

An inclusive approach to assess nature's contributions to people

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SUMMARY

Nature contributes to the quality of life of people in many ways, predominantly positive and but also negative. Nature's contributions to people (NCP) is a central notion in the assessments carried out by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). NCP represents an evolution of the concept of ecosystem services since the publication of the Millennium Ecosystem Assessment. While embracing ecosystem services, NCP take a more inclusive and diverse interpretation of human-nature relations, reflecting the increasing involvement of social sciences, humanities, and other knowledge systems (e.g. indigenous, local) in global environmental science-policy interfaces. Status and trends of NCP can now be analyzed and reported from a generalizable perspective, a contextual perspective, or a combination of both, depending on the purpose and the actors involved in assessments. This could influence environmental science and policy in ways that will be perceived as scientifically sound and more legitimate by a higher proportion of society.

The impact of society on current and anticipated, large-scale, environmental changes remains a prominent global policy issue. A major challenge in the human-dominated world of the 21st century is to maintain or even enhance the beneficial contributions of nature to a good quality of life for all people (1, 2). IPBES, established in 2012, is the most ambitious global effort ever made by governments to assess and promote knowledge on the diversity of life on Earth, and its contribution to people, in order to inform policy formulation. This broad remit requires IPBES to engage a wide range of participants. With them come their multiple knowledge systems, spanning from natural, social, and engineering sciences to those of the indigenous peoples and local communities that are custodians of much of the world's biodiversity. Such inclusiveness is necessary for advancing scientific credibility and political legitimacy of assessment findings, and thus for better sustainability policies (3, 4).

The intellectual and practical challenges of attaining IPBES's vision of geographical, sectoral, epistemological and ontological inclusiveness are unprecedented. Pre-existing framings are narrower and potentially less inclusive. In response, IPBES developed a new conceptual framework for its assessments. The IPBES conceptual framework (CF) (5) models the interactions between people and nature, and serves as analytical scaffolding for assessing knowledge in ways that are relevant to all stakeholders, including policy makers. One of the key elements of this framework is the notion of nature's contributions to people (NCP).

FROM ECOSYSTEM SERVICES TO NATURE'S CONTRIBUTIONS TO PEOPLE

NCP are all the contributions, both positive and negative, of living nature (i.e. biodiversity of organisms, ecosystems, and their associated ecological and evolutionary processes) to quality of life for people. Beneficial contributions from nature include such things as food provision, water purification, flood control, and artistic inspiration, whereas detrimental contributions include disease transmission, predation that damage people or their assets, or the release of materials from vegetation which directly or indirectly affects human health. Many NCP may be perceived as benefits or detriments depending on the cultural, temporal or spatial context (6).

The notion of NCP has arisen partly in response to challenges in application of its main antecedent, the ecosystems services concept popularized by the Millennium Ecosystem Assessment (MA) (7). Since the launch of the MA (2005), ecosystem service theory and methods have developed rapidly. There has also been widespread recognition of the importance of this approach by policymakers, though its integration into political and economic decision-making remains limited (1). Some of the newly developed tools within the ecosystem service framework have focused on economic valuation of costs and benefits, and market-oriented approaches, such as Payment for Ecosystem Services and

REDD (8). While appropriate in some cases, narrowly-focused economic approaches have been criticized for hampering the engagement of diverse stakeholders (3, 9), and giving a limited reflection of the full range of values of nature (10), sometimes triggering opposition to the ecosystem services framework (11).

Different stakeholders understand people's relationship with nature, and nature's contribution to quality of life, quite differently. While the NCP concept is firmly rooted in the MA framework (Box 1), it casts a wider net, resulting from the increasing involvement of social sciences and humanities in environmental issues (12), as well as other knowledge systems and worldviews traditionally not engaged in policy-making, such as those of indigenous people.

