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Essays and Perspectives

A call to restore the value of forests: refining definitions of tree-dominant ecosystems for social wellbeing

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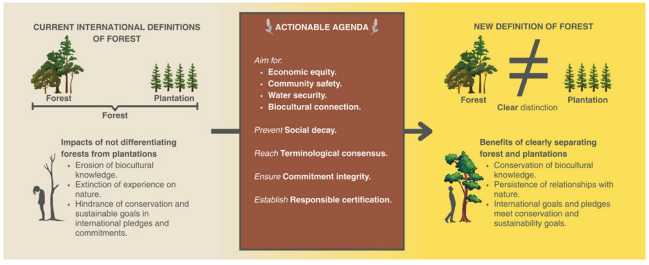
HIGHLIGHTS

- Understanding plantations as forests damages culture, knowledge and human wellbeing.
- Unclear demarcation between forests and plantations hinders conservation commitments.
- We present an actionable agenda to prevent the impacts of unclear forest definitions.
- Multi-scale systemic changes are necessary to safeguard social wellbeing.
- We propose a definition that clearly discerns forests from plantations.

GRAPHICAL ABSTRACT



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ABSTRACT

The prevailing definitions of "forest" often blur the lines between natural and production-oriented tree-dominant ecosystems, categorizing both under the same umbrella term. This includes a continuum ranging from old growth, biodiverse systems labeled as "natural" forests, and highly managed homogenous tree crops referred to as "plantation" forests. However, these two types of systems differ significantly in many ways, including their contributions to people which have been less prominent in scientific research and social discourse. Here, we argue that using the term "forest" interchangeably for both natural and plantation tree-dominant systems promotes a misleading narrative that obscures the negative impacts of plantation "forests" while diminishing the value of natural forests. This misrepresentation can lead to a loss of knowledge regarding native tree species and other flora and fauna found in natural ecosystems. Further, these definitions may encourage or facilitate the replacement of natural forests with tree crops under false environmental pretenses within the context of international sustainability or environmental agreements and certifications, depriving communities of the cultural and experiential benefits of natural forests. To address this issue, we propose an actionable agenda to prevent the negative social externalities of plantations and a socially responsible definition of forests that clearly distinguishes between natural ecosystems (forests) and production-oriented ones (plantations).

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Introduction

There is no universally accepted definition of "forest" (Chazdon et al., 2016; Colson et al., 2009; Lund, 2002; Zalles et al., 2024). Currently employed definitions of forest (e.g., CBD, 2006; FAO, 2000) are criticized due to a homogenization of biodiversity and thresholds in their criteria (area, tree cover and height) that complicate deforestation monitoring or hinder climate change mitigation objectives (Hua et al., 2022; Sasaki and Putz, 2009; Zalles et al., 2024). In addition, the multiple available definitions of forests and the decision to not standardize them, even for international agreements (FAO, 2002), result in inconsistencies of what is understood as a forest across and within countries (e.g., Colson et al., 2009; Lund, 2002; Mermoz et al., 2018; Romijn et al., 2013; Zalles et al., 2024). This increases the difficulty in assessing the achievement of common targets to restore forests worldwide. Furthermore, currently employed definitions of forest allow for plantations (i.e., crop systems) to be considered forests, despite the stark differences between the two. We contend that the lack of clear differentiation between forests and plantations has a negative impact on the human condition (well-being and culture). Thus, for the benefit of our collective welfare, we urge for a discretization of the definitions of forests and plantations, as well as a standardization of forest definitions.

What are forests and plantations?

Traditionally, the definition of what a "forest" is reflects the management goals, purposes, and priorities of those who define it (for detailed review see Chazdon et al., 2016). Historically, various definitions of forest have been used concurrently with four main underlying objectives: *timber management, biodiversity conservation, climate change mitigation*, and *earth stewardship*. Interestingly, not food production. It is the definition for timber management that is the earliest and most widely used ever since the 1700's (Chazdon et al., 2016), now taken to be "land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent" (FAO, 2000). The 1960s brought about the environmental movements and ecological advancements that solidified conservation as a science. With it, the intrinsic value of nature was prioritized, leading to the adoption of forests in the Convention on Biological Diversity as: "a dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system. Humans, with their cultural, economic and environmental needs are an integral part of many forest ecosystems (CBD, 2006)". However, the CBD does still consider the FAO led definition to be the basis moving forward.

