Received: 22 October 2024 | Accepted: 23 February 2025

DOI: 10.1002/pan3.70033

People and Nature

PERSPECTIVE

Examining Human-Nature Relationships through the Lens of Reciprocity: Insights from Indigenous and Local Knowledge

Reciprocity towards nature in the biodiversity science–policy interface

Sandra Díaz[1,2,3,4] | Unai Pascual[5,6]

[1]Consejo Nacional de Investigaciones Científicas y Técnicas, Instituto Multidisciplinario de Biología Vegetal (IMBIV), Córdoba, Argentina; [2]Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba, Córdoba, Argentina; [3]Leverhulme Centre for Nature Recovery, University of Oxford, Oxford, UK; [4]Environmental Change Institute, School of Geography and the Environment, University of Oxford, Oxford, UK; [5]Basque Centre for Climate Change (BC3), Leioa, Spain and [6]Ikerbasque, Basque Foundation for Science, Bilbao, Spain

Correspondence
Sandra Díaz
Email: sandra.diaz@unc.edu.ar

Funding information
BC3's Maria de Maeztu excellence accreditation 2023-2026, Grant/Award Number: CEX2021-001201-M; Universidad Nacional de Córdoba, Argentina; Consejo Nacional de Investigaciones Científicas y Técnicas; Red Federal de Alto Impacto CONATURAR, Grant/Award Number: 2023-102072649-APN-MCT; Oxford Martin School

Handling Editor: Irene Teixidor-Toneu

Abstract

1. The notion of reciprocity between humans and the rest of the living world is receiving increasing attention in the environmental sciences and science–policy international bodies. Here we first discuss different meanings of reciprocity, then we discuss this notion in relation to the conceptual framework of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), to date the most prominent international mechanism informing the science–policy interface on living nature.
2. We show that the notion of human–nature reciprocity is recognized and is explicitly included in the IPBES conceptual framework. However, to date, it has received comparatively little attention.
3. To overcome this, we argue that, rather than creating new separate ad-hoc categories that risk compromising the internal consistency and pluralism of the IPBES conceptual framework, co-created across different disciplines, worldviews and policy frames, a more fruitful path would be to interpret all its components in a reciprocity light, with stronger emphasis on the human shaping of, and practices of care towards the rest of the living world. Such attention to reciprocity should contribute to the evolution of IPBES and related science–policy initiatives, by incorporating a plurality of perspectives, while still maintaining the framework operational by the continued engagement of multiple disciplines and stakeholders.
4. In terms of policy and action, this would involve more attention to pre-existing practices of care for nature—of which we provide a few illustrative examples—and new practices inspired by them or created afresh.

KEYWORDS
biodiversity conservation, IPBES, nature's contributions to people, people-nature relationships, people's contributions to nature, practices of care, values of nature

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.
© 2025 The Author(s). *People and Nature* published by John Wiley & Sons Ltd on behalf of British Ecological Society.

1 | INTRODUCTION

The growing interest in the notion of reciprocity in environmental academia and science–policy interfaces (Pascual et al., 2023; Saxena et al., 2018; Teixidor-Toneu et al., 2025) begs the questions of what is meant by reciprocity, what kinds of reciprocity we are talking about, and what such emphasis may imply for science and policy. Here, we intend to provide a brighter and wider spotlight on reciprocity between the human and other-than-human realms, with the latter referred to as 'nature' for short, while fully acknowledging human embeddedness in, and interconnectedness with other life on Earth. Our focus intends to depart from the stark separation between nature and people that still dominates much of the narratives and frameworks used in environmental science and policy.

We also explain in what ways reciprocity is already considered, alongside non-reciprocal interactions, in the conceptual framework (Díaz et al., 2018; Díaz, Demissew, Carabias, et al., 2015)[1] of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), the most prominent international mechanism informing the science–policy interface on nature to date.

We argue that, although the concept of reciprocity has been at the core of the pluralistic and transdisciplinary process leading to the IPBES conceptual framework, in practice it has not been given the attention it deserves. We further contend that reciprocity, in the double meaning of human shaping of, and the practices towards the other-than-human, deserves more attention in building narratives more compatible with a better future for all life on Earth.

Finally, we discuss the most fruitful ways to highlight reciprocity in the conceptual framing, assessment and practice of people–nature relationships.

2 | WHAT DO YOU MEAN BY RECIPROCITY?

There are different meanings in the socioecological literature for the term 'reciprocity' (Vaccaro, 2024). Reciprocity can be defined as mutual care, respect, reverence and purposeful agency between humans and other living entities, as it is common among Indigenous worldviews (Descola, 2013; Himes et al., 2023; Kimmerer, 2013; Marihuan & Rapimán, 2019; Pierotti & Wildcat, 2000). It can also mean 'mutual aid' for better survival, not necessarily with intention, or it may simply refer to mutual effects, positive or negative, between entities via systemic mechanic feedbacks (Vaccaro, 2024 and references therein).

While reciprocity contemplates the possibility that other-than-human entities, as well as humans, have conscious agency, for many this is not an indispensable condition. Others disagree, sustaining that mere unintentional two-way interaction between humans and other living entities is not enough to qualify as reciprocity (for a discussion see Vaccaro, 2024). Our intention here is not to dwell on this philosophical and anthropological debate, but rather to identify a minimum common ground to advance this notion in the context of the biodiversity science–policy interface, such as IPBES.

In this article, we use the term reciprocity in the broadest sense to refer to the mutual interactions, positive and/or negative, between living entities with the capacity to act autonomously on each other, of which conscious agency at both ends is but a special case.

3 | RECIPROCITY IN THE IPBES CONCEPTUAL FRAMEWORK

The narratives used in science around the interactions between humans and nature have evolved over the last few decades (Díaz, 2019; Mace, 2014; Pascual et al., 2023; Pierotti & Wildcat, 2000). Some early yet persistent narratives nourish the idea of a stark separation between humans and the rest of the living world, where the latter is seen as a set of objects to be dominated and exploited to serve the human enterprise (e.g. economic development) or as some primaeval entity that causes awe and should be left untouched (Pascual et al., 2021). Later narratives (e.g. typically around the idea of sustainable development) mostly emphasize nature as an object without agency, which needs to be managed wisely due to its usefulness (instrumental value) to humans. More recent relational narratives depict people and nature as inextricably interwoven (Hill et al., 2021).

These narratives have replaced each other over time only partially, with a difficult coexistence. They have been deeply embedded in their times and in turn framed successive influential international biodiversity assessments and other science–policy initiatives, programmes and bodies, from the International Biological Program and the Global Biodiversity Assessment (Heywood, 1994), both anchored mainly in the 'nature for itself' and 'nature despite people' conservation framings proposed by (Mace, 2014), followed by the Millennium Ecosystem Assessment (2005) and the Economics of Ecosystems & Biodiversity (Kumar, 2011) ('nature for people'), and more recently by the IPBES assessments (e.g. IPBES, 2016, 2019, 2022) ('people and nature').

While all biodiversity assessments before the 2010s were initiated by the scientific community, IPBES is an intergovernmental body. The products of IPBES are mandated by member countries and its processes are shaped by not only a highly diverse knowledge base but also by a plural set of values and interests, each linked to culturally anchored narratives, including those of social actors beyond academia (e.g. Indigenous Peoples and local communities, civil society organizations, policymakers), as well as by the academic *zeitgeist*, with increasing involvement of the views and debates in the social sciences and humanities (e.g. ISSC, 2013).