AN INCLUSIVE SYSTEM FOR ASSESSING NATURE'S CONTRIBUTIONS TO PEOPLE

For the purposes of reporting and informing environmental and sustainability policy, the complex flows making up NCP need to be parsed into a manageable number of categories

that are meaningful to a broad range of stakeholders. Such categorization represents a formidable challenge, especially as different worldviews on nature-human relations differ in ontology, epistemology and axiology. Hence, a key issue in the framing of NCP is the degree to which different knowledge systems, such as those of indigenous peoples, as well as different natural and social scientific disciplines, view 'human' and 'nature' and their complex interactions. The NCP approach explicitly recognizes that a range of such views exist. At one extreme humans and nature are viewed as distinct (7); at the other, humans and non-human entities are interwoven in deep relationships of kinship and reciprocal obligations (9, 13, 14). In addition, the way NCP are co-produced by nature and people is understood differently through different cultural lenses. For instance, co-production of food in high-diversity agriculture can be framed as a set of biological and technological inputs aimed at maximizing coexistence between useful plant and animal species to achieve higher yields (15). Co-production of food can also be seen as the result of a "practice of care" (9, 14, 16) through social relationships and connection with spiritual entities.

Therefore, we propose two lenses through which to view NCP: a generalizable perspective and a contextual perspective. The generalizable approach is like a zoom lens where the observer sees different aspects, different levels of detail, in zooming in and out. By contrast, the contextual approach is more like a kaleidoscope: as the observer turns it, very different images will emerge. While presented here as extremes, these two perspectives can be blended and interwoven even within a given (e.g., western or indigenous) cultural context, allowing for analyses across disciplines and worldviews (Figure 2). We explore them further next.

The generalizable perspective on NCP. Typical of biophysical and economic sciences, this perspective (represented in green at the right hand side of Figure 2) is fundamentally analytical in purpose; it seeks generalization and thus strives for a universal set of categories. People and nature share the same biological substrate and interact in various ways. However, distinction between them is often sharp and agency is acknowledged only in the case of people. NCP categories can be seen at finer or coarser resolution, but can still be organized into a single, self-consistent system.

IPBES identifies 18 such categories for reporting NCP within the generalizable perspective, organized in three partially overlapping groups: regulating, material and non-material NCP (Figure 1, Table S1). These groups represent different facets of the flows between nature and quality of life, ranging from direct physical connections (e.g. food) through to the anchoring of symbolic components that give meaning to people's identity in their relationships with and through nature (17).

Regulating contributions are functional and structural aspects of organisms and ecosystems that modify environmental conditions experienced by people, and/or sustain and/or regulate the generation of material and non-material contributions. Regulating contributions affect people's quality of life in indirect ways. For example, people directly enjoy useful, beautiful or otherwise meaningful plants, but not the soil organisms that are essential for the supply of nutrients that underpin growth and long-term survival of such plants. Likewise, the risk of avalanches, which have a direct negative effect on people who live in avalanche-prone areas, can be increased or mitigated by the type of vegetation on hillsides.

Material contributions are substances, objects or other material elements from nature that directly sustain people's physical existence and infrastructure. They are typically physically consumed in the process of being experienced, for example when organisms are transformed into food, energy, or materials for shelter or for ornamental purposes.

Non-material contributions are nature's impacts on subjective or psychological aspects underpinning people's quality of life, both individually and collectively. The entities that provide these intangible contributions may be physically consumed in the process in what would be considered a material contribution (e.g. animals in ritual fishing) or not (individual trees or ecosystems as a source of inspiration).

A considerable conceptual evolution with respect to the ecosystem service framing is that culture gives meaning to all NCP, permeating through and across all three broad NCP groups (Figure 1), rather than be seen as a NCP category itself, as the MA proposed with cultural ecosystem services. In addition, the three broad groups, rather than being independent compartments, as typically framed within the ecosystem services approach, explicitly overlap. We distinguish them for practical reporting reasons, acknowledging that many of the 18 NCP categories do not fit squarely into a single group (Figure 2b). For example, food (NCP 10) is placed primarily in the material NCP category because a certain