Concern for the impacts of climate change led to the formation of the United Nations Framework Convention on Climate Change (1992) which, along with the Kyoto Protocol (UNFCCC, 2002), landed on forest as "minimum area of land of 0.05–1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10–30 per cent with trees with the potential to reach a minimum height of 2–5 metres at maturity in situ". The 2010s gave rise to the earth stewardship framework (Chapin III et al., 2011), wherein social-ecological disciplines coalesce to engage in aligning people's psychological state with nature's resilience to attempt to generate successful long-term stewardship of the planet. This led to forests being conceived as "complex adaptive systems, whose properties arise through self-organization and interactions among internal and external components, including human societies" (Messier et al., 2015).

Hence, standard definitions encompass broad terms that generally refer to a spatially explicit area dominated by tree species with a determined range of canopy cover (CBD, 2006; FAO, 2000). Within these definitions, by adding prefixes and suffixes, we can find "natural forests", "forest plantations (or plantation forests)", and "agro-forests". A natural forest is defined as "a forest composed of indigenous trees and not classified as forest plantation". Forest plantation is understood as "a forest established by planting or/and seeding in the process of afforestation or reforestation. [Consisting] of introduced (…) or indigenous species". Finally, an agro-forest "is a complex of treed areas within an area that is broadly characterised as agricultural or as an agro--ecosystem" (CBD, 2006). When subjected to conceptual analysis, these definitions are clearly not mutually exclusive, hindering the ability to distinguish them.

For example, if an old-growth forest is invaded by exotic species, does it cease to be a natural forest? If so, when? Which ratio of native to exotic species is acceptable for a forest to be considered natural? On another front, a heterogeneous plantation composed of native species established as part of a restoration program and a monoculture comprising exotic species designated for logging are both considered forest plantations, although their goals and social value differ greatly.

There is also the matter of forest classifications over time. When hundreds or even thousands of years have passed and gradual species turnover has increased diversity and complexity in man-made forests making them indistinguishable from natural forests by these criteria, will they still be agro- and plantation forests just because they were planted by people? This creates a ship of Theseus style conundrum regarding the identity of a forest.

The classification and typification of tree-dominant ecosystems is complex and has been the subject of long-lived, ideologically driven debates perpetuated by the fact that natural and planted forests are part of a continuum (Batra and Pirard, 2015). As such, we can differentiate one from the other most clearly at the end points of the spectrum. Here, we will not seek a definition of forest that tackles the greys within the spectrum. Rather, we will focus our efforts in clearly seeking an operational definition by differentiating the extremes of the forest to plantation continuum. Before we embark on this endeavor, we will explain why a new definition of forest is required for social well-being. For illustrative purposes, we will refer to forests as natural ecosystems, composed of an heterogenous ensemble of tree species, and plantations as man-made homogenous, highly managed (fumigated, logged, cultivated) ecosystems, composed of planted trees. These two examples stand at both ends of the forest-plantation continuum.

Forest and plantations: why the difference matters

Forests are different from plantations in many aspects, most notably, regarding their biodiversity (see Hua et al., 2022). However, here we will focus on the social aspects that differentiate forests and plantations.

The socioeconomic impacts of plantations (on employment, health, livelihoods, cash income, land, infrastructure, and specific cultural, regulating, provisioning and supporting ecosystem services) have been poorly studied, but have been mostly reported as negative (Malkamäki et al., 2018). However, plantations can bring about positive impacts such as greater employment, road construction and improvement, greater landscape aesthetic, and more free time from reduced level of work (D'Amato et al., 2017; Kainyande et al., 2022; Schirmer et al., 2008). In fact, in some areas such as Central Uruguay, local people can hold positive attitudes toward the forestry industry and the expansion of plantations (Vihervaara et al., 2012).

Even so, the benefits stemming from plantations can be unfairly distributed in some communities (Kainyande et al., 2022). For example, from an economic perspective, locals claim that plantation companies buy "prime agricultural land at inflated prices", creating a competitive disadvantage for young farmers (Miller and Buys, 2014), and "artificially inflating" land prices (Leys and Vanclay, 2010). Further, employment offered by plantations and mills is generally unequally distributed. In rural Australia, community members are "bewildered at the recruitment of non-resident employees and contractors for the small periods of work the plantations offer" (Miller and Buys, 2014). Local communities from Sierra Leone perceive employment in the forestry industry as unfair, benefiting mostly land-owning families, which deepens the social inequality in the area (Kainyande et al., 2022).

