POLICY FORUM

BIODIVERSITY AND ECOSYSTEMS

Assessing nature's contributions to people

Recognizing culture, and diverse sources of knowledge, can improve assessments

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A major challenge today and into the future is to maintain or enhance beneficial contributions of nature to a good quality of life for all people. This is among the key motivations of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), a joint global effort by governments, academia, and civil society to assess and promote knowledge of Earth's biodiversity and ecosystems and their contribution to human societies in order to inform policy formulation. One of the more recent key elements of the IPBES conceptual framework (*1*) is the notion of nature's contributions to people (NCP), which builds on the ecosystem service concept popularized by the Millennium Ecosystem Assessment (MA) (*2*). But as we detail below, NCP as defined and put into practice in IPBES differs from earlier work in several important ways. First, the NCP approach recognizes the central and pervasive role that culture plays in defining all links between people and nature. Second, use of NCP elevates, emphasizes, and operationalizes the role of indigenous and local knowledge in understanding nature's contribution to people.

The broad remit of IPBES requires it to engage a wide range of stakeholders, spanning from natural, social, humanistic, and engineering sciences to indigenous peoples and local communities in whose territories lie much of the world's biodiversity. Being an intergovernmental body, such inclusiveness is essential not only for advancing knowledge but also for the political legitimacy of assessment findings (*3*).

FROM SERVICES TO CONTRIBUTIONS

NCP are all the contributions, both positive and negative, of living nature (diversity of organisms, ecosystems, and their associated ecological and evolutionary processes) to people's quality of life (*4*). Beneficial contributions include, for example, food provision, water purification, and artistic inspiration, whereas detrimental contributions include disease transmission and predation that damage people or their assets. Many NCP may be perceived as benefits or detriments depending on the cultural, socioeconomic,

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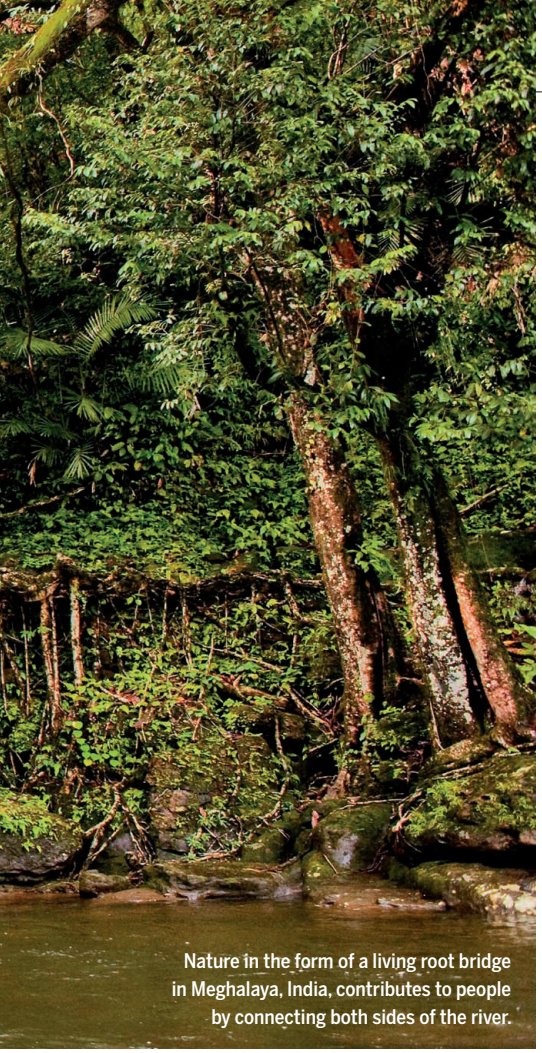

Nature in the form of a living root bridge in Meghalaya, India, contributes to people by connecting both sides of the river.

temporal, or spatial context. For example, some carnivores are recognized—even by the same people—as beneficial for control of wild ungulates but as harmful because they may attack livestock.

