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A biodiversity-crisis hierarchy to evaluate and refine conservation indicators

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The Convention on Biological Diversity and its Strategic Plan for Biodiversity 2011–2020 form the central pillar of the world's conservation commitment, with 196 signatory nations; yet its capacity to reign in catastrophic biodiversity loss has proved inadequate. Indicators suggest that few of the Convention on Biological Diversity's Aichi targets that aim to reduce biodiversity loss will be met by 2020. While the indicators have been criticized for only partially representing the targets, a bigger problem is that the indicators do not adequately draw attention to and measure all of the drivers of the biodiversity crisis. Here, we show that many key drivers of biodiversity loss are either poorly evaluated or entirely lacking indicators. We use a biodiversity-crisis hierarchy as a conceptual model linking drivers of change to biodiversity loss to evaluate the scope of current indicators. We find major gaps related to monitoring governments, human population size, corruption and threat-industries. We recommend the hierarchy is used to develop an expanded set of indicators that comprehensively monitor the human behaviour and institutions that drive biodiversity loss and that, so far, have impeded progress towards achieving global biodiversity targets.

The Convention on Biological Diversity (CBD) is the key global mechanism focused on reigning-in the world's biodiversity crisis[1–5]. The CBD's Strategic Plan for Biodiversity 2011–2020 includes the Aichi targets, which aim to address biodiversity loss, but the majority of these targets are unlikely to be met[3,6]. Procedures for updating the 2020 Biodiversity Framework are already in preparation (https://www.cbd.int/post2020/) with a view to taking new ideas to the fifteenth Conference of the Parties in China in 2020. Policy debate has now begun around how the targets should be updated[6], and already it is clear that new indicators are needed[7].

Less than half of the elements making up the 20 Aichi targets have indicators, and of those with indicators, many are a poor evaluation of the target[7]. Evaluating indicators against targets is important, but the targets themselves were arrived at through prolonged debate and political compromise[8]. The targets therefore are not the only baseline against which indicators should be compared. Here we broaden the scope for evaluating indicators by defining a biodiversity-crisis hierarchy. The hierarchy defines the relationships among all the drivers of biodiversity loss, but does not imply higher levels in the hierarchy are more important to address than lower levels. We use this hierarchy as a basis for evaluating the scope of the current set of indicators.

Biodiversity-crisis hierarchy

The biodiversity-crisis hierarchy is a conceptual model that synthesizes mechanisms driving the sixth mass extinction of life on Earth[9]. The hierarchy emphasizes the complex system of actors and institutions that induce biodiversity loss[10] by highlighting the instigating role of governments and society, and explicitly describing the links between fundamental and direct drivers (Fig. 1a). This stands in contrast to other frameworks, which collapse most drivers of biodiversity loss above the threat level into one[11] or two categories[12]. In the hierarchy, the fundamental drivers of biodiversity loss are human population size and resource consumption[13]. Society and government are ultimately responsible for trends in these two fundamental drivers[14] (Supplementary Table 1). The society component includes beliefs and cultural attitudes, individual choices and actions, non-government organizations (NGOs), corporate social responsibility, and corporate political activity (Supplementary Table 1). The government component includes political leadership, governance and political systems. Both society and government have impacts throughout the hierarchy (Supplementary Table 1). For example, population size is mediated by society, via cultural and religious attitudes to family size and contraception; and by government, via political ideology and governance structures (Supplementary Table 1).

The large, growing and increasingly affluent human population requires diverse industries to meet its demand for resources (Supplementary Table 1). The hierarchy therefore considers these threat-industries as direct drivers of biodiversity loss (Fig. 1a) because they use natural resources (that is, land, water, species and ecosystems), release pollutants, or transport invasive species. Four modifiers, representing actions of government and society, can alter the impact of threat-industries (Fig. 1a). Governments can regulate to prevent environmental damage while corruption can undermine environmental protections (Supplementary Table 1). Funding that is effectively applied to environmental protection and restoration can help curtail the impacts of threat-industries, and will be more successful with adequate knowledge about species' distributions, their vulnerability to threats and likely response to intervention (Supplementary Table 1).

