

Strategy Report: **Reducing Biodiversity Loss**

January 2026



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We are grateful to a private donor who commissioned us to produce this work as part of our [consulting services](#). Giving Green is editorially independent. The donor did not influence the findings of this report. This is our first report on biodiversity protection, which is built on the methodology that Giving Green developed and uses for assess climate change mitigation strategies.

This is a non-partisan analysis (study or research) and is provided for educational purposes.

Questions and comments are welcome at hello@givinggreen.earth.

Cover image: White heron. Photo by Richard Sagredo.

Summary

- **What is Giving Green's vision for biodiversity philanthropy?**

The global biodiversity financing gap of more than \$700 billion USD highlights the need to prioritize biodiversity philanthropy where it can be most impactful. Current biodiversity funding is only one-sixth of the total funding needs. Philanthropy—as only a minor source of biodiversity funding—cannot fill this funding gap itself. To make the most progress on biodiversity conservation, philanthropy should focus on impact strategies where it can achieve an outsized difference.

We expect that philanthropy can be most impactful by focusing on long-lasting systems-change solutions for the drivers of biodiversity loss. Philanthropy can support policy change, accelerate innovation, or shape new markets in ways that the private sector or governments cannot. This makes philanthropy uniquely positioned to lay the groundwork for the systemic change we need to tackle biodiversity loss. We evaluated different impact strategies based on our criteria of scale, feasibility, and funding need.

- **Where should donors prioritize giving for terrestrial and freshwater biodiversity?**

For biodiversity on land, we recommend donors to focus on reducing land use change from agricultural expansion. Land use change is the largest driver of terrestrial biodiversity loss because it results in a large loss of habitat. Habitat destruction threatens 85% of endangered or vulnerable species that live on land, making it by far the most common threat to terrestrial species. We expect future land use change to come from land-intensive agricultural products like animal proteins. For donors, the following impact strategies stand out as especially promising:

1. **Advocating for alternative protein policy and research** can make these products as tasty and cheap as conventional meat, which has the potential to reduce the expansion of croplands by 82% by 2050.
2. **Protecting sensitive and unique habitats at scale, such as wetlands,** which, despite accounting for just 10% of the total global land surface, are where up to 40% of the world's species live and breed. Protecting these ecosystems could help conserve the most valuable habitats from conversion in the short term until land-use pressures are solved.

- **Where should donors prioritize giving for marine biodiversity?**

For marine biodiversity, we recommend that donors focus on reducing ecosystem damage from fishing. The fishing sector is the leading driver of marine biodiversity loss. For donors, the following impact strategies stand out as especially promising:

1. **Developing and implementing improved fishing gear** can help reduce bycatch, the unintended capture of non-target species such as dolphins or seabirds.
 2. **Supporting innovation for alternatives to fish meal and fish oil (FMFO)** can reduce the quantities of forage fish caught by up to 13% by reducing the need for wild-caught fish for aquaculture.
- **Is donating to climate change mitigation a promising approach to reduce biodiversity loss?**

Climate change is the fourth leading driver of biodiversity on land and in freshwater ecosystems, and the second-largest in the oceans. As the planet continues to warm, the damage done to ecosystems will rise exponentially along with global temperatures, making climate change a more dominant threat in the years to come. We recommend that donors who are primarily interested in reducing biodiversity loss follow our recommendations for reducing land use change and overfishing. However, donors who care about both biodiversity and climate change could consider donating to the [Giving Green Fund](#) or directly support [Top Climate Nonprofits](#). In this context, alternative protein policy and research stands out as especially promising, since this strategy addresses both greenhouse gas emissions and habitat loss.

- **What are the key uncertainties and open questions?**

Our key uncertainties relate to the increasing importance of climate change as a driver of biodiversity loss, the relative importance of terrestrial, freshwater, and marine biodiversity, and whether there are promising ways to reduce biodiversity loss drivers that we did not research in detail, such as pollution.

- **What is the bottom line, and what are the next steps?**

We recommend that biodiversity-focused philanthropists fund organizations that are working on alternative protein advocacy, wetland conservation, bycatch mitigation, and innovation in fishmeal alternatives. To better inform donors, we have evaluated several biodiversity nonprofits and, as of 2026, recommend [The Good Food Institute](#) and [Wetlands International](#) as [Top Biodiversity Nonprofits](#).

Introduction

Key ideas: The role of philanthropy in addressing biodiversity loss

- **Biodiversity in decline:** While healthy ecosystems are important for humanity's security and well-being, nature is in decline. The extent and condition of natural ecosystems have declined by 47% since their earliest estimates.
- **Scarce philanthropic funds:** Philanthropy only represents 2% of all financial flows to biodiversity conservation. Overall, the biodiversity financing gap exceeds \$700 billion. This highlights the importance of using limited financial resources as effectively as possible.
- **Leverage and systemic change:** Since philanthropy is a minor source of biodiversity funding, it is unlikely to move the needle on biodiversity loss if it funds conservation approaches that are already supported by the public or private sectors. Rather, philanthropy should leverage larger resources and more powerful actors by advocating for systemic change in policies, innovation, and markets.

The Challenge of Biodiversity Loss

Nature is in decline worldwide. The extent and condition of natural ecosystems have declined by 47% since their earliest estimated states. 25% percent of species in animal and plant groups that have been studied are at risk of extinction. On land, the abundance of species has declined by 23% since prehistory. A vast majority (72%) of indicators created by Indigenous Peoples and local communities reveal a decline in aspects of nature that are important to them.¹

Healthy ecosystems are important for humanity's security, well-being, and health. Nature delivers contributions to humans that are also called ecosystem services. The Millennium Ecosystem Assessment created a distinction between four types of ecosystem services:²

¹ [IPBES, 2019, Fig. SPM2](#)

² [Millennium Ecosystem Assessment, 2005, pp. V-VI5](#)

- Provisioning services, such as food, water, timber, and fiber;
- Regulating services, such as carbon storage, climate regulation, disease regulation, water filtration, and flood prevention;
- Cultural services, such as space for recreation, aesthetic beauty, and spirituality;
- Supporting services, such as nutrient cycling, pollination, and soil formation, enable the other ecosystem services.

The decline of nature and biodiversity negatively affects humanity's ability to flourish.

The 50-year global trend of 23 out of 27 ecosystem services is trending downwards, including habitat creation and maintenance, pollination, air quality regulation, freshwater regulation, soil formation, and marine fish stocks.³ In 2023, an update to the planetary boundaries framework found that the functional integrity of the biosphere has been breached, putting us in a risk zone where ecosystems may no longer reliably sustain the services that keep Earth in the stable state in which humanity has been able to thrive.⁴

The Role of Philanthropy in Tackling Biodiversity Loss

Philanthropy is only a minor source of funding for protecting biodiversity. According to [a review by the Paulson Institute](#) and other nature organizations, philanthropies and non-profit organizations (NGOs) spend approximately \$1.7 to \$3.5 billion per year on biodiversity conservation. This is dwarfed by other funding sources, such as government budgets (appx. \$77 billion) and natural capital (appx. \$27 billion).⁵ We highlight the magnitude of global financial flows to biodiversity conservation in **Figure 1**.

Funding flows that are harmful for biodiversity are much larger than funding flows for biodiversity conservation. According to OECD estimates, the “most harmful subsidies” in OECD countries and emerging economies amount to \$230 billion per year for agriculture, \$16 billion per year for fisheries, and \$28 billion per year for forestry. These estimates roughly double in size when considering subsidies that are “potentially harmful”.⁶

³ [IPBES, 2019, Fig. SPM1](#)

⁴ [Richardson et al., 2023](#)

⁵ These estimates come from OECD data and are aggregated in: [Deutz et al., 2020](#). Natural capital includes, for example, grants and contracts by public entities for the protection of watersheds to manage water supplies.

⁶ [Deutz et al., 2020](#)

Philanthropic and NGO funding for biodiversity is dwarfed by other funding sources and harmful subsidies

Global financial flows to biodiversity conservation and harmful subsidies.

