We pay tribute to a great scientist, collaborator and friend whose research was and continues to be pivotal to the *Living Planet Report* series.

Ben’s research into the impact of a changing environment on the planet’s wildlife was central to the science that underpins our understanding of the world and the life it sustains. Having earned his PhD at the Institute of Zoology and Imperial College London from 2002 to 2005, he joined ZSL in 2005 as a Postdoctoral Research Associate. He went on to lead the Indicators and Assessments Unit, during which time he developed the conceptual and analytical basis for the Living Planet Index. During this time, he also advanced our understanding of the extinction risk of many species and helped develop the sampled approach to the Red List Index, a critical tool for assessing the extinction risk of lesser-known taxonomic groups.

In 2013 Ben moved on to become a lecturer, then reader in biodiversity, at UCL’s Centre for Biodiversity and Environment Research, but his connection to ZSL remained as a collaborator, and supervisor of many PhD and masters students who valued his leadership, knowledge and support. In 2015 he won the prestigious ZSL Marsh Award for Conservation Biology, which acknowledged his contribution to designing and using biodiversity indicators. By then his innovative approaches had been applied and operationalised with numerous worldwide collaborators. His appointments were many and varied, including as an Honorary Research Fellow for UNEP, and a member of multiple IUCN Red List committees.

Ben’s contribution to science is in no doubt. His influential and wide-ranging publications in some of the world’s most high-profile journals are a testament to his passion, great talent, and dedication to conservation science. But it is the kindness and sincerity that he brought to his relationships with his friends, colleagues, students and peers that remains with all of us. Ben brought a great deal of fun and adventure to all that he did, making a mark on all those who crossed his path, and we will miss him dearly.
Biodiversity: A multifaceted concept requires multiple indicators

Biodiversity is often referred to as the ‘web of life’. It is the variety of all living things – plants, animals and micro-organisms – and the ecosystems of which they are a part. It includes diversity within species and between species and can refer to any geographic scale – from a small study plot to the entire planet.

“The biodiversity we see today is the fruit of billions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. It forms the web of life of which we are an integral part and upon which we so fully depend. It also encompasses the variety of ecosystems such as those that occur in deserts, forests, wetlands, mountains, lakes, rivers, and agricultural landscapes. In each ecosystem, living creatures, including humans, form a community, interacting with one another and with the air, water, and soil around them.”

Convention for Biological Diversity

Species, and the natural systems around us, respond to human pressures and conservation interventions in a variety of ways and there is no single measure to capture all these changes. That’s why different metrics and indicators are needed to understand biodiversity change as well as to track progress towards biodiversity targets and to devise effective conservation programmes.

For two decades the Living Planet Index has set out the state of our planet’s biodiversity by tracking a rise or decline in numbers of specific species. Biodiversity has many components, and there is no single measure that can capture all of its changes, so in this LPR we look beyond population abundance and at three other indicators that measure species’ extinction risk, changes in species community composition and changes in species distribution. All show severe declines or changes.

In addition, the direction of abundance trends is only available for a minority of species. For example, the IUCN Red List uses information about species-level increases and decreases as one of the criteria for assessing extinction risk. The Database currently contains this information for 60% of mammals, 64% of amphibians, 92% of birds and 52% of the world’s reptiles. The magnitude of these trends is known for far fewer species. Other taxonomic groups are even less well-monitored. To compensate for this scarcity of observational data, other biodiversity measures and ecological models can be used to track biodiversity change and inform conservation strategies.

To complement the population-based Living Planet Index and put the trends that it measures in a broader context, we have included in this report an overview of three other biodiversity indicators: the Species Habitat Index, measuring changes in species distribution, the IUCN Red List Index which tracks extinction risk, and the Biodiversity Intactness Index that looks at changes in community composition.
Collecting LPI data

The Living Planet Database draws on information from 3,268 data sources. The index is based on relative changes in populations over time so the data can be collected in many ways – ranging from counting the number of individual animals in a herd of wildebeest in Kenya or camera trapping tapirs in Costa Rica and tigers in India, to surveys of nesting sites of songbirds or tracking the traces animals leave behind, for example the tracks of Eurasian lynx in Russia.