Moreover, in Chile, Argentina and Uruguay, forestry-related jobs are low-income, dangerous, informal, precarious, temporary and mostly subcontracted, hindering the control of decent labour conditions (Contreras, 2005; Ehrnström-Fuentes and Kröger, 2018; Groglopo, 2012; ILO, 2012, 2019). In fact, the forestry industry has been linked to extractivism, wherein raw materials are extracted and exported at the expense of environmental and human well being (Kröger and Ehrnström-Fuentes, 2021).

Plantation establishment has been found to impoverish human communities–financially, culturally, and in their well-being (Manuschevich et al., 2020; Reyes and Nelson, 2014; Switzer, 2014). Plantations are linked to outmigration, displacement of farmers, declines in numbers of school children (and population in general), and a demographic shift toward unemployed and older people (Leys and Vanclay, 2010; Miller and Buys, 2014). This population decline can also lead to the decay of services, including education and health, hindering community access to basic needs (Miller and Buys, 2014). These factors amount to a sense of nostalgia for what communities used to be before the advent of forestry plantations (Manuschevich et al., 2020; Miller and Buys, 2014). By experiencing the decay of their community, people undergo *solastalgia* (*sensu* Albrecht et al., 2007), wherein they feel "nostalgic" for their homes even though they have not left them. As a result, the mental health of those who remain in altered environments, such as those where plantations have been established, is negatively impacted by the loss of their home and the erosion of the solace and comfort it once provided (Albrecht et al., 2007; Manuschevich et al., 2020).

When tallying further cultural and intangible losses, we find that tradition, identity and values are in danger of disappearing with the spread of plantations (Malkamäki et al., 2018). Loss of the capacity to distinguish between forests and plantations or the belief that plantations offer the same or equal services to society can lead to perceiving exotic species as equally or even more valuable than native ones, something that can even occur in megadiverse countries, such as Brazil (de Melo et al., 2021). Though not megadiverse, Chilean biodiversity is highly endemic, yet despite this, some Chileans grow up surrounded by pine tree plantations, leading them to believe they are natural ecosystems (Aliste et al., 2018). When asked about species with which they share the landscape, pedagogy students from Southern Chile (where most forestry plantations are concentrated) frequently named pine trees, while Central and Northern Chile students did not list any species from the *Pinus* genera (Méndez-Herranz et al., 2023). This shows how plantations play a role in biocultural homogenization (*sensu* Rozzi, 2018).

In addition, the transformation of forests into plantations involves the loss of the contributions to people perceived as services or disservices from nature (Díaz et al., 2018). Plantations bring about detriments such as a decrease in water quantity and quality as well as soil fertility (D'Amato et al., 2017). In contrast, forests offer wood, native fruits and herbs, greater biodiversity, healthier water basins, and spaces for families to enjoy and build communities around (Manuschevich et al., 2020). Moreover, they are important for culture. For indigenous communities in Chile, like the Mapuche, the conversion of forests into plantations is the leading cause behind the loss of ethnobotanical knowledge of wild edible plants and fungi that were once plentiful and easily accessible in forests (Barreau et al., 2016). Such losses regarding food, medicine, shelter and rituals stemming from land use change exemplify the erosion of biodiversity, loss of nature's contributions to people, and the extinction of experience (Miller, 2005).

The continuing expansion of plantations, combined with increasing urbanisation and the lack of a clear definition that conceptually separates forests and plantations, all increase the risk of losing knowledge on what natural ecosystems are. This shifting baseline (*sensu* Pauly, 1995) can diminish benefits to human wellbeing and positive social dynamics ranging from emotions and attitudes to behaviours concerning nature. These components can bring about the extinction of experience (*sensu* Pyle, 1993) of human-nature interactions that has been thought to create a vortex of disaffection toward nature (Soga and Gaston, 2016).

Most worryingly, broad criteria for forest definitions could lead to a positive feedback loop, wherein plantations continue to expand and replace native forests, leading to a loss of knowledge and experience regarding the importance of forests, ultimately allowing the expansion of plantations to continue. Forests now face this ever-shifting baseline in society's collective perceptions of change, endangering support for conservation policies (Papworth et al., 2009). In fact, some forestry companies confound forests and plantations in their marketing as part of legitimization campaigns (Kröger and Ehrnström-Fuentes, 2021), presenting plantations as sustainable and equivalent to reforestation (Böhm and Brei, 2008).

