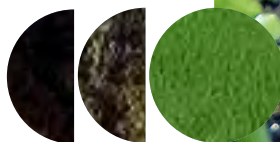


# Biodiversity: the new investment frontier

MARCH 2023



# About the authors.

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ESG Analyst Biodiversity



Elouan joined Candriam in 2022 to help build Candriam's biodiversity expertise and enhance biodiversity in investment models. This follows his internship here in which he was the focal point of a project to better meet the needs of clients, as well as regulatory requirements such as Article29. Previously, he has worked as an environmental consultant.

He holds a Masters degree in chemical engineering from the École Nationale Supérieure de Chimie de Lille, specializing in green chemistry, including environmental analysis, life cycle assessment and resource recovery.

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Alix Chosson joined Candriam in 2020 as the Lead ESG Analyst for Environmental Research & Investments.

Alix has thirteen years of experience as ESG Analyst in SRI research and portfolio management teams. She started her career at Amundi in 2010 and has more recently been sell-side ESG analyst at Natixis before joining in 2018 DNCA to contribute to the creation of the SRI team and range of funds.

Alix graduated from Science Po Lyon with a master in economics and finance in 2010. In 2011 she obtained a Master in Portfolio Management from the IAE Paris 12.

## Marie Niemczyk

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Marie Niemczyk heads Candriam's ESG Client Portfolio Management Team. Her role is to deliver Candriam's unique blend of ESG expertise, sustainable investment solutions and market wisdom to investors.

Marie joined Candriam as Head of Insurance Relations in 2018, monitoring and analysing the factors impacting the asset management of insurers, such as market, regulation, accounting and ESG. She worked particularly closely with insurers on the integration of sustainable investing.

Previously, Marie was Strategy & Development Director at AXA Investment Managers in Paris. She has also held several positions with Fidelity in London, Frankfurt and Paris. Before that, she was an Economist with EY in London, and a Research Associate with The Advisory Board Company in Washington D.C..

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# Table of contents.

## Table of contents.

Executive Summary	<b>03</b>	Biodiversity and the investment process	<b>13</b>
First things first: What is biodiversity?	<b>05</b>	Time is running out.	<b>17</b>
To what extent is biodiversity relevant to investors?	<b>07</b>	Notes & References	<b>18</b>

# Executive summary.

Investors have embraced environmental sustainability. In particular, regulators and investors alike have rallied around the fight against climate change. Many portfolios now integrate objectives for carbon emission reductions or for alignment with temperature scenarios. Other environmental issues are being closely examined as a financial issue.

It has become very clear that biodiversity is, and will continue to be, an increasingly material investment issue. *Integrating* biodiversity considerations into investments remains a very complex exercise, both because of the lack of standardised data and methodology, and more fundamentally because it must be considered through the lens of 'double materiality'. We examine the effect of biodiversity both on society, and on investments – that is, by consequence of its effect on humanity, does the growth and prosperity of investment portfolios also depend on biodiversity? We demonstrate that portfolio holdings impact ecosystems *and the converse* -- if investors want to minimize the biodiversity risks that could impact the value of their holdings, it is in their interest to consider how these very holdings impact nature and various forms of life.