At first inspection, the notion of NCP does not appear to differ much from the original MA definition of ecosystem services (*2*), which was broad and contemplated links to many facets of well-being. However, the detailed conceptualization and the practical work on ecosystem services following on the MA were dominated by knowledge from the natural sciences and economics. The natural sciences, and ecology in particular, were used to define "ecological production functions" to determine the supply of services, conceptualized as flows stemming from ecosystems (stocks of natural capital) (*5*). Economics was used to estimate the monetary value of those ecosystem services flows so as to identify trade-offs among them and their impacts on well-being. Aided by ecology and economics having readily available tools, the ecosystem services approach developed into a vibrant research field, influenced policy discourse, and advanced the sustainability agenda.

However, this predominantly stock-and-flow framing of people-nature relationships largely failed to engage a range of perspectives from the social sciences (*6*), or those of local practitioners, including indigenous peoples. This reinforced a mutual alienation process in which MA-inspired studies and policies became increasingly narrow, which in turn led to voluntary self-exclusion of disciplines, stakeholders, and worldviews. As a consequence, the ecosystem services research program proceeded largely without benefiting from insights and tools in social sciences and humanities. For example, the unpacking and valuation of some "cultural ecosystem services" not readily amenable to biophysical or monetary metrics have lagged behind (*7*), and so has their mainstreaming into policy. In addition, as diverse disciplines and stakeholders remained at the margins, the initial skepticism toward the ecosystem services framework turned into active opposition, often based on the perceived risks of commodification of nature (*8*) and associated social equity concerns (*9*).

The need to be inclusive, both in terms of the strands of knowledge incorporated and representation of worldviews, interests and values (*10*), required IPBES to move to using NCP. Although still rooted in the MA ecosystem services framework (fig. S1), this new approach has the potential to firmly embed and welcome a wider set of viewpoints and stakeholders. It should also be less likely to be subsumed within a narrow economic (such as market-based) approach as the mediating factor between people and nature.

AN INCLUSIVE SYSTEM

The NCP approach explicitly recognizes that a range of views exist. At one extreme, humans and nature are viewed as distinct (*2*); at the other, humans and nonhuman entities are interwoven in deep relationships of kinship and reciprocal obligations (*11*, *12*). 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" (*12*, *13*) 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 (*14*), enabling coconstruction of knowledge among disciplines and knowledge systems (fig. S2).

Generalizing perspective

Typical of the natural sciences and economics, this perspective (represented in green at the bottom of fig. S2) is fundamentally analytical in purpose; it seeks a universally applicable set of categories of flows from nature to people. 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.

We identify 18 such categories for reporting NCP within the generalizing perspective, organized in three partially overlapping groups: regulating, material, and nonmaterial NCP (fig. S3 and table S1), defined according to the type of contribution they make to people's quality of life.

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

Nonmaterial contributions are nature's effects on subjective or psychological aspects underpinning people's quality of life, both individually and collectively. Examples include forests and coral reefs providing opportunities for recreation and inspiration, or particular animals and plants being the basis of spiritual or social-cohesion experiences.

Regulating contributions are functional and structural aspects of organisms and ecosystems that modify environmental conditions experienced by people and/or regulate the generation of material and nonmaterial contributions. Regulating contributions frequently affect quality of life in indirect ways. For example, people directly enjoy useful or beautiful plants but only indirectly benefit from the soil organisms that are essential for the supply of nutrients to such plants.

Culture permeates through and across all three broad NCP groups (fig. S1) rather than being confined to an isolated category (the "cultural ecosystem services" category in the MA framework). 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 (fig. S3). For example, food is primarily a material NCP because calories and nutrients are essential for physi-

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cal sustenance. However, food is full of symbolic meaning well beyond physical survival. Indeed, nonmaterial and material contributions are often interlinked in most, if not all, cultural contexts (*7*).

