of value-related information should be facilitated between local, national and global levels of scale. Appropriate scales of decision making can respond quickly and

efficiently, and are able to integrate across scale boundaries. In this context, adaptive management proposes policy making as a deliberate 'experiment', emphasizing iterative cycles to ensure an envisioned outcome. A more sophisticated policy cycle then consists of envisioning, assessing, planning, implementing, monitoring and adjusting to vision. This approach is often associated with adaptive ecosystem management, and adjustment of values can be included. Participatory processes can contribute to adaptive management and inclusion of the diversity of values in order to reduce the risk of unintended consequences that can become clear after a delayed period of time.

7.3. The IPBES online catalogue on policy support tools and methodologies

The IPBES online catalogue has *four entry points*: the above mentioned (i) 'Phases of the policy cycle' and (ii) the 'IPBES conceptual framework' as well as (iii) 'Families of tools and methodologies' and (iv) 'Applications for the implementation of Multilateral Environmental Agreements (MEAs)'.

As regards the *families of policy support tools and methodologies*, the catalogue includes seven families where intercultural dialogue or the dialogue among different stakeholders is important to be considered: (i) Assembling data and knowledge, e.g., long-term ecological and socio-ecological research and monitoring (LTSER-sites); (ii) Assessments and evaluation, e.g., multi-criteria analysis and cost-benefit analysis; (iii) Public discussion, involvement and participatory processes, e.g., public hearings and government-established commissions; (iv) Selection and design of policy instruments, e.g., policy analysis; designing protected areas, payment for ecosystem services schemes; systems of life of Mother Earth; (v) Implementation, outreach and enforcement, e.g., ecosystem-based management tools; (vi) Training and capacity building; and (vii) Social learning, innovation and adaptive governance, including the assessment of the role of collective action of indigenous peoples, local communities, and local resource users.

The entry point on '*Applications for the implementation of Multilateral Environmental Agreements (MEAs)*' intends to address pressing needs of decision-makers, focusing on the needs of IPBES focal points and focal points of relevant international agreements. It aims to support common MEAs' objectives in line with IPBES Busan Outcomes (Paragraph 7(a)) and with the Joint Statement by the Biodiversity-related MEAs at IPBES-3. The catalogue includes the following applications for the implementation of MEAs (c.f. IPBES Del. 4c): (i) Strategies, action plans and targets of MEAs, (ii) Compliance, monitoring and enforcement of MEAs; (iii) National reporting of MEAs; and (iv) Capacity building for implementation of MEAs.

Assessments of the multiple values of 'nature', 'nature's benefits to people' and of those associated with 'good quality of life' can improve knowledge and skills in the regions and sub-regions with benefits for effective and synergistic implementation of the MEAs. These assessments can contribute to better informed strategies, action plans and targets of MEAs, for example the National Biodiversity Strategies and Action Plans. Likewise, these assessments can support national reporting including cross-fertilization on reporting of different MEAs which address complementary values.

Intercultural and intergenerational dialogue including multi-stakeholder consultations on diverse conceptualization of values of nature and its benefits can support social learning for implementing strategies, action plans and targets of MEAs. In particular, these types of consultations are important to enable exchange of views among different knowledge systems and among indigenous and local knowledge systems on how to address challenges at multiple scales. Valuable lessons can be drawn from the IPBES Task force on capacity-building for the effective engagement of indigenous and local communities, scientists and policy makers (see Task force on capacity-building, deliverables 1(a) and 1(b), IPBES/3/3).

7.4. Context for Designing and Implementing Policy Instruments

Policy instruments can be viewed according to various contexts and worldviews. The IPBES conceptual framework highlights the central role of institutions and governance as they influence all aspects of relationships between people and nature and thus the different focus and types of values people assign to nature, nature's benefits to people and a good quality of life. Both formal and informal institutions determine the types and levels of values and how responsibilities, costs and benefits of biodiversity conservation are distributed across society. Examples of formal institutions include law and policies e.g., macroeconomic, fiscal, monetary or agricultural policies, markets and legal property rights. These are typically based on various legal instruments, treaties and customary laws. Informal institutions in turn include social norms and rules, such as those related to collective action. Lastly, organizations are also a form of institutions.

