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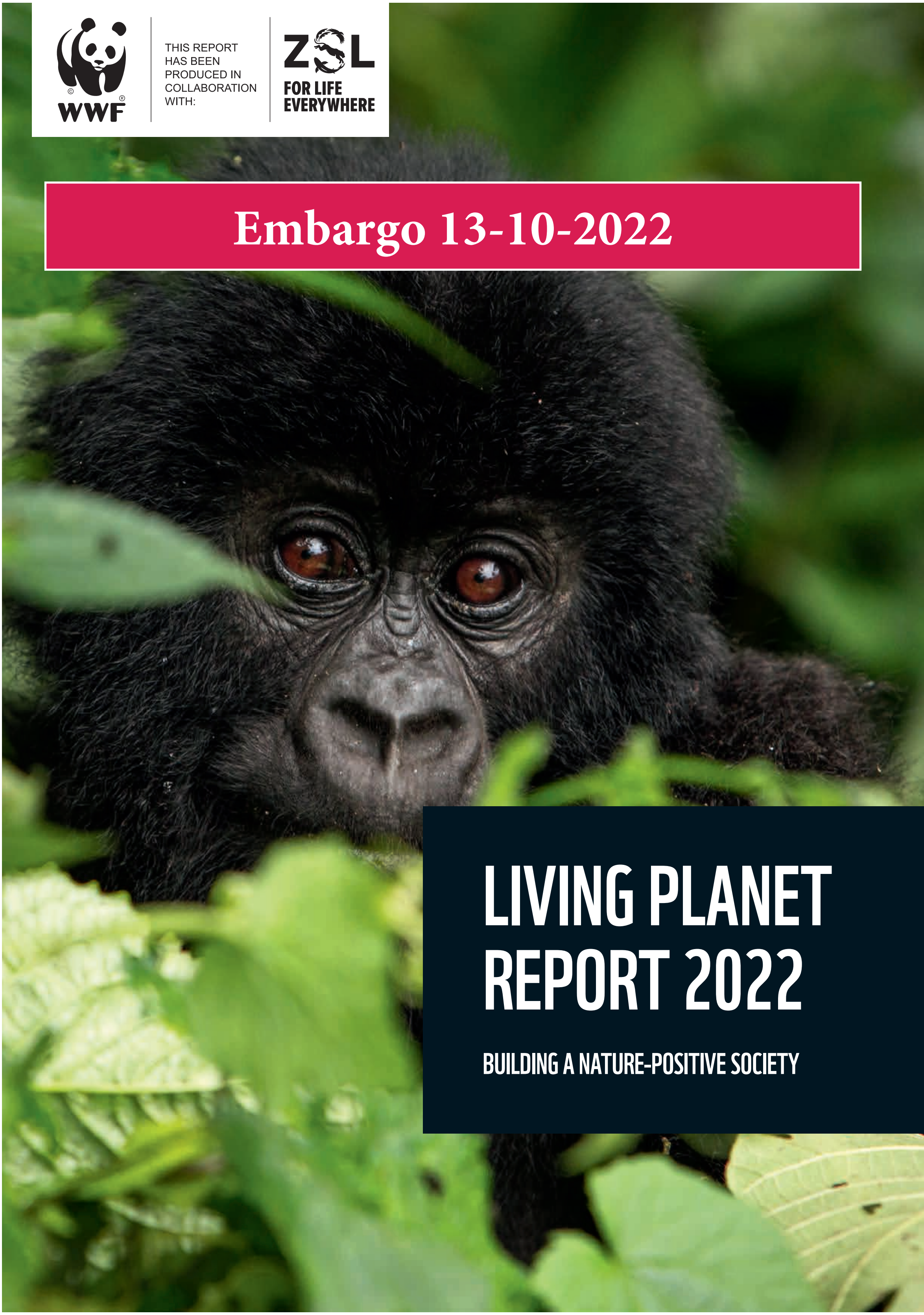

LIVING PLANET REPORT 2022

BUILDING A NATURE-POSITIVE SOCIETY

WWF

WWF is an independent conservation organisation, with more than 35 million followers and a global network active through local leadership in over 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which people live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

ZSL (Zoological Society of London) Institute of Zoology

ZSL is a global science-led conservation organisation helping people and wildlife live better together to restore the wonder and diversity of life everywhere. It is a powerful movement of conservationists for the living world, working together to save animals on the brink of extinction and those which could be next.

ZSL manages the Living Planet Index in a collaborative partnership with WWF.

Citation

WWF (2022) *Living Planet Report 2022 – Building a nature-positive society*. Almond, R.E.A., Grooten, M., Juffe Bignoli, D. & Petersen, T. (Eds). WWF, Gland, Switzerland.

Design and infographics by: peer&dedigitalesupermarkt

Cover photograph: © Paul Robinson

Mountain gorilla (*Gorilla beringei beringei*) in the Virunga National Park, Democratic Republic of Congo.

ISBN 978-2-88085-316-7

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Special thanks
We thank everyone for providing us with ideas, support, and inspiration for the content for this *Living Planet Report* edition: Jonathan Baillie (On The EDGE Conservation), Karina Berg (WWF-Brazil), Carina Borgström-Hansson (WWF-Sweden), Angela Brennan (University of British Columbia, Vancouver), Tom Brooks (IUCN), Stuart Chapman (WWF-Nepal), Thandiwe Chikomo (WWF-NL), Trin Custodio (WWF-Philippines), Smriti Dahal (WWF-Myanmar), Victoria Elias (WWF-Russia), Kenneth Er (National Parks Board, Singapore), Wendy Foden (South African National Parks - SANParks), Jessika Garcia (Coordinator of Indigenous Organizations of the Amazon River Basin – COICA), Bernardo Hachet (WWF-Ecuador), Kurt Holle (WWF-Peru), Chris Johnson (WWF-Australia), Lydia Kibarid (Lensational), Margaret Kinnaird (WWF-Kenya), Margaret Kuhlow (WWF International), Matt Larsen-Daw (WWF-UK), Ryan Lee (National Parks Board, Singapore), Nan Li (Linan) (WWF-China), Eve Lucas (Royal Botanic Gardens Kew), Abel Musumali (Climate Smart Agriculture Alliance), Tubalemye Mutwale (WWF International), Mariana Napolitano Ferreira (WWF-Brazil), Luis Naranjo (WWF-Colombia), Deon Nel (WWF-NL), Hein Ngo (FAO), Eleanor O'Leary (WWF International), Sile Obroin (FAO), Sana Okayasu (Wageningen University & Research), Jeff Opperman (WWF International), Pablo Pacheco (WWF International), Jon Paul Rodriguez (IUCN SSC and Venezuelan Institute for Scientific Investigations), Kavita Prakash-Marni (Mandai Nature), Karen Richards (WWF International), Luis Roman (WWF-Peru), Kirsten Schuijt (WWF-NL), Lauren Simmons (WWF-UK), Jessica Smith (UNEP Finance Initiative), Carolina Soto Navarro (UNEP-WCMC), Jessica Thorn (University of York), Derek Tittensor (Dalhousie University), Analis Vergara (WWF-US), Piero Visconti (International Institute for Applied Systems Analysis), Anthony Waldron (University of Cambridge), Gabriela Yamaguchi (WWF-Brazil)

We would also like to thank Stefanie Deinet and everyone who kindly shared data, specifically those who supported data collection in the last two years: The Threatened Species Index team and network; Paula Hanna Valdujo and Helga Correa Wiederhecker (WWF-Brazil); Mariana Paschoalini Frias (Instituto Aqualie/ WWF-Brazil consultant); Elildo Alves Ribeiro De Carvalho Junior (Programa Monitora/ICMBio); Luciana Moreira Lobo (KRAV Consultoria Ambiental/WWF-Brazil consultant); Felipe Serrano, Marcio Martins, Eletra de Souza, João Paulo Vieira-Alencar, Juan Camilo Díaz-Ricaurte, Ricardo Luria-Manzano (University of São Paulo)

LIVING PLANET REPORT 2022

BUILDING A NATURE-POSITIVE SOCIETY

EXECUTIVE SUMMARY

Today we face the double, interlinked emergencies of human-induced climate change and the loss of biodiversity, threatening the well-being of current and future generations. As our future is critically dependent on biodiversity and a stable climate, it is essential that we understand how nature's decline and climate change are connected.

The nature of these connections, the impacts they have on people and biodiversity, and building a positive, equitable, and sustainable future, are key themes in this edition of the *Living Planet Report*. In addressing these complex, interlinked challenges we recognise that there is no one-size-fits-all solution, nor one single source of knowledge. To create this edition, we have therefore woven together multiple voices and drawn on different sources of knowledge from around the world.

Land-use change is still the biggest current threat to nature, destroying or fragmenting the natural habitats of many plant and animal species on land, in freshwater and in the sea. However, if we are unable to limit warming to 1.5°C, climate change is likely to become the dominant cause of biodiversity loss in the coming decades. Rising temperatures are already driving mass mortality events, as well as the first extinctions of entire species. Every degree of warming is expected to increase these losses and the impact they have on people. We feature 3 stories of people on the frontline and how they are dealing with the consequences of local changes in climate and biodiversity.

Biodiversity indicators help us understand how our natural world is changing over time. Tracking the health of nature over almost 50 years, the Living Planet Index acts as an early warning indicator by tracking trends in the abundance of mammals, fish, reptiles, birds and amphibians around the world.

In its most comprehensive finding to date, this edition shows an average 69% decline in the relative abundance of monitored wildlife populations around the world between 1970 and 2018. Latin America shows the greatest regional decline in average population abundance (94%), while freshwater species populations have seen the greatest overall global decline (83%).

New mapping analysis techniques allow us to build up a more comprehensive picture of both the speed and the scale of changes in biodiversity and climate. For example, we feature the new biodiversity risk maps generated for the IPCC Working Group 2 report published in February 2022. These maps are the result of decades of work which has involved more than 1 million hours of computer time. We also explore an analysis using data from the IUCN Red List which allows us to overlay six key threats – agriculture, hunting, logging, pollution, invasive species and climate change – to highlight 'threat hotspots' for terrestrial vertebrates.

To help us imagine a future where people and nature can thrive, scenarios and models – such as the Bending the Curve work featured in the *2020 Living Planet Report* – can create 'menus' that indicate how we can most effectively address biodiversity loss under a range of climate and development scenarios. Now, researchers are exploring new lenses to add to this work, including the integration of equity and fairness. This could help to better target the urgent and unprecedented action needed to change our business-as-usual trajectory.

We know that transformational change – game-changing shifts – will be essential to put theory into practice. We need system-wide changes in how we produce and consume, the technology we use, and our economic and financial systems. Underpinning these changes must be a move from goals and targets to values and rights, in policy-making and in day-to-day life.

To catalyse this, in 2022, the United Nations General Assembly recognised that everyone, everywhere, has the right to live in a clean, healthy and sustainable environment, meaning that for those in power respecting this is no longer an option but an obligation. Although not legally binding, the UN resolution is expected to accelerate action, just as earlier resolutions on the right to water in 2010 turbocharged progress in delivering safe water to millions of people.

This edition of the *Living Planet Report* confirms the planet is in the midst of a biodiversity and climate crisis, and that we have a last chance to act. This goes beyond conservation. A nature-positive future needs transformative - game changing - shifts in how we produce, how we consume, how we govern, and what we finance. We hope it inspires you to be part of that change.

CODE RED FOR THE PLANET (AND HUMANITY)

The message is clear and the lights are flashing red. Our most comprehensive report ever on the state of global vertebrate wildlife populations presents terrifying figures: a shocking two-thirds decline in the global Living Planet Index less than 50 years. And this comes at a time when we are finally beginning to understand the deepening impacts of the interlinked climate and nature crises, and the fundamental role biodiversity plays in maintaining the health, productivity and stability of the many natural systems we and all life on Earth depend on. The COVID-19 pandemic has given many of us a new awareness of our vulnerability. This is beginning to challenge the unthinking assumption that we can continue to dominate the natural world irresponsibly, taking nature for granted, exploiting its resources wastefully and unsustainably, and distributing them unevenly without facing any consequences.

Today, we know that there are consequences. Some of them are already here: the loss of lives and economic assets from extreme weather; aggravated poverty and food insecurity from droughts and floods; social unrest and increased migration flows; and zoonotic diseases that bring the whole world to its knees. Nature loss is now rarely perceived as a purely moral or ecological issue, with a broadened sense of its vital importance to our economy, social stability, individual well-being and health, and as a matter of justice. The most vulnerable populations are already the most affected by environmental damage, and we are leaving a terrible legacy to our children and future generations to come. We need a global plan for nature, as we have for climate.

A global goal for nature: nature positive

We know what's happening, we know the risks and we know the solutions. What we urgently need now is a plan that unites the world in dealing with this existential challenge. A plan that is agreed globally and implemented locally. A plan that clearly sets a measurable and time-bound global goal for nature as the 2016 Paris accord, with the net-zero emissions goal by 2050, did for climate. But what can be the 'net-zero emissions' equivalent for biodiversity?

Achieving net-zero loss for nature is certainly not enough; we need a nature- or net-positive goal to restore nature and not simply halt its loss. Firstly, because we have lost and continue to lose so much nature at such a speed that we need this higher ambition. And, secondly, because nature has shown us that it can bounce back – and quickly – if given a chance. We have many local examples of nature and wildlife comebacks, whether it is forests or wetlands, tigers or tuna, bees or earthworms.

We need nature positive by 2030 – which, in simple terms, means more nature by the end of this decade than at its start (see the explanatory infographic on page 100). More natural forests, more fish in the ocean and river systems, more pollinators in our farmlands, more biodiversity worldwide. A nature-positive future will bring countless benefits to human and economic well-being, including to our climate, food and water security. Together, the complementary goals of net-zero emissions by 2050 and net-positive biodiversity by 2030 represent the compass to guide us towards a safe future for humanity, to shift to a sustainable development model, to support the delivery of the 2030 Sustainable Development Goals.

Unmissable opportunity

For me, for WWF, and for many other organizations and a growing number of country and business leaders (e.g. the Leaders' Pledge for Nature group of 93 heads of state and the President of the European Commission, and the Business For Nature, the Taskforce on Nature-Related Financial Disclosure and the Finance for Biodiversity coalitions), agreeing on a nature-positive global goal is crucial and urgent.

World leaders have an unmissable opportunity in December 2022 to embrace a nature-positive mission at the long-awaited 15th conference of the UN Convention on Biological Diversity (COP15) in Montreal, Canada, under the presidency of China. This is key to ensuring the right level of ambition and measurability in the goals and targets of the agreement.

It is key to mobilizing and aligning governments, communities, businesses, financial institutions and even consumers towards contributing to the same shared global goal, inspiring a whole-of-society approach. And it is key to injecting the same high degree of accountability that we are beginning to witness around climate action.

Just as the global goal of 'net-zero emissions by 2050' is disrupting the energy sector so that it shifts towards renewables, 'nature positive by 2030' will disrupt the sectors that are drivers of nature loss – agriculture, fishing, forestry, infrastructure and extractives – driving innovation and acceleration towards sustainable production and consumption behaviours.

Our society is at the most important fork in its history, and is facing its deepest systems change challenge around what is perhaps the most existential of all our relationships: the one with nature. And all this at a time when we are beginning to understand that we depend on nature much more than nature depends on us. The COP15 biodiversity conference can be the moment when the world comes together on nature.

Marco Lambertini,

Director General
WWF International

Bengal tiger (*Panthera tigris tigris*) mother with cub age four months, Ranthambhore, Rajhasthan, India.

SETTING THE SCENE

Mike Barrett (WWF-UK),
Elaine Geyer-Allély (WWF International)
and Matt Walpole (WWF International)

This report presents the largest dataset yet from the Living Planet Index, and the most comprehensive analysis of the global state of nature from a wide array of voices and perspectives. The findings are stark. While we need to urgently act to restore the health of the natural world, there is no sign that the loss of nature is being halted, let alone reversed. The declining trend in vertebrate populations continues, despite an array of political and private sector commitments. Data gathered from almost 32,000 populations of 5,230 species across the planet leaves no doubt that the UN Decade on Biodiversity, meant to implement broad-based action to transform society's relationship with nature, has fallen far short of what is needed.

The impacts of the global nature and climate emergency are already being felt: displacement and deaths from increasingly frequent extreme weather events, increasing food insecurity, depleted soils, a lack of access to fresh water, and an increase in the spread of zoonotic diseases to name just a few. These impacts affect all of us but fall disproportionately on the poorest and most marginalised people.

One part of the world from where we have included significantly more data is Latin America, not least the Amazon. And we also showcase studies from the region. This is of particular significance as rates of deforestation are increasing. We have already lost 17% of the original extent of the forest and an additional 17% has been degraded[163]. The latest research indicates that we are rapidly approaching a tipping point beyond which our largest tropical rainforest will no longer function[176]. This lays bare some of the challenges we face, ranging from the direct impacts of land grabbing and habitat conversion on people and wildlife, to changes in rainfall and soils and the catastrophic impact these have on global efforts to avert extreme climate change.

We need to urgently ramp up mitigation actions to avert a dangerous rise in global temperatures beyond 1.5°C, and to help people adapt to the climate change we are already experiencing. We need to restore nature and the environmental services it provides – both the tangible provision of our clean air, fresh water, food, fuel and fibre; and also the many intangible ways in which nature contributes to our lives and well-being.

Finally, we need an inclusive 'whole of society' approach that empowers each of us to act, recognises the plurality of values and knowledge systems that can put us on a more sustainable path, and ensures that the costs and benefits from our actions are socially just and equitably shared.

This edition of the *Living Planet Report* makes a start in that direction by bringing multiple values, voices, and kinds of evidence to bear to show that change is still possible, from our individual, day-to-day choices to global change, especially in our food, finance and governance systems.

The landmark recognition in July 2022 by the UN General Assembly of the right to a healthy environment cements our understanding that climate breakdown, nature loss, pollution and the pandemic are human rights crises. And as the UN Sustainable Development Goals prescribe, we can only achieve a fair, green and prosperous future if we find integrated solutions to the humanitarian and environmental challenges we face. By recognising the links between interconnected crises, we stand a better chance of being able to remedy them.

The United Nations meets in Montreal in December 2022 to agree a new Global Framework for Biodiversity. This is the last chance we will get. By the end of this decade we will know whether this plan was enough or not; the fight for people and nature will have been won or lost. The signs are not good. Discussions so far are locked in old-world thinking and entrenched positions, with no sign of the bold action needed to achieve a nature-positive future.

We need a plan that is both fair and inclusive, that everyone can play a part in delivering. We need a rights-based approach including securing the rights of Indigenous Peoples and local communities to their land, freshwater and seas. We need to recognise that protecting and restoring nature will only be achieved by addressing the drivers of biodiversity loss and ecosystem degradation – including the global food system – that are primarily driven by those of us who live outside those places. And above all we need to deliver lasting results on a greater scale and with greater urgency than we have ever seen before. It is now or never.

AT A GLANCE

This report is designed as a springboard for action, to provide food for thought and to act as a catalyst for transformational change. We hope it inspires you to be part of that change.

CHAPTER 1

The global double emergency

- We are living through climate and biodiversity crises; these are not separate from each other but are two sides of the same coin.
- Land-use change is still the most important driver of biodiversity loss.
- The cascading impacts of climate change are already affecting the natural world.
- Unless we limit warming to 1.5°C, climate change is likely to become the dominant cause of biodiversity loss in the coming decades.
- Three photo stories explore how communities use their knowledge to adapt to local changes in climate and biodiversity.

CHAPTER 2

The speed and scale of change

- Indicators help us to build up a picture of both the speed and scale of change in biodiversity around the world, and the impacts of this change.
- The Living Planet Index acts as an early warning indicator by tracking trends in the abundance of mammals, fish, reptiles, birds and amphibians around the world.
- The 2022 global Living Planet Index shows an average 69% decrease in monitored wildlife populations between 1970 and 2018.
- Latin America shows the greatest regional decline in average population abundance (94%).
- Population trends for monitored freshwater species are also falling steeply (83%).
- New mapping analysis techniques allow us to build up a more comprehensive picture of both the speed and scale of changes in biodiversity and climate, and to map where nature contributes most to our lives.
- This edition has been written by 89 authors from around the world, and they have drawn on a range of different knowledge sources.

CHAPTER 3

Building a nature-positive society

- We know that the health of our planet is declining, and we know why.
- We also know that we have the knowledge and means to address climate change and biodiversity loss.
- The landmark recognition in July 2022 by the UN General Assembly of the human right to a healthy environment cements our understanding that climate breakdown, nature loss, pollution and pandemics are human rights crises.
- We know that transformational change – game-changing shifts – will be essential to bring theory into practice.
- There must be system-wide changes in how we produce and consume, the technology we use, and our economic and financial systems.
- To help us imagine a future where people and nature can thrive, we have explored a number of scenarios and models, such as the pioneering Bending the Curve work featured in the *Living Planet Report 2020*.
- Researchers are exploring new lenses to add to these models, including climate change impacts, equity and fairness.
- Linking international trade to its impacts on nature is a key part of bending the curve of biodiversity loss at scale.
- In addressing these complex, interlinked challenges there is no one-size-fits-all solution. To illustrate this we have collected examples from around the world, ranging from the Amazon to Canada, Zambia, Kenya, Indonesia and Australia.

Butterflies (*Rhopalocera spp.*) near the Augusto Falls on the Juruena River, Juruena National Park, Brazil.


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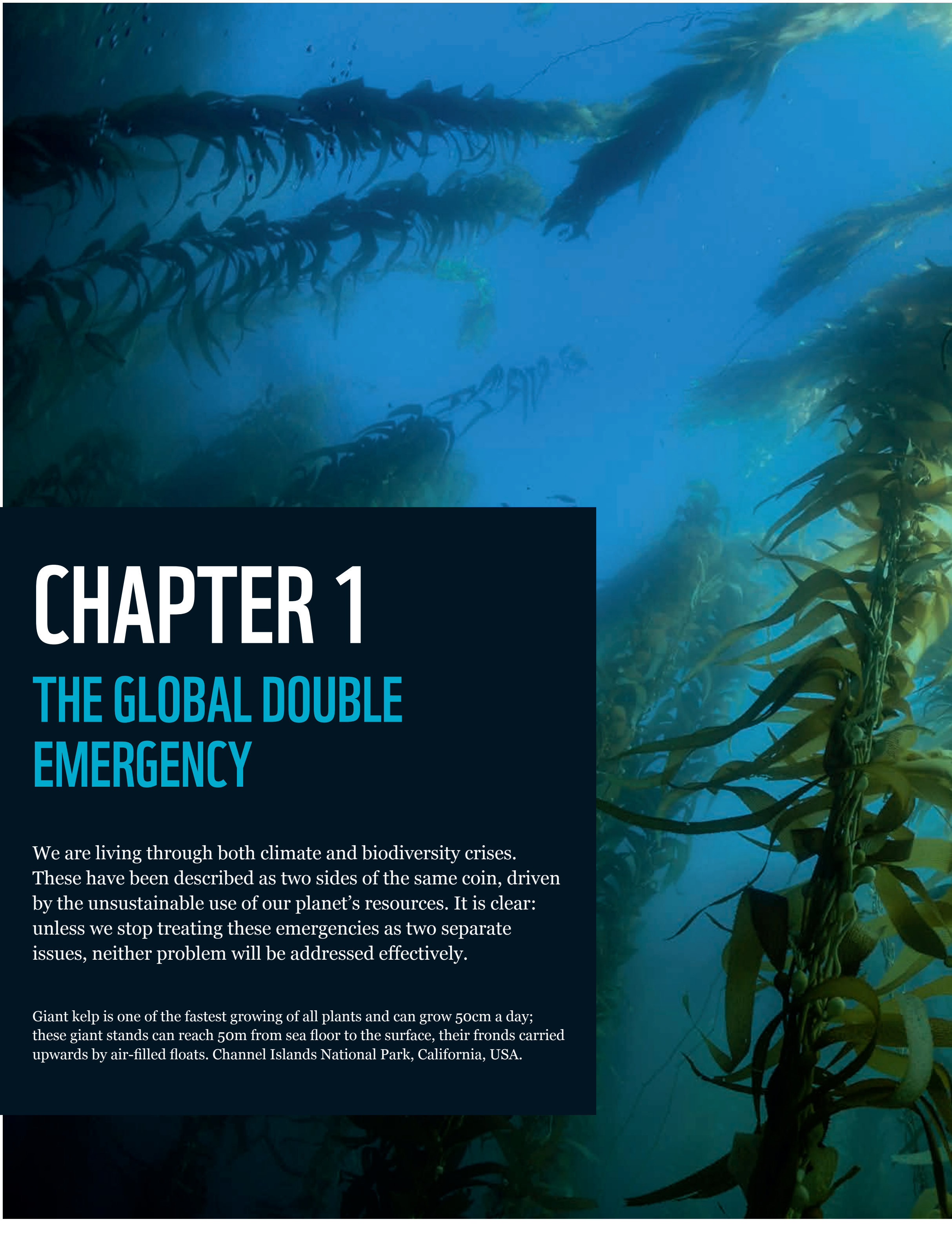


CHAPTER 1

THE GLOBAL DOUBLE EMERGENCY

We are living through both climate and biodiversity crises. These have been described as two sides of the same coin, driven by the unsustainable use of our planet's resources. It is clear: unless we stop treating these emergencies as two separate issues, neither problem will be addressed effectively.

Giant kelp is one of the fastest growing of all plants and can grow 50cm a day; these giant stands can reach 50m from sea floor to the surface, their fronds carried upwards by air-filled floats. Channel Islands National Park, California, USA.

THE CLIMATE AND BIODIVERSITY CRISES – TWO SIDES OF THE SAME COIN

Today we face the double, interlinked emergencies of human-induced climate change and the loss of biodiversity, threatening the well-being of current and future generations.