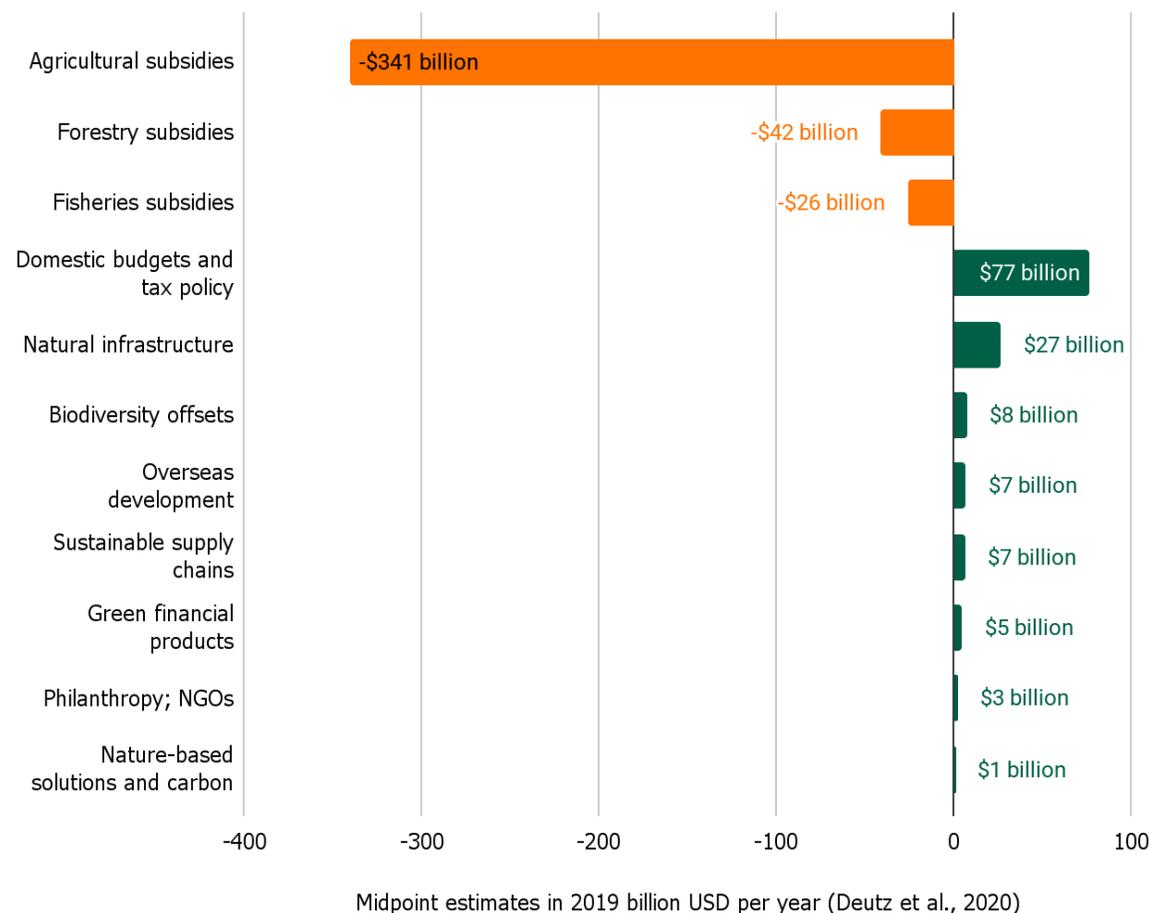


Figure 1: Biodiversity-related finance flows per year⁷

The biodiversity funding gap is immense. To reach global goals for projected areas (30% of land and sea by 2030) and the sustainable management of productive landscapes, seascapes, and urban areas, a five- to seven-fold increase in global biodiversity funding is needed. This amounts to a financing gap of \$598 to \$924 billion per year.⁸

The biodiversity finance gap highlights the need for smart and cost-effective investments for biodiversity conservation. We show the biodiversity financing gap in **Figure 2**. As long as global funding for biodiversity remains scarce, humanity should

⁷ Data: [Deutz et al., 2020](#); Figure: Giving Green

⁸ [Deutz et al., 2020](#)

invest its limited resources into exceptionally effective solutions. Since there are still insufficient funds available to cover the biodiversity financing gap, we can protect and conserve more biodiversity by prioritizing problems, strategies, and solutions that are highest in scale, more feasible to address, and can effectively absorb more funding.

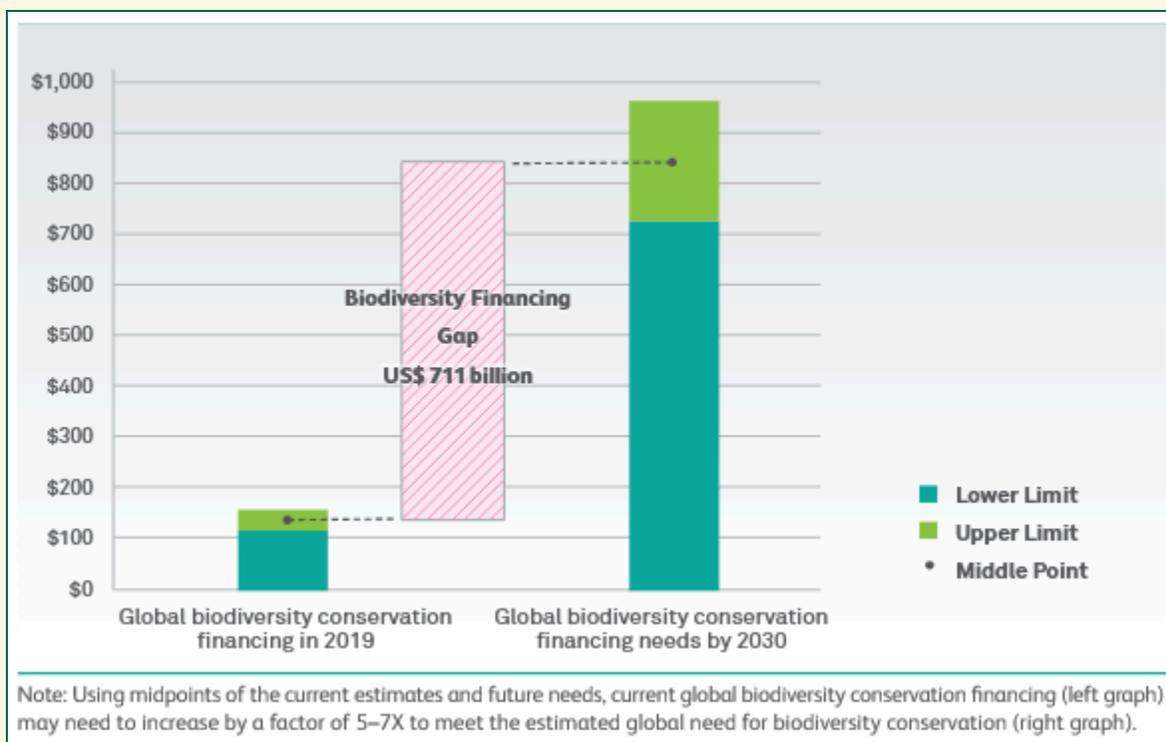


Figure 2: The biodiversity financing gap⁹

Biodiversity loss is a systemic problem that demands systemic solutions. At its core, biodiversity loss arises from profit incentives that destroy or degrade ecosystems. These incentives are caused by demand for environmentally harmful products and technologies. Conventional conservation strategies tend to prioritize tangible, short-term outcomes like protecting individual habitats or monitoring specific species. These direct actions matter, but without deeper structural shifts, they won't be enough to halt biodiversity decline.

Philanthropy is uniquely positioned to catalyze the systemic change needed to halt biodiversity loss. Since it represents only a small share of biodiversity funding, philanthropy is unlikely to move the needle if it funds conservation approaches that are already supported by governments or the private sector. Instead, philanthropy must focus on neglected opportunities where its resources offer the greatest leverage, such as by advocating for policy change, shaping new markets, or accelerating innovation.¹⁰

⁹ [Deutz et al., 2020](#)

¹⁰ You can read more about Giving Green's approach to systems change in climate philanthropy in our report on [How and why we think about systems change as a climate funder](#).

Our Research Approach

Key ideas: Giving Green's approach to reducing biodiversity loss

- **Research method:** Our goal is to find the most impactful philanthropic strategies for reducing biodiversity loss for every dollar donated. Our research process first highlighted promising impact areas, which we assessed based on our criteria of scale, feasibility, and funding need. We evaluate promising nonprofits in separate Nonprofit Evaluations.
- **Drivers of biodiversity loss:** We focus on research on addressing the 'direct drivers' of biodiversity loss: land/sea use change, overexploitation of organisms, pollution, climate change, and invasive alien species. We think that this approach reduces the risks of non-permanence and leakage and can reduce pressures on biodiversity at a global and systemic scale.

