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Assessing Nature: perceptions, knowledge, and gaps

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where there once was prairie
a few remaining fireflies abstract themselves
over roads and concrete paths
prairie wants to stretch full out again and sigh
(Dungy 2023)

In 2022, the US Global Change Research Program initiated the first National Nature Assessment (NNA) via presidential Executive Order, addressing the need to "take stock of US lands, waters, wildlife and the benefits they provide to our economy, health, climate, environmental justice, and national security" (Global Change Research Act of 1990). This order was rescinded in January 2025, effectively cancelling the NNA before the final assessment was published. However, many of its authors deemed this multi-year endeavor important enough to keep alive because the NNA was needed to provide the American public with a "comprehensive understanding of nature, an assessment enriched by braiding together the stories, scientific findings, Indigenous knowledge, and lived experiences of people from across the US" (Tallis *et al.* 2023).

Performing such an assessment requires moving beyond a mere snapshot of the status and trends of environmental features, ecosystems, and organisms, and weaving in diverse perspectives and knowledge systems representing the cultural complexity and heritage of American communities (Chan *et al.* 2016). As experts convened by the NNA, we—the authors of this commentary—represent different scientific disciplines including ecology, genomics, entomology, science communication, psychology, natural resource management, Earth and environmental sciences, and human dimensions of natural resources. We explored the status, trends, and future projections of nature but recognized that our own perspectives and training represent only a slice of the many cultural perspectives and knowledge systems addressing the human–nature nexus. Regardless, we were tasked, as part of the NNA, with assessing the available scientific literature and associated knowledge sources (including information from museums, zoos, participatory databases, and government agencies). We were and are deeply committed to the view that humans are part of nature, and that human values and perceptions of nature shape what we measure, protect, manage, and love in the environments that surround and sustain us.

The original vision of the NNA is still critically important as it required us to interlink social perceptions with scientific information and knowledge gaps as ways to understand how the nature of today is uniquely shaped by American society, what the nature of the future will likely be, and how we can use that understanding to support nature that benefits all Americans. We argue that interlinkages among people's perceptions of nature and the data available to measure nature across different biological scales—including populations, communities, and ecosystems—shape a future nature in complex and potentially unpredictable ways.

Here, we share our approach of using constructive dialogues and storytelling as exemplified by the Talanoa Dialogues introduced by Fiji to the UNFCCC in 2017. We frame the status and trends of nature as being informed by the perceptions and values of American society, which shape future projections of nature. Our writing here is based on Talanoa: Where are we now, where do we want to go, and how are we going to get there?

Where are we now?

Perceptions of humanity's place within or apart from nature, and our shared responsibilities toward nature, shape assessments of nature. These different perceptions of nature and how to assess it can be based on occupation (eg farmer, scientist), landscape (eg urban, rural), or social-cultural groupings within America. Past international assessments of the status of nature have been conducted through the IPCC and IPBES (Pörtner *et al.* 2021) and have included human values of nature. However, incorporating how these conceptions of nature shape perceptions and motivate actions in the US and its territories (hereafter, the US)—given the complexity of American landscapes, coupled with the rich diversity of peoples residing in those landscapes—is a unique and challenging undertaking.

One of the most common ways to describe the status of nature is to focus on the most well-defined units of biodiversity—species. In this approach, "status" is based on the species' likelihood of going extinct throughout all or a significant portion of its range (Endangered Species Act of 1973, 16 USC § 1532(6)). However, species' definitions become problematic as technological advances highlight how few species we know. Species new to science are being described with startling

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regularity. Additionally, a multitude of species unrecognized by academic science may already be documented by traditional knowledge and other sources of information, and their status could be either known or unknown. Thus, our knowledge of which species are important within the US is skewed, based on what some people observe or have direct interest in. Larger and less cryptic vertebrates appear in the forefront of most assessments, while invertebrates (which comprise the bulk of biodiversity) are mostly in the shadows with insufficient information to determine their status or population trends.

Where do we want to go?

