Title: Recognize diverse approaches to area-based conservation of nature

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Main Text:

Area-based environmental governance systems safeguard biodiversity by conserving wildlife habitats, ecological corridors, and functioning and resilient ecosystems (1). Protecting ecosystems through area-based governance systems can mitigate climate change by sequestering carbon and reducing greenhouse gas emissions (2). Through conserving habitats for life below water and on lands and providing other ecosystem services, area-based conservation also contributes to many Sustainable Development Goals (3). Current high rates of biodiversity loss are unprecedented in human history, leading scientists and policymakers to call for protection of at least 30% of earth's lands and waters by 2030 (1).

Current policy discussions and tracking systems (1, 3) do not yet fully recognize the range of area-based conservation systems, providing an incomplete picture of available conservation opportunities. Some area-based systems are designed with conservation intentions; these include state-designated protected areas, conservation concessions, conservation agreements, and privately- or community-owned reserves. Many other area-based systems, though not necessarily intended for conservation, may foster positive biodiversity conservation outcomes, including Indigenous and community-managed areas, sacred natural sites, military training grounds, eco-certification programs, and recreational sites, among others (Table S1). Recognizing and supporting the full range of area-based conservation systems is essential to meeting societal commitments to conserve biodiversity, mitigate and adapt to climate change, and foster sustainable development.

The extent and types of area-based conservation systems

Area-based conservation systems and efforts to track them have traditionally focused on state-recognized protected areas (PAs).Expansions to PA coverage, according to the World Database of Protected Areas (WDPA), have brought approximately 16.64% of the world's lands and 7.74% of coastal and marine areas under protection (3), though legal changes have reversed some protections (4). While most PAs are designated and managed by national governments, recent discussion on increasing the area under conservation note the importance of non-state actors (5, 6). Emerging evidence suggests that payments for ecosystem services (PES) programs, Indigenous lands, forest certification, and conservation concessions can reduce forest cover loss (7, 8). Several initiatives aim to recognize and inventory a more diverse array of governance systems beyond state PAs, including some being recognized as "other effective area-based conservation measures" (OECMs), Indigenous and community lands, and eco-certified areas (9–11). Despite these efforts, current global tracking systems still overlook key area-based governance systems relevant to conservation, while country and local level tracking efforts are often scattered and inconsistent with global databases.

A closer look at conservation initiatives in Amazonia reveals the scientific and policy imperative for recognizing diverse approaches to area-based conservation of nature. Area-based systems with the intent and/or potential to contribute to conservation, including and beyond state protected areas, cover at least 5.6 million km^2 (41.3%) of the total terrestrial area of the nine Amazonian countries (**Fig. 1**). State-designated PAs covered 2.48 million km^2 (18.2%) of the terrestrial territories, while other forms of area-based conservation covered 4.29 million km^2

(31.5%) of the terrestrial territories*, respectively. In comparison, Amazonian countries reported a variety of area-based governance systems to the WDPA, which characterized 3.76 million km^2 (27.7%) of their terrestrial territories as protected by 2016. The largest contribution to area under some form of conservation beyond state-designated PAs in Amazonian countries is communal tenure, including state-recognized Indigenous lands (2.22 million km^2, 16.3%) and community-based natural resource management systems (0.21 million km^2, 1.6%). In Brazil, Indigenous lands are recognized as part of the formal conservation estate†; in other countries, the level of recognition, tenure security, regulations and objectives for Indigenous lands and other community-based natural resource management systems vary. Formally registered and reported privately protected areas cover only 13,659 km^2 (0.1%).

Beyond the commonly recognized and reported categories, area-based conservation systems in the Amazon countries also comprise sustainable production areas, areas under conservation contracts and agreements, and other designations (Fig 1; Table S1, S7). Sustainable production areas cover 746,973 km^2 (5.5% of the terrestrial territories) of natural forests under state legislation and 104,023 km^2 (0.77%) under forest certification schemes, with some forests under multiple schemes. Contract and agreement-based exchanges for conservation were introduced in the early 2000s; PES programs, conservation agreements, and conservation concessions cover at least 127,134 km^2 (0.94%), 15,107 km^2 (0.11%), and 12,815 km^2 (0.09%), respectively. PA buffer zones comprise 153,168 km^2 (1.1%); designated recreational areas represent merely 2,335 km^2 (0.02%). Other areas with access restrictions but not intended or designated for conservation may also conserve nature. For instance, the military training areas in Brazil collectively provide 36,380 km^2 (0.27%) of habitat for endangered species (Table S1). Additional private, state-required, and community-based conservation areas are yet to be recognized or mapped, some of which cover large areas (e.g. legal reserves established under the 2012 Brazilian Forest Code cover ~1.67 million km^2[12.3%]) (Table S7).

