



COMMENT



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# Ecosystem accounting and the need to recognise Indigenous perspectives

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Ecosystem accounting has been advocated as a potential ‘game changer’ for managing the environment and economy and was recently standardised by the United Nations (UN) in the System of Environmental-Economic Accounting Ecosystem Accounting (SEEA-EA). However, Indigenous Peoples, their lands, values, and knowledge have not been explicitly included in the SEEA-EA. With more than 40% of global land under some form of Indigenous management or tenure, this omission must be addressed if Indigenous Peoples are to use the SEEA-EA; and if the values and aspirations of Indigenous Peoples are to be reflected in broader environmental and economic management and policy. We outline how Indigenous perspectives differ from those currently recognised in SEEA-EA. A key difference is that Indigenous Peoples view themselves as part of ecosystems rather than distinct from them, and this relationship is two-way, not one-way, as presented in the SEEA-EA. Reconciling these perspectives is possible but will require collaborative engagement with Indigenous Peoples guided by the principles of free, prior, and informed consent. To achieve a reconciliation, we call for two actions: (1) including recognition of Indigenous values as a new item on the SEEA-EA research agenda, and; (2) that Indigenous Peoples be part of the UN processes governing the development of the SEEA-EA.

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## Introduction

Ecosystem accounting was standardised via the System of Environmental-Economic Accounting-Ecosystem Accounting (SEEA-EA) in March 2021 (UN et al., 2021). Developed in response to the call in Agenda 21 for the values of nature to be recognised within the information systems of governments (UN, 1992), the SEEA is a promising information system for environmental and economic management, formalising the concepts of natural capital and ecosystem services in alignment with the System of National Accounts (SNA). The SEEA-EA is important as it makes nature's contributions to society more visible and enables the impact of human activity to be reflected in changes to ecosystem condition and extent (Vardon et al., 2021).

Internationally, the SEEA framework has been endorsed as a means to ensure natural capital forms a regular part of mainstream decision-making by the United Nations (UN) (UN et al., 2014), the Organisation for Economic Co-operation and Development (OECD, 2021) and the European Union (ESSC, 2019). To date, ecosystem accounts informed by the SEEA-EA are being developed or have been published in 24 countries (Hein et al., 2020), with more countries preparing for implementation (UNCEEA, 2021). Application of accounts by governments, corporate and research groups (e.g., Bagstad et al., 2021) has demonstrated their usefulness for informing decision-making and the potential of natural capital accounting as a 'game changer' for supporting the conservation of the environment (Burnett and Vardon, 2021).

If the SEEA-EA is to provide a 'comprehensive and multi-purpose view of the interrelationships between the economy and the environment...and the benefits these bring to humanity' (UN-SEEA, 2018), then the priorities must be considering how the diverse values of nature articulated by those people with connections and responsibilities for land, sea and water management can be included in the SEEA-EA, and how the framework can be used by all user groups. This includes considering how the values of a diversity of peoples align with SEEA-EA principles. The development and application of the SEEA-EA, while including participation from low- and middle-income countries, was and remains dominated by European values and perspectives, with no examples of the use of accounting for, or by, Indigenous Peoples in the SEEA-EA reference list.

The lack of active engagement of Indigenous Peoples in the SEEA-EA's development is a failure of process. Recognition of how Indigenous knowledge, cultures and traditional practices contribute to sustainable and equitable development and proper management of the environment is laid out by the UN Declaration on the Rights of Indigenous Peoples (UNDRIP) (UN, 2007). By failing to engage with the plural knowledges and co-production of ecosystem services that are recognised as key to Indigenous Peoples' relationships with the environment (Stoeckl et al., 2021), the SEEA-EA has marginalised important values that are derived from, and delivered to, ecosystems. These omissions must be addressed if Indigenous Peoples are to use the SEEA-EA for their needs and to ensure procedural justice in the environmental and economic policy driven by the SEEA.

We call for two actions to ensure that Indigenous Peoples and their values are recognised within the SEEA-EA so that it may be of use to their land and sea management. Firstly, Indigenous perspectives should be added as a new item to the SEEA-EA research agenda. Secondly, the UN Committee of Experts on Environmental-Economic Accounting (UNCEEA; the body governing the development of the SEEA-EA and other SEEA components) should include Indigenous representatives. To help initiate this process and provide a starting point for discussions,

we outline how ecosystem accounting could provide a framework to reflect Indigenous Peoples' values in decision-making and identify theoretical and practical challenges in aligning Indigenous perspectives with the SEEA-EA. We finish by proposing three core principles of free, prior and informed consent, to enable Indigenous Peoples' values to be reflected in the SEEA-EA, which should lead to Indigenous Peoples becoming active contributors and users of the framework.

