Biodiversity loss is a development issue

A rapid review of evidence

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Photo caption: Planting mangroves on Nusa Lembongan, Bali, Indonesia (creative commons, courtesy of Patrick Chabert on Flickr)

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From genes to micro-organisms to top predators and even whole ecosystems, we depend on biodiversity for everything from clean air and water to medicines and secure food supplies. Yet human activities are destroying biodiversity around 1000 times faster than natural 'background' rates. This global biodiversity crisis is hitting the poorest communities first and hardest, because they can ill-afford to 'buy in' biodiversity's previously-free goods and services (and are already bearing the brunt of climate change). So why does the development community often ignore biodiversity loss? This paper unpicks misunderstandings and sets out the evidence that biodiversity loss is much more than an environmental problem – it is an urgent development challenge.

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Biodiversity loss is a development issue

Biodiversity isn't just iconic and charismatic wildlife, it is the diversity of life, from genes and micro-organisms to top predators and whole ecosystems. We depend on biodiversity for everything from clean air and water to medicines (modern and traditional) and secure food supplies in the face of changing climate.

Yet human activities are destroying biodiversity around 1000 times faster than natural 'background' rates. This global biodiversity crisis is hitting the poorest people first and hardest, because biodiversity underpins environmental goods and services that poor communities can ill-afford to 'buy in' – things like flood protection, drought resilient crops, and wild-caught protein. Biodiversity loss already poses risks to hard-won development gains and will impede further progress. So why does the development community often ignore biodiversity loss?

Misunderstanding and misinterpretation

The problem partly stems from confusion. Some people misinterpret biodiversity as meaning iconic species of wildlife which, while nice to have, appear largely irrelevant to mainstream poverty alleviation and development efforts (other than tourism). Indeed some species of wildlife and some approaches to conservation bring about significant costs to poor people and actually appear to undermine development efforts. Others understand biodiversity as the amount or extent of plants/animals/natural space and miss the significance of 'diversity', for example seeing a monoculture plantation as an equivalent replacement for natural plant assemblages.

Insidious damage

Another problem is that damage from biodiversity loss is far less obvious than damage from climate or weather-related disasters, making it seem less urgent. For example, a forest may appear healthy for decades after it loses the animals that disperse the seeds of its biggest and longest-lived trees.

Complexity is key

But thousands of studies tell us that a large and *diverse* mix of species, and crucially the interactions between these, are needed to ensure nature can deliver the goods and services people rely on. Biodiverse environments offer more fodder, more fisheries, better pest control, cleaner water, wider livelihood options… in other words, more and better development opportunities.

Risks to development gains

Biodiversity loss already challenges development gains in many ways. It can mean fewer wild foods, reduced nutritional security, poorer pollination, and less productive and resilient agricultural systems. It can bring higher exposure to agri-chemicals, reduced access to traditional medicines and lost opportunities for drug development, as well as translating into higher disease burdens. Lost ecosystem services can affect gender-specific labour burdens (for example where women walk further for fuel or clean water). Biodiversity loss can also make private sector investments more risky. And as for climate change, biodiversity loss compromises adaptive capacity, exacerbates natural disasters, and often reduces carbon storage.

Poor people are hit hardest

The world is losing biodiversity fastest from the tropics. The statistics are staggering. Over the past half a century, vertebrate abundance alone has fallen roughly 89 per cent in the Caribbean and Latin America, 64 percent in the Indo-Pacific region, and 56 percent in Sub-Saharan Africa [Living Planet report 2018]. Biodiversity hotspots in forests are being rapidly degraded, but we're losing biodiversity from drylands too, which are home to 20 percent of the centres of global plant diversity and support nearly a third of the global human population, including nearly half a billion people who are chronically poor. These people will bear the brunt of lost services and resources, partly because it is here that climate change hits hardest too. And, like climate change, biodiversity loss can be considered a social injustice, often driven by unsustainable use of natural resources underpinned by developed country consumption habits.

What are the solutions?

'Biodiversity-safe' development

When we allow biodiversity loss, we accept losing all biodiversity's potential benefits, for example the largely unexplored toolkit biodiversity offers for building resilience to climate change. Many development projects already try to 'climate proof' investments. Development projects and private sector investments need to be 'nature-proofed' to ensure they don't contribute to, or exacerbate, biodiversity loss. And where they do potentially impact on biodiversity, steps need to be taken to address that impact.

Investments in biodiversity for development and climate resilience dividends

And we should go further. Development projects should proactively invest in biodiversity for climate change resilience. However, 'nature-based solutions' to development challenges must actively protect *diversity*, not just nature, because intensive monoculture approaches, while potentially productive at first, don't offer the same wide-ranging and flexible services as natural systems and are vulnerable to climatic shocks, pests and diseases.

Conservation that empowers rather than disenfranchises

Action is needed within the conservation sector too. Since the 1970s, formal protected area coverage has increased 660 percent. But the global populations of most major animal groups have declined by roughly 60 percent. Simply declaring 'parks' isn't enough to halt biodiversity decline. Indigenous people and local communities own around 25 percent of the world's land area, and they need support, in terms of tenure rights, resources and economic opportunities, that help them steward biodiversity. Beyond protected areas other mechanisms include paying for conservation services, with jobs as well as direct payments and supporting biodiversity friendly small-holder production such as agroforestry.

Conservation that recognises poor peoples' priorities

While the world's attention is focussed on charismatic megafauna – particularly those targeted by illegal wildlife trade – it is also important to prioritise the uncharismatic species that matter most to poor people, for example pollinators, soil microbes, traditional crop varieties and species that are important for food or fibre or medicines.

A new deal for nature and people

In 2020 the international community will agree a new 10-year framework for biodiversity management. Developing this new framework into one that works for both biodiversity *and* for people requires much more coordinated thinking and action than has happened to date. Many drivers of biodiversity loss also drive development gains, so there exists a trade-off. But in the long term, biodiversity loss threatens to undermine these gains because biodiversity underpins ecosystem productivity and resilience. The biodiversity crisis is thus a development crisis and demands an engaged response from the development community.

Introduction

Biodiversity is a scientific term describing the variability of life on Earth (wild and cultivated). So, it is about sheer numbers of different species, genetic variation between and within species, and the extent and variety of natural habitats and ecosystems. We are losing this diversity and abundance at increasing and alarming rates (now around 1000 times higher than natural background rates).

Why does it matter? Because humanity depends on the goods and services nature generates, and biodiversity underpins nature's ability to deliver these goods and services over the long term. What's more, poor people are disproportionately dependent on biodiversity, both to meet their day to day livelihood needs, and to be resilient to climate change and other external stressors. So they are hardest hit by its loss, especially when coupled with climate change (which in turn affects and is potentially affected by biodiversity).