Sir Robert Watson (Tyndall Centre for Climate Change Research)

Biodiversity is the variety of life and the interactions between living things at all levels on land, in water and in the sea and air – genes, populations, species and ecosystems. Terrestrial, freshwater and marine ecosystems – for example forests, grasslands, wetlands, mangrove swamps and the oceans – provide us with services essential for human well-being such as food and feed, medicines, energy and fibres. They regulate climate, natural hazards and extreme events, air quality, the quantity and quality of fresh water, pollination and the dispersal of seeds, pests and diseases, soils, ocean acidification, and the creation and maintenance of habitats. These ecosystems also provide for physical and psychological experiences, learning and inspiration, while supporting identities and a sense of place. Everything that enables us to live comes from nature.

The major direct driving forces for the degradation of terrestrial, freshwater and marine systems are changes in land and sea use, the overexploitation of plants and animals, climate change, pollution and invasive alien species. These direct drivers of biodiversity loss, and the degradation of ecosystems and their services, stem from increasing demands for energy, food and other materials because of rapid economic growth, increases in population, international trade, and choices of technology, especially over the last 50 years.

We have exploited the services that have market value – for example the production of food, fibre, energy and medicines – at the expense of the services that have no market prices but broader economic and social value.

One million plants and animals are threatened with extinction. 1-2.5% of birds, mammals, amphibians, reptiles and fish have already gone extinct; population abundances and genetic diversity have decreased; and species are losing their climatically determined habitats.

The Earth has already warmed by 1.2°C since pre-industrial times. While climate change has not been the dominant driver of the loss of biodiversity to date, unless we limit warming to less than 2°C, and preferably 1.5°C, climate change is likely to become the dominant cause of biodiversity loss and the degradation of ecosystem services in the coming decades. About 50% of warm-water corals have already been lost due to a variety of causes. A warming of 1.5°C will result in a loss of 70-90% of warm-water corals, and a 2°C warming will result in a loss of more than 99%. And yet, progress to conserve and restore biodiversity has largely failed in all countries – none of the 20 Aichi biodiversity targets for 2020 were fully met, and in some cases the situation in 2020 was worse than in 2010. Equally we are failing to achieve the Paris target of less than 2°C – current pledges put us on a pathway to 2-3°C and possibly higher. To be on a pathway to 1.5°C requires global emissions to be about 50% less than current emissions by 2030, and net zero by mid-century. Unfortunately, we are likely to pass the 1.5°C target before 2040.

Climate change and biodiversity loss are not only environmental issues, but economic, development, security, social, moral and ethical issues too – and they must therefore be addressed together along with the 17 UN Sustainable Development Goals (SDGs). While industrialised countries are responsible for most environmental degradation, it is poor countries and poor people who are the most vulnerable. Unless we conserve and restore biodiversity, and limit human-induced climate change, almost none of the SDGs can be achieved – in particular food and water security, good health for everyone, poverty alleviation, and a more equitable world.

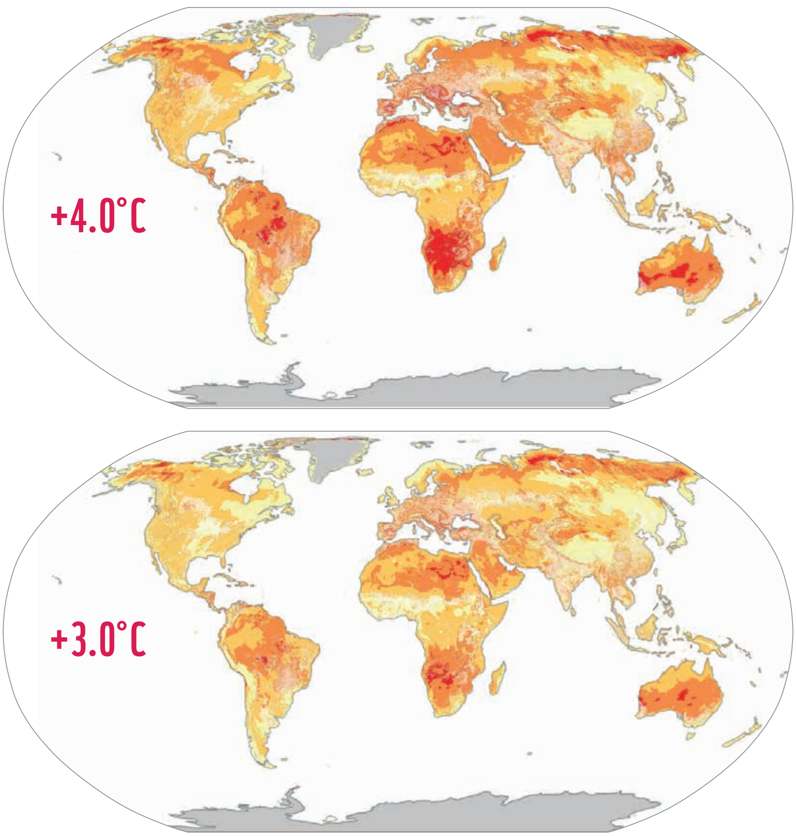
Everyone has a role to play in addressing these emergencies; and most now acknowledge that transformations are needed. This recognition now needs to be turned into action.

The cascading impacts of climate change on people and nature

Human-driven global warming is changing the natural world, driving mass mortality events as well as the first extinctions of entire species. Every degree of warming is expected to increase these losses and the impact they have on people.

Camille Parmesan (Theoretical and Experimental Ecology (SETE), CNRS, France; Department of Geology, University of Texas at Austin, USA; School of Biological and Marine Sciences, University of Plymouth, UK)

An updated synthesis of the impacts of climate change on wild species, and on the ecosystems they live in, was recently published by the Intergovernmental Panel on Climate Change (IPCC 6th assessment report) [11, 170]. These impacts include increasing heatwaves and droughts that are driving mass mortality events in trees, birds, bats, and fish. A single hot day in 2014 killed more than 45,000 'flying fox' bats in Australia. Climate changes have also been linked to the loss of whole populations of more than 1,000 plant and animal species.



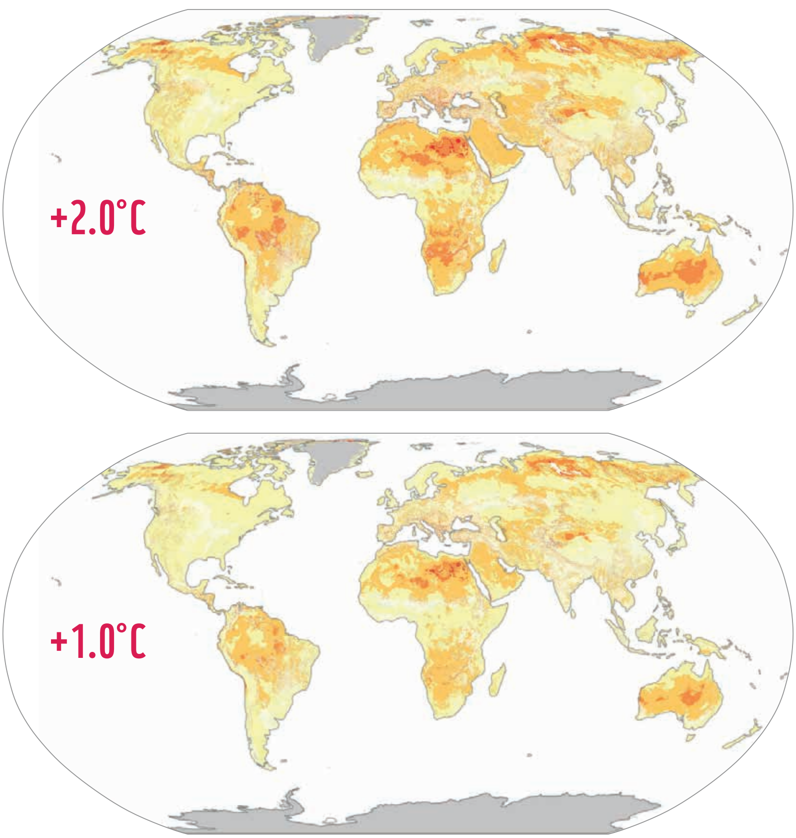
We are also seeing the first extinctions of entire species. The golden toad went extinct in 1989 due to more and more days without the fog normal to Costa Rican cloud forests. The Bramble Cay melomys, a small rodent that lived on a single small island between Australia and Papua New Guinea, was declared extinct in 2016 after sea level rise and a series of heavy storms flooded its home, killing its food plant and destroying its nesting sites. Every degree of warming is expected to increase these losses (Figure 1).

Figure 1: Projected loss of terrestrial and freshwater biodiversity compared to pre-industrial period

Biodiversity loss with increasing global warming. The higher the percentage of species projected to be lost (due to loss of suitable climate in a given area), the higher the risk to ecosystem integrity, functioning and resilience to climate change. Colour shading represents the proportion of species for which the climate is projected to become sufficiently unsuitable that the species becomes locally Endangered (sensu International Union for the Conservation of Nature, IUCN) and at high risk of local extinction within a given area at a given global warming level. Source: Reprinted from Figure 2.6 in Parmesan et al. (2022)[11], based on data from Warren et al (2018)[178].

Key

- < 25%
- 25 - 50%
- 50 - 75%
- > 75%



Not all species are suffering from climate change. Beetles and moths that attack northern forests are surviving better in warmer winters and producing more generations per year with the longer growing season, causing mass die-offs of trees in the northern temperate and boreal zones of North America and Europe. Many insects and worms that cause diseases in both wildlife and humans have moved into new areas and are causing new diseases to emerge in the high Arctic and Himalayan highlands.

Warming is also changing how ecosystems function, putting into motion ecological processes that, themselves, in time cause more warming: this process is called a 'positive climate feedback'. Increases in wildfires, trees dying due to drought and insect outbreaks, peatlands drying and tundra permafrost thawing, all release more CO_2 as dead plant material decomposes or is burned. This is starting to transform systems that have historically been solid carbon sinks into new carbon sources.

Once these ecological processes reach a tipping point they will become irreversible and commit our planet to continue warming at a very high rate. This is one of the biggest risks from "overshoot" of the internationally agreed-upon thresholds for dangerous climate change, (exceeding a defined threshold of warming for at least a decade or more), and would be a disaster for society as well as for much of our planet's wildlife.

A queen garden bumblebee (*Bombus hortorum*) visiting a white nettle (*Lamium album*). Bumblebees are important pollinators for both wild plants and many crops. Even though individual species are expected to benefit from climate change, a study of 66 bumblebee species across North America and Europe [171] found declines in most bees at most sites. This is probably due to harm caused by pesticides and herbicides that surpasses any potential positive effects of climate change.


© Ola Jennersten / WWF-Sweden

Vital links between forests, climate, water and food

Forests are critical for stabilising our climate, but deforestation threatens this vital function as well as other ecosystem services including buffering against the impact of heatwaves, and providing freshwater to agricultural lands.

Stephanie Roe (WWF International) and Deborah Lawrence (University of Virginia)

Forests are fundamental for regulating the Earth's climate, exchanging more carbon, water and energy with the atmosphere than any other terrestrial ecosystem [1]. Forests also affect rainfall patterns and the severity of heatwaves, impacting the resilience of agricultural systems and local communities [2].

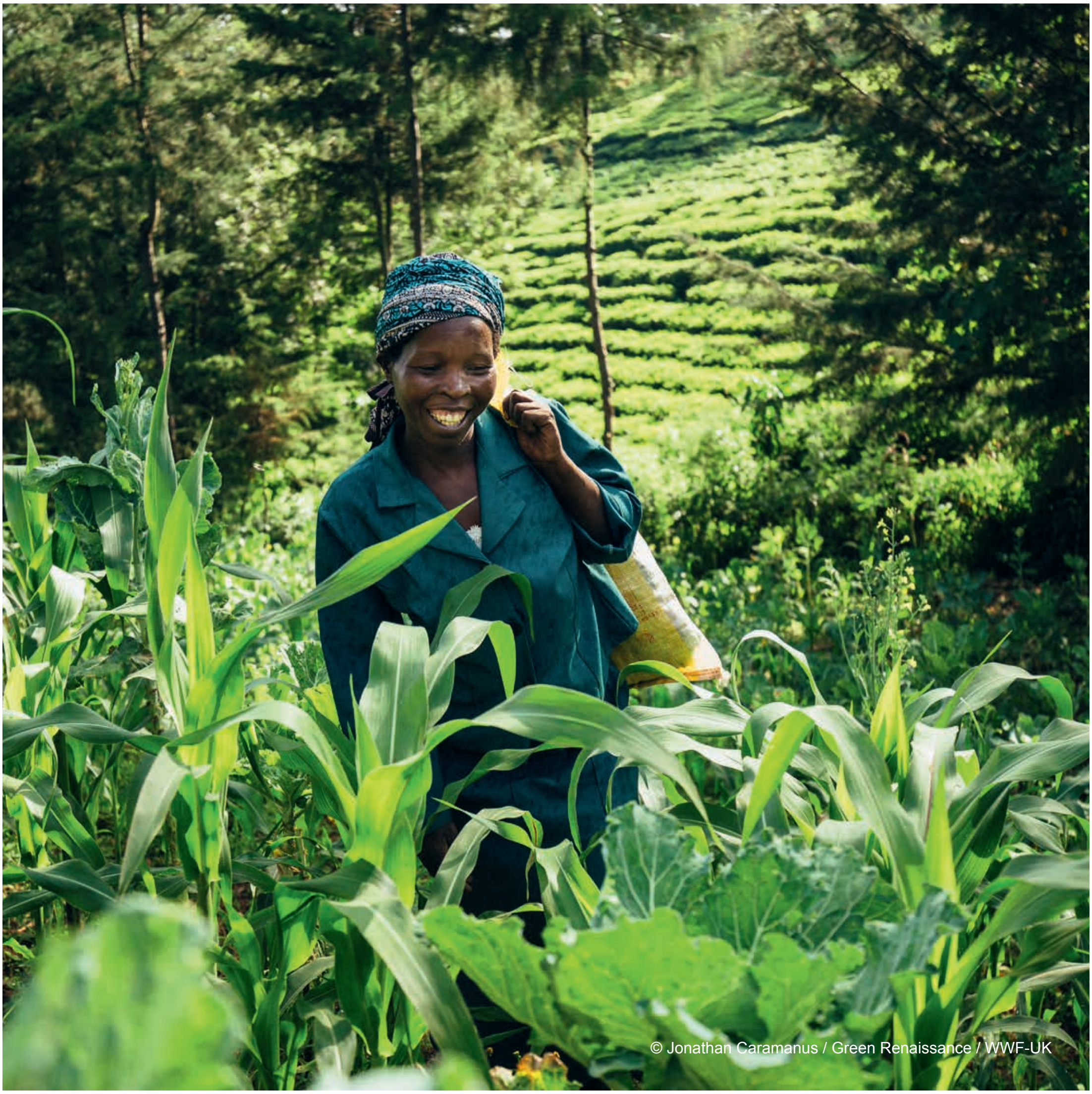
Forests store more carbon than all the Earth's exploitable oil, gas and coal [3,4], and between 2001 and 2019 forests absorbed 7.6 gigatonnes of CO_2 from the atmosphere every year [5], or about 18% of all human-caused carbon emissions [6].

In addition to carbon, the physical structure of forests also affects both the global and local climates. Forests absorb energy from the sun because they are dark. This energy is used to move vast quantities of water from the soil back into the atmosphere, through a process called evapotranspiration, cooling the surface temperature locally and globally. The roughness of forest canopies contributes to the upward mixing of warm air into the atmosphere, drawing away heat and redistributing essential moisture. These biophysical processes stabilise weather as well as climate, limiting maximum daily temperatures by up to several degrees, reducing the intensity and duration of extreme heat and dry spells, and maintaining rainfall seasonality [7]. The combined net effect of forests cools the planet by about 0.5°C [7].

Yet every year we lose roughly 10 million hectares of forests – an area about the size of Portugal [8]. Deforestation, especially in the tropics, causes carbon emissions and leads to warmer, drier local climates, increasing droughts and fires and, depending on the scale, reducing rainfall and shifting global precipitation patterns. For example, clearing the tropical forests in Central Africa or South America could increase average daytime temperatures by 7-8°C and decrease rainfall across those regions by around 15% [2,7].

Rainfed agriculture uses 80% of global croplands and is responsible for 60% of all food produced [9]. Forest destruction could therefore put the food security of billions of people and the livelihoods of millions at risk. This risk is compounded by impacts from climate change that can make droughts more frequent and more severe and reduce agricultural and labour productivity [10,11]. The global Sustainable Development Goal of halting deforestation and restoring and sustainably managing forests therefore plays an important role in protecting biodiversity and in limiting global warming, adapting to climate change, and providing valuable water for our food system.

Nancy Rono, a farmer, on her farm in Bomet County, Mara River Upper Catchment, Kenya.



Restoring natural connections across the landscape

Ecological connectivity is severely threatened by the destruction and degradation of nature that fragments habitats. To counter this, connectivity conservation is rapidly emerging as a solution to restore the movement of species and the flow of natural processes.

Gary Tabor (Center for Large Landscape Conservation) and Jodi Hilty (Yellowstone to Yukon Conservation Initiative)

Ecological connectivity refers to the unimpeded movement of species and the flow of natural processes that sustain life on Earth [12]. Habitat fragmentation across land, air and waters breaks this connectivity and is a global threat to the conservation of biodiversity and the ecological processes that sustain the biosphere [13,14]. Through the destruction and degradation of habitat, fragmentation impacts nature in three specific ways. Firstly, it reduces overall habitat area and quality. Secondly, it also increases isolation from other habitat patches. Finally, it amplifies edge effects around the boundary of a habitat fragment, for example, by increasing the frequency of abrupt transitions from natural to altered habitats [14].

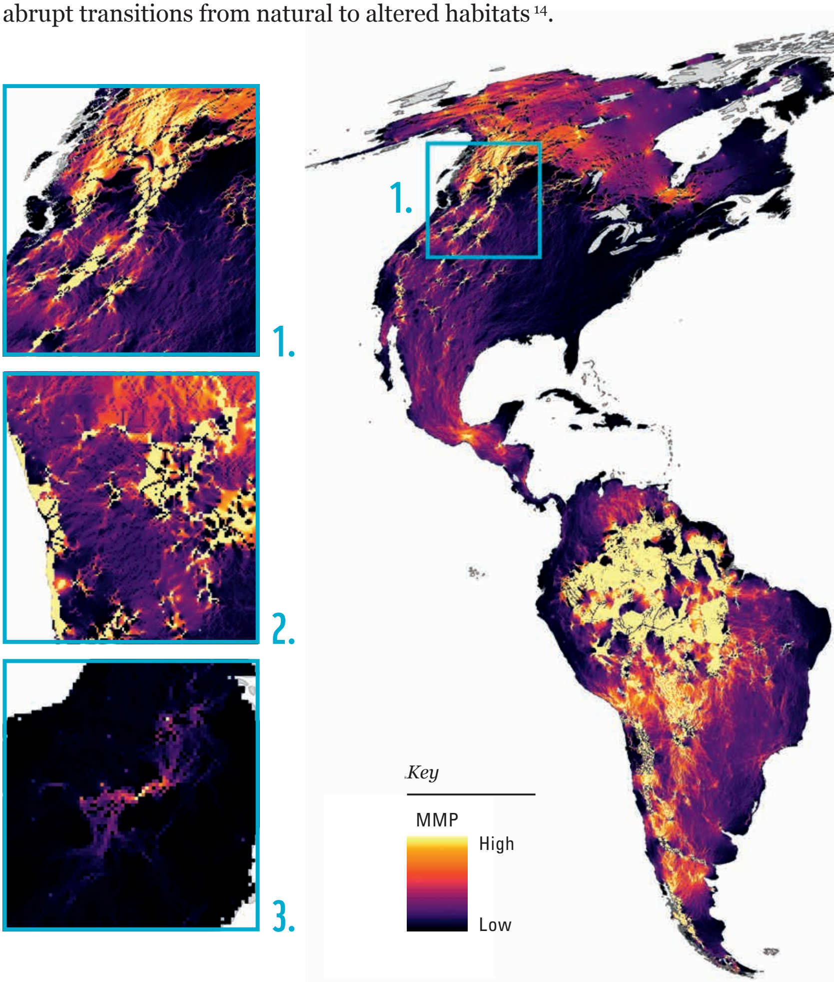
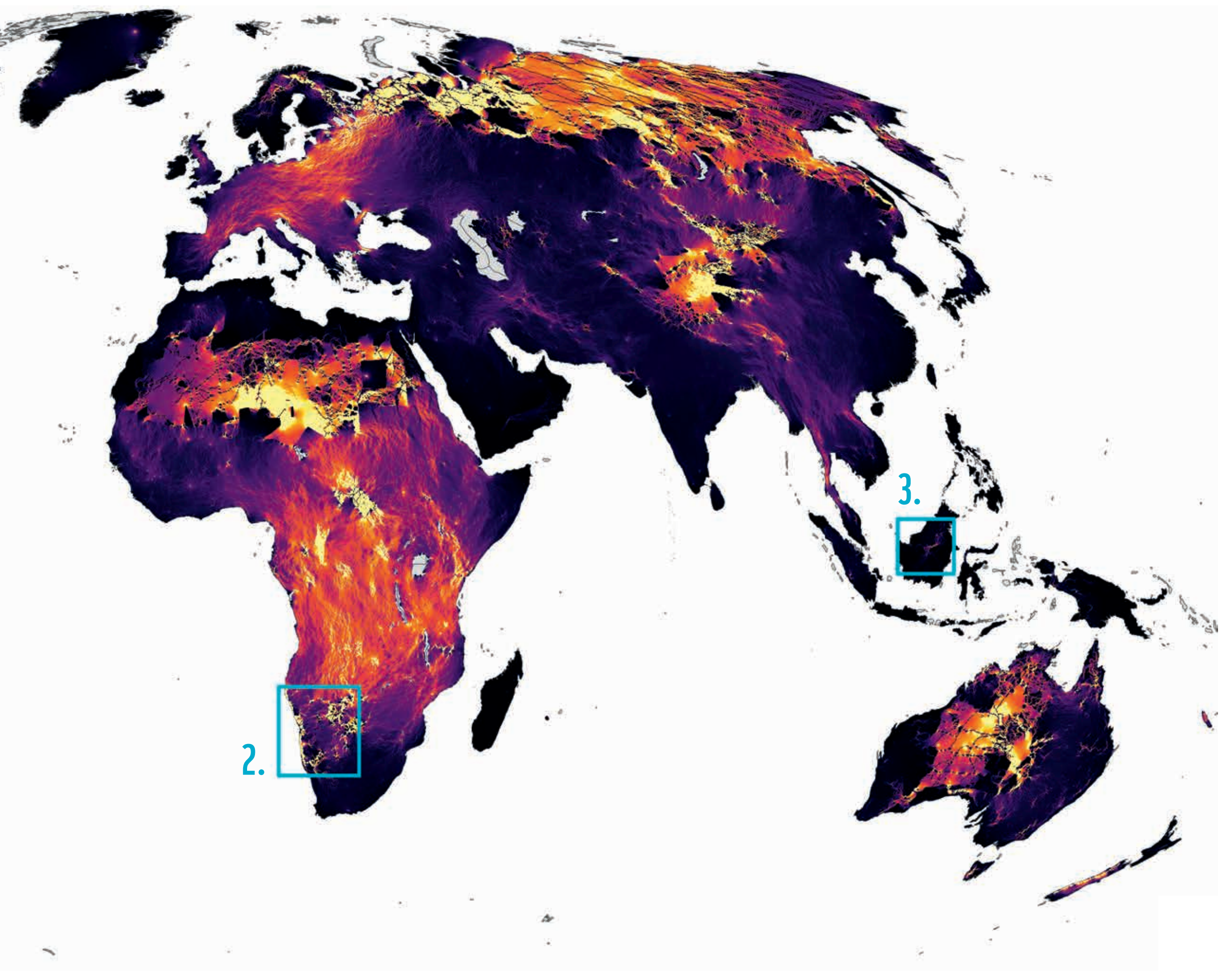


Figure 2: Global mammal movement probability (MMP) between terrestrial protected areas (PAs)
MMP is the predicted flow of mammal movement between PAs and reflects how medium to large mammals are moving in response to human pressures on the environment. High MMP reflects concentrated movements, typically within corridors that funnel mammals between higher human footprint areas or within large blocks of intact land situated within a network of large PAs (e.g. the Amazon basin). Orange and purple reflect areas where the flow of mammals is dispersed among many pathways. Black regions are not devoid of connectivity, but rather depict areas of lower mammal movement between PAs relative to the global scale. Box 1: corridors through mountains of western North America (e.g.the Yellowstone to Yukon corridor). Box 2: corridors and dispersed flow across sub-Saharan Africa's Kavango-Zambezi Transfrontier Conservation Area and coastal deserts of Namibia. Box 3: flows through rainforests of Indonesia and Malaysia (e.g. Heart of Borneo conservation area). Source: Brennan et al. (2022)[17]

This leads into a downward spiral of ecological dysfunctions. From the unravelling of food webs to the loss of ecological processes such as freshwater flows or pollination, fragmentation limits the ability of species to move to fulfil their needs – to migrate, to disperse, to find mates, to feed and to complete their life cycles – and can lead to extinction [15]. Finally, fragmentation exacerbates the wide-ranging, damaging impacts of climate change. Today just 10% of the world's terrestrial protected areas are connected [16]. Around the globe, two-thirds of critical connectivity areas linking protected areas are unprotected [17].