Some of these datasets are part of long-term research monitoring programmes. Others are generated as part of citizen science programmes or large-scale monitoring surveys, such as the North American Breeding Bird Survey.

Axel, an intern at The Biodiversity and Education Center, Gamba, replaces a card in a camera trap in Gabon, Africa.
PUTTING THE LPI IN CONTEXT

Distribution: the Species Habitat Index

The Species Habitat Index, an aggregate measure of the extent of suitable habitat available for each species, has been proposed as an additional indicator to help provide a richer picture of both past and projected future biodiversity change. This index captures changes in species range and incorporates information about species habitat preferences, observed or modelled data on habitat loss and restoration, habitat fragmentation and climate change. When used together, species distribution and habitat suitability models can estimate the combined impact of habitat loss and climate change on species, in both the past and the future\textsuperscript{1-12}.

The overall trends in the Species Habitat Index for mammals declined by 22% from 1970 to 2010, with the greatest declines in the Caribbean (>60%). Other regions with declines of more than 25% were Central America, North-East Asia and North Africa\textsuperscript{13}.

Extinction risk: the IUCN Red List of Threatened Species

Thousands of experts periodically assess the extinction risk of nearly 100,000 species using the criteria and categories of the IUCN Red List. Using information on life-history traits, population and distribution size and structure, and their change over time, Red List assessors classify species into one of eight categories (Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern or Data Deficient). As species are reassessed over time, some species may genuinely improve in status owing to conservation action, while others may deteriorate owing to increasing threats. The Red List Index shows the net balance between these factors, and filters out reclassifications owing to improved knowledge or taxonomic revision\textsuperscript{14,15}.

A Red List Index value of 1.0 equates to all species within a group qualifying as Least Concern (i.e. not expected to become Extinct in the near future). An index value of 0 equates to all species having gone Extinct. A constant value over time indicates that the overall extinction risk for the group is unchanged. If the rate of biodiversity loss were reducing, the index would show an upward trend.

Currently, the Red List Index is available for five taxonomic groups in which all species have been assessed at least twice: birds, mammals, amphibians, corals and cycads (an ancient group of plants). Current index values for all groups show declines, indicating that species are moving towards extinction more rapidly.

Thematic versions of the index show that pollinators are in decline (at least among birds and mammals\textsuperscript{16}), and that wild relatives of farmed and domesticated species are also declining, potentially threatening future food security through loss of genetic diversity\textsuperscript{17}.
Composition: the Biodiversity Intactness Index (BII)

The Biodiversity Intactness Index (BII) estimates how much of a region’s originally present biodiversity remains, relative to if the region were still covered with primary vegetation and facing minimal human pressures.

The BII – as an indicator – has been implemented in the PREDICTS modelling framework. It is underpinned by a large global database of local sites facing different pressures. Importantly, the database is reasonably representative in its coverage of both species and terrestrial biomes. With most of the data being on insects and plants, BII is one of the few indicators not predominantly based on vertebrates.

The Index ranges from 100–0% with 100 representing an undisturbed or pristine natural environment with little to no human footprint. The most recent global estimates suggest that the BII fell from 81.6% in 1970 to 78.6% in 2014 (figure 26).

Models that focus on tropical and subtropical forest biomes, using finer-scale land-use data, suggest their BII is both lower and declining more rapidly – from 57.3% in 2001 to 54.9% in 2012 (figure 26). Yet, as alarming as these estimates are, they may be over-optimistic. That’s because the PREDICTS framework does not yet incorporate the effects of climate change or the delayed impacts of land-use change and because global land-use data does not distinguish plantations from natural forest.

