



Original Research Article

Mainstreaming indigenous and local communities' connections with nature for policy decision-making

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ABSTRACT

Exclusion of Indigenous and local communities' connections to the rest-of-nature is a typical problem in policy-decision making. This paper highlights the key attributes of these connections and suggests evaluation pathways to mainstream them into policy development. For this, we integrate and apply the ecosystem services (ES) and human capability concepts. Five socio-cultural and economic values relating to peoples' well-being are identified as the core attributes for developing policy tools: (1) livelihoods; (2) social values; (3) cultural values; (4) spiritual values; and (5) capabilities. For policy tools, common ES frameworks and the relevant ES evaluation techniques that can be applied along with community participatory approaches, are considered. We recommend that developing a pluralistic policy platform is essential to appropriately comprehend Indigenous and local communities' connections with nature for enhancing well-being, not just sustaining livelihoods. A three-step process: (1) identifying attributes of natural systems that are vital for peoples' well-being (beyond their livelihoods); (2) developing locally-specific integrated frameworks; and (3) evaluating identified attributes (monetary and non-monetary), is clearly described in this paper to inform the policy-makers. Recognition and understanding of Indigenous and local communities' values for nature beyond livelihood opportunities is essential for informing inclusive sustainable development processes and policies.

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1. Introduction

Indigenous and local communities' connections with the rest-of-nature are widely appreciated (Millennium Ecosystem Assessment 2003, IPBES, 2018). Despite this, the role of these connections to peoples' well-being continues to be overlooked, particularly with meaningful engagement in sustainable development, and welfare planning and implementation policies (Bockstael and Watene, 2016; Sangha and Russell-Smith, 2017; Choy, 2018, The Economics of Ecosystems and Biodiversity [TEEB] 2018a). One main reason for this neglect is that these connections generate intangible benefits whose measurement is beyond the capability of conventional economic approaches (Costanza et al., 1997a, 2014; Daly, 2013, 2015). This should not mean that such benefits and values be excluded from policy planning—but effectively this is still a common practice at local, national and regional scale across the globe (Bockstael and Watene, 2016; Choy, 2018).

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In light of this failure of public policy development to include nature-related Indigenous and local community values, a key question is how to better understand and incorporate those critical values into appropriate decision-making processes. This paper attempts to address this question: first, by describing the relationships between people and the rest-of-nature to identify key attributes that are critical for peoples' well-being; second, by describing the main ecosystem services frameworks that are applicable to Indigenous values, and that support integrating those services with peoples' well-being; and third, we propose a mixed set of evaluation mechanisms including well-being related indices and metrics that can help inform welfare policy decisions.

The importance of natural ecosystems for peoples' well-being received worldwide recognition through the United Nations Millennium Ecosystem Assessment (MA) program (MA, 2003; 2005a–e), The Economics of Ecosystems and Biodiversity (TEEB), and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) established in 2012. IPBES particularly focuses on the links between science and policy (IPBES, 2018). All these global initiatives have contributed significantly to a greater awareness of nature's role in human well-being, at least in the scientific world. They have also fostered research on Indigenous and local community themes to better comprehend people-rest-of-nature connections. For example, IPBES supports a special 'Indigenous and Local Knowledge' work program (IPBES, 2018). Both the MA and IPBES have proposed frameworks (discussed later) to better link ecosystem services and human well-being, but not specifically for Indigenous and local communities.

Before the MA, TEEB, and IPBES initiatives, advances in ecological sciences over the last three decades or so have pioneered understanding of the roles of ecosystem services in modern development (Braat and de Groot, 2012). To manage and address economics under a sustainable development paradigm, a bridging concept embracing natural and social scientific notions—Ecosystem Services (ES)—was developed and coined by Ehrlich and Ehrlich (1981). Ecosystem Services are the benefits people obtain from ecosystems (Costanza et al., 1997a; MA, 2003). This includes the material and non-material values people hold for their natural systems. Following the United Nations definition of Indigenous peoples (UNPFII 2009), here we define Indigenous and local communities as those which continue to more fully recognise their enduring inter-dependence with the rest-of-nature, particularly through ongoing interactions and cultural relationships with their customary or traditional estates.

Despite the relevance of the ES concept for Indigenous and local peoples (Archer, 2015), there are only few comprehensive assessments addressing the roles of ecosystems for Indigenous and local community well-being at local, regional or global scales (e.g. Sangha et al., 2015a, 2017). This is mainly due to lack of appropriate frameworks and valuation tools. Absence of such frameworks and assessments has had significant consequences for the development and implementation of culturally appropriate and/or adequate public, sustainable development, and welfare policies (Grieves, 2007; Taylor, 2008; Bockstael and Watene, 2016; Yap and Yu, 2016). For example, the ongoing well-funded Australian 'Closing the Gap' program, commenced in 2008, to date has achieved little success (Commonwealth of Australia, 2017) in attempting to address chronic disadvantages (e.g. life expectancy, education, jobs, incarceration) faced by Indigenous (Aboriginal and Torres Strait Islander) people. The program's failure, at least for remote communities still reliant and resident upon their traditional estates, can arguably be attributed to ignoring the well-being and health benefits that Indigenous people obtain from maintaining connections to their lands (Burgess et al., 2009, Australian Institute of Health and Welfare, 2011). Many similar examples are reported across the globe (e.g. MA, 2005a, b, e, IPBES, 2018), indicating that there is an urgent need to appropriately assess and incorporate people-rest-of-nature values beyond livelihood options when mainstreaming policy decisions.