Connectivity conservation – protecting and restoring ecological connections across lands and waters through ecological corridors, linkage areas and wildlife crossing structures – is rapidly emerging around the world as an effective way to combat habitat fragmentation and to enhance climate resilience [18]. Scientific evidence built on island biogeography research and species meta-population studies demonstrates that connected habitats are more effective for preserving species and ecological functions [19]. Globally-agreed IUCN guidelines define how to advance ecological corridors to achieve connectivity from policy to on-the-ground action, at the same time recognising the needs and rights of Indigenous and local peoples [20]. As ways of enhancing connectivity are developed, it is important to recognise the intersectionality of this work: it can and should also advance social and economic targets, which interact with the benefits that nature provides [21].



The magic of mangroves – a key nature-based solution for coastal communities

Mangrove forests are a win-win-win solution for biodiversity, climate and people, if we continue to conserve and restore them.

Daniel Friess and Radhika Bhargava (National University of Singapore) and Juan Felipe Blanco Libreros (Universidad de Antioquia)

Mangroves are unique forests of the sea. They are an important reservoir of biodiversity, and support the livelihoods of coastal communities by providing services such as food and fuel, by underpinning economically-important fisheries, and through cultural services such as ecotourism, education, and spiritual values [22,23].

Mangroves are also a key nature-based solution to climate change. They contribute to mitigation through sequestering and storing 'blue carbon' in their waterlogged soils, at densities exceeding many other ecosystems [24]. Some of the most carbon-rich mangroves are found on the Pacific coast of Colombia – these exceed 50m in height [25]. In addition, mangroves help climate change adaptation, as their tangled above-ground roots are a buffer to waves [26] and trap sediments, allowing some mangroves to increase their surfaces and keep pace with sea-level rise [27].

Despite their importance, mangroves continue to be deforested by aquaculture, agriculture and coastal development, at current rates of 0.13% per year [28]. Many mangroves are also degraded by overexploitation and pollution, alongside natural stressors such as storms and coastal erosion. Mangrove loss represents the loss of habitat for biodiversity and the loss of ecosystem services for coastal communities, and in some locations it can mean the loss of the very land where coastal communities live. For instance, 137km^2 of the Sundarbans mangrove forest have been eroded since 1985 [29], reducing land and ecosystem services for many of the 10 million people who live there.

Encouragingly, mangrove deforestation has reduced dramatically since the 1980s [30] and we now have plausible scenarios where the global mangrove area may stabilise or even increase by 2070 [31]. The latter would require extensive mangrove restoration, but such actions, when successful, can bring back valuable ecosystem services that improve livelihoods and mitigate climate change.

However, hotspots of mangrove loss still remain, particularly in Myanmar [28], and several countries are developing food security policies that may lead to further mangrove conversion. Ambitious restoration targets, while welcome, often prove difficult to translate into on-the-ground success. Further conservation and restoration efforts are needed for mangroves to continue to improve climate, biodiversity and livelihoods across the world.

Mangroves in Los Túneles on Isabela Island, Galapagos, Ecuador.

Voices for Just Climate Action

Climate change impacts will be felt by everyone everywhere, but not equally. Some of the communities most vulnerable to climate change live in countries in the Global South – and some of these, despite resource constraints, are applying creative solutions to tackle the crisis that co-benefit people and nature, leaning on a wealth of local knowledge to support their efforts. To amplify these local voices, a global coalition has come together to create the Voices for Just Climate Action (VCA) alliance. This alliance partnership includes Akina Mama wa Afrika, Fundación Avina, Slum Dwellers International, SouthSouthNorth, Hivos, and WWF-Netherlands. The Netherlands Ministry of Foreign Affairs is providing VCA with technical and financial support between 2021 and 2025 via a €55 million grant.

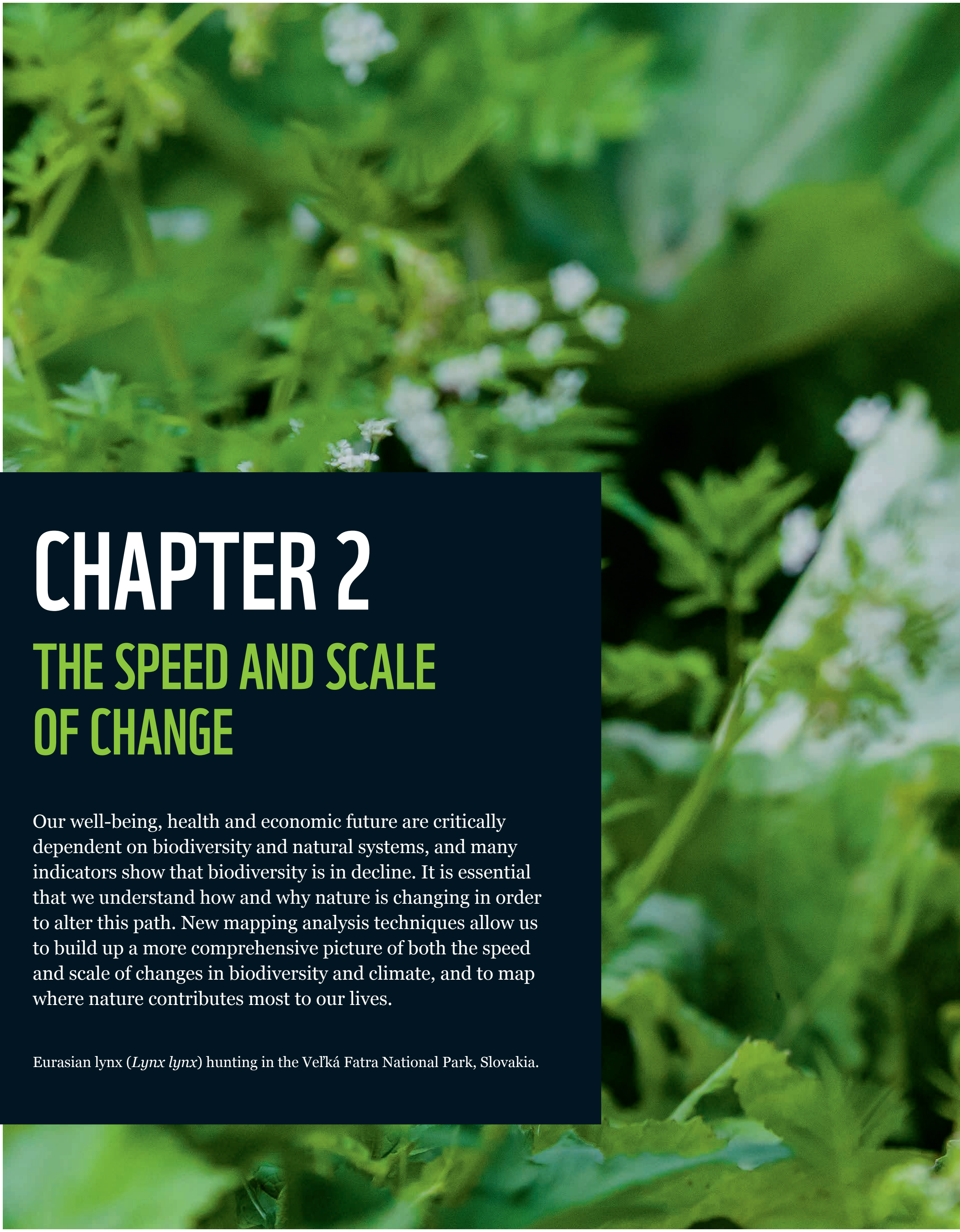
A natural barter system in Kenya

Droughts are intensifying in many parts of Africa, threatening food security as well as the livelihoods of countless communities. In Amboseli, Kenya, Maasai communities have been impacted as their livelihoods rely entirely on selling livestock – but the drought has left their livestock in poor health, making it difficult for the Maasai to put food on the table. Maasai women – often left behind when their husbands undertake long journeys with their livestock in search of green pastures – assume responsibility for the well-being of their families.

Faced with increasing hardships, these women are using their local knowledge to find solutions. In Esiteti, a village in Amboseli, Maasai women have created a barter system with farmers who live across the border in Tanzania. They exchange *Magadi*, the salty mineral soil found in abundance in their region, for items including beans, potatoes, maize, cooking oil and sugar from the farmers. This mutually beneficial arrangement is possible because the climate varies markedly between the border areas of the two countries; the Tanzanian side is located under the foot of Mount Kilimanjaro, where the drought is not as intense as in Kenya. *Magadi* is also a healthier alternative to mineral salt and is not readily available in Tanzania.

A Maasai woman with a camera in Kenya. Lensational.org is a non-for-profit organisation who are training underrepresented women across 22 locations to share their own stories through photography, video, and digital storytelling.

© Claire Metito/Lensational



CHAPTER 2

THE SPEED AND SCALE OF CHANGE

Our well-being, health and economic future are critically dependent on biodiversity and natural systems, and many indicators show that biodiversity is in decline. It is essential that we understand how and why nature is changing in order to alter this path. New mapping analysis techniques allow us to build up a more comprehensive picture of both the speed and scale of changes in biodiversity and climate, and to map where nature contributes most to our lives.

Eurasian lynx (*Lynx lynx*) hunting in the Veľká Fatra National Park, Slovakia.


© Tomas Hulik

The Living Planet Index: an early warning indicator

We now have a better picture than ever before of how species populations are faring around the world. The 2022 global Living Planet Index shows an average 69% decrease in relative abundance of monitored wildlife populations between 1970 and 2018.

Valentina Marconi, Louise McRae, Sophie Ledger, Kate Scott-Gatty, Hannah Puleston, Charlotte Benham, and Robin Freeman (Zoological Society of London)

The Living Planet Index (LPI) tracks changes in the relative abundance of wild species populations over time [42-44]. The global Index is constructed by calculating an average trend for tens of thousands of terrestrial, freshwater and marine vertebrate populations from across the globe. Despite 30 years of policy interventions to stop biodiversity loss we continue to observe similar declines to those shown in previous reports.

The 2022 global LPI shows an average 69% decline in monitored populations between 1970 and 2018 (range: -63% to -75%). The Index contains both increasing and declining trends.

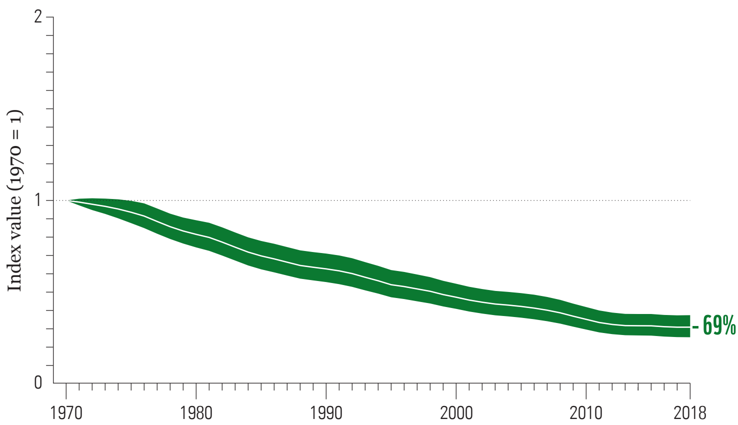
To ensure the accuracy of the statistics, the Index has been stress-tested by recalculating it excluding certain species or populations. This confirms it is not driven by extreme declines or increases in species or populations. The LPI is continually changing: 838 new species and 11,011 new populations have been added to the dataset since the 2020 *Living Planet Report*. The new data has led to a substantial increase in the number of fish species included (29%, +481 species) and has improved coverage for previously underrepresented areas such as Brazil.

Figure 3: The global Living Planet Index (1970 to 2018)
The average change in relative abundance of 31,821 populations, representing 5,230 species monitored across the globe, was a decline of 69%. The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (95% statistical certainty, range 63% to 75%). Source: WWF/ZSL (2022)[184].

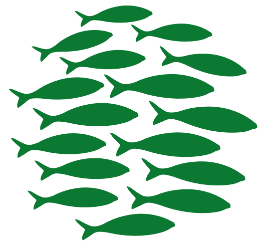
Key

Global Living Planet Index

Confidence limits



Why trends in abundance are important



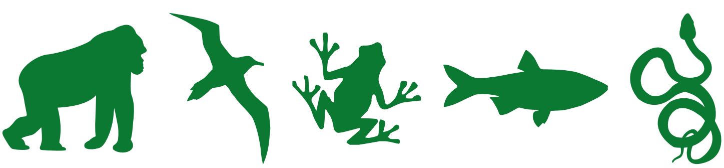
The Living Planet Index tracks the abundance of populations of mammals, birds, fish, reptiles and amphibians around the world. In 2022 the Index included almost 32,000 species populations, which is 11,000 more than in 2020, the largest increase yet in number of populations between two editions of this report.

These populations, or trends in relative abundance, are important because they give a snapshot of changes in an ecosystem. Essentially, declines in abundance are early warning indicators of overall ecosystem health. At the same time, population trends are responsive – therefore if conservation or policy measures are successful, species abundance trends will quickly show this.

Sourcing data in languages other than English

Around the world, many languages are used to communicate science [46]. However, global biodiversity databases such as the LPI store fewer records for countries where English is not widely spoken [47], which are often in the most biodiverse regions. This is partly a result of the greater accessibility of English language data sources, and also because the working language of the LPI team is English.

For this year's *Living Planet Report*, collaborators from WWF-Brazil and the University of São Paulo have searched through journals and environmental impact reports in Portuguese. Thanks to their efforts, we now have 3,269 populations for 1,002 Brazilian species (575 of which are new to the database) contributing to the LPI. The number of scientific articles on conservation in other languages has been increasing over the past few decades at a rate similar to English-language articles [48]. In the future, we plan to expand our collaboration network to introduce data in many other languages into the Living Planet Index Database. This not only creates a more representative biodiversity data set, but also ensures that important scientific and monitoring studies from around the world are included in the index.



Changes in biodiversity vary in different parts of the world

The global Living Planet Index does not give us the entire picture – there are differences in abundance trends between regions, with the largest declines in tropical areas.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) divides the world into different geographic regions [39, 45]. This breakdown is designed to support the monitoring of progress towards the targets developed under the Convention on Biological Diversity.

Valentina Marconi, Louise McRae and Robin Freeman (Zoological Society of London)

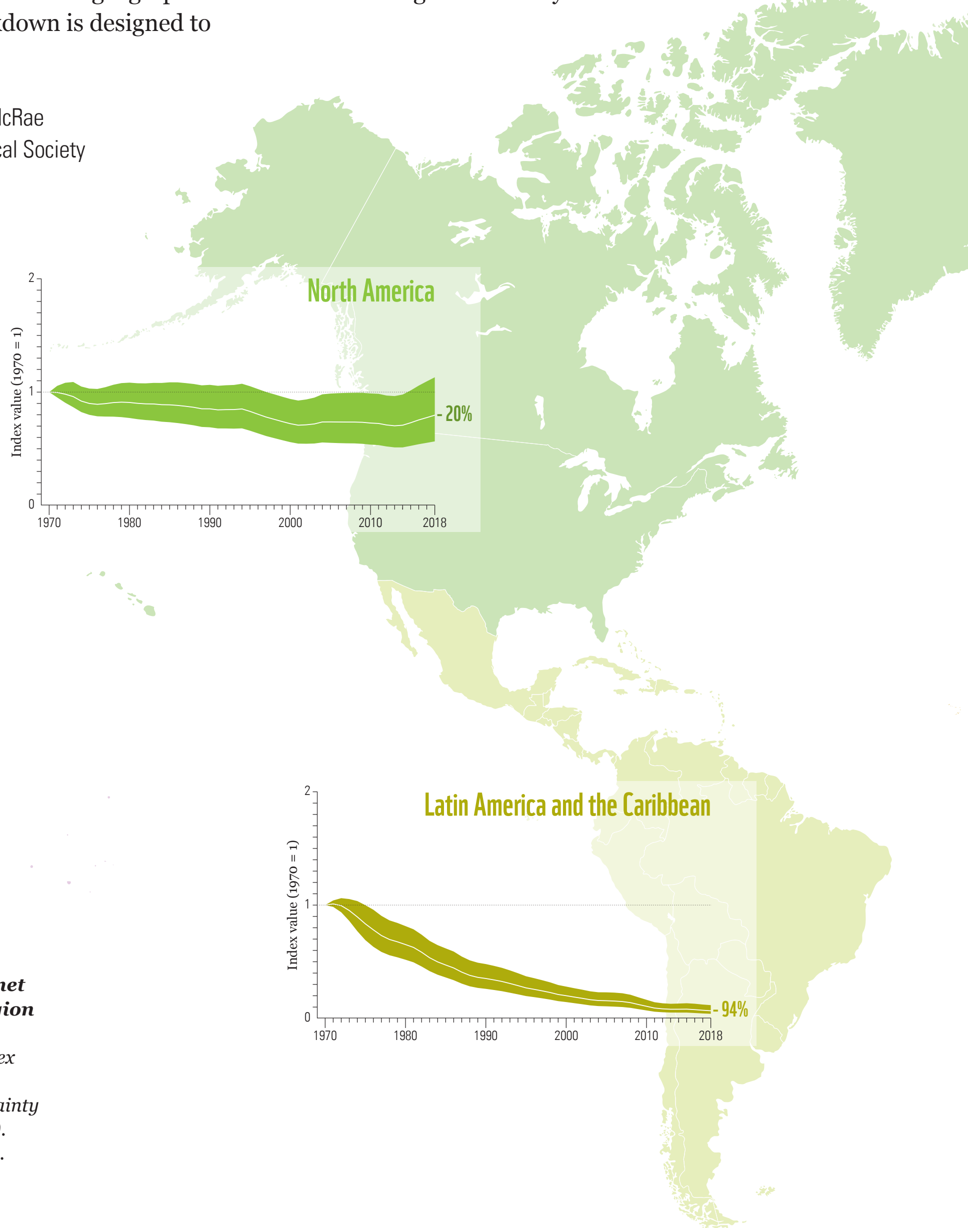
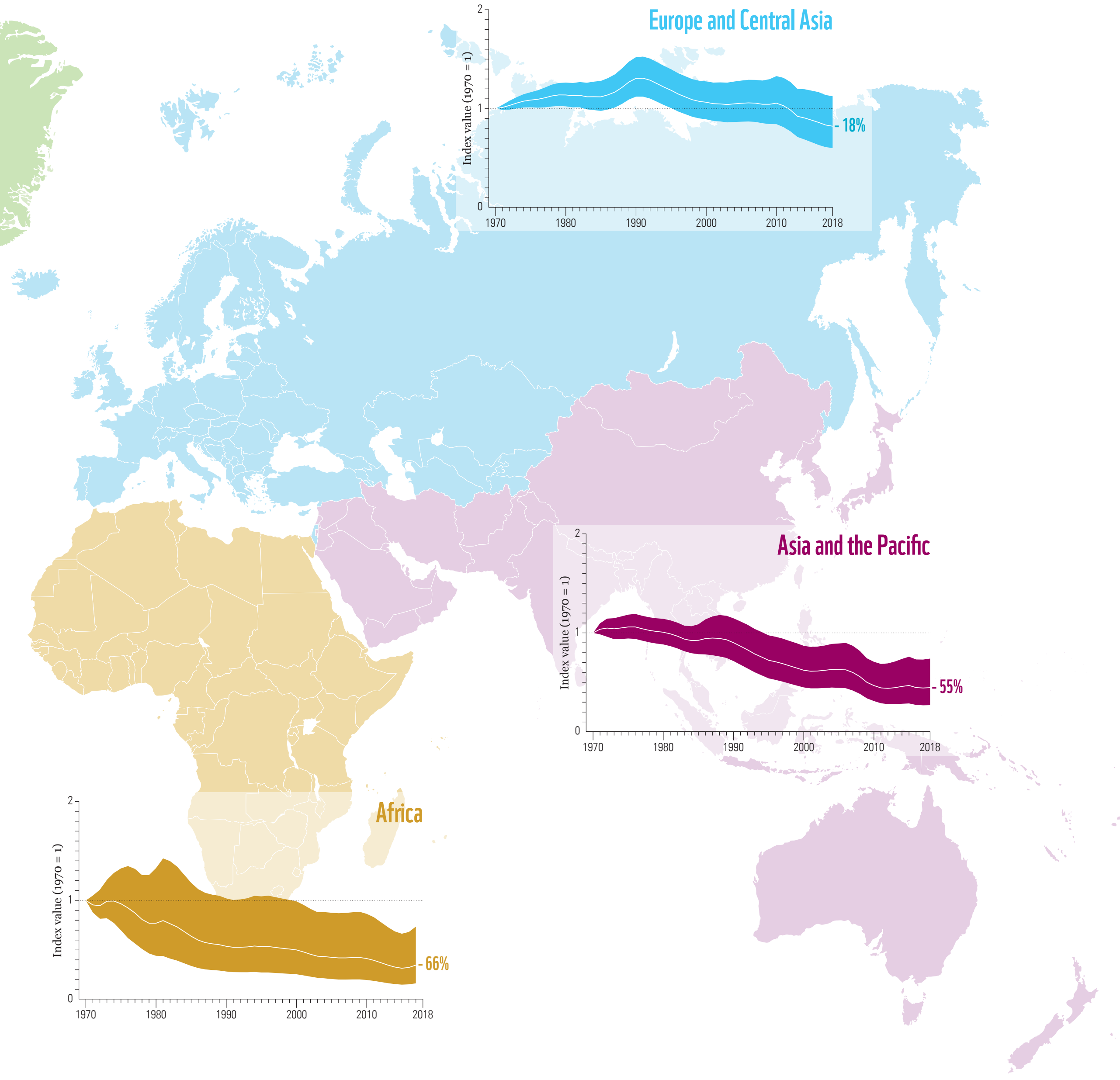


Figure 4: The Living Planet Index for each IPBES region (1970 to 2018)
The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (95%). Source: WWF/ZSL (2022) [184].

The LPI trends presented here follow the IPBES regional classifications, with all terrestrial and freshwater populations within a country assigned to an IPBES region. The Americas are further subdivided into North America, and Latin America and the Caribbean (Mesoamerica, the Caribbean and South America combined).

Trends for each species group are weighted according to how many species are found in each IPBES region. More details about these regional trends and the other cuts of the Living Planet Index can be found in the *2022 Living Planet Report: Deep dive into the Living Planet Index*.



The Freshwater Living Planet Index

Populations in the freshwater Living Planet Index have been hit the hardest, declining by an average of 83%, with the addition of a large amount of new data confirming the results shown in previous reports.

Valentina Marconi (Zoological Society of London), Monika Böhm (Indianapolis Zoo), Louise McRae and Robin Freeman (Zoological Society of London)

Freshwater environments host a rich biodiversity, including one-third of vertebrate species. Freshwater is also essential to our survival and well-being [49] in domestic use, energy production, food security, and industry [50]. Although fresh water covers less than 1% of the planet's surface, more than 50% of the human population lives within 3km of a freshwater body [51].

This human proximity can be a threat to freshwater species and habitats, including many biodiversity hotspots [182], via pollution, water abstraction or flow modification, species overexploitation and invasive species. Because freshwater environments are highly connected, threats can travel easily from one location to another [52,53].

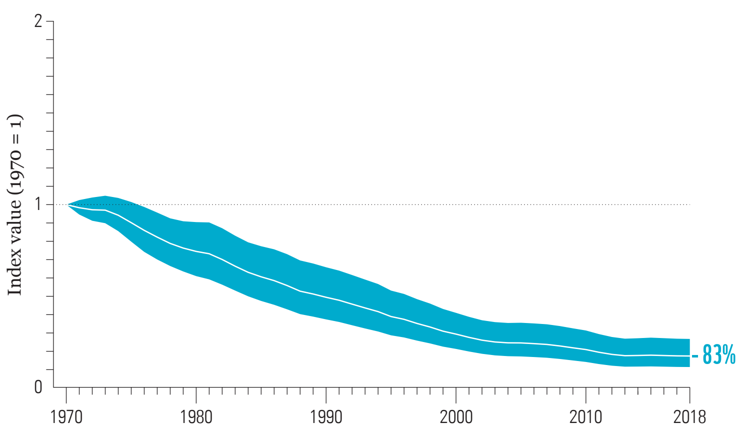
Based on 6,617 monitored populations, representing 1,398 species of mammals, birds, amphibians, reptiles and fish, the freshwater LPI provides an indication of the status of freshwater habitats. Since 1970 these populations have declined by an average of 83% (range: -74% to -89%). Using the largest sample size so far – 454 new freshwater species and 2,876 new populations have been added to the dataset – we can see that, as with the global LPI, the decline is similar to those presented in previous editions of the *Living Planet Report*.

Figure 5: The Freshwater Living Planet Index (1970 to 2018)
The average abundance of 6,617 freshwater populations across the globe, representing 1,398 species, declined by 83%. The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (95% statistical certainty, range 74% to 89%). Source: WWF/ZSL (2022)[184].

Key

Freshwater Living Planet Index

Confidence limits



What's happening to fish on the move?

Many fish species migrate to feed and breed, yet this movement is dependent on the connectivity of freshwater ecosystems – which is declining.

Louise McRae
(Zoological Society of London)

Only 37% of rivers longer than 1,000km remain free-flowing over their entire length[54]. When some fish species migrate large distances along these 'Swimways'[55], the presence of dams and reservoirs poses a threat to their survival.

The LPI of freshwater migratory fish (fish that live in freshwater habitats either partly or exclusively) shows an average decline of 76% between 1970 and 2016, with habitat loss and modifications, in particular barriers to migration routes, accounting for around half of the threats to these populations.

Key solutions for reconnecting freshwater habitats are to improve fish passages through barriers and to remove dams. For example, the removal of two dams and improvements to other dams in the Penobscot River in Maine, USA, resulted in an increase in river herring numbers from a few hundred to nearly 2 million within five years, enabling people to return to fishing[55].