amount of calories and nutrients are essential for physical sustenance. However, food is much more than material sustenance; across cultures, food is full of symbolic meaning. Indeed, non-material and material contributions are often fundamentally interlinked in most if not all cultural contexts (18). To indicate this, in Figure 1B the NCP in the material and non-material groups extend into each other's column. The non-material dimension of regulating NCP is not as widely recognized across cultures; therefore they are represented as encroaching only slightly beyond their column in Figure 2 B. Maintenance of options (NCP 18), conveying the various dimensions of the opportunities offered by nature, spans all three groups. Agreement within the scientific community as to which would be the main NCP, and how to best allocate them to the three broad groups is clearly not complete, but is comparatively high. Therefore it makes sense to propose a unified typology.

The contextual perspective on NCP. This is the perspective typical of but not exclusive to local and indigenous knowledge systems (represented in blue at the right hand side of Figure 2). Here, knowledge production typically does not explicitly seek to extend or validate itself beyond specific geographical and cultural contexts (19). The contextual perspective tends to emphasize the reciprocal relationships between people and nonhuman entities, often involving agency and responsibility on both sides (13, 14).

While subdivision into internally consistent systems of categories is common in many local knowledge systems, a universally applicable classification, -such as the one proposed in the generalizable perspective- is not currently available and may be inappropriate due to cultural incommensurability. The contextual perspective is more likely to organize NCP into bundles that follow from distinct lived experiences, such as fishing, farming or hunting, or from places, organisms or entities of key spiritual significance such as sacred trees, animals or landscapes (e.g. 13, 18); see also Table S2). It conveys the idea that there are multiple ways of understanding and categorizing relationships between people and nature. In sum, by explicitly incorporating the contextual perspective, the NCP concept avoids leaving diverse worldviews out of the picture or forcing them into the 18 generalizable NCP categories (19).

NURTURING A PARADIGM SHIFT FOR THE ENVIRONMENTAL SCIENCE-POLICY INTERFACE

The NCP approach contributes to a paradigm shift in the interpretation of human-nature relations in the environmental science-policy interface, especially in order to fulfil the sustainable development goals and put at check dangerous global environmental change, including biodiversity loss. NCP extend beyond the highly influential, yet often contested, notion of ecosystem services, incorporating a number of recent disciplinary and interdisciplinary advances, with the most transformative being a broader and more explicit consideration of culture permeating all the relationships between people and nature, and thus the perceptions of how nature underpins people's quality of life.

We anticipate that the NCP reporting system, already being tested in on-going IPBES assessments, could influence science and policy in ways that will be perceived as scientifically sound and more legitimate by a greater diversity of social actors. This is because it provides a practical way to engage different but equally legitimate worldviews on human-nature relationships. NCP can be analyzed and reported from a generalizable perspective, a contextual perspective or a combination of both, depending on the purpose and the social actors involved. Environmental governance and associated policies would likely increase their effectiveness and social legitimacy by drawing on the NCP reporting system, which facilitates interweaving of scientific and other perspectives in finding contextually-tailored options to the design and implementation of incentive mechanisms for conservation and sustainable use of nature, be it through command and control regulation or through voluntary programs.