## Indigenous Peoples and the protection of natural capital

Globally, over 370 million people identify as Indigenous, and around 40% of the planet's land area is recognised as under some form of Indigenous management or tenure (Garnett et al., 2018). Ecological services from cultural and environmental management practices on Indigenous Lands (ILs)<sup>1</sup> are widely recognised (Gómez-Baggethun et al., 2013). In November 2021, the United States government, for example, committed to elevating Indigenous knowledge in federal policy decisions in recognition that this knowledge 'promotes environmental sustainability and the responsible stewardship of natural resources through relationships between humans and environmental systems' (Lander and Mallory, 2021, p. 1). In Australia, Indigenous Peoples are recognised in several ways, including in the *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia). Three objects in Section 3 of the Act reference Indigenous Peoples, namely: Objects: (d) to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and Indigenous Peoples; (f) to recognise the role of Indigenous People in the conservation and ecologically sustainable use of Australia's biodiversity, and; (g) to promote the use of Indigenous Peoples' knowledge of biodiversity with the involvement of, and in co-operation with, the owners of the knowledge. ILs are also viewed as critical for delivering on international goals, including the post-2020 global biodiversity targets (Reyes-García et al., 2022), the Global Goals for Sustainable Development (SDGs) (UNDESA, 2016), and the COP 26 climate targets (UNFCCC, 2021).

Indigenous Peoples have the right to self-determine the use of their lands and associated natural resources (UN, 2007). Despite the increasing recognition of the benefits of Indigenous management practices for the protection and enhancement of natural capital (e.g., Fa et al., 2020; Sze et al., 2021), a historic lack of investment in Indigenous communities, underrepresentation of Indigenous Peoples in governance, and sidelining of cultural values and knowledge from decision-making means biocultural values have commonly been overlooked in policy to the detriment of ILs, their owners and managers (Cámara-Leret and Dennehy, 2019; Oloriz and Parlee, 2020). A more equitable system for managing natural capital will require consideration of how current systems of management at both national and global scales can be reframed to support Indigenous Peoples to better communicate and advocate their rights and values in land management and help ensure that non-Indigenous people appreciate these values, so they are reflected in broader policy and environmental and economic decision-making.

With some elaboration, the SEEA-EA can be used as the backbone for an information system that supports transparent, self-determined governance of ILs. As ecosystem accounts provide consistent information linking environmental, economic and socio-cultural data, they help ensure management and policy options can be assessed objectively, and trade-offs considered between different objectives over time and space and between environmental, economic and socio-cultural domains (Vardon et al., 2016). Developing accounts for ILs would equip Indigenous Peoples with integrated information about their land and

resources, with such information important to informing autonomous decision-making. Further, since for many Indigenous Peoples, wellbeing is inextricably linked to ecosystem and environmental condition (Sangha et al., 2015), ecosystem accounts could provide important information that links to socio-economic indicators and outcomes. In the long-term, this could lead to the more effective compensation and financing of ILs for the benefits these areas provide to both conservation and broader socio-economic wellbeing via Indigenous land management (e.g., Allam et al., 2021).

**Indigenous perspectives and the SEEA-EA**

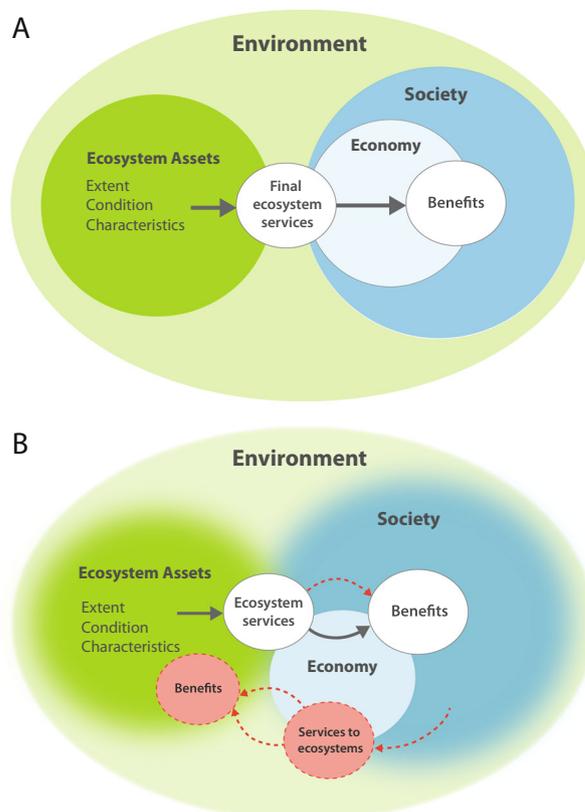
An ongoing challenge for integrating Indigenous Peoples’ perspectives within existing governance frameworks is around questions of value, specifically, whose values are being represented (Morphy, 2008). Western-oriented indicators and frameworks of management often have the unintended consequence of the ‘governance and knowledge effect’, whereby: ‘the [indicators] represent the perspective and frameworks of those who produce them as well as their underlying political and financial power... who gets counted depends on which groups and organisations can afford to count’ (Merry, 2011, p. S88). The recognition of Indigenous values within the SEEA-EA could address this challenge and help align Indigenous conceptions of human–nature relationships with the ecosystem services framings already included in the SEEA-EA. To do this, conceptual differences (and similarities) between Indigenous values and those values included in the SEEA-EA need to be identified, a process established for their resolution of difference, and practical ways to measure Indigenous values developed.