The IPBES conceptual framework (hereafter IPBES CF) emerged as the result of a global co-construction process that brought together an unprecedently wide spectrum of disciplines,

[1]The IPBES Conceptual Framework was approved by the IPBES Plenary in two successive instances: first, in 2013 the CF as a whole (Díaz, Demissew, Carabias, et al., 2015); then, in 2017, the unpacking, full definition, typology and amendment of terminology of nature's contributions to people (Díaz et al., 2018; Díaz, Demissew, Joly, et al., 2015).

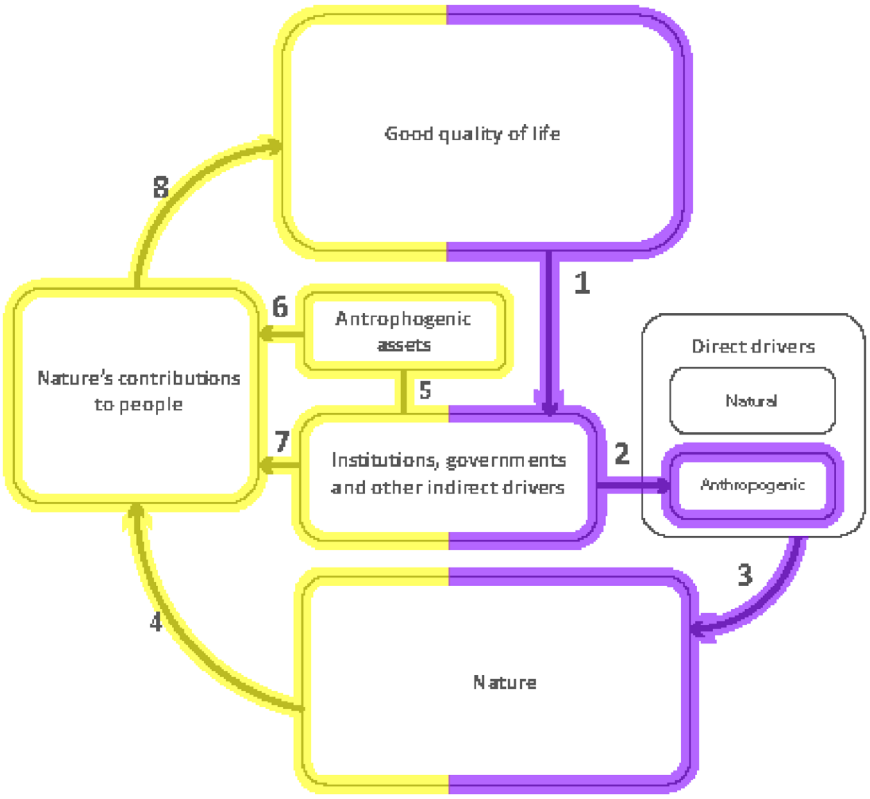

FIGURE 1 The Intergovernmental Platform on Biodiversity and Ecosystem Services conceptual framework (IPBES CF), represented here in simplified form, contemplates two ways in which people can act on the rest of the living world: The *nature's contributions to people pathway* (yellow shading) and the *drivers pathway* (purple shading). Some elements (boxes) of the IPBES CF participate in both pathways. Note that the boxes do not denote starkly separate domains; rather, they are intended to focus attention and organize evidence and questions on different aspects. Boxes and unidirectional arrows should be interpreted as a 'wheel in motion', as part of a continuous flow of relationships, many of which are bidirectional. For the full IPBES CF diagram, see https://www.ipbes.net/conceptual-framework.

perspectives and social actors. For the first time in the international environmental science–policy interface, it explicitly recognizes a plurality of values and knowledge systems about human–nature relations. There is no homogeneous humankind separate from, and simply destroying biodiversity, but rather a heterogeneous constellation of societies perceiving and valuing various components of nature in contrasting ways, and shaping them accordingly (Díaz, 2019; Díaz, Demissew, Carabias, et al., 2015; Himes et al., 2023). The IPBES CF is descriptive, rather than normative, in the specific sense that in its diagrammatic representation[2] the arrows denoting connections between major elements can be seen as being 'good' or 'bad' (and often both) depending on the value lens (IPBES, 2022), rather than being prescribed as one one way or the other in the framework itself.

One of the core aspects of the IPBES CF is that people are seen as acting on nature in two different ways: through a set of drivers of change of nature and through the coproduction of nature's contributions to people (NCP) (Figure 1). The *anthropogenic drivers pathway* (drivers pathway for short) involves linking humans with nature via two main elements–institutions, governance and other indirect drivers, and anthropogenic direct drivers (through arrows 2 and 3). The *NCP pathway* involves the human–nature linkage via four central elements–institutions, governance and other indirect drivers, anthropogenic assets, NCP, and human quality of life (linkages represented by arrows 4 to 8 in Figure 1). A single human action and associated knowledge and technology, for example, cutting trees with a chainsaw, clearing a patch of land with fire, tending hedgerows in an agricultural landscape, hunting and processing an animal with various tools, can be seen through these two lenses. It can be seen as the deliberate application of anthropogenic assets (e.g. tools such as chainsaws, torching equipment, knives, the specific skills to use them, the human labour in applying them, the knowledge needed to create such tools, the biological knowledge to identify the plants and animals to be targeted) to coproduce NCP (e.g. timber) together with a particular component of nature (e.g. trees) (NCP pathway).

On the other hand, following the drivers pathway, the same action can be seen as an anthropogenic direct driver, that is, a process that affects (negatively or positively) any aspect of nature not directly involved in the coproduction and appropriation of focal NCP. These are often collateral, unintended effects that might, or might not, ripple onto the delivery of NCP for the human actor that exerts it. For example, when a logger fells a tree for timber (thus coproducing material NCP), the ecological disruption caused can be interpreted as a positive anthropogenic direct driver affecting light-demanding plant species in the understory, and a negative anthropogenic direct driver for tree-dwelling birds and mammals, but both effects tend to be unintended by the logger.

Hence, whether one chooses to frame a human action affecting nature through the NCP pathway or the drivers pathway or both at the same time is a question of whether the main focus is on *the coproduction of NCP* for a good quality of life or on the ecological *effects on particular components of nature* (irrespective of what NCP are coproduced). In both pathways, the physical actions are underpinned—organized, constrained or incentivized—by institutions such as management rules and norms, policies, property rights, markets and the values embedded in them (Vatn et al., 2024).

[2]https://www.ipbes.net/conceptual-framework.

Despite the wide adoption of the IPBES CF (Díaz et al., 2018; Díaz, Demissew, Carabias, et al., 2015) in IPBES assessments, academia and policy (e.g. the Kunming-Montreal Global Biodiversity Framework[3]), some misinterpretations remain, including that the IPBES CF fails to recognize reciprocal relationships between people and nature (e.g. Peterson et al., 2018). We contend that reciprocity is indeed explicitly acknowledged as one (not the only) way of conceiving human connectedness to nature (Brondízio et al., 2019; Díaz et al., 2018; Díaz, Demissew, Carabias, et al., 2015; Hill et al., 2021).[4] Perhaps this important point was missed because the idea of reciprocity, while present, was not sufficiently unpacked in the original formulation of the conceptual framework. In addition, the term 'nature's contributions to people', an admittedly imperfect translation of ideas debated and agreed upon across multiple languages (Díaz et al., 2018; Hill et al., 2021), does not do full justice to the concept. Similarly, the visual representation of the IPBES CF faced the formidable challenge of capturing diversity of knowledges and worldviews in a single, concise diagram and therefore can hardly do full justice to the pluralism of the framework. Both the term NCP and the diagrammatic expression of the IPBES CF might have diverted attention from the explanations in the main text. This is why, as warned in the original articles about the IPBES CF, the diagram ought to be interpreted alongside, and not independently, from the accompanying main text. The boxes were drawn to help focus the attention on particular fields and organize pieces of evidence in assessments, rather than to denote distinct, starkly separate domains; for example, the degree to which humans are considered part of nature depends on the disciplinary and ontological perspective, not on the conceptual framework itself.[5] Importantly, the arrows between the boxes are unidirectional in order to represent a wheel in motion, implying that all the components of the framework are interrelated. That is, what may appear as a slightly mechanomorphic set of arrows and boxes should be seen as a *continuous flow of relationships*. The choice of arrowheads was intended to emphasize two dominant foci in policy and in the mainstream literature at the time of the creation of IPBES: the multiple and often undervalued ways in which human life and livelihoods depend on different facets of nature, and their human-driven large-scale and rapid decline.

