

Biodiversity valuation

How measuring the value of biodiversity can help avoid an ecological collapse and fight climate change

Roland
Berger

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The last half century has seen wildlife populations shrink by as much as 70 percent. Biodiversity loss on this scale poses a significant risk to the environment. Biodiversity supports the vital functions provided by ecosystem services including the provision of clean water and air, the fertilization and pollination of agriculture lands, the natural sequestration of carbon, the protection of our shores from weather events, and nature-based tourism opportunities among others. If we are to avoid ecological collapse and a potential climate disaster, we need to take urgent action.

Global awareness of the biodiversity crisis is on the increase. But to finally shift the emphasis back onto the natural environment, businesses need adjust their economic models. Translating biodiversity into dollar terms and including this valuation in decision-making processes can reveal the true costs and benefits of planned projects.

Biodiversity valuation establishes a sound basis for sustainable policymaking and economic development. It creates a common language for conservationists, policymakers and the business community. The direction of change is clear: Sooner or later, companies will need to respond to public and regulatory pressure and include it in their calculations and decision-making processes.

In this study we present our own five-step approach to using biodiversity valuation in practice and examine how a concerted and collaborative effort can help save the planet from ecological collapse and climate catastrophes. The proposed approach sheds the light on the opportunity for governments and businesses alike to lead this critical transition. As part of our research, we also interviewed several leading figures in the fields of biodiversity valuation and conservation and include their insights throughout the study.

Contents

P 4	1/ On the brink of ecological collapse
P 7	2/ The push for a common global framework
P 11	3/ A pragmatic approach to valuing biodiversity and ecosystem services
P 17	4/ Working together for change

On the brink of ecological collapse



The rapid economic growth of the past centuries has led not only to a climate crisis but also to a crisis of biodiversity – that is, the variability and variety of life on Earth. According to the World Wide Fund for Nature (WWF), economic growth and the development of cities, agriculture, industry and infrastructure have had a startling impact on biodiversity and habitats, causing nearly 70 percent of wildlife on the planet and as much as 83 percent of freshwater species populations to be lost in just the last 50 years.¹ ▶ **A**

This ongoing rapid loss of biodiversity creates risks for both society and the economy. Our economic system is completely dependent on nature and damage to natural systems harms both the planet and our economic prospects.² In fact, biodiversity supports the vital functions provided by ecosystem services including the provision of clean water and air, the fertilization and pollination of agriculture lands, the natural sequestration of carbon, the protection of our shores from weather events, and nature-based tourism opportunities among others. As early as 1972, the report *The Limits to Growth*, commissioned by the Club of Rome and based on a model developed by the Massachusetts Institute of Technology (MIT), predicted that if we kept growing at the then-current rate, the planet could expect ecological collapse sometime towards the middle of the twenty-first century. Yet the action we have taken since that gloomy prediction has been insufficient. Indeed, recent research indicates that we have now crossed six of the nine planetary boundaries mapped out by the Stockholm Resilience Center – interrelated processes within the complex biophysical system on Earth. Loss of biodiversity affects all of these planetary boundaries.³

What would ecological collapse mean for society? First and foremost, it would impact our access to food and clean water, potentially leading to the uncontrolled spread of invasive species and diseases. But even now, before we reach the point of total ecological collapse, we are seeing the effects of environmental imbalance. A recent report

by the United Nations identified more than 3,500 harmful invasive alien species that are currently spreading due to a combination of the rebalancing of ecosystems and global warming or climate change.⁴

ADJUSTING ECONOMIC MODELS

Our disregard for the loss of biodiversity is reflected in the economic models that we use. Today's models fail to properly take into account the "externalities" – that is, the environmental costs and impact on biological diversity of business, industry, infrastructure projects and so on. Indeed, some analysts have even suggested that most businesses would probably not be profitable today if these costs were properly accounted for⁵

This lack of accountability has a direct impact on precisely the things that humanity needs in order to survive: access to fresh water, clean air, quality soils and healthy ecosystems. To continue along this path would be to court disaster. But there is hope, in the shape of growing global awareness about the need to protect or restore biodiversity and to turn to models that translate biodiversity into economic terms – as we discuss in the following chapter.