Higher-level drivers in the upper hierarchy are further removed from responses of biodiversity, with interactions among components and indirect effects leading to biodiversity change. Interactions and indirect effects mean that some components of the hierarchy may favour biodiversity; however, biodiversity may still decline because

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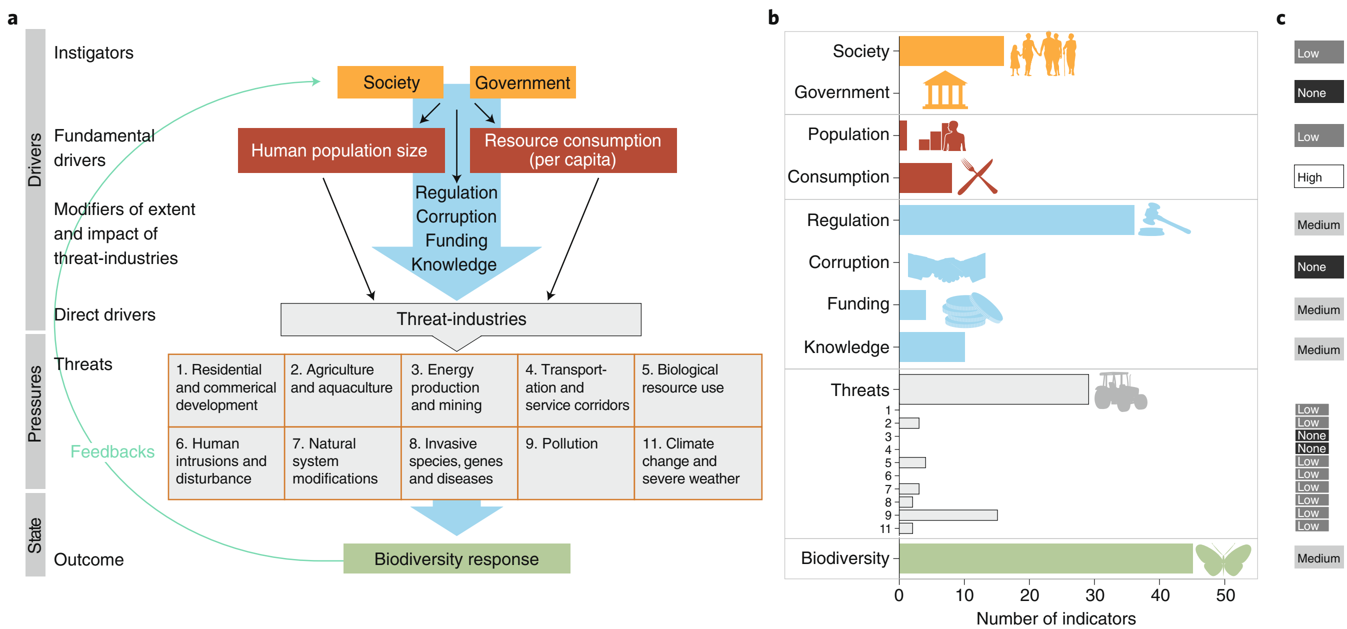


Fig. 1 | The Biodiversity-crisis hierarchy is used to evaluate the coverage and adequacy of indicators for the Aichi biodiversity targets. a, The biodiversity-crisis hierarchy. Government and society influence the two fundamental drivers of biodiversity loss; human population size and per-capita consumption. Population size multiplied by per-capita consumption in turn drives economic activity in threat-industries; industries that directly threaten biodiversity. Society and government can modify the extent and impact of threat-industries through four main modifiers: regulation, corruption, funding for biodiversity conservation and knowledge of biodiversity. Twelve main threat types are defined by the International Union for Conservation of Nature Red List of Threatened Species Threat Classification Scheme version 3.2, ten of which are included in the hierarchy, and trigger biodiversity responses at the outcome level of the hierarchy (for further explanation see Supplementary Methods). Biodiversity outcomes have potential to feed back to alter effects of the instigators, including through ecosystem services or biodiversity outcomes with undesirable effects[73]. The left-hand grey boxes highlight alignment of the hierarchy with the driver–pressure–state–impact–response framework. The hierarchy reflects an extensive literature on causes of the biodiversity crisis[3,9,85]. **b**, The number of Aichi biodiversity indicators that report on each component of the biodiversity-crisis hierarchy. Total threats are broken down into individual threats (counts here do not include sub-classes, full details in Supplementary Table 4). **c**, Qualitative evaluation of how well indicators represent the scope of each hierarchy component (Supplementary Table 3). Threats 1 and 6 were rated 'low', despite having no direct indicators, because other hierarchy components addressed these threats (Supplementary Table 4).

