



Indigenous knowledge and the shackles of wilderness

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The environmental crises currently gripping the Earth have been codified in a new proposed geological epoch: the Anthropocene. This epoch, according to the Anthropocene Working Group, began in the mid-20th century and reflects the “great acceleration” that began with industrialization in Europe [J. Zalasiewicz et al., *Anthropocene* 19, 55–60 (2017)]. Ironically, European ideals of protecting a pristine “wilderness,” free from the damaging role of humans, is still often heralded as the antidote to this human-induced crisis [J. E. M. Watson et al., *Nature*, 563, 27–30 (2018)]. Despite decades of critical engagement by Indigenous and non-Indigenous observers, large international nongovernmental organizations, philanthropists, global institutions, and nation-states continue to uphold the notion of pristine landscapes as wilderness in conservation ideals and practices. In doing so, dominant global conservation policy and public perceptions still fail to recognize that Indigenous and local peoples have long valued, used, and shaped “high-value” biodiverse landscapes. Moreover, the exclusion of people from many of these places under the guise of wilderness protection has degraded their ecological condition and is hastening the demise of a number of highly valued systems. Rather than denying Indigenous and local peoples’ agency, access rights, and knowledge in conserving their territories, we draw upon a series of case studies to argue that wilderness is an inappropriate and dehumanizing construct, and that Indigenous and community conservation areas must be legally recognized and supported to enable socially just, empowering, and sustainable conservation across scale.

Indigenous and local ecological knowledge | tropical forest | conservation | rethinking wilderness

The current environmental crises gripping the Earth have prompted the formation of a new geological epoch: the Anthropocene. The dominant framing of the Anthropocene today, as defined by the Anthropocene Working Group, suggests that the epoch began in the 1950s: an outcome of the “Great Acceleration” that started with industrialization in Europe (1) and intensified with greater levels of consumption, market expansion, and human settlement in the mid-20th century (2). Tropical ecosystems have been framed as the epicenter for the Anthropocene, because they simultaneously represent the key terrestrial biomes for either buffering against—or amplifying—the negative impacts of past and current human behavior on global socioecological systems (3, 4). These tropical landscapes face threats from a range of direct

and indirect human activities, including climate change, land clearance/conversion, invasive species, ecosystem fragmentation, biodiversity loss, and landscape homogenization (5, 6), which could breach ecological or “earth system” tipping points that foreshadow ecological (and societal) ruptures (3, 6). These systems are thus generally considered high-value terrestrial landscapes (e.g., biodiversity hotspots) whose protection is fundamental for maintaining human well-being and global biodiversity, but whose very integrity is contingent on abating human-caused threatening processes (7).

Approaches to protecting tropical ecosystems are almost universally seen through the lens of ecosystem service and biodiversity conservation (8, 9), and often follow protectionist ideals (10). Under this framework,

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most human impacts tend to be viewed as threats to ecological integrity, despite nearly all tropical landscapes being home to Indigenous and local peoples who have actively created and managed them for millennia (11–13). This ignorance can pervade so deeply within conservation discourse that it overlooks the fact that many of these “high-value,” biodiverse landscapes are the historical product of, and thus require, human intervention to maintain the very values for which they are lauded (13–17).