A camera trap captures an endangered snow leopard (Panthera uncia) in Hemis National Park, a high altitude national park in the eastern Ladakh region of the state of Jammu and Kashmir in India.

Figure 26: Trends in the Biodiversity Intactness Index (BII)

Dark brown line: Global average BII 1970-2014 from projections made at 0.25-degree scale. Light brown line: Average BII for tropical and subtropical forest biomes 2001-2012 from projections made at 1km resolution.

Key
- Global (using coarse-scale pressure data)
- Tropical forest (using 1km-resolution pressure data)
The immense changes in societies around the globe, especially since the Industrial Revolution, have brought equally immense impacts on nature. Without a dramatic move beyond ‘business as usual’ the current severe decline of the natural systems that support modern societies will continue – with serious consequences for nature and people. With two key global policy processes underway there is currently a unique window of opportunity to reverse the trend – and bend the curve of biodiversity loss. Lessons can be learned from progress towards solving other critical global issues, like climate change, and everyone – governments, business, finance, research, civil society and individuals – has a part to play.

Polar bear jumping on ice, Spitsbergen, Norway.
**BENDING THE CURVE OF BIODIVERSITY LOSS**

Biodiversity has been described as the ‘infrastructure’ that supports all life on Earth. The natural systems and biochemical cycles that biological diversity generates allow the stable functioning of our atmosphere, oceans, forests, landscapes and waterways. They are, simply, a prerequisite for our modern, prosperous human society to exist, and to continue to thrive.

The Rio de Janeiro Earth Summit in 1992 was a critical landmark in mankind’s relationship with nature. For the first time the global community came together and collectively agreed on the importance of the natural world and our responsibility to protect it. In the quarter-century since then, there have been some successes – the recovery of great whale populations and the huge growth in protected areas among them. But these remain isolated wins and, as this report makes clear, the continued decline in species shows that we have failed the natural world.

Many of these changes have been driven by a spiralling increase in our consumption. This has now reached a scale whereby it is interfering profoundly with biodiversity and all the other natural systems.

This 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. This chapter is inspired by a paper that was conceived during the brainstorming for this anniversary edition of the *Living Planet Report* and published on 14 September 2018 in *Nature Sustainability*. The paper – ‘Aiming Higher – bending the curve of biodiversity loss’ – argues that what the world requires is 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. In the paper – and this chapter – the authors stress that without this dramatic change in efforts to reverse the Earth’s ongoing biodiversity decline, the persistent failure to meet conservation and biodiversity targets is likely to continue. If this trend is not reversed there is a question as to whether the Agenda 2030 Sustainable Development Goals (SDGs) can be achieved, including mitigating climate change, adapting to climate impacts, 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.

**A unique opportunity**

Between now and the end of 2020, there is a unique window of opportunity to shape a positive vision for nature and people. The Convention on Biological Diversity (CBD – see box 1), is in the process of setting new goals and targets for the future. These, together with the Sustainable Development Goals, will become the key international frameworks for protecting nature and enhancing biodiversity.

Existing CBD goals and targets are to be achieved by 2020. The 196 countries that are parties to the Convention are currently working on a post-2020 strategic plan with new goals and targets. This provides a vital opportunity to create a bold and achievable plan of action. If the loss of biodiversity is to be halted and reversed, this opportunity must be seized.

Although the CBD has a vision for 2050 (box 1), currently there are no biodiversity policy commitments beyond 2030. However, because of the nature of the challenge we face, it’s critical to consider a longer timescale. When wildlife populations and habitats are damaged, or lost, some kinds of recovery can take decades. Also, the intensity of some threats, such as climate change, will increase after 2030. Climate change targets are routinely set for 2050 and 2080, recognizing the long-term dynamics of the climate system. Species and ecosystems also demonstrate dynamics that may play out over decades to centuries, hence longer-term goals, supported by policy commitments, are also crucial.