Another misinterpretation pertains to the link between the IPBES CF and nature's values: the IPBES CF emphasized the plurality of values about nature, for instance by bringing to the fore the concept of relational values (sensu Chan et al., 2016; Pascual et al., 2017), i. e. those values that focus on the meaningfulness of people-nature interactions, and interactions among people through other living entities, including reciprocity, which are expressed in different ways, mediated by culture, identity and place (Pascual et al., 2023). It is important to clarify that, although relational values are commonly associated with reciprocal relations (as emphasized by e.g. Ojeda et al., 2022), they do not strictly define them. Neither are relational values necessarily the only values involved in reciprocal relations. Indeed, instrumental values (related to using an entity for one's own ends) are pervasive, even in reciprocities where purposeful agency is recognized on both humans and other living entities, as in many territorial management strategies by Indigenous people and local communities. For instance, the idea of 'caring for country', a term used by the aboriginal peoples of Australia (Gorman & Vemuri, 2012), and similar perspectives by Indigenous communities in the Ecuadorian and Colombian Amazon, involve the duty of respect (relational value) towards wildlife, which is seen as much more than a simple a consumptive resource (instrumental value), in a system of reciprocity with the ecosystem where the conservation and consumption of wildlife are not contradictory (Krause et al., 2020; Sirén, 2012).

A third misinterpretation is that the IPBES CF ignores the manifold positive roles of humans on nature. The pervasive role of humans shaping nature, taking many forms from simply creating disturbance that favours plant species coexistence all the way to complex stewardship and kinship practices, and including the positive influence of Indigenous peoples and local communities in maintaining or increasing the number of species or varieties of organisms, has featured prominently in the IPBES assessments in connection to the IPBES CF (e.g. Brondízio et al., 2021; Hill et al., 2019; Purvis et al., 2019) and is highlighted in the definition of 'living nature' given by (Díaz et al., 2019).[6]

[3]https://www.cbd.int/gbf.

[4]Excerpts from various pieces that merit highlighting include (1) Díaz et al. (2018, p. 271): 'The NCP approach explicitly recognizes that a range of views exist. At one extreme, humans and nature are viewed as distinct; at the other, humans and nonhuman entities are interwoven in deep relationships of kinship and reciprocal obligations. In addition, the way NCP are coproduced by nature and people is understood through different cultural lenses. For instance, coproduction of food in high-diversity agriculture can be framed as a process that combines a set of biological and technological inputs aimed at maximizing coexistence between useful plants and animals in order to achieve higher yields. Alternatively, coproduction of food can be seen as a "practice of care" through social relationships and connection with spiritual entities. Therefore, we propose two lenses through which to view NCP: a generalizing perspective and a context-specific perspective. Although presented here as extremes, these two perspectives are often blended and interwoven'. (2) Brondízio et al. (2019, p. 16): 'The range of descriptions of the human dependence of living nature contemplated in the NCP approach is thus vast. On one extreme, nature is seen as a stock of natural capital (or natural assets) from which goods and services flow to humans unidirectionally (e.g. timber provided by forests) in the form of an ecological production function. The flow depends on human agency and also on the existing physical and biological conditions needed for the persistence of the biological entity from which the flow originates. Improving or sustaining the condition of the biological entity would be akin to investing in natural capital from which an interest would accrue to society, that is, the flow of goods and services. Maintaining the productive potential of the stock of natural capital to sustain the flow of services to society would be seen as an intergenerational social objective. On the other extreme are descriptions where both people and other biophysical entities are seen as having agency and being inextricably linked by reciprocal ties of mutual care and obligations, described with, for example, the term nature's gifts used by many indigenous and non-indigenous cultures, or services-to-ecosystems in some hybrid framings. The notion of nature's contributions to people is intended to embrace and include, rather than replace and exclude the abovementioned descriptions and any others in between'. (3) Hill et al. (2021, p. 911): 'The term itself, "nature's contributions to people", is not necessarily envisaged as unidirectional flows from nature to people; rather, NCP is derived from the relationships between people and the rest of the living world. These relationships are conceived in a vast range of ways, from unidirectional flows from a stock (nature) to an agent of demand (people), to intricately reciprocal and intertwined, where nature may be viewed as having agency'.

[5]See for example, discussion on what nature means and to what degree humans are part of it in the IPBES CF in Brondízio et al. (2019, p. 14) and IPBES (2022, p. 8).

[6]'The fabric of life on Earth that has been "woven" by natural processes over many millions of years and in conjunction with people for many thousands of years' (Díaz et al., 2019).

4 | AN EVOLVING FOCUS

There have been suggestions to introduce a new element to the IPBES CF: 'people's contributions to nature'. The term is evocative and aligns with the demand to place more emphasis on reciprocity, in the sense of caring for nature, giving back or giving in return (Larson et al., 2023; Matuk et al., 2020). However, juxtaposing a new element onto the preexisting six core elements (boxes) and ten arrows (flows) could introduce redundancies, discrepancies and dissonances in a framework that strives for plurality by embracing different worldviews, and that seems to have reached a broad and painfully achieved consensus among a wide range of social actors, including all IPBES member countries. A discussion of the precise meaning of people's contributions to nature is essential for this idea to be an enriching step, rather than a source of potential confusion and even put-off for other social actors in the intergovernmental process.

If one were to introduce such a new element in the IPBES CF (i.e. a seventh box in its diagrammatic representation), a key question would be where to place it in relation to the other preexisting six elements, and what would be the new flows (arrows) connecting it to them. There seems to be a certain degree of vagueness and also differences in understanding as to what precisely the term means. In the still scarce literature on the subject, formal definitions do not abound. In most cases, the term is used but not defined or linked to a reference that in turn provides a clear definition. In the sources that do provide explicit definitions, these seem to vary from very general mutual interactions between humans and other living entities, all the way to active collaboration and empathy in a circle of agentic mutual aid, and span both the NCP pathway and the drivers pathway of the IPBES CF depicted in Figure 1.

As defined by Bridgewater and Rotherham (2019), Larson et al. (2023) and Matuk et al. (2020),[7] people's contributions to nature appear to involve both the NCP and the drivers pathways and both positive and negative interactions. Further elaboration in these papers, however, suggests that their main focus is on the NCP (coproduction) pathway, and on mutual *benefits* (positive contributions) for people and nature. For example, Larson et al. (2023) state that '"Giving" to nature (looking after Country) is as important to wellbeing as "taking" (e.g., gaining ecosystem service benefits)' (p. 2). Ojeda et al. (2022) do not define people's contributions to nature; they propose instead the concept of reciprocal contributions between people and nature,[8] also involved mostly in the NCP pathway, and focused explicitly on positive contributions.[9]

The works of Kimmerer (2013) and Comberti et al. (2015) are often cited as antecedents of the recognition of reciprocal benefits between nature and people. Kimmerer (2013) speaks of a circle of mutual care and obligations, in which 'everyone knows that gifts will follow the circle of reciprocity and flow back to you again' (p. 381). Comberti et al. (2015) define services to ecosystems as positive actions aimed at obtaining and sustaining benefits from ecosystems to humans.[10] Both place the equivalents of people's contributions to nature clearly within the NCP pathway, with such contributions being positive.