2. Indigenous and local peoples' connections with the rest-of-nature

Many Indigenous and local peoples are well connected with their local ecosystems and assume responsibilities for their care and maintenance as custodians (e.g. Clarkson et al., 1992, Posey and Oxford Centre for the Environment, Ethics and Society 1999; Maffi, 2001; Altman et al., 2006, 2011; Sangha et al., 2018). Land defines people's identity, customs and traditions for present and future generations, and it is a common custom to think of land as 'mother' (Clarkson et al., 1992).

From an Australian Indigenous perspective, peoples' connections with land encompass physical, human and sacred dimensions (Fig. 1) that are uniquely reflected in a commonly used term—*country*—denoting peoples' customary and familial relationships to their traditional estates.

Similarly, many Indigenous and local communities around the globe have livelihood, cultural, spiritual or sacred, language and knowledge relationships with nature (UNEP, 2017, World Resource Institute [WRI] 2018). Some of these are highlighted by Indigenous platforms such as LandMark—a Global Platform of Indigenous and local community lands (Reytar and Veit, 2017), UNPFII, and others by many case studies. These relationships may exist in different forms and shapes, but they typically suggest a profound sense of respect for, and belonging to, nature (Chan et al., 2012, 2016; Sangha et al., 2015b; UNEP, 2017).

The fostering of people-rest-of-nature relationships is reliant on the over-time development of knowledges and skills which Sen (1993, 1999ab) has called 'capabilities'. Capabilities constitute a vital element of peoples' well-being along with connections mentioned in Fig. 1. In western societies, enabling capabilities include formal education and training. While these same enablers are just as critical for Indigenous societies, their less obvious (to outside observers) structural forms means that such capabilities are often ignored and typically undervalued.

Recognising and building capabilities, as Sen (1993) argues, is a key aspect of (progressive) development that requires providing suitable opportunities for people that they value doing or being. For example, Indigenous peoples' knowledge and

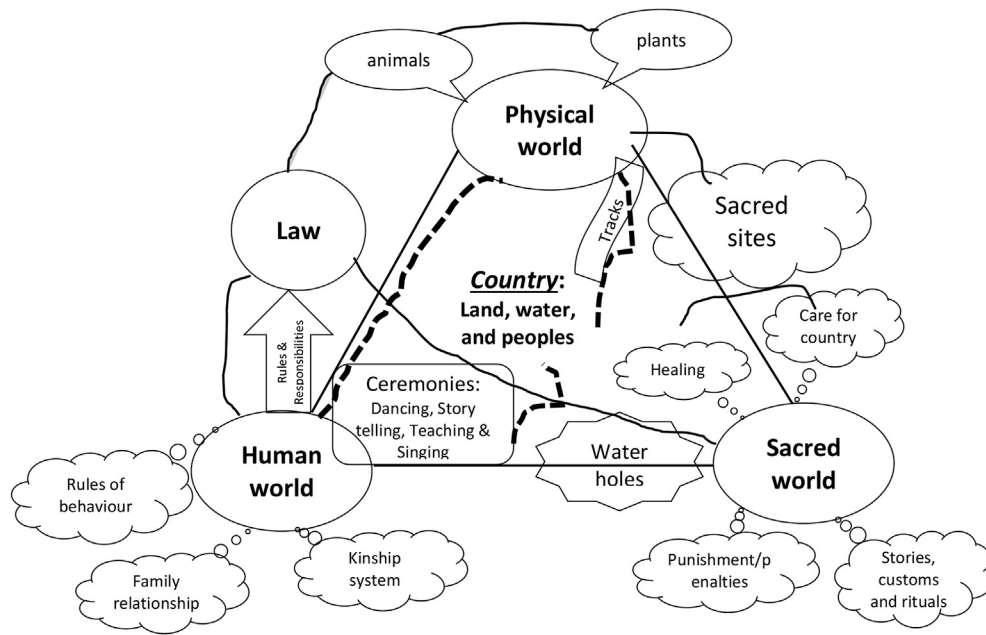


Fig. 1. Various connections between peoples' physical, sacred and human worlds. *Country* supports all these connections (adapted from Aboriginal Art by the Institute for Aboriginal Development; source [Sangha et al., 2015a](#)).

skills enable them to live on their traditional lands, and to use and value preferred resources in time-tested manners. Unlike non-Indigenous capabilities, Indigenous capabilities are directly supported by the ecosystems and passed on from one generation to another through living on and caring for their lands ([Sangha et al., 2018](#)). Thus, capabilities require careful consideration when valuing Indigenous and local peoples' connections with nature.

To characterize and account for Indigenous nature-related values for policy development applications, based on a literature research we have identified five key attributes that directly relate to Indigenous peoples' well-being: livelihood (material) benefits; cultural values related to traditions, norms and peoples' ways of living (non-material benefits); spiritual/sacred (non-material, transcendent) values; social (non-material) relationships; and capabilities ([Table 1](#)). This list of attributes largely relates to the cultural and provisioning ES (following [MA, 2003](#)). These services are important for peoples' well-being and help address observations that cultural ES are vital but remain elusive in policy decisions due to their intangibility and incommensurability ([Chan et al., 2012](#); [Milcu et al., 2013](#); [Cooper et al., 2016](#)).

Mainstreaming the above core Indigenous values and capabilities helps address nine out of the 17 Sustainable Development Goals (SDGs) established by the UN in 2015 ([UN, 2015](#)): reducing poverty (SDG1); good health and well-being (SDG3); quality education (SDG4); decent work and economic growth (SDG8); reduced inequalities (SDG10); sustainable cities and communities (SDG11); climate action (SDG13); life on land (SDG15); and partnerships for the goals (SDG17) ([UN, 2015](#)), which afford multitude benefits for the wider global community.