Method

The objective of our research is to identify impact strategies for donors that offer the highest impact per marginal dollar. Our research process is based on our existing [research process](#) for identifying, assessing, and recommending impact strategies for climate change mitigation. Our research process can be summarized as follows:

1. Prioritize broad areas for further investigation.

Because biodiversity is an inherently multi-dimensional and non-fungible good, comparing specific impact strategies in terms of scale is methodologically challenging. For this reason, we prioritized among the five direct drivers of biodiversity loss, for which quantitative comparisons in scale exist. From this, we selected land use change and overfishing for further research.

2. Identify impact strategies within our priority areas.

For both land use change and overfishing, we created a list of impact strategies based on data, academic literature, and input from experts. These impact strategies can be seen as levers to make progress on our priority areas.

3. Assess strategies using the framework of scale, feasibility, and funding need.

We compared the potential of each listed impact strategy against others in the same category using the following heuristic:

- **Scale:** How big is the problem that this strategy addresses?
For land use change, we looked at the surface area of land conversion avoided as a heuristic for scale, while weighing this against the importance of different biomes in terms of ecosystem services. For overfishing, we used heuristics such as the harmfulness and extent of fishing practices and the percentage of fish caught.
- **Feasibility:** How easy is it to address this problem?
We want to understand the likelihood of this impact strategy achieving scale, relative to the counterfactual.
- **Funding need:** How much would more donations help?
We assess whether an impact strategy is constrained by a lack of philanthropic funding and whether opportunities exist for philanthropy.

4. Longlist organizations working on our prioritized impact strategies

Based on this report, we compiled a list of non-profits that we considered recommending. We created a longlist to map potential opportunities, then evaluated each based on their focus (alignment with the strategy), effectiveness (potential impact), and size (scale and likely funding needs).

5. Nonprofit evaluations

Based on a longlist of organizations, we thoroughly evaluated a smaller number of nonprofits to determine whether an organization has a promising theory of change and clear funding needs. Following this evaluation, we decided to recommend two nonprofits as [Top Biodiversity Nonprofits](#) in early 2026.

Guiding Principles

We used the following guiding principles to identify promising approaches for biodiversity philanthropy:

- **Additionality:** We look for funding opportunities where the biodiversity benefit is not likely to happen without additional philanthropic support. If funding supports initiatives that would not have happened otherwise, it is considered additional. If it is likely that the same result would have happened because of government policy, market forces, or other actors, then a strategy has low additionality. This concept is central because donations are intended to fill gaps and unlock outcomes that would not have happened otherwise.
- **Permanence:** We look for funding opportunities where the positive outcomes are likely to last a long time, ideally indefinitely. Protecting biodiversity is only valuable if the benefits are not quickly undone because of policy reversal, new economic incentives, climate change, or natural disturbances like fire.
- **Leakage risks:** We aim to support initiatives where protection of biodiversity in one area is not likely to lead to much increased biodiversity loss elsewhere. For example, establishing protected areas can displace hunting, fishing, and deforestation to unprotected areas, reducing the net effect of the intervention.
- **Preservation versus restoration:** Generally, preserving relatively intact or biodiverse ecosystems is more cost-effective and more likely to be successful than restoring ecosystems once they are degraded. It is often difficult to restore ecosystems to a pre-modification state. Even if restoration efforts are successful,

preservation and conservation activities may still be required to ensure permanence.¹¹

- **Co-benefits for humans and animals:** In principle, co-benefits for human health, development, and animal welfare were not part of our prioritization, but we took care to not recommend strategies that may cause harm.
- **Geographical spillovers:** We seek funding opportunities that deliver biodiversity gains at a global scale, not just within a single ecosystem. For this reason, we are less likely to recommend narrowly targeted conservation projects, and more likely to support technological advances or international agreements that can influence biodiversity worldwide.
- **Systems change and leverage:** Since philanthropic support for biodiversity is small relative to the total flow of biodiversity finance, we look for opportunities where philanthropy can have an outsized impact by creating systemic change, such as better policies, increased or better government budgets, or creating improved technologies.
- **Ecosystem services:** While there are many indicators for biodiversity, we decided to focus on ecosystem services as the biodiversity indicator to prioritize. Since ecosystem services describe the benefits that humans derive from ecosystems, this definition is closest to Giving Green's mission to maximize human and ecological well-being. In practice, there are often no concrete quantitative indicators of ecosystem services for the strategies that we evaluate, so we often rely on heuristics from other indicators.

Given these considerations, we decided to focus our biodiversity strategy on reducing the economic and direct drivers of biodiversity loss. Reducing the drivers of biodiversity loss—by definition—preserves biodiversity that is at risk of being lost (high additionality). Because addressing drivers reduces pressures on ecosystems, it reduces the risk of impermanence and leakage. This approach also allows for a systems change lens focused on changing technologies, markets, and policies responsible for the decline in biodiversity at a global, regional, or jurisdictional scale.

The Drivers of Biodiversity Loss

The term 'direct drivers' refers to the immediate, measurable factors that directly cause changes in ecosystems, species population, or genetic diversity. These five main drivers are:

- Land and sea use change, such as the conversion of forests and wetlands to agriculture, infrastructure, and urban areas.
- Direct exploitation of organisms, such as unsustainable fishing, hunting, logging, and harvesting.

¹¹ "Here, we emphasize the importance of prioritizing the preservation of relatively intact and pristine areas when identifying protected areas, and of avoiding the common misconception that, if intact nature is degraded or lost, it can simply be restored. Even the best restorations, after many decades of investments and efforts, are only a shadow of the natural systems they are meant to recreate. [...] In general, restoration is often more cost-demanding, and less successful, than the preservation of species and original habitats. [...] [M]ore focus should be given to [...] that the benefits of restoration are not permanent" ([Mori and Isbell, 2023](#)).

- Climate change, which leads to different weather patterns, thermal stress on species, sea level rise, and ocean acidification.
- Pollution, such as excessive pesticide and fertilizer use.
- Invasive alien species, which are non-native organisms that spread in a new area and outcompete or disrupt native species and ecosystems.

The direct drivers of biodiversity loss are downstream of indirect drivers, such as demographic and sociocultural trends, economic systems and technologies, institutions and governance, and conflicts and epidemics. Strategies to reduce biodiversity loss often involve changing the available and used technologies (such as by promoting Indigenous practices and precision agriculture) or changing rules and regulations.¹²

¹² IPBES ([2019, pp. 55-60](#))

Terrestrial and Freshwater Biodiversity: Halting Land Use Change

Key ideas: Giving Green's approach to reducing terrestrial and freshwater biodiversity loss

- **Importance of land use change:** Land use change is the most dominant driver of terrestrial and freshwater biodiversity loss. The habitat loss from land use change is the most common threat to endangered and vulnerable species on land and in freshwater. We think that biodiversity philanthropists should prioritize addressing land use change.
- **Reducing agricultural expansion:** Agricultural expansion is responsible for most land use change. Croplands to grow animal feed and food for humans are expanding, especially in biodiverse tropical regions. We can reduce future habitat loss by switching to plant-rich diets, closing yield gaps, and reducing food loss and waste.
- **Advocating for alternative proteins:** We think that advocating for alternative protein policy and research is the most promising strategy to reduce future habitat loss. Alternative proteins can reduce the expansion of croplands by 82% by 2050, but so far have gained relatively little support from governments and philanthropists.
- **Protecting wetlands:** Since reducing agricultural expansion will take time, it is promising to protect unique and biodiverse habitats in the short-term to steer future land use change away from these sites. Wetlands only cover about 10% of the Earth's surface, but are exceptionally important for biodiversity and ecosystem services. Up to 40% of species live or breed on wetlands.

Why Do We Focus on Land Use Change?

Land use change, such as the conversion of natural habitats to agricultural land, is the most dominant direct driver of biodiversity loss on land and in freshwater ecosystems. Based on a meta-analysis of studies comparing the relative importance of drivers of

biodiversity loss, land use change has a dominance score of 3.16 on a 0–4 score in terrestrial ecosystems, meaning it nearly consistently outranked other drivers in weighted comparisons.¹³ In freshwater ecosystems, the dominance score was 2.69/4.00, which still makes land use change the most dominant driver in this realm.¹⁴ We visualize the dominance of the direct drivers in the terrestrial and freshwater realms in **Figure 3**.