The main underlying reason behind biodiversity loss and ecosystem degradation is due to various institutional failures that are often catalogued as (i) law and policy failures (e.g., perverse subsidies), (ii) market failures (externalities in the use of public goods and services), (iii) organizational failure (e.g., lack of transparency and political legitimacy in decision making) and (iv) informal institutional failures (e.g., break of collective action norms due to erosion of trust and reciprocity). *Law and Policy failures* include for example, lack of implementation of legal systems for sustainable resource management, laws that foster unsustainable practices, fragmentation and conflicting laws as barriers for mainstreaming biodiversity and addressing interlinked risks to ecosystems, and laws not suited to address unexpected global risks. Policy failures further include issues like failure of government policies to correct externalities and those that perversely enhance these negative externalities on society. For example, agricultural subsidies and incentives tend to add pressure on land degradation. *Market failures* occur when the allocation of goods and services by market price signaling is not efficient, leading to external costs, especially in the allocation of public goods and services. In these cases, market prices generally fail to reflect the true social costs and benefits of the use of biodiversity and associated ecosystem services. This requires internalizing such external costs, what is normally known as "getting the prices right" through various policy instruments, such as taxes and subsidies, voluntary schemes (e.g., payments for ecosystem services), and other measures, for example, the allocation of property rights to users, which can include private, public (state) and communal property rights. *Organizational failure* occurs when governmental, non-governmental authorities and community based organizations who manage natural resources are ineffective, absent and/or lack inter-organizational coordination. Lastly, *informal institutional failure* occurs due to a variety of reasons such as lack of or conflicting interactions in decision-making processes between formal and informal institutions which for example can inhibit collective action to sustainably manage natural resources.

It should also be noted that in the context of some worldviews, such as those associated with the systems of life of Mother Earth, it may not be adequate nor possible to frame the problem of biodiversity loss and ecosystem degradation through the above four underlying reasons. For example, some views, such as the Living-well in balance and harmony with Mother Earth' (see IPBES Conceptual Framework) may deviate from the idea of "getting the price right" as a policy perspective for governing biodiversity and ecosystem services. A relevant context for designing and implementing systems of life of Mother Earth may instead be operationalized through the following three interrelated actions that can support decision making (Pacheco, 2014): (i) characterization of systems life, considering the relationship between ecosystems and peoples (socio-cultural entities) living in a given territorial jurisdiction at multiple scales (e.g. local, regional, and national); (ii) agreements of complementarity with Mother Earth, which constitute a commitment among public, community and private actors in a given territorial area, showing trust, reciprocity and compliance with respect to the rights of peoples and of Mother Earth, and addressing a set of objectives and goals oriented to the integral and sustainable management of ecosystems; and (iii) harmonization of systems of life, which are composed of a bundle of actions for strengthening harmonious relations among systems of life and for restoring systems of life in areas where the balance between peoples and nature has broken or undermined.

7.5. Categorization of policy instruments

Policy instruments can be categorized into four main categories: (i) legal and regulatory instruments; (ii) rights-based instruments and customary norms; (iii) economic and financial instruments; (iv) social and cultural instruments. These need to be considered independently or within a policy mix context, reflecting different circumstances and priorities across administrative scales, e.g., subnational, national and international. These different categories are applied in concordance with people's worldviews and socio-cultural contexts. It may be noted that for instance certain economic instruments can be contradictory to some rights-based approaches. The choice of policy instruments necessarily implies altering the distribution of responsibilities, costs and benefits from the conservation and use of biodiversity. Any policy instrument can only be effective if the supporting formal and informal institutions are in place.

Legal and regulatory instruments: Implementing and articulating laws and regulations at different levels can foster positive relationships between the protection of environmental functions, the development of sustainable production systems, and peoples' well-being. A balance between flexibility and legal certainty in the design and implementation of these instruments can foster socio-ecological resilience and contribute to address unexpected risks. Social and environmental standards and principles can inform substantive and procedural dimensions of policy instruments in order to continuously improve environmental performance. Planning instruments sometimes take the form of environmental management plans which outline programs of actions, which have been identified as part of the environmental management systems. These are sometimes required as part of due diligence and compliance with environmental legislation and regulations.