3. Main frameworks describing people-nature connections

Two landmark frameworks have been developed to date to highlight the role of nature for human well-being. In 2003, the MA proposed the first framework of its kind linking ES and human well-being ([Fig. 2a](#); [MA, 2003](#)), which was followed by several seminal reports ([MA, 2005b–e](#)). The MA framework categorizes nature's ES as provisioning, regulating, cultural, and supporting; and human well-being into five constituents as basic materials for life, security of resources, good health, social relations, and freedom and choice. Both ES and human well-being components are impacted by direct (e.g. anthropogenic, natural, demographic, etc.), indirect (e.g. institutional, governance, climate change, etc.) and other drivers (see [Fig. 2a](#)).

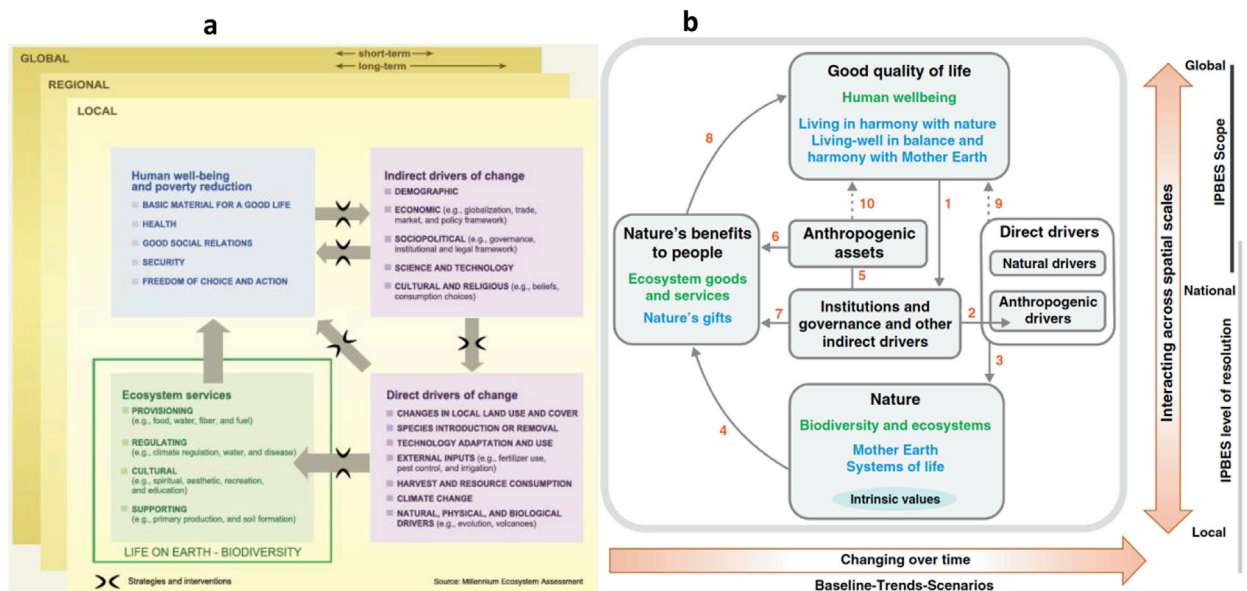
The IPBES framework particularly emphasizes the role of nature and its resources for public policy ([Fig. 2b](#); [IPBES, 2018](#); [Díaz et al., 2015](#)). It applies simple terminology for including nature (biodiversity and ecosystems) and its benefits—ES—as two separate compartments, and links the latter with the quality of life (human well-being) without categorizing benefits or well-being. It further outlines how direct and indirect drivers impact on nature and its benefits to people, thus on peoples' quality of life ([Fig. 2b](#)).

In addition, several frameworks are proposed in ecological and socio-ecological sciences with a main focus on ecological systems, e.g. how changes in different ecological systems impact on ecosystem functions and processes that deliver services to people or how the resilient systems perform under different circumstances (e.g. [de Groot et al., 2002](#); [Folke, 1991](#); [Folke et al., 2016](#) and others). Others are on people's livelihoods, particularly by [Babington \(1999\)](#) on how to understand

Table 1

Identification of five key attributes based on main sources of relevant literature (following a chronological order).

Attribute	Context/resources	Reference
1. Livelihood benefits (Provisioning ES—material benefits)	Food, medicine, fuelwood, water, raw materials, and other livelihood benefits.	Isaacs (1987), Keen (2004), Ramakrishnan et al. (2005), de Groot and Ramakrishnan (2005), Kipuri (2009), UN (2009), TEEB-ES database by van der Ploeg and de Groot (2010) with 441 provisional values across the globe, and many other studies.
2. Cultural values (Cultural ES—non-material benefits related to traditions, norms and peoples' ways of living)	Indigenous cultural values of biodiversity and natural resources from local, regional and global perspective; and their importance for local languages and the environment, particularly in managing protected areas. Indigenous cultural norms and practices have traditionally helped in protecting biodiversity and natural landscapes (e.g. sacred groves, Indigenous Protected Areas, languages) at many places across the globe.	Strang (1997), Muir (1998), Posey and the Oxford Centre for the Environment Ethics and Society (1999), Maffi (2001), de Groot and Ramakrishnan (2005), Collings (2009), TEEB-ES database with 190 cultural values (mainly recreational; TEEB, 2018a), Chan et al. (2012), Milcu et al. (2013), Bernbaum (2017), UNEP (2017), Archer et al. (2018), James et al. (2018), WRI (2018), and Verschuuren et al. (2018).
3. Spiritual/Sacred values (Cultural ES—non-material benefits of being with oneself, transcendent, and close to nature)	Spiritual and sacred values of Indigenous lands and natural resources across the globe.	de Groot and Ramakrishnan (2005), TEEB-ES database with only two studies (grossly under-represented values in ecological studies), Archer (2015), Bernbaum (2017), Archer et al. (2018), and James et al. (2018).
4. Social (kinship) relationships (Cultural ES—non-material services nurturing connections with other members of the community)	Social importance of land and other natural systems in maintaining and supporting social norms, customs and kinship systems.	MA (2003, 2005a), Archer et al. (2018), James et al. (2018), Sangha et al. (2018).
5. Capabilities (Cultural ES—non-material services that support educational and knowledge learning activities and skills)	Importance of people's knowledges and skills in managing Indigenous or traditional lands and the natural environment.	Maffi (2001), Ramakrishnan et al. (2005), Collings (2009), Bockstael and Watene (2016), Klein (2016), Yap and Yu (2016), Sangha and Russell-Smith (2017), James et al. (2018), Verschuuren et al. (2018).