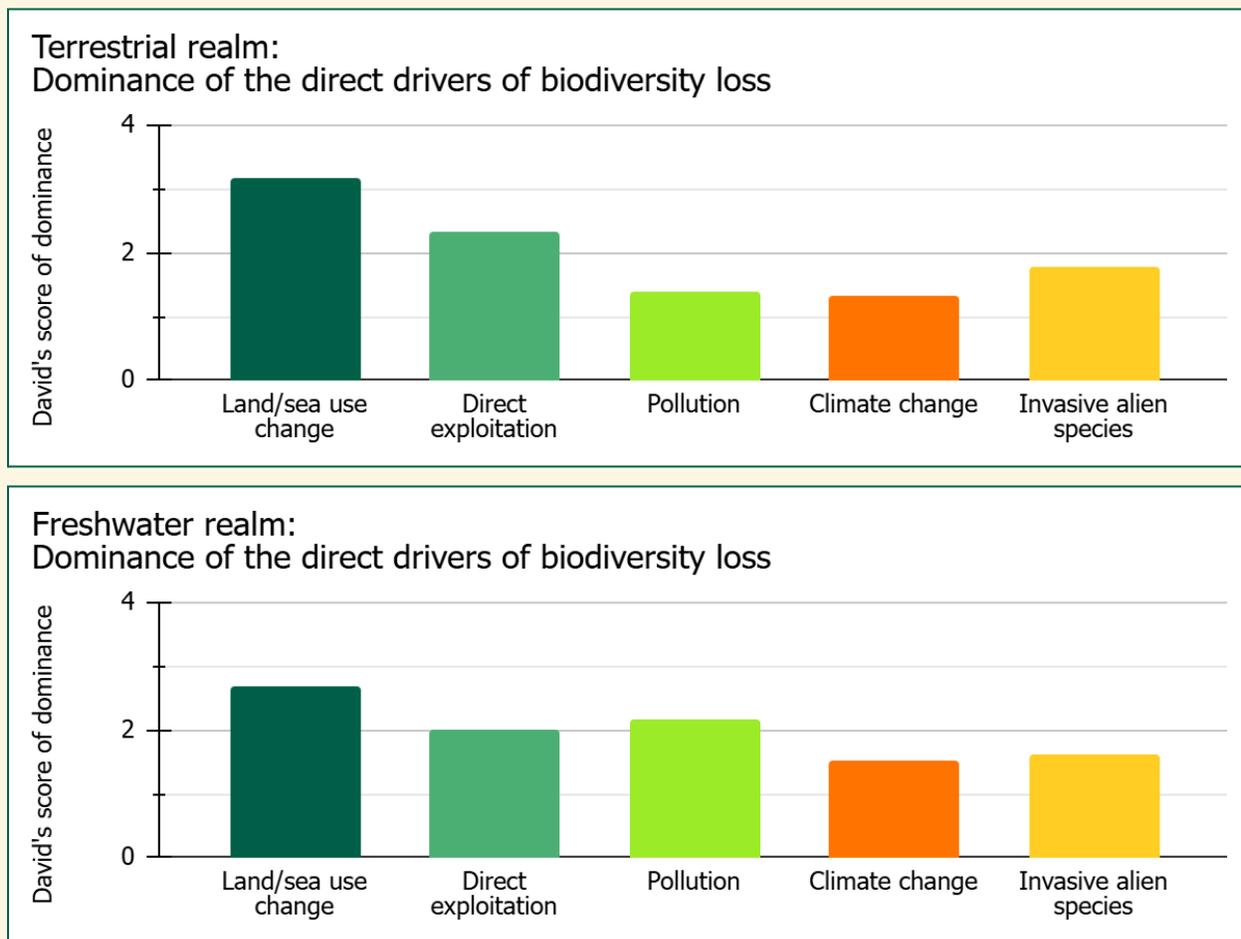


Figure 3: Relative dominance of direct drivers of biodiversity loss in terrestrial (top) and freshwater (bottom) ecosystems, based on pairwise comparisons between drivers.¹⁵

¹³ Point estimate of the dominance of land use change in the terrestrial realm: 3.16/4.00 (95% confidence interval: 2.77–3.40, n=87 studies) ([Jaureguiberry et al., 2022, Fig. 1B](#)). Dominance scores are built from published studies that directly compared at least two drivers of biodiversity loss. Each study was converted into weighted head-to-head matchups: the more important driver received 1 point, the less important driver 0, and ties 0.5. Weights reflected study scale (local to global) and under-represented indicators. These weighted results were summed and converted into normalized David's scores, which range from 0 (always lowest ranked) to 4 (always highest ranked), with 2 expected if all five drivers were equally important. A score of 3.16 for land-use change in terrestrial ecosystems shows it consistently outranked other drivers.

¹⁴ Point estimate of land use change in the freshwater realm: 2.69/4.00 (95% confidence interval: 2.42–3.51, n=38 studies). There is no significant ($p > 0.5$) difference in the among-driver dominance hierarchy between the terrestrial and freshwater realms ([Jaureguiberry et al., 2022, Fig. 1B](#)).

¹⁵ Data: Jaureguiberry et al., 2022, Fig. 1B, processing by Giving Green.

In addition, habitat destruction (the result of land use change) is by far the most common threat to terrestrial species at risk of extinction.¹⁶ Based on our analysis of species on the [IUCN Red List](#), 85% of endangered or vulnerable species that live on land are threatened by habitat destruction, making it by far the most common threat to terrestrial species.¹⁷ As shown in Figure 4, the next most common threats (overexploitation and pollution) each threaten only 18% of endangered or vulnerable terrestrial species. In freshwater ecosystems, habitat destruction is an equally common threat (84%), although pollution and invasive species are also highly relevant. This highlights the priority to address habitat destruction as a strategy to reduce terrestrial biodiversity loss.

¹⁶ Land use change describes how people repurpose land. Habitat destruction describes how those changes (and other pressures) harm the living systems on that land. For the purposes of this report, they can be considered interchangeable.

¹⁷ We retrieved data from the [IUCN Red List of Threatened Species](#) in October 2025 and filtered for species that are critically endangered (CR), endangered (EN), or vulnerable (VU) and live—at least partially—on land (n=41444 species). We then grouped IUCN's categorization of threats to these species into the five groups included in the diagram in line with the method by [Hogue and Breon \(2022\)](#):

Habitat destruction: Threat codes 1-3, 6-7, 4.1-4.3, 5.3.3-5.3.5.

Overexploitation: Threat codes starting with 5, except 5.3.3-5.3.5.

Pollution: Threat codes starting with 9.

Climate change: Threat codes starting with 11.

Invasive species: Threat codes starting with 8.

The sum of the percentages exceeds 100% because species may be affected by more than one extinction threat.