European Enlightenment and the Growth of “Wilderness” Thinking

Classification of the Anthropocene as a static epoch is, at its core, a Eurocentric construct. It is the progeny of the European “Enlightenment” that prioritized “Western” notions of “reason” over all else in its problematic attempt to “emancipate” all of humankind from authoritative Christian and other religious dogma (18). Rather than emancipation, the Enlightenment, extending ideals of “universality” and “objectivity” born from the Scientific Revolution, has reduced interpretations and narrowed solutions to current environmental crises through the erasure of diverse epistemologies in ways that threaten our very survival on the planet. Instead of providing an alternative to rigid and authoritative religion, the Enlightenment was built on the very central and religious tenet that humans are separate from nature (18). This premise held that humans can be abstracted from the rest of the world and, in doing so, possess the faculties to understand the world in its entirety through the objective pursuit of universalities (18, 19). When coupled with the concurrent expansion of European imperialism in the global tropics, this worldview saw the widespread establishment of colonial agendas that sought to “enlighten” the rest of the world by “conquering wildness and bringing order and rationality to ‘uncivilized’ peoples and nature” (20). This endeavor was executed zealously and justified casting of “wild” nature and its “primitive” people as external to “civilized” Europe (21). Like other binaries constructed from Enlightenment thinking, such as space and time, human and nonhuman, mind and body, the dualism between nature–culture remains so entrenched in mainstream Western culture and environmental conservation that it is seldom critically challenged in dominant institutions (22). Despite mounting calls to decolonize conservation (20, 23) and decades of critical engagement by Indigenous and non-Indigenous scholars (23–31), contemporary Western conservation discourse and practice continues to strip away non-European notions of reciprocity between humans and the world around us. Many major conservation categories and interventions thus still rationalize extractive and subordinating relationships between those who govern landscapes and those peoples governed in them, often irrespective of their culture, knowledge, livelihoods, and environmental impacts (32).

In this context, universal categories and representations about pristine, people-free nature have emerged and powerfully informed the conservation of tropical habitats, from rainforests to deserts. These dominant narratives carry little, if any, regard for Indigenous and local ways of knowing, using, and living in these landscapes (i.e., Indigenous territories). The notion of wilderness is one such category that has arisen from the Enlightenment and imperial processes, and continues to cast high value, biodiverse spaces as pristine and people-free environments that are in need of preservation: supposedly, the very antidote to the Anthropocene (10, 33). Despite decades of critique and resistance during and after the colonial era, a resurgence of the wilderness myth around the world (34) has once again found traction among large

international nongovernmental organizations, private philanthropists, major foundations, and corporations, and certain nation-states (35–37) who seek to reimpose aspects of “fortress conservation,” whereby Indigenous and local peoples are excluded from land and the life it gives (23, 38).

Wilderness: Origin. Old English *wildēornes* ‘land inhabited by wild animals,’ from *wild* *dēor* ‘wild deer’ + -ness.

Rather than enlighten and save humanity, wilderness thinking has facilitated the perverse outcome of landscapes being idealized, imagined, and managed as intact, high-value biodiversity areas free from human disturbance (39, 40). In many respects, such narrow interpretations of forest landscapes have justified the inhumane eviction of Indigenous and local peoples from their homelands following annexation as parks and protected areas, driving dispossession and conflict similar to the colonial period across the Americas, Africa, Asia-Pacific, and Australia (29, 38, 41, 42). The Wilderness Project (9, 13) and efforts to map and classify high-value, intact wilderness zones (many of which overlap with the tropics and regions with high Indigenous populations) (Fig. 1), continue to this day (43–45).

Challenging the Wilderness Ideal: Case Studies from the Tropics

Central to the idea of wilderness is the absence of people (46) [see also The Wilderness Act 1964 (USA) s. 2c]. Contemporary efforts to redefine “wilderness” through objective scientific metrics and preservationist ideologies only manage to further distance wilderness-driven practices and society from the governance and agency of Indigenous and local peoples. In doing so, they eschew, explicitly or implicitly, the deep and profound influence that Indigenous and local peoples have had on landscapes for millennia (11, 13, 30, 47, 48).

Tropical forests represent a habitat type that perhaps most commonly evoke perceptions of pristine, lightly impacted landscapes within mainstream Western conservation discourse. However, far from escaping significant human modification, areas mapped as wilderness across tropical biomes (Fig. 1) have been profoundly shaped by humans in deep time, and continue to be occupied and used by diverse Indigenous and local populations today (Figs. 2–4). For example, the Amazon is thought to be a center for the domestication of over 80 crop species, including many that humans rely on today, such as cassava (*Manihot esculenta*), wild rice (*Oryza* sp.), peanuts (*Arachis hypogaea*), and chili (*Capsicum baccatum*) (49–51). The domestication and cultivation of these key crop species resulted in substantial human impact over the composition and structure of soils and forests in these landscapes (13, 52–54) that continue to support significant agroecological diversity today (55) (Fig. 2). Despite clear human intervention in the Amazon forest system for millennia, Indigenous and local peoples’ use of these forests have promoted biodiversity and maintained forest structure (11, 13). On the other side of the globe, the application of swidden agriculture—a way of farming involving rotational clearing, burning, and fallow that has been used for millennia and today supports between 14 and 34 million highlanders in tropical South and Southeast Asia (56)—is thought to have played an important role in shaping the structure and resilience of forests (13), as well as maintaining diverse ecosystem services (14) (Fig. 3).