* The areas of state-designated PAs and other forms of conservation add up to more than the total area under area-based conservation because they overlap spatially.

† Indigenous lands in Brazil are reported to WDPA and counted to the total percentage of land protected in the country.

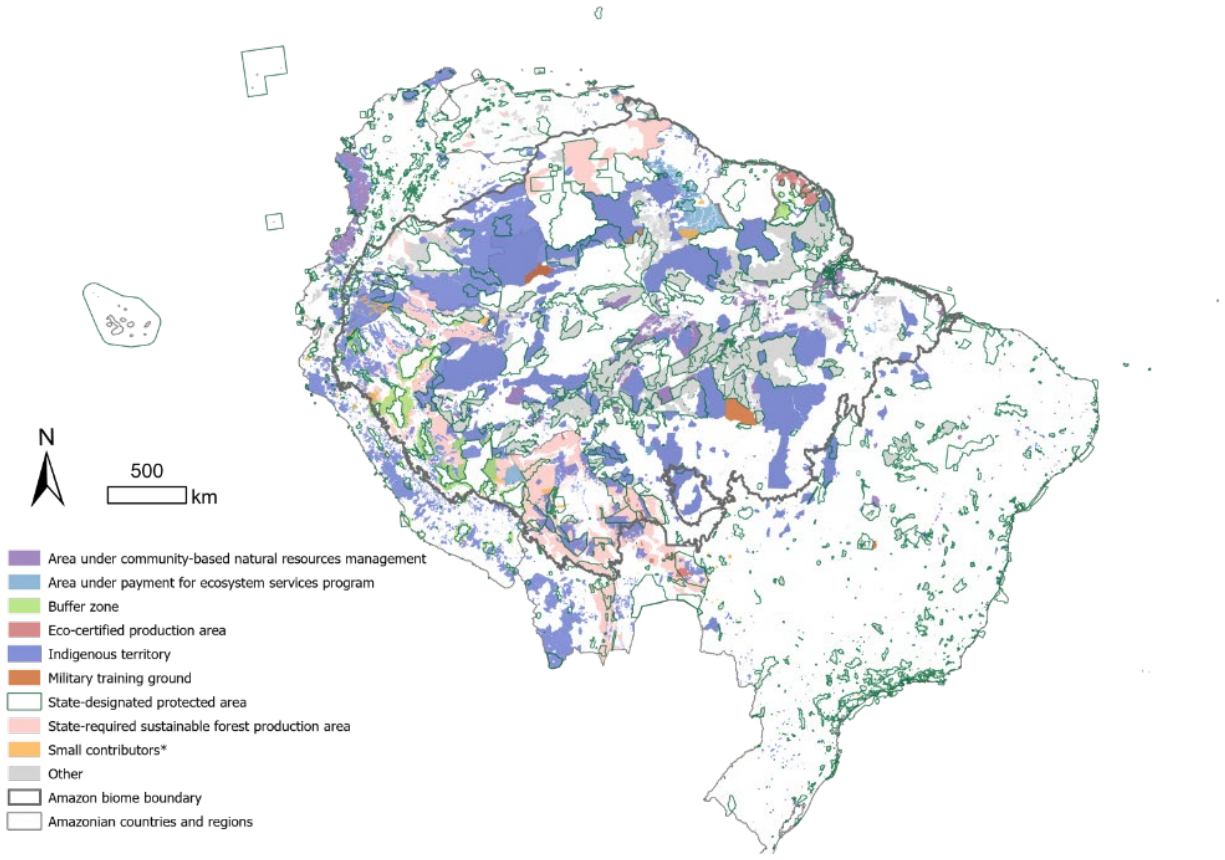

Fig. 1. Map of area-based conservation systems in the Amazonian countries and regions. The map contains all polygon data (i.e., excluding data represented by points or statistics) of area-based conservation governance systems, in 2016. "Small contributors" include private recreational areas, Indigenous and community conservation areas (ICCAs), conservation concessions, conservation agreements, privately protected areas, and state-designated recreational areas; they collectively cover less than 1% of total area-based conservation systems in the Amazonian countries and regions. See Supplementary Methods for detailed data collection and classification methods and data sources for area-based conservation systems.