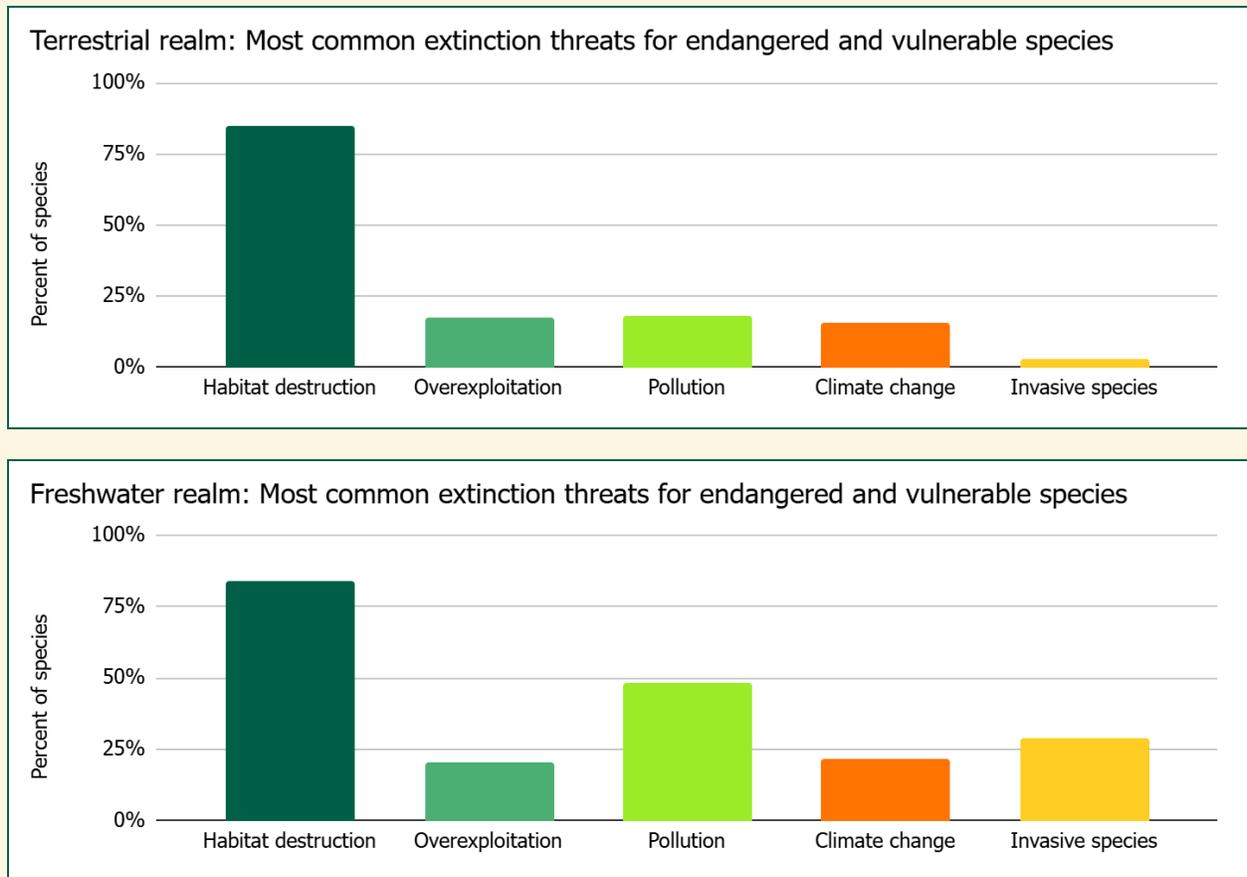


Figure 4: Most common extinction threats for endangered and vulnerable terrestrial species (top) and freshwater species (bottom).¹⁸

Addressing land use change offers a dual benefit: it reduces biodiversity loss and advances climate change mitigation. Solutions in the agriculture, forestry, and other land use (AFOLU) sectors, such as shifting dietary patterns and improving agricultural yields, can deliver gains for both climate and ecosystems. The Intergovernmental Panel on Climate Change (IPCC) estimates that AFOLU activities account for 22% of global greenhouse gas emissions.¹⁹ Climate change itself is a mid-level but growing driver of biodiversity loss, which underscores the urgency of tackling land use change as part of biodiversity conservation strategies.²⁰ For further details on Giving Green’s analysis of land use change and emissions, refer to our [philanthropic strategy report on food systems emissions](#).

Biodiversity loss from land use change can, to some extent, be tackled on a global scale because it is largely influenced by a small number of economic drivers. Agricultural expansion accounts for the largest share of global land use change between

¹⁸ Data: [IUCN](#), retrieved October 2025. Analysis and figure: Giving Green

¹⁹ IPCC ([2023, §A.1.4](#)). The data year is 2019.

²⁰ Climate change as a mid-level driver: Jaureguiberry et al. ([2022, Fig. 1A](#))

1960 and 2019 (~7.6 million km²), approximately the size of Greece every year.²¹ Out of the 5 million hectares of forest that the world loses every year, 95% is lost in the tropics. Nearly half of all tropical forest loss happens in just two countries (Brazil and Indonesia) and because of three major products (beef, soy, and palm oil). Another considerable economic driver of forest loss, at 17.5% of deforestation, is the growth of agricultural land on the African continent because of increased demand for agricultural production.²² A summary of the causes of tree cover loss between 2001 and 2024 is seen in **Figure 5**.

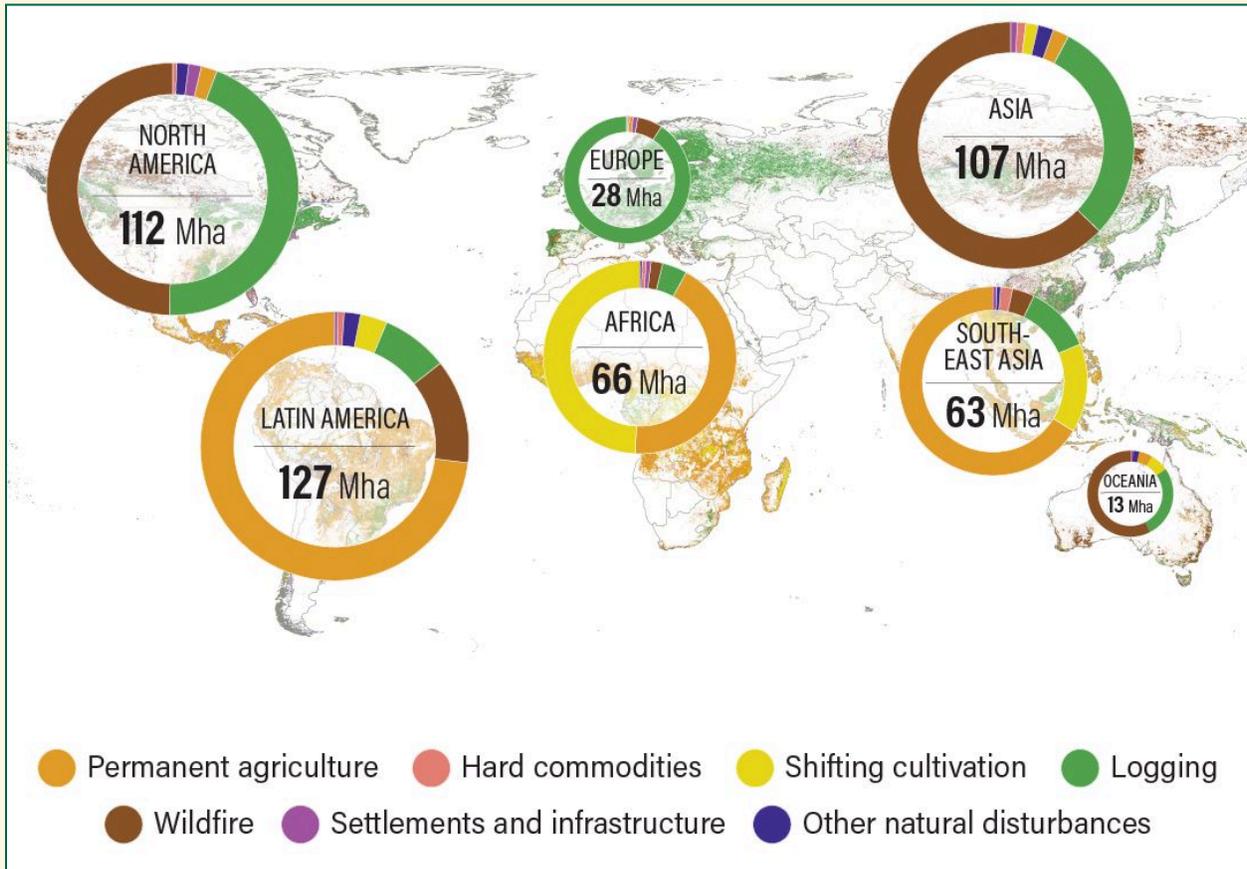


Figure 5: Tree cover loss by dominant driver, 2001-2024.²³

Global agricultural land use is going down, but is still increasing in some areas and for the creation of croplands. Land use continues to increase in some countries, especially in tropical regions, which are rich in biodiversity. Additionally, most of the decline in agricultural land is because of disused lands for pastures and grazing. The surface area

²¹ "We identify 12 major land use transitions and find that agricultural expansion accounted for the largest share of global land use change (~7.6 million km²), an area as large as Greece every year between 1960 and 2019. A major portion of this land is made up of pasture/rangeland expansion, mainly used for nomadic pastoralism. Areas of cropland expansion are mainly located in the Global South, particularly in South America (Argentina, Brazil), Africa (Ethiopia, Nigeria, Uganda), India and Thailand." ([Winkler et al., 2022](#))

²² We base this on a [summary](#) by Ritchie ([2021](#)) of Pendrill et al. ([2019](#)).