Despite numerous international scientific studies and policy agreements confirming that the conservation and sustainable use of biological diversity is a global priority, worldwide trends in biodiversity continue to decline. Figure 27 shows starkly how poorly natural systems have fared since internationally agreed policy commitments such as the CBD targets came into force. However, it also offers a vision for the future: if we aim higher and move away from business as usual, implementing approaches designed to restore nature rather than simply tracking a managed decline, then we can achieve a healthier, more sustainable world that is good for people as well as our natural systems.

**Setting a clear global biodiversity target, turning our knowledge into greater action for bigger impact**


**People will need a resilient basis for the food, fuel and fibre that future generations of people can achieve a healthier, more sustainable world that is good for people as well as our natural systems.**

**WE NEED TO AIM HIGHER, AND DO BETTER, TO PROTECT AND RESTORE OUR LIFE SUPPORT SYSTEMS – TO BEND THE CURVE OF BIODIVERSITY LOSS. THIS MEANS GOING BEYOND BUSINESS AS USUAL.**

**Chapter 4: Aiming higher: what future do we want? page 111**
Box 1: The Convention on Biological Diversity and the Aichi Targets

At the 1992 Rio Earth Summit, two binding agreements were initiated: the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD). The CBD was the first global agreement on the conservation and sustainable use of biological diversity and came into force in 1993. Every country in the world, except the USA, is now a Party to the Convention. While the CBD sets overall goals and policies with general obligations, the responsibility for achieving these goals rests largely with countries themselves.

The current CBD Strategic Plan for Biodiversity (2011–2020) is intended to be an overarching framework for biodiversity conservation, not only for the biodiversity-related conventions, but for the entire UN system and all other partners engaged in biodiversity management and policy development. The plan includes a long-term 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.”

To meet this vision the CBD, through agreement with the Parties, has developed a set of five medium-term strategic goals with 20 targets – called the Aichi Targets.

**Goal C** is “To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity” and includes three targets.

**Target 11** concerns the global coverage of protected areas

**Target 12** is directed at the conservation of species

**Target 13** concerns the conservation of genetic diversity of cultivated plants, farmed and domesticated animals, and their wild relatives

Target 12 is the most direct and straightforward measure of biodiversity, and metrics exist at global scale that have already been adopted by the CBD in various assessment processes. It states, “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.” The target is only directed at “known threatened species” – those listed as Critically Endangered, Endangered or Vulnerable on the IUCN Red List (www.iucnredlist.org). In 2017 this was just over 25,000 species, out of over 60,000 that have been assessed for the Red List. Note that this is only a small proportion of all known species (more than 1.3 million) and a sample that is strongly biased towards terrestrial and large-bodied vertebrates.

To meet Target 12, none of these threatened species should have gone extinct, and those species in steepest decline should show improvements in their status by at least moving to a category of lower threat (see Chapter 2 for more details about these categories).
Box 2: The UN Sustainable Development Goals

On 1 January 2016, the 17 Sustainable Development Goals (SDGs) with their accompanying 169 targets came into force. These underpin the UN-led 2030 Agenda for Sustainable Development. Collectively, they represent a hugely ambitious blueprint for the sustainable future of humanity on this planet with the aspirational pledge “that no one will be left behind”. Critically, they are defined as being “integrated and indivisible”, meaning that countries are not able to pick and choose which elements to address but must work towards the achievement of them all. Collectively, they also balance the three dimensions of sustainable development: environmental, social and economic. The stated aim is that the SDGs will be delivered by 2030, although some targets, and especially the environmental targets, have end dates of 2020.

Within the preamble the signatories declare that they will “protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations”.

This commitment is translated into 3 of the 17 goals that are specifically directed at the natural world:

**Goal 13 (Climate change):** Take urgent action to combat climate change and its impacts.

**Goal 14 (Life below water):** Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

**Goal 15 (Life on land):** Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Both Goals 14 and 15 have specific targets directed at reducing threats, securing ecosystem functions and services, and supporting the flows of benefits from biodiversity to people. One target in Goal 15 concerns the state of biodiversity itself (“Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species”). This target reflects Aichi Target 12. There is no equivalent target in Goal 14 (Life below water) but we can infer that the goal of halting biodiversity loss also applies to species living in the oceans.