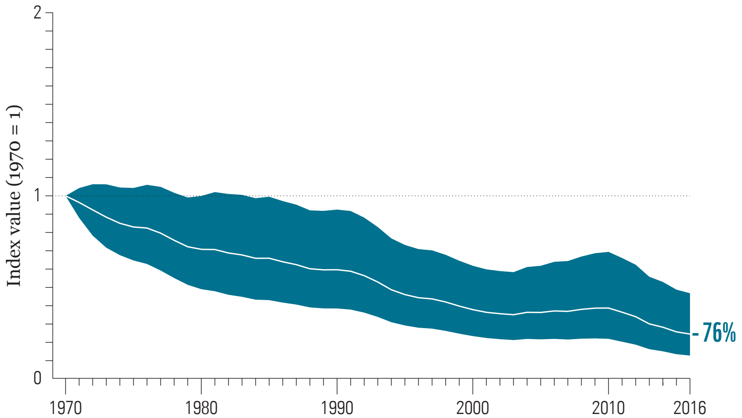


Figure 6: The freshwater migratory fish Living Planet Index (1970 to 2016)
The average change in relative abundance of 1,406 monitored populations of 247 species was a decline of 76%. The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (95% statistical certainty, range 88% to 53%). Source: Deinet et al. (2020)[56].

Key

Freshwater migratory fish Living Planet Index

Confidence limits

From abundance to extinction: what do we know about species extinction risk and recovery?

The IUCN Red List of Threatened Species assesses the relative risk of a species' extinction. Now, new Green Status assessments provide a tool for assessing the recovery of species populations and measuring their conservation success.

Craig Hilton Taylor (International Union for Conservation of Nature)

More than 140,000 species have been evaluated using information on life-history traits, population, distribution size and structure, and their change over time to assign them to one of eight categories: Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern, or Data Deficient[57].

For five taxonomic groups in which all species have been assessed at least twice, the Red List Index (RLI) shows trends over time in their relative survival probability based on genuine changes in these Red List Categories. These data show that cycads (an ancient group of plants) are most threatened, while corals are declining fastest. Baseline RLI values are available for additional groups which have only been assessed once; reptiles have a similar initial RLI value to mammals, and dragonflies a similar RLI value to birds.

EXTINCTION RISK

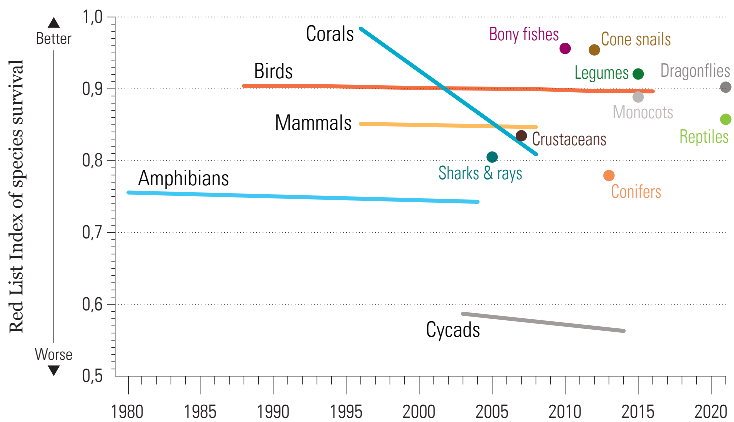
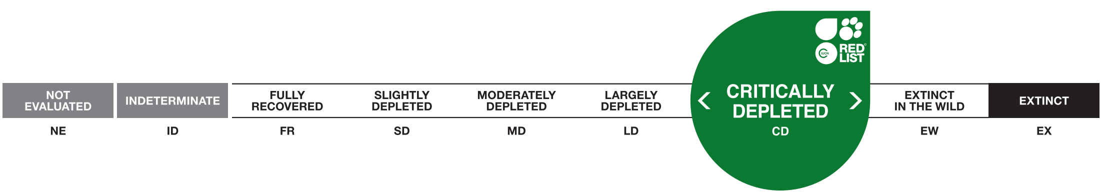


Figure 7: The Red List Index (RLI)
It shows trends in survival probability (the inverse of extinction risk) over time[61]. An RLI value of 1.0 equates to all species within a group qualifying as Least Concern (i.e. not expected to become Extinct in the near future[61]). An index value of 0 equates to 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. A decline in the Index means that species are being driven towards extinction at an accelerating rate. Source: IUCN (2021)[57].

While the IUCN Red List assesses extinction risk, it does not provide a roadmap for species recovery. Now, new classifiers of species recovery and conservation impact – known as the Green Status of Species[58] – provide a tool for assessing the recovery of species populations and measuring their conservation success.

When viewed alongside Red List assessments, Green Status assessments show a fuller picture of a species' conservation status. This reveals that some species' extinction risk can be low, yet they are still depleted compared with their historical population levels (e.g. black stork[59]). The Green Status can also show the past, current and potential future impact of conservation for a species, showing the value of targeted actions for species recovery (e.g. Darwin's frog[60]).

Darwin's frog (*Rhinoderma darwinii*) has a Green Status of Critically Depleted but has high Recovery Potential.



Using the IUCN Red List to build a picture of threat hotspots

A new analysis based on data from the Red List allows us to overlay six key threats – agriculture, hunting, logging, pollution, invasive species and climate change – to terrestrial vertebrates.

Mike Harfoot (Vizzuality and UNEP-WCMC), Neil Burgess (UNEP-WCMC) and Jonas Geldmann (University of Copenhagen)

Combining expert-based information from the IUCN Red List on the spatial distributions of and threats to all terrestrial amphibians, birds and mammals – a total of 23,271 species – we have generated global maps of the threat to these groups from agriculture, hunting and trapping, logging, pollution, invasive species and climate change[62].

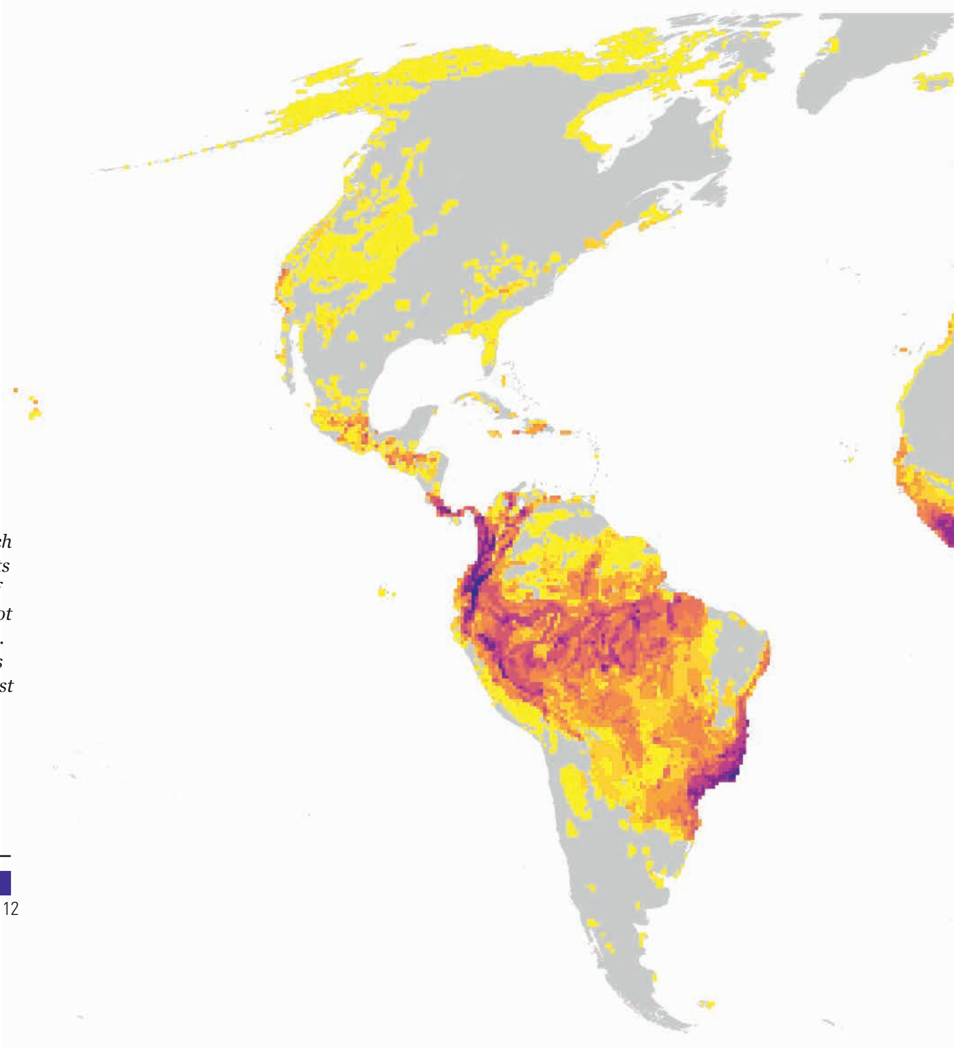


Figure 8: Global hotspots of risk
The relative importance of each pixel across species and threats as measured by the number of times a pixel falls into a hotspot region for any taxon or threat. Hotspot regions are defined as locations containing the highest 10% of numbers of species at risk from each major threat and taxonomic group. Source: Harfoot et al. (2022)[62].

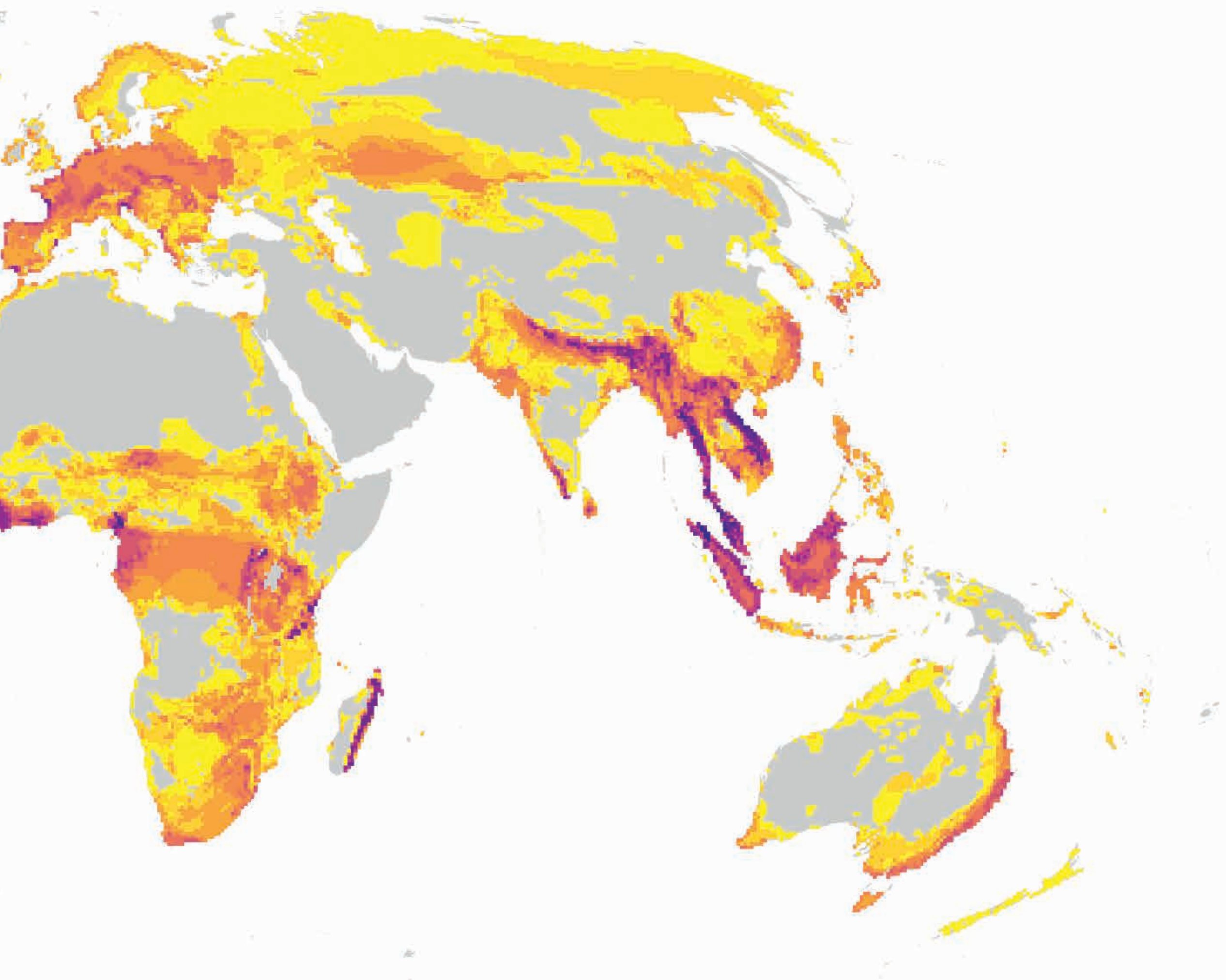
Key

These maps show that agriculture is the most prevalent threat to amphibians, whereas hunting and trapping are most likely to threaten birds and mammals. Geographically, Southeast Asia is the region where species are most likely to face threats at a significant level, while polar regions, the east coast of Australia and South Africa showed the highest impact probabilities for climate change, driven in particular by impacts on birds.

Mapping the likelihood of impact of the six threats and combining this with information on areas of high conservation priority (determined for example by species richness) allows the identification of novel 'hotspots' of conservation priority and threat intensity (Figure 8).

This work has revealed that threats from agriculture, hunting and trapping, and logging are predominantly occurring in the tropics; while pollution hotspots are most prominent in Europe.

The Himalayas, Southeast Asia, the east coast of Australia, the dry forest of Madagascar, the Albertine Rift and Eastern Arc Mountains in eastern Africa, the Guinean forests of West Africa, the Atlantic Forest, the Amazon basin and the Northern Andes into Panama and Costa Rica in South and Central America were all deemed 'high-priority areas for risk mitigation' for all taxonomic groups across all threat categories.



Disappearing oceanic sharks and rays

The global abundance of oceanic sharks and rays has declined by 71% over the last 50 years, due primarily to an 18-fold increase in fishing pressure since 1970.

Nathan Pacoureau
and Nicholas K Dulvy
(Simon Fraser University)

Sharks and rays are important to the health of our oceans, yet they have become increasingly valued for their meat, for parts used for their purported medicinal properties (e.g. manta and devil ray gill plates), or for use in dishes such as shark fin soup [63,64].

The global abundance of 18 of 31 oceanic sharks and rays has declined by 71% over the last 50 years [65]. This collapse in their abundance reflects an increase in extinction risk for most species. By 1980, nine of the 31 oceanic sharks and rays were threatened. By 2020, three-quarters (77%, 24 species) were threatened with an elevated risk of extinction. For example, the oceanic Whitetip Shark has declined by 95% globally over three generation lengths, and has consequently moved from Vulnerable to Critically Endangered on the IUCN Red List [66].

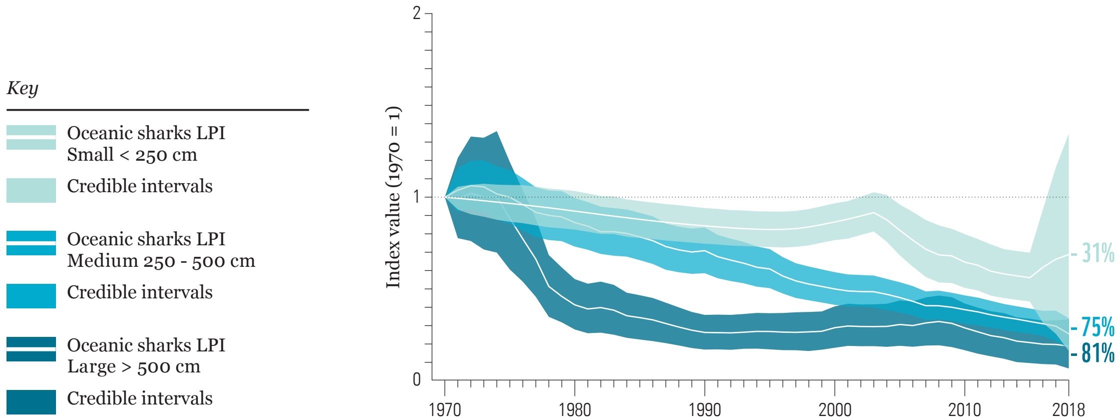


Figure 9a: Living Planet Index from 1970 to 2018 disaggregated by body size *(maximum total length divided into three categories: small, ≤250 cm; medium, 250–500 cm; large, >500 cm). The overfishing of sharks and rays has followed a classic pattern of serial depletion. The large-bodied species were caught first and therefore initially declined faster than smaller species, as they are generally more valuable with a greater volume of meat and fins. But critically these larger-bodied species live longer and are late-maturing, hence they have less capacity to replace the numbers lost due to unrestrained fishing pressure. Smaller sharks and rays have faster life histories and can withstand greater fishing mortality than larger sharks. Source: Pacoureau et al. (2021)* [65].

Scalloped hammerhead sharks (*Sphyrna lewini*),
Cocos Island, Costa Rica, Pacific Ocean.


© naturepl.com / Jeff Rotman / WWF

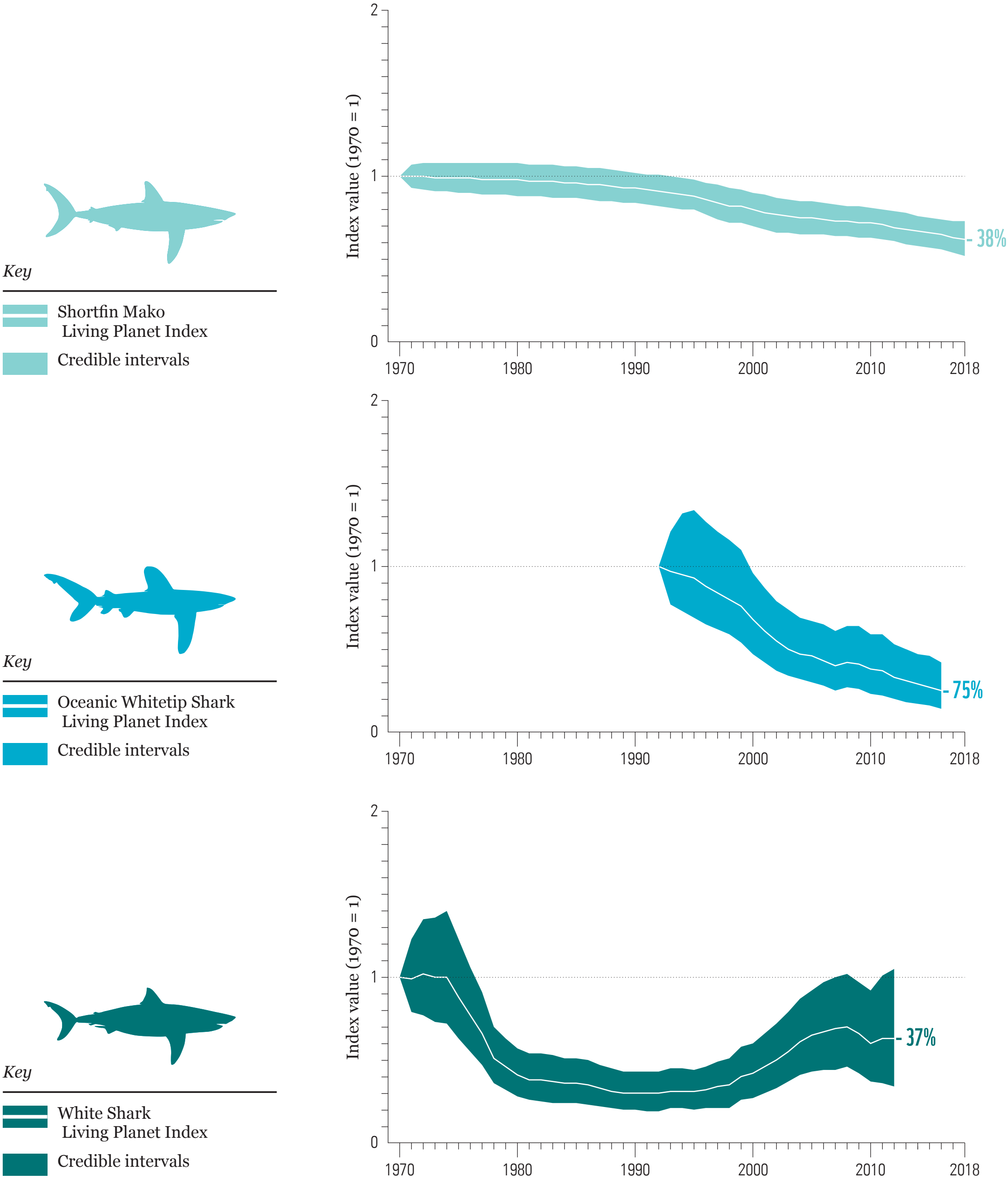


Figure 9b: Living Planet Index from 1970 to 2018 for three species of oceanic sharks
Some formerly abundant, wide-ranging shark species have declined so steeply that they now fall into the two highest threat categories on the IUCN Red List. For example, the commercially valuable Shortfin Mako shark was recently classified as Endangered, while the iconic oceanic Whitetip Shark is now considered Critically Endangered. White Shark numbers had declined on average by an estimated 70% worldwide over the last five decades, but they are now recovering in several regions, including off both coasts of the US (where their retention has been banned since the mid-1990s). Source: Pacoureau et al. (2021)[65].

Due to the complexity and scale of oceanic food webs, the impact of the decline in oceanic sharks and rays on the ecosystem is uncertain [67-69], however the profound effects of depleting these predatory species are becoming apparent. For example, the decline of large apex predators such as sharks and tunas can result in significant functional changes to oceanic food webs [69,70].

Sharks and rays are also critical to many local communities and economies [71]. The severe declines reported also threaten food security and income in many low-income nations [72]. Subsistence fisheries for a variety of sharks and rays have existed in these countries for hundreds of years [73], and the development of alternative livelihood and income options for fishers could significantly ease transitions to sustainability. Halting declines and rebuilding populations to sustainable levels through catch limits will help secure the future of these iconic predators, as well as the ecosystems and people that depend on them.

Spotted eagle ray (*Aetobatus narinari*) swimming near the ocean floor near Darwin Island, Galapagos Islands.

© Daniel Versteeg / WWF

How intact is nature?

The Biodiversity Intactness Index estimates how much of an area's natural biodiversity remains, helping us to understand past, current and future changes to nature.

Andy Purvis (Natural History Museum) and Samantha Hill (UNEP-WCMC)

Biological communities can change fundamentally because of human pressures compared to the state in which they would have been in pristine conditions, even without any species going locally extinct.

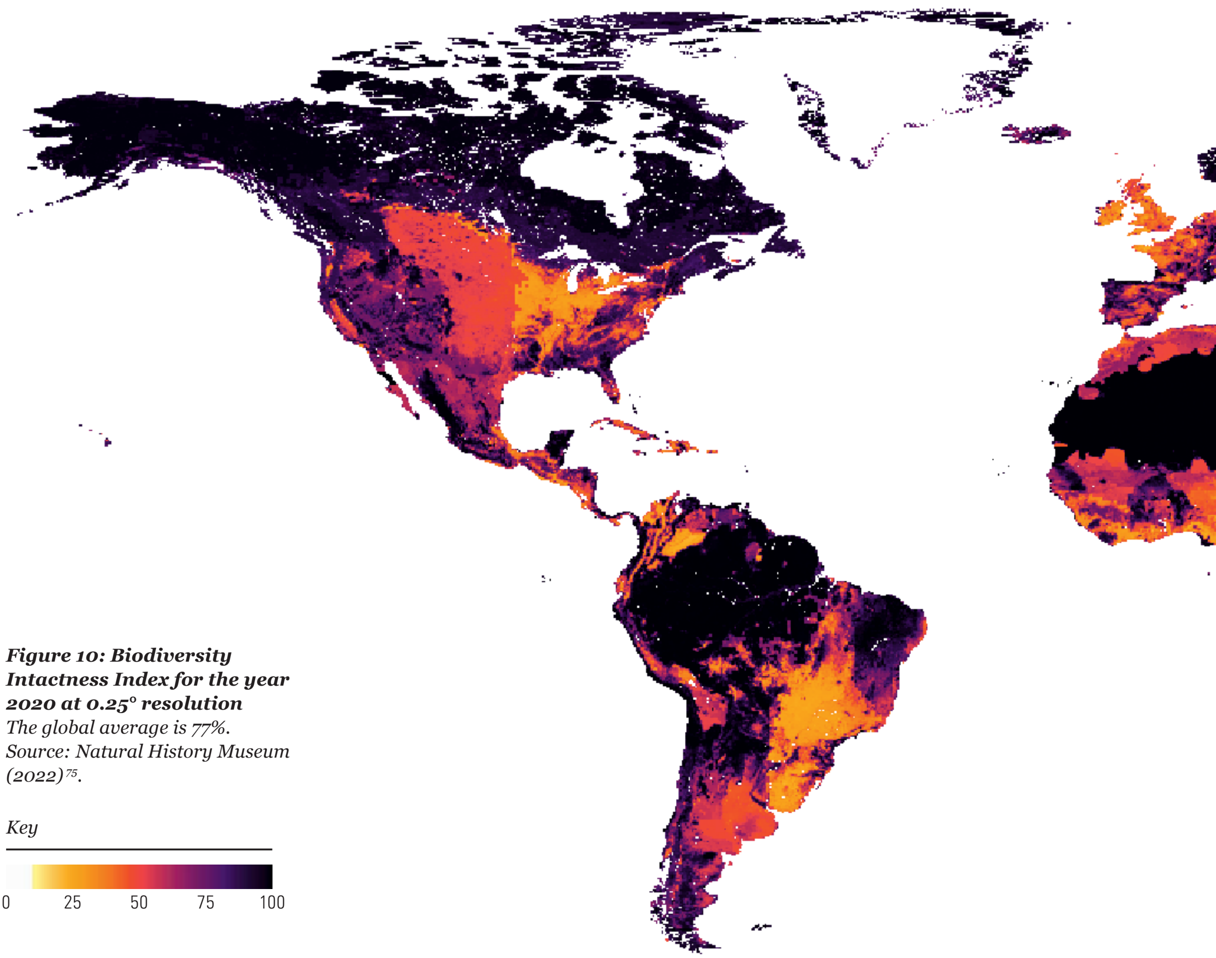


Figure 10: Biodiversity Intactness Index for the year 2020 at 0.25° resolution
The global average is 77%. Source: Natural History Museum (2022)[75].