To date, biodiversity loss has been treated only as an environmental problem. Yet continued biodiversity loss threatens to undermine development gains made in health, resilience, food security and GDP earnings. In this report we briefly review the evidence on how biodiversity loss affects development, and highlight why, if we're serious about development, we need to invest in conserving biodiversity now. This report is not intended to be a thorough systematic mapping, review and synthesis of evidence. Rather, it highlights recent important findings that have advanced our scientific knowledge of the impacts of biodiversity loss and brings increased clarity to the development risks that biodiversity loss will present, if left unattended. The paper focuses on raising awareness that biodiversity loss is a development challenge, hence we devote more space to setting out the evidence for this than on suggesting solutions (which will be discussed in a follow up paper).

"Biodiversity crisis" or development challenge?

Scientific and popular media warns us that we are facing a "biodiversity crisis"[1] and that we are heading into – if not already in the midst of – the sixth great extinction.[2] Globally, there could be up to 690 species extinctions per week.[3] The Living Planet Report 2018 finds that global populations of fish, birds, mammals, amphibians and reptiles declined by an average of 60 percent between 1970 and 2014 and projects that this could become 66 percent by 2020.[4] The Food and Agriculture Organisation (FAO) estimates that nearly one third of global fish stocks are over-fished and one-third of freshwater fish are considered threatened.[5] While we usually hear about biodiversity loss in the form of extinctions of wild animals – particularly those that we can see, have four legs, fur or feathers – biodiversity loss also means loss of genetic resources, crop varieties, fungi and invertebrates as well as loss of entire ecosystems such as coral reefs. For example: the biomass of flying insects has declined 75 percent in Germany (and so probably also elsewhere) over the past 27 years;[6] 30-50 percent of mangroves have died or been removed in the past 50 years; and nearly 50 percent of coral reefs have been destroyed.[4]

The biodiversity crisis is attracting some media attention – although much less than climate change,[7] but it is not a new discovery. The UN agreed the Convention on Biological Diversity (CBD) in 1992 in response to an already recognised crisis, and 25 years ago a

stark paper warned of "Empty Forest Syndrome"[8] – reporting seemingly healthy forests, full of trees, but increasingly devoid of any animal inhabitants. Now, improved evidence, analyses and communications, as well as 'shock' revelations, such as the impact of plastics on ocean life and the collapse of bee colonies, have heightened people's awareness of the speed and scale of nature degradation and biodiversity loss. From a human development perspective, this loss has severe implications, including escalating threats to food security, water security, climate change adaptation, disaster risk, pollution control and human health, not to mention reduced options for future innovations. **Biodiversity loss is an environmental crisis but also a major barrier to future development and a risk to hard-won development gains.**

"Just as development projects can jeopardize the benefits that flow from ecosystem services, changes in ecosystems can endanger project outcomes."[9]

What is biodiversity (and what is it not)?

Part of the difficulty with understanding the significance of biodiversity loss, and why it is a development challenge, is that the term is misused and misunderstood. Biodiversity means the *variety* of life.* But it is often misused to describe wildlife, sometimes just a single species as a noun for multiple wildlife species. When the popular media tells stories of biodiversity loss, the story is usually about the deaths of iconic wildlife species such as rhinos or orangutans, or damage to iconic ecosystems such as the Amazon rainforest or the Great Barrier Reef. It does not refer to the loss of *diversity*. Part of the reason for this is that the number of species and the number of individuals of a particular species are amongst the most common metrics used to measure biodiversity. There are also many other terms out there that get used interchangeably with biodiversity, but which are not quite the same thing (Table 1).

Biodiversity is not the same as nature, wildlife, natural capital or any of these other commonly used terms. **But it *supports and enhances* all of these other aspects of the natural world, and/or *reduces the risks* to them.**

Different people value biodiversity for different reasons, but these can be grouped into three key categories:**

- **Functional reasons** – biodiversity sustains flows of many benefits that have material value and that underpin the **economy.**
- **Cultural reasons** – biodiversity is an intimate part of community, aesthetic and spiritual values that are essential for **society.**
- **Security reasons** – biodiversity is a fundamental basis for life itself, the foundation of a secure and functioning **environment.**

* The term biodiversity was first used in 1986 as shorthand for biological diversity and then popularised by E. O. Wilson.[10] The internationally agreed definition is that contained in the text of the Convention on Biological Diversity (CBD) which describes it as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." According to the scientific community and the CBD definition, biodiversity is a fundamental *property* of the natural world, not specific elements of the natural world itself.
** Steve Bass, IIED, personal communication

Table 1: Terms that often get used interchangeably with biodiversity but are not the same thing

BIODIVERSITY IS NOT THE SAME AS…	
Nature	Nature refers to the world's natural features – living and non-living – that are not created by humans: plants, animals, mountains, rivers, oceans etc. Biodiversity is the *variety* of the living components of nature.
Wildlife	Biodiversity is the variety of *all* living organisms, so it includes not just well-known wild mammals and birds, but also plants, fish, fungi, insects and micro-organisms, as well as crop and livestock varieties and landraces. Individual wildlife species are supported by diverse communities of other plants, animals, fungi and microbes.
Natural resources	Natural resources are materials or substances occurring in nature that can be exploited for economic gain. They may be renewable, and derived from living resources, such as timber, bushmeat, and firewood; or finite, and derived from inanimate sources, such as oil and gas and minerals. Biodiversity secures the long-term production of these resources.
Natural capital	Natural capital is a way of explaining the value of nature and biodiversity to economically-minded decision makers. A deliberate parallel is drawn to financial systems where stocks of financial capital generate financial flows. Similarly, natural capital is the world's stock of natural assets such as water, land, soil and wildlife, from which flow a multitude of valuable goods and services. Just as a more diverse portfolio of financial stocks is more resilient to external shocks, so is a more diverse portfolio of natural capital.
Ecosystem services	Ecosystem services are the flows of benefits that people gain from natural ecosystems. Biodiversity strengthens and sustains ecosystem services. More diverse ecosystems are more resilient and therefore more able to continue to deliver ecosystem services in the long term. Biodiversity also makes many of these services more productive and efficient.
Green infrastructure	Green infrastructure is a term used to describe a network of natural and semi-natural features – hedgerows, rivers, green roofs, parklands – that provide benefits to people, including reduced air pollution, managed rainwater run-off, and recreation facilities. Green infrastructure doesn't have to be biodiverse. But the more biodiverse it is, the more resilient and able to continue to provide benefits it will be.
The biosphere	The biosphere is the part of the Earth's system, comprising all ecosystems and living organisms – the living layer of the planet. Biodiversity describes the diversity of life within the biosphere.