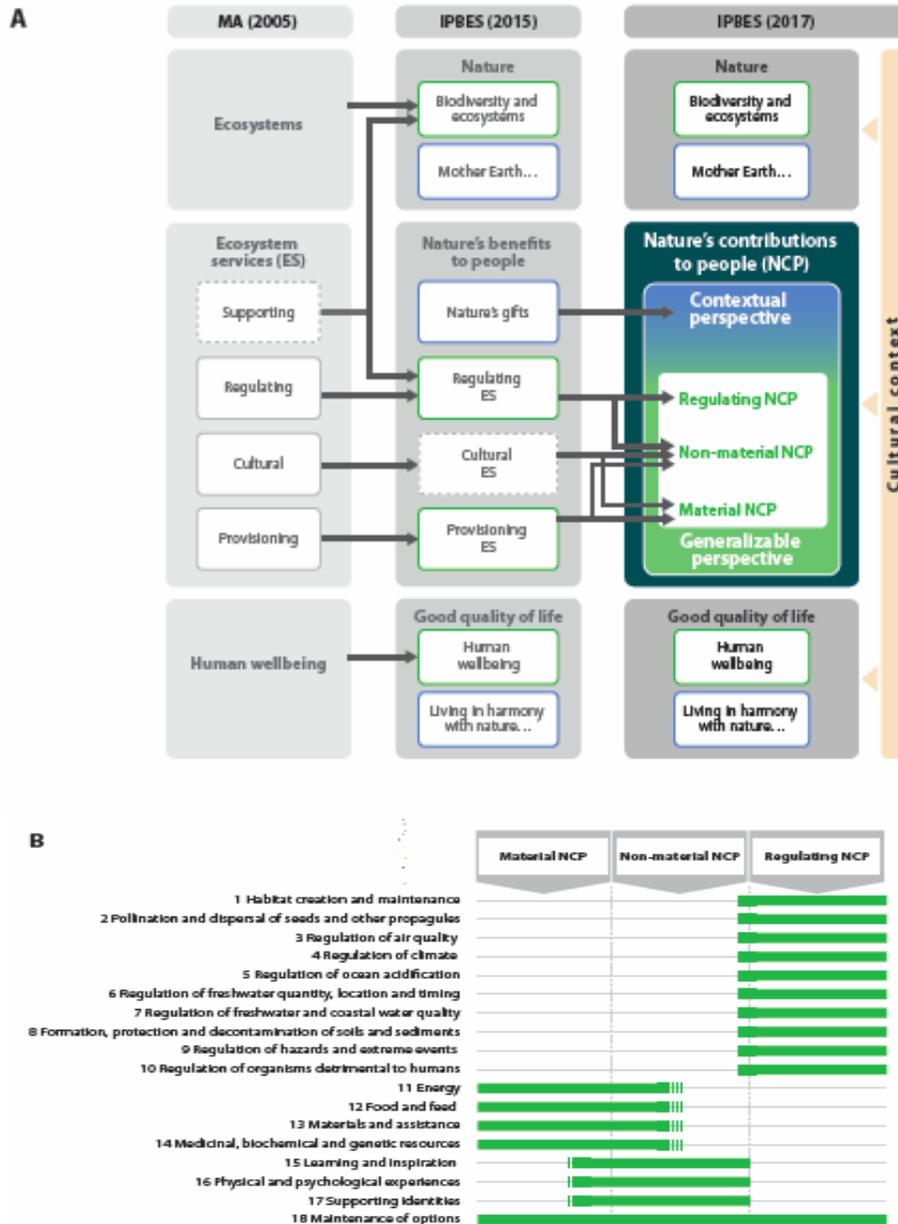


Figure 1 (A) Evolution of nature's contributions to people (NCP) and other major categories in the IPBES Conceptual Framework (5), with respect to the concepts of ecosystem services and human wellbeing as defined in the Millennium Ecosystem Assessment (7). Categories in grey are part of the frameworks but not the main focus of this paper. The element “nature’s benefit to people” was adopted by IPBES Second Plenary, and further developed into NCP by IPBES Fifth Plenary in order to reflect that the concept is meant to cover all the contributions, both positive and negative, to people. Concepts pointed by arrow heads replace or include concepts near arrow tails. Concepts in dotted-line boxes are no longer used: following the present view of the MA community (20), supporting ecosystem services are now components of nature or (to a lesser extent) regulating NCP. “Cultural ecosystem services” was defined as a separate ecosystem

service category in the MA; IPBES departs from this. It recognizes that culture mediates the relationship between people and all NCP, including the most concrete ones, such as food, shelter and energy (17}. For more details of NCP according to the generalizable and conceptual perspectives, see Figure 2 and main text. **(B) Mapping of the 18 NCP reporting categories used in IPBES assessments onto three broad groups distinguished within the generalizable perspective (see text and Figure 2). Note that most NCP straddle across groups to some degree. Explanation and examples of the 18 NCP are given in Table S1.**