In most cases, these forests are classified as some of Earth’s most valuable ecoregions of high conservation significance (8) and, in some instances, wilderness zones (43) (Fig. 3). Top-down conservation approaches to these high-value systems are still

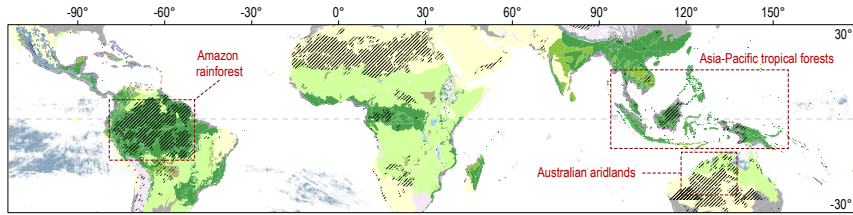


Fig. 1. Map showing the locations of mapped wilderness regions across different tropical biomes (colored shading): Tropical forest (dark green); tropical savanna (light green); desert (yellow). Shown are the location of so-called “last wild” terrestrial (black hatching) (43) and marine (65) (blue shading) places on the planet relative to the mapped “natural” distribution of major tropical and subtropical biomes (79). Insets show the focus regions discussed in this paper.

informed by reductionist, human–nature dichotomies that depict these landscapes as wilderness spaces. Such exclusionary conservation approaches persist despite the significant and growing pool of compelling evidence that suggests Indigenous and local perspectives, knowledge, and practices have, and do, sustain highly biodiverse and multifunctional ecosystems that support thriving local communities. The diagrams in Figs. 2 and 3 combine data from the physical and social sciences to illustrate how deep human legacies and contemporary community action shape the composition and function of two, very high-value, wild tropical forest zones—the Amazon Basin (Fig. 2) and the Asia-Pacific (Fig. 3)—and explore some ways in which top–down application

of wilderness thinking may ultimately stifle their function, longevity, and productivity.

The managed tropical forest case studies showcase the interconnected relationship between functioning forests and the spiritual, economic, and cultural needs of past and present Indigenous and local inhabitants, both within these zones, and in the global tropics more broadly (57). Indeed, the future health and biodiversity of protected landscapes globally may be contingent on Indigenous occupancy, use, and stewardship (11, 16, 58, 59). Indigenous and local reciprocity and obligations to forests, lands, waters, and other people largely remain absent from dominant conservation approaches still informed by Cartesian binaries