Halting biodiversity loss is a more ambitious target than the Aichi Target of preventing the extinction and improving the status of known threatened species, because it concerns all species and is not restricted to extinction risk alone. Halting the “loss of biodiversity” should be interpreted as also halting declines in abundance and distribution of species, as well as the structure and functioning of biological communities.

Collectively, the Sustainable Development Goals aspire to take us towards ‘the world we want’ and the UN frames them as creating a “blueprint to achieve a better and more sustainable future for all”. Figure 28 explores these SDGs in more detail. Although the 17 Goals are presented separately, they are not independent of each other. Johan Rockström and Pavan Sukhdev modified an infographic developed by the science director of the Stockholm Resilience Centre, Carl Folke, and others to present new way of viewing the Sustainable Development Goals and to show how they are all linked to food.

This framework emphasizes that, given pressing needs to simultaneously avoid dangerous climate change, feed the world’s growing population and restore biodiversity, cross-cutting solutions are crucial. These must 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.
Box 3: Global biodiversity commitments to 2020, 2030 and 2050 enshrined in the CBD and SDG frameworks

Convention on Biological Diversity

**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 vision).**

**CBD Aichi target 5:** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

**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.

Sustainable Development Goals

**SDG 14:** Conserve and sustainably use the oceans, seas and marine resources.

**SDG 15:** Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

**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.

NB. Although the SDGs are set to 2030, some biodiversity-related targets give 2020 as an end date. Given the difficulty of abruptly halting current trends, we suggest 2030 for the two biodiversity-related SDG targets.

A roadmap for 2020 to 2050

As well as the existing global targets, many regional, national and local initiatives and projects aim to protect biodiversity. Given the continuing loss of nature as shown in figure 27, however, it’s clear that these efforts are not enough. So, what will it take to ‘bend the curve’ of biodiversity loss?

We can learn lessons from other critical global issues as we develop a roadmap for reaching biodiversity goals and obtaining national commitments with appropriate levels of ambition. For climate change, the world has mobilized around one clearly specified goal – keeping global warming below 2°C. Future climate targets are based on scenario analyses that identify the most impactful suite of actions to achieve this long-term goal. For example, the climate stabilization ‘wedges’ were developed as a portfolio of available technologies that could collectively achieve the necessary cuts in greenhouse gas emissions over a 50-year period. The wedge approach has also been successfully applied to other environmental challenges, such as water stress.

The SDG process has similarly focused on motivating societal engagement around its 17 goals, building buy-in for an integrated agenda. 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.

In the *Aiming Higher* paper, the authors 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. Here we describe each of them.

**Step 1: Translate the aspirational vision to an ambitious goal**

The first step in the development of a biodiversity roadmap is to specify the goal.

The current CBD vision is that “By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people.”
When it was written, it was an aspirational vision for the future. The Aiming Higher paper argues that this vision is concrete and achievable enough to be the basis of the goal of a post-2020 agreement on biodiversity. Achieving this ambitious goal will require a new set of targets that aim higher and are effective beyond 2020.

**Step 2: Identify ways to measure progress towards the goal**

Keeping track of the status of biodiversity, and progress towards targets, requires suitable indicators. Since the current targets were set, almost a decade ago, there has been an explosion of these, so the second step is to identify the best metrics to measure true progress towards the chosen goal.

Measuring progress towards biodiversity targets is more complicated than tracking progress under the Paris Climate Agreement on greenhouse gas emission reductions. Biodiversity assessment requires multiple measures at different spatial scales and across different ecological dimensions. The different metrics that are in common use capture different properties of biodiversity, and their responses to pressures vary. Mace et al. has argued for indicators that can track three key dimensions of biodiversity necessary for the vision and the goals described here, and in the CBD and SDG targets:

1. **Changes in population abundance:** Trends in the abundance of wild species are well captured by population-level indicators such as the Living Planet Index (LPI).