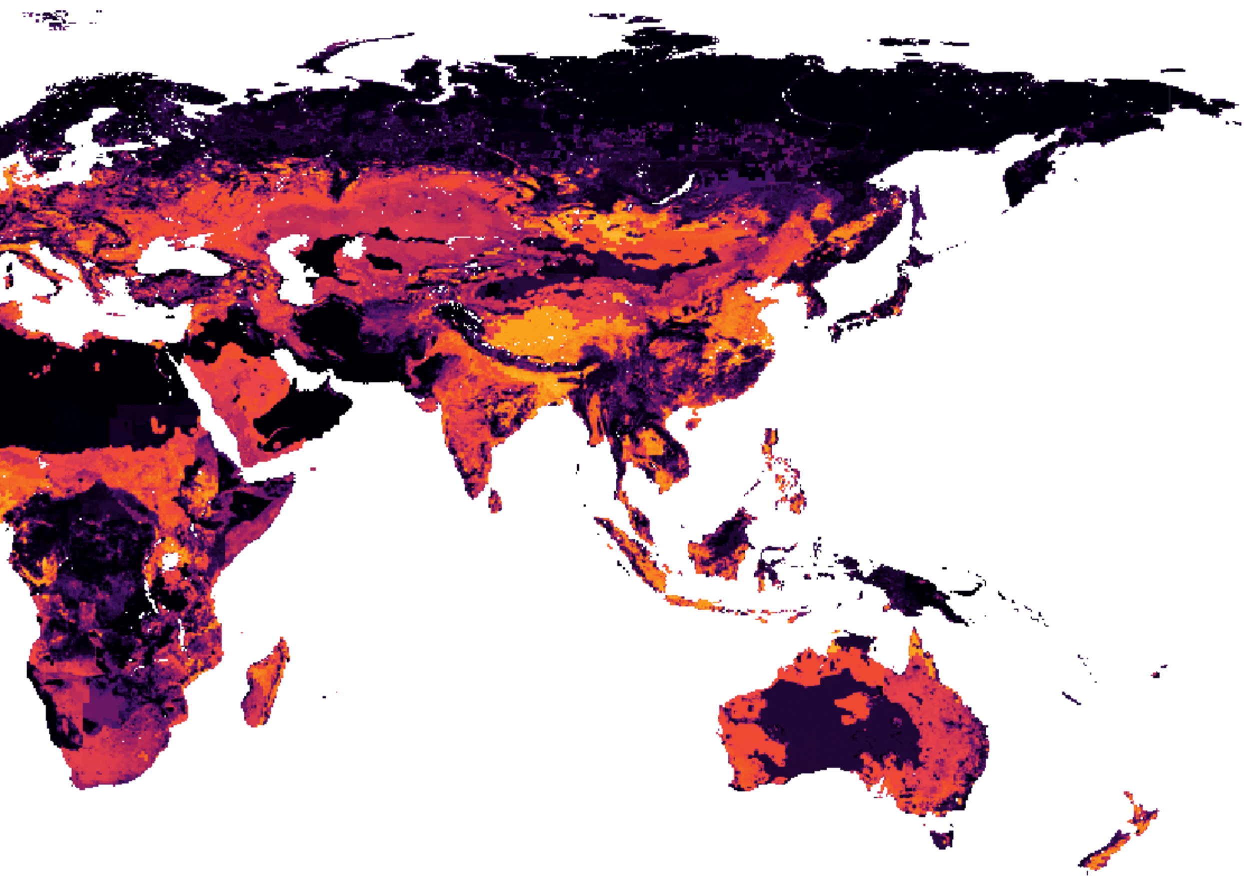
Key

0 25 50 75 100

The Biodiversity Intactness Index (BII) ranges from 100-0%, with 100 representing an undisturbed natural environment with little to no human footprint[74,75]. If the BII is 90% or more, the area has enough biodiversity to be a resilient and functioning ecosystem. Under 90%, biodiversity loss means ecosystems may function less well and less reliably. If the BII is 30% or less, the area's biodiversity has been depleted and the ecosystem could be at risk of collapse.

BII models now include site-level pressures, simple measures of landscape-scale pressures, and landscape history – that is, how long ago human use first covered 30% of the land. Such indicators can be used to test whether planned conservation actions will be enough to stop the further loss of biodiversity[76].

COMPOSITION



People and nature

The science of mapping and modelling Nature's Contributions to People involves predicting how a change in ecosystems leads to a change in their benefits to people.

Rebecca Chaplin-Kramer (Institute on the Environment, University of Minnesota; SPRING, springinnovate.org; Natural Capital Project, Stanford University)

Nature's Contributions to People (NCP) are the contributions that nature makes to people's quality of life, which can be assessed by modelling the ecological supply of those benefits and the human demand for them. The supply side of NCP is based on ecosystem processes and functions. For example, bees and other wild pollinators nesting in natural areas pollinate nearby crops; plants growing along streams and on hillsides help trap pollutants, naturally purifying our water; mangroves, coral reefs and other coastal habitats protect us from coastal storms, erosion and flooding. The demand side of NCP depends on people's location and activity as well as their needs and preferences, which reflect the extent of their dependence on nature. Special attention should be paid to vulnerable populations, which may lack access to substitutes for NCP.

To identify where nature contributes most to people's quality of life, the areas benefitting dependent populations must be mapped [132]. How these areas are mapped depends on how the benefit is delivered – for example, bee flight patterns between their nesting sites and pollination-dependent crops; the path water takes through a watershed on its way to a stream used by people for drinking water, recreation, fishing or other activities; or the physical features that reduce the destructive force of waves on a shoreline where people and property are exposed.

Global analyses have found trade-offs between biodiversity and NCP, specifically with carbon, water provisioning, and fisheries production [77, 78], which suggests that multiple strategies for conservation will be needed to manage the benefits for nature and people. Regional analyses further reveal that synergies may be somewhat limited if conservation efforts are constrained by existing protected area structures, which were not necessarily designed to maximise NCP [79].

Looking at bluebells (*Hyacinthoides non-scripta*) in a wood in Hertfordshire, England, UK.


GAP

Indigenous leadership is key to taking care of our living planet

The importance of Indigenous leadership in conservation is being increasingly recognised. By learning from Indigenous experts, we (re)open a door to an approach to conservation that respects the inherent interconnections between people and place.

Andrea Reid (Nisga'a Nation and the Centre for Indigenous Fisheries, University of British Columbia)

Around the globe, it is clear that leaders in dominant societies have failed to control the human activities driving climate change and habitat loss, while Indigenous lands and waters have been successfully taken care of over millennia [80]. In Canada, Brazil and Australia, for instance, vertebrate biodiversity in Indigenous territories equals or surpasses that found within formally protected areas [81]. Far from the colonial idea of separating people from nature in order to preserve it – and the concept of the *pristine* or *wilderness* free from human influence – Indigenous approaches to conservation regularly place reciprocal people-place relationships at the centre of cultural and care practices. These approaches hinge on systems of Indigenous knowledge which include scientific and ecological understandings that are carried across generations through language, story, ceremony, practice and law (Figure 11).

Global biodiversity loss carries profound consequences for Indigenous Peoples and their ways of life. The loss of fish, for example, is far more than simply a loss of food. Fishing enables the monitoring of waterways, provides a vehicle for knowledge and language transfer, and embodies Indigenous legal traditions. Elders across British Columbia, Canada have reported a loss of access to salmon that parallels the trends in this report (an 83% decline in their lifetimes) [82].

The plural 'Peoples' recognises that more than one distinct group comprises the many Indigenous populations of the world, totalling more than 370 million across 70 countries worldwide. 'Indigenous Peoples' is capitalised in the same way as other nations or cultures, such as Canadian or European.

Indigenous Peoples – "Inheritors and practitioners of unique cultures and ways of relating to people and the environment. They have retained social, cultural, economic and political characteristics that are distinct from those of the dominant societies in which they live." Source: UN (2022) [84].

These elders advocate for Indigenous language revitalisation and fundamentally Indigenous leadership as being keys to unlock more sustainable and just futures.

Part of this just future involves recognising the distinct value in knowledge systems – both Indigenous and non-Indigenous. These include *Etuaptmumk*, or two-eyed seeing – that is, learning to see from one eye with the strengths of Indigenous knowledge and ways of knowing, and from the other eye with the strengths of mainstream knowledge and ways of knowing, and to use both these eyes together for the benefit of all [83]. *Etuaptmumk*, when practised and honoured appropriately, means not only working with Indigenous knowledge as another source of evidence, but also the people and the land inherently tied to these ways of knowing.

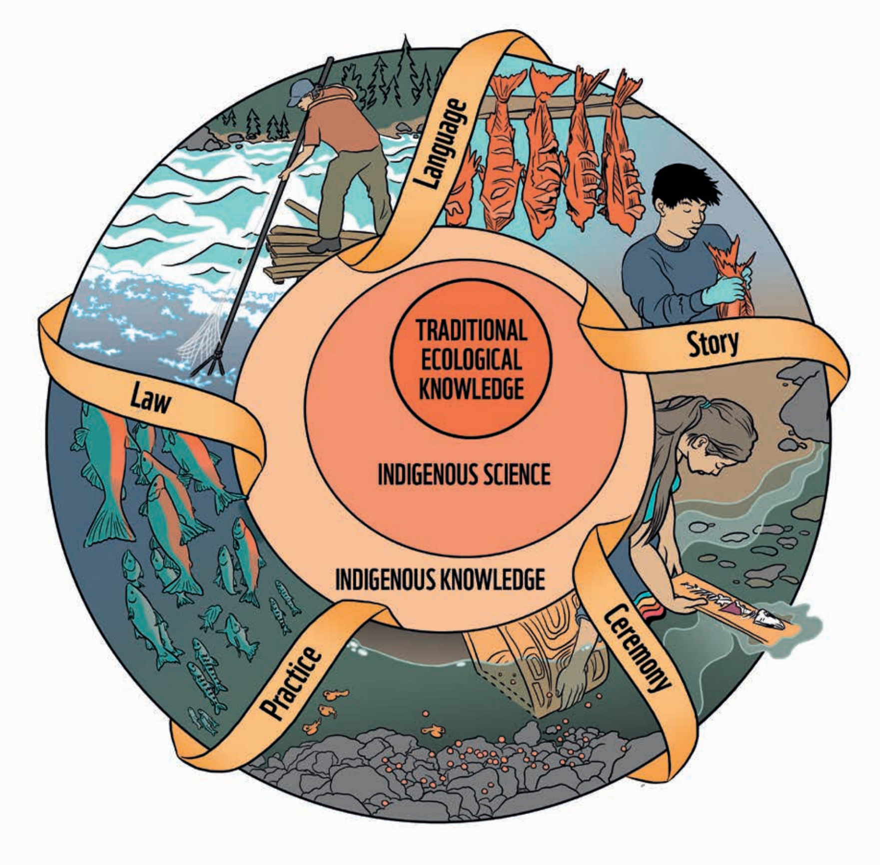


Figure 11: Interrelationships between traditional ecological knowledge, Indigenous science and Indigenous knowledge systems
are depicted here using the symbology of the life cycle of Pacific salmon, starting with the salmon egg at the core of the image. The understandings and philosophies embedded with this centre are carried through time and across generations, through language, story, ceremony, practice and law. Salmon and Salmon People not only coexist in these settings but are interdependent on one another. Source: Illustration commissioned from Nicole Marie Burton.

The cultural and economic importance of indigenous plants

Forest tree species that provide edible fruit and nuts are being planted in initiatives in countries such as Guinea to support conservation and improve livelihoods.

Denise Molmou, Sekou Magassouba, Tokpa Seny Doré (Herbier National de Guinée),

Charlotte Couch (Herbier National de Guinée and Royal Botanic Gardens, Kew),

Isabel Larridon (Royal Botanic Gardens, Kew),

Melanie-Jayne Howes (Royal Botanic Gardens, Kew and King's College London),

Iain Darbyshire, Eimear Nic Lughadha and Martin Cheek (Royal Botanic Gardens, Kew)

Motivating local communities to protect natural habitats rich in diversity, such as Tropical Important Plant Areas (TIPAs), is crucial for plant conservation [85]. Supporting the propagation and planting of 'useful' indigenous plant species to improve livelihoods is one path to achieving this goal.

In the Republic of Guinea, the fruit and seed of several forest tree species have traditionally been harvested from the wild. However, by the 1990s, 96% of the nation's original forest had been cleared [86], and deforestation is still ongoing today [87]. Demand exceeds supply for edible nuts such as tola (*Beilschmiedia mannii*), petit kola (*Garcinia kola*) and the gingerbread plum bansouma (*Neocarya macrophylla*) that have long been popular [88,89] and are increasingly recognised as a source of nutrients that could help support human health [90-92].

These useful species are included in the planting mix of an initiative [93] designed to multiply Critically Endangered tree species in the buffer zones of three TIPAs in Guinea [94]. This approach incentivises conservation and offers the potential to increase incomes and provide nutrients for local communities in a country ranked among the lowest in the Human Development Index.

Habitat of the wild bansouma tree or gingerbread plum tree (*Neocarya macrophylla*). Seeds are locally traded in Guinea as an edible nut. Redtail monkeys eat the fruits but not the nut-containing endocarps. The trees are currently being cleared for charcoal, and those on flat land for plantations of invasive non-native cashews.


© Martin Cheek

Protection, preservation and resilience in Zambia

In Zambia, rising temperatures and changing rainfall patterns have led to an increase in the frequency of floods and droughts. Among other things, these events have disrupted water systems that are fundamental to sustaining ecosystems as well as the livelihoods and health of local communities. In Lusaka and the Southern Province of the country, water scarcity is a reality due to past prolonged dry spells, tree cutting, and the disturbance of water catchment areas. There are both environmental and social impacts of water insecurity, which are further exacerbated by the changing climate. This is especially true for women and girls who primarily bear the burden of providing this core necessity for their families.

A local initiative, Climate Smart Agriculture Alliance (CSAA), is working with community members in the area, planting indigenous crop species within water catchment zones of one of the districts Chikankata to protect water resources for future use. This strengthens and amplifies their choice of a local solution to this crisis and enables those who are most affected by water scarcity to take responsibility for sustainably managing the resource. Local community members manage the water catchment areas, protecting and preserving them while at the same time building resilience to the impacts of the climate crisis.

A local woman carrying empty buckets down to the Luangwa River in Zambia to collect water.

The state of Indigenous land and water knowledge in Australia

Indigenous Peoples have cared for and managed surface and groundwater for many generations – in the case of Australia, many thousands of generations stretching back more than 65,000 years. Indigenous Peoples' connection to water is strong and is a basis of cultural identity, language, gender, law and, most of all, survival on a dry continent.

Bradley J. Moggridge (University of Canberra)

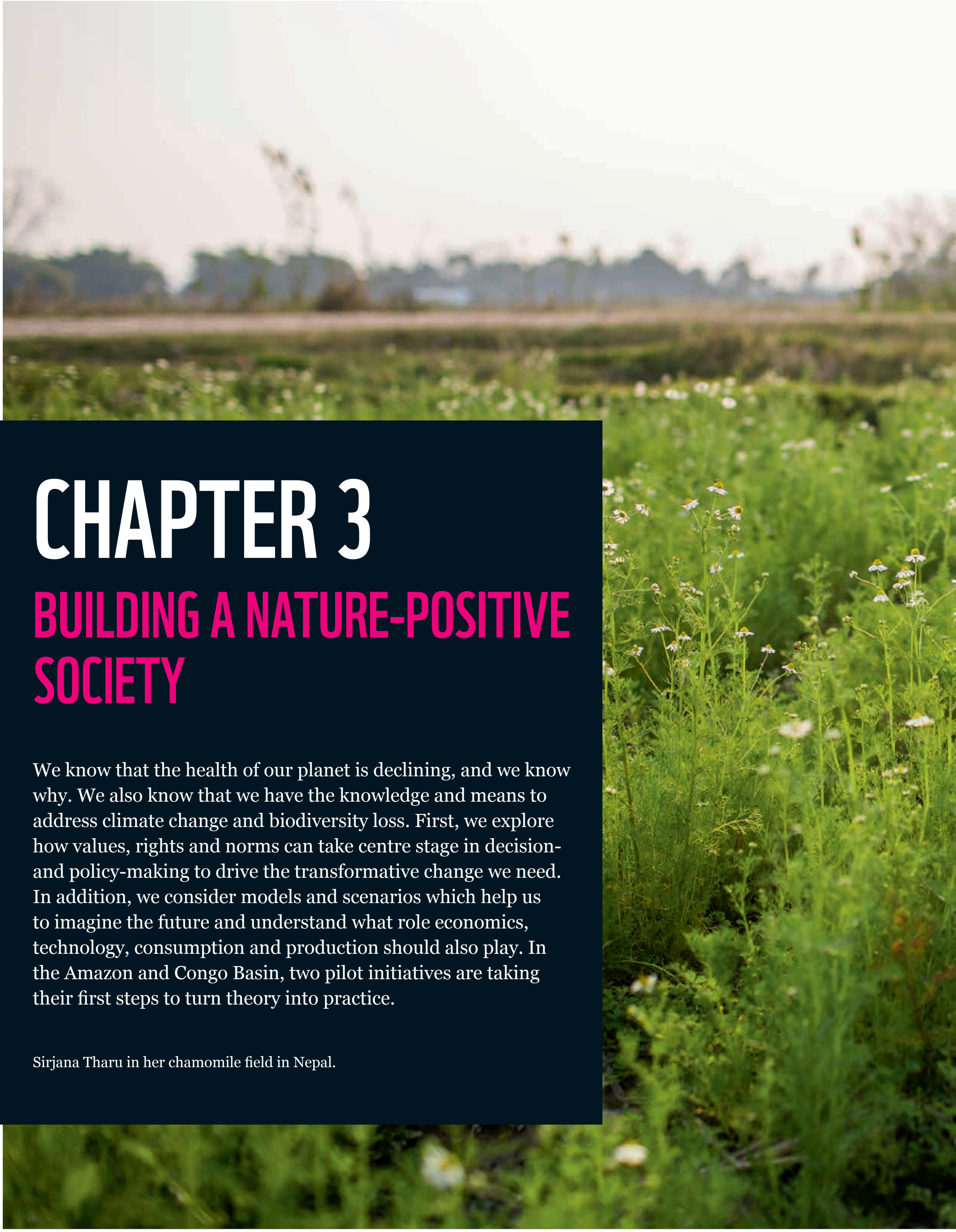
The knowledge and stories held by Indigenous Peoples have been acquired through many generations of observing and understanding their territories, and through knowing and protecting water.

Indigenous research methodologies can provide a basis for the exploration of this knowledge in a way that is culturally appropriate and which generates a culturally safe space for Indigenous researchers and communities [95]. In southeast Australia, the National Cultural Flows Research Project (NCFRP) has supported capacity-building, free, prior and informed consent, and Indigenous-led science. The NCFRP developed an assessment of Aboriginal cultural water values; robust methodologies for ecological, socioeconomic, health and well-being outcomes; and recommended policy, legal and institutional changes to enable the implementation of cultural flows [96]. However, the take-up by jurisdictions of the NCFRP methods to date in Australia is limited.

The development of Indigenous research methodologies in the context of water continues to be limited in Australia, primarily due to government inaction, the limited number of Indigenous water practitioners, and non-Indigenous researchers dominating the sector. Indigenous knowledge, research and perspectives can be well placed to inform and complement western science, but finding this common ground is one of the struggles of cross-cultural research [97,98]. At a national and regional scale Indigenous paradigms can impact the way society values and manages water. If this were to be incorporated into water planning, Australians would benefit through the protection and recognition of different types of flows. So too would water itself, in its many forms.

Gum tree (*Eucalyptus*) growing along Yellow Water River, Kakadu National Park, Northern Territory, Australia.


© Wim van Passel / WWF



CHAPTER 3

BUILDING A NATURE-POSITIVE SOCIETY

We know that the health of our planet is declining, and we know why. We also know that we have the knowledge and means to address climate change and biodiversity loss. First, we explore how values, rights and norms can take centre stage in decision- and policy-making to drive the transformative change we need. In addition, we consider models and scenarios which help us to imagine the future and understand what role economics, technology, consumption and production should also play. In the Amazon and Congo Basin, two pilot initiatives are taking their first steps to turn theory into practice.

Sirjana Tharu in her chamomile field in Nepal.


© Emmanuel Rondeau / WWF-US

OUR RIGHT TO A CLEAN, HEALTHY AND SUSTAINABLE ENVIRONMENT

In 2022 the United Nations Human General Assembly recognised that everyone, everywhere, has the right to live in a clean, healthy and sustainable environment, meaning that for those in power respecting this is no longer an option but an obligation.

David Boyd (UN Special Rapporteur on human rights and the environment, University of British Columbia)

Imagine a world where everyone breathes clean air, drinks safe water and eats sustainably produced food. Imagine a world free from pollution and toxic substances, with a safe climate, healthy biodiversity and flourishing ecosystems.

Is this an impossible dream? No, absolutely not. This is a vision of a world where everyone's fundamental human right to live in a clean, healthy and sustainable environment is respected by governments and businesses.

In 2022 the United Nations Human General Assembly finally recognised that everyone, everywhere, has this right [99]. Now it's time to implement it, as world leaders urged at the Stockholm+50 conference in 2022, a meeting commemorating the UN's first-ever international environmental conference in 1972 [100]. Fulfilling this right is no longer an option, but an obligation.

Implementing the right to a clean, healthy and sustainable environment means taking a rights-based approach to the interconnected crises that are preventing people from living in harmony with nature – the climate emergency, the collapse of biodiversity, and pervasive pollution [101-104].

With rights come responsibilities – for governments, businesses and individuals. The primary burden falls upon governments to put in place laws and policies to ensure that everyone, without discrimination, is able to enjoy their rights. In the context of saving nature, this means enacting and enforcing restrictions on fossil fuels, making laws to protect endangered species and spaces, funding ecological restoration, phasing out and better regulating extractive industries, requiring businesses to carry out human rights and environmental due diligence across their supply chains, ending subsidies that encourage activities that degrade ecosystems, and shifting to sustainable production and consumption, including the transition to a circular economy.

A rights-based approach means listening to everyone's voices and ensuring that the people whose lives, health and rights could be affected by a proposed action have a seat at the table where decisions are made. This approach focuses on the most vulnerable and disadvantaged populations and ensures accountability.

History demonstrates – through the progress achieved by abolitionists, suffragettes, civil rights activists and Indigenous Peoples – the powerful role of human rights in sparking transformative societal changes. The right to a clean, healthy and sustainable environment can be a catalyst for systemic changes, as has been demonstrated by leading nations and recent events [103].

In more than 80 nations, the right to a healthy environment has sparked stronger environmental laws and policies, better implementation and enforcement, greater public participation, and – most importantly – improved environmental performance. It has been used by citizens around the world to protect threatened species and endangered ecosystems.

After adding the right to a healthy environment to its constitution in 1994, Costa Rica became a global environmental giant. Thirty per cent of Costa Rica is in national parks. Ninety-nine per cent of its electricity comes from renewables, including hydro, solar, wind and geothermal. Laws ban open pit mining and oil and gas development, while carbon taxes are used to pay Indigenous Peoples and farmers to restore forests. Back in 1994, deforestation had reduced forest cover to 25% of all land, but today reforestation has driven that number back above 50% [105].

France embraced the right to a healthy environment in 2004, sparking strong new laws to ban fracking, implement the right to breathe clean air, and prohibit the export of pesticides that are not authorised for use in the European Union because of health and environmental concerns.

Costa Rica and France lead the High Ambition Coalition for Nature and People [106], are key members of the Beyond Oil and Gas Alliance [107] and have been leading voices in the campaign for universal recognition of the right to a healthy environment.

In recent months, the right to a healthy environment has been used by communities to block offshore oil and gas activities in Argentina and South Africa, because of the potential impacts on marine mammals. The right was used to compel governments in Indonesia and South Africa to take action to improve air quality and to stop an ill-advised coal-fired power project in Kenya. The right was used to protect forests from mining in Ecuador and to eliminate the use of a bee-killing pesticide in Costa Rica. Climate lawsuits drawing upon the right to a healthy environment are occurring all over the world, and research indicates they are more likely to be successful than not [108].

Although not legally binding, the UN resolution is expected to accelerate action to address the global environmental crisis, just as UN resolutions on the right to water in 2010 turbocharged progress in delivering safe water to millions of people.

It's time to turn the dream of a healthy environment into a reality for everyone on Earth by harnessing this fundamental human right to spark transformative and systemic changes.

An Amazon river dolphin or boto (*Inia geoffrensis*) in flooded forest on the Ariau River, a tributary of Rio Negro in Amazonia, Brazil.

THE ROOTS OF AN INTERTWINED CRISIS

In 2021, for the first time, the UN climate and biodiversity bodies – IPBES and the IPCC – came together to highlight the multiple connections between the climate and biodiversity crises, including their common roots, and warn of the emerging risks of an unlivable future.