²³ Image: World Resources Institute ([2025](#)). Data: Sims et al. ([2025](#))

of global croplands for animal feed and human consumption is still trending upwards at the expense of natural ecosystems.²⁴

While land use change already receives considerable attention in biodiversity circles, we still think there is room for more funding to address this driver. While we are not aware of an overview of total biodiversity funding by impact strategy, there are multiple funding mechanisms to (among other strategies) protect land from conversion, the most well-known being REDD+.²⁵ Philanthropy, too, is funding AFOLU solutions through initiatives such as the [Climate and Land Use Alliance \(CLUA\)](#) and the [Protecting Our Planet \(POP\)](#) pledge. However, a considerable amount of philanthropic funding is spent on location-specific projects and forest conservation,²⁶ contrary to our view that biodiversity philanthropy is (usually) more impactful by catalyzing global or regional systems-change solutions in policy, innovation, and market shaping, or safeguarding neglected ecosystem types. We still think there is considerable room for more funding for some of the most promising land use change funding opportunities that we have identified.

Strategies to Reduce Land Use Change

The three largest levers to tackle the expansion of croplands (and therefore habitat loss) at scale are increasing agricultural yields, a transition to plant-rich diets, and reducing food waste. A modelling study by [Williams et al. \(2020\)](#) predicts that achieving 80% of the maximum yield on croplands, following plant-rich dietary guidelines, and halving food waste can reduce the need for cropland by 25% by 2050. The overall effect of plant-rich diets is larger, because it also avoids the expansion of pastures. **Figure 6** shows the potential of these three approaches to reduce cropland expansion by 2050.

²⁴ Ritchie et al. ([2022](#)).

²⁵ "REDD' stands for 'Reducing emissions from deforestation and forest degradation in developing countries. The '+' stands for additional forest-related activities that protect the climate, namely sustainable management of forests and the conservation and enhancement of forest carbon stocks." ([UNFCCC, n.d.](#))

²⁶ "Critics of the POP challenge have said the plan risks entrenching 'fortress conservation' and may divert attention from the underlying causes of biodiversity loss, such as the expansion of plantation agriculture, overfishing, mining, logging and overconsumption." ([Pye, 2023](#))

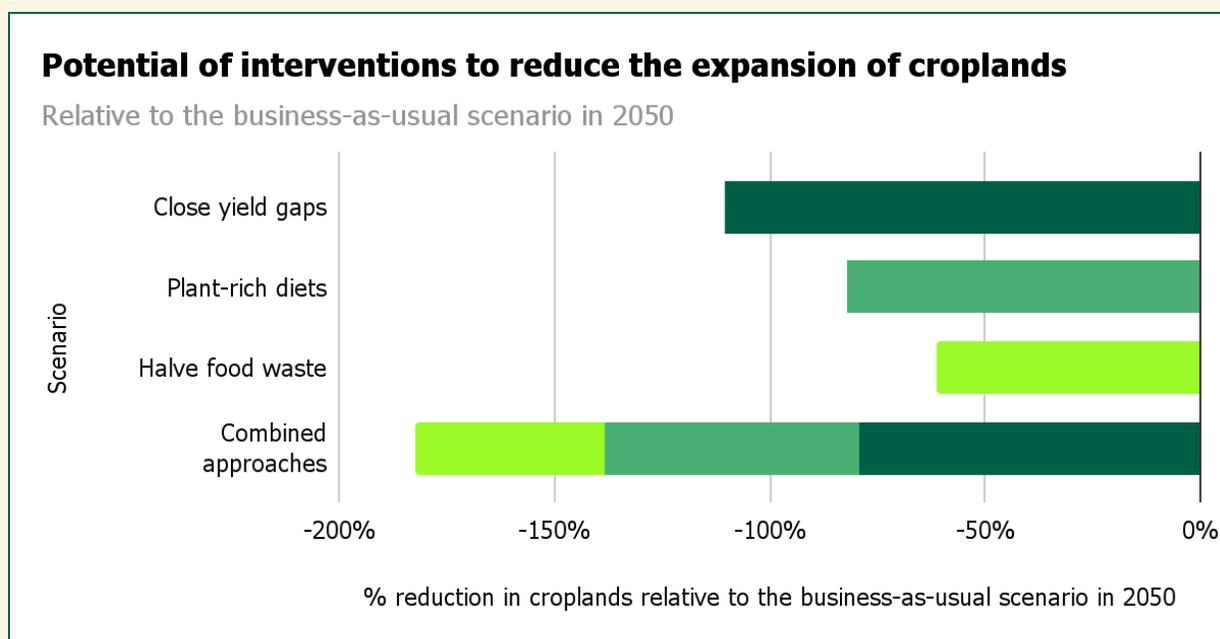


Figure 6: Potential of approaches to reduce the expansion of croplands by 2050.²⁷

Reducing demand for agricultural land should be combined with effective and inclusive conservation policies. Targeted conservation efforts should focus on areas with the highest conservation value that are likely to be converted before long-term solutions for reducing agricultural land exist. Conservation can be used to (a) steer agricultural development to areas with lower conservation priority and (b) prevent a situation where increases in yields locally provide a profit incentive to clear vulnerable land for agriculture, as discussed later in this chapter.

In the remainder of this chapter, we discuss the several strategies to reduce land use change based on scenarios modeled in Williams et al. (2020):

- For plant-rich diets, we look at **advocating for alternative protein policy and research**. In our [strategy report on reducing food system emissions](#), we landed on alternative proteins as the most promising way to reduce meat consumption.
- For closing yield gaps, we look at **increasing yields in Sub-Saharan Africa**. In this region, yields are lowest while population and consumption are increasing.
- We cover **reducing food loss and waste** holistically.

In addition to the strategies based on the scenarios in Williams et al. (2020), we evaluate developing technical alternatives to soybean meal as a future solution that might be unlocked with technological progress. We also consider a qualitative argument for protecting vulnerable habitats, in order to steer land use change away from the most sensitive and biodiversity ecosystems.

²⁷ Data from [Williams et al., 2020](#) with processing by Our World in Data and Giving Green. The combined effect of the strategies is less than their sum because of interaction effects. Values below -100% represent a decrease in cropland area in 2050 relative to 2020. The 'close yield gaps' line represents increasing yields to 80% of the maximum sustainable yield. The 'plant-rich diets' scenario is the global implementation of the [EAT Lancet diet](#).

Table 1: Philanthropic sub-strategies that could reduce the biodiversity impacts of land use change

Sub-strategy	Scale	Feasibility	Funding Need	Notes
Advocating for alternative protein policy and research	High	Medium	High	Alternative proteins are food products that are designed to replace conventional animal products. Animal agriculture is responsible for more than half of all global forest loss because of high pastureland and feed requirements. We see alternative proteins as a solution that can reduce the growth in global animal consumption.
Increasing agricultural yields in Sub-Saharan Africa	High	Medium	Medium	Agricultural expansion is projected to lead to substantial habitat losses, especially in Sub-Saharan Africa, where both agricultural yields and productivity growth are lowest. Increasing the yields per hectare of land reduces the amount of land needed to grow food, which allows other land to be spared from conversion to agriculture. Because of high heterogeneity in Sub-Saharan Africa, unsuccessful previous efforts, and interest from development funders, we rate both the feasibility and funding need as medium.
Reducing food loss and waste	High	Medium	Low	About one-third of the world's food production does not get consumed. This implies that approximately one third of agricultural land is used to grow food that gets lost or wasted. Halving food loss and waste could reduce cropland expansion by 18 percentage points by 2050. There is a strong financial and humanitarian incentive to reduce food loss and waste. We therefore rate the funding need as low. We rate the feasibility as medium because of supply chain and data complexity.
Developing technical alternatives to soybean meal	High	Low	High	Feed alternatives like algae and single cell protein could reduce the need for soy plantation for animal feed. Fishmeal and fish oil alternatives are a more logical first market for feed alternatives, so this strategy is discussed in our fishing section.

