

The suggestion that landscapes should contain 40% of forest cover lacks evidence and is problematic

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Novelty statement: Arroyo-Rodriguez *et al.*'s (2020) suggestion that forest cover needs to be restored or maintained to at least 40% is unhelpful and potentially dangerous. We advocate for regionally-defined thresholds to inform conservation and restoration.

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23 Abstract: A recent review suggests that forest cover needs to be restored or maintained on at least
24 40% of land area. In the absence of empirical evidence to support this threshold, we discuss how this
25 suggestion is unhelpful and potentially dangerous. We advocate for regionally-defined thresholds to
26 inform conservation and restoration.

27

28 Main text

29 Arroyo-Rodriguez *et al.* (2020) suggest that forest cover needs to be restored or maintained to at
30 least 40% of any given landscape. While we agree with the importance of preserving and restoring
31 forests worldwide, we find this suggestion problematic for several reasons:

32 *Ecological.* Not only there is a lack of evidence to suggest the existence of *forest thresholds* (i.e., the
33 minimum amount of forest required to maintain biodiversity) at 40% of cover, there is also no
34 evidence to support using a fixed value such as this as a rule of thumb around the world. The forest
35 threshold proposed was based on only two studies, which actually suggest the existence of a
36 threshold at 30% of cover and not at 40%. In fact, Arroyo-Rodriguez *et al.* (2020) ignored a plethora
37 of empirical evidence on ecological thresholds (e.g., Betts *et al.* 2010; Melo *et al.* 2018; Macchi *et al.*
38 2019). For instance, while a recent review found that on average roughly 30% forest cover is
39 required to maintain bird diversity across the world, threshold values in the tropics varied between
40 20% and 50% and in the temperate zone they varied from 1.3% to 90%. Moreover, forest thresholds
41 vary with the scale at which forest cover is measured (Homan *et al.* 2004), something that Arroyo-
42 Rodriguez *et al.* (2020) only briefly discuss in the context of “appropriately sized landscapes”.

43 Defending a generic figure of 40% is highly problematic because this is likely not to be enough in
44 some areas and too much in other areas. Furthermore, ecological researchers now have the
45 technical capacity and empirical evidence to determine optimal forest cover for entire regions.
46 These analyses will require more resources than a generic guideline, but ultimately provide stronger
47 evidence for decision-makers. For instance, three new environmental laws in Brazil were
48 underpinned by empirical evidence of a forest threshold at 30% in the Brazilian Atlantic Forest
49 (Banks-Leite *et al.* 2014). It is unlikely that policy makers would have acted so decisively on a generic
50 guideline, and the suggestion that 40% may be needed instead undermines the confidence that
51 society may place in scientists, by creating confusion and the impression of scientific dissent.

Implementation. A focus on a 40% target, without acknowledging the challenges of implementation, risks diverting attention from the crucial task of spatial allocation of restoration efforts. For instance, Strassburg *et al.* (2020) show that focusing only on the amount of restored area is ineffective for biodiversity conservation and could lead to up to six-fold variation in the desired outcomes depending on the spatial allocation of areas for restoration. With the upcoming Decade of Restoration, it is imperative that complementarity, irreplaceability and trade-offs between biodiversity and ecosystem services (Brancalion *et al.* 2019) are appropriately accounted for in order to obtain the most cost-effective and biologically-relevant results for any given area.

Economic. The proposed rule of thumb could make overambitious restoration projects unviable if economic constraints are not considered. In the case of the Atlantic Forest, using a 40% target would bring additional benefits to biodiversity but at prohibitive economic costs. Banks-Leite *et al.* (2014) calculated that restoring priority areas back to 30% of forest cover would cost US\$ 198m, but restoring them back to 40% forest cover would cost five times more. Arroyo-Rodriguez *et al.* (2020) also suggest that restoring biomes back to 40% would bring us closer to preserving half of Earth's natural area; however this "Half-Earth Project aspiration" is highly controversial (Büscher *et al.* 2017; Mehrabi *et al.* 2018) and presents strong trade-offs with global food production (Mehrabi *et al.* 2018).

Social. Unrealistically high restoration targets can lead to large social impacts. Restoring 40% of forest cover in highly populated areas could displace marginalised and vulnerable people to more forested areas, thereby driving deforestation elsewhere. It is not adequate to suggest that loss of access to land-based resources (whether that be for conservation or development) can be offset by an improvement in ecosystem services in the remaining areas (Jones *et al.* 2019). Instead, there are approaches to spatial planning which work with land-users to directly address the trade-offs and synergies between human development and biodiversity conservation in a participatory and respectful way (Heiner *et al.* 2019).

If we are to conserve forests effectively, we need an approach that is feasible and that aligns with the upcoming Global Biodiversity Framework (Convention on Biological Diversity 2020). Decades of research into systematic conservation planning have shown that problem-specific and regionally-defined ecological thresholds are key to cost-effective interventions. With recent modelling and empirical developments in spatial prioritisation, coupled with advances in technology and interdisciplinary understanding, we should aim to determine optimal forest cover at the appropriate resolution, supporting effective, targeted, restoration programs that reconcile ecological, social and economic needs.

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