1 <https://www.worldwildlife.org/press-releases/69-average-decline-in-wildlife-populations-since-1970-says-new-wwf-report>

2 <https://www.ft.com/content/66fa93fa-2766-4eff-8bba-d528fdcc410b>

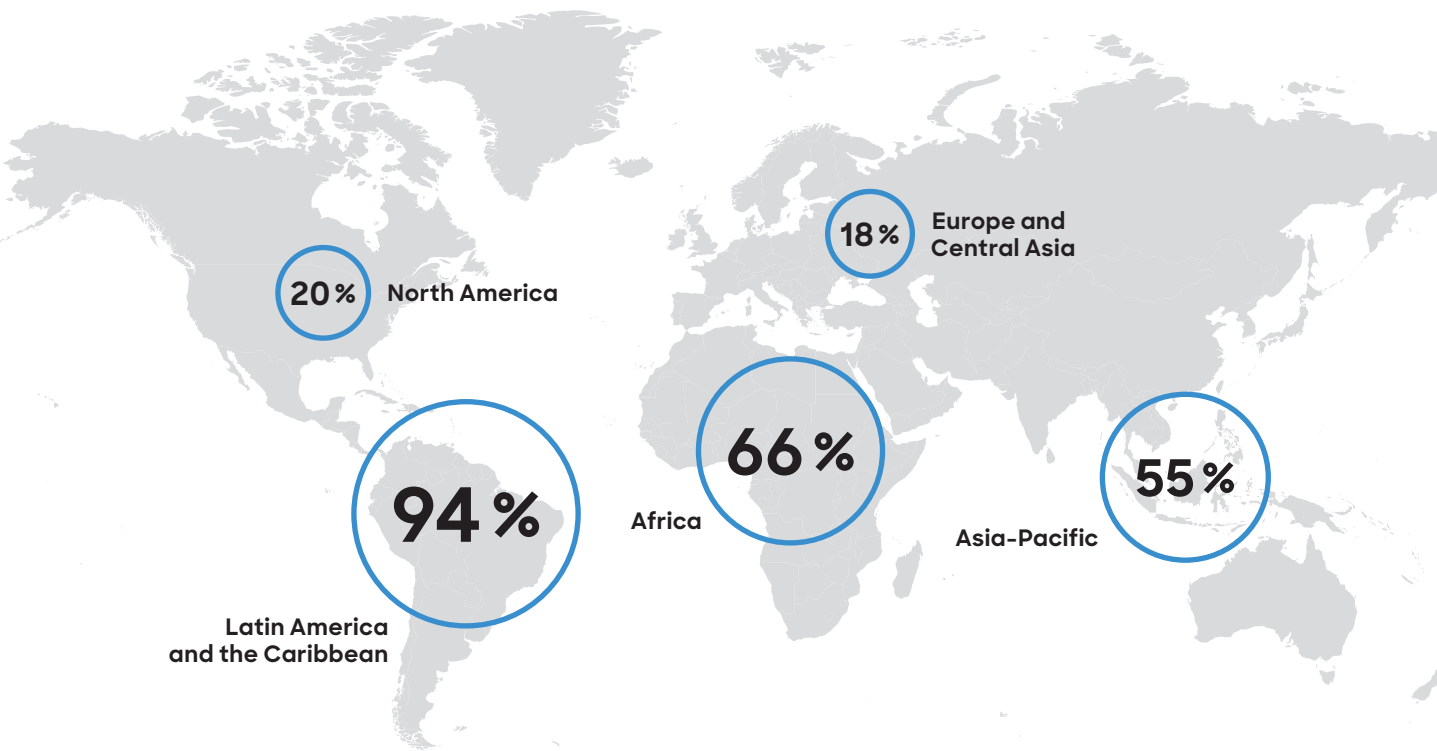
3 <https://www.stockholmresilience.org/research/planetary-boundaries.html>

4 <https://www.ipbes.net/IASmediarelease>

5 <https://grist.org/business-technology/none-of-the-worlds-top-industries-would-be-profitable-if-they-paid-for-the-natural-capital-they-use/>

A Biodiversity loss

Regional breakdown of decrease in monitored wildlife populations (1970–2022)



69%

Average global decrease
in monitored wildlife
populations 1970–2022

83%

Decline in freshwater
species populations, which
are the species with the
greatest observed decline

Based on the 2022 Living Planet Index (LPI) which
tracks the population of over 32,000 species including
mammals, birds, fish, reptiles and amphibians

Source: WWF Living Planet Report (2022)