**Conceptual issues.** A key difference between Indigenous and non-Indigenous conceptualisations of ecosystem services is that Indigenous Peoples view themselves as part of ecosystems, rather than distinct from them, and this relationship is two-way, not one-way, as presented in the SEEA-EA (Normyle et al., 2021). ILs provide cultural services to people (e.g., the symbolic value of a waterhole), and in return people provide a range of services to nature (e.g., people maintain the waterhole by removing weed species) (Comberti et al., 2015). The SEEA-EA model (UN et al., 2021, p. 28) shows a one-way conceptualisation of nature contributing positively to people (e.g., Fig. 1) and the dissection of the landscape as distinct ‘ecosystem assets’. This presents a perspective of the biophysical environment and people as separate and ecosystem services as one-way flows to people. This ‘atomistic’ view fails to account for the values of many Indigenous Peoples, which emphasise the connections both between and within human and natural systems and the co-production of ecosystem services (Stoeckl et al., 2021).

If the SEEA-EA is to provide a holistic representation of the world, then people must be viewed as part of ecosystems. People create constant and continuous change to the biophysical environment, and these changes have both positive and negative effects on ecosystems. Considering people are part of ecosystem assets may be possible using the SEEA-EA’s definition of ecosystem assets, which is:

Ecosystem assets are contiguous spaces of a specific ecosystem type characterised by a distinct set of biotic and abiotic components and their interactions. (UN et al., 2021, para. 2.11, p. 26)

As a biotic component of ecosystem assets, people have interactions with other biotic and abiotic components of ecosystems. The inclusion of agricultural areas (e.g., cropland) and urban settlements as types of ecosystem assets, both of which



**Fig. 1 Conceptual diagram of ecosystem accounting flows.** In **A** the SEEA-EA conceptual diagram of ecosystem service flows (UN et al., 2021, p. 28) shows a one-way flow of benefits from ecosystems to people via the economy. In **B**, an indicative example of how two-way flows may be included within this model is provided. Benefits from ecosystem services are recognised as both flowing through the economy and outside of it. Society contributes services to ecosystems (e.g., enhancing, restoring, protecting services (Comberti et al., 2015)), and these services may be provided via the economy (e.g., through labour), but also outside the formal economy. The blurred boundaries of the ‘ecosystem’ and ‘society’ entities depicted are representative of the continuity of relationships that underpin many Indigenous relationships between humans and ecosystems.

are dependent on people for their continued existence (or in terms of the SEEA-EA terminology, their extent and condition) points to this. Extending this recognition to the ecosystems under Indigenous management would seem to align with this conception.

It is important to note two key caveats to this approach. First, the current definition of an ‘undisturbed’ ecosystem in the SEEA-EA is its ‘pre-industrial state’ (UN et al., 2021, p. 115). In the Indigenous context, where human occupation (and hence interactions) on many ILs have been documented for thousands of years prior to European industrialisation (Clarkson et al., 2017), this is, at the very least, culturally inappropriate and evidence of a dominant European perspective. Second, in considering people as a component of ecosystem assets, the association of the term ‘assets’ with owned property or resources of economic value needs to be considered. Transferring the definition of an economic asset to people risks subjecting individuals or communities to the notion that they can be owned, used, or valued monetarily for the sake of economic comparison (Spash and Hache, 2021). This has moral and ethical implications, and it is recommended that local people should not necessarily be viewed as merely another ecosystem asset, but

**Box 1 | Principles of free, prior and informed consent extracted from UNPFII (2005)**

According to the ‘common practical understanding’ of free, prior and informed consent (FPIC) elaborated by the UN Permanent Forum on Indigenous Issues (2005), FPIC can be explained as follows:

- **Free** should imply no coercion, intimidation, or manipulation.
- **Prior** should imply that consent has been sought sufficiently before any authorisation or commencement of activities. Respect should be shown for the time requirements of Indigenous consultation and any consensus processes.
- **Informed consent** should imply sufficient information for all key project and activity details. Consent requires consultation and participation as crucial components of research and decision-making processes. Consultation should be undertaken in good faith and requires time and an effective communication system among interest-holders.