Broad forest definitions have given policymakers enough leeway to include plantations along with forests even when the situation is clearly nature centric. For example, "The Bonn Challenge" is a global pledge (signed by 61 countries) to restore 350 Mha of forest landscapes by 2030 for meeting biodiversity targets, sustainable development objectives (balancing economic, social and ecological goals), and climate change mitigation (IUCN, 2024). The goal is to restore forest landscapes and their ecological function in degraded and deforested areas through various means, including "new tree plantings, protected wildlife reserves, regenerated forests, ecological corridors, agroforestry, riverside planting, managed plantations and agriculture" (IUCN, 2024). However, up to 45% of committed hectares include monoculture plantations, likely because of policymakers exploiting the broad definitions of forest and forest restoration (Lewis et al., 2019). Given that plantations perform poorly on biodiversity, soil erosion control, water provisioning, and carbon storage as compared to native forests (Hua et al., 2022), they stand in opposition to the Bonn Challenge's goal of halting and reversing land degradation.

Similarly, for the FAO-FRA Global Forest Resources Assessment, change in surface area of forests is calculated as the subtraction of gains (reforestation) and losses (deforestation) of forested areas (FAO, 2020). However, no difference is made between industrial tree plantations and native forests (Brown and Zarin, 2013; FAO, 2020). This can obscure the meaning and impact of pledges and commitments vowing "zero deforestation" and "zero carbon emission" (Brown and Zarin, 2013).

Further, even though the majority (75%) of non-governmental agencies (including for-profit and non-profit organizations) carrying out reforestation efforts in tropical and subtropical areas declare forest-restoration and conservation goals, they mostly plant species for agroforestry and forestry use (Martin et al., 2021). This could be for the benefit of communities in which these reforestation efforts are carried out, however, the integration of local people into these efforts is unclear (Martin et al., 2021). For example, reforestation programs in Mexico have failed to provide meaningful help for the community due to most (78%) community members participating only as temporary workers (such as for weeding, planting and digging holes) (Ceccon et al., 2020).

Loss of experience will tend to increase in future generations unless actions are taken. Thus, it is crucial to use accurate terminology and clearly define forests and plantations from a nomological perspective to responsibly employ scientific and management terms when communicating with the public. This means considering how society's perception can be influenced or manipulated by political and economical interests not aligned with sustainability goals, which can hinder equitable biodiversity conservation.

The relevance of forest narratives in society

The way forest ecosystems are defined transcends the realms of science and management. Societies depend on and are shaped by language (Chaika, 1982). The words we use are determined by attitudes and vice versa, with language being able to influence our perception of the world. Sexist language–such as male generics–reflects societies' attitudes towards women, but can also perpetuate them (Kleinman, 2002). However, language can impact our perception about people in other ways.

For example, a study on clinician bias found that in-training physicians exposed to stigmatizing language (such as "[the patient] is narcotic dependent") as opposed to neutral language to describe a patient (i.e. "[the patient] has about 8–10 pain crises per year, for which he typically requires opioid pain medication") held significantly more negative attitudes toward the patient and chose less aggressive management for the patient's pain (Goddu et al., 2018).

The effect of language on people's attitudes and ultimately their behaviour has been studied through framing, in which certain aspects of an issue are made more salient (Entman, 1993). To illustrate, two messages with the same meaning (i.e., equivalence framing [Druckman, 2001]), such as a gain instead of a loss scenario referencing the same dataset, can influence people's decisions differently (Kahneman and Tversky, 1983), cementing the importance of the words we choose to communicate a message. Frames are important for people to interpret the world around them. Therefore, it should come as no surprise that the framing of concepts is also important, especially from a nomological standpoint. Even though the terms "global warming" and "climate change" are sometimes used interchangeably in the media to refer to the same concept, they can evoke different cognitive associations. Conservatives in the United States made significantly stronger associations between rising temperatures (and melting polar ice) and "global warming" instead of "climate change" (Schuldt and Roh, 2014). Thus, frames can be especially relevant for biological conservation, which requires public support to achieve its goals (Kusmanoff et al., 2020).

Science has its own language, characterized by strict and specific terminology that facilitates universal communication among peers. However, as society is inextricably linked to science, especially in fields that require societal collaboration and change such as biodiversity conservation (Schultz, 2011), scientific concepts and terminology inevitably flow into the public domain, which can mould the way people understand nature.