Fromentin et al.'s (2022) definition of people's contributions to nature[11] is as broad as those by Bridgewater & Rotherham (2019), Larson et al. (2023) and Matuk et al. (2020); however, in elaborating on the concept, the authors associate it mostly with the drivers pathway,[12] and explicitly include both positive and negative contributions.[13]

Other authors, including van der Wal et al. (2022) and Cantor et al. (2024), focus on beneficial reciprocity between people and nature, but with a much more restricted scope: the cooperation between humans and wild vertebrates (dolphins, honeyguide birds, orcas and wolves) in what van der Wal et al. (2022) call 'human–wildlife mutualisms'[14] in pursuit of benefits for both sides. A similar notion is involved for example in the 'commoning' between birds and the people who provide them with nesting boxes and in exchange take a sustainable proportion of their eggs in Estonia by Kalle et al. (2024), and in the case involving Chilean fishing communities and some marine fish and invertebrate species described by Alvarez et al. (2025). In all these cases, the focus is firmly on the NCP pathway, with the practices involving important nonmaterial benefits for humans, but at the same time being firmly anchored on material benefits for humans and other partners.

Most of the authors discussed here present people's contributions to nature or reciprocal contributions between people and nature in a normatively specific way: the contributions by people are *benefits*; they are *positive* for nature or, more precisely, for some components of it. This poses a contradiction and a source of confusion with the neutral way in which the word 'contribution' is used in the IPBES CF: an input, the part that something or somebody plays in bringing about a result; it can be either a benefit or a detriment or often both depending on the perspective of the social actor involved. These authors also tend to concur in people's

[7]'Role of people in shaping nature'.

[8]'Actions, interactions, and experiences between people and other components of nature that result in positive contributions and feedback loops that accrue to both, directly or indirectly, across different dimensions and levels' (p. 952).

[9]'These positive actions are interconnected with nature's contributions in a circle of mutual aids' (Ojeda et al., 2024).

[10]'Actions humans have taken in the past and currently that modify ecosystems to enhance the quality or quantity of the services they provide, whilst maintaining the general health of the cognized ecosystem over time' (p. 247).

[11]'The multiple ways humans engage with, maintain, and, to varying degrees, produce nature' (p. 10).

[12]'... the importance of conceptual symmetry between nature's contributions to people and an expanded understanding of what is taken into account as direct and indirect anthropogenic drivers ... include ... caring for, nurturing, or stewarding nature, as well as broader concepts such as responsibility and reciprocity relative to the complex interactions between the natural world and human societies' (Fromentin et al., 2022, p. 10). See also fig. 1.2 on the same page.

[13]'...just as nature's contributions to people may be beneficial or adverse, people's contributions to nature can include positive and negative outcomes' (Fromentin et al., 2022, p. 12).

[14]'Human–wildlife mutualisms—reciprocally beneficial interactions between humans and free-living, wild, nonhuman animals' (van der Wal et al., 2022, p. 3).

contributions being in exchange for benefits, actions in which people 'give back' in exchange or gratitude for good things (ecosystem services, gifts, etc.) delivered by nature, as in the many examples including fish and seafood (Alvarez et al., 2025; Ojeda et al., 2024), bird (Kalle et al., 2024) or fish (Alvarez et al., 2025) eggs, honey (van der Wal et al., 2022), meat (Lewis et al., 2004), or grass material for ceremonies, medicine and basketry (Kimmerer, 2013). This corresponds well with the NCP pathway under the reciprocal perspective on NCP contemplated by Díaz, Demissew, Carabias, et al. (2015) and Díaz et al. (2018), with the concrete knowledge and practices clearly fitting the pluralistic definition of anthropogenic assets[15] and connecting flows 5–8 in the IPBES CF diagram (Figure 1). All this suggests that people's contributions to nature, reciprocal contributions between people and nature, and many stewardship practices sensu (Mattalia et al., 2025) should be considered a particular way of seeing the coproduction of NCP between people and nature, one that emphasizes reciprocity rather than focusing only on the utilitarian extraction from a passive nature. The angle of reciprocal contributions is thus a refreshing albeit normative take on NCP coproduction, as it emphasizes how two or more partners are intertwined by mutual *positive* contributions, that is, benefits and care which, at least on the human side, include instrumental aspects but go well beyond them (Alvarez et al., 2025; Mattalia et al., 2025; Ojeda et al., 2022, 2024). This is one of the many ways in which the NCP pathway can be interpreted by the diverse actors that participate in the nature science–policy interface using the IPBES CF as an intellectual meeting point.

The exception to these converging views is perhaps the work of Fromentin et al. (2022), who place people's contributions to nature in the drivers pathway, as a special kind of driver, a positive action, deliberately oriented to the care of nature, in respect, gratitude and reciprocity to and for nature itself, not in the pursuit of NCP, i. e. involving flows 2 and 3 rather than 5–8 in Figure 1. But virtually all the examples given by these authors are actions that involve highly specific components of nature and are framed in the deliberate pursuit and expectation of achieving both material and nonmaterial benefits (=positive contributions) for the human social group carrying them out. Indeed, in the vast majority of examples given in the literature, people's contributions to nature, reciprocal contributions between people and nature, and stewardship practices appear to be in pursuit of specific material or nonmaterial benefits, or in respect for an entity that is assumed to be able to retaliate, and focus on particular components of nature, rather than on a more generic nature or biodiversity. For example, in Ojeda et al.'s (2024) study of reciprocity between Chilean fisherfolk and some seabird species, the sharing of hake offal, for all its symbolic and relational meaning, is firmly embedded in the fishing activities that are the basis of livelihoods, not an act to 'improve nature' in general or for its own sake. In East-Central European traditionally managed hay meadows, management practices have resulted in one of the highest numbers of plant species per square meter in the world (Wilson et al., 2012); however, although locals are proud of their stewardship based on very detailed knowledge of the agro-ecosystem, their main aim is to 'produce' the best hay for their livestock, with the high plant species richness resulting from their management actions being a collateral effect not specifically valued by them (Babai & Molnár, 2014). Whether these positive collateral effects could be seen as reciprocity depends on what kind of reciprocity we are referring to: it would definitely qualify for reciprocity as mutual influence, but hardly as mutual care. This creates a discrepancy with the logic of the NCP and drivers pathways explained in the previous section.

In sum, among the examples discussed above, there seem to be two different processes to which the notion of people's contributions to nature refers: (a) the coproduction of NCP under a reciprocity lens (a meaning shared with reciprocal contributions between people and nature, and many stewardship practices) and (b) the collateral effect of human actions on some aspects of nature not directly involved in the benefits these actions are seeking. Both processes are explicitly contemplated in the original formulation of the IPBES CF. Therefore, the addition of a completely new conceptual element and corresponding in- and out-flows appear unnecessary and probably counterproductive. One could use people's contributions to nature to jointly refer to both kinds of processes, but then it would be as broad as the idea of 'human actions on the rest of the living world', basically an equivalent of the 'human shaping of nature' mentioned in the previous section, which, while useful in general discourse, is analytically too general and heterogeneous to have enough traction. In addition, it could lead to further confusion of terms: NCP and people's contributions to nature sound symmetrical but strictly speaking they are not, because the latter is either already included in the former, or refers to a different pathway.