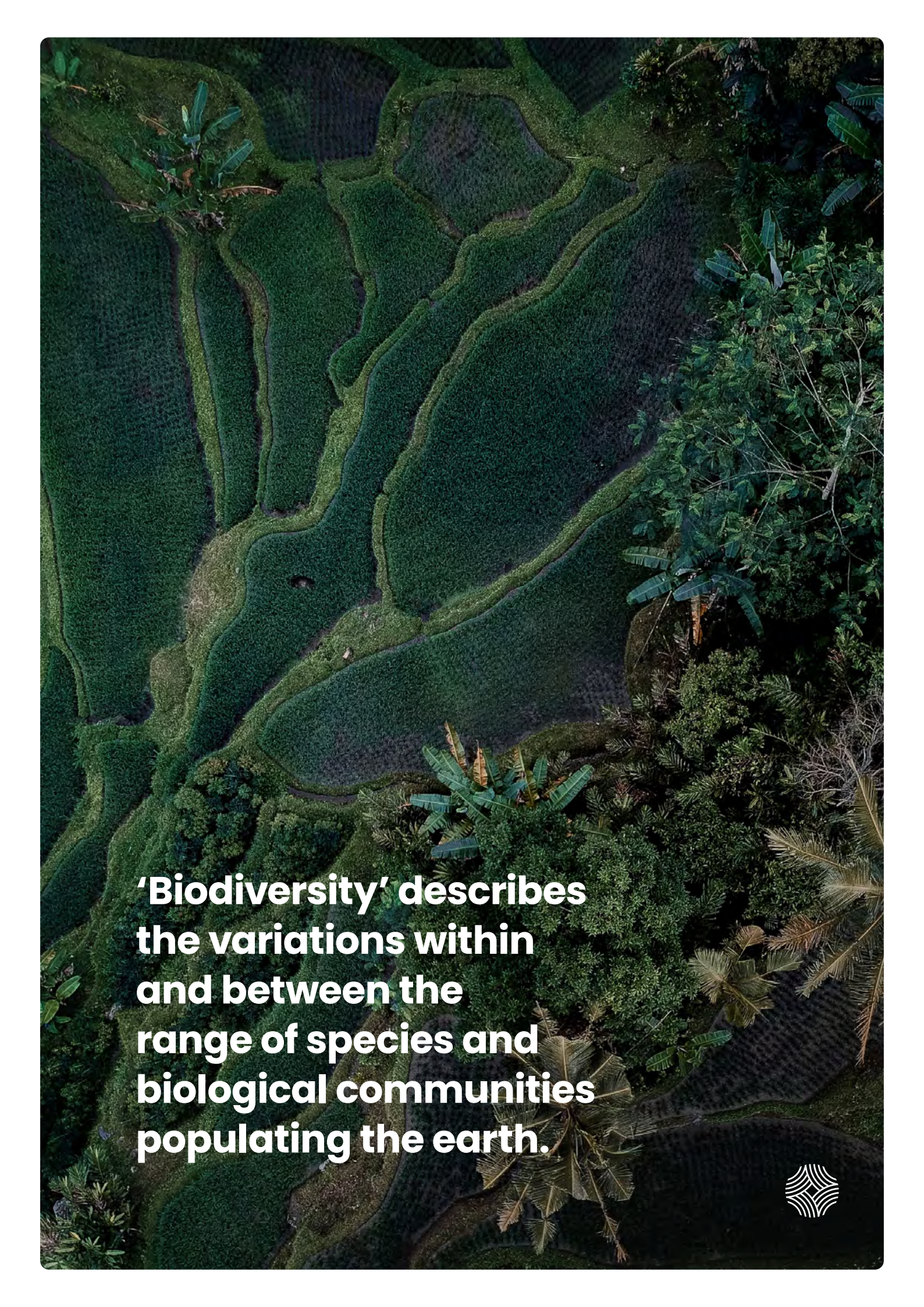
In practical terms, how can we properly assess and integrate biodiversity into investment decisions? –Although international standards, regional regulation and current data challenges currently lag, it is crucial that we discuss how to integrate biodiversity as a serious investment factor, incorporate what we have learned from including climate considerations in investments, yet encompass the unique complexities in the assessment of biodiversity.



**In pushing other species to extinction, humanity is  
busy sawing off the limb on which it perches.**

**– Paul Ehrlich**





**'Biodiversity' describes  
the variations within  
and between the  
range of species and  
biological communities  
populating the earth.**





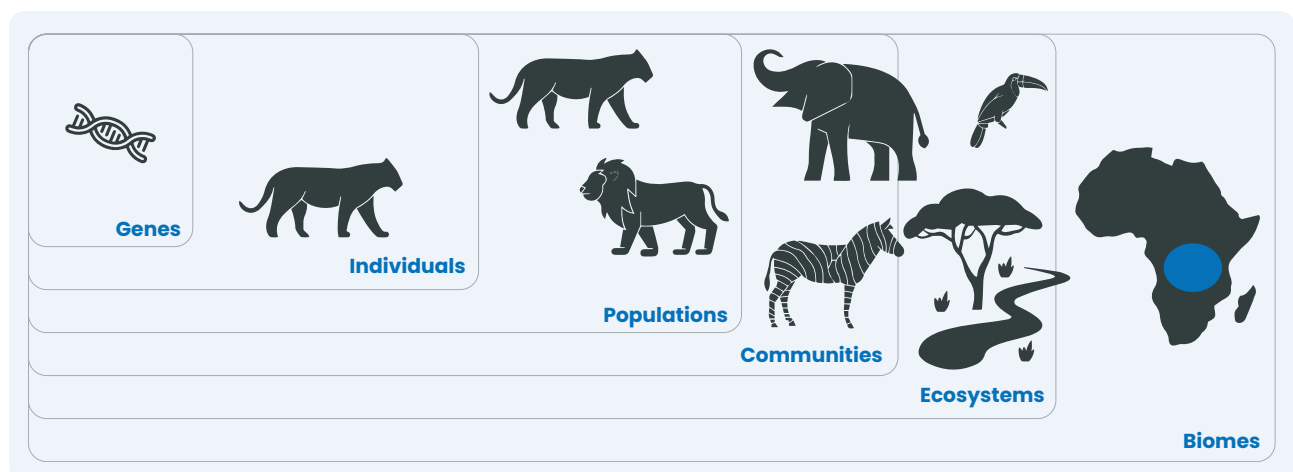
# First things first: What is biodiversity?