David Leclère (International Institute for Applied Systems Analysis),
Bruna Fatiche Pavani (International Institute for Sustainability, Brazil),
Detlef van Vuuren (University of Utrecht),
Aafke Schipper (Radboud University),
Michael Obersteiner (Oxford University),
Neil Burgess (UNEP-WCMC),
Rob Alkemade (Wageningen University & Research),
Tim Newbold (University College London),
Mike Harfoot (Vizzuality and UNEP-WCMC)

The recent assessment reports from the IPBES[39], the IPCC[109-111] and the joint IPBES-IPCC workshop[112] unambiguously document further climate change and the continuing degradation of biodiversity and nature's contributions to people. Over the last 50 years, the mean global temperature and the frequency of extreme weather events have increased, as have the number of species threatened with extinction.

These trends result from direct human drivers, such as greenhouse gas emissions from fossil fuel combustion, habitat conversion and degradation from land-use change, pollution and unsustainable harvests, and the introduction of invasive species. Some direct drivers like land-use change and pollution can cause both climate change and biodiversity degradation, while others primarily drive one or the other: for example, biological invasion has a limited impact on our climate.

Direct drivers are underpinned by a range of more indirect drivers, such as increases in human population and affluence, as well as sociocultural, economic, technological, institutional and governance factors, connected to values and behaviours. Over the last 50 years, the human population has doubled, the global economy has grown nearly fourfold and global trade has grown tenfold, together dramatically increasing the demand for energy and materials. Economic incentives have generally favoured expanding economic activity, often with environmental harm, rather than conservation or restoration.

Aerial view of a harvested corn field and forest under the haze of smoke from uncontrolled forest fires in Brazil.

Humanity's Ecological Footprint exceeds Earth's biocapacity

Humans use as many ecological resources as if we lived on almost two Earths. This erodes our planet's health and humanity's prospects.

Amanda Diep, Alessandro Galli, David Lin and Mathis Wackernagel (Global Footprint Network)

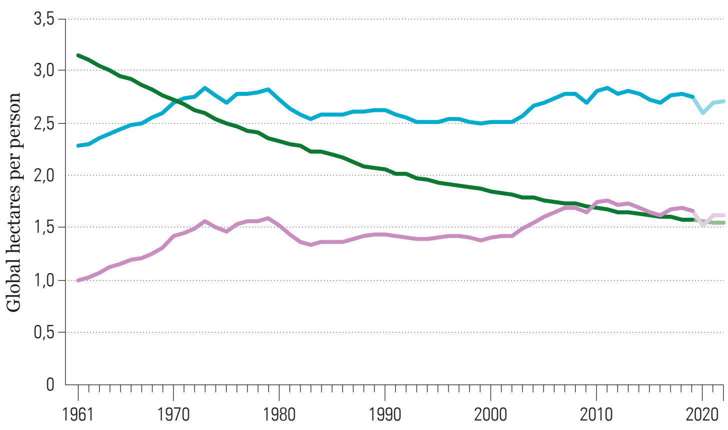
Our planet's biocapacity is the ability of its ecosystems to regenerate [113, 183]. It is the underlying currency of all living systems on Earth. For instance, biocapacity provides people with biological resources and absorbs the waste that they produce. We can measure both biocapacity and the demand people put on it; the latter we call people's Ecological Footprint. It includes all competing demands on nature, from food and fibre production to the absorption of excess carbon emissions. Ecological Footprint accounts document that humanity overuses our planet by at least 75%, the equivalent to living off 1.75 Earths [113,115]. This overshoot erodes the planet's health and, with it, humanity's prospects.

Human demand and natural resources are unevenly distributed across the Earth [113,115]. Consumption of these resources differs from resource availability, as resources may not be consumed at the point of extraction. Ecological Footprints per person provide insights into countries' resource performance, risks and opportunities [114,116,117]. Varying levels of Ecological Footprint are due to different lifestyles and consumption patterns, including the quantity of food, goods and services residents consume, the natural resources they use, and the CO_2 emitted to provide these goods and services.

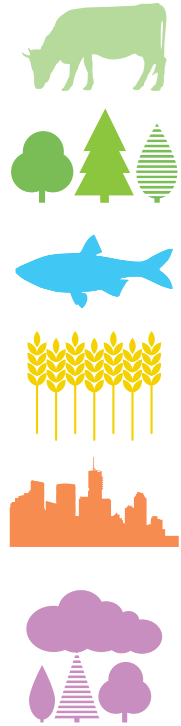
Figure 12: The global Ecological Footprint and biocapacity from 1961 to 2022 in global hectares per person
The blue line is the total Ecological Footprint per person, and the pink line is the Carbon Footprint per person (a subset of the Ecological Footprint). The green lineshows the biocapacity per person. Results for 2019-2022 are nowcast estimates; remaining data points are directly taken from the National Footprint and Biocapacity Accounts, 2022 edition.

Key

- Ecological Footprint
- Biocapacity
- Carbon footprint



Breaking down the Ecological Footprint



Grazing land footprint measures the demand for grazing land to raise livestock for meat, dairy, leather and wool products.

Forest product footprint measures the demand for forests to provide fuel wood, pulp and timber products.

Fishing grounds footprint measures the demand for marine and inland water ecosystems needed to restock the harvested seafood and support aquaculture.

Cropland footprint measures the demand for land for food and fibre, feed for livestock, oil crops and rubber.

Built-up land footprint measures the demand for biologically productive areas covered by infrastructure, including roads, housing and industrial structures.

Carbon footprint measures carbon emissions from fossil fuel burning and cement production. These emissions are converted into forest areas needed to sequester the emissions not absorbed by oceans. It accounts for forests' varying rates of carbon sequestration depending on the degree of human management, the type and age of forests, emissions from forest wildfires and soil build-up and loss.

Humanity's Ecological Footprint by land use

Key

- Grazing land footprint
- Forest product footprint
- Fishing grounds footprint
- Cropland footprint
- Built-up land footprint
- Carbon footprint

Humanity's Ecological Footprint by activities

Key

- Food
- Housing
- Personal transportation
- Goods
- Services

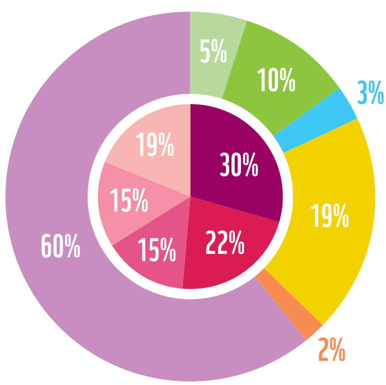


Figure 13: Humanity's Ecological Footprint by land use and by activities
The Ecological Footprint measures how much demand human consumption places on the biosphere and compares it to what ecosystems can renew. In 2020, the world average Footprint amounts to 2.5 global hectares per person, compared to 1.6 global hectares of biocapacity. The Footprint can be broken down by area categories (outer circle) or, using Multi-Regional Input-Output Assessments, by activity fields (inner circle)[185,186,187,188,189].

Consumption around the world

The Ecological Footprint per person is a country's Ecological Footprint divided by its population.

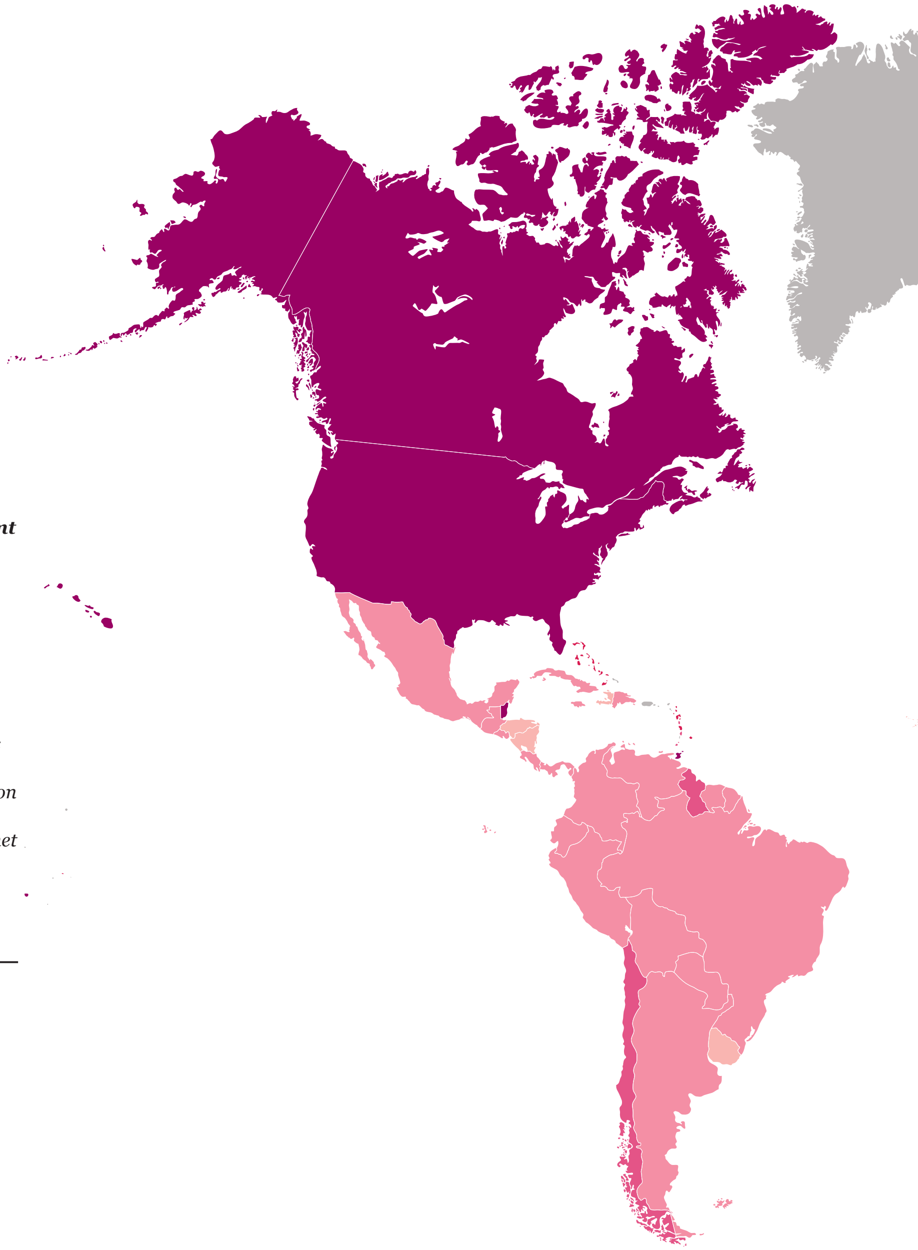
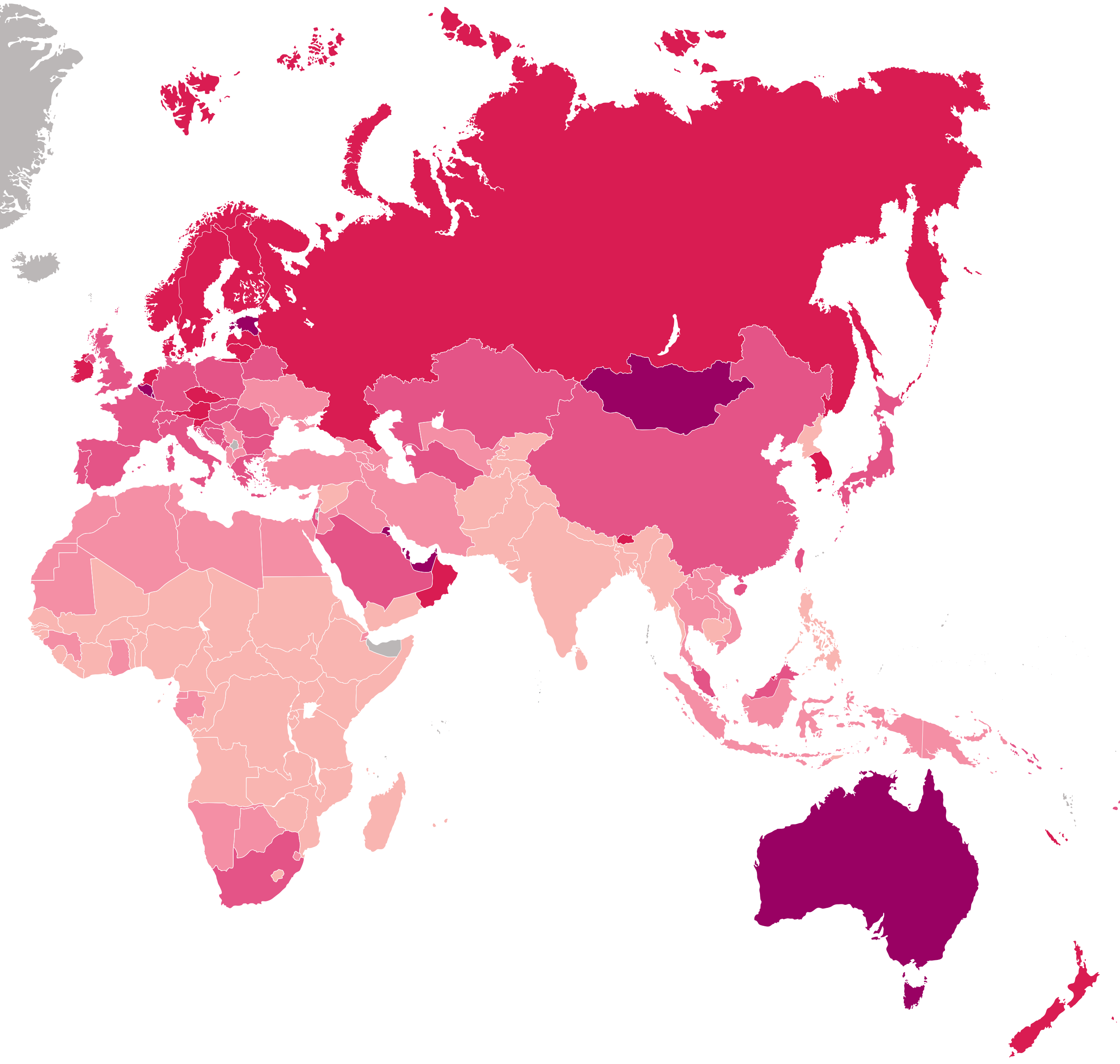


Figure 14: The Ecological Footprint per person is a country's Ecological Footprint divided by its population
To live within the means of our planet, humanity's Ecological Footprint would have to be lower than our planet's biocapacity, which is currently at 1.6 global hectares per person. So, if a country's Ecological Footprint is 6.4 global hectares per person, its residents' demand on nature for food, fibre, urban areas and carbon sequestration is four times more than what's available on this planet per person. For more details see data.footprintnetwork.org.

Key

- < 1.7 gha/person
- 1.7 - 3.4 gha/person
- 3.4 - 5.1 gha/person
- 5.1 - 6.7 gha/person
- > 6.7 gha/person
- Insufficient data

To live within the means of our planet, humanity's Ecological Footprint would have to be lower than our planet's biocapacity, which is currently at 1.6 global hectares per person. So, if a country's Ecological Footprint is 6.4 global hectares per person, its residents' demand on nature for food, fibre, urban areas and carbon sequestration is four times more than what's available on this planet per person.



THE NEED FOR A RAPID SYSTEM-WIDE TRANSFORMATION

With a fundamental, system-wide reorganisation across technological, economic and social factors, including paradigms, goals and values, there might still be a chance that we can reverse the trend of nature's decline.

David Leclère (International Institute for Applied Systems Analysis),
Bruna Fatiche Pavani (International Institute for Sustainability, Brazil),
Detlef van Vuuren (University of Utrecht),
Aafke Schipper (Radboud University),
Michael Obersteiner (Oxford University),
Neil Burgess (UNEP-WCMC),
Rob Alkemade (Wageningen University & Research),
Tim Newbold (University College London),
Mike Harfoot (Vizzuality and UNEP-WCMC)

Over the coming decades, if unaddressed, most drivers are expected to cause further climate change and biodiversity loss and, hence, loss of Nature's Contribution to People. This will negatively impact many aspects of a good quality of life for all, and entails a large risk of jeopardising the Sustainable Development Goals.

As illustrated in Figure 15, under current policies, sustained increases in net greenhouse gas emissions are expected to push global war-ming to about +3.2°C by 2100 (range 2.5-3.5°C) [110], while negative trends in biodiversity and ecosystem functions are projected to continue, with new threats such as climate change progressively adding to pressures from other direct drivers such as land-use change and overexploitation [112]. As ecosystems degrade, their capacity to both support the provision of agricultural and forestry products and to store carbon from the atmosphere deteriorates: these mutually reinforcing climate and biodiversity crises mean that satisfactorily resolving either requires consideration of the other [39].

To keep the sustainable development agenda in sight, a strong sustainability transition is needed in the coming decades. Limiting global warming to 1.5°C, to avoid severe impacts (in line with the Paris Agreement) will require rapidly bending the curve of greenhouse gas emissions to reach net zero around mid-century. Reversing global biodiversity declines by mid-century (as foreseen by the post-2020 Global Biodiversity Framework) will also require reversing the decline in natural ecosystems and the degradation of all ecosystems.

Such transitions can only be achieved by acting on all indirect drivers simultaneously, representing rapid, far-reaching and unprecedented "transformative changes" – a term defined by IPBES as "a fundamental, system-wide reorganisation across technological, economic and social factors, including paradigms, goals and values".

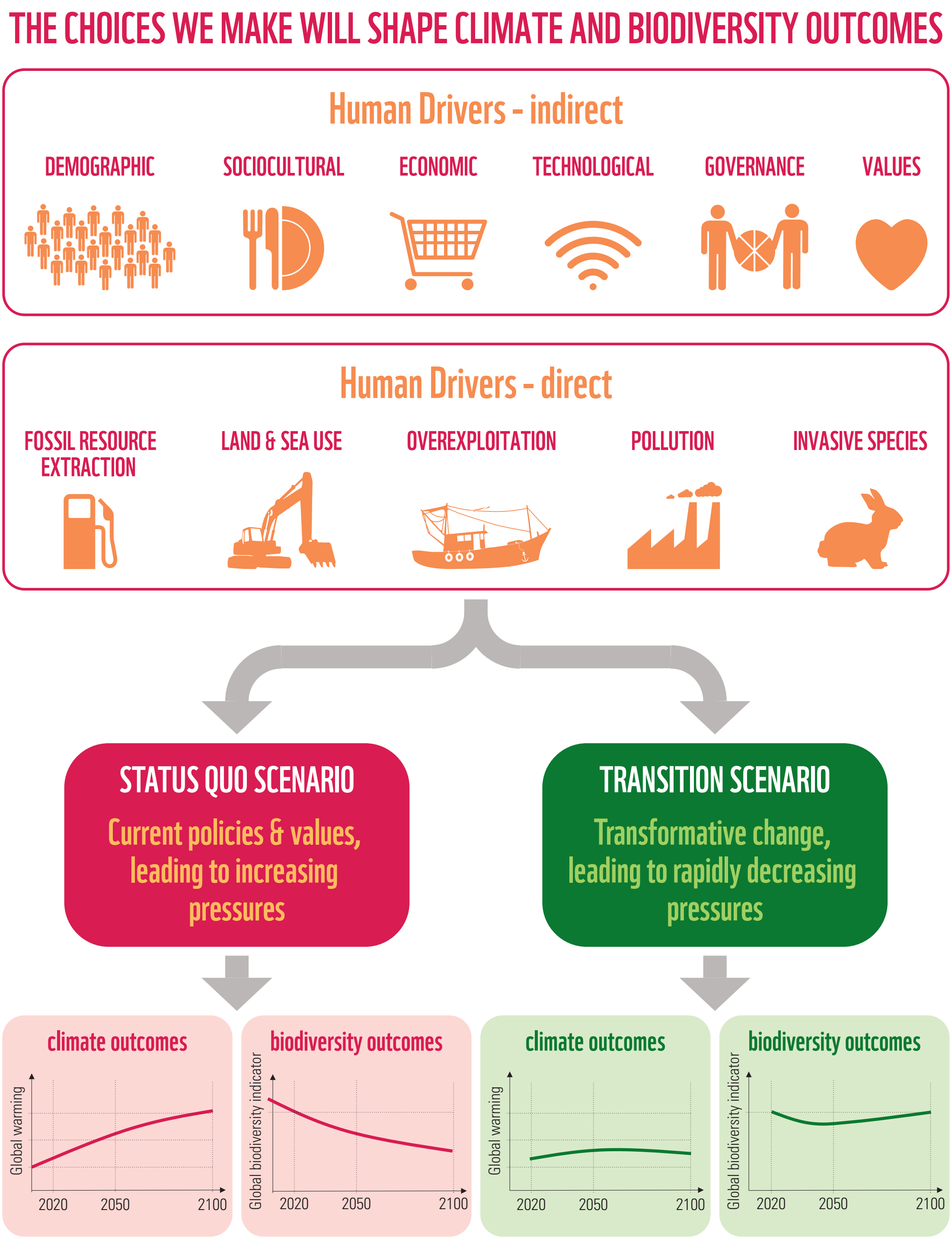


Figure 15:
Earth's climate, biodiversity and people at a crossroads

TRANSFORMATIVE CHANGE NEEDS DELIBERATE ACTION ON DRIVERS

Scenario-based modelling is increasingly mobilised at the science-policy interface to identify plausible futures. It highlights the need to tackle drivers as a clear element of the required transformative change.

David Leclère (International Institute for Applied Systems Analysis),
Bruna Fatiche Pavani (International Institute for Sustainability, Brazil),
Detlef van Vuuren (University of Utrecht),
Aafke Schipper (Radboud University),
Michael Obersteiner (Oxford University),
Neil Burgess (UNEP-WCMC),
Rob Alkemade (Wageningen University & Research),
Tim Newbold (University College London),
Mike Harfoot (Vizzuality and UNEP-WCMC)

Studies exploring how to reach ambitious targets for biodiversity (as illustrated in Figure 16) suggest that increasing traditional conservation and restoration efforts is key, but this will fail to bend the curve if it is not complemented by a significant effort to address direct and indirect drivers of biodiversity loss.

In particular, more sustainable production and consumption practices – such as sustainable increases in yield and trade, reduction of waste, and the adoption of a higher share of plant-based products in our diets – can be instrumental in limiting future land-use expansion and making space for ecosystem restoration.

While the joint effect of climate change and land-use change on biodiversity is uncertain, biodiversity declines cannot be reduced if we fail to limit warming below 2°C (or preferably 1.5°C) [39,111]. This will require rapid and deep decarbonisation in all sectors – energy, buildings, transport, industry, agriculture and land use. Demand-side efforts based on responsible consumption principles could represent 40-70% of net emission reductions by 2050 [111]. For both climate and biodiversity this will require deliberate challenging of routine values and practices to act on indirect drivers, through multi-actor governance interventions on leverage points.

Woman selling fruit and vegetables in the towns central market, Kota Bharu, Kelantan State, Malaysia.

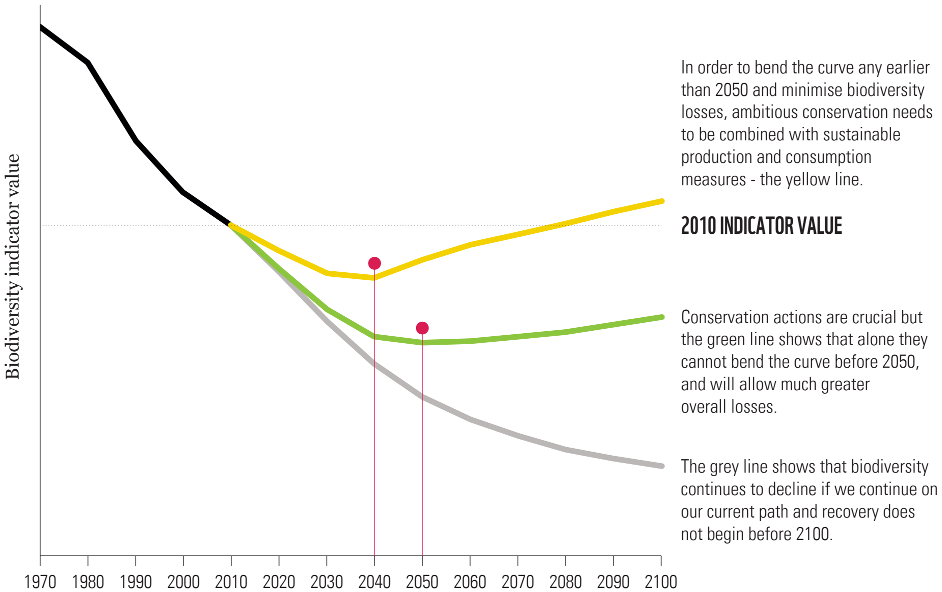


Figure 16:
What bending the curve means for biodiversity, and how to get there. This illustration uses one biodiversity indicator (Mean species abundance, MSA) for one biodiversity model (GLOBIO), averaged across four land use models, to explain what the different scenarios mean for projected biodiversity trends and what this tells us about how to bend the curve. Adapted from Leclère et al. (2020)[76].

Scenarios on future efforts to bend the curve *(mean across land-use change models)*

- Historical
- No action
- Increased conservation efforts
- Integrated Action Portfolio
- The date when recovery begins

TRADE Hub: towards sustainable global supply chains

There is an urgent need to address the sustainability of natural resource supply chains, given the impact they have on nature and people. A new ambitious multi-country collaboration is linking international trade systems to social and environmental impacts to try to bend the curve of biodiversity loss at scale.

Amayaa Wijesinghe and Neil Burgess (UNEP-WCMC)

There is compelling evidence that global trade is associated with significant negative impacts on biodiversity and people, particularly in producing countries [118]. The intricate web of supply chains underlying our economies means that these negative trade-related impacts on nature and people can be shifted around the world, from buyers to sellers and exporters to importers. Therefore, the phenomenon of exported biodiversity risk through international supply chains, such as exported deforestation, is a critically important driver of biodiversity loss that must be addressed [119].