FPIC should be sought sufficiently in advance of the commencement or authorisation of research and/or data collection activities. These activities must account for Indigenous Peoples’ own decision-making processes across all phases of assessment, planning, implementation, monitoring, evaluation, and project closure. FPIC also requires explicit agreement from all participants around data ownership, information sharing and projected project outcomes and benefits. In practice, Indigenous Peoples, organisations and/or communities should be able to participate in engagement through their own freely chosen representatives and customary or other institutions.

rather as (co)managers of ecosystem assets and of the corresponding services arising from these systems.

Indigenous Peoples’ conceptions of culture and its relationship to wellbeing have also largely been excluded from environmental and development frameworks, with reporting on human wellbeing an ongoing challenge for quantifying reporting frameworks. For example, while the UN’s Millennium Ecosystem Assessment (MA) highlighted the role of natural systems in human wellbeing and included subjective measures for values such as cultural services, the framework did not suggest any methods to link people’s values to ecosystems in terms of human wellbeing (Sangha et al., 2015). In defining a system of stocks and flows, whereby ecosystem assets (such as a forest or river) produce ecosystem services that in turn provide benefits to human beneficiaries, the SEEA-EA framework recommends quantification in physical or monetary terms and acknowledges that the benefits of these flows contribute to wellbeing. Wellbeing is mentioned in the opening sentence of the Introduction to the SEEA-EA (UN et al., 2021, p. 2), but it is not defined nor included in the conceptual model of the SEEA-EA (Fig. 1). Wellbeing is also mentioned in the description of the ecosystem services related to non-use values and to ‘ecosystem and species appreciation’ (UN et al., 2021, p. 134) and in the section on indicators, but no wellbeing metric is proposed.

Wellbeing for Indigenous Peoples is inextricably linked to nature, and specifically the condition and flows from ecosystem assets (Yap and Yu, 2016). Failure to consider wellbeing when defining the ‘value’ from cultural ecosystem service flows (CES) on ILs would limit the recognition of the concept of relationality, which is about the connections, to, and between, people and the landscape that brings about a ‘good life’ (Gould et al., 2019). Relationality enhances both the monetised and substantive values arising CES, as it is Indigenous Peoples’ interactions with the landscape that shape its recreational and aesthetic value (Stoeckl et al., 2021). For many communities, sentiments of relationality are of equal or greater importance than monetary value (Graham, 1999), and therefore incorporating plural perspectives that account for the complexity of Indigenous Peoples’ relationships to biocultural systems will be a key priority for any valuation of stocks, flows or benefits (e.g., Zafra-Calvo et al., 2020).

How to recognise and account for Indigenous Peoples’ concepts of wellbeing in the SEEA-EA is an issue requiring research. One example of an approach to recognise and report on human–nature links to wellbeing is provided by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (Díaz et al., 2018). IPBES has emerged as a potential way to ‘extend’ the ecosystem services concept by

including regulating, material, and the nonmaterial contributions that link human–nature relations beyond the ‘stock-flow, ecosystem services concept of decision-making framing’ (Ellis et al., 2019). A particular emphasis of IPBES is on recognising the detailed knowledge on biodiversity and ecosystems that Indigenous Peoples and local communities possess (IPBES, 2021). However, some critics have dismissed the IPBES as merely a ‘duplication of effort or division of an increasingly strong and diverse community’ (e.g., de Groot et al., 2018), with calls for the framework to extend further to link human–nature relations (Stevance et al., 2020).

The Capability Approach has also been explored for its potential to measure people’s experiences of wellbeing in relation to their values, concerns, and capabilities involving natural systems (Sangha et al., 2015). The approach is noted for its flexibility to support the identification of important capabilities based on specific contexts and people’s own values, aligning it to the UNDRIP’s assertion that Indigenous Peoples must be agents of their own development (Yap and Yu, 2016). By providing a socio-economic-ecological perspective on Indigenous wellbeing and its links to biophysical values (Sangha et al., 2015), the Capability Approach offers scope to better demonstrate how people’s social, economic and cultural worlds as exemplified through their capabilities related to their natural systems. Given the current inability for current CES approaches to address relational values (Chan et al., 2016), it seems reasonable that alternate approaches such as the IPBES and Capability Approach be examined for lessons as to how these values may be better evaluated within the SEEA-EA’s approach to ecosystem service classification and its links to human wellbeing.