Biological diversity,<sup>1</sup> or 'biodiversity', entered the lexicon in the 1980s as part of the movement seeking to alert the international community to the dramatic degradation of the environment at all levels and for all forms of life.

'Biodiversity' describes the variations within and between the range of species and biological communities populating the earth. Importantly, it reflects diversity across all scales -- genetic, individuals, populations, species, communities, ecosystems and biomes. The concept also encompasses the *interactions* between species and how these vary in the biomes, as well as the totality of ecosystem processes. Biodiversity is a complex and multifaceted concept extending far beyond measuring the fauna and flora, or protecting endangered species. A simplistic approach neglects the interplay among species and their roles in maintaining the health and balance of ecosystems.

**Figure 1:**

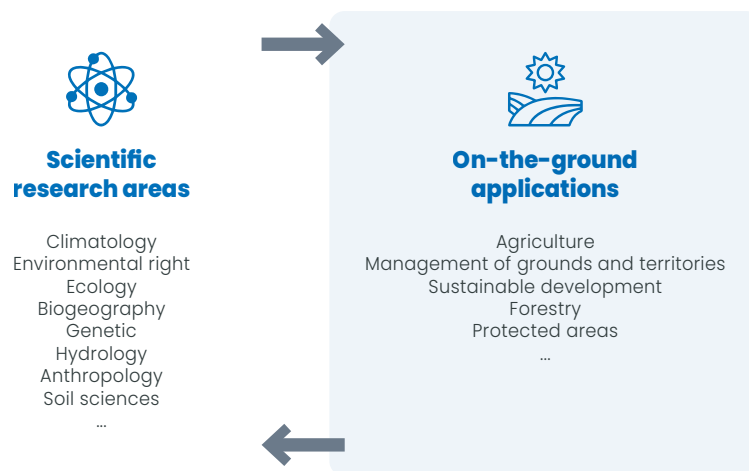
Biodiversity is critical at all levels



Source: The Dasgupta Review, 2021. <https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review>

The concept of biodiversity knits together several areas of science and research pertaining to the environment and to all forms of life, as well as bringing in disciplines which analyse the threats to which species are subjected. This is a complex interweaving of a number of scientific fields which are simultaneously interconnected and yet distinct disciplines. Given the critical impact of human society on biodiversity and vice versa, its study often also involves social sciences and environmental ethics. The findings of these multidisciplinary efforts are often implemented on the ground in projects and initiatives, while these practical experiences in turn feed back into the theoretical research.

**Figure 2:**  
Interdependence of science and practice



Source: Biologie de la conservation, Primack, Sarrazin, and Lecomte, 2012.



# To what extent is biodiversity relevant to investors?



**Our research shows that \$44 trillion of economic value generation – more than half of the world's total GDP – is moderately or highly dependent on nature and its services and is therefore exposed to nature loss.**

**World Economic Forum, 2020<sup>2</sup>**

As the science of biodiversity is so complex and wide-ranging, investors might ask why, and to what extent, it is relevant to investment performance.

We believe the science demonstrates that the erosion of biodiversity creates material risks that will impact not only our societies and economic structures, but consequently the value of our investments. At the same time, the very issuers whose securities are held in portfolios also directly impact biodiversity. This is an important feedback loop in the overall sustainability of the portfolio.

## Double materiality

The complex links among human activities and biodiversity works in two directions. Humans have impacts on biodiversity, but at the same time, humans depend on biodiversity. This way of thinking is a stark departure from the old philosophical dichotomy between nature on the one hand, and culture and society on the other. This 18<sup>th</sup>-century binary approach, along with the definition of nature and its relation to humankind, are outdated. Humans are part of nature and our ability to thrive on this planet is very much linked to our ability to protect natural habitats and ecosystems. The European Commission concept of double materiality<sup>3</sup> is a better model for the linkages -- our business and financial activities impact biodiversity and create risks for society and the environment, while biodiversity risks create risks for our financial system.