The demographics and beliefs of the peoples of America are dynamic, and this dynamism shapes our construction of what nature is and how to assess it. During the NNA's development, we sought to construct a future projection of nature that reflects the diversity of people's beliefs. Doing so has sometimes revealed conflicts among different people's behaviors, as we attempt to do justice to varying economic, political, social, cultural, or geographical concerns and priorities.

One important way to meet the challenges this presents is acknowledging community-based knowledge, which can increase participation in science and data collection, and can often inform community-based endeavors to make environments more hospitable for biodiversity in ways that meet the needs of multiple groups of people. For example, urban residents can incorporate native flowering plants in place of—or in addition to—lawns in their yards, providing suitable nesting and foraging resources for pollinators including native bees, butterflies, and hummingbirds (Cooper *et al.* 2021). Likewise, in agricultural landscapes, the inclusion of flowering habitats in marginal lands along field edges and as inter-row cover crops in orchards improves species diversity and abundance of beneficial organisms, thus reducing the need for agrochemicals. In coastal communities, hardened seawalls are being replaced with living shorelines, which improve the safety and well-being of coastal residents, enhance local biodiversity as well as fish stocks, and ensure ecosystem health. Lastly, although land degradation and recovery are often linked to soil microbes, some of which have yet to be identified, new technologies are rapidly revealing essential information about these taxa. These efforts are all indicative of proactively creating future visions of nature and where we want to go.

How are we going to get there?

We see all these efforts—from cutting-edge science, to community participation, to local knowledge, values, and solutions—merging into a vision of a future nature. Several approaches transcend the conventional focus on species and assess nature in a way that is comprehensive and considers diverse perspectives and knowledge systems. Emerging technologies can engage communities as active participants in creating a vision of a future nature that benefits all. AI-informed databases that gather community-based knowledge, such as iNaturalist and eBird, have become the fastest growing online databases of species, representing one-quarter of described species, with non-expert participants documenting most of these observations. These databases rely on participatory science efforts and the resulting data reduce information gaps for organisms that belong to small, understudied, or less accessible taxa, including invertebrates and nonvascular plants. Also, initiatives tracking community-based restoration projects, such as the Homegrown National Park or the National Wildlife Federation's Native Plant Habitats, are informed by stakeholders reporting data using taxonomic identification tools built on AI and include digitized museum specimens aggregated in platforms like GBIF.

The management of American lands, waters, and protected areas reflects how society values and perceives nature's contributions to people. Federal agencies have been directed by Congress and past presidents to monitor and assess the nation's shared resources through laws and executive orders, respectively, and as such, there is a wealth of data collected and assessed by these agencies. Continued access to these data is vital to the well-being of all Americans. Integration of local community knowledge of species within these assessments is important and the increasingly accurate species identification that this knowledge enables is notable. In addition, while often quite small, urban greenspaces provide crucial opportunities for urban dwellers to interact with nature. In a future America, consideration of how and where nature is experienced by humans should include these small spaces as they sometimes have a startling wealth of species, while providing a place to sit and benefit from connecting to nature.

Final thoughts

…prairie wants to stretch full out again and sigh—

purple prairie clover prairie zinnia
prairie dropseed nodding into solidago
bee balm brushing rabbitbrush—prairie wants prairie wants prairie wants
(Dungy 2023)

Human actions shape the natural world and nature's future will be influenced not only by our ability to monitor and understand it, but also and especially by our shared societal values and actions, which are shaped by our perceptions of how we are connected to nature. Any assessment of nature will invariably contain data gaps that prevent a truly holistic snapshot, unknowingly ignoring a wealth of species—unappreciated and undescribed by humankind, yet indispensable for ecological viability. "*Prairie wants prairie wants prairie wants*" perhaps best expresses future projections of nature that will be shaped through the geographical and biological diversity, as well as the complex cultural heritages, of America. As scientists assessing perspectives, values, ecosystems, and species, we need to analyze

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our current knowledge about biodiversity and ecosystem functions, gather evidence to fill the gaps, and describe a future nature that could benefit all. Although the cost of such efforts might superficially appear too high for society to address, the cost of silent extinctions and the loss of the many benefits that nature provides will undeniably be even higher.

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