The push for a common global framework

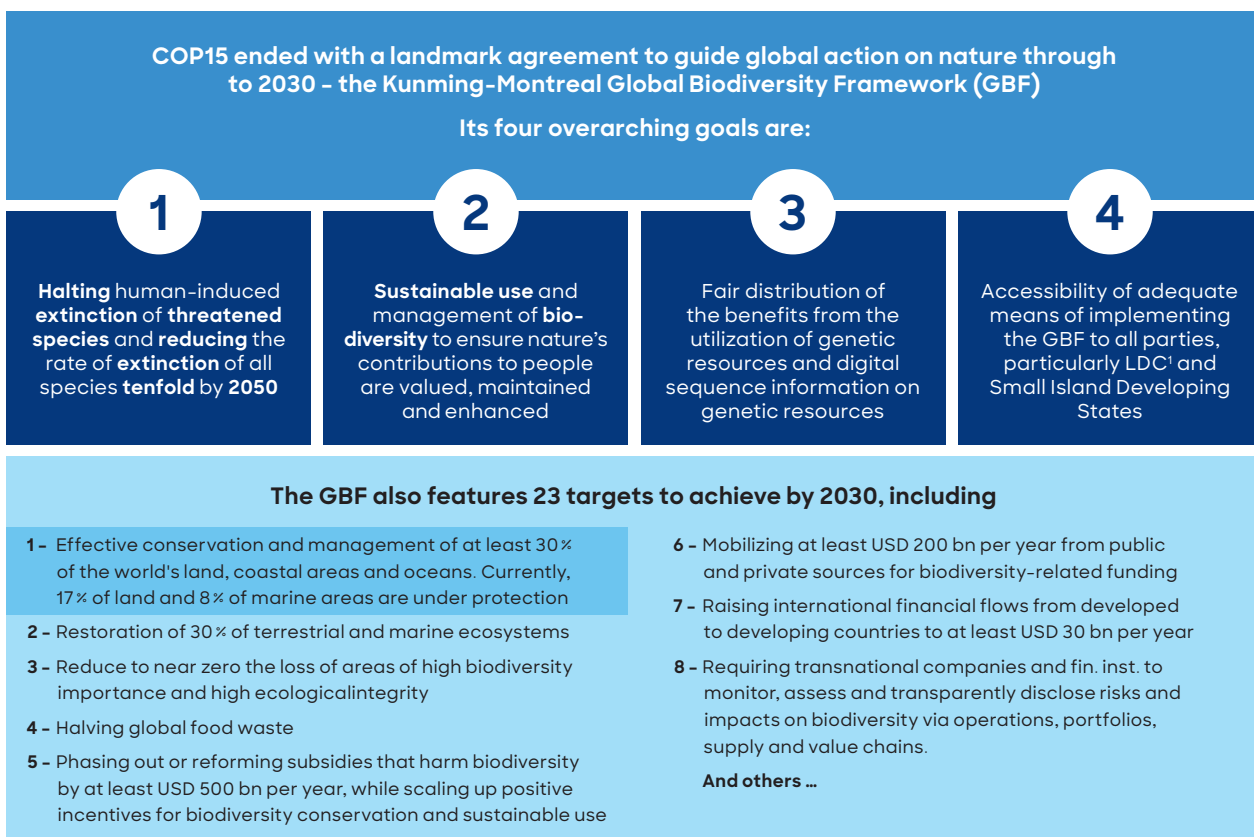
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Thankfully, the biodiversity crisis is starting to get the global attention it deserves. Nations are launching new conservation initiatives, and ESG (environment, social and governance) standards that include biodiversity are gradually emerging. A significant step forward was the signing of the Kunming-Montreal Global Biodiversity

Framework (GBF) by 188 governments at the United Nations Biodiversity Conference COP 15 in December 2022. The GBF contains 23 targets for actions that are to be started immediately and completed by 2030. Dr. Patrice Longour, Founder of the Monts d’Azur Biological Reserve, explains the importance of this global milestone

B Kunming-Montreal GBF at COP15

Overview of the GBF and the 30x30 initiative



Source: Convention on Biological Diversity/COP15 (2022)