Sub-strategy	Scale	Feasibility	Funding Need	Notes
Protecting select vulnerable habitats, such as wetlands	Medium	Medium	High	The strategies above are intended to reduce total land use change, but are not specific as to which biomes and ecosystems are being halted from conversion. Since we expect that both accelerating alternative proteins and increasing agricultural productivity are long-term strategies, we think that coupling these strategies with a shorter-term strategy of protecting ecosystems that are exceptionally unique or valuable is a promising hedge against other strategies failing to yield results in time.

Advocating for Alternative Protein Policy and Research

Scale ●●● High

Feasibility ●●○ Medium

Funding need ●●● High

Alternative proteins (alt proteins) are food products that are designed to replace conventional animal products while offering a similar nutritional value, taste, and mouthfeel. Partially replacing the consumption of beef, milk, and other animal proteins with nutritionally similar products made without animal proteins would reduce the land needed for animal agriculture and feed. Some alt protein products are:²⁸

- Plant-based meat, such as the Impossible Burger, is made of plant products and emulates conventional meat in terms of taste, smell, and preparation method.
- Cultivated meat is meat grown directly from animal cells in a bioreactor, a controlled environment similar to vessels used in beer brewing.
- Precision fermentation products use selected microorganisms to produce the flavor, texture, and other properties of conventional meat. This can be used to make substitutes or specific ingredients.
- Blended products combine different types of alt proteins, such as incorporating cultivated animal fats into plant-based meats.

As part of this philanthropic strategy, we consider activities that enable a supportive policy environment for the development and market uptake of alt proteins, spur innovation in the taste, price, and convenience of these products, and shape a larger market. These activities can include:

- Policy advocacy for increased research and development (R&D) funding, regulatory approval, meat-like labeling practices, and improved dietary guidelines.
- Corporate outreach to increase the availability of alt proteins in grocery stores and restaurants and to drive private investment in this space.
- Directly funding or working with researchers to identify and fill important research gaps. This is especially useful for research questions that get little interest from the private sector, or where open-source research leads to quicker and more equitable growth of technologies. Funding research can help to de-risk alt protein investments and inform more targeted policy support.

We have previously evaluated alt protein policy advocacy and research as part of our research on food sector emissions. Our evaluation of this strategy leans on the findings presented in our [food systems report](#).²⁹

Scale: High

The production and consumption of animal products is responsible for more than half of all global forest loss, in particular pasture expansion for beef and the cultivation of

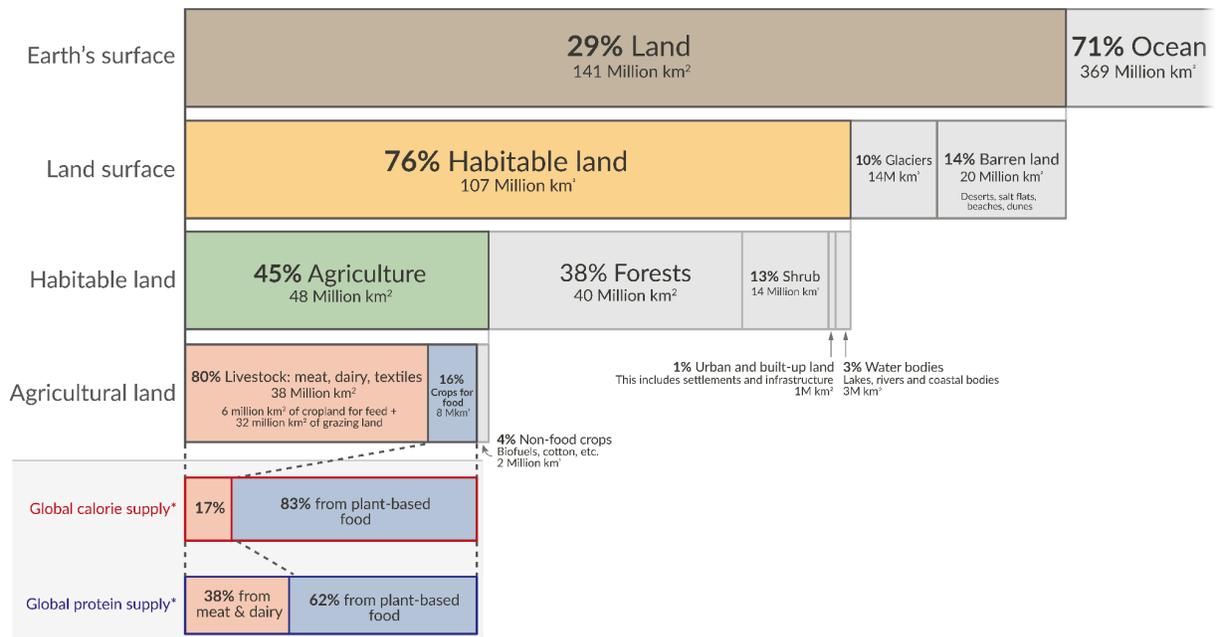
²⁸ Food Frontier ([n.d.](#))

²⁹ Giving Green ([2024](#))

oilseeds for animal feed.³⁰ Because animal agriculture requires a lot of land per calorie produced, the sector takes up a considerable amount of land. Out of all habitable land, nearly half (45%) is used for agriculture, of which 80% is used for animal agriculture or to grow animal feed (**Figure 7**). Besides being a driver of land use change, animal agriculture is a major cause of nutrient pollution because of animal manure and the use of fertilizer for growing crops,³¹ and a considerable driver of climate change.³²

Global land use for food production

Our World in Data



*Includes fish and seafood from aquaculture production, which uses land for feed. If wild fish catch is also included, animal products would provide 18% of calories and 40% of protein. Data sources: UN Food and Agriculture Organization (FAO) and Poore and Nemecek (2018). OurWorldinData.org – Research and data to make progress against the world's largest problems. Licensed under CC-BY by the authors Hannah Ritchie and Max Roser (September 2023).

Figure 7: Global land use for food production. Agriculture takes up nearly half of all habitable land, of which 80% is used for animal agriculture, despite the sector only being responsible for a small part of global calorie and protein supply.³³

Alt protein products are a considerable improvement in terms of land use and environmental impact, as shown in **Figures 8-10**. An analysis by the UK non-profit Green Alliance highlights the potential of high alt protein innovation to free up land in Europe for semi-natural habitats (from 13% to 30% of total domestic farming) and agroecological farming (from 17% to 36%), while only requiring a quarter of former overseas land

³⁰ [Pendrell et al., 2019](#)

³¹ [NOAA, n.d.](#)

³² [Giving Green, 2024](#)

³³ [Ritchie and Roser, 2024](#)

requirements.³⁴ Because alt protein products require much less land than conventional meat, its adoption would reduce deforestation and could free up land for restoration.³⁵

- Plant-based protein sources—which are the main ingredient for plant-based meat—have a land footprint that is several orders of magnitude lower than animal-based proteins, especially lamb and beef.³⁶ A comparative life cycle assessment (LCA) of plant-based and conventional meat products reveals that the plant-based products with the highest environmental impacts still score 90%, 58%, and 4% better than beef, pork, and chicken, respectively, per kilogram. Plant-based meat products also have 88% less or even lower environmental impacts in terms of global warming, acidification, eutrophication, ecotoxicity, and water consumption than beef.³⁷
- A prospective LCA of cultivated meat predicts that cultivated meat production in 2030 will use 55% less land than beef from dairy herds and 90% less land than beef from beef herds, with their qualitative findings being broadly in line with previous research. Cultivated meat also has a lower carbon footprint than beef and pork, especially when the energy used for production comes from clean sources.³⁸

³⁴ "With the right policy support, products created by precision fermentation or cultivated meat could replicate some cuts of meat and more complex cheeses. This could enable alternative proteins to displace two thirds of the animal products currently consumed across Europe. If this were the case, alternative proteins could displace Europe's land crunch with an enormous land dividend. Reducing demand for meat and dairy by two thirds would mean 44 per cent of the farmland in the ten European countries we studied would no longer be needed for growing feed and grazing animals. Overseas land use would fall even further, by 57 per cent" [Green Alliance, 2024](#)

³⁵ "Extensive land uses to meet dietary preferences incur a 'carbon opportunity cost' given the potential for carbon sequestration through ecosystem restoration." [Hayek et al., 2021](#)

³⁶ Poore and Nemecek (2018)

³⁷ EarthShift (2024, Table 5-1)

³⁸ Sinke et al. (2023, Supplementary materials Table B.2)