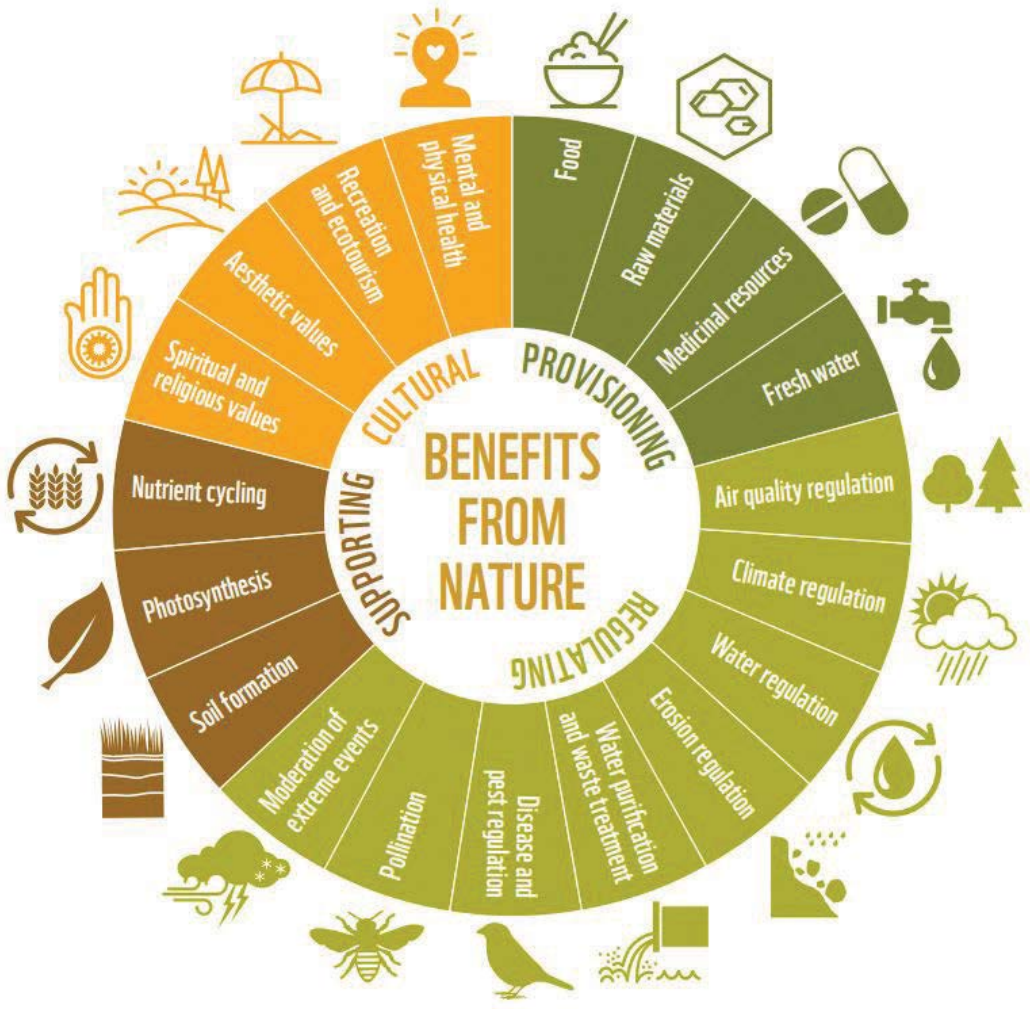
BOX 1. IF BIODIVERSITY IS ABOUT THE VARIABILITY OF LIFE ON EARTH, DO ICONIC SPECIES MATTER?

In short, yes. Although it is diversity that underpins resilience, productivity and ecosystem functioning, interactions among species are critically important. Not all species play equal ecological roles. Species towards the top of the food chain (which include many iconic species) can often have more important ecological roles than those lower down the chain, where more than one species may perform the same function and hence there is some overlap. Large birds such as toucans are critical for dispersing seeds from large fruiting trees. Forest elephants disperse more seeds, of more species of trees, and over greater distances, than any other animal.[11] Apex predators, particularly large carnivores such as big cats, help maintain ecological functions via multiple food web interactions.[12] Unfortunately, those at the top of the chain are naturally low in number and so easier to drive to extinction. They are also larger and often targeted for hunting. And when this happens, ecosystems lose their integrity and ability to function – although this effect may take some time to become obvious.

What has biodiversity ever done for us?

To understand why biodiversity loss matters for development it is important to understand what biodiversity does. Nature produces and delivers a wide range of goods and services on which humans depend – from breathable air, to fertile soil to food. And biodiversity underpins nature's ability to deliver those goods and services over the long term. Species do not exist in isolation, but interact with each other and with their environment. A large and diverse mix of species, and the interactions between them, is critical to ensuring nature continues to deliver its goods and services (Figure 1). Over the past 25 years, evidence from thousands of experiments and observations in a range of ecosystems shows that these goods and services are produced more efficiently and with more stability where the diversity of microbes, plants, fungi, herbivores and predators is higher.[13, 14, 15]

Figure 1: Different types of ecosystem services or benefits from nature



Source: Living Planet Report 2018[4]

BOX 2. EXPLORING THE EVIDENCE THAT DIVERSITY MATTERS

Biodiversity has a significant impact on ecosystems' productivity and stability, and on the services they generate. Specifically: crop genetic diversity increases the yield of commercial agricultural crops; tree species diversity enhances and/or stabilises wood production in plantations; plant species diversity produces more fodder in grasslands; fish species diversity is associated with more stable catches.[12] There is also evidence that biodiversity's impacts on productivity and stability are **more significant than either climatic or nutrient influences.**[16] Furthermore, **biodiversity makes ecosystem productivity more resilient to climate extremes.**[17, 18]

Beyond productivity impacts, plant biodiversity also: increases a system's resistance to invasion by exotic plants and reduces the prevalence of plant pathogens;[19] increases above-ground carbon sequestration;[20] and increases nutrient mineralisation and soil organic matter.[21] Overall there is a substantive body of evidence which shows that **diversity confers both social**[22] **and ecological**[23] **resilience and adaptive capacity – particularly under a changing climate.**[18]

Of course, biodiversity is not the only factor: a report for The Economics of Ecosystems and Biodiversity (TEEB) initiative correctly notes that "the economic importance of wild nature does not rely solely on variability".[24] Indeed, and particularly from a development and poverty reduction perspective, **many of the benefits people get from nature rely as much on the amount (eg the abundance of particular species) as on diversity.**[25] How well ecosystems provide people with developmental benefits also depends on their condition and extent, and on the specific functions certain species, groups of species or ecosystems perform – as sources of food, absorbers of air pollution, natural barriers against sea storms and so on. But, crucially, **diversity underpins the abundance, extent and condition of nature, natural resources and ecosystems and secures the flow of benefits to people in the future, particularly in the face of changing environmental conditions**.