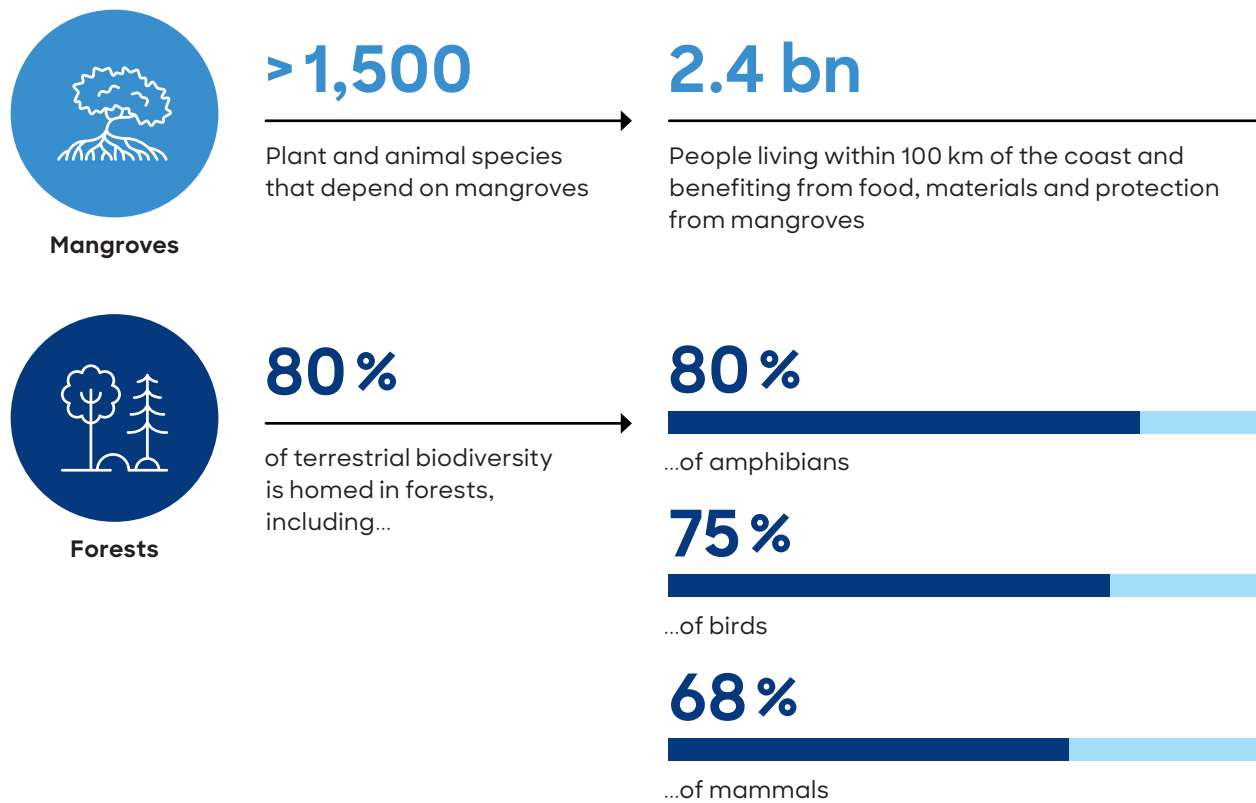
1 Least Developed Countries

for biodiversity: "COP 15 was a major turning point, as it acknowledged that wild areas are crucial for future human existence on Earth. One practical initial route to prevent biodiversity loss, develop ecological solidarity and ensure the protection of wild areas around the world is to establish the concept and status of 'nature producers' – those who

help expand and restore ecosystem services." ▶B
In parallel, the Taskforce on Nature-related Financial Disclosures (TNFD) proposed a framework for companies to assess, disclose and manage their environmental risks and impact on the natural world. TNFD recommendations closely align with those of the Science Based Targets

C Vital role of ecosystems

Importance of mangrove and forest ecosystems



Source: UNEP Decades of Mangrove Forest Change (2023); FAO The State of the World's Forest (2020)

initiative (SBTi), emphasizing the adoption of Science Based Targets (SBTs) for the assessment and management of nature-related impacts.

Moreover, in the late 2000s the idea of "nature-based solutions" (NbS) emerged as a way to describe solutions for climate change that work with natural ecosystems rather than being based on engineering interventions. ▶ C

This increased awareness about climate change and biodiversity has had a major impact on the policies of countries such as the United Arab Emirates, for example, which is hosting the 2023 United Nations Climate Change Conference COP 28. Marina Antonopoulou, Senior Director of Emirates Nature WWF, explains: "NbS support the global goal of protecting 30 percent of biodiversity by 2030, as well as the United Arab Emirates' strategic initiative to reach net zero by 2050. In fact, natural ecosystems – particularly coastal blue carbon ecosystems – are also recognized as an integral component of the UAE's Nationally Determined Contributions (NDCs) – the national climate action plan to cut emissions and adapt to climate impacts."