**Fig. 2.** The MA and IPBES frameworks:

a. The MA framework links human well-being and ES (on the left-hand side), which are influenced through various direct and indirect drivers of change (on the right-hand side) (MA, 2003; 2005a).

b. The IPBES framework offers six main elements: Nature, Nature's benefits, Good quality of life, Anthropogenic assets, Direct drivers, and Institutions and governance, and other drivers. The arrows denote the links between elements, along with temporal and spatial scales (side arrows). (Source: IPBES, 2018 and Díaz et al., 2015).

people's livelihood needs for developing policy perspectives. He emphasised on peoples' access to, and interactions among, five types of capitals (i.e. human, social, natural, cultural, and produced), institutional arrangements, and mechanisms that enable people to enhance their capabilities to make a meaningful living. Another 'Sustainable Livelihood Framework' proposed by the Department for International Development (2000) suggested the main factors including vulnerability context,

assets, structures and processes, and related strategies that affect people's livelihoods to achieve desired outcomes. However, these latter frameworks focus mainly on people's livelihoods, not on how nature-people relationships are important for people's overall well-being (i.e. beyond the livelihood opportunities)—a focus for this paper.

Nonetheless, both the MA and IPBES frameworks clearly explain the role of nature for human well-being, but in a one-way relationship. They omit key aspects: how do people shape their natural systems i.e. two-way relationships; how their skills and knowledges (capabilities) enable them to maintain their natural systems; and what is the economic contribution of these connections in peoples' well-being (Chan et al., 2016; Yap and Yu, 2016; Sangha and Russell-Smith, 2017; Sangha et al., 2018).

To address the above concerns and incorporate peoples' role in shaping natural systems, Sangha and Russell-Smith (2017) developed a framework suggesting two-way relationships between people and their nature systems (Fig. 3). This framework underlines the role of natural resources and peoples' capabilities in providing services and goods to people, and in return how those natural resources are managed by people following customary practices. To continue these two-way relationships, it is critical for peoples' capabilities to be passed-on from one generation to another through sharing life-long experiences, knowledges and stories (James et al., 2018). Just as importantly, the economic importance of Indigenous and local management of natural systems is vital, which is underlined in a recent framework proposed by Sangha et al. (2018) incorporating socio-economic, cultural and capability values for policy mechanisms. Both these frameworks particularly recognise the importance of an intergenerational perspective encompassing traditional learning and associated peoples' capabilities that enable them to manage their natural systems. Other similar frameworks can be developed at local scales to inform modern economic approaches and development of public policy.

4. Economic tools to inform policy decision-making

Acknowledging an existing lack of valuations and tools to measure people-rest-of-nature connections, there is a pressing need to include the value of these connections into policy decision-making (IPBES, 2018; Daly, 2015; Costanza et al., 2014; TEEB, 2010). Such a consideration becomes crucial for Indigenous and local peoples whose living largely depends on, and includes interaction with, ecosystems. An economic assessment of such connections can be expressed in monetary and/or non-monetary units. The above identified five attributes i.e. livelihood, cultural, spiritual, social, and capability benefits are used here to demonstrate how applying various monetary and non-monetary methods using an ES approach can help to evaluate people-nature connections for informing policy decision-making (Table 2).

A combination of revealed and stated preference methods is typically used in ecological sciences to infer the price of an ES (good or service) from an equivalent market product or from people's stated choices, respectively (Costanza et al., 1997b; TEEB, 2010). The revealed methods include Replacement Cost (RC) i.e. using a price tag for a comparable market service or good; Avoided Cost (AC) i.e. costs saved by obtaining an ES; and Travel Cost (TC) or Hedonic Prices (HP) i.e. value added to