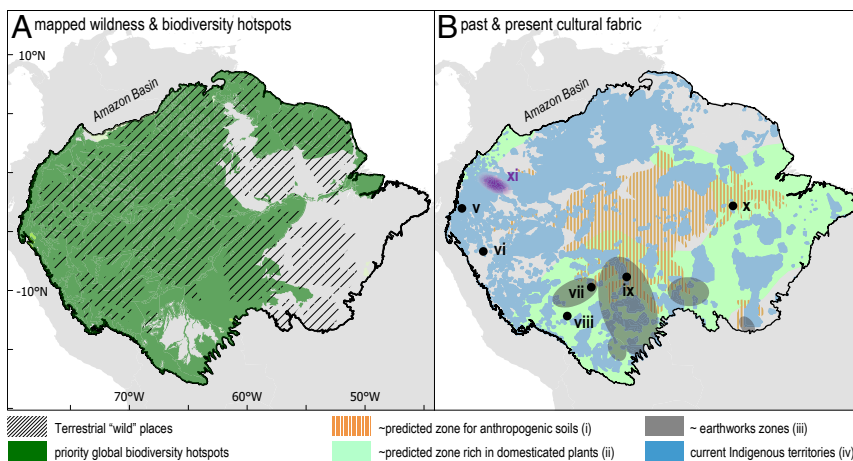


Fig. 2. Maps contrasting the “wild” Amazon (A) with the Amazon as an Indigenous cultural landscape (B). In (A) the dark green shading corresponds to mapped biodiversity hotspots (8), and the black hatching represents mapped “last wild” terrestrial places (43). Shading in B corresponds to the past and present cultural fabric of the Amazon. (A) The “wilderness” lens as applied to the Amazon basin, where forests are assumed represent high-value biodiversity hotspots that were “in place prior to major human impacts.” (green shading) (8) and some of the “last wild places” on Earth (hatching) (10, 43). Data from the physical and social sciences, including traditional ecological knowledge, paint a very different map (B), highlighting that this region has long been, and continues to be, shaped by people. Currently, Indigenous territories make up approximately half of land classified as “wilderness” [blue shading, iv (80)] and the landscape, more broadly, reflects spatially and temporally heterogeneous fingerprints of human activity over more than 10,000 y (81), including the construction of significant earthworks in the south (iii, modified from ref. 82). The Amazon is considered to be a center for the domestication of many common crops that we use today (49–51). This has influenced forest composition to such an extent that much of the forest is disproportionately rich in domesticated species. The pale green shading (ii) shows the predicted region where domesticated shrubs and trees comprise >4% of the relative richness of the forest (modified from ref. 54). There is evidence for agroforestry and cultivation of nonforest crops (including maize) from >6,300 to 3,500 y ago [v (83–85), vi (86), vii (87), viii (83, 85, 88), ix (87, 89), x (11)]. However, land management likely intensified across the basin from ~4,500 to 3,000 y ago, and relied on the active development of organic, anthropogenic soils termed Amazonian Dark Earths (ADEs) that are predicted to extend across a significant portion of the Amazon (brown hatching (i); modified from ref. 89). Today, these soils support a distinct, human-modified forest (53, 90). Treating Amazon forests as the last of the “wild” not only diminishes the past role of people in shaping forest composition and structure, but, in doing so may erode extant ecosystem health and service provision by removing the influence of human disturbance drivers that helped to create them in the first place. Other applications of (Western) scientific binaries, including drawing clear lines between “high-value forest” and “low-value nonforest” using satellite imagery, may also prove counterproductive for conservation. Recent research on livelihood practices (Chagra) that have been long used by the Nonuya, Andoque, and Ceima Chacivera communities in the northwestern Columbian Amazon (xi), shows that traditional modes of cultivation are adaptive and ecocentric, and lead to diverse and highly dynamic landscapes that shift across forest cover thresholds set by entities such as the Food and Agriculture Organization and the Kyoto Protocol (24).