VALUING BIODIVERSITY

A powerful tool in the push for a common global framework is "biodiversity valuation". This is a way of translating what in the past was a purely qualitative evaluation of the importance of biological diversity and ecosystem services (that is, any positive benefits that ecosystems provide to humans) into quantitative economic terms – putting a dollar figure on biodiversity, so to speak.

Biodiversity valuation forms the basis for sound policymaking and economic development. It makes it possible to compare conservation projects and NbS with more conventional economic development and infrastructure projects, considering their long-term costs and benefits in terms of the environment. It provides a powerful operational foundation for conducting cost-benefit analyses (CBA) for NbS, such as nature-based tourism and conservation projects. And, crucially, it establishes for

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Dr. Patrice Longour

Founder of the Monts d'Azur Biological Reserve, where European bison and Przewalski's horses have been reintroduced

the first time a common language for conservationists, policymakers and the business community.

How is biodiversity valuation applied in practice? In the following chapter we present the five-step approach used by Roland Berger, looking in detail at what each step involves.

A pragmatic approach to valuing biodiversity and ecosystem services



Currently, a number of different valuation frameworks coexist. For example, The Economics of Ecosystems and Biodiversity (TEEB) initiative and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) offer guidance for conducting valuations. However, their recommendations tend to be broad and in many cases they are difficult to implement effectively. To operationalize these frameworks there is a need for practical approaches that are both feasible and aligned with key stakeholders. Paul Chatterton, Lead and Founder of Landscape Finance Lab, elaborates on the need for further framework development: "Developing a natural capital valuation framework is crucial, and this must inspire investment at landscape scale. A new Natural Capital and Landscapes Valuation tool designed by our Lab, the EBRD and Arcadis has been tested in six countries and with a range of multi-lateral banks. This will be rolled out shortly."

Following a similar approach to enhance the applicability of existing frameworks, Roland Berger has developed the following five steps for applying biodiversity valuation in practice.

STEP 1

IDENTIFY BIODIVERSITY AND ECOSYSTEM SERVICES IN THE AREA IN QUESTION

The first step is to identify biodiversity and ecosystem services in the area in question. Several approaches exist to help guide this identification process. For example, TEEB emphasizes the concept of total economic value (TEV), encompassing both "use" and "non-use values". "Use values" include all key ecosystem services, from carbon sequestration (carbon capture and storage) and nurseries for various animal and fish species consumed by humans to nature-based tourism/ecotourism and other tourism-related activities, such as diving and snorkeling. Also categorized as use values are climate risk-related services, such as preventing erosion and reducing the impact of

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Paul Chatterton

Lead and Founder, Landscape Finance Lab

weather events. "Non-use values" refer to values irrespective of direct and indirect use, such as "existence value", which comes from knowing an environmental feature will continue to exist in the future.

An alternative way to identify ecosystem services is to use the Millennium Ecosystem Assessment methodology. This divides ecosystem services into "regulating", "provisioning" and "cultural" services. "Regulating" services encompass ecological processes and functions that help regulate and maintain environmental conditions, such as climate regulation and water purification. "Provisioning" services cover benefits that support basic human needs and economic activities, including food and raw material production. "Cultural" services refer to non-material benefits connected with spiritual and recreational aspects, such as tourism and cultural heritage.

EXAMPLES

Luxury whale-watching in Alaska

Alaska is an established destination for luxury whale-watching expeditions. For more than USD 3,000 per person, travelers can rent a private yacht for a four-hour tour with a US Coast Guard Master Captain.⁶ Such luxury experiences are a lucrative part of the wider whale-watching industry in Alaska, which is in total worth around **USD 86 million** annually in tourist receipts.⁷

Coral reefs

Coral reefs play a vital role in supporting economies, safeguarding coastlines and sustaining livelihoods in coastal communities. They are incredibly valuable to society, providing resources and services with an estimated financial value of **USD 375 billion annually**.⁸ According to a report by the United Nations Environment Programme, (UNEP) a single hectare of coral reef has an average financial value of USD 130,000 a year owing to its contribution to tourism, shoreline protection and fisheries; and in areas with a thriving tourism sector this value can be as high as USD 1.25 million.⁹ This underscores the importance of areas with vast coral reefs, such as the Great Barrier Reef in Australia and the Red Sea in the Middle East.¹⁰

6 <https://activities.marriott.com/things-to-do/V28Hi3nE7n7pE-private-luxury-whale-watch?startDate=2023-11-04>

7 <https://www.fisheries.noaa.gov/feature-story/new-study-shows-economic-importance-alaskas-whale-watching-industry>

8 <https://www.unep.org/news-and-stories/story/coral-reefs-we-continue-take-more-we-give>

Mangrove carbon sequestration in Jamaica

A study by the World Bank looked at the value of preserving mangrove ecosystems in Jamaica compared to alternative developments. The study includes an assessment of the mangrove-covered area, the social cost of carbon and the mean value of carbon sequestered per hectare of mangroves. The findings show that the average value of carbon sequestered by mangroves is 386 tons of carbon per hectare, equivalent to an annual carbon sequestration value of **USD 180 million**¹¹ – a compelling case for protecting mangroves and safeguarding the environment.