of the pressures exerted by other components. For example, benefits of reduced human population size could be countered by interacting with increases in per-capita consumption. Benefits of decoupling energy production from carbon emissions might not turn around biodiversity loss due to climate change because the effect of energy production on biodiversity is indirect via carbon emissions. Other sources of carbon emissions could increase, expanding impacts of climate change on biodiversity (for example, livestock production due to increased demand for meat by growing and wealthier populations[15]). The potential for decoupling means that links from higher-level drivers through to biodiversity responses need to be re-evaluated periodically to recognize areas of success and to identify emerging risks. We provide the following case studies to illustrate the causal links between biodiversity loss and the relevant proximate and distal drivers.

Climate change and coral reefs

Climate change (threat 11, Fig. 1a) is one of the greatest and most pervasive threats to biodiversity globally[16,17]. A high-profile and recent example of the impacts of climate change is the widespread bleaching of coral reefs in 2016–2017, including Australia's Great Barrier Reef (GBR)[18]. During this period, increased sea surface temperatures were associated with bleaching of 93% of the corals on the GBR. Up to 50% of the corals in the worst affected areas may die, and cascading effects through dependent faunal communities are expected[19].

The path to preventing further damage to coral reefs, and ideally encouraging their recovery, can be illustrated through the biodiversity-crisis hierarchy. Governments (instigators, Fig. 1a) that are committed to policies of increasing population size (fundamental driver) and sustained, positive economic growth (fundamental driver) create an ever-increasing demand for resources, and an associated increase in burning fossil fuels[20–22] (Fig. 1a). Carbon emissions from burning fossil fuels drive up global temperatures, creating climatic instability and extreme weather events[23] that can severely damage or kill coral reefs[18] (Fig. 1a). Hence, the long-term state and condition of coral reefs ultimately depends on changes at the instigator level of the biodiversity-crisis hierarchy, including changes in social norms, community knowledge of ecosystem services and degree of effective government[24].

Other modifiers have a key role in potentially decoupling threat-industries that produce goods and services from their associated carbon footprint[25]. For instance, regulation has a critical influence, including in driving carbon trading or taxing[26], and in setting and working to meet international targets such as the COP21, which aims to keep global warming to under 2 °C[27]. But regulation to transform fossil-fuel-dependent economies has been undermined by corruption, where governments receive political donations or other favours from fossil fuel interests[26,28]. In Australia, fossil fuel companies (threat 3, Fig. 1a) — who make substantial donations to Australian political parties — are attempting to develop new coal mines in the region immediately adjacent to the GBR, with substantial co-investment from government[29]. If such new projects are prioritized by government, in preference to more sustainable energy production, the threat of climate change and extreme weather events (threat 11, Fig. 1a) will be exacerbated, and in turn, escalate and intensify the degradation of coral reefs (outcome, Fig. 1a).

Habitat loss through urban growth

Residential and commercial development (threat 1, Fig. 1a) is a major driver of biodiversity loss, with urban areas now containing on average just 8 and 25% of their native bird and plant species, respectively[30]. By 2030, the amount of urban land is projected to almost triple, and biodiversity hotspots are particularly threatened[31]. In addition to habitat loss, other compounding impacts of urbanization include roadkill, invasive species, and noise and light pollution (threats 4, 8 and 9, Fig. 1a)[32].

The values held by governments (instigators, Fig. 1a) have an overwhelming influence on policy direction, which can drive outcomes for biodiversity as cities grow[33,34]. Society (instigator, Fig. 1a) can influence the actions of government by supporting different political parties and lobbying for regulatory change, such as adoption of sustainable development policies[35]. Unsustainable housing growth may be promoted by societies who desire to live near natural areas[36] or in fully detached houses[37].