Biodiversity loss and the risk to development gains

It is because of biodiversity's importance in maintaining (and enhancing) stable, productive and resilient natural ecosystems – and the resources and services they provide – that biodiversity loss is an important development issue. Biodiversity is not just about the *wealth* of nature but also about the *health* of nature. Loss of biodiversity undermines ecosystems' abilities to function effectively and efficiently and thus undermines nature's ability to provide us with a healthy environment. This is particularly important in a changing climate where loss of biodiversity reduces nature's resilience to change.

While some loss of species is perfectly normal – extinction is a normal part of the evolutionary process – the current rate is estimated to be about 1000 times higher than natural background rates.[26] This loss is largely human-caused (anthropogenic), driven by conversion of forests and other ecosystems for agriculture, infrastructure and urban development, as well as over-exploitation through hunting and fishing. It is also, and increasingly, linked to climate change, because changing climatic conditions is altering species' distributions and the extent and quality of ecosystems.

Biodiversity loss is often measured in terms of losses of particular species.* But it is also about loss of ecosystems – living places – that matter to people, and loss of genes which determine for example, the varieties of agricultural crops that we eat. Mangrove forests are highly productive ecosystems on which millions of coastal communities depend, and they are being lost at a rate of 1 percent per year, which is double that of terrestrial forests.[27] Mangrove restoration that doesn't pay due attention to species diversity, is proving to be an inadequate solution to coastal degradation.[28] And at the other end of the spectrum, loss of *genetic* diversity within our global food system has huge implications for its future sustainability. Out of the millions of species and varieties that people have described and recorded, only 30 crops provide 95 percent of human food energy needs, and just four of them – rice, wheat, maize and potatoes – provide more than 60 percent.[29] This homogenisation of agricultural production has resulted in significant genetic erosion as farmers worldwide have replaced multiple local varieties and landraces with genetically uniform, high-yielding varieties.[30]

Any loss, degradation or relocation of biodiversity can impinge on human wellbeing, but it can have a particular impact on poor and marginalised people who often a) depend more directly on natural resources and the services nature provides to meet their immediate livelihood needs, and b) cannot afford substitutes for previously freely-available natural resources and services. There is a lot we *don't* know about the impacts of biodiversity loss (Box 3) but the evidence we *do* have suggests that **biodiversity loss will challenge our ability to achieve many development priorities** – from health to food security to disaster risk reduction.

These development challenges are summarised in Table 2 and discussed in more detail below.

Food systems and food security

Biodiversity loss means reduced availability of key wild foods such as fish and wild meat. Large declines in the diversity of fish species is strongly associated with lower catches, lack of resilience to exploitation and higher incidence of stock collapse.[31] Biodiversity loss also means reduced productivity in cultivated food systems. Specifically, there is unequivocal evidence that biodiversity loss makes ecological communities less efficient at capturing biologically essential resources (nutrients, water, light) and producing biomass.[13] Hence biodiversity loss reduces crop yields.[32] In particular, loss of soil biodiversity makes soil less resilient and undermines its ability to support vegetation – whether wild or cultivated.[33]

Beyond primary productivity, losing components of biodiversity that have key functions – pollinators for example – seriously threatens food production.[34] And pollinators themselves depend on biodiversity: plant diversity is a key driver of bee health, and biodiversity loss is a key factor behind bee population declines.[35]

And within the food crops themselves, losing genetic diversity reduces resilience: to pathogens and pests; to poor soils; and to changing climatic conditions. Agricultural systems' capacity to adapt to environmental change depends on maintaining diversity in cropping systems, crop varieties and animal breeds.[30]

BOX 3. IMPACTS OF BIODIVERSITY LOSS: WHAT WE DON'T KNOW, AND WHAT WE DO

While the evidence is increasingly clear that more biodiverse systems are more productive and more stable and resilient, we do not yet know where the thresholds and tipping points are, how long it might take for the full impacts of loss to be felt, how much biodiversity is sufficient to support well-functioning ecosystems, or what impact different levels of biodiversity loss will have on the resilience of ecosystem functions.[56] We do not even know how much biodiversity we have. One estimate puts the total number of species at close to 9 million with around only 9-14 percent having been described to date.[57]

We do know, however, that loss of biodiversity is associated with loss of ecosystem function and resilience, thus reducing the insurance capacity that a diverse system provides.[56] We also know that the change in ecosystem functioning brought about by biodiversity loss accelerates as loss increases. Initial losses of biodiversity in diverse ecosystems have relatively small impacts on ecosystem functions, but increasing losses lead to accelerating rates of change.[23]

* Biodiversity loss can be a reduction in abundance, or the outright extinction of individual species or groups of species. Species reductions and extinctions are often measured and reported at the global level (such as in the IUCN Red List of Threatened Species or the Living Planet Index. But they also occur, and are important, at the local level, particularly, for example, if a species' geographical distribution changes because of climate change. And even if these represent a small dint in global populations, local extinctions can have significant ecological and socioeconomic impacts.

Table 2: Risks to development priorities from biodiversity loss

DEVELOPMENT PRIORITY	IMPLICATIONS OF BIODIVERSITY LOSS
Food systems and food security	Reduced availability of wild foods, reduced productivity of agricultural systems, reduced nutritional security.
Health	Nutrition impacts, exposure to chemicals to compensate for reduced agriculture productivity, reduced access to traditional medicines, reduced options for future drug development, increased disease burden, reduced protection against pollution.
Climate change mitigation	Reduced carbon storage and sequestration
Climate change adaptation and disaster risk reduction	Reduced adaptive capacity and resilience, exacerbation of natural disasters, increased vulnerability.
Gender equality	Increased time and labour burden – different genders and ages affected by different types of losses – with knock on effects on time availability of other activities.
Private sector development	High risk to doing business – in terms of likelihood and severity of impact – particularly in the Least Developed Countries (LDCs).