Globally, area-based systems beyond state protected areas also govern wide expanses of lands and waters, with significant implications for biodiversity conservation, climate mitigation, and sustainable development. An estimated 45% or more of the world's lands (~60 million km^2), for example, is customarily held by Indigenous peoples and local communities (IPLCs) (**Fig. 2**) (6, 10). While not all IPLC-held lands are governed or managed with a conservation objective, research shows that Indigenous lands overlap with 36% of intact forests globally and host a similar amount of threatened species as protected areas (6, 12). Documented IPLC governance systems cover 24 million km^2 (12.4%) of global lands, among which only 14 million km^2 (58% of the 24 million km^2) are acknowledged by state governments (10). The Forest Stewardship Council has certified approximately 1,770 forestry operations covering 2.2 million km^2 (1.1% of global lands) across 80 countries (13); at least 10% of these 2.2 million km^2 are required to be set aside for conservation (see SI). Biodiversity offsets, implemented to compensate for negative

impacts on biodiversity that result from development activities, represent at least 12,983 documented projects in 37 countries extended over 153,679 km^2 (+25,013, - 64,223 km^2) (0.08% of global lands)(14), many of which are located outside of state-designated protected areas. Beyond Amazonia, data regarding extent and exact location of sustainable production areas, recreational areas, and areas under communal or contract-based approaches remains largely unreported, representing a barrier to policy-relevant science and evidence-based policy.

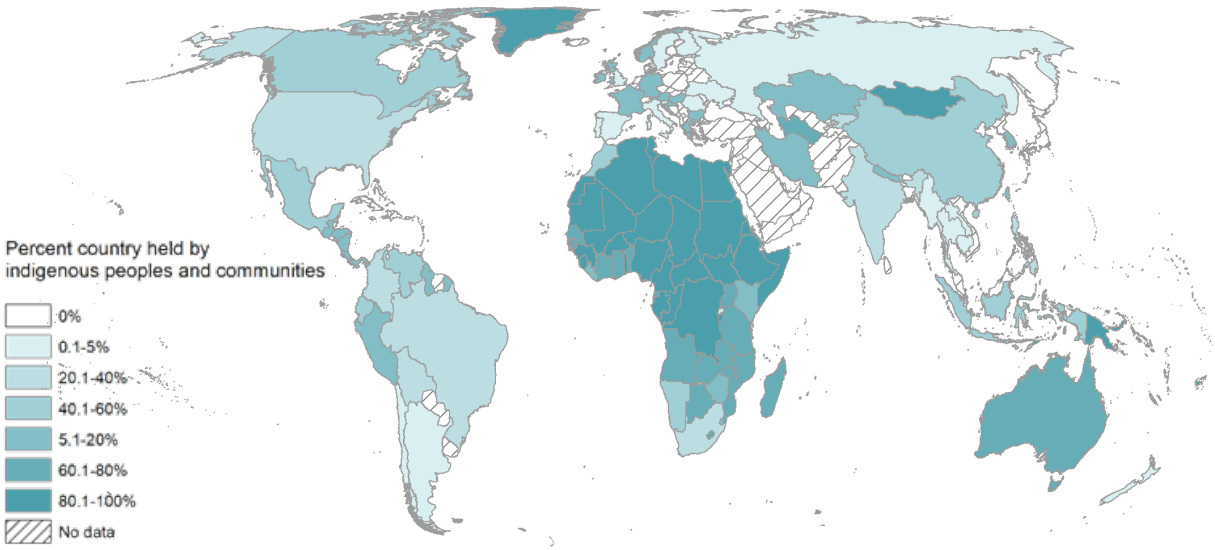

Fig. 2. Indigenous and community lands globally. The color shows the percentage of terrestrial area in each country held by indigenous peoples and communities – including those lands acknowledged and not acknowledged by the governments. See supplemental information for data sources and methods. Data comes from LandMark (10).

An empirically driven inventory towards recognizing diverse approaches to conservation

Because of extent and potential contributions of diverse area-based conservation systems beyond protected areas, there is a clear need to recognize these systems in both research and policy. Given the heterogeneity in objectives and governance types, properly recognizing and accounting for contributions of diverse governance systems to conservation poses fundamental questions: What counts as an area-based conservation system and who has the authority to decide? A narrow definition of area-based conservation risks discounting current progress and ignoring the contributions of widespread "nontraditional" governance systems to nature conservation. Conversely, inventorying all geographies under area-based governance risks overestimating and obscuring critical conservation priorities. In either scenario, the potential for misaligned financial resources and human capacity on a global scale is considerable – and potentially catastrophic for both nature and humanity.