Conservation of marine turtles in the Asia-Pacific region

A recent study by WWF reveals that 82 percent of the residents of the Asia-Pacific region are willing to contribute a collective **USD 45 billion** annually towards the conservation and protection of marine turtles. Median willingness-to-pay is USD 79 per household per year.¹²

9 <https://www.unep.org/news-and-stories/story/coral-reefs-we-continue-take-more-we-give>

10 https://gcrmn.net/wp-content/uploads/2023/04/GCRMN_Souter_et_al_2021_Status_of_Coral_Reefs_of_the_World_2020_V1.pdf

11 <https://openknowledge.worldbank.org/entities/publication/9ed5cb4b-78dc-42a4-b914-23d71cef24a2>

12 https://wwfint.awsassets.panda.org/downloads/wwf11963_wwf_australia_turtle_valuation_report_a4__120pp__september_2021_vaw_lr.pdf

STEP 2

CONDUCT A VALUATION OF BIODIVERSITY AND ECOSYSTEM SERVICES

Step 2 is to carry out a valuation of the biodiversity and ecosystem services identified in step 1. This is the core of the biodiversity valuation process and its purpose is to assess the potential loss of biodiversity (due to inaction or economic development) or the potential gain from implementing NbS, conservation, nature-positive and regenerative approaches. For example, the value of nature-based tourism – diving and snorkeling, birdwatching, whale-watching, safaris, hiking and the like – consists of the current and projected tourism revenues generated by those nature-based activities, so an economic value related to tourism can be attributed to these natural assets. Similarly, the value of carbon sequestration depends on the area of biomass ecosystems such as mangroves and forests, while the value of fish and seafood nurseries depends on the quantity of marine life available and the health of marine habitats.

The figures above relate to use values. For intangible non-use values, which are often particularly challenging to quantify, surveys of local communities can be used to assess willingness to pay for conservation. This proxy value can then be translated into a dollar term.

Putting a dollar figure on the value of ecosystems is not always straightforward, of course. Dr. Oliver Schelske, Natural Assets & ESG Research Lead at Swiss Re Institute, explains: "Biodiversity is mainly a common good. The key goals of biodiversity valuation are to assess its multifunctionality, the cost of biodiversity loss or the investment needed to reverse current loss trends. It is important to note that one cannot directly exchange 'biodiversity' on the market like one can trade, for example, commodities – also because there are intrinsic or future values involved."

A key tool for valuing the impact of ecosystem services across scenarios is the Integrated Valuation of Ecosystem

Services and Tradeoffs (InVEST) tool. The tool was developed by the Natural Capital Project (NATCAP), a collaboration of various academic partners, including Stanford University. InVEST is an open-source tool that uses geospatial and environmental data to model the value of ecosystem services. It models its results in both biophysical and economic terms, such as tons of carbon sequestered or net present value (NPV) of the sequestered carbon.

STEP 3

ASSESS THE COSTS OF BOTH ECONOMIC DEVELOPMENT AND CONSERVATION PROJECTS

The next step is to assess the costs of economic development projects such as infrastructure projects, and/or the NbS and conservation projects that can mitigate the environmental impact of those economic projects. The costs of economic projects should be assessed comprehensively, incorporating potential biodiversity loss and other environmental costs. This comprehensive assessment facilitates decisions about the viability of economic projects, as well as the NbS and conservation projects required to directly mitigate these economic projects or to increase overall conservation of high-value biodiversity areas.

NbS and conservation projects come in all shapes and sizes, from ecotourism and restoration projects (reforestation, wetland rehabilitation, coastal habitat restoration) to urban green space development. The key costs involved here are capital expenditure to design and construct the solution, as well as operating and maintenance expenses.