Health

Human health is directly linked to food production and since biodiversity affects food availability, as discussed above, it also affects health. Attempts to *increase* food productivity – often to compensate for loss of biodiversity – can also damage health outcomes. Poor land management and over-use can, for example, reduce soil biodiversity, making soil less able to suppress disease-causing organisms or to purify water.[32] Loss of crop diversity, and subsequent reliance on agro-chemicals to compensate for plants' lack of disease resilience and/or for poor soil, can expose both people and the environment to pollutants.[36]

Even if the *quantity* of food is maintained, a lack of *diversity* in food production severely limits dietary diversity and nutritional health. Studies have found a positive correlation between agricultural diversity and dietary diversity and hence the inverse can be assumed – as agricultural diversity declines, so would dietary diversity and quality of nutrition.[30] Research on wild foods also finds a strong correlation between forest diversity, dietary diversity and nutritional outcomes,[37] according to the World Health Organisation (WHO) 'Healthy local diets, with adequate average levels of nutrients intake, necessitates maintenance of high biodiversity levels'.[38]

In terms of more direct linkages, 60 percent of the world's population use traditional medicines, of which medicinal plants are the most common constituent.[38] Biodiversity loss that makes wild-collected medicinal plants less available compromises the health of people who cannot afford to buy modern medicines. It also limits ecosystems' evolutionary potential to continue to produce new, therapeutic plant varieties, not to mention missing out on potentially useful compounds that are lost before the species that bear them have even been recorded. Nearly 20 years ago, researchers estimated that 50 percent of modern drugs have been developed from natural products,[39] and new discoveries are continuously emerging. Loss of biodiversity undermines future options for new drug discovery. Furthermore, given that the Nagoya Protocol provides for source countries to benefit fully from commercial products derived from their natural resources, biodiversity loss reduces potential revenue streams from well-managed bio-prospecting.

Aside from these direct medicinal uses of biodiversity, there is also evidence that loss of intact natural systems is increasing the disease burden on humans, particularly on poor, vulnerable groups.[40] For example, in rural areas where local people depend on untreated water from rivers and lakes, watershed degradation from loss of tree cover is directly correlated with an increase in diarrhoea – a major cause of death in children under 5 years old.[41] Loss of biodiversity can also reduce protection against air pollution. Different shapes and sizes of leaves capture particulates and chemicals in different ways, thus the diversity of plant types, and their abundance within an area, affects air quality. Biodiversity loss reduces natural systems' 'pollution scrubbing' functions. The Rockefeller Foundation-Lancet Commission on Planetary Health suggests that improvements in human welfare achieved in the past are likely to be reversed if the current trends of environmental degradation continue.[42]

Climate change mitigation

Humankind is rapidly realising the vital importance of natural ecosystems for carbon sequestration and storage.[43] However, biodiversity loss is impairing natural ecosystems' capacity to provide such mitigation benefits. For example, large tree species, which are rich in carbon, tend to produce large fruits that can only be processed and dispersed by large bodied birds and mammals. Losing these species can lead tropical forests to become dominated by fast-growing, small seeded plants that store less carbon.[31] Indeed, diverse intact forests tend to hold more carbon than less diverse logged forests.[15, 44] They are also more able to resist, recover and/or adapt to changing conditions and disturbances now and into the future,[17] and hence are more able to sequester carbon over the long term.[15] Biodiversity loss undermines this potential. Furthermore, more diverse ecosystems can be restored more successfully[45] and are more able to recover from extreme events: and hence are more likely to be able to continue supplying functions and services in the face of rapid environmental change.[17, 18, 23, 46]

Climate change adaptation and disaster risk reduction

Beyond climate change mitigation benefits, biodiverse ecosystems also support a wide range of climate change adaptation services, including disaster risk reduction.[47] For example, natural habitats in watersheds can secure and regulate water supplies and protect communities from flooding and soil erosion,[48] while mangroves, reefs and salt marshes offer protection from storm surges, salt water intrusion and coastal erosion.[49] Even if natural ecosystems can't *prevent* natural disasters, their loss can *exacerbate* the impacts. For example, if drained wetlands cannot contribute to flood protection, flood damage will be worse. The UN International Strategy for Disaster Reduction has identified ecosystem degradation as one of the main drivers of disaster risk worldwide.[50]

As well as helping people cope with extreme weather events, biodiversity plays a key role in other aspects of adaptation to climate change, and its loss undermines adaptive capacity. For example, diverse, old-growth woodlands are more effective at reducing surface temperatures – essential for mitigating climatic extremes – than are tree plantations.[51] Genetic diversity within agriculture makes small-scale farmers' livelihoods more resilient to climate change problems such as drought, salinity or new diseases. The narrow genetic base of modern agriculture is already causing genetic vulnerability, and further biodiversity loss will exacerbate this. The Food Agriculture Organisation (FAO) notes that many locally adapted varieties and breeds of crops and livestock are poorly documented and may be lost before their potential roles in climate change adaptation are recognised.[52]

Gender equality

Biodiversity loss affects men, women, elderly people and youth in different ways, depending on their livelihoods and their different roles in society. For example, the Women and Development Network notes: "As forests are depleted and fresh water supply exhausted, it is women and young girls who travel farther each day to collect firewood and water for their communities. Having to devote more time to water collection and travelling longer distances, means that girls may be unable to attend school and often puts women at greater risk for sexual harassment".[53] However, to date there has been no overall assessment of whether biodiversity loss affects any particular age group or gender disproportionately. This lack of evidence resonates with findings from a synthesis of research on ecosystem services and poverty alleviation, which highlighted that gender has been a "blind spot" in ecosystem services research.[54]