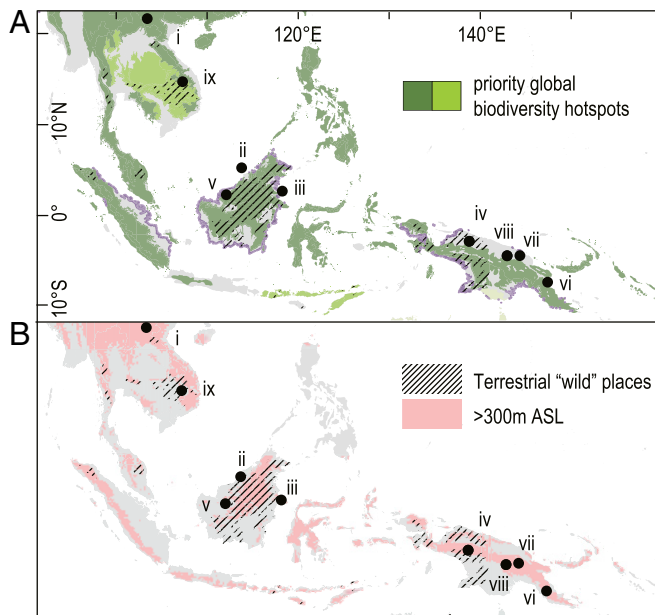


Fig. 3. Maps showing the location of “wilderness” regions (hatching) and biodiversity hotspots (green shading in A) in tropical Asia and New Guinea that are overlain with selected archaeological research sites (black points). Pink shading (B) denotes regions that are higher than 300 m above sea level. Ever-wet and seasonally dry tropical forests in Southeast Asia and New Guinea (respectively, dark green and light green shading in A) have been inhabited by people for as long as 40,000 to 50,000 y: i (91), ii (92), iii (93). There is the evidence for mixed occupancy and land-use patterns by Indigenous peoples engaged in hunting-gathering and horticulture including swidden (shifting or rotational) cultivation, potentially as early as the Pleistocene [iv (94, 95), v (96), vi (97)] with more clear intensification in the mid- [vi (97, 98)] to late Holocene [iv (94, 95), v (97), viii (98)]. Today, tens of millions of people still rely on swidden farming this region (56), particularly in the uplands (>300 m above sea level (99), pink shading in B), where fallows are often longer. Despite long being cultivated, these highland zones capture some of the most bio- (8), linguistically, and culturally diverse zones on earth (72). Nonetheless, swiddening is often framed as “incompatible with nature conservation” (100) or having “significantly perturbed the pristine ecology of tropical forest” (101), leading to it being criminalized and vilified under top-down conservation approaches, including REDD+ (United Nations collaborative program on reducing emissions from deforestation and forest degradation in developing) schemes (102). Paleocological and ethnographic research has, however, shown that varied fallow swidden systems may not only increase landscape-scale biodiversity and forest resilience to climate change [ix (14)], but positively contribute to supporting livelihoods and ecosystem service flows (103). Better consideration of the role of Indigenous highlanders in making, and perhaps even shaping, forest landscapes and their resilience parameters in conservation initiatives is critical and timely given the rapid land-use transitions in highland regions to intensified cropping, infrastructure development, and or people-free conservation sites.

drawn between nature and humans (19) or landscapes worthy—or unworthy—of protection (24).

Similarly, the tropical arid lands of Australia have been the continual home to Indigenous people possibly longer than anywhere on Earth today (60). Far from being one of the Earth’s remaining wilderness areas (10), the Western Deserts of Australia are the ancestral home of a number of Aboriginal peoples (61), who have managed these landscapes for millennia (Fig. 4). Indeed, the effects of removing Indigenous peoples from the landscape in the 1960s was catastrophic, resulting in uncontrolled

wildfires and a degradation of the ecological qualities for which this landscape was originally valued (61, 62). Unsurprisingly, the return of these lands to Indigenous traditional owners over the past two decades has seen improvements in the socioecological dynamics of the region (63). Indeed, some Aboriginal peoples in Australia view “wild country” (wilderness) as “sick country” (64): land that has been degraded through a lack of care through use. Thus, Aboriginal notions of wilderness are antithetical to the technocratic and romantic notions of wilderness representing “pristine” and healthy ecosystems that underpin many modern-day conservation efforts (37). The outcome continues to be a clash of worldviews in a globalizing society where the Western epistemologies governing dominant conservation practices operate in an echo-chamber that continues to erase other ways of knowing from conservation dialogue (64).