Much urban development is linked with economic growth, with urban land in China, for example, expanding by 3% for every 10% increase in gross domestic product[38]. In turn, economic growth can drive immigration[39], which increases population size[40] and resource consumption[41] (fundamental drivers, Fig. 1a). Governments can regulate to reduce the impacts of urban growth, such as urban-growth-boundary regulation[42], protected area systems, or urban greening policies (modifier, Fig. 1a). In Tampa, USA, for instance, a tree protection policy resulted in increased urban tree cover[43], which typically improves urban biodiversity values[44]. Regulation can also enforce compact settlement that has lower ecological impacts, including for birds[45] and ground-dwelling mammals[46]. But such policies can be undercut by corruption in society (modifier, Fig. 1a), especially when governments facilitate approvals in contradiction of environmental laws or selectively channel funds and information[47,48].

Indicators of the biodiversity-crisis hierarchy

To understand how well current indicators represent the drivers of the biodiversity crisis (as opposed to outcomes), we classified the 147 indicators for measuring progress towards the Aichi targets into the components of the hierarchy, (Fig. 1b, Supplementary Table 2, Supplementary Methods). We assessed how well the indicators represented the scope of each component by adapting the qualitative approach previously used to evaluate alignment of indicators with Aichi targets[7] (Supplementary Table 3).

Components of the biodiversity-crisis hierarchy were not well represented by the Aichi indicators (Fig. 1b). Four components of the hierarchy had no coverage, ten had low coverage and four had medium coverage (Fig. 1c, Supplementary Table 3). The only one of 19 components in the hierarchy with high coverage was consumption.

Society featured in 16 indicators (~11% overall), 10 of which were related to human access to biodiversity benefits (ecosystem services), while the remaining six indicators spanned relatively narrow scope (Supplementary Table 3). Important ways in which society influences the trajectory of biodiversity were not included, such as beliefs and attitudes promoting large families, effective environmental NGOs, cultures of consumption, or willingness to boycott threat-industries (Supplementary Table 1). Furthermore, no indicators accounted for the underlying characteristics of government (Fig. 1b), so aspects of political leadership, governance and political systems that can have overwhelming influence throughout the biodiversity-crisis hierarchy are not measured or reported (Supplementary Tables 1, 3).

Only one indicator — the ecological footprint — was related to human population size, but this indicator confounds population size with consumption of a range of resources[49]. Consumption was well represented by eight indicators (plus one of the regulation indicators, Fig. 1b, Supplementary Table 3) spanning material consumption, water, primary productivity and land.

Of the four categories of modifiers, corruption was completely omitted from the Aichi biodiversity indicators (Fig. 1b). Four indicators related to funding provided medium coverage, particularly strengthened by the indicator 'Information provided through the financial reporting framework', which aims to comprehensively evaluate how much money is needed to conserve biodiversity compared with how much is actually spent, on national and sub-national scales. Knowledge about biodiversity was represented with ten indicators providing medium coverage, including the Species Status Information Index and the proportion of species assessed through the International Union for Conservation of Nature Red List, which provide substantive global indicators of the state of biodiversity knowledge. The key weakness was related to knowledge that could be applied to manage threatened species, such as population dynamics and interactions with the biotic and abiotic environment[50].

Although threat-industries and threats were represented across multiple components of the hierarchy, threat-industries were poorly represented by indicators and all threats had low or no coverage by indicators (Supplementary Table 3). There were no indicators for threat 3 (energy production and mining) or threat 4 (transportation; Supplementary Table 3). Indicators for agricultural threats were indirect, measuring organic, conservation or sustainable agriculture rather than extent, expansion or drivers of unsustainable agriculture.

There were substantial biases in the coverage of threat 5 (biological resource use) with 21 of 29 (72%) indicators related to fisheries (Supplementary Table 3). While fishing was well represented, logging had poor coverage, and hunting was very poorly represented by indicators with no reporting for wildlife that is hunted but not trafficked. Invasive species had regulation, funding, threat and biodiversity indicators; however, there were no indicators for associated threat-industries, such as the pet trade, horticulture, biofuels and plantation forestry.

Biodiversity state had many indicators, but was rated as having medium coverage due to substantial biases that left many aspects of the state of biodiversity unreported. One study[51] emphasized that the current indicators of biodiversity do not provide adequate detail in a timely manner, and presented a subset of essential biodiversity indicators needed to improve coverage.