We thus contend that it would be better to reserve the terms people's contributions to nature and reciprocal contributions between people and nature for a particular way to refer to the engagement of people with nature in the realization of NCP, that is, a reciprocal, positive interpretation of the NCP pathway. Here, the reciprocity involved is deliberate and also associated with relational values such as respect and gratitude. In this way, reciprocal ways of coproducing NCP are highlighted and, at the same time, full consistency with the pluralistic IPBES CF is maintained. We discuss how to spotlight reciprocity in other aspects of the people-nature relationships in the next section.

There are reasons for this attention to consistency: transdisciplinary pluralistic frameworks, of which the IPBES CF is a prominent example, are not ideal to any but are workable for most of the stakeholders involved. They are conceptually and politically difficult to achieve, and once in place they offer the common intellectual space to facilitate the cross-disciplinary and

[15]'Anthropogenic assets' refers to built infrastructure, health facilities, knowledge (including ILK and technical or scientific knowledge, as well as formal and nonformal education), technology (both physical objects and procedures), and financial assets, among others' (Díaz, Demissew, Carabias, et al., 2015, p. 5).

cross-cultural understanding (Díaz, Demissew, Joly, et al., 2015; Himes et al., 2023) that is essential for concerted action (West et al., 2020). They should thus evolve incorporating the insights of various perspectives, while still fully respecting other views at the table, and not causing internal inconsistencies unless strictly necessary.

5 | A WIDER AND BRIGHTER FOCUS ON RECIPROCITY

We argue that there is a more general, useful and radical way to contribute to the evolution of the IPBES CF regarding reciprocity: to contemplate all the elements (boxes in the diagrammatic expression) and their interconnections (arrows) in a reciprocity light. We propose that the reciprocal ways of looking at all these links, which are contemplated in the IPBES CF formulation but often ignored, do not remain underconsidered. This calls for paying more attention to the numerous examples of reciprocal ways to relate with other living entities at different levels that already exist within and beyond the context of Indigenous and local knowledge and practices, and also for finding new ways designed afresh or inspired by them.

When dealing with *anthropogenic assets* and their interconnections in the *coproduction of NCP*, making a reciprocal perspective more explicit would involve going beyond the understanding of anthropogenic assets as mere inputs for the exploitation of nature and putting more emphasis on the ideas of giving back, nurturing, respecting and celebrating nature. When assessing NCP under the 18 generalizing categories adopted by IPBES (Brauman et al., 2020; Díaz et al., 2018), originally described highlighting the contribution from nature, a greater focus could be offered on what anthropogenic assets and institutions are involved in the coproduction of NCP, and how these could emphasize practices and ethics of care towards nature (Jackson & Palmer, 2015; West et al., 2018).

When dealing with *direct drivers* that affect nature, it would involve focusing on pre-existing and new ways (value chains, technologies, institutions, lifestyles) of 'treading softly', by extracting or damaging only the strictly necessary and striving to reduce the physical impact and cruelty embedded in supply and value chains and individual lifestyles. Examples include promoting fishing methods that minimize bycatch, structures that facilitate the safe transit of wildlife through urban space and road infrastructure, the initiatives to turn off non-indispensable lights to reduce light pollution at night that impacts wild biota,[16] the calls for a moratorium on deep sea mining (Gilbert, 2024), or those seeking to minimize interference with the evolutionary process of wild organisms (Sarrazin & Lecomte, 2016). It would also involve paying more attention to the ancient, widespread and ongoing human shaping of ecosystems (Boivin et al., 2016; Ellis et al., 2021).

When dealing with *good quality of life* and its links with *institutions, governance and other indirect drivers*, it would mean paying more attention to notions of a 'worthy life' with mutual flourishing (O'Neill, 2008), and 'doing the right thing' with the other-than-human, contemplated in longstanding Western, Eastern and Indigenous traditions (Anbleyth-Evans et al., 2023; Chan et al., 2016; O'Neill, 2008 and references therein). In other words, departing from an over-emphasis on market-based instrumental values and embracing much more explicitly non-market instrumental, intrinsic and relational values in decision making (Pascual et al., 2023 and references therein). The common good invoked in the calls to prioritize the common good over the excessive immediate profit of a privileged minority (International Science Council, 2022) could be extended beyond the human. Two vigorously emerging trends in academic and policy circles further exemplify a focus on reciprocity. At the 'mutual influence' end of the reciprocity spectrum, the One Health approach (The Lancet, 2023) stresses the inextricable connections of human health with that of other organisms and whole ecosystems. Another example, representing a whole range of discourses from mutual influence to full mutual agency, are the rights to nature and rights of nature approaches (Anbleyth-Evans et al., 2023; Chapron et al., 2019; James, 2020).

6 | CONCLUSION AND PERSPECTIVES

Reciprocity in the double sense of entanglement and mutual aid is a fundamental, indispensable angle when considering the relationships between people and nature. Both the human imprint on life on Earth (Díaz & Malhi, 2022; Ellis et al., 2013) and relational practices towards the other-than-human, including practices of care (Himes et al., 2023; Jackson & Palmer, 2015; Knippenberg et al., 2018) are widespread. In line with this, the explicit inclusion of reciprocity in the IPBES CF as one of the ways of thinking about people's codependence on nature has been a significant step forward.

However, narratives in much of the science and policy arenas still hinge on a narrow utilitarian worldview that promotes humans as separate from, and superior to, the rest of the living world (Vatn et al., 2024). The recent calls for attention to reciprocity are thus justified and timely.

In doing so, juxtaposing new elements on pre-existing intergovernmental frameworks may cause more confusion and backlash than progress. We contend that a more useful intervention (sensu Ojeda et al., 2022) would be to spotlight, gather more empirical examples of, and zoom into the reciprocal aspects of not only the coproduction of NCP but also all the interactions between people and the rest of the living world.

This would involve a shift from 'control' or 'harmony' framings towards one of coexistence and care (including practices of care sensu Jackson & Palmer, 2015), co-inhabiting, conviviality and empathy (van Dooren et al., 2016), acknowledging that 'the others' are alive,

[16]For example the European Union Night Light Project (https://projects2014-2020.interregeurope.eu/nightlight/) or the Plan Lumiére of Montpellier city (https://www.montpellier3m.fr/sites/default/files/digest_planlumiere_en-brochure.pdf).

inextricably intertwined with us, need to be negotiated with, and deserve respect. Perhaps this lens could be broadly called 'caring for nature' or 'reciprocity to other-than-human (or more-than-human) nature' to bridge across different worldviews.

This bringing reciprocity closer to the foreground can happen in two complementary ways: by recognizing and learning from the experiences that already exist around the world, and by coming up with new ways of deepening this reciprocity in actions, either completely new or inspired by the pre-existing ones.

AUTHOR CONTRIBUTIONS

Sandra Díaz designed the article and led the writing. Both authors actively contributed to the development of ideas, writing, literature review, and critical revision of the manuscript, and gave final approval for publication.

ACKNOWLEDGEMENTS

We thank the Guest Editors of this special issue for encouraging us to write this contribution. The arguments presented here were enriched by insightful discussions with Giulia Mattalia, Zsolt Molnar, Victoria Reyes-García, Irene Teixidor-Toneu and Noelia Zafra-Calvo, and by comments from Susan Preston and Tetsukazu Yahara.