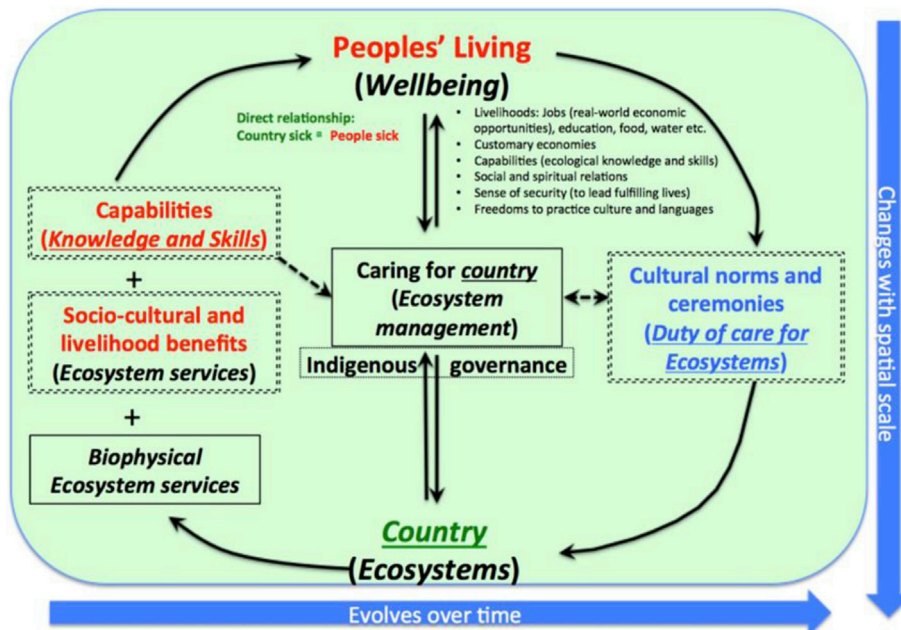


Fig. 3. An Australian Indigenous framework proposed by Sangha and Russell-Smith (2017) describing two-way relationships for how people care for country and how country (Indigenous estates) benefits people. Both the benefits (on the left) and cultural norms (on the right) change over time and space. Corresponding meaning in scientific/common language is written in italics.

Table 2

Application of ES valuation methods to assess Indigenous and local peoples' nature-related values.

Ecosystem Services	Revealed Preference Methods (inferring values from market measures)	Stated Preference Methods (inferring values from people's choices/behaviours (simulated markets))	Others Evaluating the role of ES for peoples' well-being in participation with local communities
Common methods	Replacement Cost (RC), Avoided Cost (AC), Travel Cost (TC) and Hedonic Price (HP) methods.	Contingent Valuation (CV)—WTP for a service or WTA the loss of a service, Choice Modelling (CM), etc.	Frameworks, Tradeoffs, Well-being Indices, Ordinal Ranking (following the Borda rule ^a) using surveys or interviews, and Scenario Planning (SP).
1. Livelihood benefits such as food or medicine	A comparable price from the market, applying RC method. <i>Concerns:</i> sometimes the market price may not reflect the actual value of a good/service, due to omitting or neglecting the importance of associated learning and storylines.	Not appropriate. <i>Concerns:</i> WTP may not be applicable as locals' affordability to pay for a service may be much less compared to the importance of a service/good for them, and similarly, WTA for their limited capacity to comprehend and afford the loss of a service.	Ranking, SP or Tradeoffs can help infer livelihood values of natural resources.
Examples	Sangha and Jalota (2005) evaluated exotic and native tree plantations in India applying direct market price for timber, and indirect market price for fuel wood, fodder (shadow prices assigned by the locals) and other non-market benefits (e.g. ash from burnt fuel using shadow price for potash); Jackson et al. (2014) used the market price of sea food to value fish, turtle and crocodile food collected by the Aboriginal people in the Fitzroy and Daly river catchments in northern Australia.		Oliver (2013) reported subjective qualitative assessment of health benefits of bushfood and medicine interpreted from interviews, surveys, etc. based on relevant literature in Australia; Burgess et al. (2009) reported improvements in people's medical health e.g. blood pressure, Body Mass Index, type2 diabetes, cardio-vascular disease risk, etc. for Arnhem Land community living on country in the NT.
2. Cultural values	Usually TC method, WTP/WTA or CM are applicable to typically reflect the market value if a place is of wider public interest, which may ignore any ceremonial or traditional values. <i>Concern:</i> Local and Indigenous cultural places are important usually only for the locals for cultural and social relationships, stories and associated traditional learning. The above methods often fail to capture their actual value for affording multiple benefits.		Ranking the role of cultural and social relationships and values particularly in Indigenous well-being using surveys, interviews, focus group or SP meetings. For monetary assessment, the ranks/scores can be further proportioned according to well-being costs (reduced) or benefits (enhanced) ^b .
Examples	Costanza et al. (1997a) and de Groot et al. (2012) estimated the value of recreational services of natural places for >100 case studies across the globe. Most of these values were derived using CV–WTP, Benefit transfer or TC methods. TEEB-ES database offers details (https://www.es-partnership.org/services/data-knowledge-sharing/ecosystem-service-valuation-database/). Milcu et al. (2013) reviewed 107 global studies on cultural ES, out of which 35 estimated the monetary values of recreational and ecotourism services of nature. Out of 35, 20 applied CV, 15 TC and others market price and HP with some degree of overlap among them.		Sangha et al. (2017) estimated socio-cultural value of an Indigenous estate in northern Australia using tradeoffs of government welfare expenditure on welfare services; Infield et al. (2015) conducted a global study on analysing key methods to measure the value of cultural services which include ranking, mapping, photos, and change over time in ES and their importance towards peoples' well-being; Birckhead et al. (2011) assessed the qualitative value of cultural services of water for health, food and societal values in South Australia using narrative interviews and participant views expressed during the workshops.
3. Spiritual and sacred values	Estimated cost savings for some degree of health benefits using RC or AC method. <i>Concerns:</i> It may not reflect the real value.	CM only if choices are designed adequately. <i>Concerns:</i> It may fail to reflect the actual value due to limited financial capacity of local peoples, and the complexity of this technique.	Ranking, interview, SP, focus group meetings, etc. (as above).
Examples	Social Ventures Australia (2016) applied health expenditure to assess the spiritual benefits of traditional healing from Indigenous Protected Areas in northern Australia.		Chan et al. (2012) suggested to measure the bundle of cultural benefits using relational qualitative value approaches which include narratives, cultural or mental models (logic), norm-based preference surveys, discursive and citizen juries (elicit broad values) or structured decision making (identifying values as statements), paired comparisons (relative weights across

Table 2 (continued)