**Practical issues.** Recognition of Indigenous perspectives and the development of appropriate concepts and classifications for ecosystem assets and service flows are necessary first steps that need to be followed by the development of metrics. The quantification of assets and services of relevance to Indigenous Peoples is likely to involve qualitative data, such as semi-structured interviews and surveys that do not lend themselves to replicability over time (Lewis and Sheppard, 2006). It is common for Indigenous research studies to include small sample sizes based on limited numbers of knowledge-holders with authority to speak about cultural values (Guillemin et al., 2016). Considering how such data may be regularly and cost-effectively replicated and aggregated to align with regional and national scale ecosystem accounts, will require testing through a diverse range of case studies. Cultural values can be expressed and aggregated

without monetisation, and valuation is at the top of the SEEA-EA research agenda.

### The way forward

The rapidly expanding global production of ecosystem accounts and the recent adoption of the SEEA-EA presents a timely opportunity for Indigenous voices to be included in the push towards finding a better balance between environmental, economic and societal imperatives. To take this opportunity requires action by Indigenous Peoples and those involved in the governance and implementation of the SEEA-EA, including the UN, national governments and the research community. To this end, we call for two actions: (1) including recognition of Indigenous perspectives as a new item on the SEEA-EA research agenda, and; (2) that Indigenous Peoples become part of the UN processes governing the SEEA-EA via their inclusion in the UNCEEA.

Since Indigenous Peoples remain largely alienated from the use of data and its utilisation within the channels of policy power (Walter et al., 2021), Indigenous representation on UNCEEA is essential. Indigenous representatives on UNCEEA will need to actively seek input from Indigenous leaders and organisations. In nations such as the United States, Canada, and Australia where Indigenous recognition and engagement forms a key priority on the national agenda (e.g., Commonwealth of Australia, 2018; Government of Canada, 2021; Lander and Mallory, 2021), elevating Indigenous leadership and recognition of ILs within accounting development could set a precedent for more inclusive environmental management and policy. This is particularly important to begin the process of decolonising current approaches to valuation and better ensure that environmental and ecosystem accounting approaches are inclusive of the diversity of people and their relationships with natural systems (Trisos et al., 2021).

To aid engagement, we suggest using the core principles of free, prior and informed consent (Box 1). Applying these principles in the context of the SEEA-EA's development and implementation will help avoid the common criticism of such attempts that they are Eurocentric. For example, for two decades, the international development agenda driven by the Millennium Development Goals (MDGs) and SDGs has improved focus on human and societal indicators but has sidelined culture as a dimension of development (Yap and Watene, 2019). Moving towards meaningful reconciliation will require renewed efforts to address this gap and value culture in a meaningful and appropriate manner to the diversity of Indigenous knowledge and values. Guidance from principles such as cultural relativism, here, can support the development of accounting approaches based on local needs and values, thus overcoming the inherent biases associated with applying universal numerical metrics (Groenfeldt, 2003).

It is also acknowledged that there are several risks associated with bringing human–nature relationships and Indigenous values into an accounting system. Issues including definitional problems, data inadequacy and concerns around data ownership and use will be important to resolve to ensure that complex plural values are both represented and shared within broader discourse in a manner that appropriately respects and represents Indigenous data sovereignties (Walter et al., 2021). Given that no approaches to elicit peoples' values are inherently neutral, there is a risk of the unintended consequence of inequity that may occur as the SEEA-EA framework is built and applied predominantly by large-scale agencies such as the UN and national governments (Jacobs et al., 2020). To reduce such risks, it will be an imperative for all those involved in the SEEA-EA's development to build opportunities for participation and empowerment into the framework's application across scales, to ensure that the SEEA-EA is fit-for-purpose

and reflective of the values of Indigenous Peoples, and the wide range of other potential user groups.

### Conclusion

The SEEA-EA promises to mainstream nature within decision-making. We call for the framework to ensure that in this, the relationships with, uses of, and values derived from nature of all people are mainstreamed within the SEEA-EA. For this to happen, the perspectives of Indigenous Peoples must be recognised and respected within the SEEA-EA, and Indigenous Peoples must be involved in the ongoing development and governance of accounting standards. Without this, Indigenous Peoples are less likely to use the SEEA-EA to manage ILs, and decision-makers will be less able to take Indigenous perspectives into account in decision-making process. This would risk the SEEA-EA becoming another example of Indigenous Peoples' disenfranchisement within environmental and economic policymaking globally.

