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Policy Forums

Past references are insufficient for Latin American biodiversity conservation in the Anthropocene

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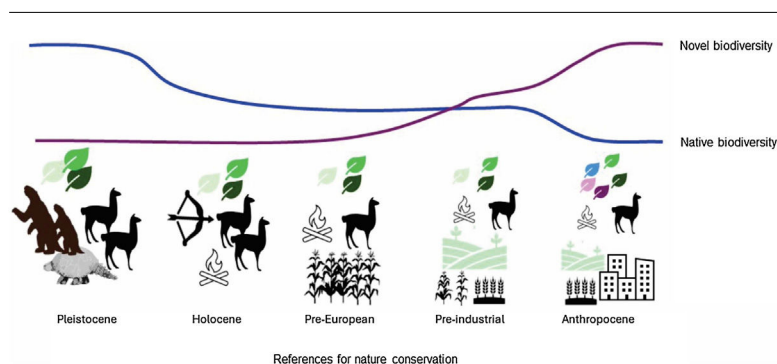
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HIGHLIGHTS

- Referencing conservation exclusively in the past is unrealistic, and limits adaptation to present and future ecological functioning.
- Conservation in the Anthropocene should embrace complex nature-society interactions, including the role of new biodiversity.
- Achieving sustainable futures requires to balance nature protection with economic growth.

GRAPHICAL ABSTRACT



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ABSTRACT

Often, Latin America conservation policy implicitly assumes past references to define worth-conserving ecosystems. However, the Pleistocene/pre-human reference is based on biophysical conditions impossible to be restored; the early Holocene reference overlooks that early humans likely caused massive extinctions; pre-European references fail to acknowledge that indigenous societies were often unsustainable and that many valuable ecosystems are in part a colonial legacy; pre-industrial references underplay the role of biological invasions, modern technology and socioeconomic development to preserve, increase or generate biodiversity. The Anthropocene rapid dynamics requires forward-looking policies that incorporate change as a source of biodiversity and resilience, actively accept that urbanization and modern agriculture can play a key role in conservation, challenge the prevalence of nativism and eco-alarmism, and emphasize that research should focus on shaping future socio-ecological scenarios, that would necessarily differ from the past.

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Introduction

The Anthropocene is a reality that implies the transformation of the biosphere functioning (Corlett, 2015; Edgeworth et al., 2024) and thus needs adaptations of management approaches. Biogeochemical cycles and the biota are rapidly changing by

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human influences that originate in the search for benefits for our species (food, fiber, fuel) but also imply undesirable consequences. By harboring very high biodiversity, Latin America is the focus of major conservation initiatives. In them, native biodiversity is interpreted as a main proxy of environmental “health”, assuming a fundamental conflict between the “natural” and the human/technified/simplified. Historically, conservation efforts in Latin America have prioritized less populated and remote natural areas (Baldi et al., 2019) as dominant conservation policy largely assumes that changes originating directly or indirectly in human action should be stopped or mitigated. And, transformed ecosystems should be “rewilded” or “restored” to a pre-existing condition (Root-Bernstein et al., 2017). The conceptual baseline, in summary, lies in a reference to the past.

Here, we first describe the limitations of past references as goals for conservation (Young and Duchicela, 2020). Then, we identify features of the Anthropocene that merit conservation attention. Finally, we suggest some guidelines for rethinking and redesigning conservation and nature management in the present and near future context.

Past conservation references

Different past references can be considered. All of them are valuable, but also have difficulties for application to present-day (“Anthropocene”) conditions.

Pre-human reference (Pleistocene)

In contrast with the other continents, the Americas have been mostly free of human influence until as recently as 13–20 k years BP (Barnosky and Lindsey, 2010; Becerra-Valdivia and Higham, 2020). Pre-human conditions, however, were very different from present ones. Tropical rainforests were much reduced and fragmented due to drier conditions (Häggi et al., 2017), elevational belts along the Andes were lower than their current elevation by as much as 1000 m due to 5–7 °C lower temperatures (Torres et al., 2013), and the biota included a large set of mammals now extinct (Barnosky and Lindsey, 2010). While the Pleistocene reference provides insights for present and near future scenarios (e.g., suggesting that Amazon or Atlantic forest biodiversity may be resilient to habitat reduction and fragmentation, and Andean vegetation can withstand major temperature change) it also means that no pre-human ecosystem can be truly preserved or restored.

