Aiming higher to bend the curve of biodiversity loss

The development of the post-2020 strategic plan for the Convention on Biological Diversity provides a vital window of opportunity to set out an ambitious plan of action to restore global biodiversity. The components of such a plan, including its goal, targets and some metrics, already exist and provide a roadmap to 2050.

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The Convention on Biological Diversity (CBD) outlines an ambitious vision: "...by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people." In November 2018 the 195 countries (plus the EU) that are parties to the CBD will meet to start work on a new strategic plan for the period after 2020. These deliberations come in the wake of the well-publicized failure to meet the 2010 target to significantly reduce biodiversity loss and evidence that the ambition of the plan for 2020 (the Aichi Targets) will also not be achieved[1]. Far from it: biodiversity continues to decline steeply. Without a substantial change in approach and ambition, these successive failures will almost certainly be repeated.

The degradation of nature is among the most serious issues that the world faces, but current targets and consequent actions amount, at best, to a managed decline. Required now are bold and well-defined goals and a credible set of actions to restore the abundance of nature to levels that enable both people and nature to thrive. Crucially, given pressing needs to simultaneously avoid dangerous climate change, feed a growing population and restore biodiversity, we need cross-cutting solutions that enable our land and oceans to support all three objectives effectively and equitably, while recognizing the interactions and interdependencies between them that offer opportunities as well as risks.

Here we argue that well-defined, ambitious and measurable targets must support the next CBD vision, and we propose three indicators that would together measure the required progress in biodiversity recovery.

The problem

Over 25 years have passed since the 1992 Rio Earth Summit where the first
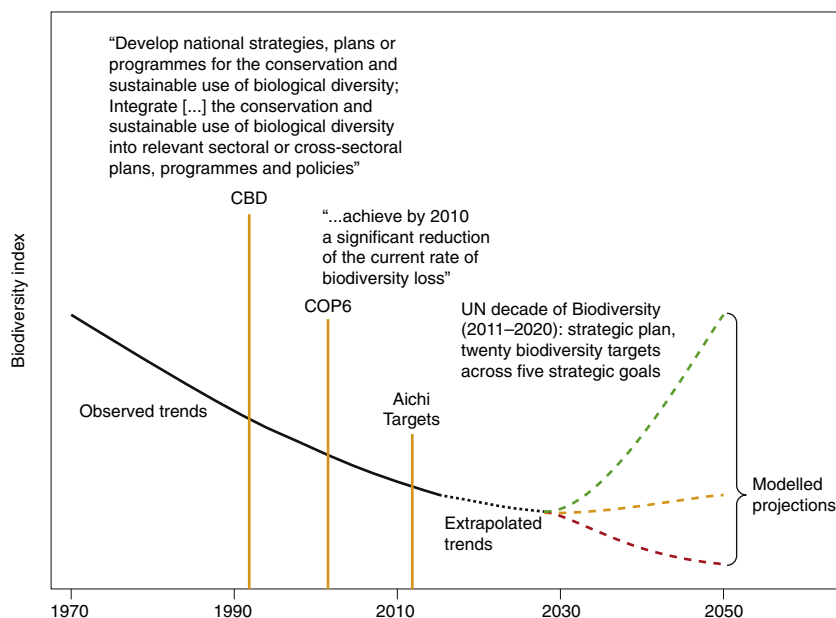

Fig. 1 | Biodiversity declines have continued despite repeated policy commitments aimed at slowing or halting the rate of loss. The Strategic Plan for the Convention on Biological Diversity (2010–2020) includes the 20 Aichi Targets to be achieved by 2020. Recent projections suggest that this is unlikely for most of the targets[1]. Yet the 2050 vision requires a much more ambitious goal, which will necessitate recovery of biodiversity and bending the curve by 2030. The black line indicates currently observed trends (to 2015), dotted lines show extrapolations from current trends (black) and projections for biodiversity after 2030 that are declining (red), stabilising (orange) or recovering (green).

global commitment for biodiversity conservation was agreed. Despite numerous international scientific studies and policy agreements confirming that conservation and sustainable use of biological diversity is a global priority, worldwide trends in biodiversity continue to decline. The Living Planet Index, based on trends in vertebrate population sizes, reports an estimated 58% decline since 1970[2], current rates of species extinction are 100 to 1,000 times higher than the background rate[3] and although net changes in local species diversity reflect a variable mix of extirpation and introductions[4] approximately 13% of local

species diversity has been lost on average across the world since 1500[5].

This declining trend must not only be halted but also reversed if the Agenda 2030 Sustainable Development Goals (SDGs) are to be achieved. Nature has a critical role to play in mitigating climate change[6], adapting to climate impacts[7], maintaining the quality of soil, air and water and supporting a resilient basis for the food, fuel and fibre that future generations of people will need[8]. Failure to address these challenges will hit the poorest hardest and most immediately.

Without a dramatic change in efforts to reverse the on-going decline, our persistent

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Box 1 | Global biodiversity commitments enshrined in the CBD and SDG frameworks

CBD vision: "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people."