### Data availability

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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### Note

1 Indigenous Lands are defined here as areas of land that are traditionally owned, managed, used or occupied by Indigenous Peoples.

### References

- Allam Z, Jones, DS, Biyik C (2021) Introducing a global planetary ecosystem accounting in the wake of the Amazon Forest fires. *Humanit Soc Sci* 8(1). <https://doi.org/10.1057/s41599-021-00937-0>
- Bagstad KJ, Carter J, Shapiro CD et al. (2021) Lessons learned from development of natural capital accounts in the United States and European Union. *Ecosyst Serv* 52:101359. <https://doi.org/10.1016/j.ecoser.2021.101359>
- Burnett P, Vardon M (2021) Environmental accounting could revolutionise nature conservation, but Australia has squandered its potential. *The Conversation*. <https://theconversation.com/environmental-accounting-could-revolutionise-nature-conservation-but-australia-has-squandered-its-potential-163661>. Accessed 04 Jan 2022
- Cámara-Leret R, Dennehy Z (2019) Information gaps in indigenous and local knowledge for science-policy assessments. *Nat Sustain* 2(8):736–741. <https://doi.org/10.1038/s41893-019-0324-0>
- Chan KMA, Balvanera P, Benessaiah K et al. (2016) Why protect nature? Rethinking values and the environment. *Proc Natl Acad Sci USA* 113(6):1462–1465. <https://doi.org/10.1073/pnas.1525002113>
- Clarkson C, Jacobs Z, Marwick B et al. (2017) Human occupation of northern Australia by 65,000 years ago. *Nature* 547(7663):306–310. <https://doi.org/10.1038/nature22968>
- Comberty C, Thornton TF, Wyllie de Echeverria VR et al. (2015) Ecosystem services or services to ecosystems? Valuing cultivation and reciprocal relationships between humans and ecosystems. *Glob Environ Change* 34:247–262. <https://doi.org/10.1016/j.gloenvcha.2015.07.007>
- Commonwealth of Australia (1999) Environment Protection and Biodiversity Conservation Act, Pub. No. 91, 1999. <https://www.legislation.gov.au/Details/C2016C00777>. Accessed 04 Jan 2022
- Commonwealth of Australia (2018) Final report of the joint select committee on constitutional recognition relating to Aboriginal and Torres Strait Islander Peoples. [https://www.aph.gov.au/Parliamentary\\_Business/Committees/Joint/Former\\_Committees/Constitutional\\_Recognition\\_2018/ConstRecognition/Final\\_Report](https://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Former_Committees/Constitutional_Recognition_2018/ConstRecognition/Final_Report). Accessed 04 Jan 2022
- de Groot R, Costanza R, Braat L et al. (2018) Ecosystem services are nature's contributions to people: Response to: Assessing nature's contributions to people. *Sci Prog* 359:270–272. <http://science.sciencemag.org/content/359/6373/270/tab-e-letters>
- Díaz S, Pascual U, Stenseke M et al. (2018) Assessing nature's contributions to people: recognizing culture, and diverse sources of knowledge, can improve assessments. *Science* 359(6373):270–272. <https://doi.org/10.1126/science.aap8826>