# Biodiversity risks and dependency

Our societies and modern ways of living are utterly dependent on nature. For example, agriculture and food systems are intrinsically dependent on biodiversity: More than 75%<sup>8</sup> of the leading global food crops rely to some extent on animal pollination.

Our need for healthy ecosystems does not end with food. As of 2022, an estimated four billion people use natural medicine.<sup>8</sup> Even in the most technologically advanced pharmaceuticals, a significant portion of drug development relies in one way or another on biodiversity. Two billion individuals depend on wood for heat.

Ecosystems are also key in fighting climate change, as they act like carbon sinks and temperature regulators. Oceans and terrestrial ecosystems currently absorb around *half* of anthropogenic CO<sub>2</sub> emissions each year.<sup>8</sup> We cannot address the climate question without an informed understanding of biodiversity, and there will be no net zero world without the help of nature to limit carbon dioxide concentration.

All this begs the question of how to incorporate these social and environmental benefits in economic models, and more specifically how to assess and *price* them into these models and decisions. Historically, environmental costs and benefits have been part of the long list of economic ‘externalities’. Like carbon, pollution, and workforce diversity, economists are beginning to measure, or at least estimate, externalities and demonstrating the folly of leaving them out of either economic or investment models. Today, the concept of ‘ecosystem services’ more accurately describes the benefits that the biosphere can offer human society. It is a step towards measuring the value of nature and highlighting its contributions to human activities, as well as the environmental costs of these activities.

The Common International Classification of Ecosystem Services (CICES), developed in conjunction with the European Environment Agency, recognizes three categories of ecosystem outputs that contribute directly or indirectly human well-being:

- **Provisioning services** fuel our economy. They provide materials and energy, including food, water and energy sources.
- **Regulating and maintenance services** are critical for the equilibrium of our planet and balance of its ecosystems. They help preserve our atmosphere, climate, the cycle of water and nutrients, etc. For example, wetlands filter fresh water and in doing so protect ecosystems from diseases.

- **Cultural services** offer humans recreation in nature, well-being, and sense of place.

Originally, only provisioning services were considered of critical interest to humans and our economic activities. Yet, our societies and economies also depend on regulating and maintenance services, and consequently many companies present in investment portfolios depend on these as well. For instance, pollination, soil fertility, and water quality are conditions for agricultural activities. Services such as the prevention of soil erosion and of disease are critical for a myriad of economic activities to be feasible and thrive. These sensitive equilibrium-managing services impact a range of elements in the value chain, from the physical safety of industrial plants to the fitness of the labour force. Regulating and maintenance services also balance and control the primary production which underlies provisioning services. Cultural services, too, while in part intangible, have very concrete repercussions on certain parts of our economy and investments, such as tourism. We would be hard-pressed to find an investment portfolio whose underlying investments do not directly or indirectly depend on ecosystem services for their prosperity and growth.

Once ecosystems are depleted beyond a tipping-point -- a point which is typically unexpected and unpredictable -- they shift to a new and usually less-favourable equilibrium. By 'less-favourable', think less biodiverse, and less favourable to humans and our needs. In many respects we are approaching a point of no return.