Context-specific perspective

This is the perspective typical, but not exclusive, of local and indigenous knowledge systems (represented in blue at the top of fig. S2). In local and indigenous knowledge systems, the production of knowledge typically does not explicitly seek to extend or validate itself beyond specific geographical and cultural contexts (*14*). Indeed, the context-specific perspective on NCP often tends to resist the scientific goal of attaining a universally applicable schema.

Although 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 generalizing perspective on NCP (table S1)—is not currently available and may be inappropriate because of cultural incommensurability and resistance to universal perspectives on human-nature relations. The context-specific perspective may instead present NCP as 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 (*11*, *13*).

Providing space for context-specific perspectives recognizes that there are multiple ways of understanding and categorizing relationships between people and nature and avoids leaving these perspectives out of the picture or forcing them into the 18 generalizing NCP categories. The NCP approach thus facilitates respectful cooperation across knowledge systems in the co-construction of knowledge for sustainability.

NURTURING A PARADIGM SHIFT

The NCP concept extends beyond the highly influential yet often contested notion of ecosystem services, incorporating a number of interdisciplinary insights and tools. Most of them were called for during the past decade (*9*, *10*, *12*, *14*) but only now are enshrined explicitly in an environmental assessment framework.

The implementation of the NCP approach and its reporting categories (tables S1 and S2) is still in its infancy and is expected to be fully fledged only in the IPBES Global Assessment, but the NCP approach is already changing assessment procedures and their outcomes. For example, the ongoing IPBES regional assessments include an unprecedented effort to tap indigenous and local knowledge, from the literature and also from dialogues with indigenous and local knowledge-holders, to which they contributed information presented in their own narratives. In the Europe and Central Asia assessment, these narratives (*15*) revealed complex interactions between detrimental (predation on livestock) and beneficial NCP (carcass removal or protection by shepherd/guard dogs) that were not considered in previous national ecosystem assessments. This kind of evidence also enhanced the confidence about the status and trends of other NCP in cases in which the evidence based on published literature was scarce (such as for NCP "Supporting identities"). In this regional assessment, it was relatively easy to fit most narratives into the 18 categories of the generalizing perspective on NCP.

In assessing pollinators, pollination, and food production (*16*), the dialogue with local and indigenous knowledge-holders highlighted some NCP that were defined as practices of care gifted to people, such as fostering pollinator nesting resources in forests, totemic relationships requiring reciprocal obligations between people and pollinators, and traditional governance that depends on ongoing presence of bees and butterflies in the landscape (table S2) (*13*). These context-specific NCP do not fit easily in the 18 generalizing NCP categories. Nevertheless, these knowledge sources underpinned innovative strategic responses highlighted in the main messages to policy-makers that were agreed on among all the member countries of IPBES (*16*): to strengthen traditional governance and tenure systems that support pollinators, which are critical in many places where these systems are being eroded through rapid industrialization.

"The NCP approach aims at ... products that are ... more likely to be incorporated into policy and practice."

These examples illustrate how the interweaving of epistemologically diverse lines of evidence (*14*) about specific subjects can result in richer solutions for people and nature, even within the context of large-scale assessments. But regardless of the outcomes of the assessments, the consideration of different knowledge systems—and the fact that generalizing, context-specific, and mixed perspectives are considered as equally useful—matters in terms of making IPBES procedures and outcomes more equitable. This should help overcome existing power asymmetries between western science and indigenous and local knowledge, and among different disciplines within western science, in the science-policy interface. The NCP approach aims at coming up with products that are better and also more legitimate and therefore more likely to be incorporated into policy and practice.

In addition to assessments, environmental governance and associated policies would likely increase their effectiveness and social legitimacy by drawing on the NCP approach. This is because it facilitates much more than previous framings the connection with rights-based approaches to conservation and sustainable use of nature and their implications for quality of life. The presence of multiple worldviews and diverse ways of expressing them in the wording of the Convention on Biological Diversity's strategic plan for biodiversity and specific objectives, such as the Aichi Targets, further illustrates how important inclusive framings are to the broad political legitimacy of these international objectives and their implementation instruments. ■

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