CBD Aichi Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

SDGs 14 and 15: By 2030 "Conserve and sustainably use the oceans, seas and marine resources." (SDG 14) and "Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss." (SDG 15). Target 15.5: "Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and protect and prevent the extinction of threatened species."

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failure to meet conservation and biodiversity targets (Fig. 1) is likely to continue beyond 2020, the end-date for the current round of international commitments for biodiversity.

Learning from others
A productive target-setting approach used by recent international environmental policy agreements has been to establish ambitious globally agreed goals advised by science, to build progressively upon national responses, and to encourage interest and engagement from the multiple sectors where change is needed — from business and investment institutions, community groups and individuals. For example, the process that delivered the Paris Agreement of the UN Framework Convention on Climate Change (UNFCCC) is based upon an explicit goal (a maximum average global warming of 1.5 to 2 °C), agreed internationally. The science-based target is then devolved to national governments for implementation through multi-actor actions, and mutual reporting and monitoring. The SDG process has similarly focused on motivating societal engagement around its 17 goals. Both agreements explicitly recognize that the status quo is not an option and instead set necessarily hard-hitting global targets to reverse business-as-usual trends.

There are also lessons to be learned about practical implementation of targets. In climate change policy, future targets are based on scenario analyses that identify the most impactful suite of actions to achieve the goal. For example, the climate stabilization wedges[9] were developed as a portfolio of available technologies that could collectively achieve the necessary cuts in greenhouse gas emissions over a 50-year period. This approach demonstrated how focused deployment and timely implementation could enable an aggressive emissions target to be achieved. The CBD can build upon such approaches to develop its biodiversity goals and obtain national commitments with appropriate levels of ambition.

We suggest three necessary steps in a roadmap for the post-2020 agenda: (1) clearly specify the goal for biodiversity recovery, (2) develop a set of measurable and relevant indicators of progress, and (3) agree a suite of actions that can collectively achieve the goal in the required timeframe.

A roadmap for 2020 to 2050
The first step in the development of a roadmap is to specify the goal, analogous to the UNFCCC 1.5 to 2 °C target. International biodiversity agreements already commit to sustaining a healthy planet that delivers essential benefits to all people by 2050. Governments have also agreed to specific targets, such as tackling the extinction of threatened species by 2020 and halting biodiversity loss by 2030 (see Box 1 and Supplementary Information). Given the extensive consultative and technical processes behind these commitments, and bearing in mind the multiple dimensions and diverse values of biodiversity, we propose adopting the CBD vision as a goal. Achieving this goal will then require a new set of targets beyond 2020.

The second step is to identify indicator metrics capable of measuring progress towards the goal. In contrast with progress under the Paris Agreement, which can be tracked using atmospheric greenhouse gas concentrations, biodiversity measurement is complicated, requiring multiple measures across different spatial scales and ecological dimensions. We suggest that for the goal and targets in Box 1, progress can be adequately represented using metrics that are already widely applied in the scientific and policy communities (Supplementary Fig. 1 and Supplementary Information), for example:

(1) Near-future global losses of species (extinctions) may be estimated using the Red List Index (RLI)[10]
(2) Trends in the abundance of wild species are reflected by population-level indicators such as the Living Planet Index (LPI)[2]

(3) Changes in terrestrial biotic integrity (the 'health' of the biota) can be estimated and mapped globally using the Biodiversity Intactness Index (BII)[11]

These indicators were developed for different policy applications, so there is still a need for better representativeness, integration and data coverage if they are to support concrete global action, including in marine areas. We suggest that a clear policy process would stimulate improved metrics.

Figure 2 shows the trajectories required for each of these three indicators to meet the policy goals and targets in Box 1 (see Supplementary Information for more detail on how the three indices map onto goals and targets, and for other potential indicators in the same categories). The RLI and LPI are measured across the Earth as a whole and reflect the diversity and abundance of species globally. The BII is based on estimates of the average abundance of originally present species for any defined area relative to their abundance in undisturbed habitat. Estimates are mapped and averaged within spatial units, providing an appropriate metric of biosphere intactness for the CBD 2050 vision[11]. We suggest analysis at both medium (ecoregions) and large scale (biomes). The BII can assess the proportion of these spatial units that show biodiversity above 'safe' levels for biotic integrity. There is uncertainty about what this level should be[12] but we here set it above 90%, the precautionary level proposed in the planetary boundaries framework[13]. We suggest that 100% of biomes and 70% of ecoregions should meet the 90% target in 2050.