Ecosystem Services	Revealed Preference Methods (inferring values from market measures)	Stated Preference Methods (inferring values from people's choices/behaviours (simulated markets))	Others Evaluating the role of ES for peoples' well-being in participation with local communities
			different values) or using conceptual diagrams how a change in ecosystem can impact on peoples' well-being. Cooper et al. (2016) applied qualitative deliberative approaches to underline the importance of aesthetic and spiritual services of nature for the western world including formal and informal discussions to explore the core principles important to the community for mainstreaming them into decision-making.
4. Social values	Estimating total costs to meet and perform ceremonies with other clan members and/or activities on land, applying TC Method. Sangha et al. (2017) estimated the costs of cultural-knowledge camps (mainly for travel and food) on traditional land for the relevant clan members to get-together for ceremonial purposes. These costs depend on the number of participants, local expenses and duration of the camp.	As above.	Ranking, interview, SP, focus group meetings, etc. (as above).
Examples			Chan et al. (2016) suggested valuing a bundle of cultural services using relational (qualitative) value approach which pertains to all relationships between people and nature, including relationships that are between people but involve nature. It includes values such as cultural identity, social cohesion, learning, and moral responsibility, which can be expressed using conceptual diagrams.
5. Capabilities	RC to achieve equivalent skills in a formal setting.	NA	Ranking the role of nature-related peoples' capabilities for well-being
Examples	Social Ventures Australia (2016) and Sangha et al. (2017) used the expenditure costs on formal land management training as a substitute for traditional learning on Indigenous land to develop local capabilities.		Yap and Yu (2016) applied subjective assessment of peoples' capabilities using interviews and surveys through participatory research with Yawuru people in northern Australia. This included identifying and listing well-being indicators, including capabilities that people recognised were important to learn and pass-on to their future generations.

Total well-being expenditure for an individual = \$16,000, which also includes several other benefits.

An estimated value of selected social, spiritual and cultural benefits = $22/50 \times 16,000 = \$7040$.

Note, this type of monetary assessment requires detailed analysis of well-being attributes and related expenditure that are important to the local community.

^a The Borda rule is a method for rank-order scoring to obtain an aggregate score. For example, individual scores for 5 chosen well-being attributes, ranking each from 1 to 10, can be aggregated to obtain a final score (for details see [Dasgupta, 2004](#)). Usually, this is sufficient to inform policy decisions.

^b To extend ordinal ranking for monetary assessment, well-being costs can be estimated from welfare services expenditures and then proportioned according to cultural, spiritual or social scores. For example: an aggregate of social, spiritual and cultural score out of all well-being benefits = $22/50$.

people's experience or assets by an ES ([Table 2](#); details in [Costanza et al., 1997b](#); [Daly and Farley, 2004](#)). Stated preference methods help derive values from simulated market behaviours. These include Contingent Valuation (CV)—Willingness To Pay (WTP) for obtaining a service and Willingness To Accept (WTA) for losing a service, and Choice Modelling (CM) based on individual or group choices for a selected option to infer its value, as discussed below.

Applying these techniques to the selected five core attributes, peoples' ecosystem benefits can be evaluated. For livelihood benefits, the RC method interprets the economic value of an equivalent product from the market ([Table 2](#)). For example, value of bush food (e.g. yams) can be estimated from money spent on buying a similar item (e.g. potatoes) in the market.

Cultural, spiritual, social and capability benefits, vital for peoples' well-being, however are difficult to measure. To infer their values, stated preference methods such as CV, CM, and Trade-offs are generally applied ([Table 2](#); as suggested and applied by [Costanza et al., 1997b](#); [deGroot et al., 2012](#); [TEEB, 2010](#), and many others). Usually, the value of these benefits is indirectly inferred from how people value them. For example, the value of a National Park can be estimated by surveying the visitors for the amount of money they are willing to pay to protect the park. However, a locally important cultural place belonging to Indigenous or local peoples is difficult to evaluate following such a method because of associated ceremonial, cultural or traditional contexts. This requires innovative ways to understand these non-marketable values.

Other non-monetary techniques such as ranking, analyzing and assessing links between peoples' well-being and nature, scenario planning, complement the monetary and non-monetary valuation techniques mentioned in [Table 2](#). For example, ordinal ranking through carefully designed surveys and/or interviews can help to capture non-market values in the form of scores. To estimate their monetary values, these scores can be further proportioned to total well-being expenditure following

the Borda Score (Dasgupta, 2004). For this, a total value of nature-linked well-being benefits and costs needs to be estimated separately, which may include the costs saved and/or the benefits obtained, e.g. savings from health-related expenditure due to people-nature connections, or the benefits of provisioning food and water from their natural systems (details in Table 2).

A major drawback of the marketable/revealed methods (presented in Table 2) is that the estimated economic values may not be valid or even comparable to the real value that Indigenous peoples hold for their lands. This can simply be attributed to inappropriate measures, and people's limited financial capacity to pay for nature's benefit or service. Thus, a profound understanding of local and Indigenous context for applying a right set of measures to capture the right value is essential. Similar concerns are previously highlighted by Chan et al. (2016), Sangha et al. (2017), Small et al. (2017) and others. In addition, the net worth of inter-linked socio-cultural, spiritual and capability benefits is much more than their individual values, mainly due to an overlap of benefits, local knowledges and learning experiences (Chan et al., 2016). For example, the replacement method used to assess the monetary value of bush food does not capture the value of associated benefits such as capability building, or gaining knowledge about how, when, and where to collect bush food from, and the stories related to a place or product itself (Sangha et al., 2017; Yap and Yu, 2016). Thus, caution and profound understanding of values is essential when applying ES evaluation techniques for assessing the value of benefits that Indigenous and local peoples obtain from nature.