Applying the biodiversity-crisis hierarchy beyond 2020

Recent evaluation of the Aichi indicators has focused on gaps associated with current targets[7]. Our evaluation of coverage across the biodiversity-crisis hierarchy provides new insights into major information gaps and clear guidance on how to improve the scope of indicators in the next CBD Strategic Plan for Biodiversity (Box 1). To properly highlight and monitor the factors driving biodiversity decline, indicators are needed for all of the instigators, drivers, modifiers, threat-industries, threats and outcomes in the biodiversity-crisis hierarchy. New indicators are needed.

Some indicators are already available to fill gaps in monitoring the effects of government on the biodiversity crisis, including the Environmental Democracy Index[52]. This index evaluates the degree to which laws that regulate aspects of the biodiversity-crisis hierarchy enable collection and disclosure of information, public participation in decision-making and access to justice such as challenging court decisions[52]. For example, Guideline 2, Law 1, of the Environmental Democracy Index asks: "To what extent does the law require information on environmental quality to be made proactively available to the public?" Legally requiring government scientists to publically release knowledge about biodiversity impacts of government policy is essential for effective democracy, but this contrasts with current policy positions in countries such as Australia and the United States[53–55].

Box 1 | How to apply the biodiversity-crisis hierarchy

We envisage five steps for applying the biodiversity-crisis hierarchy (see figure).

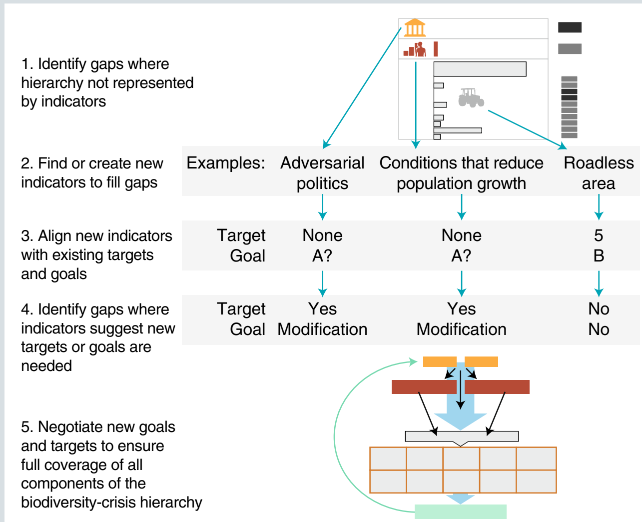
Identify gaps in indicator coverage (step 1). Align existing indicators against the scope of each component of the biodiversity-crisis hierarchy to identify hierarchy components that are either not represented, or are poorly represented (Supplementary Table 3). To enable prioritization of elements within the scope of each hierarchy component, further research is needed to define elements in more detail and to evaluate their relative importance. Nevertheless, the general definition of scope provided here (Supplementary Table 3) highlights major areas for reform.

Develop or identify new indicators (step 2). Seek existing indicators to monitor unrepresented components (for example, Environmental Democracy Index, gROADS) and create new indicators where none are available, but data sets are available or could be created (for example, adversarial politics, conditions that reduce population growth). Indicator utility should be evaluated against indicator testing frameworks.

Align indicators with existing targets (step 3). Align the biodiversity-crisis hierarchy against existing goals and targets, so that gaps in indicators for hierarchy components also show where there are gaps in coverage of existing targets and goals, and where new targets or goals are needed.

Identify gaps in targets and goals (step 4). For example, there are inadequate indicators for population growth (fundamental driver) and none for government (instigator), and new indicators for these do not align with any existing target, requiring new targets. They also may not align with goal A: 'Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society'. Although the first clause of the definition would include all instigators and fundamental drivers, the second clause narrows the scope to exclude important components of the hierarchy.

Negotiate new targets or indicators against a set baseline (step 5). The biodiversity-crisis hierarchy can be used as a baseline against which negotiations of the next round of targets and indicators for the targets are evaluated. Each suggested compromise or omission of a target during the debate could be evaluated against the biodiversity-crisis hierarchy. Preventing biodiversity loss requires all of the drivers to be identified, measured and ultimately annulled. We suggest that ignoring major drivers is a fundamental flaw of the current set of targets and indicators.



Five steps to applying the biodiversity-crisis hierarchy.