To navigate these tensions, we propose an empirical approach that begins with a spatially explicit, regularly repeated census of area-based conservation systems globally. Such a census would answer the following questions: What are the existing forms of area-based governance that have conservation objectives or potential outcomes? Who governs these lands and how? When were these governance systems established, when and how have they changed, and how

long do or did they last? Inputs from local knowledge holders and non-peer-reviewed sources would enhance the inventory. Necessary data anonymization and aggregation can be employed to address data privacy concerns. Instead of reporting to pre-defined governance categories, this empirically driven approach can better capture the diversity and dynamics of existing governance systems and flexibly integrate emerging actors and arrangements, hence providing a more representative global picture of current conservation progress, gaps, and opportunities than previously understood. Some of these strategies could also be considered as potential OECMs and analyzed according to the proposed criteria (9). A holistic view will lay the foundation for knowledge production and informed policy debates.

Implications for science

Given that much of the earth's surface is currently governed by some form of area-based conservation systems, recognizing the diversity of governance systems beyond PAs will have profound implications for the sustainability science. Most fundamentally, recognizing the full range of area-based conservation systems will make visible the extent, diversity, and dynamics of the myriad governance systems that mediate the relationship between humanity and nature globally. Recognizing these systems will further enable scholars to better describe, explain, and predict their emergence and evolution, as well as their impacts on social and ecological processes at a variety of scales. It will also enable researchers to conduct more comprehensive, rigorous, and more nuanced analyses of government policies and corporate practices, particularly with respect to evaluating the efficacy of area-based conservation initiatives – an essential input into evidence-informed planning and policy. Knowledge co-production – with local expertise from researchers, Indigenous Peoples and other local residents, civil society organizations, corporations, and government agencies – will be required to generate, analyze, and interpret these insights, identify context-based policy responses, and articulate evidence-based and collectively desired futures for all life on Earth (15).

Implications for policy and practice

Recognizing diverse area-based conservation systems will enable governments, corporations, Indigenous Peoples, and civil society to better combat biodiversity loss, mitigate and adapt to climate change, and foster sustainable development globally. First, a more accurate representation of the extent, diversity, and dynamics of area-based conservation systems will inform design of more appropriate policy targets, including how much land and water to protect globally and how to do so (1, 9). Secondly, realizing the existence, locations, and diversity of these systems will enable decision makers to more effectively plan where and how to invest to deliver desired policy outcomes. Nonstate actors and conservation initiatives, in particular, may benefit from greater attention and investment, including improved safeguards and support for the rights of Indigenous people and local communities. This may include expanding formal recognition of their customary ownership of resource and land upon which to root sustained conservation practices and culture. Third, a more comprehensive picture of areas under some form of conservation and their associated outcomes will foster improved transparency, accountability, and adaptive management – making more visible the progress (or lack thereof) toward stated targets and other policy objectives. Lastly, by marshalling the data that enables policymakers to ask and answer fundamental questions about what they seek to achieve, how,

and why, recognizing diverse area-based conservation systems may foster more adaptive and evidence-based policy and practice.

Conclusion

Area-based conservation is a fundamental approach necessary to address biodiversity loss, climate change, and sustainable development. While multiple conceptual perspectives have emerged in developing future biodiversity targets (1), a thorough inventory of the existing area-based systems will substantively inform the scientific and policy dialog by clarifying the types, extent, outcomes and challenges of existing area-based conservation systems, and subsequent implications for the people living in these areas. Efforts to mitigate climate change (*2*) and achieve global conservation targets – whether area-based (e.g. "30 by 30"; "half-earth")(*1*) or outcome-based (e.g. net-zero biodiversity loss)(*14*) – will affect significant swaths of lands and waters and potentially billions of people globally. Rather than relying on expanding current state protected areas, our data from Amazonia and across the globe illustrates that recognizing and supporting diverse conservation governance systems may offer more equitable, effective, and sustainable paths than state protection alone. We hence call for more careful consideration of – and active support to – existing area-based conservation efforts when making future conservation plans and assessing their potential impacts.

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Supplementary Text

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