FUNDING INFORMATION

SD acknowledges support by Red Federal de Alto Impacto CONATURAR (2023-102072649-APN-MCT), CONICET and Universidad Nacional de Córdoba, Argentina, and the Oxford Martin School, Oxford, UK. UP acknowledges BC3's Maria de Maeztu excellence accreditation 2023–2026 (Ref. CEX2021-001201-M) provided by MCIN/AEI/10.13039/501100011033.

CONFLICT OF INTEREST STATEMENT

The author declares no conflict of interest.

DATA AVAILABILITY STATEMENT

No primary data were used in this review.

ORCID

Sandra Díaz https://orcid.org/0000-0003-0012-4612
Unai Pascual https://orcid.org/0000-0002-5696-236X

REFERENCES

Peterson, G. D., Harmá, ková, Z. V., Meacham, M., Queiroz, C., Jiménez-Aceituno, A., Kuiper, J. J., Malmborg, K., Sitas, N., & Bennett, E. M. (2018). Welcoming different perspectives in IPBES: "Nature's contributions to people" and "Ecosystem services". *Ecology and Society*, *23*. https://doi.org/10.5751/ES-10134-23013

Alvarez, A., Caniullán, D., Catín, J., Cheuquenao, P., Coñuecar-Llancapani, Y., Diestre, F., Jara, P., Millatureo, N., Vargas, D., & Ojeda, J. (2025). Reciprocal contributions: Indigenous perspectives and voices on marine-coastal experiences in the channels of Northern Patagonia, Chile. *People and Nature*, *00*, 1–13. https://doi.org/10.1002/pan3.70004

Anbleyth-Evans, J., Ñanculef-Huaiquinao, J., Coñuecar-Llancapani, Y., Leiva, F. A., Maulén, W. R., & Raymond, C. (2023). Mapuche Az-Mapu and nature's contribution to people: Eudemonic values for living well. *Environmental Values*, *32*(3), 291–314. https://doi.org/10.3197/096327122X16569260361760

Babai, D., & Molnár, Z. (2014). Small-scale traditional management of highly species-rich grasslands in the Carpathians. *Agriculture, Ecosystems & Environment*, *182*, 123–130. https://doi.org/10.1016/j.agee.2013.08.018

Boivin, N. L., Zeder, M. A., Fuller, D. Q., Crowther, A., Larson, G., Erlandson, J. M., Denham, T., & Petraglia, M. D. (2016). Ecological consequences of human niche construction: Examining long-term anthropogenic shaping of global species distributions. *Proceedings of the National Academy of Sciences of the United States of America*, *113*, 6388–6396. https://doi.org/10.1073/pnas.1525200113

Brauman, K. A., Garibaldi, L. A., Polasky, S., Aumeeruddy-Thomas, Y., Brancalion, P. H. S., DeClerck, F., Jacob, U., Mastrangelo, M. E., Nkongolo, N. V., Palang, H., Pérez-Méndez, N., Shannon, L. J., Shrestha, U. B., Strombom, E., & Verma, M. (2020). Global trends in nature's contributions to people. *Proceedings of the National Academy of Sciences of the United States of America*, *117*, 32799–32805. https://doi.org/10.1073/pnas.2010473117

Bridgewater, P., & Rotherham, I. D. (2019). A critical perspective on the concept of biocultural diversity and its emerging role in nature and heritage conservation. *People and Nature*, *1*(3), 291–304. https://doi.org/10.1002/pan3.10040

Brondízio, E. S., Aumeeruddy-Thomas, Y., Bates, P., Carino, J., Fernández-Llamazares, Á., Ferrari, M. F., Galvin, K., Reyes-García, V., McElwee, P., Molnár, Z., Samakov, A., & Shrestha, U. B. (2021). Locally based, regionally manifested, and globally relevant: Indigenous and local knowledge, values, and practices for nature. *Annual Review of Environment and Resources*, *46*(1), 481–509. https://doi.org/10.1146/annurev-environ-012220-012127

Brondízio, E. S., Díaz, S., Settele, J., Ngo, H. T., Guèze, M., Aumeeruddy-Thomas, Y., Bai, X., Geschke, A., Molnár, Z., Niamir, A., et al. (2019). Chapter 1: Introduction to and rationale of the global assessment. In E. S. Brondízio, S. Díaz, J. Settele, & H. T. Ngo (Eds.), *Global assessment report of the intergovernmental science-policy platform on biodiversity and ecosystem services* (pp. 5–47). Secretariat of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services. https://doi.org/10.5281/zenodo.5517203

Cantor, M., Santos-Silva, B., Daura-Jorge, F. G., Machado, A. M. S., Peterson, D., da-Rosa, D. X., Simões-Lopes, P. C., Valle-Pereira, J. V. S., Zank, S., & Hanazaki, N. (2024). *Changes in the users of the social-ecological system around a reciprocal human-dolphin relationship*. https://doi.org/10.1002/pan3.10679

Chan, K. M. A., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., Gould, R., Hannahs, N., Jax, K., Klain, S., Luck, G. W., Martín-López, B., Muraca, B., Norton, B., Ott, K., Pascual, U., Satterfield, T., Tadaki, M., Taggart, J., & Turner, N. (2016). Why protect nature? Rethinking values and the environment. *Proceedings of the National Academy of Sciences of the United States of America*, *113*, 1462–1465. https://doi.org/10.1073/pnas.1525002113

Chapron, G., Epstein, Y., & López-Bao, J. V. (2019). A rights revolution for nature. *Science*, *363*(6434), 1392–1393. https://doi.org/10.1126/science.aav5601

Comberti, C., Thornton, T. F., Wyllie de Echeverria, V., & Patterson, T. (2015). Ecosystem services or services to ecosystems? Valuing cultivation and reciprocal relationships between humans and ecosystems. *Global Environmental Change*, *34*, 247–262. https://doi.org/10.1016/j.gloenvcha.2015.07.007

Descola, P. (2013). *Beyond nature and culture*. University of Chicago Press.

Díaz, S. (2019). Why care about nature? A pluralistic agenda for biodiversity. In C. Wyborn, N. Kalas, & N. Rust (Eds.), *Seeds of change: Provocations for a new research agenda, biodiversity revisited symposium conference proceedings, 11–13, September 2019* (pp. 62–65). Luc Hoffman Institute.

Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., Larigauderie, A., Adhikari, J. R., Arico, S., Báldi, A., Bartuska, A., Baste, I. A., Bilgin, A., Brondizio, E., Chan, K. M. A., Figueroa, V. E., Duraiappah, A., Fischer, M., Hill, R., … Zlatanova, D. (2015). The IPBES conceptual framework—Connecting nature and people. *Current Opinion in Environmental Sustainability*, *14*, 1–16. https://doi.org/10.1016/j.cosust.2014.11.002

Díaz, S., Demissew, S., Joly, C., Lonsdale, W. M., & Larigauderie, A. (2015). A Rosetta Stone for nature's benefits to people. *PLoS Biology*, *13*, e1002040. https://doi.org/10.1371/journal.pbio.1002040

Díaz, S., & Malhi, Y. (2022). Biodiversity: Concepts, patterns, trends, and perspectives. *Annual Review of Environment and Resources*, *47*(1), 31–63. https://doi.org/10.1146/annurev-environ-120120-054300

Díaz, S., Pascual, U., Stenseke, M., Martin-Lopez, B., Watson, R. T., Molnar, Z., Hill, R., Chan, K. M. A., Baste, I. A., Brauman, K. A., et al. (2018). Assessing nature's contributions to people. *Science*, *359*, 270–272. https://doi.org/10.1126/science.aap8826