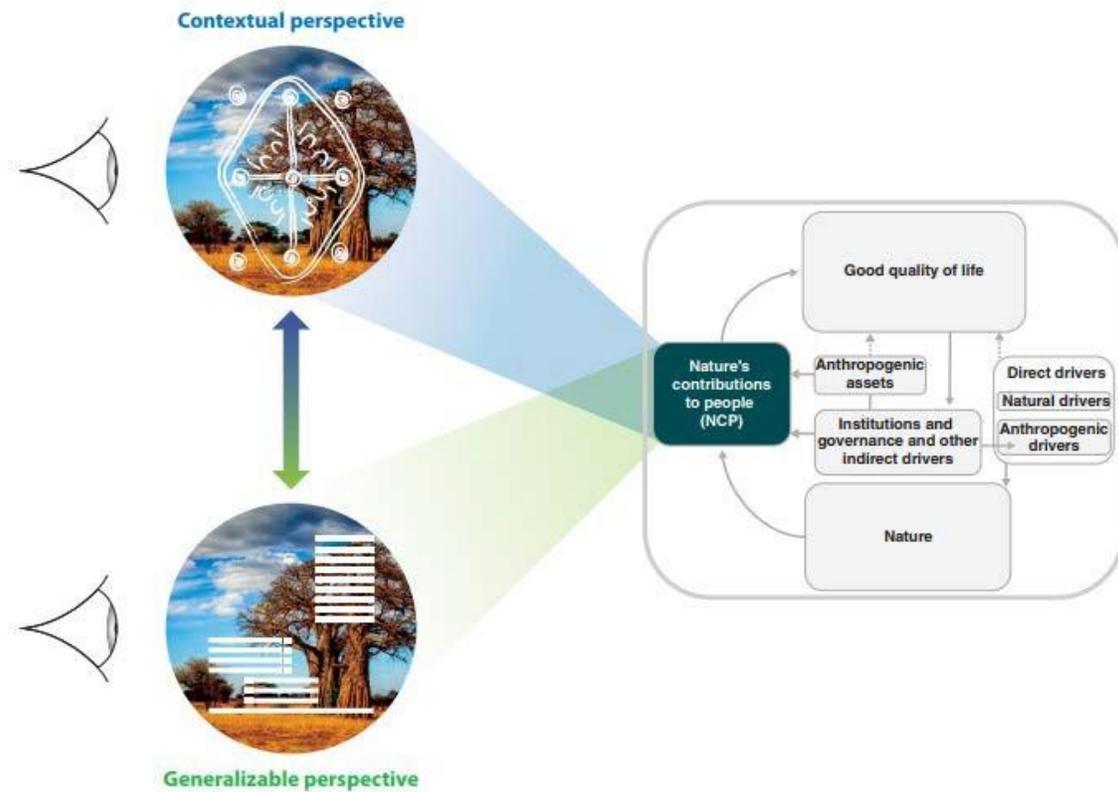


Figure 2 - Two perspectives on nature's contributions to people (NCP)

NCP is a key element of the IPBES conceptual framework (Díaz, 2015 #244) (shown in simplified version at the bottom). NCP can be seen through the generalizable lens (green, bottom), or through the contextual lens (blue, top). In the generalizable perspective, 18 NCP are distinguished and organized in three broad groups –regulating, material and non-material- of general applicability (represented by the white-line figure overlapping the landscape at the bottom, shown in full in Figure 1B). In the contextual perspective such universally applicable categories are largely not meaningful; the white-line figure overlapping the landscape at the top (a simplification of the Warlpiri perspective) represents only one of very many possible framings of NCP; see Table S2 for explanation and examples. Note that between the generalizable and contextual perspectives there are gradual transitions, rather than sharp distinctions. Depending on the context, a social actor

(including, but not exclusively, indigenous peoples and local communities) can report a specific NCP as part of any of the 18 NCP in the generalizable perspective, as part of a bundle of contextual NCP (see examples in Table S2) or as transitional between the two.

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