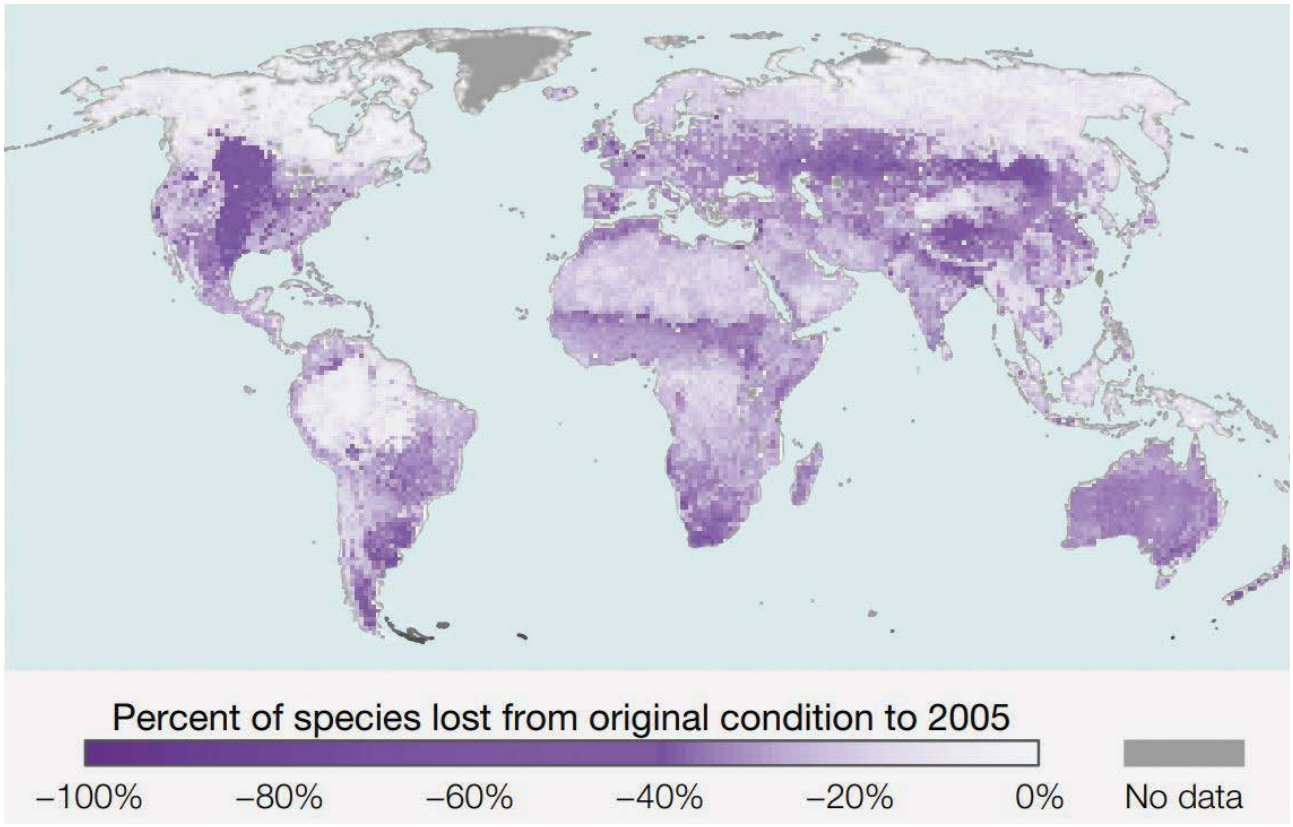
Private sector development

There is a growing awareness of how biodiversity loss affects private sector investment risks and opportunities in less developed countries. The World Economic Forum has highlighted that business is increasingly concerned about the impact of escalating biodiversity loss.[55] The 2019 Global Risks Report lists biodiversity loss and ecosystem collapse as the sixth most important perceived risk to the global economy in terms of severity of impact. At a global level, biodiversity loss is ranked as the 26th risk of highest concern for doing business both in terms of likelihood of the risk occurring and severity of impact. Moreover, many of the risks that are ranked more highly are linked to biodiversity loss, including food crises, water crises, failure of climate change mitigation and adaptation, and natural disasters. Furthermore, in many less developed countries biodiversity loss is ranked at a much higher level of concern (the 6th highest risk in Cambodia, 9th in Nepal, 11th in Uganda, 15th in DRC). Having made 'nature' a key theme of the WEF 2019 Davos meeting, WEF is now pursuing an action agenda for nature, including developing a "New Deal for Nature" and commissioning new research into the economic implications of biodiversity loss.

Who is, and will be, hardest hit by biodiversity loss?

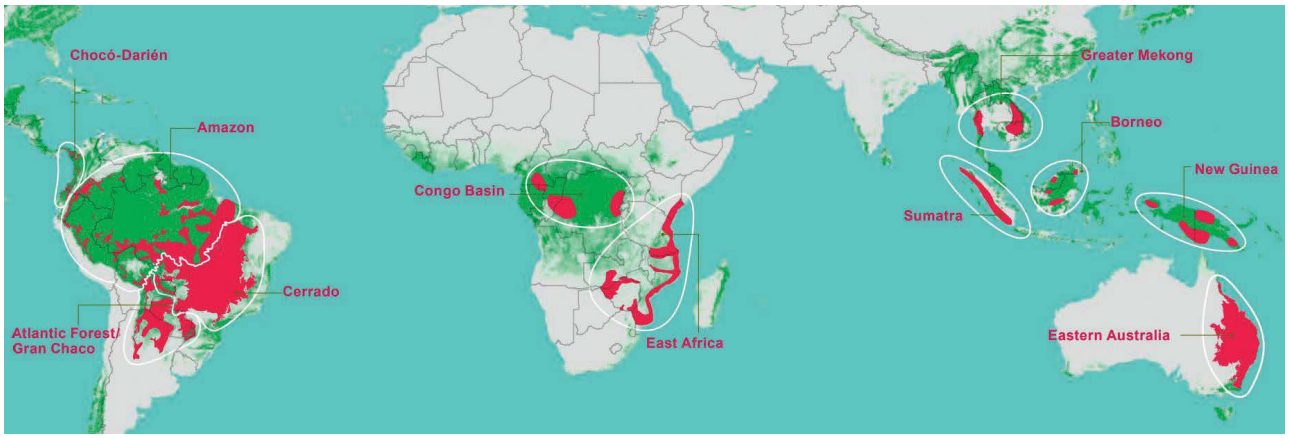
The highest rates of biodiversity loss are currently in the tropics – although historically there has been extensive biodiversity loss in temperate zones, as Figure 2 illustrates. More recently, however, the 2018 Living Planet Report finds that declines in vertebrate populations since the 1970s are greatest in Latin America and the Caribbean, where abundance has declined by 89 percent between 1970 and 2014.[4] Comparable figures from other regions[4] are a 64 percent decline in the Indo-Pacific region, and 56 percent in Sub-Saharan Africa, 31 percent in the 'palearctic' realm (Europe, Middle East, North Africa, Central Asia) and 21 percent in North America. Tropical forests are one of the most diverse types of ecosystem on the planet but include major hotspots for biodiversity loss (Figure 3). Drylands too are being rapidly degraded, risking much biodiversity loss (drylands include 20 percent of the centres of global plant diversity, 30 percent of important bird areas, and 8 of 25 global 'biodiversity hotspots'[58]). These regions of high biodiversity loss coincide substantially with areas of high poverty and those likely to be hardest hit by climate

Figure 2: Geographical distribution of biodiversity loss



Source: Reproduced from IPBES 2018[60]