To assess the biodiversity cost of economic development projects, their impacts on biodiversity loss and the deterioration of ecosystem services need to be estimated and then monitored. Many of these negative impacts are difficult to assess in dollar terms with the limited approaches and solutions currently available. Existing tools primarily assess environmental risks. For example, "spatial finance" integrates geospatial data and

analysis into financial theory, providing a framework for understanding and managing sustainability-related risks. By analyzing the boundaries of protected areas and the ranges of endangered species, this approach enables the monitoring of land use and supply chains, making ecological risks more transparent.

Another notable tool, more specialized in assessing the biodiversity risk of project sites, is RepRisk Geospatial, developed in collaboration with the Integrated Biodiversity Assessment Tool (IBAT). This is a biodiversity due diligence tool and can be used to assess whether projects are in the proximity of environmentally sensitive sites.

These solutions have the potential to be extended into valuations, enabling more robust project comparisons and assessments, and hence guiding more. More informed

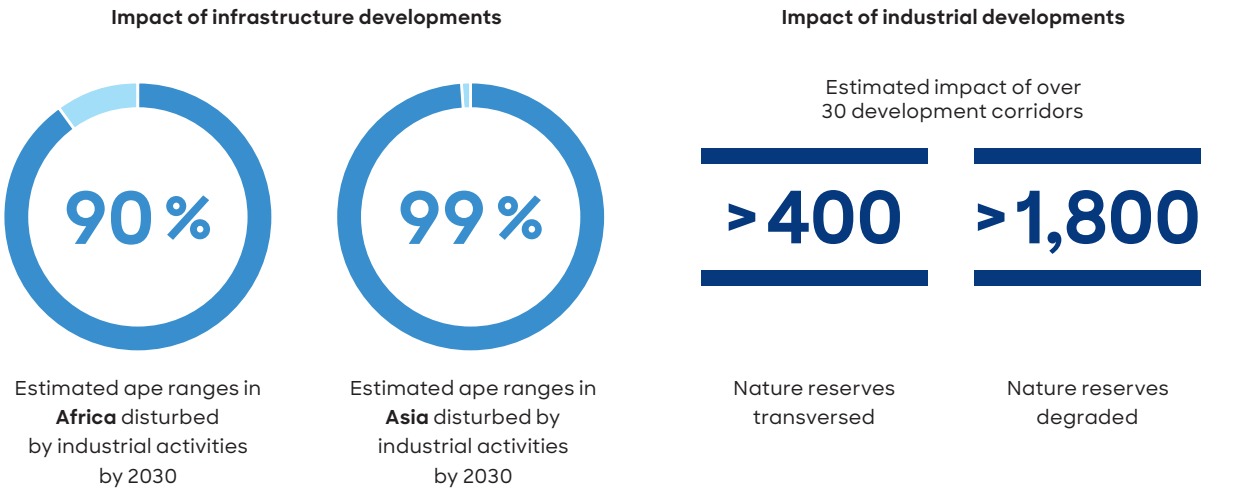
decision-making and valuation processes promote the adoption of regenerative projects, yielding nature-positive outcomes.

The European Bank for Reconstruction and Development (EBRD) is currently leading work, supported by Landscape Finance Lab, on a natural capital valuation model that can assess the economic value of nature risks and the opportunities associated with project activities. The EBRD has tested its model successfully in Kyrgyzstan and Uzbekistan and continues to pilot it across other EBRD projects, quantifying the expected economic impact of nature-related interventions.

Traditional industrial development and infrastructure project valuations overlook the hidden long-term environmental costs, including biodiversity loss, damage

D Effects of industrial development

Impact of industrial and infrastructure development on biodiversity in Africa



Source: Cambridge University State of the Apes (2018)

to ecosystems and resource depletion. Failing to account for these costs can lead to projects appearing economically viable, when in reality they have significant negative externalities. ► **D**

Understanding the full impact of such projects on biodiversity and ecosystem services can help us make more informed decisions and in some cases lead to alterations to infrastructure designs or even the halting of projects. This can prevent biodiversity loss and ecosystem degradation, processes that in turn disrupt the delicate balance of natural systems, agriculture, water and climate regulation. For example, Landscape Finance Lab's work in the Red Sea found that freshwater streams are important for the health of coral reefs, saltwater animals, overall ecosystem health and hence the coastal tourism economy. This finding was important in ensuring that landscape designs enable continued freshwater flow to support the coral reef ecosystem.