2. **Extinction rate on a global scale:** The extent to which species are threatened with the risk of extinction is estimated by the Red List Index (RLI).

3. **Changes to local biodiversity:** Changes in the ‘health’ of ecosystems can be estimated by comparing what currently exists with what once existed in a given place using indicators such as the Biodiversity Intactness Index (BII).

The required trajectories for these three biodiversity indicators are shown in figure 29.

**Figure 29:** Required trajectories for the three proposed biodiversity indicators reflecting conservation status (i.e., 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 in Box 3. These curves would represent a successful recovery and restoration of nature. Note that while the curves are based on recent data and analyses they are necessarily approximate and so the indicator axes do not have figures attached to them.

The two top graphs show lines for both threatened and all species because preventing extinction is the aim of the current Aichi Target 12 and is an absolute measure of conservation success or failure. In the bottom graph, we have included biomes as tracking changes to biomes is critical to Aichi Target 5. There is also a line for ecoregions, as these are used within Target 11 as part of the element on protected areas and to ensure that biodiversity in different areas of the world is equally represented (see boxes 1, 2 and 3 for more information about all these targets).
These three indicators are by no means the only indicators that could be used. However, they have the advantage of already being applied widely in the scientific and policy communities and of being globally relevant and robust. Their methodologies have been peer-reviewed for scientific publication. There is extensive data behind each one, with global coverage; and they have open-access methods and datasets that are continually being refreshed and expanded. If they are to be used to support concrete global action, there is a need to improve taxonomic representativeness, integration and data coverage. A clear policy process could act as a spur to improve and build on the underlying datasets.

**Step 3: Identify actions to deliver the required transformation in global biodiversity**

Scenarios and models can help scientists to visualize and explore how alternative actions affect the dynamic interdependencies between nature, nature’s benefits to people and quality of life. The CBD Global Biodiversity Outlook 4 report represents one of the more recent authoritative assessments of biodiversity status and trends. Scenario and projection models have also started to explore future biodiversity impacts associated with climate change scenarios as well as scenarios where the Sustainable Development Goals are met through changes in factors such as production, consumption, waste, protected areas and forestry.

Global projections, scenarios and models of ecosystems provide insights into the trajectory of change in biodiversity and ecosystem services over the coming century on land, in the sea and, still to a much lesser extent, in fresh water (reviewed in Tittensor et al. 2017). However, the challenge we face is that we not only need to identify potential pathways that will allow us to restore biodiversity, we also need to achieve the necessary transformation while feeding a still-growing population under the accelerating effects of climate change in a rapidly changing world. Therefore, although traditional biodiversity conservation interventions such as protected areas and species conservation planning remain crucial, action must also address the major drivers of biodiversity loss and ecosystem change, such as agriculture and overexploitation.

Guided by these analyses, integrative policies for sustainable consumption and production (such as changing modern (Western) diets to contain less meat) can benefit biodiversity, climate and food supply. Their role in policy-making is examined in more detail in the next section.
How scenarios can imagine the future and help to create good policy

David Leclère, International Institute for Applied Systems Analysis (IIASA)

Scenario analysis and modelling play an important role in building visions of the future based on different policy choices and actions. Models are simplified representations of the real world, based on available knowledge. They allow exploring the possible future states of biodiversity, under a set of assumptions concerning future human actions and environmental conditions, referred to as scenarios. As such, scenarios and models are vital tools for building a biodiversity roadmap, and can be used to combine the best available scientific, indigenous and local knowledge in assessments and to support decision-making at various stages of the policy cycle (Figure 30).

Exploratory scenarios can help set an agenda by examining a range of plausible futures, often based on possible storylines. These provide a means of framing what to expect in the future and with level of certainty, depending on which storyline materializes or how uncertain our knowledge is.