Failure to establish differential criteria between plantations and forests by international organizations can lead to the social transmission of diffuse definitions that enable top-down trickling of unclear differences between the two from state and government to the public. This can damage the psychological and physical well-being, along with the cultural and natural knowledge of the people they mean to serve. Such disservice to the public is both direct, when ecosystems are replaced by plantations solely for economic gain (robbing communities of valuable forest ecosystems and all the contributions they bring), and indirect, by creating the perfect environment for generational amnesia to occur (Papworth et al., 2009; Speziale et al., 2012). Thus, combating the extinction of experience (Pyle, 1993) regarding human-nature interactions and the knowledge, recognition and appreciation of natural forested ecosystems (Soga and Gaston, 2016) will depend on how society perceives the differences between forests and plantations. The harms on societal wellbeing derived from plantations require immediate attention to prevent further damage and repair that which has already been done.

A way forward

Definitions for forests need to clearly differentiate natural forests from plantations, which can be achieved with mutually exclusive criteria. For this, we must first recognize that plantations, as well as other "working lands" (Kremen and Merenlender, 2018) are necessary for humanity and thus, we cannot aim to eliminate them. Rather, we should strive to change the way plantations work so that they can benefit biodiversity as well as human needs (Kremen and Merenlender, 2018). Concerning human well-being, governments and companies who own plantations need to consider the people and communities that live in and around land that will be changed into plantations or used for infrastructure necessary to process plantation derived products. Further, governments must hold forestry companies accountable for the risks and consequences they bring to communities, including wildfires, water flow reduction, community impoverishment and cultural erosion.

For example, to mitigate negative impacts regarding risks —such as wildfires and storm damage— and water availability, two key measures are necessary: first, establish a buffer zone between plantations and residential areas; second, ensure companies offset reduced water flow by providing ample water supplies to affected communities. In Chile, forestry companies provide water to communities living within plantation dominated landscapes, however, this water is often difficult to access and insufficient for their needs (Oppliger et al., 2019). Thus, the forestry sector must be pressed to create a system whereby affected communities have ease of access to generous amounts of clean water. Moreover, forestry companies should either spare an area of forest remnants for communities to use or allow people to use plantation patches and their resources, including understory vegetation and perhaps a determined quota of wood. This would protect communities' economy, psychological and physical well-being, culture, and aid in preserving biocultural heritage.

To further encourage the adoption of these measures, they could be included in sustainability certifications such as the Forest Stewardship Council (FSC). However, similarly to other certification systems, the FSC has faced controversies by certifying lumber companies engaged in illegal logging (Nygaard, 2023). On another front, the IUCN (and other organizations) should determine a percentual limit for accounting plantations to achieve The Bonn Challenge and future goals (IUCN, 2024). Setting such criteria will prevent countries from pledging land to The Bonn Challenge (and future agreements) by just using productive landscapes such as agroforestry, agriculture, and plantations, which deplete biodiversity and human well-being. Both sustainable certifications and international conservation or environmentally friendly agreements need to implement monitoring plans to assess that sought-after goals are being reached and avoid their misuse for hidden purposes (Martin et al., 2021; Nygaard, 2023; Romero et al., 2017).

In summary, to halt the negative socioeconomic and cultural externalities of plantations and foster a state of biocultural appreciation, we propose an *actionable agenda* (Table 1) that requires multiscale systemic change across three levels: corporate practices (forestry companies), national policy (national and local governments, water authorities), and international governance (IUCN, FAO, CBD and Certifying Agencies). This agenda addresses eight core areas of necessary reform, five at the local community level and three at an international level. At the community level we address *(i) economic equity* by requiring companies to share profits or provide secure employment for community members; *(ii) community safety* by mandating buffer zones to mitigate risks such as wildfires and storm damage; *(iii) water security* by ensuring plentiful access to potable and clean water for human and agricultural use, respectively, for nearby communities; *(iv) biocultural connection* by requiring companies to maintain forest patches for community use; and finally, *(v) social decay* by actively mitigating social impacts by ensuring basic services (such as schools and health facilities). At an international level, the agenda demands global accountability from international bodies on reaching *(vi) terminological consensus* to clearly distinguish natural forests from plantations, ensuring *(vii) commitment integrity* to ensure global land restoration goals (e.g., the Bonn Challenge) meet conservation goals, and establishing *(viii) responsible certifications* to end "greenwashing". Our agenda outlines the specific actions that must be taken by governments, international organizations and forestry companies to prevent the risks and consequences brought by plantations to human well-being and secure equitable biodiversity conservation.