Acknowledging that people-nature connections are complex, pluralistic and site-specific, we suggest using marketable and non-marketable valuation techniques in combination with community-based participatory approaches. These approaches include scenario planning, ranking, and focus group meetings which can prove useful to project peoples' values by genuinely engaging with the communities (Tengö et al., 2014; Stewart et al., 2007; Strang, 1997).

Developing a simple metric using key attributes, described in Table 1, and measuring each of them as contributions to peoples' well-being, applying techniques mentioned in Table 2, could serve as a quick accessible policy tool at local or regional scales (Table 3) to inform relevant welfare policies. From a policy context, basic materials for living, good health, security, freedom and choice, and socio-ecological relationships (in contrast to social alone) domains are considered following MA (2003). However, a sustainability domain is included in this metric to consider the importance of continuity of various connections between people and the rest-of-nature (Table 3).

Another feasible (non-monetary) approach is the application of an integrated well-being index that reflects people's quality of life using a composite set of socio-economic and nature-related indicators (World Happiness Report, 2012; Costanza et al., 2007; The Economist Intelligence Unit, 2005). For example, the Government of Bhutan implements a Gross National Happiness Index (GNH index; Centre for Bhutan Studies & GNH Research, 2016) to measure people's happiness around nine domains of human development. Interestingly, these also includes a domain on 'Ecological Diversity and Resilience' (Fig. 4); unlike the exclusive socio-economic well-being indicators applied by many developed and developing countries. The GNH index is then used to inform various public and welfare policies nationally (Centre for Bhutan Studies & GNH Research, 2016). These indices do not reflect the monetary value of people-nature linkages. For Indigenous and local communities, a specifically designed well-being index at the regional or national scale, similar to the GNH index, can be a useful tool (Grieves, 2007; Sangha et al., 2015b).

For a reasoned, pertinent and genuine assessment, application of a mixed set of techniques, at a local scale, is important while recognising that such an assessment may not return the absolute value of nature's services (Sangha et al., 2017; Kumar and Kumar 2008). Effectively, the purpose of an evaluation study is to appropriately understand peoples' values to support appropriate decision-making that enhances peoples' well-being. Our purposed mixed set of techniques can lead to effective and integrated assessments that can inform the policies. In addition, we recommend developing a pluralistic policy platform (Fig. 5), which is critical if the Indigenous and local communities values are to be appropriately understood for implementing

Table 3
A simple metric integrating policy and peoples' perspectives in relation to nature.

	Main benefits people obtain from their traditional or Indigenous estates	Policy: Well-being perspectives					
		Basic materials for living: provision of good quality food, water, air, etc.	Good health: a state of feeling healthy/good to be able to do things that one would like to do.	Socio-ecological relationships: bonds among people, with their lands, and between people because of land.	Freedom and choice: ability to use and value resources as people want.	Security: a sense of certainty to use and value resources over a long-term.	Sustainability: longevity/continuity of systems involving peoples and the rest of nature for affording benefits
Indigenous and local peoples' perspectives	Livelihoods	X ^a	X		X	X	X
	Social		X	X	X	X	X
	Cultural		X	X	X	X	X
	Spiritual		X	X	X	X	X
	Capabilities	X		X	X	X	X
	Measurement using methods described in Table 2	Monetary and/or non-monetary units	Monetary and/or non-monetary units	Mainly in non-monetary units	Mainly in non-monetary units	Mainly in non-monetary units	Mainly in non-monetary units

^a X denotes the value in monetary or non-monetary terms (rank, etc.) depending upon the method used for evaluation.



Fig. 4. The nine domains and 33 indicators of GNH of Bhutan (Source: Centre for Bhutan Studies & GNH Research, 2016).

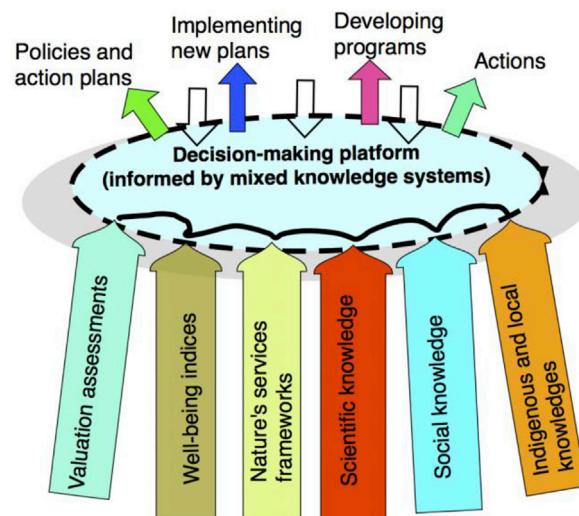


Fig. 5. Interaction of diverse knowledges, represented as 'pillars', to inform decision-making and appropriate policy choices following two-way flows of information.

right policy decisions. Such a pluralistic approach including diverse knowledges and methodologies can yield much better and enriched outcomes. Diverse pillars of knowledges bring the richness of ideas to the decision-making platform where exploring interactions and cross-fertilization among the various issues to find appropriate solutions can help develop a

pertinent set of policies, actions and plans (Neßhöver et al., 2016). Moreover, such platforms will support coordinated formulation and implementation of policies across various well-being and/or natural resource management sectors, relevant from a local to regional scales.