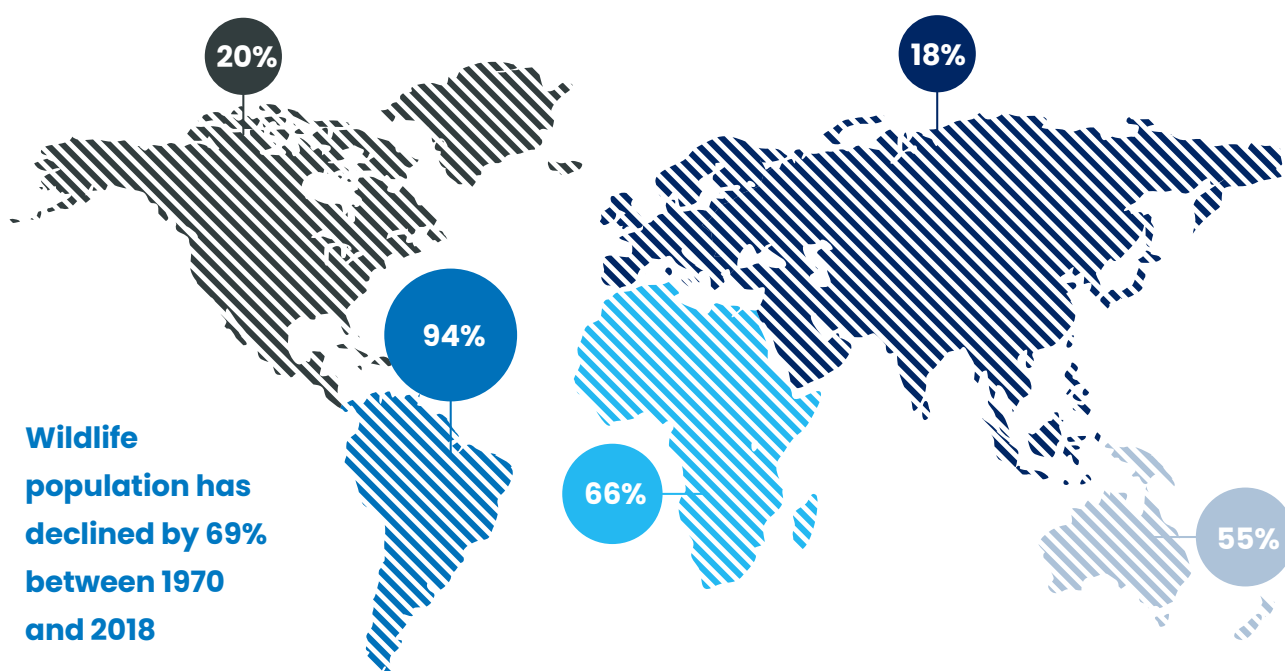
The risks to ecosystems and the services they provide are not solely an environmental issue, but also significant issue for investors given the feedback loop between corporates and biodiversity. With biodiversity deteriorating at an unprecedented rate and scale, its importance to investors is expanding.

## An accelerating pace

The scale and speed at which we are losing our biodiversity are alarming. The 2022 edition of the Global Living Planet Index, which measures the average rate of change in animal populations, shows that wildlife population has dropped by 69% between 1970 and 2018.<sup>4</sup>

**Figure 3:**

Biodiversity loss by region



Source: Data from WWF World Wildlife Foundation, [https://livingplanet.panda.org/#:~:text=The%20Living%20Planet%20Index%20\(LPI,analysed%20almost%2032%2C000%20species%20populations.](https://livingplanet.panda.org/#:~:text=The%20Living%20Planet%20Index%20(LPI,analysed%20almost%2032%2C000%20species%20populations.)

While the 20% fall in North America and Europe appears less stark by comparison to the average, in absolute terms, even here the situation is nevertheless critical. In fact, in the U.S, the area of distribution of bees has decreased by 80% over a few decades,<sup>5</sup> and in protected forests of New Hampshire, the diversity of species has decreased by 40%.<sup>6</sup> In Germany, the mass of insects in protected forests has decreased by 75% over 30 years.<sup>7</sup> Other studies, with different protocols, arrived at similar results. The reality is simple to visualize -- anyone who has taken long road trips over this period will have noticed an increasingly clean windshield on their car.

Worse, this trend is accelerating. At present, we are locked in a long-term trend of unprecedented biodiversity loss, that some scientists believe could become the planet's sixth mass extinction. One of

the most concerning attributes of the loss of biodiversity is its speed. Between the years 1600 and 1700, the rate of extinction of birds and mammals was one per decade. The extinction rate increased to one per year between 1850 and 1950. It is important to note here that the declaration of the extinction of a species requires decade-long observations, and therefore extinction *data* lags the loss. We can expect that the coming years will confirm a significant number of species will have become extinct between 1950 and 2000. The IPBES<sup>8</sup> has declared many to be 'living dead' and condemned to extinction. Four out of ten amphibian species are considered 'dead species walking'.



# Humans, investments, and biodiversity

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**The current extinction has its own novel cause: not an asteroid or a massive volcanic eruption but ‘one weedy species’.**

**Pulitzer-Prize Winner Elizabeth Kolbert,  
in *The Sixth Extinction: An Unnatural History***

The Intergovernmental science-policy **Platform on Biodiversity and Ecosystem Services (IPBES)** has identified five main drivers of biodiversity loss:

- **Land use change:** The conversion of land from its original state to another, such as the transformation of forests into fields for agricultural use or in the course of urbanization. The transformation often involves deforestation, soil degradation, pollution and the destruction of natural habitat. It is particularly detrimental to terrestrial and freshwater biodiversity.
- **Direct exploitation:** The extreme exploitation, and often overexploitation, of natural resources. Examples include intense logging by the timber industry, and overfishing, which is a key driver in the degradation of marine life.
- **Climate change:** Greenhouse gas emissions (GHGs) reduce biodiversity at all levels. And again, climate change in turn is further aggravated by the loss of biodiversity.
- **Pollution:** Our atmosphere, soil, and water -- both freshwater and marine -- are subject to man-made pollution. Pesticides, nitrogen, and sulphur dioxide are just a few of the contaminants which affect numerous forms of life and damage the functioning of ecosystems and ecosystem services.
- **Invasive alien species:** The damage from invasive non-native species, both fauna and flora, can be catastrophic for ecosystems. This risk is accelerating with globalization, particularly through international freight and travel.