Díaz, S., Settele, J., Brondízio, E. S., Ngo, H. T., Agard, J., Arneth, A., Balvanera, P., Brauman, K. A., Butchart, S. H. M., Chan, K. M. A., Garibaldi, L. A., Ichii, K., Liu, J., Subramanian, S. M., Midgley, G. F., Miloslavich, P., Molnár, Z., Obura, D., Pfaff, A., … Zayas, C. N. (2019). Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science*, *366*(6471), eaax3100. https://doi.org/10.1126/science.aax3100

Ellis, E. C., Gauthier, N., Goldewijk, K. K., Bird, R. B., Boivin, N., Diaz, S., Fuller, D. Q., Gill, J. L., Kaplan, J. O., Kingston, N., Klein Goldewijk, K., Bliege Bird, R., Locke, H., McMichael Crystal, N. H., Ranco, D., Rick, T. C., Shaw, M. R., Stephens, L., Svenning, J.-C., & Watson, J. E. M. (2021). People have shaped most of terrestrial nature for at least 12,000 years. *Proceedings of the National Academy of Sciences of the United States of America*, *118*(17), e2023483118. https://doi.org/10.1073/pnas.2023483118

Ellis, E. C., Kaplan, J. O., Fuller, D. Q., Vavrus, S., Klein Goldewijk, K., & Verburg, P. H. (2013). Used planet: A global history. *Proceedings of the National Academy of Sciences of the United States of America*, *110*, 7978–7985. https://doi.org/10.1073/pnas.1217241110

Fromentin, J. M., Emery, M. R., Donaldson, J., Danner, M. C., Hallosserie, A., Kieling, D., Balachander, G., Barron, E. S., Chaudhary, R. P., Gasalla, M., et al. (2022). *Summary for policymakers of the thematic assessment report on the sustainable use of wild species of the intergovernmental science-policy platform on biodiversity and ecosystem services*. IPBES Secretariat.

Gilbert, N. (2024). Complex deep-sea expeditions try to size up seabed mining impacts. *Proceedings of the National Academy of Sciences of the United States of America*, *121*(15), e2404667121. https://doi.org/10.1073/pnas.2404667121

Gorman, J., & Vemuri, S. (2012). Social implications of bridging the gap through 'caring for country' in remote indigenous communities of the Northern Territory, Australia. *The Rangeland Journal*, *34*, 63–73. https://doi.org/10.1071/RJ11037

Heywood, V. E. (1994). *Global biodiversity assessment*. Cambridge University Press.

Hill, R., Díaz, S., Pascual, U., Stenseke, M., Molnár, Z., & Van Velden, J. (2021). Nature's contributions to people: Weaving plural perspectives. *One Earth*, *4*, 910–915. https://doi.org/10.1016/j.oneear.2021.06.009

Hill, R., Nates-Parra, G., Quezada-Euán, J. J. G., Buchori, D., LeBuhn, G., Maués, M. M., Pert, P. L., Kwapong, P. K., Saeed, S., Breslow, S. J., Carneiro da Cunha, M., Dicks, L. V., Galetto, L., Gikungu, M., Howlett, B. G., Imperatriz-Fonseca, V. L., Lyver, P. O., Martín-López, B., Oteros-Rozas, E., … Roué, M. (2019). Biocultural approaches to pollinator conservation. *Nature Sustainability*, *2*, 214–222. https://doi.org/10.1038/s41893-019-0244-z

Himes, A., Muraca, B., Anderson, C. B., Athayde, S., Beery, T., Cantú-Fernández, M., González-Jiménez, D., Gould, R. K., Hejnowicz, A. P., Kenter, J., Lenzi, D., Murali, R., Pascual, U., Raymond, C., Ring, A., Russo, K., Samakov, A., Stålhammar, S., Thorén, H., & Zent, E. (2023). Why nature matters: A systematic review of intrinsic, instrumental, and relational values. *Bioscience*, *74*(1), 25–43. https://doi.org/10.1093/biosci/biad109

International Science Council. (2022). *A letter to fellow citizens of the Earth—stockholm +50*.

IPBES. (2016). *Summary for policymakers of the assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production*. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IPBES. (2019). *Summary for policymakers of the global assessment report of the intergovernmental science-policy platform on biodiversity and ecosystem services* (S. Díaz, J. Settele, E. S. Brondizio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. Brauman, S. Butchart, K. Chan, L. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. Midgley, P. Miloslavich, Z. Molnár, D. Obura, …, C. Zayas, Eds.). IPBES Secretariat.

IPBES. (2022). Methodological assessment of the diverse values and valuation of nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) 1.2 ed. *Zenodo*.

ISSC. (2013). *International Social Science Council world social science report, 2013: Changing gobal environments*.

Jackson, S., & Palmer, L. R. (2015). Reconceptualizing ecosystem services: Possibilities for cultivating and valuing the ethics and practices of care. *Progress in Human Geography*, *39*(2), 122–145. https://doi.org/10.1177/0309132514540016

James, S. P. (2020). Legal rights and nature's contributions to people: Is there a connection? *Biological Conservation*, *241*, 108325. https://doi.org/10.1016/j.biocon.2019.108325

Kalle, R., Svanberg, I., Leas, M., Prakofjewa, J., Sartori, M., Danto, A., Schiavone, A., Pehlak, H., Plaan, J., Pieroni, A., & Sõukand, R. (2024). Commons are cared for: Coexistence between humans and wild birds on the Island of Kihnu, Estonia. https://doi.org/10.1002/pan3.10669

Kimmerer, R. W. (2013). *Braiding sweetgrass—Indigenous wisdom, scientific knowledge and the teachings of plants*. Milkweed Editions.

Knippenberg, L., de Groot, W. T., van den Born, R. J. G., Knights, P., & Muraca, B. (2018). Relational value, partnership, eudaimonia: A review. *Current Opinion in Environmental Sustainability*, *35*, 39–45. https://doi.org/10.1016/j.cosust.2018.10.022

Krause, T., Quiceno Mesa, M. P., & Matapí Yucuna, U. (2020). Indigenous ecological knowledge in the Colombian Amazon—Challenges and prospects for a more sustainable use of local forest fauna. In A. Breidlid & R. Krovel (Eds.), *Indigenous Knowledges and the sustainable development agenda* (pp. 109–127). Routledge.

Kumar, P. E. (2011). *The economics of ecosystems and biodiversity: Ecological and economic foundations*. Routledge.

Larson, S., Jarvis, D., Stoeckl, N., Barrowei, R., Coleman, B., Groves, D., Hunter, J., Lee, M., Markham, M., Larson, A., Finau, G., & Douglas, M. (2023). Piecemeal stewardship activities miss numerous social and environmental benefits associated with culturally appropriate ways of caring for country. *Journal of Environmental Management*, *326*, 116750. https://doi.org/10.1016/j.jenvman.2022.116750

Lewis, S. L., Phillips, O. L., Baker, T. R., Lloyd, J., Malhi, Y., Almeida, S., Higuchi, N., Laurance, W. F., Neill, D. A., Silva, J. N. M., Terborgh, J., Torres Lezama, A., Vásquez Martinez, R., Brown, S., Chave, J., Kuebler, C., Núñez Vargas, P., & Vinceti, B. (2004). Concerted changes in tropical forest structure and dynamics: Evidence from 50 South American long-term plots. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, *359*, 421–436. https://doi.org/10.1098/rstb.2003.1431

Mace, G. M. (2014). Whose conservation? *Science*, *345*, 1558–1560. https://doi.org/10.1126/science.1254704

Marihuan, O. S., & Rapimán, D. Q. (2019). Cambio climático en Lonquimay: Conocimiento científico y conocimiento local Mapuche-Pehuenche. *Revista Austral de Ciencias Sociales*, *37*, 123–138.