Figure 3: Extent of tropical forest (green) and projected deforestation 2010–2030 (red)



Source: Living Planet Report 2018[4]

change. Drylands, for example, support over 30 percent of the global human population including nearly half a billion people who are chronically poor.[59]

The ecological functions and services that biodiversity supports are critical to human wellbeing globally, so all of humanity will ultimately be affected by the degradation of nature and biodiversity loss. More immediately and directly however it is poor rural communities in developing countries who are the most dependent on nature to meet their day-to-day livelihood needs. To illustrate this point, the TEEB came up with the concept of 'GDP of the poor'. Using India as a case study, they showed that the value of forest services, such as fresh water, soil nutrients and non-timber forest products (NTFPs), to national GDP was approximately 7 percent. However, if the contribution of forest services to poor people only was calculated, it was more like 57 percent of GDP.[61]

There are many other examples that highlight specific contributions to livelihoods from natural ecological systems such as forests and fisheries – the productivity of which is underpinned by biodiversity – including:[62]

- A quarter of the world's poor and over 90 percent of people living in extreme poverty depend on forests for some part of their livelihoods.
- Forestry provides more than 10 percent of the GDP in many of the poorest countries and up to 20 percent of export earnings in several developing countries.
- The forestry sector in developing countries provides formal employment for 10 million people and informal employment for a further 30–50 million.
- Fisheries provide employment for over 38 million fishers in developing countries – the majority small-scale – and up to 150 million (particularly women) in associated processing and marketing.
- In low income, food-deficient countries, fish accounts for 22 percent of protein consumption.
- Fisheries products are the largest agricultural export from African LDCs.

Not only are the poor disproportionately dependent on nature and biodiversity for their livelihoods, they are also disproportionately vulnerable to losses because of their limited ability to pay for substitutes. Over a decade ago, the Millennium Ecosystem Assessment warned

"… the harmful effects of the degradation of ecosystem services are being borne disproportionately by the poor, are contributing to the growing inequities and disparities across groups of people, and are sometimes the principal factor causing poverty and social conflict".[63]

Why has the development community largely ignored biodiversity loss?

It is clear that continued biodiversity loss will be a challenge to development, especially in the context of a changing climate. The poorest will be hit not just the hardest and but hit doubly hard due to these interconnected challenges. To date, progress in economic development has been measured as if nature has no value, yet the annual revenue from nature-based resources has been estimated as worth 125 trillion US$.[4] At the same time, much conservation has proceeded without taking local needs and knowledge into account. Yet it is local communities who are the primary stewards of most of Earth's biodiversity.[64] As a result, efforts to protect biodiversity are failing: since the 1970s, there has been a 660 percent increase in protected area coverage yet a 60 percent decline in the global populations of most major animal groups.[65]

Key reasons for the biodiversity conservation–development disconnect include:

Miscommunication and misunderstanding. The biodiversity crisis is usually presented by the popular media in terms of iconic species such as elephants and rhinos potentially going extinct. The development community, understandably, fails to see the connection between the fate of these species and the fortunes of poor people – especially as conservation of such species generally fails to generate adequate benefits for poor people and often disenfranchises them. Yet biodiversity is so much more than charismatic species – a fact that development professionals ignore.

International environmental justice vs national sovereignty. Managing biodiversity, even though it is in global crisis, is generally perceived as a local responsibility. By contrast, climate change is recognised as a situation where emissions generated in the North have disproportionate impacts in the global South. But biodiversity loss is also an issue of environmental injustice. Northern consumption is driving unsustainable use of natural resources through international corporate supply chains, resulting in unjust losses of valuable local assets.

Time lags. It can take a long time for biodiversity loss to have obvious impacts – whether on people or on ecological systems. For example, recent work in Amazonia shows how some forest that appears to be functioning (ie seem to be structurally intact) is unlikely to have any valuable large, carbon rich timber species in the future[66] because hunting has removed the relatively few, but large-bodied and fruit-eating, mammal species needed to disperse seeds of these trees. While everyone can see the impacts of climate change – especially as increasingly frequent and severe extreme weather events – biodiversity loss is taking a toll all around us, almost invisibly. The world keeps turning and the sky hasn't fallen in, but the effects are insidious, often irreversible and longterm.

Complexity masked by simple metrics. Biodiversity is a complex, multi-faced concept which requires systems level thinking. Unlike climate change, where progress can be measure in terms of emissions, tonnes of carbon and degrees of warming, there is no one clear indicator for biodiversity loss (or for conservation success). The indicators that have gained prominence, which focus on endangered species, fail to resonate with the development community.

Responses to biodiversity loss to protect development gains: some first steps

'Nature-proof' development investments. For many years now, development professionals have recognised the need to 'climate-proof' their investments. Similarly, they should understand the risks of biodiversity loss and build biodiversity safeguards into development interventions, particularly investments in infrastructure, extractive industries, large-scale agriculture and tourism.

Take, for example, the high-profile disasters in Brazil's mining sector in November 2015 and February 2019, when dams failed, releasing tailings in toxic mudslides that killed hundreds and caused long-term damage to livelihoods and biodiversity downstream. These events are recognised as safeguarding failures. But they were not just failures in managing the tailings, they were also failures to correctly value the downstream risks to people's lives and livelihoods, and to the biodiversity local people rely on, when it came to corporate decision-making.

Evidence of growing concern can be found in ongoing work to strengthen environmental safeguards, particularly for new infrastructure investment. Some multilateral finance institutions include standards and safeguards for biodiversity management, for example the recently reviewed International Finance Corporation's (IFC's) Performance Standard 6* and the analogous World Bank Environmental and Social Standard 6. Similarly, the EU has developed guidance on 'biodiversity-proofing'** its investments in order to minimise harmful impacts and maximise biodiversity benefits.

Leading fund managers worldwide (including from BlackRock, Goldman Sachs, and Schroders) are now emphasising the central importance of Environment, Social and Governance (ESG) measures, particularly in the investment choices of large sovereign and public sector pension funds. These drive the asset management sector and are willing to trade-off some short-term returns for anticipated long-term sustainability. Such approaches should be extended to all aspects of development intervention – not just to financing.