The causes of biodiversity loss are multifaceted but crystal clear -- We are the cause, that is, our ways of living, producing, consuming are the cause of biodiversity loss. As we trigger losses at an unprecedented rate, we are paving the way for our own end. As Stanford ecologist, Paul Ehrlich said: *"In pushing other species to extinction, humanity is busy sawing off the limb on which it perches."*

An obvious example is agriculture, which is particularly interdependent with biodiversity. Farming and food systems alone are responsible for about *half* of biodiversity loss – indeed, humans and our activity are the key drivers of biodiversity erosion. Yet biodiversity loss is a rising threat to the productivity and even existence of many crops.

For investors, this means that the investments in their portfolios and their activities have an impact on the very diversity that they depend on to preserve the value of those investments. Investors who fail to consider biodiversity in their portfolios will increase the global problem, and will in turn increase the risks weighing on their own investments and reduce their growth potential.



**The causes of biodiversity loss are multifaceted but crystal clear -- We are the cause, that is, our ways of living, producing, consuming are the cause of biodiversity loss.**



# Biodiversity and the investment process.

The challenge is how to integrate biodiversity considerations into investments. This leads to the issues of international standards, comparable data, and regulatory guidelines that can serve as a frame of reference, and what approaches make sense from a double materiality perspective.

## International standards and government engagement on biodiversity

The issue of climate change has benefitted from a strong acceleration in international coordination and standard-setting over the past decade. By contrast, the environmental, social, and investment risks of biodiversity loss are desperately lacking in coordinated government commitment and action so far. A 'catalyst moment' is needed, similar to the turning point provided by the Paris Agreement in the fight to halt climate change.

The expectations in the lead-up to the Biodiversity COP15 of December 2022 were high. This biological diversity conference was intended to lay out a new, more ambitious direction as the Aichi<sup>9</sup> targets faded through lack of momentum. These previous targets, set in 2010 for the period 2011 to 2020, expired largely unachieved. The intent of the 20 targets had originally been to address the underlying causes of biodiversity loss, reduce the direct pressure on biodiversity, improve the status of the topic, and increase implementation of these targets through participatory planning, knowledge management and capacity-building.



One of the outcomes of the COP15 is a set of 23 new targets for 2030, united through the objective of living in harmony with nature by 2050. Here, one of the main considerations was to consider the rights of local populations. Indigenous people are indeed amongst the primary victims of biodiversity loss, as their societies rely heavily on nature. A correlation can be demonstrated between damage to biodiversity and human rights violations. Another aim of this new set of COP targets was to emphasize the knowledge of these populations in nature conservation: *"The framework acknowledges the important roles and contributions of indigenous peoples and local communities as custodians of biodiversity and partners in the restoration, conservation, and sustainable use of biodiversity."*<sup>10</sup>

Target 3, to protect 30% of lands and 30% of seas, is amongst the most-anticipated of the new goals. While some observers compare this to the 1.5°C statement of the Paris Agreement, others highlight the need for enforcement. A significant portion of currently protected areas already face important biodiversity loss from human pressure. The target by itself will not help recover the lost biodiversity.

Targets 15 and 18 directly address investors. Target 18 aims to reduce harmful subsidies by USD 500 billion per year by 2030. Target 15 calls on investors (and transnational companies) to:

- Regularly monitor, assess, and transparently disclose their risks, dependencies and impacts on biodiversity. This includes requirements for

large and transnational companies and financial institutions with regards to their operations, supply and value chains and portfolios.

- Provide information needed to consumers to promote sustainable consumption patterns.
- Report on compliance with access and benefit-sharing regulations and measures, as applicable.

A set of indicators was developed and published to accompany these targets. For example, recommended metrics for Target 15 include the STAR metrics (by IBAT),<sup>11</sup> the ecological footprint and the number of companies publishing sustainability reports. Target 18 indicators include two critical measurements. First, the number of countries with biodiversity-relevant taxes, charges, and fees. Secondly, it calls for measuring the trends in the number of *harmful* elements in government incentives and/or subsidies. Here, the objective is to push for more economic incitation from governments, notably to make harmful economic activities less profitable.