Intervention scenarios show alternative ways to reach an agreed-upon target.

Target-seeking scenarios inform the policy design phase by exploring what actions and preconditions could allow reaching a given target. During policy implementation, policy-screening scenarios can represent potential outcomes of alternative policy options.

Retrospective policy evaluation provides a gap analysis by comparing the observed trajectories of implemented policies to scenarios that would have achieved the intended target.

Models and scenarios can help in designing policy roadmaps, but their use in contexts that link nature and human wellbeing has so far been hampered by the complexity associated with projections of pressures, subsequent biodiversity responses, and how these would affect human wellbeing. In addition, the many targets of the sustainable development agenda are interrelated, and identifying actions that avoid trade-offs and exploit synergies remains challenging in terms of how much knowledge needs to be integrated. More comprehensive models are therefore needed and foundations for this work are under way through initiatives such as the IPBES Modelling and Scenarios Task Force and specific projects such as the climate change-oriented Inter-Sectoral Impact Model Intercomparison Project (reviewed in Tittensor et al. 2017).

These will need to be scaled up and broadened to incorporate biodiversity as an integral component of the models, to better represent interactions between ecological, social and economic factors but also to increase their relevance for various stakeholders at multiple scales.

Figure 30: Illustration of the use of models and scenarios at various stages of the policy cycle

In all cases, models mobilize available knowledge to link future biodiversity states to assumptions about future actions or environmental conditions. These can then be explored using different scenarios. Figure reproduced from 25.
THE PATH AHEAD

The evidence becomes stronger every day that humanity’s survival depends on our natural systems, yet we continue to destroy the health of nature at an alarming rate. It’s clear that efforts to stem the loss of biodiversity have not worked and business as usual will amount to, at best, a continued, managed decline. That’s why we, along with conservation and science colleagues around the world, are calling for the most ambitious international agreement yet – a new global deal for nature and people – to bend the curve of biodiversity loss. Decision-makers at every level from individuals to communities, countries and companies need to make the right political, financial and consumer choices to realize the vision that humanity and nature can thrive. This vision is possible with strong leadership from us all.

A male Bengal tiger (Panthera tigris tigris) in Kanha National Park, Madhya Pradesh, India.
NATURE IS OUR HOME

Reframing the debate

This *Living Planet Report* joins an ever-increasing number of research and policy papers building the case that our planet’s natural systems are fundamental to our society. Underpinning our health, wealth, food and security they are core to our existence, not just a ‘nice to have’.

This report’s Living Planet Index also outlines how much nature we are losing. It shows an overall decline of 60% in species population sizes between 1970 and 2014, while current rates of species extinctions are 100 to 1,000 times higher than the background rate (the extinction before human pressure became a prominent factor). Other indicators measuring different changes in biodiversity all paint the same picture – that of dramatic, continued loss.

Yet, the future of millions of species on Earth seems not to have captured the imagination or attention of the world’s leaders enough to catalyse the change necessary. We need to radically escalate the political relevance of nature and galvanize a cohesive movement across state and non-state actors to drive change, to ensure that public and private decision-makers understand that business as usual is not an option.

Between now and 2020, a year when global leaders will make key decisions on biodiversity, climate and sustainable development, we have a unique opportunity to build momentum towards the most ambitious deal yet – one that provides a blueprint for biodiversity and for people to 2050 and beyond.

A global deal for nature and people

Indeed, in 2017, almost 50 conservation scientists challenged the business-as-usual approach, calling for a far more ambitious response to the extinction crisis. They published a paper proposing a new ‘Global Deal for Nature’ as a “companion to the Paris Climate Agreement to promote increased habitat protection and restoration, national and ecoregion scale conservation strategies, and the empowerment of indigenous peoples to protect their sovereign lands.”

As an idea it has fast gained momentum. Bending the curve of biodiversity loss – with a new framework for biodiversity that can start to reverse the loss of nature by 2030 – needs to be at its core. Such a deal is essential not just for nature but for people too, because addressing the decline in natural systems is key to achieving the 2030 agenda for Sustainable Development and the Paris Agreement on Climate Change.