5. Discussion and conclusion

This paper applies a trans-disciplinary ES approach for evaluating the roles of Indigenous and local communities' connections with the rest-of-nature for informing welfare and economic policy development. Necessary steps include: i. identifying key attributes; ii. developing a suitable framework; and iii. assessing the monetary and non-monetary contributions of ecosystem benefits to peoples' well-being in participation with people at local/appropriate scales (IPBES, 2018; TEEB, 2018a). It clearly describes a three step approach operating at a pluralistic policy platform to correctly inform the policy makers for comprehending Indigenous and local values of natural systems above and beyond the livelihood opportunities that are typically considered for developmental policies by the international agencies (e.g. Department for International Development, United Nations Development Programme—Strategic Plan, 2018–21, World Bank—Rural Development Strategy).

To influence policy decision-making, we advocate a mixed approach that essentially includes monetary valuation. There is much topical debate concerning the appropriateness of economic valuation for nature's services (Maier, 2018). The purpose of valuation needs to be clearly defined. Most modern economies continue to ignore the role of nature's services for enhancing human well-being (Costanza et al., 2014). Since industrialization, GDP (Gross Domestic Product) has provided the main focus of measurement for national economies, i.e. solely valuing marketable as opposed to both marketable and non-marketable products or services (Daly, 2015; Costanza et al., 2014). As Sen (1989, 1999a) has noted, the modern economy is an 'engineered economy' which is largely based on increasing material choices, typically disregarding human ethics considerations including connections between people and the rest-of-nature. As illustrated in Table 2, monetary valuations can contribute useful insights where such valuations are appropriate.

A recent global initiative, the Well-being Alliance (WE-ALL), which focuses on peoples' well-being rather than the utilitarian economy, is a pioneer example of emerging international attitudes to more broadly address economic priorities and paradigms. WE-ALL, launched in 2017, by a group of governments including those of Scotland, Costa Rica, Slovenia, and New Zealand, is committed to creating an organisation through which to share good practice in well-being policy making and to champion well-being as the goal of development—contrasting with the current economic development approach (Costanza et al., 2018). WE-ALL recognises that the modern economy is embedded in nature and society.

Nonetheless, there are significant challenges associated with evaluating intricately woven, often complex, people-rest-of-nature connections—for example, valuation of services which are largely delivered communally and benefiting people offsite. In Indigenous and local community contexts ES can often be shown to deliver multi-faceted benefits where the net worth of ES is much more than the sum of individual parts (UNEP, 2017; Chan et al., 2012; de Groot and Ramakrishnan, 2005). Measurement or assessment of these challenges is better dealt with on a case-by-case basis at local or regional scales by exploring connections between people and their supporting natural systems, clearly defining the purposes of valuation, and applying monetary and non-monetary metrics as and where appropriate.

As with Indigenous communities, millions of local agricultural communities around the world are dependent on their land and water resources and derive many non-monetary well-being benefits from their traditional estates (e.g. Gliessman, 2015). In contrast, connections between agricultural societies in contemporary broad-scale agro-economic systems typically are seriously fractured or broken (Shiva, 2016; Nayak, 2018). More traditional communities usually apply time-tested, non-mechanical and non-extractive, generally sustainable land cultivation and water management practices that contribute to the well-being of not only local but also global communities (Food and Agriculture Organisation (FAO) 2010, UNEP 2017). For these small-scale agro-ecological systems, peoples' capabilities—skills and knowledges learnt to manage and cultivate land sustainably—represent a critical element of any evaluation study in addition to market valuation of agricultural outputs (Sangha and Russell-Smith, 2017; Bockstael and Watene, 2016; Yap and Yu, 2016). These agro-ecosystems effectively represent systems of Economies-in-Society-in-Nature (ESN: Costanza et al., 2012). The recent 'Towards TEEB AgriFood' initiative is a first of its kind for assessing the multiple values of small-scale Eco-Agri-Food systems (TEEB, 2018b, 2015).

Support for Indigenous, local or small-scale agricultural communities to continue practising sustainable use of natural resources requires rewarding people via monetary mechanisms such as Payments for Ecosystem Services (PES) (Farley and Costanza, 2010; UN, 2016; Barton et al., 2017). Under PES, the beneficiaries (public and/or private) provide support to suppliers of ES to maintain sustainable practices to manage land for farming or other purposes, and/or improving existing natural systems to maintain or enhance the flow of ES. As Veit and Ding (2016) have proposed, application of PES schemes rewarding Indigenous and local communities for promoting sustainable use of resources as well as addressing current declines in natural resources, is a feasible rational economic approach.

Despite many examples of PES projects, relatively few specifically recognise and support the efforts of Indigenous and local peoples—but see, for example The Nature Conservancy (2006), Forest Trends, the Katoomba Group, and the UNEP (2008), Schomers and Matzdorf (2013), and TEEB (2018ab).

A salutary example of an effective local-scale PES scheme involves supporting watershed management by a group of 29 households from Namey Nichu village in Bhutan, for water users that include five hotels and the local Satsham Water Association (<http://www.snv.org/update/third-pes-agreement-bhutan>). At global scale, the REDD+ (Reduced Emissions from Deforestation and Forest Degradation, with enhanced community benefits) program aims to reduce emissions, conserve

carbon stocks, and promote sustainable management of forests in developing countries (<https://www.unredd.net/about/what-is-redd-plus.html>). Both local- and global-scale PES programs offer significant opportunities for mitigating environmental damage, and supporting livelihood options of rural communities. Such programs also address various of the United Nations' Sustainable Development Goals (UN, 2015, 2016).

By presenting step-wise integrated information on key ES vital for Indigenous and local communities, ES frameworks and relevant valuation techniques including using a pluralistic policy platform, this paper outlines a clear pathway to streamline the role of nature for Indigenous and local peoples' well-being as well as the role that they play towards sustaining natural resources for its inclusion in development policies at various local, regional or global scales.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gecco.2019.e00668>.

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