Other gaps in monitoring how governments improve or worsen the biodiversity crisis will require new indicators. One area for attention is adversarial politics. Adversarial politics renders major reforms in contentious areas almost impossible because there are political gains to be made in highlighting the potential costs of reforms. Evidence-based policies can be thwarted by political opportunism[56] (Supplementary Table 1). A previous study[57] quantified adversarial governance by scoring eight attributes of political systems, such as the percentage of time that power is concentrated in single-party majority cabinets, and the number of effective political parties. This system[57] could be used directly as an indicator, but could also be further refined by evaluating the extent to which adversarial politics is used to prevent passage of new regulations to protect biodiversity. One possibility is to collate data on the votes for environmental legislation and the consistency of political positions on key issues.

Politicians can face major constraints when threat-industries act to undermine policy initiatives. Actions by extractive, agriculture and development industries have elicited favourable government decisions at the expense of the environment by mounting public media campaigns and making political donations (Supplementary Table 1). Mechanisms for shifting this power balance are available[56]. Indicators that evaluate the influence of threat-industries on government might therefore include enumerating political donations and assessing media coverage achieved by threat-industries on proposed policy changes, easily collated using media-monitoring services. Further, to reduce the power held by threat-industries and increase the political feasibility of protecting biodiversity, government strategies could focus on strengthening public opposition to threat-industries and reducing threat-industry power[28]. Additional indicators could therefore measure government support for green NGOs or industries that are consistent with protection of biodiversity (some tourism, renewable energy). Subsidies to threat-industries increase threat-industry power[28] and there are already indicators for subsidies to agriculture and fisheries. Similar indicators could be developed for other threat-industries, which would be measurable using government budget documents about taxation for many countries[58].

Achieving the Sustainable Development Goals (SDGs) of the United Nations (UN), including those related to human wellbeing and biodiversity conservation, is unlikely[59], especially with current rates of population growth. Yet human population size is barely represented among Aichi indicators, even though it is a fundamental driver of the biodiversity crisis[13]. The three main areas for action to reduce population growth are: (1) increase education so that fertility becomes a conscious choice; (2) alter economic incentives so that large families are not necessary (for example, provision of adequate aged care, benefits for working women, preventing child labour); and (3) providing the means to reduce fertility while reducing child mortality[60]. Indicators of the social and governmental factors that influence these three areas need to be developed as a priority to encourage actions that curtail human population growth. Most nations undertake a regular census of their population and the addition of questions related to the three areas that influence fertility could be done cost-effectively with support of the UN World

Population and Housing Census Programme[61]. Existing indicators of the UN SDGs provide information sources on, for example, child mortality rates, access to medical care (physician density), and female literacy and education.

Corruption was not measured by the Aichi indicators, yet corruption is a well-established threat to biodiversity conservation (Supplementary Table 1). Corruption is a threat in both rich[48,62] and poor[63] countries, and its influence can be non-linear in relation to per-capita gross domestic product[64]. Corruption indicators are already used to evaluate the SDGs and these should be more widely applied (SDG indicators 16.5.1, 16.5.2, 16.6.1). Other indicators are available, including Control of Corruption as part of the World Bank's Worldwide Governance Indicators, which combines multiple criteria (for example, trust in public officials, irregular payments, diversion of public funds) capturing the extent to which public power is controlled for private gain[65]. In addition, corruption associated with specific threat-industries needs attention, including logging, mining and corrupt land rezoning (Supplementary Table 1). Indicators for sustainable cities are beginning to be developed[66] and these should be expanded to consider corruption in urban development.

Major gaps in evaluating threats remain to be addressed[67] but there are new opportunities for indicators. The Global Roads Open Access Data Set (gROADS[68]) provides a potential basis for indicator development on land-based transportation, a threat currently lacking indicators (Fig. 1b). For example, the proportion, size, and spatial arrangement of roads and roadless areas indicate habitat disturbance and fragmentation, and large tracts of roadless areas are important for sustaining key refugia for biodiversity[69]. More generally, indicators of the magnitude of threat-industries may also be derived from data documenting economic activity, industrial outputs, trade and consumption patterns. These are widely reported in publically available company annual reports, government statistics and international databases. Indicators of the resource use and environmental footprint of threat-industries can be devised, such as area of land use, water use, greenhouse gas emissions, and nutrient and chemical pollution used in particular classes of threat-industries[70,71]. These indices could directly quantify the impacts of threat-industries on biodiversity if new research or reviews can define the typical biodiversity response to each industry.