Rights-based instruments and customary norms: Synergizing rights and norms for the conservation and protection of systems of Mother Earth can foster complementarity with human well-being. International and national human rights instruments whether binding or non-binding can be creatively interpreted to fit socio-ecological systems and foster resilience. Strengthening of collective rights, customary norms and institutions of indigenous peoples and local communities, can promote adaptive governance including the equitable and fair management of natural resources.

Economic and financial instruments: They can be used to change people's behavior towards desired policy objectives. Instruments typically encompass a wide range of designs and implementation approaches. They typically include traditional fiscal instruments, including for example subsidies, taxes, charges and fiscal transfers. Additionally, instruments such as tradable pollution permits or tradable land development rights rely on the creation of new markets. Further instruments represent conditional and voluntary incentive schemes such as payments for ecosystem services. All these can in principle be used to correct for policy or/and market failures and reinstate full-cost pricing. They aim at reflecting social costs or benefits of the conservation and use of biodiversity and ecosystem services of a public good nature ("getting the price right"). Financial instruments, in contrast, are often extra-budgetary and can be financed from either domestic sources or foreign aid, external borrowing, debt for nature swaps, etc. It should be noted that economic instruments do not necessarily imply that commodification of environmental functions is promoted. Generally, they are meant to change behavior of individuals (e.g., consumers and producers) and public actors (e.g., local and regional governments).

Social and cultural instruments: They include instruments with an emphasis on the intertwined relationships between ecosystems and socio-cultural dynamics for the management of natural and cultural assets, including for instance heritage sites such as sacred sites, peace parks, indigenous and community conserved areas. Depending on the instrument, the applicable territorial jurisdiction varies (e.g. bi-national, national and local). Social instruments are beyond economic and financial instruments. Awareness based voluntary interventions may include for example (i) information related instruments like environmental education, eco-labelling, pollutant release and transfer registers, biodiversity registers, awareness raising (including award schemes) / information dissemination/ Community right to know; (ii) self-regulation/ voluntary agreements/ corporate social responsibility/ buyer-supplier relations; (iii) participation (social pressure, worshipping etc. and (iv) enhancement of collective action of indigenous peoples, local communities, and local resource users, etc.

7.6. Valuation assessments supporting policy makers

Findings of assessments are often underutilized within the policy cycle. Whilst there are multiple reasons for this, the lack of interaction and the lack of relationships between policy makers and research due to ineffective communication between these groups, or due to non-overlapping agendas are often confounding / driving factors of the lack or misuse of assessments within the policy cycle. For critical results to reach the policy space these relationships need to be established, interaction is required at the professional levels where dialogue and trust are developed and enhanced to share understanding generated around both valuation methods and their outcomes. Once the flow of information and the co-production of valuation approaches through trust is established numerous interventions and products which contain valuation information / knowledge can be purposefully assembled to provide appropriate information and support by valuation assessments in the policy cycle. It is thus important that policy makers, scientists and ILK holders are part of the creation processes (co-creators), and where possible, the use and adoption of current tools and mechanisms should be encouraged. Some policy support tools that can enhance the communication between these groups and that have been found to be useful are listed below:

- Annotated presentations that policy makers can extract information from and use;
- Maps and mapping products;
- Dissemination of legal frameworks; e.g. laws of rights of Mother Earth and indigenous peoples;
- Technical data and spatial information available on shared portals;
- Hard copy maps and resource atlases;
- Electronic PDF's with linked information tables on values;
- The development of guidelines;
- Summary documents, brochures and communication tools;
- Case studies grounded in science that demonstrate / highlight specific values;
- Portals that provide and enhance access to information and act as repositories must be established;
- Training support tools (educating policy makers), e.g., the use of Webinars, YouTube clips and TED talks – made locally available.

CHAPTER 7 REFERNCES:

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