There are many examples of this echo-chamber in the science behind the wilderness movement (10, 37, 43). In setting strict rules for accounting and measuring what constitutes a “human footprint,” models designed to identify wilderness areas self-validate and provide a putatively objective and universal measure of wilderness (43, 65). By focusing only on quantifiable inputs and

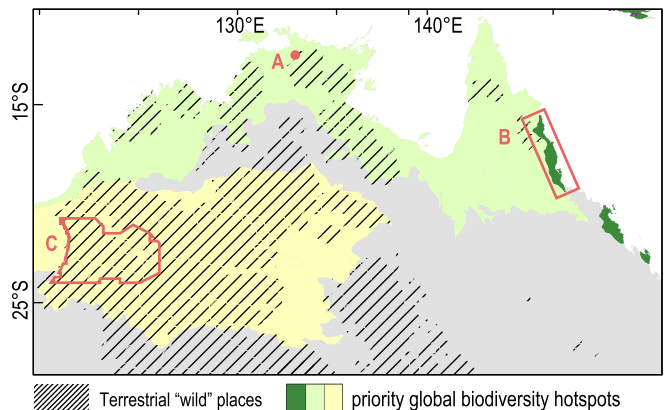


Fig. 4. Map showing the location of “wilderness” regions (hatching) and biodiversity hotspots (colored shading) in tropical Australia that are overlain with selected archaeological and anthropological research sites. Discussions about landscape restoration rarely acknowledge the ecological functions performed by people (63). Tropical and subtropical Australia plays host to the oldest continuous culture on the planet (A) (i.e., >65,000 y) (60), yet much of this peopled region has been classified as wilderness (hatching) (10, 43) and as preserving minimally impacted tropical desert (pale yellow), tropical savanna (green), and tropical forest (dark green) ecoregions of critical conservation significance (8). Long-term, multidisciplinary data from all three biomes indicate the long, continuing legacies of humans in shaping these supposedly “wild” landscapes, ranging from food tree manipulation in the Australian Wet Tropics (B) (12), to the construction of place-based societies across the Western Deserts (C) (103, 104). Coupling Indigenous knowledge with ecological work within Martu Country in the Western Deserts demonstrates the importance of low-intensity patch burning and hunting on increasing floral diversity via mosaics and facilitating the persistence of endemic faunal communities (104). Moreover, such burning has been shown to be vital for supporting keystone species (105). Removing people and traditional land management from the landscape (as demonstrably occurred between the 1960s and 1980s) would have profoundly negative consequences, simplifying ecological networks and triggering the decline and extinction of valuable floral and faunal species (62, 105). These data clearly demonstrate that striving for wilderness as a conservation baseline ignores millennia of coevolution of place and people, and risks preserving systems in an impoverished state of low resilience (63).

outputs—such as built environments, crop lands, pasture lands, population density, nighttime lights, railways, major roadways, and navigable waterways to measure human ecological impacts (43, 66)—these scientific endeavors consciously exclude an array of Indigenous and local practices, reinvigorating the Enlightenment-born project that sought to elevate scientific beliefs and practices over “other” ways of knowing and being (19, 20). Despite some exceptions, Western-oriented conservation thinking and approaches continue to pay insufficient attention to, or neglect outright, other ways of knowing or being in the world (19, 64). They pay lip-service to Indigenous peoples and local communities “who have been part of wilderness areas for millennia through deep bio-cultural connections to the land” and other ecologies (43), while typically failing to engage with them in any meaningful way. In so doing, wilderness-inspired conservation movements build a “house of cards” that justifies and sustains the exclusion or marginalization of Indigenous and local peoples’ agency, connection, and obligation to their ancestral lands (15, 19, 67). It is this removal or marginalization of Indigenous and local peoples and their management regimes under the guise of managing wilderness that, somewhat paradoxically, serves to degrade the ecological quality and resilience of these long-peopled landscapes (15, 63) (Figs. 2–4).