- Ellis EC, Pascual U, Mertz O (2019) Ecosystem services and nature's contribution to people: negotiating diverse values and trade-offs in land systems. *Curr Opin Environ Sustain* 38:86–94. <https://doi.org/10.1016/j.cosust.2019.05.001>
- ESSC (2019) European strategy for environmental accounts 2019–2023. European Statistical System Committee. <https://ec.europa.eu/eurostat/documents/1798247/6191525/European+Strategy+for+Environmental+Accounts/>. Accessed 06 Jan 2022
- Fa JE, Watson JE, Leiper I et al. (2020) Importance of Indigenous Peoples' lands for the conservation of Intact Forest Landscapes. *Front Ecol Environ* 18(3):135–140. <https://doi.org/10.1002/fee.2148>
- Garnett ST, Burgess ND, Fa J et al. (2018) A spatial overview of the global importance of Indigenous lands for conservation. *Nat Sustain* 1(7):369–374. <https://doi.org/10.1038/s41893-018-0100-6>
- Gómez-Baggethun E, Corbera E, Reyes-García V (2013) Traditional ecological knowledge and global environmental change: research findings and policy implications. *Ecol Soc* 18(4):72. <https://doi.org/10.5751/ES-06288-180472>
- Gould RK, Pai M, Muraca B et al. (2019) He 'ike 'ana ia i ka pono (it is a recognizing of the right thing): how one indigenous worldview informs relational values and social values. *Sustain Sci* 14(5):1213–1232. <https://doi.org/10.1007/s11625-019-00721-9>
- Government of Canada (2021) Principles respecting the Government of Canada's relationship with Indigenous peoples. <https://www.justice.gc.ca/eng/csj-sjc/principles-principes.html/principles.pdf>. Accessed 06 Jan 2022
- Graham M (1999) Some thoughts about the philosophical underpinnings of aboriginal worldviews. *Worldviews: Environ Cult Relig* 3(2):105–118. <https://doi.org/10.1163/156853599X00090>
- Groenfeldt D (2003) The future of indigenous values: cultural relativism in the face of economic development. *Futures* 35(9):917–929. [https://doi.org/10.1016/S0016-3287\(03\)00049-1](https://doi.org/10.1016/S0016-3287(03)00049-1)
- Guillemin M, Gillam L, Barnard E et al. (2016) “we're checking them out”: indigenous and non-Indigenous research participants' accounts of deciding to be involved in research. *Int J Equity Health* 15(1):1–10. <https://doi.org/10.1186/s12939-016-0301-4>
- Hein L, Bagstad KJ, Obst C et al. (2020) Progress in natural capital accounting for ecosystems. *Science* 367(6477):514–515. <https://doi.org/10.1126/science.aaz8901>
- IPBES (2021) Indigenous and local knowledge in IPBES. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. <https://ipbes.net/indigenous-local-knowledge>. Accessed 04 Jan 2022
- Jacobs S, Zafra-Calvo N, Gonzalez-Jimenez D et al. (2020) Use your power for good: Plural valuation of nature—the Oaxaca statement. *Global Sustainability* 3:E8. <https://doi.org/10.1017/sus.2020.2>
- Lander E, Mallory B (2021) Indigenous traditional ecological knowledge and federal decision making. Executive Office of the United States President. <https://www.whitehouse.gov/wp-content/uploads/2021/11/111521-OSTP-CEQ-ITEK-Memo.pdf>. Accessed 04 Jan 2022
- Lewis JL, Sheppard SRJ (2006) Culture and communication: Can landscape visualization improve forest management consultation with indigenous communities? *Landsc Urban Plan* 77(3):291–313. <https://doi.org/10.1016/j.landurbplan.2005.04.004>
- Merry SE (2011) Measuring the world indicators, human rights, and global governance. *Curr Anthropol* 52(SUPPL. 3). <https://doi.org/10.1086/657241>
- Morphy F (2008) Whose governance, for whose good? The Laynhapuy Homelands Association and the neo-assimilationist turn in Indigenous policy. In: Hunt J, Smith D, Garling S, Sanders W (eds.) *Contested governance: culture, power and institutions in Indigenous Australia*. Centre for Aboriginal Economic Policy Research College, The Australian National University, Canberra
- Normyle A, Doran B, Vardon M et al. (2021) Accounting for Indigenous perspectives in SEEA-EA in theory and practice. Paper presented at the 27th Meeting of the London Group on Environmental Accounting, Bonn, 27 Sep–4 Oct 2021. [https://seea.un.org/sites/seea.un.org/files/normyle\\_accounting-for-indigenous-perspectives-in-seea-ea-in-theory-and-practice\\_paper.pdf](https://seea.un.org/sites/seea.un.org/files/normyle_accounting-for-indigenous-perspectives-in-seea-ea-in-theory-and-practice_paper.pdf). Accessed 14 Jan 2022
- OECD (2021) Biodiversity, natural capital and the economy: a policy guide for finance, economic and environment ministers. <https://doi.org/10.1787/1a1ae114-en>. Accessed 04 Jan 2022
- Oloriz C, Parlee B (2020) Towards biocultural conservation: local and indigenous knowledge, cultural values and governance of the White Sturgeon (Canada). *Sustainability* 12(18). <https://doi.org/10.3390/SU12187320>