The Trade, Development and Environment Hub (TRADE Hub) is a multi-country, interdisciplinary collaboration that seeks to understand international trade systems and their social and environmental impacts. Using this knowledge, the Hub seeks to inform transformational change at all levels, from international trade agreements through to national legislation, including through the mainstreaming of biodiversity impacts and dependencies in trade policy and implementation [120].

At present, global momentum is building to go beyond voluntary sustainability commitments previously put in place by individual entities, towards legally binding due diligence processes governed by importing countries or blocs [121]. In the UK, for instance, mandatory due diligence to evidence that imports are sustainably produced has already been introduced through Schedule 17 of the UK's Environment Act. Secondary legislation, to determine mechanisms for implementation, is now being drafted.

TRADE Hub provides ongoing analyses on nation-to-nation trade that feeds directly into these discussions, such as through the development of indicators that can trace how biodiversity loss can be attributed to global supply chains [119]. Further, together with partners in Indonesia, Brazil, Central Africa, China and Tanzania, TRADE Hub focuses on pathways towards equitable and sustainable upstream practices, especially supporting producer livelihoods, while aligning with downstream requirements, such as from end consumers.

Palm oil being poured into a bottle for purchase. Oshwe, Democratic Republic of the Congo.

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The importance of diversification

Many contemporary agrifood systems are unsustainable and, as currently governed, not fit for purpose. To achieve the Sustainable Development Goals, agrifood systems must be transformed to nourish people, nurture the planet, advance equitable livelihoods and build resilient ecosystems.

Ismahane Elouafi (Food and Agriculture Organization of the United Nations),*
Preetmoninder Lidder (Food and Agriculture Organization of the United Nations),*
Mona Chaya (Food and Agriculture Organization of the United Nations),*
Thomas Hertel (Purdue University, USA),
Morakot Tanticharoen (University of Technology Thonburi, Thailand)
Frank Ewert (Leibniz Centre for Agricultural Landscape Research (ZALF) and University of Bonn, Germany)

In 2021, close to 193 million people in 53 countries or territories experienced acute food insecurity at crisis levels or worse (IPC/CH Phase 3-5), an increase of nearly 40 million people compared to the previous high reached in 2020[122]. Almost 3.1 billion people cannot afford a healthy diet and millions of children suffer from stunting or wasting, while the global obesity rate continues to grow[123].

Interconnected and colliding global and local crises are unfolding. Right now, conflicts including the war in Ukraine, economic slowdowns, and the lingering impacts of COVID-19 are further pushing millions of people into poverty and hunger. High inequalities in income, employment opportunities and access to assets and services are increasing vulnerability, especially of small-scale producers, women, youth and Indigenous Peoples, furthering food and nutrition insecurity.

The importance of building efficient, inclusive, resilient and sustainable agrifood systems that provide affordable, nutritious and healthy diets for all with simultaneous improvements in the economic, environmental and social dimensions of sustainability has never been more apparent.

A radical transformation of agrifood systems is urgently needed, with diversification at many different levels and across components of the entire system at its core.

Diversification in food production, particularly across cropping and animal systems, is a means of increasing productivity, building resilience to climate change, enhancing resistance to pests and diseases, buffering economic shocks, improving the ecological performance of crops, and conserving biodiversity[124].

* The views expressed in this article are those of the authors and do not necessarily reflect the views or policies of FAO.

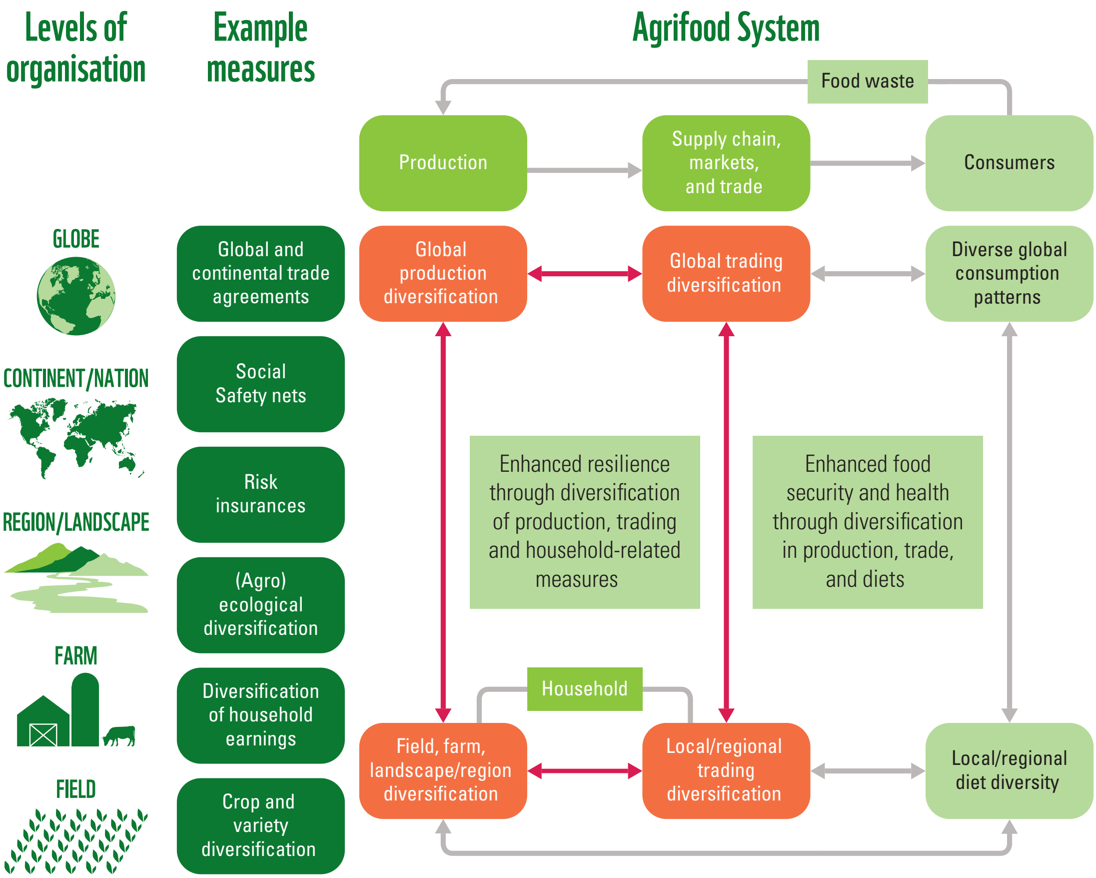
At the household level, **diversification of income sources** through risk management, safety nets and labour market diversification is key to improving the well-being of individuals.

Diversification through robust markets and trade, i.e. imports from multiple trade partners and across multiple commodities, is important for increasing food supply diversity [125].

Diversity in well-connected food supply chains is essential for absorbing and recovering from shocks and stresses. Finally, **diversity in diets** is critical for ensuring healthy and nutritious outcomes at the consumer level.

Diversifying agrifood systems leads to multiple benefits. Nonetheless, the interactions among diversification of production and other parts of the agrifood system are complex and need more attention.

Figure 17:
Food system diversification to enhance food systems resilience. Source: Adapted from Hertel et al. (2021) [124].



TRANSFORMATIVE CHANGE NEEDS TO PLACE PEOPLE AND NATURE AT ITS HEART

Integration across sectors and embedding social and environmental justice principles at the heart of the transition will be crucial.

David Leclère (International Institute for Applied Systems Analysis),
Bruna Fatiche Pavani (International Institute for Sustainability, Brazil),
Detlef van Vuuren (University of Utrecht),
Aafke Schipper (Radboud University),
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Neil Burgess (UNEP-WCMC),
Rob Alkemade (Wageningen University & Research),
Tim Newbold (University College London),
Mike Harfoot (Vizzuality and UNEP-WCMC)

A critical transformative change intervention will be to adopt a cross-sectoral, integrated approach (also termed 'nexus approach'), to promote solutions with co-benefits and avoid solutions with trade-offs between biodiversity, climate and other SDGs [39,109,112]. Examples of potential synergies include actions such as protecting remaining forests and restoring ecosystems – sometimes labelled 'nature-based solutions' and often promoted as double-wins for biodiversity and the climate. Such solutions are also gaining interest for their potential to offset further greenhouse gas emissions and/or ecosystem degradation elsewhere. However, appropriate safeguards are needed to ensure adequate design and the maintenance of co-benefits: the afforestation of natural grassland and the reforestation of forested ecosystems with monocultures of non-native species will be detrimental – not beneficial – to biodiversity.

Model and scenario work can explore pathways that maximise co-benefits and minimise trade-offs between climate and biodiversity and identify hard-to-avoid trade-offs (see Future modelling frontiers 1): while technically challenging (see Future modelling frontiers 2), this will support a needed shift in governance and policy towards integrated thinking and nexus approaches. This concept needs to cover also indirect, and sometimes long-distance, inter-relationships; for example in global supply chains, and the broader sustainable development agenda, including other environmental and social issues such as freshwater use, pollution, poverty and hunger. For example, model and scenario work shows that some forms of climate action may entail risks for the Sustainable Development Goals related to water use and pollution, biodiversity, health and hunger, while sustainable production and consumption measures in the food and energy systems can be beneficial for all these goals [76,126,127].

Nexus thinking can also be applied in support of conservation and restoration action, such as in spatial planning tools from global to sub-national scales (see Future modelling frontiers 4), helping to prioritise restoration actions for multiple goals [128].

Factors such as the capacity to mobilise resources for the transition, the degree to which basic material living conditions are satisfied, the expected vulnerability to environmental degradation, and the historical responsibility for ongoing environmental degradation are not equally distributed across countries, sectors and actors. Considerations of equitable effort-sharing in the transition are key points of discussion during international negotiations under the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity. For example, as compared to other nations, developed countries have achieved a higher level of development, have a larger capacity to mitigate and mobilise funding for adaptation, will be less affected by future environmental degradation, and are responsible for about half of cumulative historical greenhouse gas emissions: the application of equity principles implies that developed nations should undergo faster emission reductions than other nations, and contribute to international financial transfers for climate mitigation and adaptation.

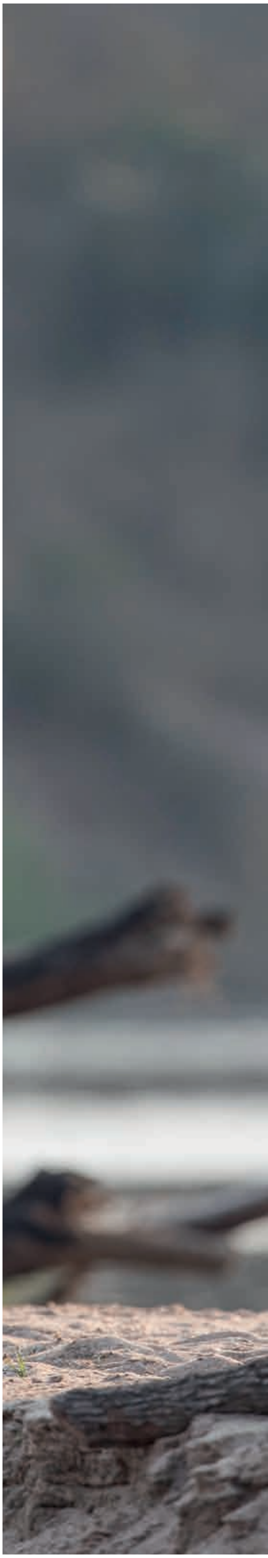
A sustainability transition will affect the lives and livelihoods of people in both positive and negative ways, and should contribute to reducing existing inequalities and injustices rather than exacerbating them. This requires a recognition of values, rights and the interests of all people, a shift in governance towards rights-based approaches and adequate procedural mechanisms to ensure effective and inclusive representation, and a more systematic assessment of the distributional impacts of costs and benefits of actions across actors.

Much work remains to be done, but model and scenario work has been used to explore the implications of various equity principles for distributing climate mitigation efforts across nations [129,130] and the potential climate implications of ensuring decent living standards for all [131], as well as distributional aspects of Nature's Contributions to People [132]. It has also explored the economic impacts of further ecosystem degradation [133], funding gaps to reach specific conservation targets [134], and how equity questions could be included in the design of ambitious pathways for biodiversity (see Future modelling frontiers 3).

Assisted natural forest regeneration in Zambia

The forests in Zambia are under serious threat due to large-scale deforestation, with most occurring in open access zones that are under a weak or ineffective management regime. Wood fuel (charcoal and firewood), agricultural expansion, timber extraction, bush fires, and mining and infrastructural development are some of the main causes of deforestation in the country.

In the Assisted Natural Forest Regeneration project, the Climate Smart Agriculture Alliance (CSAA) is working with farmers in the Central Province to manage the natural regeneration of deforested areas. Natural regeneration requires time and zero external intervention to flourish, so farmers from local communities are trained in areas such as fire management and continuous monitoring to ensure that areas under regeneration are protected. Local farmers actively participate in the restoration and protection of the forest. They assume the role of traditional leaders who are considered the custodians of nature in such communities.



A woman prepares a fire by the side of the Luangwa River in Zambia.

Future modelling frontiers 1: pathways integrating both climate and biodiversity action

Aafke Schipper (Radboud University), David Leclère (International Institute for Applied Systems Analysis) and Rob Alkemade (Wageningen University & Research).

Global biodiversity scenario studies have recently shifted focus from making exploratory projections to identifying strategies for achieving objectives for desirable nature futures [76,135]. For strategies to be effective, they need to tackle the direct and indirect drivers of biodiversity change and account for synergies and trade-offs with other Sustainable Development Goals [136-139]. The IMAGE-GLOBIO framework was used to assess the effectiveness of two contrasting strategies for putting nature on a path to recovery while contributing to halting climate change and feeding an increasing and wealthier global population [179].

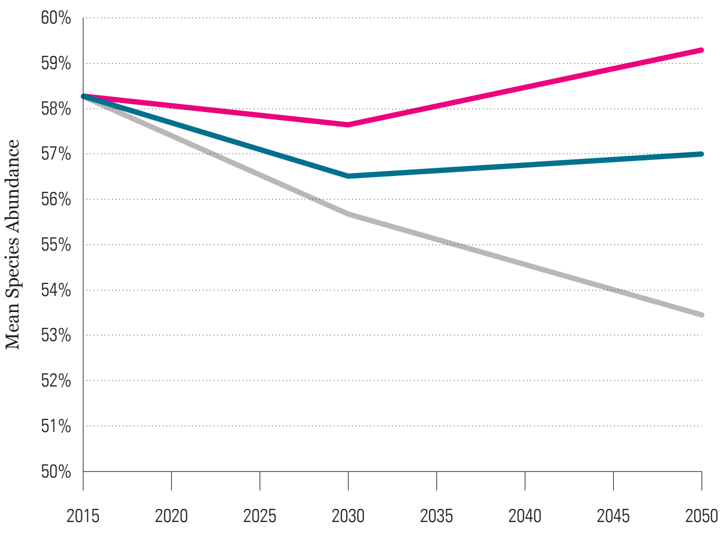
The strategies reflect different values of nature [140], different approaches to area-based conservation, and differences in agricultural production systems, thus broadening our view on the 'solution space'. The study revealed that both strategies may 'bend the curve' of biodiversity, but only if area-based conservation is combined with changes in the energy and food systems, minimising food waste, reducing the consumption of animal products and limiting climate change (Figure 18).

Figure 18: Contribution of conservation measures to biodiversity intactness in 2050 for two contrasting conservation strategies, and a baseline comparison
Biodiversity intactness is expressed by the mean species abundance (MSA) indicator of the GLOBIO model. a) Overall global terrestrial mean species abundance. b) Measures contributing to preventing terrestrial mean species abundance loss in 2050. Source: Adapted from Kok et al. (2020) [179].

Key

- Half Earth - integrated sustainability
- Sharing the Planet - integrated sustainability
- Shared Socioeconomic Pathways 2 baseline

a.



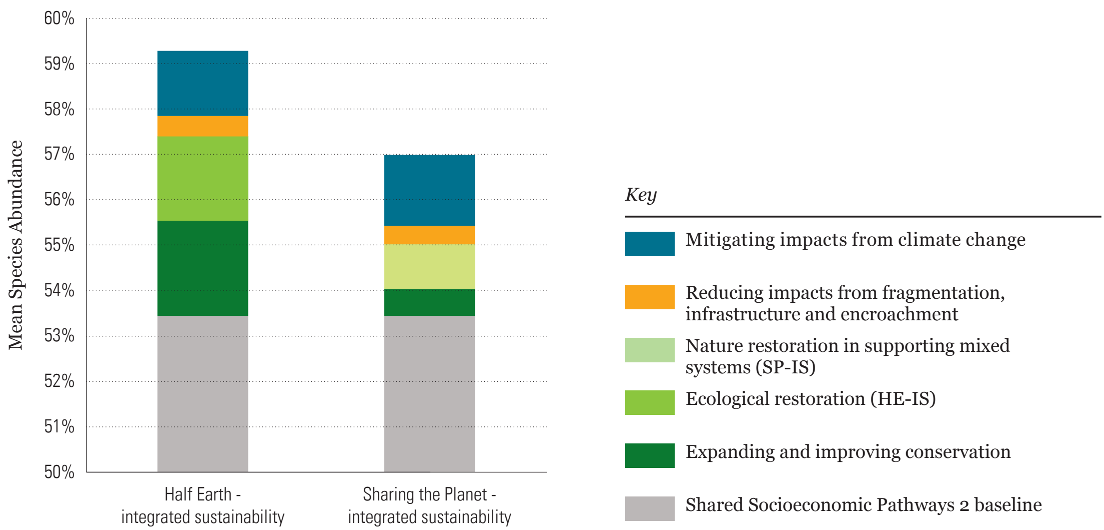
Future modelling frontiers 2: better modelling of climate and land-use impacts on biodiversity

Tim Newbold (University College London), Bruna Fatiche Pavani (International Institute for Sustainability, Brazil), Aafke Schipper (Radboud University) and David Leclère (International Institute for Applied Systems Analysis)

Model and scenario studies are investigating pathways for ambitious targets for biodiversity and climate (see Future modelling frontiers 1), with explicit accounting for both climate and land-use change pressures on biodiversity. Yet these two major drivers of biodiversity change may reinforce one another [141-144] for two key reasons [145]. First, land-use changes create fragmented landscapes, through which it is harder for species to move to keep up with climate change [144]. Second, land-use change from natural habitats to human-used land (agriculture and cities) alters the local climate, typically creating hotter and drier conditions, and so adding to the effects of regional climate warming [146].

These interactions further highlight the importance of integrated approaches, but they are challenging to include in models. For example, recent work suggests that increasing natural habitats within landscapes might reverse the direct impacts of land-use change on biodiversity, and buffer the effects of climate change by providing cooler and wetter local climate conditions and corridors [143, 144, 147]. However, this might not work everywhere [148].

b.



Towards multi-use landscapes in Africa

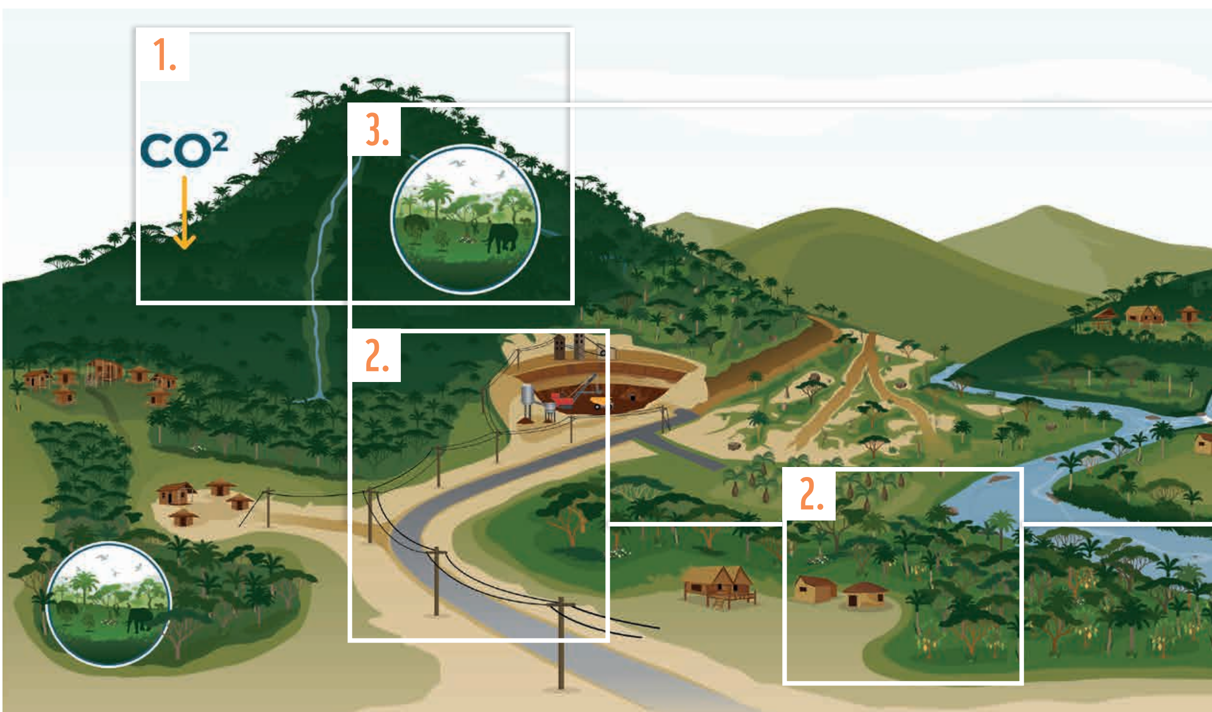
Urgent and transformative action is needed to address the complex, interconnected challenges facing society today. Siloed and fragmented approaches cannot adequately fight climate change, biodiversity loss, water scarcity, food security and poverty. A new approach is putting nature at the heart of decision-making and calls for collaborative action within and between sectors to achieve success.

Pippa Howard, Nicky Jenner, Koighae Toupou, Neus Estela, Mary Molokwu-Odozi, Shadrach Kerwillain, Angelique Todd (Fauna & Flora International)

In West Africa, in the transboundary forest landscape that extends from southeast Guinea into Sierra Leone to the west, Liberia to the south and Ivory Coast to the east, Fauna & Flora International, with partners and stakeholders, is introducing the CALM (Collaboration Across the Landscape to Mitigate the impacts of development) framework [149] to put nature at the heart of sustainable development.

The region is rich in biodiversity and home to a rapidly growing population. Many rural communities rely on small-scale agriculture for subsistence and are heavily dependent on access to land and the essential services provided by nature. Multiple economic sectors reliant on natural resource extraction also operate in this landscape, which is expected to face intensifying pressure from planned large-scale mining projects as well as

Figure 19:
The CALM framework at a glance: individual, collective and collaborative actions all contribute to landscape objectives. Source: Adapted from FFI (2021) [149].

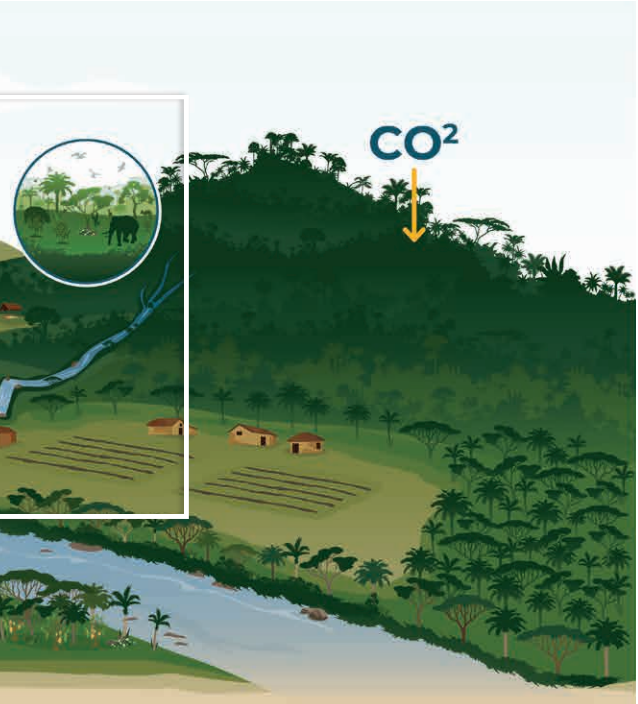


associated transport infrastructure. The potential for significant cumulative impacts on biodiversity and communities is high.

CALM builds on the strengths of existing concepts and approaches: landscape approaches, the mitigation hierarchy, and the concept of socioecological systems. The framework is designed to embed nature into land use and development processes and calls for greater coordination and collaboration towards achieving common sustainable landscape objectives.

The framework is designed to be used in complex multi-use landscapes where pressure from concurrent developments is intensifying or is anticipated, and to address shortcomings in current business-as-usual management, so that landscapes are resilient, development is sustainable, and social and ecological values survive and thrive.

As each decision, project and activity cuts away a little more forest, adds pollutants to the rivers and soils, and extracts more natural resources than are put back, the cumulative effects on species, ecosystems and the people that depend on them are often significant. There is growing concern that this will lead to 'death by a thousand cuts'[150]. In piloting the CALM framework, Fauna & Flora International is engaging diverse actors and institutions to better understand forest landscapes under pressure from development, foster dialogue, and identify opportunities for collective and collaborative action to achieve sustainable landscape objectives.



All land users contribute to landscape objectives through individual, collective and collaborative actions to:

1. AVOID and SECURE priority areas to maintain biodiversity and ecosystem services
2. MITIGATE and MANAGE induced and cumulative effects across the landscape
3. RESTORE degraded ecosystems and AVOID and MINIMISE future impacts

What do we need from economics for transformative change?

Economics, at its core, is the study of how people make choices under conditions of scarcity, and of the consequences of those choices for society. Simply put, we need to move to an economy that values well-being in its diverse forms, not only monetary, and one which is fully responsive to resource scarcity.