Imagining the future: Scenarios and leadership for the future we want

In our contribution to this ambitious pathway, WWF is collaborating with a consortium of almost 40 universities, conservation organizations and intergovernmental organizations to launch the research initiative Bending the Curve of Biodiversity Loss.

Models and scenarios can assist in mapping the best path ahead. This critical work will explicitly include biodiversity in future systems modelling, helping us to identify potential win-win solutions for both nature and people. These new models will form the cornerstone of a future edition of the *Living Planet Report*.

We are proud to be a part of this collective initiative. We all need to embrace this ambition. Piecing together the biggest threats to nature means that we can better protect it. Not much time is left.

WE ARE THE FIRST GENERATION THAT HAS A CLEAR PICTURE OF THE VALUE OF NATURE AND THE ENORMOUS IMPACT WE HAVE ON IT. WE MAY ALSO BE THE LAST THAT CAN ACT TO REVERSE THIS TREND. FROM NOW UNTIL 2020 WILL BE A DECISIVE MOMENT IN HISTORY.
CHILDREN AND NATURE

5. Celebrating nature

In Southern Myanmar this local community is celebrating seven new community forests in the region with a traditional Karen dance, and children are encouraged to participate. Ceremonies are an important part of almost all traditional cultures. In some cases they celebrate a good harvest, others strengthen connections with less visible aspects of the environment, such as holy places.
Chapter 1: Why biodiversity matters

1 TEEB. The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB. (European Commission, Brussels, Belgium, 2010).


10 Cooper, E., Burke, L. & Bood, N. The contribution of Belize’s Coral Reefs and Mangroves. (WRI), Washington, DC, USA, 2009).


15 O'Brien, L. TEEB. The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB. (European Commission, Brussels, Belgium, 2010).


19 Rosen, M. Stop saying that 2016 was the ‘worst year’. Washington Post 29th December 2016 (2016).


21 IPBES. Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for the Americas of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 41 (IPBES Secretariat, Bonn, Germany, 2018).

22 IPBES. Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Africa of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 49 (IPBES Secretariat, Bonn, Germany, 2018).

23 IPBES. Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Asia and the Pacific of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 48 (IPBES Secretariat, Bonn, Germany, 2018).

24 IPBES. Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Asia and the Pacific of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 48 (IPBES Secretariat, Bonn, Germany, 2018).


27 IPBES. Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Asia and the Pacific of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 48 (IPBES Secretariat, Bonn, Germany, 2018).

28 Reference page 131
Chapter 2: The threats and pressures wiping out our world


10. ESA. Sentinel Online data portal <https://sentinel.esa.int/web/sentinel/home> European Space Agency (ESA), EO Ground Segment and Mission Operations Department, EO Common Services Section, Rome, Italy, 2018.


Chapter 3: Biodiversity in a changing world


Chapter 4: Aiming higher: what future do we want?


17 CBD. *Global Biodiversity Outlook 4* (Convention on Biological Diversity, Montréal, Canada, 2014).


23 IPBES. *Summary for policymakers of the methodological assessment of scenarios and models of biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany, 2016).


25 IPBES. *The methodological assessment report on scenarios and models of biodiversity and ecosystem services* (Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2016).
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Biodiversity is essential for our health, wellbeing, food and security as well as the stability of economic and political systems worldwide.

Biodiversity

The Living Planet Index, which measures biodiversity abundance levels based on 16,704 populations of 4,005 vertebrate species across the globe, shows an overall decline of 60% since 1970.

AIMING HIGHER

A new global deal for nature and people, with clear, ambitious goals, targets and metrics, is needed to bend the curve of biodiversity loss.

THREATS

The biggest drivers of current biodiversity loss are overexploitation and agriculture, both of which are the result of continually increasing human consumption.

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To stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature.

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