- Reyes-García V, Fernández-Llamazares Á, Aumeeruddy-Thomas Y et al. (2022) Recognizing indigenous peoples' and local communities' rights and agency in the post-2020 Biodiversity Agenda. *Ambio* 51(1):84–92. <https://doi.org/10.1007/s13280-021-01561-7>
- Sangha KK, Le Brocq A, Costanza R et al. (2015) Ecosystems and indigenous well-being: an integrated framework. *Glob Ecol Conserv* 4:197–206. <https://doi.org/10.1016/j.gecco.2015.06.008>
- Spash CL, Hache F (2021) The Dasgupta Review deconstructed: an exposé of biodiversity economics. *Globalizations*. <https://doi.org/10.1080/14747731.2021.1929007>
- Stevance AS, Bridgewater P, Louafi S et al. (2020) The 2019 review of IPBES and future priorities: reaching beyond assessment to enhance policy impact. *Ecosystem People* 16(1):70–77. <https://doi.org/10.1080/26395916.2019.1702590>
- Stoeckl N, Jarvis D, Larson S et al. (2021) Australian Indigenous insights into ecosystem services: beyond services towards connectedness—People, place and time. *Ecosyst Serv* 50. <https://doi.org/10.1016/j.ecoser.2021.101341>
- Sze JS, Carrasco LR, Childs D et al. (2021) Reduced deforestation and degradation in Indigenous Lands pan-tropically. *Nat Sustain* 2. <https://doi.org/10.1038/s41893-021-00815-2>
- Trisos CH, Auerbach J, Katti M (2021) Decoloniality and anti-oppressive practices for a more ethical ecology. *Nat Ecol Evol* 5(9):1205–1212. <https://doi.org/10.1038/s41559-021-01460-w>
- UN (2007) United Nations Declaration on the Rights of Indigenous Peoples. <https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html>. Accessed 14 Jan 2022
- UN et al. (2021) System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA). White cover publication, pre-edited text subject to official editing. <https://seea.un.org/ecosystem-accounting>. Accessed 04 Jan 2022
- UN (1992) United Nations Conference on Environment and Development, 1992. Agenda 21, Rio Declaration. <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>. Accessed 12 Mar 2022
- UN et al. (2014) System of Environmental-Economic Accounting 2012: Central Framework. <https://doi.org/10.5089/9789211615630.069>. Accessed 02 Jan 2022
- UNCEEA (2021) Update on the UNCEEA and the 52nd Session of the UN Statistical Commission. [https://unceea.org/sites/default/files/2021-03/S1\\_UNCEEA\\_EN.pdf](https://unceea.org/sites/default/files/2021-03/S1_UNCEEA_EN.pdf). Accessed 04 Jan 2022
- UNDESA (2016) Indigenous Peoples and the 2030 Agenda. United Nations Department of Economic and Social Affairs. <https://www.un.org/development/desa/indigenouspeoples/focus-areas/post-2015-agenda/the-sustainable-development-goals-sdgs-and-indigenous.html>. Accessed 14 Jan 2022
- UNFCCC (2021) COP26 strengthens role of indigenous experts and stewardship of nature. United Nations Framework Convention on Climate Change. <https://unfccc.int/news/cop26-strengthens-role-of-indigenous-experts-and-stewardship-of-nature>. Accessed 14 Jan 2022
- UNPFII (2005) Permanent forum on indigenous issues, report of the international workshop on methodologies regarding free, prior and informed consent and indigenous peoples. <https://www.un.org/development/desa/indigenouspeoples/meetings-and-workshops/international-workshop-on-methodologies-regarding-free-prior-and-informed-consent-and-indigenous-peoples.html>. Accessed 14 Jan 2022
- UN-SEEA (2018) The role of the system of environmental-economic accounting as a measurement framework in support of the post-2020 agenda. <https://www.cbd.int/doc/strategic-plan/Post2020/postsbi/unceea.pdf>. Accessed 14 Jan 2022
- Vardon M, Burnett P, Dovers S (2016) The accounting push and the policy pull: balancing environment and economic decisions. *Ecol Econ* 124:145–152. <https://doi.org/10.1016/j.ecolecon.2016.01.021>
- Vardon M, Keith H, Burnett P et al. (2021) From natural capital accounting to natural capital banking. *Nat Sustain* 4(10):832–834. <https://doi.org/10.1038/s41893-021-00747-x>
- Walter M, Lovett R, Maher B et al. (2021) Indigenous data sovereignty in the era of big data and open data. *Aust J Soc Issues* 56(2):143–156. <https://doi.org/10.1002/ajs4.141>
- Yap MLM, Watene K (2019) The Sustainable Development Goals (SDGs) and Indigenous Peoples: another missed opportunity? *J Human Dev Capabil* 20(4):451–467. <https://doi.org/10.1080/19452829.2019.1574725>
- Yap MLM, Yu E (2016) Operationalising the capability approach: developing culturally relevant indicators of indigenous wellbeing—an Australian example. *Oxf Dev Stud* 44(3):315–331. <https://doi.org/10.1080/13600818.2016.1178223>
- Zafra-Calvo N, Balvanera P, Pascual U et al. (2020) Plural valuation of nature for equity and sustainability: insights from the Global South. *Glob Environ Change* 63:102115. <https://doi.org/10.1016/j.gloenvcha.2020.102115>

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**Additional information**

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