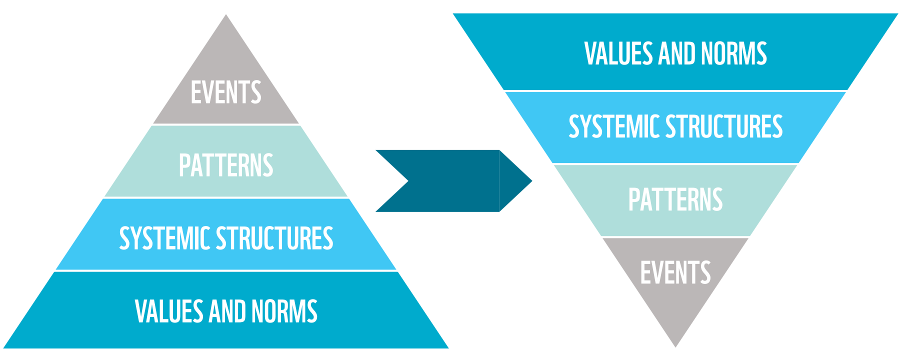
Francisco Alpízar and Jeanne Nel
(Wageningen University & Research)

Conventional environmental policy and management has mainly focused on the direct causes of nature's degradation. For example, deforestation directly causes biodiversity loss, and the excessive use of agrochemicals pollutes the soil and water. While necessary, there is widespread agreement among the science and policy communities that this conventional conservation approach alone is failing to change the destructive way in which our economies and societies use and relate to nature[39, 76, 112].

More urgent and ambitious 'transformative changes' are needed to the ways in which we live in modern human society to reduce the root causes of nature degradation[151]. These causes can be demographic (e.g. human population dynamics), sociocultural (e.g. production and consumption patterns, status-seeking behaviour), financial (e.g. the focus on GDP growth and increasing wealth through investments or profits), technological, or related to poor institutions and governance.

In all cases, these root causes relate to the way in which individuals, households, firms, and organisations use scarce natural resources to achieve multiple, sometimes competing goals, and the value allocated to nature in making the necessary trade-offs.

Figure 20:
Conventional conservation efforts have mainly focused on events that directly drive biodiversity loss (e.g. habitat loss or over-exploitation of species), or understanding the patterns causing these events (e.g. trends in land use over time linked to species decline). While these approaches help us to react to events and anticipate and plan for them, they ignore the root causes that led to these events and patterns in the first place – the so called 'indirect drivers'. Transformative approaches focus on addressing these indirect drivers: the systemic structures (e.g. economics, political and social systems) and the values and norms that shape our relation to nature. Source: adapted from Abson et al. (2017)[181].



There are three key principles that need to be embedded into economics to drive the transformative changes required:

Creating a future in which people and nature flourish depends on how society values nature and how that is built into daily decisions.

Different perspectives and multiple values (not only money-based) define everyday practices and decisions. Institutions should articulate these values into social conventions, norms and rules. Yet current institutions and government policies lopsidedly favour nature's degradation, thereby either actively promoting destructive practices or failing to regulate them. Harmful subsidies, e.g. those making fossil fuels cheaper or land clearing less costly, were estimated at US$ 4-6 trillion in 2020 [38], and existing governance of common pool natural resources relies on weak legislation (e.g. voluntary incentives) with no clear line of responsibility. As a result it frequently fails to protect key natural infrastructure, for example the world's oceans, rainforests and wetlands, that provide critical services to people.

Embedding nature more explicitly into financial and economic systems can help to shift choices towards sustainable practices.

Three global transitions are key from an economic perspective:

The prices of commodities and inputs should reflect the true cost to society in terms of environmental and human impacts, thereby rebalancing the demand and supply of consumption goods, from food to sneakers, to within the limits of nature's capacity.

The use of economic tools like social cost-benefit analysis, and improved discounting to account for very long-term horizons, should become part of the global standard of practice for credible decision-making by businesses, financial institutions, and multilateral organisations. For example, infrastructure projects funded by multilateral banks should undergo a thorough social cost-benefit analysis.

An improved recognition of the public nature of key natural resources (e.g. our oceans, rivers and riparian forests, wetlands) should lead to special attention in terms of governance and precautionary safeguards.

Transformative changes can be triggered by carefully designed interventions, targeting critical leverage points, at different scales of action that change the choice architecture underpinning day-to-day decisions.

The design of such interventions and associated enabling conditions needs to consider trade-offs between competing goals that span different places and people throughout the entire socioecological system, and the role of incentives and political barriers to policy implementation [152]. Transformative change requires a mix of regulations, public engagement and behavioural/market-based instruments, while simultaneously discontinuing harmful subsidies and disincentives [153, 154].

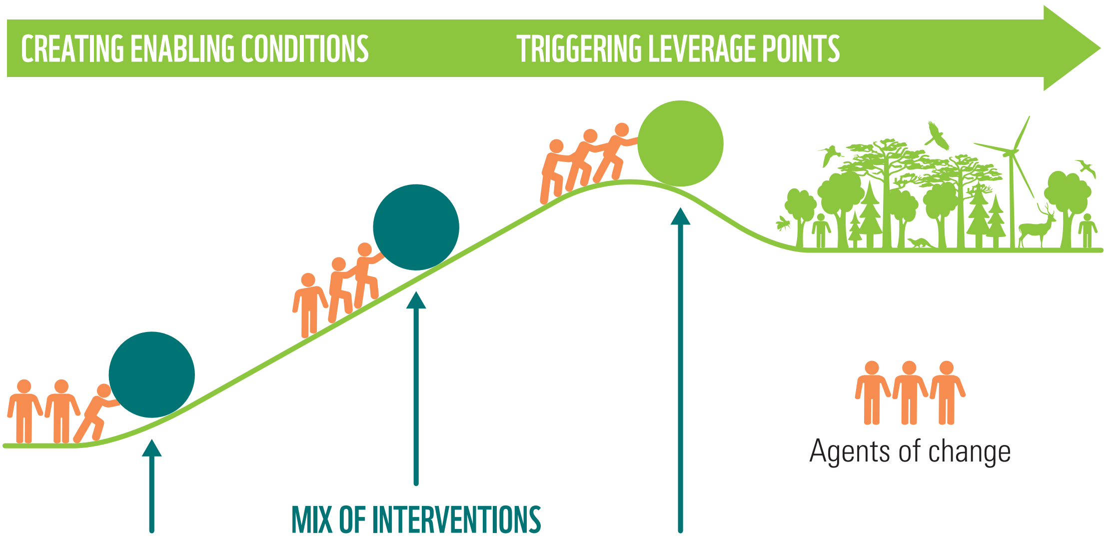


Figure 21:
System tipping dynamics-agents of change and a mix of interventions can create enabling conditions that trigger and accelerate transformative pathways to sustainable extraction, production, consumption and trade. Source: After Chan et al. (2020) [180]*; Lenton et al. 2022* [155]*.*

Dzame Shehi handles a chameleon found by the roadside. Dzombo village. Kwale, Kenya.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Making technology work for the planet

The economics are simple, the science is complicated. Can technology help us to explore, monitor, model, and ultimately manage Earth's natural resources sustainably?

Lucas Joppa (Microsoft)

The economics are simple – the foundation of modern life is built upon the natural resources delivered by climates, ecosystems and species.

The science is complicated. Determining how natural systems are created and maintained – and how they become destabilised when disrupted – is a complex task requiring deep insights from physics, chemistry, biology and ecology.

Our understanding of these systems is not perfect. We have only discovered a fraction of the species on this planet and have an even more rudimentary understanding of the traits they possess and the interactions they engage in to achieve the balance of nature humans are completely reliant on.

But we also know that for far too long people have borrowed from our environmental future to pay for our economic present. We know climates are quickly destabilising, ecosystems are decaying, and species are going extinct. We now have an urgent choice – to repay our debts, or continue to destabilise the infrastructure of modern human society.

Logic dictates the answer; defaulting is not an option. We know what we must do: balance to zero the accumulation of greenhouse gases in our atmosphere, the destruction of our forests, fields, and water, and the population declines and extinctions of species.

But questions remain. How should we structure policies to achieve this, and how should we enforce them and measure their impacts while constantly increasing our basic understanding of the natural systems we are working to conserve?

The technology to answer these questions is now available. Access to unprecedented amounts of data from sensors on satellites, smartphones and *in situ* devices can be combined with incredible amounts of computing power through advanced algorithms to help us classify, predict and make decisions about managing natural systems.

We can explore for new species using visual, acoustic and genomic sensors, monitor deforestation in all the world's forests and protected areas in real time, model and predict the ecosystems that will be most under threat, and manage these systems through decision support frameworks – *if* we want to.

Because the difficulty ahead is not one of technological capability, but of human desire. Harnessing the infrastructure of the information age to protect our planet will require a rapid, purposeful, coordinated and dedicated global agreement and investment. An effort that moves beyond experimentation to deliver actual products that can be deployed at scale by governments and organisations around the world. An effort that feeds into repeatable reporting frameworks that allow us to manage our world more adaptively. One can imagine a *Living Planet Report* underpinned by a vast technological infrastructure feeding information from ecosystems around the world into a centralised repository overseen by scientists dedicated to maintaining the system and responding to its alerts. I do.

It is time to do more than imagine. We must put technology to work for the planet – to help people explore, monitor, model and ultimately manage Earth's natural resources. Doing so will represent one of the most valuable investments human societies can make – simultaneously ensuring the future of humanity while paying off the debts of our past.

Greening Kaptagat in Kenya

"We are the generation who inherited the world from the pioneers of yesteryears and our great contribution will be anchored on sustainability. Our task, however, is not so simple. It is a race against time to save what is left of our home. Every minute counts just like a marathon. My generation of athletes will run this marathon to save our forests." Dr. Eliud Kipchoge, renowned world marathon and nature champion.

Jackson Kiplagat, Joel Muinde, Kiunga Kareko and Gideon Kibusia (WWF-Kenya)

Dr. Eliud Kipchoge (two time Olympic Champion & Kenya's Delegate to COP 26 in Glasgow)

Stretching across 32,941 hectares, the Kaptagat landscape, including a 13,000 hectare forest, is an extension of the larger Cherangany-Elgeyo Hills ecosystem, one of Kenya's five key water towers [156]. Due to its high altitude and climate it is where many elite athletes, including Eliud Kipchoge, the renowned world marathon champion, train [157].

Like many landscapes across Kenya, Kaptagat faces countless threats including climate change, unsustainable agricultural practices, illegal logging, overgrazing, forest encroachment, forest fires and landslides [156]. So, in line with the Kenyan government's development strategy, Kenya Vision 2030 (Constitution of Kenya, 2010; Government of Kenya, 2016), WWF-Kenya and the Eliud Kipchoge Foundation are implementing the project *Greening Kaptagat: Establishing Agroforestry and Clean Energy Solutions within a Forest-Based Landscape* [160].

By working with community members, and in partnership with government agencies and passionate nature champions, more than 225 hectares of land has been restored in the last two years. Seedlings have been sourced from women and youth groups as well as nurseries owned and run by local community forest groups, enhancing their livelihoods through increased income. Overall, the Greening Kaptagat project will lead to at least 1,000 hectares of deforested and degraded land being put under restoration, and at least 1,000 people benefiting from improved land productivity.

Dr. Eliud Kipchoge at the Fourth Annual Kaptagat Tree Planting Drive in 2020. Through the Eliud Kipchoge Foundation, he has adopted 50 hectares in Kaptagat forest for restoration as part of WWF's Greening Kaptagat Landscape Restoration Programme with the government of Kenya and local communities.

Further, by training local farmers on sustainable crop and animal farming, there will be less pressure on the landscape, especially from overgrazing and encroachment on the forest for more farmland. Through the provision of grain silos and hermetic bags there will be lower post-harvest losses. The project has also facilitated global and national advocacy to mainstream climate policy.


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Future modelling frontiers 3: better inclusion of equity and fairness in biodiversity pathways

Mike Harfoot
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David Leclère
(International Institute for
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A fair and just transition will need several interventions, from the effective recognition and participation of marginalised groups in decision-making, to promoting deliberation on the fair distribution of efforts and benefits. The implications of various equity principles for the distribution of climate action across nations have been explored [129], but less so for biodiversity; this might be a significant barrier to the implementation of the post-2020 Global Biodiversity Framework. What could a fair distribution of actions across nations towards an emblematic goal, such as a global net gain of natural ecosystems, look like?

In available land-use change projections we pictured such a net gain in the global area of natural ecoystems [76] but, is the distribution of efforts across countries fair? Such projections are broadly consistent with the idea that nations which have already converted a large share of their natural ecosystems and reached a high human development level could be asked to reach ambitious net gain trajectories, while countries in the opposite situation might still be allowed a managed net loss trajectory – a frame that was proposed by others to illustrate how equity principles such as historical responsibility and right to development could play out [161].

Beyond this illustration, the development of fair transition models and scenarios could be used to explore pathways compatible with a broader set of alternative equity principles, representing a diversified set of worldviews. Models could also explore the distribution of efforts and benefits at various scales and for various groups, including the risks to Indigenous Peoples and Local Communities from additional conservation and restoration efforts, and the potential benefits from rights-based approaches.

Future modelling frontiers 4: modelling biodiversity targets at regional and global scales

Bruna Fatiche Pavani, Bernardo Baeta Neves Strassburg, Paulo Durval Branco and Rafael Loyola (International Institute for Sustainability, Brazil)

The benefits and costs arising from restoration, conservation and conversion activities can vary significantly for a given landscape. The multicriteria optimisation of priority areas should afford better results for biodiversity and Nature's Contribution to People in efforts to increase agricultural productivity and ecosystem restoration. The recent Amazon 2030 initiative recommends the immediate development and adoption of spatial prioritisation maps, to optimise costs and benefits for Amazon forest restoration, by private and public decision-makers and agents of international cooperation and investment [191].

Modelling exercises are currently being carried out to assess the different levels of global efforts [193] to discuss the goals that will guide the action-oriented targets from parties to the Convention on Biological Diversity until 2050 [192]. It is important to point out that these scenarios account for future projections on agricultural and urban expansion, population growth and climate change, beyond restrictions for restoration on a local level.

Feasible targets should aim for environmental and socioeconomic gains simultaneously, bending the curve for biodiversity and Nature's Contribution to People through systematic spatial planning.

The Amazon We Want: a transition to sustainable development

The *Amazon Assessment Report 2021*, produced by the Science Panel for the Amazon, is the most comprehensive and compelling scientific portrait of the Amazon ever produced, providing a roadmap for the region's survival and sustainable development.

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Mercedes Bustamante (University of Brasilia),
Germán Poveda (Universidad Nacional de Colombia),
Marielos Peña-Claros (Wageningen University)
and Emma Torres (UN Sustainable Development Solutions Network)

The *Amazon Assessment Report 2021*, developed by more than 240 scientists, looks at the Amazon's current state, threats, and policy-relevant solutions based on the knowledge of the scientific community of the region and Indigenous and local knowledge.

Based on the current state and its threats, the authors recommend four key actions: (1) an immediate moratorium on deforestation and degradation in areas approaching a tipping point; (2) the achievement of zero deforestation and degradation by 2030; (3) the restoration of terrestrial and aquatic ecosystems; and (4) an inclusive and just bioeconomy of healthy forests and rivers.

These actions are urgent because 17% of the Amazon basin has been deforested [162], with an additional 17% of the biome degraded [163]. This is threatening the Amazon, a critical element in the Earth's climate system, storing 150 to 200 billion tonnes of carbon [164, 165], and its biodiversity – including 18% of vascular plant species, 14% of birds, 9% of mammals, 8% of amphibians and 18% of fishes that inhabit the tropics (data calculated for the biogeographic limits of the Science Panel for the Amazon utilising data from [166] and [167]).

Currently, 27% of the Amazon is occupied by Indigenous territories with the lowest rates of deforestation [168]. To safeguard and strengthen their rights, and advance sustainable development, the Science Panel for the Amazon considers investments in science, technology, innovation, and Indigenous Peoples and local community-led land conservation essential to avoid catastrophic outcomes in the Amazon and globally.

Figure 22:
Multiple and connected dimensions for a fair and just transformation towards the Vision of the Living and Sustainable Amazon. Source: Science Panel for the Amazon (2021)[169].

An urgent call to protect 80% of the Amazon by 2025

Amazonian Indigenous organisations representing 511 nations and allies are calling for a global agreement for the permanent protection of 80% of the Amazon by 2025 as an urgent measure to avert an imminent tipping point and planetary crisis.

Gregorio Diaz Mirabal and Zack Romo Paredes Holguer (Coordinator of Indigenous Organizations of the Amazon River Basin – COICA), Alonso Córdova Arrieta (WWF-Peru)

The Amazon is the largest and most bioculturally diverse tropical forest in the world. It is home to more than 500 Indigenous Peoples (IP) groups, including 66 groups living in voluntary isolation and initial contact [172]. The Amazon River system holds nearly 20% of the world's fresh water [173], while Indigenous Territories physically occupy 2.37 million km^2 of the Amazon basin [174]. By themselves, Amazonia Indigenous Territories are responsible for storing nearly one third (32.8%) of the Amazonia region's above-ground carbon (28.247 million tonnes), making a significant contribution to the mitigation of, and adaptation to, climate change. In 2021, the IUCN highlighted the role of Indigenous territories by recognising them as "spaces for sustainable conservation" [175].

These are scientific and statistical data, but for Amazonian Indigenous Peoples the Amazon is more than that. It is the space where our past, present and future converge; it is the energy and connection with our ancestors, with the rivers, the mountains, and the animals. It represents our home, our source of healing and food; it is our life.

Yet, governments and national leaders do not understand this worldview and do not use the integrative approach of Indigenous Peoples for environmental and social safeguards. As a result, both impacts and threats are advancing in our territories, bringing the Amazon region to a dangerous tipping point.

Science has established that the tipping point is between a threshold of 20 to 25% of deforestation and forest degradation combined [177]. Data shows that **26% of the Amazon is under a state of advanced disturbance** [176] which includes forest degradation, recurrent fires, and deforestation. This is not a future scenario; we are currently experiencing a continuous level of destruction in the region with devastating local impacts and negative implications at a global level for climate stability.

The horizon set for global conservation goals is the year 2030, but **in eight years the Amazon as we know it might have ceased to exist**. Facing this scenario, we the Indigenous Peoples dream about working with territorial and global alliances to protect and defend our Amazon, mother jungle, and to stop it from breathing its last breath. We need its air, its water, its medicine and its food, we need its spiritual strength, and that will only be possible with the unity, respect and inclusion of all wisdom, technologies and knowledge, sitting at the same table and at the same level.

That is why COICA is calling for a global agreement for the permanent protection of 80% of the Amazon by 2025, backed by all Amazon governments and by Indigenous Peoples and the global community, as an urgent response to the current climate and biodiversity crises facing humanity.

To accomplish this we need legal security for our territories as a guarantee for life; recognition of the right to free, prior, and informed consultation; protection and respect for the traditional knowledge systems of Indigenous Peoples as solutions; an end to the criminalisation of Indigenous defenders as well as the violence, systemic threats and murders against them; and direct financing for Indigenous Peoples with permanent technical support for human and economic resource management.

Finally, we direct a question to politicians, academics and to the world: is it possible for the Amazon biome to be declared as living Intangible Cultural Heritage, and for all the creatures who live in it to no longer be murdered, burned and contaminated? Is it possible to save this ecosystem from extinction? We believe it certainly is, but to achieve it, it is urgent to value Indigenous Peoples and to allow them to lead this process together with all of you.

About COICA

Coordinator of the Indigenous Organizations of the Amazon Basin, is an indigenous organization of international convergence that acts on behalf of 511 Indigenous Peoples, of which approximately 66 are Indigenous Peoples in Voluntary Isolation and Initial Contact (PIACI). COICA is articulated through organizations with a political-organizational base, present in the 9 Amazonian countries:

AIDESEP (Peru): Interethnic Association for the Development of the Peruvian Jungle. COIAB (Brazil): Coordinator of the Indigenous Organizations of the Brazilian Amazon (Coordenação das Organizações Indígenas da Amazônia Brasileira). ORPIA (Venezuela): Regional Organization of the Indigenous Peoples of Amazonas. CIDOB (Bolivia): Confederation of Indigenous Peoples of Bolivia. CONFENIAE (Ecuador): Confederation of Indigenous Nationalities of the Ecuadorian Amazon. APA (Guyana): Amerindian Peoples Association of Guyana. OPIAC (Colombia): National Organization of the Indigenous Peoples of the Colombian Amazon. OIS (Suriname): Indigenous Organizations of Suriname (Organization van Inheemsen in Suriname). FOAG (French Guiana): Federation of Autochthonous Organizations of French Guiana (Federation Organizations Autochtones Guyane).

Source: https://coicamazonia.org/somos/

THE PATH AHEAD

Gavin Edwards, Scott Edwards,
Lin Li and Guido Broekhoven
(WWF International)

The evidence presented in this edition of the *Living Planet Report* is clear. The pressure we are placing on the natural world is driving an escalating nature crisis which, in turn, is undermining its ability to provide crucial services, including climate change mitigation and adaptation. Our destruction of nature is also increasing our vulnerability to pandemics, while placing the most vulnerable at the greatest risk.

There is still time to act, but urgency is needed. A number of solutions are available, developed by many different stakeholders, from business to Indigenous Peoples and local communities. These range from new financial disclosure initiatives to better understand and align the impact of finance, to the multi-use landscape approaches and case studies detailed in this report.

The drivers of biodiversity loss are complex and cross-cutting, and it is vital to acknowledge that there is no single, simple solution. It is therefore all the more important that the world adopts a shared global goal for nature, to guide and drive action across governments, business and society.

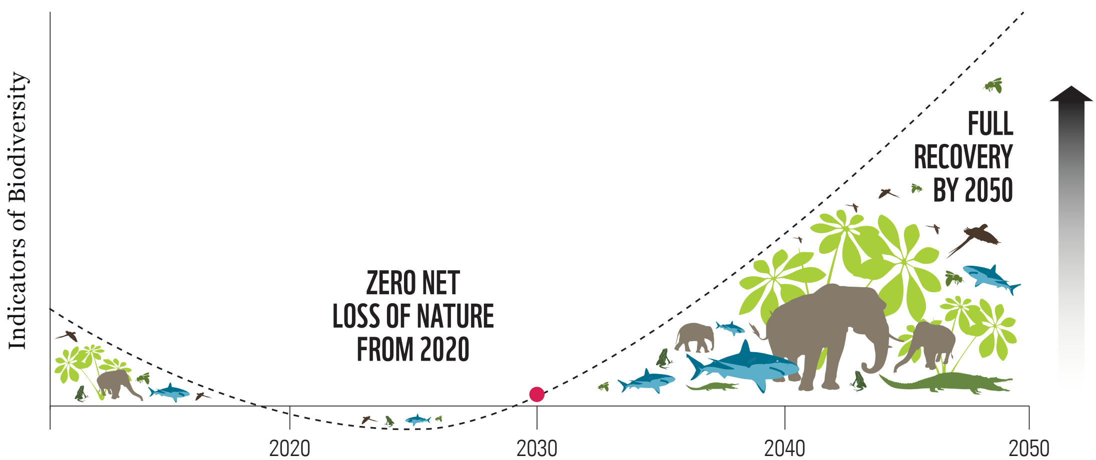
A global goal of reversing biodiversity loss to secure a nature-positive world by 2030 is necessary if we are to turn the tide on nature loss and safeguard the natural world for current and future generations [193]. It must be our guiding star, in the same way that the goal of limiting global warming to 2°C, and preferably 1.5°C, guides our efforts on climate.

Action to secure a nature-positive world this decade, measured through an increase in the health, abundance, diversity and resilience of species, populations and ecosystems, can be taken by everyone, and also adopted nationally and ultimately globally, to urgently transform our relationship with nature.

Encouragingly, momentum is building. More than 90 world leaders have endorsed a Leaders' Pledge for Nature, committing to reverse biodiversity loss by 2030, and G7 have signalled their ambition to secure a nature-positive world.

The UN Convention on Biological Diversity's COP15 provides a momentous opportunity for world leaders to adopt an ambitious global biodiversity framework that drives immediate action for a nature-positive world. When governments protect 30% of the world's land, freshwater and oceans through rights-based and community-led approaches; tackle the drivers of nature loss that largely originate in the other 70%; ratchet up their actions if they are collectively falling short; and commit the requisite resources for conservation and sustainable use of biodiversity, then a nature-positive world will be within reach. World leaders who have signed the Leaders' Pledge for Nature must play a special role in early implementation, leading the way, including by securing the necessary finance.

Figure 23: Nature Positive by 2030
A measurable global goal for nature. Source: Locke et al. (2021)[193].



Recognition of the integrated nature of our environmental challenges in turn enables the search for win-win solutions. Again, the science is clear: immediate action to reverse biodiversity loss is essential if we are to succeed in limiting climate change to 1.5°C; and climate change is expected to become a dominant driver of biodiversity loss if left unchecked. It will only be through identifying and pursuing solutions that tackle these connected challenges while also benefiting people that we will be able to course-correct and secure a healthier natural world, to help achieve the Sustainable Development Goals.

The *Living Planet Report 2022* provides a snapshot of the health of our natural world, our life support system. There are causes for dismay, but there are also causes for optimism. It must be our rallying cry for the urgent action needed to deliver a nature-positive, net-zero emissions and equitable future for all.

Baobab trees in the allée des baobabs (the alley of baobabs) in the western coastal region of Madagascar.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Publication details

Published in October 2022 by WWF – World Wide Fund for Nature (Formerly World Wildlife Fund), Gland, Switzerland ("WWF").

Recommended citation:

WWF (2022) *Living Planet Report 2022 - Building a nature-positive society.* Almond, R.E.A., Grooten, M., Juffe Bignoli, D. & Petersen, T. (Eds). WWF, Gland, Switzerland.

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