Invest in biodiversity *for* development and climate change resilience. There is increasing international interest in 'nature-based solutions' to development and climate change challenges.*** However, while the international development sector has long valued the *abundance* of natural resources, it has not valued the *diversity* of the ecosystems that support these resources. This has sometimes resulted in seemingly 'nature-based' solutions that do not in fact protect biodiversity. For example, development projects might support low-cost monocultures (plantations involving single, usually non-native species) over diverse natural ecosystems or agroforestry. This is a problem because, while a monoculture might provide the main resource needed now (food, timber, carbon storage or flood control etc), it offers little resilience, for example to climate change or disease emergence.[13, 14]

A worrying development under the Paris Agreement is that most intentions for 'nature-based solutions' (Article 5.2) involve restoration and afforestation without pledging to use diverse and indigenous species.[67] In Zambia, where monoculture agriculture was prioritised over diverse, traditional systems, an outbreak of army worm in 2016 affected 20 percent of the national, monoculture maize crop, and cost the government over US$ 3 million in pest control.[30] Similarly, large

* www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policiesstandards/performance-standards/ps6
** http://ec.europa.eu/environment/nature/biodiversity/comm2006/proofing.htm
*** See, for example, http://www.naturebasedsolutionsinitiative.org/

scale afforestation programmes on the Loess Plateau in China have involved plantations of single non-native species. While these have been effective at reducing soil erosion, they have compromised water supplies for agriculture and domestic use and have brought fewer ecosystem services overall compared to areas where natural vegetation has been allowed to re-grow.[68]

Investment in biodiversity needs to emphasise diversity not just abundance, and needs to establish and maintain multifunctional landscapes where nature can flourish alongside humans – not one at the expense of the other.[69, 70]

As well as avoiding undermining biodiversity, we need to invest in ways that maximise its potential. Biodiversity directly supports export earnings, GDP and jobs in a wide variety of economic sectors from tourism to agriculture. Biodiversity's role in contributing to – and sustaining – development priorities needs to be better recognised and investments must reflect that recognition. New tools for taking stock of biodiversity's value, for example through natural capital accounting, are gaining momentum and offer a promising way forward.

Invest in biodiversity conservation and restoration in ways that empower rather than disenfranchise the poor. State-owned, strictly protected areas have been a cornerstone of international conservation policy for the past century. But a huge literature documents the disadvantages that many of these bring to neighbouring rural communities in the form of evictions or restricted access to land and resources. Furthermore, their effectiveness in tackling biodiversity loss is questionable, given recorded declines discussed earlier. By contrast, indigenous people and local communities own or manage an estimated 25 percent of the world's land area[64] – far more land than is in formally protected areas – yet they often are unable to protect these areas due to weak rights and tenure regimes, inadequate resources and lack of economic opportunities. Supporting and strengthening policy and practice that recognise rights, enhance equity and draw on local knowledge and stewardship, are key to advancing human wellbeing through conservation – as recognised by the Convention on Biological Diversity and its recent focus on "Other Effective Conservation Measures" (OECMs) alongside traditional protected areas.[71]

Both the Paris Agreement and the emerging post-2020 global biodiversity framework* place increasing emphasis on restoring degraded lands. Noting the caveats highlighted above, this can be an effective way of creating jobs (for example South Africa's well-known Working for Water programme)** or reducing reliance on man-made infrastructure (for example better water management achieved through restoring wetlands or forests) while at the same time enhancing biodiversity. Equally, agroforestry (planting trees among crops or crops within forest) can maintain and even enhance yields in drier more variable climates, while supporting increased biodiversity.[72]

Invest in those components of biodiversity and those sites that are important to poor people. While the world's attention is focussed on charismatic megafauna – particularly those targeted by illegal wildlife trade – it is also important to prioritise the uncharismatic species that matter most to poor people, for example pollinators, soil microbes, traditional crop varieties and species that are important for food or fibre or medicines.

* www.cbd.int/post2020/
* www.environment.gov.za/projectsprogrammes/wfw

A new deal for nature and people, or, making development sustainable again

In 2020 the international community will agree a new 10-year framework for biodiversity management. Developing this new framework into one that works for both biodiversity *and* for people requires much more coordinated thinking and action than has happened to date. Many drivers of biodiversity loss – notably in the agriculture and infrastructure sectors – also drive development gains. But in the long term, biodiversity loss threatens to undermine these gains because biodiversity underpins ecosystem productivity and resilience. The biodiversity crisis is thus a development crisis and demands an engaged response from the development community.

However, improved evidence of biodiversity's effectiveness in supporting sustainable development will not necessarily translate into action on the ground. We also need to know how to effectively govern and finance biodiversity. And we need to consider the political processes that shape which interventions are adopted and why.

One major challenge is the *mismatch between the long-term nature of development needs and the short-term dynamics of governance and decision-making.* For example, engineered infrastructure can be costed and implemented and the benefits measured within a short timeframe, whereas biodiversity can offer long-term flexible solutions but in ways that are harder to measure in conventional planning cycles.

Furthermore, investing in biodiversity to tackle development challenges requires communication and cooperation over multiple sectors and scales of governance. Local situations vary, and differing institutions may need to jointly coordinate resource management over varying geographical or administrative scales. This flexible model of governance is hard to achieve and thus rare.

Despite – and perhaps because of – these challenges, it is critical that we put increased effort into tackling biodiversity loss, in the same way that climate change has achieved political priority (backward moves in some countries notwithstanding). In 2015, the global community agreed the Sustainable Development Goals, setting a policy framework for development to 2030. Pursued in isolation, some of the SDGs could seriously damage biodiversity. Conversely, some biodiversity conservation or restoration strategies could hold back progress towards the SDGs. The forthcoming assessment by the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) will help shape an integrated biodiversity and development agenda for the next decade. It will no doubt emphasise the concerted efforts needed to strengthen coordination between responses to biodiversity loss, climate change and sustainable development, rather than treating them in isolation. Now is the time to put the word 'sustainable' back into the development agenda, but also to make sure people are included in any new agenda for nature and biodiversity.

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From genes to micro-organisms to top predators and even whole ecosystems, we depend on biodiversity for everything from clean air and water to medicines and secure food supplies. Yet human activities are destroying biodiversity around 1000 times faster than natural 'background' rates. This global biodiversity crisis is hitting the poorest communities first and hardest, because they can ill-afford to 'buy in' biodiversity's previously-free goods and services (and are already bearing the brunt of climate change). So why does the development community often ignore biodiversity loss? This paper unpicks misunderstandings and sets out the evidence that biodiversity loss is much more than an environmental problem – it is an urgent development challenge.

IIED is a policy and action research organisation. We promote sustainable development to improve livelihoods and protect the environments on which these livelihoods are built. We specialise in linking local priorities to global challenges. IIED is based in London and works in Africa, Asia, Latin America, the Middle East and the Pacific, with some of the world's most vulnerable people. We work with them to strengthen their voice in the decision-making arenas that affect them – from village councils to international conventions.

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