The third step will be to identify actions to deliver the required biodiversity improvements. Traditional biodiversity conservation interventions such as protected areas and species conservation planning remain crucial, but actions must also address major drivers of biodiversity loss and ecosystem change. Here there are inevitable trade-offs and conflicts because of demand for land for climate mitigation (biofuels and sequestration) and food production. For example, conservation efforts aimed narrowly at protecting biodiversity hotspots from land conversion (SDG 15) can result in food price-spikes that undermine other SDGs. However, insights emerging from modelling scenarios for meeting the SDGs have also shown that combinations of societal actions can deal with problematic trade-offs[14]. Integrative policies for sustainable consumption and production (such as diet shifts) can benefit biodiversity, climate and food supply, especially if underpinned by the shifts in
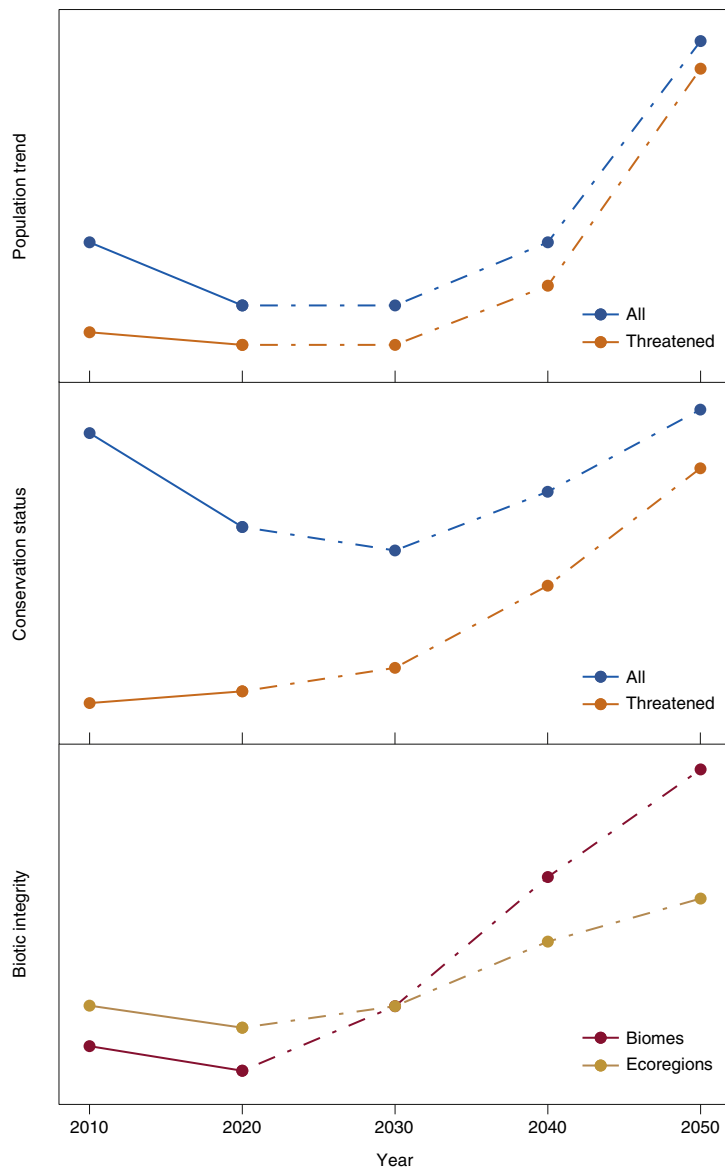
Fig. 2 | Required trajectories for three biodiversity indicators. These reflect conservation status (that is, global extinction risk), population trend (changes to average population abundance) and biotic integrity (changes to local, functional diversity) from the present to 2050, based on the commitments shown in Box 1. See Supplementary Information for justification of trends and details of potential indicators.

have the potential to become drivers of positive change. Their reach is global and their decisions can address biodiversity impacts across the entire value chain and in all aspects of investment.

- Researchers can deliver improvements to integrated assessments to better represent the ecological processes and biodiversity indicators needed to identify plausible pathways to achieve the goals. More comprehensive models are also needed to identify potential win–win solutions — and strategies to avoid negative consequences of siloed policy responses. Foundations for this work are underway through the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services modelling and scenarios task force and the climate change oriented Inter-Sectoral Impact Model Intercomparison Project, but will need to be scaled up and broadened.

- The conservation community should come together around clear key messages related to biodiversity goals and the actions that are required to deliver them. With their broad societal reach in communications and on-the-ground engagement, they can play a powerful role moving beyond the notion that single solutions can be enough, and instead promoting and supporting combinations of actions that long-term sustainability requires. ❑

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underlying demographic and economic conditions that the SDGs require. With a more comprehensive approach, different combinations of economic, technological and behavioural changes can be identified that contribute to meeting multiple SDGs simultaneously, avoiding trade-offs and emphasizing win–win actions[15].

An agenda for action

The global goals to halt species loss and restore biodiversity need to be supported by a new and more ambitious work plan.

Success will depend upon greater ambition, but crucially this must be underpinned by new analytical and modelling work informing polices and decisions of business and government, and testing them against the range of identified indicators. Many sectors must take urgent action if we are to bend the curve of biodiversity decline:

- Governments will play a central role in defining and agreeing the goals (step 1). They will also need to commit to specific nationally defined actions that can collectively achieve the goal.

- The business and finance sectors, increasingly visible biodiversity actors,

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