Biodiversity responses, including ecosystem services, have potential to act as a feedback mechanism from biodiversity outcomes to influence the actions of society and government (Fig. 1a). For example, as the mental health benefits of a dose of nature are recognized, societies may respond by protecting or rebuilding natural areas in cities[72]. Reduced exposure to pathogens in healthy soils may encourage better soil management[73] and improved fisheries outcomes from investing in marine protected areas may encourage better marine park management[74]. Recent reviews of linked social-ecological systems related to ecosystem services acknowledge that feedbacks are potentially important, but feedbacks are poorly understood and remain a priority for future research[75,76]. While there are already ten indicators related to ecosystem services, areas for advancement are to address biases in measuring ecosystem services[77], assess whether governance and social systems enable data about ecosystem services to be translated into policy[78], and determine if policy changes would provide a net benefit to biodiversity[79].

Data availability, particularly spatial and temporal resolution of indicators, can critically influence their utility[7,67]. Indicators with high spatial resolution, such as human population size, can be applied on global, national and sub-national scales, but many other indicators are limited to the spatial scale of whole countries. This includes the Worldwide Governance Indicators[65], which are available at the national level, whereas action to improve governance in some cases may need to happen at sub-national level. Data availability has been evaluated for threats and there are substantial gaps, particularly for threat 5 (biological resource use)[67]. A previous study[67] emphasized that with global coordination and access to a full range of funding sources, existing data sets can be improved or new data sets established. Although we have suggested several areas where new indicators could be developed, these would need to be carefully evaluated for performance, including in different governance contexts[80]. To this end, indicator testing frameworks provide essential guidance for assessing the utility of data streams as indicators[81,82].

The major gaps in indicator coverage of the biodiversity-crisis hierarchy can be extrapolated to identify gaps in the goals and targets of the Strategic Plan for Biodiversity 2011–2020[3] (Box 1). For instance, the instigators, drivers and the moderator corruption from the hierarchy could align with goal A, except for the restrictive second clause of that goal (see Box 1); threats align with goal B; outcomes with goal C; feedbacks with goal D; and knowledge and funding with goal E. The moderator regulation makes contributions across all goals. The gaps in coverage of the hierarchy components by indicators highlight areas where new targets need to be developed or existing targets updated with new indicators (Box 1). It will be important for delegates to the Fifteenth Conference of the Parties (CoP15) to consider which targets should be added, with which indicators, to fill the gaps highlighted using the biodiversity-crisis hierarchy. The effectiveness of any new targets will need to be evaluated using scenarios and models[83].

As the time to renew the 2011–2020 CBD Strategic Plan approaches, innovative ideas for the next round of targets and indicators are now being proposed[6,7]. These proposals also must be integrated into the SDGs to address the broader sustainability agenda on national[59] and global[10,84] scales. We believe that considering the comprehensive, systems-based, biodiversity-crisis hierarchy (Fig. 1a) is essential for developing indicators, and indeed targets, that will bring a critical focus to all of the actors and processes that drive, or try to counter, the biodiversity crisis. Paying too little attention to higher-level components so far has coincided with catastrophic biodiversity loss[1]. Maintaining a focus on threats remains important[6], but the next step must be to bring sharp focus to the instigators, fundamental drivers, modifiers, threat-industries and outcomes, using new indicators with appropriate alignment, and temporal and spatial coverage[7]. Currently, the Aichi indicators do not measure some of the most important processes driving biodiversity loss. Careful revision based on a comprehensive biodiversity-crisis hierarchy is therefore essential for developing an effective set of indicators and targets that address all of the causes of biodiversity loss post-2020.

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D.A.D., T.M.N., E.G.R. and T.S.D. conceived the ideas, with L.M.B., E.N. and B.A.B. contributing further ideas throughout writing. L.M.B. and E.N. provided expert guidance on indicator concepts. D.A.D. lead writing, analysis and synthesis, with contributions from B.A.B., T.M.N., E.G.R. and T.S.D. T.S.D. helped with Fig. 1 and provided additional feedback, writing and proofing.

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