A Path Out of the Wilderness: Hearing Indigenous Voices

Despite sustained critique by Indigenous peoples, Indigenous scholars, and various others in the academe and civil society, the continued use of the wilderness moniker in conservation practice serves only to disempower Indigenous and local peoples and to deceive non-Indigenous people into the false belief of a transcendent “nature” free from the influence and active intervention of humans (35, 36). It is past the time to abandon the wilderness trope, to deprioritize disembodied notions of objectivity and universality, and to embrace situated Indigenous and local knowledge systems in scaled and relational approaches to ecosystem and landscape management. While there is no singular Indigenous or local knowledge system, there are key lessons to be learned from the dynamic cross-scalar ways that Indigenous and local peoples collect, strengthen, and transmit knowledge that are critical for maintaining healthy people and healthy landscapes. Rather than an assembly of facts and information to be forcibly integrated into conservation designs (68) and practices (69), conservation scientists and practitioners must see Indigenous and local knowledge and experiences as being forged through situated practices, transformations, and events over time and space. Indigenous and local peoples’ knowledge and practices must be recognized as *Sui generis* (22). Both emerge as part of journeys as much as they are understandings and enactments; they cannot be abstracted out from place. Rather, as part of livelihoods and social relations, they require a constant relationship and renegotiation between people and place over time and space (70). Understanding how such knowledge and practice is acquired and revitalized in human endeavors (song, dance, story, politics, and so forth) and ecologies, is essential for understanding the relationships between people and place in conservation endeavors (19, 57, 71).

Along with incorporating multiscale and locally situated Indigenous and local knowledges in approaches to ecosystem and landscape management, protecting and bolstering Indigenous and local livelihoods, customs, and languages must be a priority; each inform, reinvigorate, and store enormous reservoirs of environmental knowledge and beliefs that inform practices that

nourish lands, forests, and waters. It is no coincidence that the most linguistically diverse regions of Earth are also those that are most biologically diverse (72). On the island of New Guinea, areas that host the highest linguistic diversity on Earth occur in the same place as some of the earliest evidence of agriculture and some of the most biodiverse ecological communities (73), yet this area is still today erroneously mapped as wilderness (43) (Fig. 3). Indeed, the vast and expanding network of global protected areas overlap with, have been sustained by, and benefitted from ancestral territories long shaped and managed by Indigenous and local peoples that predate conservation enclosures by several centuries to millennia (59, 74, 75). Rather than simply being about knowledge integration (29), partnerships, and adaptive engagement (15), there is a need for nation-state, international institutions, and nongovernmental organizations to: 1) legally enable relatively autonomous Indigenous and locally led and managed territories; 2) truly engage with, embed and prioritize Indigenous and local knowledges; and 3) support Indigenous rights to land, resources, diverse livelihoods, and lifeways (57, 76).

The formal recognition of, and support for, Indigenous and community conserved areas (ICCAs), Indigenous protected and conserved areas, or similar rights-based initiatives are one way forward in effectively decolonizing conservation. ICCAs and related initiatives have the potential to ensure Indigenous and local peoples have greater agency, autonomy, and sovereign control over how, when, and why natural and cultural resources are used and managed on their territories, territories that are often the basis of and overlap with conservation enclosures (77, 78). In the context of appropriate state and nonstate support, it is through ICCAs that Indigenous and local peoples can protect ancestral territories while bolstering linguistic and cultural connections to their territories, and the local–global economic and political networks necessary for sustaining and revitalizing reservoirs of environmental knowledge and practice for current and future generations. Indigenous peoples, Indigenous and non-Indigenous scientists, and others increasingly demonstrate that, through genuine consultation and power-sharing (e.g., recognition of Indigenous authority and rights and empowering free and prior informed consent), considerable potential remains for the effective coproduction of knowledge between conservation initiatives and Indigenous and local knowledge systems. Among other benefits, such collaborative efforts can provide new insights into understanding how biodiverse environments have been used and managed sustainably well before the so-called Enlightenment (15). Rather than seeking to impose external conservation processes and institutional structures, collaborations that respect the multilevel governance and political structures of Indigenous and local peoples allow the robust and appropriate production, strengthening, and transmission of complex knowledge and diverse resource use practices in and through ICCAs. As Indigenous and local peoples across the globe have long advocated, their voices, concerns, and needs must take precedence in the existing and new conservation governance arrangements that involve their ancestral territories and embrace multifunctional landscapes. Rather than espousing the exclusive wilderness territories as an antidote to the ills of the Anthropocene, externally funded, designed, and implemented conservation initiatives must now align with or cede to Indigenous and local governance initiatives that drive research, policy making, and variegated landscape management.

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