STEP 4

CONDUCT A COST-BENEFIT ANALYSIS

Step 4 is to carry out a cost-benefit analysis (CBA). In the context of NbS and conservation projects, a CBA should include direct costs and benefits, ecosystem restoration or management costs, and also ancillary ecosystem benefits such as coastal protection. All benefits and gains relating to the protection of biodiversity and ecosystem services (assessed in step 2) are compared to the costs of implementing the NbS or conservation project. As in traditional CBAs, projected costs and benefits are converted into net present values (NPV), with a positive NPV indicating that implementing a project will create value and positive returns. In the case of traditional economic development and infrastructure projects, for example, the economic benefits are compared to all costs, including costs relating to the loss of biodiversity and ecosystem services.

STEP 5

IMPLEMENT PROJECTS AND MONITOR BIODIVERSITY AND ECOSYSTEM SERVICES

The fifth and final step is to implement projects (both economic projects and NbS/conservation projects) and monitor biodiversity and ecosystem services. This is a multifaceted process that requires collaboration with local stakeholders. To achieve a successful implementation of projects, it is crucial to involve local businesses and communities early on in the process and to ensure buy-in. Local residents can also be empowered to participate in the process through "citizen science" programs.

The monitoring should focus on the health of the biodiversity and ecosystem services and should consider other factors such as local perceptions and preferences. This calls for continuous data collection and analytics, leveraging advanced technologies and artificial intelligence (AI). As Rachel Delacour, CEO and Co-founder of Sweep, puts it: "Injecting business expertise into biodiversity valuation rules will be a prerequisite for efficient and robust monitoring. What will be truly key is to build up data platforms that businesses can rely on to perform analytics on granular and high-volume data, to store, process and check a multitude of datapoints and to guarantee data auditability. Such technology solutions as already developed by Sweep, for instance, are mandatory if we are to manage all this data and make the proper connections between datasets."

**Working together
for change**

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To ensure sustainable economic development and avoid ecological collapse, decision-makers must integrate biodiversity valuation into their economic models as a matter of urgency. To do this effectively, they need a clear common valuation framework. Given the scale of the biodiversity crisis, this needs to be a framework that is easily adapted and implemented, and that can be replicated and scaled across the globe and in different natural environments.

As we saw in Chapter 2, awareness is growing. This is reflected in the attention the topic of biodiversity is receiving at the United Nations COP Conferences. Sophie Duval-Huwart, Head of Strategy at Veolia, agrees: "COP 15 in Montreal benefited from unprecedented visibility last year. The mere fact that biodiversity will be on the COP 28 – a generalist COP – agenda is a major step forward. Decision-makers are tackling the issue at the right level."

However, this is not an endeavor for the public sector alone. It requires collaboration with corporations, non-governmental organizations and other stakeholders. For companies to start adapting and using the frameworks as a matter of course, greater awareness and more education will be needed. Guillaume Bregeras, Chief Knowledge Officer and Managing Director of 2050.do, believes that efforts in the public sector will ultimately impact the private sector and beyond: "It is crucial that public decision-makers incorporate biodiversity into their decisions, be it financing or infrastructure-related decisions. Biodiversity generates a systemic impact. Providing quality training on biodiversity to civil servants trickles down to their private contractors and to the general public." This is currently happening through new ESG biodiversity frameworks such as TNFD that companies across sectors will have to comply with in the near future.

Companies that seize the opportunity and lead the way as responsible stewards, will position themselves to thrive in a rapidly evolving and environmentally conscious world. ProactivelyBy proactively accounting for

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Head of Strategy, Veolia

environmental consequences and biodiversity loss avoids the, companies can avoid the potential repercussions of regulatory bottlenecks, damaged reputations, and legal entanglements. MoreEven more importantly, acknowledging the value of biodiversity and ecosystems should lead to transformations incan transform the way companies design their projects and run their businesses are operated and projects are designed as opposed to – a better solution than simply buying carbon or biodiversity offsets or credits. This would ultimately enhance the, and one that in the long run enhances their longevity of the businesses.. Responsible and conscious companies will certainly minimize their exposure to risks and the potential fees, taxes and fines they would expect to pay to compensate for their impacts on biodiversity.

With this in mind, all stakeholders need to make a conscious effort to recognize, value and finance biodiversity and ecosystems. Ultimately, this will change the way our urban landscapes and economic projects are designed and planned. Only this collective commitment will ensure the reversal of both the biodiversity and climate crises.

Credits

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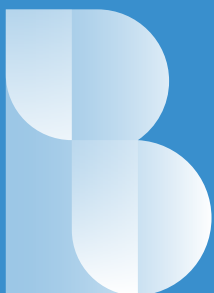
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