While some progress is being achieved, significant opportunity for improvement remains through concerted enforcement. The pressure is on to apply international frameworks, such as the outcome of the COP15, in a truly effective way.

# Biodiversity and the data challenge

At the regional level, biodiversity is increasingly a component of sustainable finance regulation. We expect governments will increasingly encourage investors to integrate this critical issue into their decision-making. We also expect companies and investors will be asked to provide greater transparency on biodiversity risks in both directions—the risk of loss of biodiversity on companies and investments, and the risk to biodiversity from these companies and investments.

For example, the European Union's Sustainable Finance Disclosure Regulation (SFDR) encourages greater disclosure making biodiversity part of its list of Principle Adverse Impacts (PAIs). Such regulatory guidelines support the awareness and integration of biodiversity as a core sustainability issue.

Yet regulation is not a complete solution for the challenges investors face when they try to integrate biodiversity considerations into portfolios. Biodiversity represents a real data challenge, notably due to its complexity. Biodiversity is not easily represented in a single metric, unlike in carbon dioxide accounting, where tons of CO<sub>2</sub> can offer a sense of the magnitude of the greenhouse gas emissions of a company across its full value chain.

The concept of a single indicator to summarize biodiversity states and trends is both highly debatable and challenging to implement. The number of species that become extinct each year, the species endemism in a river, the vascular plant diversity in a forest, or the integrity of an ecosystem are but a few examples of the array of indicators needed to measure biodiversity. The challenge in assessing biodiversity is not just the lack of data – it is also the breadth of data and of issues, and how to aggregate and determine their relative importance.

Biodiversity is a topic that is best analysed and understood at local level, contrary to climate, whose impacts are global. Biodiversity thus requires both a spatial (i.e., geographic) perspective and detailed asset-level data pertaining to operations and supply chains. The precise locations of each company's sites and manufacturing facilities must be known, along with the biodiversity context and ecosystems of these locations and how their multiple dimensions are impacted by each company's activities. This is an enormous reporting task for corporates and investors.

Many of today's approaches to sustainable finance do not yet accommodate this level of complexity. Let's take the example of the Principle Adverse Impacts 7 (PAI) requirement of the EU SFDR on activities negatively affecting biodiversity. Investors use a number of different approaches to make this assessment. One frequently-used metric is based on the number of controversies, notably identified through media coverage. In other words, this approach flags companies when it is revealed that they are involved in a controversy in a protected area. Such information intrinsically provides an incomplete view and is only very rarely tied to a precise location. It does not reflect how companies impact biodiversity outside of the realm of these reported controversies, nor does it provide enough specificity to draw definite conclusions on the material impacts of economic activities on local ecosystems. Furthermore, in many applications of this approach, the list of protected areas included in the screening process is incomplete, as certain biodiversity-related databases are not public.

The very partial assessment of this PAI provided by this example does not currently allow proper evaluation of the actual impacts of companies on biodiversity.

# How to tackle this new investment frontier?

With the measurement of biodiversity in an investment context still in a very early stage of development, what are the key elements to consider when selecting strategies that take into account biodiversity? How should asset owners conduct their due diligence?

- **Analytical Process:** Similar to climate change, it is important to develop a dedicated biodiversity framework that can take into account the multifaceted and complex nature of biodiversity. In practical terms, this means that investors must go much further than traditional ESG analysis and focus on developing dedicated biodiversity indicators and methodologies that integrate asset-level data. The notions of biodiversity impacts and dependencies must be integrated, but also differentiated to understand the associated risks and impacts. Asset owners should thus deploy specific due diligence to assess the quality of biodiversity assessments and how they are translated into investment decisions. For countries, the management of natural capital, including life on land, in the air and marine life should be carefully assessed with specific indicators.<sup>12</sup>
- **Data:** Because biodiversity is best assessed and interpreted locally, investors need to consider new types of data and new indicators. Difficulties lie both with the collection of such data but also with their interpretation. Emerging

indicators such as  $msa.km^2$  (mean species abundance) and geospatial data shed some new insight, but they suffer from limits. As for climate, we can expect a myriad of indicators with different objectives and time horizons to be developed, both historical and forward-looking. Asset owners will have to consider the meaning and usefulness of indicators selected very carefully, along with the potential biases. Like all investors, asset owners should be particularly vigilant regarding 'net biodiversity positive' claims and assess to what extent they are substantiated by relevant indicators.

