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**Is biodiversity as intact as we think it is?**

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Since it was first proposed as a metric for assessing progress in reducing the rate of biodiversity loss, the intactness of biodiversity has become an influential concept [1]. The Biodiversity Intactness Index (BII) is intended to be an indicator of the average abundance of wild species in a given geographical area, relative to a reference level: either the abundance assumed in pre-modern times [1] or that expected to prevail in primary vegetation under current climatic conditions [2]. The BII has several advantages over other biodiversity indicators. For example, it reduces the risk of setting conservation goals that are insufficiently ambitious because of shifting baselines [3] in which misleading short-term comparisons are made of the current state of biodiversity with that in the recent past.

Recently, the BII has been endorsed by the Group on Earth Observations of the Biodiversity Observation Network and adopted by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) as a "core" indicator of trends and biodiversity and ecosystem services. This means that IPBES assessments must use it to report on progress towards the Convention on Biodiversity’s Aichi targets 12 and 14 (extinction risk and ecosystem resilience). It has also been adopted by the Biodiversity Indicators Partnership as an indicator to track progress towards Aichi target 5 (that the rate of habitat loss is reduced by half by 2020).

Newbold et al [2] mapped the BII globally by modelling the abundance of species of a broad range of taxa as a function of human-induced pressures and extrapolated these values using remote-sensed data. This map represents an estimate of the current total abundance of organisms as a proportion of the total abundance expected in primary vegetation in the absence of human activities. However, some of the values for BII presented on this map are surprising. Using recently published estimates of current biomass stock relative to that without human activities, which we call biomass intactness (BMI) [7], it is clear that in many areas where BMI has been reduced dramatically in BII is predicted to be relatively high (Fig 1b). This highlights areas such as the northern European lowlands, India, and the Atlantic forest region of Brazil where a large proportion of primary vegetation has been replaced by farmland or plantations of non-native trees. Similarly, large parts of Sundaland, southern China and Southeast Asia in which a substantial fraction of primary vegetation has been removed, as indicated by low BMI, are indicated by the BII as having lost <5% of their total biodiversity. A relatively small, but still substantial area, shows low BII but high BMI (blue on Figure 1B). Hence, the BII and BMI concur (grey on Figure 1B) on much less than half of the Earth’s land surface, mostly in areas of boreal taiga and tundra and large remnants of tropical rain forest.

We also find it surprising that there are striking differences in the spatial patterns of BII and the human footprint (HF), a composite measure of the pressure on natural ecosystems from humans. An illustration of this is the difference between the northern European lowlands (very high HF; quite low reduction in abundance according to BII) and southern Africa (low/moderate HF, but with among the largest reductions in BII of >40%).

Although populations of some wild species that occur in natural habitats such as forest and wetland can also persist on farmland studies of species population densities in farmland relative to primary vegetation [5] indicate that densities of most species of the taxa studied showed greater declines than would be suggested by the BII results of [2]. Had these studies examined a range of taxa more representative of biodiversity as a whole we might would expect the reduction in total abundance relative to that in primary vegetation to be even more substantial. Hence, we doubt that the true reduction in the average abundance of a representative set of native species, relative to that in primary vegetation, is as low as the global average reduction of approximately 15% indicated by the BII [2].

We are concerned that uncritical acceptance of the BII as a biodiversity metric will lead to unjustified complacency about the security of wild nature. The safe operating space for humanity, proposed under the planetary boundaries framework, suggests that BII should be maintained at values above a threshold somewhere between 30% and 90% (a 70% to 10% reduction in total abundance) [8]. Using a 30% BII threshold, the mean BII in every WWF ecoregion on Earth is well above the safe planetary boundary. Even using the 90% threshold, about half of the ecoregions, and over half of those in biodiversity hotspots, are above the planetary boundary. We are sceptical that biodiversity is really as intact and secure as the BII suggests. We recommend rigorous further testing and, if necessary, the development of alternative methods.

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