Pre-agriculture reference (early Holocene)

This reference (since ~11 K years BP; Svenning and Faurby, 2017) assumes a climate relatively similar to the present and landscapes without permanent human settlements. These ecosystems, however, were significantly affected by mobile and widespread human hunter-gatherers which adopted fire to modify landscapes and contributed to the extinction of c. 80% of medium and large mammals (Becerra-Valdivia and Higham, 2020; Pinter et al., 2011). With pre-agriculture humans as top predators, main vegetation disturbance agents, and drivers of species redistribution, it would be ironic to take this condition as a reference for biodiversity conservation. For example, camelids (iconic representatives of the “native” herbivore community) may have been introduced by these early humans in some areas such as the island of Tierra del Fuego (Franklin, 2022) and their large monodominant populations along the Andes and southern plains could be the result of the massive human-driven extinction of other large herbivores.

Pre-European reference

Given the above mentioned difficulties to find a reference in the distant past, and the popularity of “anti-colonialist” ideology, conservation is often referenced in ecosystems that hypothetically existed prior to the European arrival (late 15th century): they prioritize conservation of American agriversity (often assuming this provides the basis for “sustainable” agriculture) and the extirpation of old-world herbivores (cattle, horses, sheep, goats, pigs) from wild ecosystems. This vision rightly values ethnobiology and indigenous knowledge but overlooks the fact that many pre-European societies were unsustainable and collapsed due to their inability to cope with environmental change (Brenner et al., 2001); they tend to underestimate creole or colonial cultural heritage, and fail to acknowledge that some introductions (e.g. equids) could restore functional types and ecological functions that disappeared with the Pleistocene megafauna extinction (Donlan et al., 2006; Di Bitetti et al., 2022). Further, they rarely realize that many of the “natural” ecosystems currently targeted for conservation are a consequence of the European arrival (Mann, 2005). For example, Andean cloud forests and grasslands, Mesoamerican forests, coastal Amazon ecosystems, or Chaco woodlands were heavily transformed by pre-European land use and were “restored” (or possibly, in some cases, even generated) by the agriculture retraction and/or fire reduction due to livestock introduction (e.g., Grau et al., 2015) resulting from European colonization, including the massive mortality of native American human population resulting from disease spread.

Pre-industrial (rapid globalization) reference

Finally, conservation efforts often focus on limiting the impact of relatively recent (20th century) globalization, which triggered deforestation, habitat loss, resources overexploitation, and rapid spread of industrial agriculture and non-native species. While these effects have been real and in many cases clearly negative, this reference tends to disregard the associated positive effects on socio-economic development and favor negative attitudes against urbanization and modern agriculture which, due to its high productivity and efficient resource uses, are a main source of economic growth (the basis for investment in conservation), cultural and technological innovation, and of “sparing” natural and semi-natural lands (Daskalova and Kamp, 2023). In academic circles, the sparing-sharing debate (Grau et al., 2013) has clarified the role of high yield agriculture in reducing the pressure on natural ecosystems, but, despite some innovative initiatives (e.g., Brown, 2019) the concept of land sparing through agriculture modernization is hardly included in the mainstream conservation agenda. There are well documented cases in which non-native invasions are highly disruptive of ecosystems, severely reducing biodiversity and ecosystem services, but prioritizing species identity on the basis on geographic origin rather on functional characteristics might overlook the role, functioning, and services provided by ecosystems composed of non-native species in general; and the bias against them (Pereira et al., 2024) disregards the fact that they often increase local biodiversity without excluding native species, as communities tend to be “unsaturated”, and that most non-native species are not harmful to native ones (Thomas and Palmer, 2015). Policies based on this reference may limit the possibilities of newly evolved species through horticulture, isolation and hybridization, species that, as well as the newcomers, could be better adapted to new environmental conditions (Thomas, 2017).