Mattalia, G., McAlvay, A., Teixidor-Toneu, I., Lukawiecki, J., Moola, F., Asfaw, Z., Cámara-Leret, R., Díaz, S., Franco, F. M., Halpern, B. S., et al. (2025). Cultural keystone species as a tool for biocultural stewardship. A global review. *People and Nature*, 1–13 https://doi.org/10.1002/pan3.10653

Matuk, F. A., Behagel, J. H., Simas, F. N. B., Do Amaral, E. F., Haverroth, M., & Turnhout, E. (2020). Including diverse knowledges and worldviews in environmental assessment and planning: The Brazilian Amazon Kaxinawá Nova Olinda indigenous land case. *Ecosystems and People*, *16*, 95–113. https://doi.org/10.1080/26395916.2020.1722752

Millennium Ecosystem Assessment. (2005). *Ecosystems and human well-being*. Island Press.

Ojeda, J., Morello, F., Suazo, C. G., Astorga-España, M. S., Salomon, A. K., & Ban, N. C. (2024). *Two lenses for exploring relationships between seabirds and fishers: Unveiling reciprocal contributions*. https://doi.org/10.1002/pan3.10703

Ojeda, J., Salomon, A. K., Rowe, J. K., & Ban, N. C. (2022). Reciprocal contributions between people and nature: A conceptual intervention. *Bioscience*, *72*, 952–962. https://doi.org/10.1093/biosci/biac053

O'Neill, J. (2008). Happiness and the good life. *Environmental Values*, *17*, 125–144.

Pascual, U., Adams, W. M., Díaz, S., Lele, S., Mace, G. M., & Turnhout, E. (2021). Biodiversity and the challenge of pluralism. *Nature Sustainability*, *4*, 567–572. https://doi.org/10.1038/s41893-021-00694-7

Pascual, U., Balvanera, P., Anderson, C. B., Chaplin-Kramer, R., Christie, M., González-Jiménez, D., Martin, A., Raymond, C. M., Termansen, M., Vatn, A., Athayde, S., Baptiste, B., Barton, D. N., Jacobs, S., Kelemen, E., Kumar, R., Lazos, E., Mwampamba, T. H., Nakangu, B., … Zent, E. (2023). Diverse values of nature for sustainability. *Nature*, *620*, 813–823. https://doi.org/10.1038/s41586-023-06406-9

Pascual, U., Balvanera, P., Diaz, S., Pataki, G., Roth, E., Stenseke, M., Watson, R. T., Dessane, E. B., Islar, M., Kelemen, E., Başak Dessane, E., Maris, V., Quaas, M., Subramanian, S. M., Wittmer, H., Adlan, A., Ahn, S. E., Al-Hafedh, Y. S., Amankwah, E., … Yagi, N. (2017). Valuing nature's contributions to people: The IPBES approach. *Current Opinion in Environmental Sustainability*, *26-27*, 7–16. https://doi.org/10.1016/j.cosust.2016.12.006

Pierotti, R., & Wildcat, D. (2000). Traditional ecological knowledge: The third alternative. *Ecological Applications*, *10*(5), 1333–1340. https://doi.org/10.1890/1051-0761(2000)010[1333:TEKTTA]2.0.CO;2

Purvis, A., Molnar, Z., Obura, D., Ichii, K., Willis, K., Chettri, N., Dulloo, E., Hendry, A., Gabrielyan, B., Gutt, J., et al. (2019). Chapter 2.2: Status and trends–nature. In E. S. Brondízio, S. Díaz, J. Settele, & H. T. Ngo (Eds.), *Global assessment report on biodiversity and ecosystem services of the intergovernmental science-policy platform on biodiversity and ecosystem services* (pp. 206–308). Secretariat of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services.

Sarrazin, F., & Lecomte, J. (2016). Evolution in the Anthropocene. *Science*, *351*(6276), 922–923. https://doi.org/10.1126/science.aad6756

Saxena, A. K., Chatti, D., Overstreet, K., & Dove, M. R. (2018). From moral ecology to diverse ontologies: Relational values in human ecological research, past and present. *Current Opinion in Environmental Sustainability*, *35*, 54–60. https://doi.org/10.1016/j.cosust.2018.10.021

Sirén, A. (2012). Festival hunting by the Kichwa people in the Ecuadorian Amazon. *Journal of Ethnobiology*, *32*(1), 30–50. https://doi.org/10.2993/0278-0771-32.1.30

Teixidor-Toneu, I., et al. (2025). (Special Feature). Examining human-nature relationships through the lens of reciprocity: Insights from indigenous and local knowledge. *People and Nature*.

The Lancet. (2023). One health: A call for ecological equity. *The Lancet*, *401*, 169. https://doi.org/10.1016/S0140-6736(23)00090-9

Vaccaro, I. (2024). Defining socioecological reciprocity: Intentionality, mutualism or collateral effect. *People and Nature*, *00*, 1–6. https://doi.org/10.1002/pan3.10685

van der Wal, J. E. M., Spottiswoode, C. N., Uomini, N. T., Cantor, M., Daura-Jorge, F. G., Afan, A. I., Attwood, M. C., Amphaeris, J., Balasani, F., Begg, C. M., Blair, C. J., Bronstein, J. L., Buanachique, I. O., Cuthill, R. R. T., Das, J., Deb, A., Dixit, T., Dlamini, G. S., Dounias, E., … Cram, D. L. (2022). Safeguarding human–wildlife cooperation. *Conservation Letters*, *15*(4), e12886. https://doi.org/10.1111/conl.12886

van Dooren, T., Kirksey, E., & Münster, U. (2016). Multispecies studies: Cultivating arts of attentiveness. *Environmental Humanities*, *8*, 1–23. https://doi.org/10.1215/22011919-3527695

Vatn, A., Pascual, U., Chaplin-Kramer, R., Termansen, M., Arias-Arévalo, P., Balvanera, P., Athayde, S., Hahn, T., & Lazos, E. (2024). Incorporating diverse values of nature in decision-making—Theory and practice. *Philosophical Transactions of the Royal Society, B: Biological Sciences*, *379*(1903), 20220315. https://doi.org/10.1098/rstb.2022.0315

West, S., Haider, L. J., Masterson, V., Enqvist, J. P., Svedin, U., & Tengö, M. (2018). Stewardship, care and relational values. *Current Opinion in Environmental Sustainability*, *35*, 30–38. https://doi.org/10.1016/j.cosust.2018.10.008

West, S., Haider, L. J., Stålhammar, S., & Woroniecki, S. (2020). A relational turn for sustainability science? Relational thinking, leverage points and transformations. *Ecosystems and People*, *16*, 304–325. https://doi.org/10.1080/26395916.2020.1814417

Wilson, J. B., Peet, R. K., Dengler, J., & Pärtel, M. (2012). Plant species richness: The world records. *Journal of Vegetation Science*, *23*(4), 796–802. https://doi.org/10.1111/j.1654-1103.2012.01400.x

How to cite this article: Díaz, S., & Pascual, U. (2025). Reciprocity towards nature in the biodiversity science–policy interface. *People and Nature*, *00*, 1–10. https://doi.org/10.1002/pan3.70033