- **Engagement:** Accelerating the integration of biodiversity in investing will require tremendous engagement efforts for both sufficient disclosure, and for biodiversity management. Successful engagement requires high-quality data and relevant methodologies. Asset-level data is necessary to target engagement efforts if we are to address the most material biodiversity impacts and risks and foster real-life change. As for many ESG topics, engagement which brings together various stakeholders can be a powerful way to harness change. Asset owners should carefully consider biodiversity-related engagement efforts and focus on engagement outcomes with meaningful KPIs in assessing the quality of engagement strategies.



# Time is running out.

The journey is just starting, but time is already running out. Biodiversity is an important investment issue both because the value of portfolios is at risk when biodiversity is lost, and because the issuers held in the portfolio can worsen the dangerous long-term trend of biodiversity erosion.

The conundrum is that the complexity of biodiversity makes it difficult to measure, and tricky to incorporate in the investment process. We do not have the luxury to wait for perfect data or for a ready-to-use comprehensive framework. Neither can we afford to wait for a 'Paris-like' moment<sup>13</sup> that would impose global objectives and regulation. Time is running out. It is our responsibility as investors to develop innovative ways to understand, assess and integrate biodiversity, well beyond traditional ESG analysis.

As this complex journey has just begun, efforts should be focused both on engaging with corporates in order to improve disclosure practices and to share best practices through collaboration with peers and stakeholders. We must start down this road today if we are to assess and integrate biodiversity meaningfully.

Asset owners play a key role in the integration of biodiversity in investments. By requiring asset managers to set dedicated methodologies and engagement efforts that fully consider and integrate the complexity of biodiversity, asset owners can be a powerful spearhead in this investment frontier.

# Notes & References.

- 1 The term “biodiversity” was coined in 1985 by biologist Walter Rosen as a contraction of the words “biological diversity”, which in turn had been introduced in 1980 by Thomas Lovejoy.
- 2 *Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy*, January 2020, World Economic Forum in collaboration with PwC.
- 3 Particularly as employed in the sustainable finance efforts of the European Commission.
- 4 [https://wwfint.awsassets.panda.org/downloads/embargo\\_13\\_10\\_2022\\_lpr\\_2022\\_full\\_report\\_single\\_page\\_1.pdf](https://wwfint.awsassets.panda.org/downloads/embargo_13_10_2022_lpr_2022_full_report_single_page_1.pdf)
- 5 Source: Sydney A. Cameron et. Al., 2011
- 6 Source: Jennifer E. Harris et. al., 2019
- 7 Source: Caspar A. Hallmann et al., 2021
- 8 IPBES is the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services.
- 9 Called ‘Aichi’ because the convention was held in Nagoya, Japan, in the Aichi prefecture. Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany.
- 10 UN Environment Programme, Convention on Biological Diversity – Global Biodiversity Framework, 26 June, 2022. <https://www.cbd.int/doc/c/079d/0d26/91af171843b6d4e9bee25086/wg2020-04-I-02-annex-en.pdf>, accessed 17 February, 2022.
- 11 STAR, or Species Threat Abatement and Restoration metric, is based in the IUCN Red list of Threatened Species™, a comprehensive global assessment of the status of biodiversity produced in collaboration of 55 organisations. [https://ec.europa.eu/environment/biodiversity/business/assets/pdf/tool-descriptions/STAR\\_summary\\_description.pdf](https://ec.europa.eu/environment/biodiversity/business/assets/pdf/tool-descriptions/STAR_summary_description.pdf), accessed 17 February, 2023. IBAT, or Integrated Biodiversity Assessment Tool, is a data tool which can be used to analysis STAR data. <https://www.ibat-alliance.org/>, accessed 17 February, 2023.
- 12 Sovereign Sustainability Report 2022, The age of the grey swan, [https://www.candriam.com/en/professional/SysSiteAssets/medias/publications/brochure/research-papers/sustainability-in-the-age-of-the-grey-swan/2022\\_11\\_sovereign\\_report\\_en\\_web.pdf](https://www.candriam.com/en/professional/SysSiteAssets/medias/publications/brochure/research-papers/sustainability-in-the-age-of-the-grey-swan/2022_11_sovereign_report_en_web.pdf)
- 13 That is, the Paris Agreement which arose from the 2015 COP 21.



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\*As of 31/12/2022, Candriam changed the Assets Under Management (AUM) calculation methodology, and AUM now includes certain assets, such as non-discretionary AUM, external fund selection, overlay services, including ESG screening services, [advisory consulting] services, white labeling services, and model portfolio delivery services that do not qualify as Regulatory Assets Under Management, as defined in the SEC's Form ADV. AUM is reported in USD. AUM not denominated in USD is converted at the spot rate as of 31/12/2022.



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