Although we recognize the different needs and characteristics of countries which motivated a harmonization (i.e., facilitation of comparisons) instead of a standardization of forest definitions (FAO, 2002), we believe this has led to the areas in need of reform that we have identified above. Thus, we need definitions that decouple forests from plantations. A good example is the system employed by the new International Union for Conservation of Nature's (IUCN) Global Ecosystem Typology v2.1 (global-ecosystems.org) that draws from Keith et al.'s

Table 1
Actionable agenda for restoring biocultural value and accountability in tree-dominated plantations.

Target area for reform	Goal	Specific action required	Responsible Actor(s)
Economic equity	Mitigate community impoverishment & promote equity.	(i) Ensure economic enrichment: provide secure, well-paid jobs for community members or share a portion of the plantation's profit.	Forestry Companies, Governments.
Community safety	Ensure security against increased risks (e.g., wildfires, storm damage).	(ii) Establish buffer zones: require adequate management practices and the establishment of enough distance between communities and plantations so that towns are not threatened by wildfires and other potential risks.	Governments, Forestry Companies.
Water security	Address water scarcity & reduced water flow.	(iii) Warrant water security: ensure easy, plentiful access to potable and clean water (for human and agricultural use, respectively) for communities near plantations, offsetting reduced water flow.	Forestry Companies, Water Authorities.
Biocultural connection	Prevent biocultural homogenization & restore biocultural appreciation.	(iv) Grant nature access: maintain a forest patch for community use or allow access to the plantation for community members to gather resources.	Forestry Companies, Governments.
Social decay	Prevent decay of community services (health/education).	(v) Mitigate social decay: actively mitigate social impacts by ensuring basic services (such as health facilities and schools).	Governments, Forestry Companies.
Terminological consensus	Combat terminological misuse/ambiguity.	(vi) Standardize definitions: establish an unambiguous, mutually exclusive definition that clearly distinguishes natural forests from plantations.	International Organizations (e.g., FAO, CBD).
Commitment integrity	Ensure global pledges meet conservation goals (e.g., Bonn Challenge).	(vii) Set use thresholds: determine a percentual limit for accounting plantations to achieve commitments (such as The Bonn Challenge) and future goals.	IUCN, International Organizations.
Responsible certification	End "Greenwashing" via misuse of sustainability certifications.	(viii) Strengthen monitoring & enforcement: include all social and environmental measures (i-v) in sustainability certifications (e.g., FSC) and actively monitor compliance.	Certifying Agencies (e.g., FSC), Governments.

(2022) typology for earth's ecosystems based on function. This new IUCN ecosystem typology clearly delineates a distinction between natural and intensive land-use biomes. Natural biomes on land include forests, shrublands, grasslands and deserts, and polar/alpine biomes, while intensive land-use biomes incorporate urban and industrial ecosystems, annual croplands, pastures and fields (including semi-natural and old pastures and fields), and yes, plantations. Here, plantations are (1) clearly established as crops: "Plantations are generally long-rotation perennial woody crops established and maintained for a variety of food and materials" (Keith and Young, 2022); and (2) grouped within a completely distinct biome than the ones containing forests. No mention of forests is needed, and conversely, tropical, subtropical, temperate, and boreal forests are defined in such a way that cannot be confused for croplands. Thus, this typology lacks a definition of "forest" as a whole.

Based on this new typology (Keith et al., 2022), we propose forests be defined as "*dynamic tree-dominated ecosystems with varying canopy closure, found globally across diverse latitudes with moderate to high productivity, exhibiting diverse physiognomic and structural expressions that reflect evolutionary adaptations to (i) varying environmental conditions, such as by climate and soil, (ii) disturbances like fire, storms, and (iii) ecological interactions, which in turn shape habitats, drive nutrient cycles and ecosystem processes, all leading to unique ecological communities.*"

It could probably take decades for the forestry industry to adopt socially and environmentally responsible practices. While we wait, standardizing the definition of "forest" to a more restrictive one is, perhaps, a more attainable goal that will prevent conservation programmes from being misinterpreted for economic gain and help avert the extinction of ecological knowledge within our communities.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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