All these past references do have value for preserving components of biodiversity in a comparatively efficient way, but they are partly rooted in unrealistic idealizations and are insufficient to protect biodiversity components in the modern world. They often embrace forms of “eco-alarmism” and “nativism”, suggesting that

every change is dangerous based on a restrictive version of the “precautionary principle”. By limiting our capacity to incorporate rapid change (e.g. of climate and socio-economic systems) and to accept environmental values specific to the Anthropocene, they limit the potential for co-existence of nature, social changes and technological development.

Anthropocene reference

Referencing conservation to the Anthropocene implies considering features of ongoing contexts of change (e.g., concepts of “Capitalocene” and “Technocene”) that will likely persist. They include: (i) changing climate with effects on local extinctions, migration, and speciation; (ii) generalized “greening” (increase in leaf area and primary productivity), derived from climate change, atmospheric and soil fertilization, agriculture technology, fire reduction, forest expansion (Piao et al., 2020); (iii) redistribution of “natural”, “semi-natural” and heavily transformed areas, with agriculture intensification and expansion in some areas, and forest, shrubland and grassland expansion in others (Aide et al., 2013); (iv) technology and information flows (including modern communications and finances) that significantly modify flows of energy and matter, and consolidate the role of Latin America as a global commodities net exporter that contribute to global sustainability, as well as global biodiversity refuge; (v) growing and aging human population that becomes wealthier, more urban, and tends towards stabilization (and potentially reduction), changing the relationship between nature and society; (vi) growing importance of cities as centers of consumption, decisions and knowledge production, and emergence of counter-urbanization centers that modify landscapes and promote new relationships with nature (Jimenez et al., 2022); (vii) “globalization” of the biota, with widespread dispersal of non-native plants around the world, changing community composition and often increasing local biodiversity (Thomas, 2017); (viii) change on the species pool by extinction and evolution of new species (Daskalova and Kamp, 2023) and expansion of new ecosystems such as cities and peri-urban environments, which, despite their negative local environmental impacts, can also act as engines of new species evolution (Diamond and Martin, 2021). In summary, different factors that generate novel patterns of biodiversity and their relationship with societies.

We propose a dynamic approach for conservation strategies to adapt to changing conditions and societal needs, with humans integrated into ecosystems as beneficiaries, consumers, designers, creators and, occasionally, guardians of nature. For this purpose, we suggest some guidelines for biodiversity policies.

- Explicitly assume that change (including species and ecosystem redistribution) is a functional part of socio-ecosystems that sometimes can result in negative outcomes (e.g. in terms of biodiversity and ecosystem services) but it can also reflect or be part of resilient ecosystem responses, it may favor conservation and generate new biodiversity. The meaning of “nature” itself, may change (Ducarme and Couvet, 2020). Include adaptable planning and periodic revisions of strategies and goals based on this assumption.
- Accordingly, internalize that costs and benefits vary with time and context. Any valuation is in part contingent, transient, and depending on cultural preferences. Conservation initiatives should be adaptable to valuations emerging from new social and cultural contexts. Utilitarian benefits and costs of conservation should be balanced, based on quantification and monitoring.
- Conservation in remote places should be complemented with the design and conservation of new ecosystems/communities/species with functions that benefit human

resilience; for example, in peri-urban areas or specific urban or modern agriculture settings.

- Much of the resilience and adaptability of social-ecosystems (e.g. low vulnerability to shocks, efficient conservation, sustainability of telecoupled systems) result from economic growth and positive attitude towards change, which in turn generates a number of collateral environmental damages. Consider the later in the context of the benefits derived from the former. Accept that intensive use of transformed ecosystems (croplands, feedlots, cities) relieves pressure in other sites, and develop land planning accordingly.
- Prioritize the aesthetic/spiritual benefits we obtain from nature that are difficult to replace with technology (in contrast to most material ecosystem services) and may have little to do with how native or ancient an ecosystem is.
- Research on wild areas should not only focus on knowing the functioning of “natural” systems referenced in the past, but also on understanding the rules of change and of the interactions with human systems, with an active role of experimentation and learning. The scientific and conservation communities should avoid dogmatism and assume the Anthropocene as a reality at the same time challenging and promising.
- Past references for conservation may be necessary, but they are not sufficient. We should accept that while preexisting biodiversity may be decaying, new biodiversity is emerging, thus becoming a target of conservation, promotion and research.

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Conflict of 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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