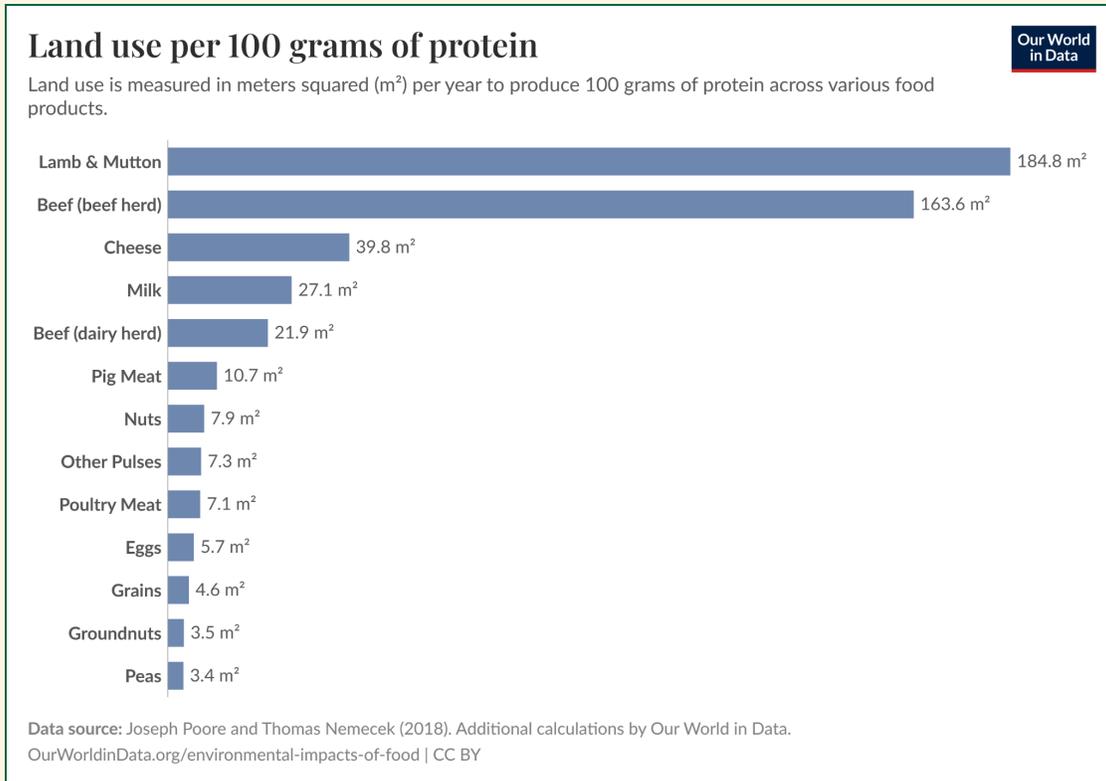


Figure 8: Land use requirements of different animal-based and plant-based sources of proteins per 100 grams of protein³⁹

Comparative Life Cycle Assessments

Producing this alternative protein	instead of this conventional meat	reduces this environmental impact category by this much		
		GHG EMISSIONS	LAND USE	AIR POLLUTION (PM)
Impossible Burger ^I	Beef burger patty	89%	96%	–
Beyond Burger ^{II}	Beef burger patty	90%	97%	–
Quorn Fillet ^{III}	Chicken breast	75%	78%	–
Morningstar Original Chik Patties ^{IV}	Chicken sausage patty	46%	84%	69%
Plant-based burger (soy protein) ^V	Beef burger patty	98%	87%	99%
	Chicken burger patty	90%	82%	90%
	Pork burger patty	90%	85%	90%
Plant-based burger (soy) ^{VI}		82%	84%	95%
Plant-based burger (pea) ^{VI}	Beef burger patties	84%	64%	91%
Fermentation-based burger (mycoprotein) ^{VI}		82%	69%	91%

Sources: I. Khan, et al. (2019); II. Heller, et al. (2023); III. Kazer, et al. (2021); IV. Dettling, et al. (2016); V. Saerens, et al. (2021); VI. Smetana, et al. (2021)

Figure 9: Comparative LCAs of the environmental impacts of plant-based and fermentation-based alt proteins, including the differences in land use in column 4.⁴⁰

³⁹ [Our World in Data, n.d.](#)

⁴⁰ Several sources, compiled by [GFI \(n.d.\)](#)

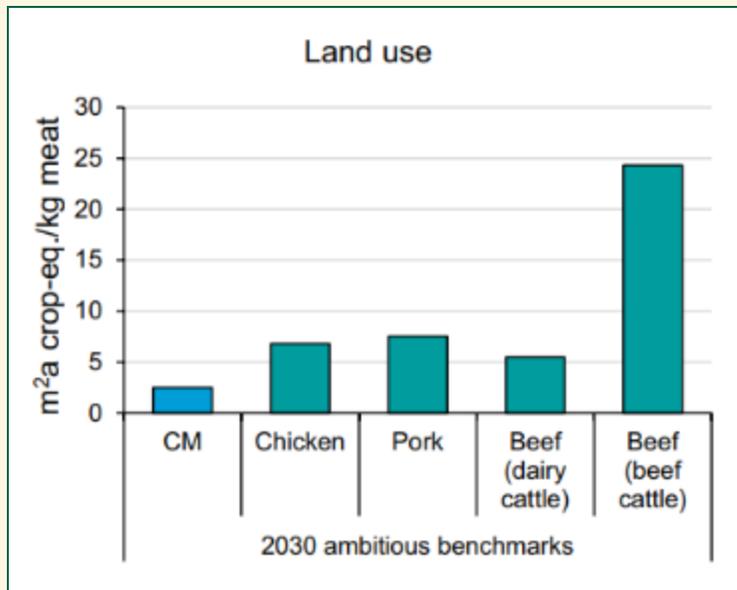


Figure 10: Land use requirement per kg of cultivated meat (CM) and various conventional animal products.⁴¹

Feasibility: Medium

For this strategy to be feasible, governments must be willing to support alt proteins, innovators must be able to make progress on alt protein technologies, and consumers must be willing to adopt alt proteins.

In recent years, we have seen a number of significant wins for public investments into alt proteins from several layers of government. The US state of Illinois, the EU, Denmark and the Netherlands have announced over a billion dollars in public funding.⁴²

Companies are scaling up cultivated meat and precision fermentation dairy, while advances in 3D printing and extrusion are enhancing alternative protein textures.⁴³ However, there are still unresolved technical challenges to scaling up cultivated meat production.⁴⁴ Additionally, while the first cultivated meat products have been allowed on

⁴¹ [Sinke et al, 2023](#)

⁴² In 2021, Denmark announced an investment of 1 billion kroner (\$196 million) to advance plant-based foods. [GFI Europe, 2021](#)

In 2022, the government of the Netherlands invested €60 million (\$70 million) into education, research, and upscaling facilities for cellular agriculture, including cultivated meat and precision fermentation. [Nationaal Groeifonds, 2022](#)

In 2023, the European Union announced investments totalling €50 million (\$59 million) in startups producing food using precision fermentation technology. [FoodBev Media, 2023](#)

In 2024, the US state of Illinois invested \$680 million to create a hub for fermentation and agriculture biomanufacturing in the state. [Vegconomist, 2024](#)

⁴³For example, cultivated meat companies like UPSIDE Foods and Aleph Farms are expanding their pilot production, and precision fermentation companies like Perfect Day, Formo, New Culture and Imagindairy are producing or developing dairy products. Progress in 3D printing and extrusion technologies are improving the textures of alt proteins. [ProVeg, 2025](#)

⁴⁴"The identified challenges include a low cell growth rate, consistency, muscle satellite cell differentiation, completely defined medium components and their roles in myogenesis, effective

the market in select countries (e.g., Singapore, US, Israel, Australia), other places have taken action to halt its commercialization (e.g., Italy, and some US states).⁴⁵

It is our impression that consumer and regulatory acceptance show carefully optimistic trends, although we are uncertain about the future acceptance of alt proteins and how much meat consumption they will displace. Plant-based food sales are growing in European countries, while they're falling in the United States.⁴⁶ For alt proteins to displace conventional meat, products should not only match the price, taste, and convenience of conventional meat, but also address the social and psychological factors that determine food choices.⁴⁷

We rate the feasibility of this strategy as medium because of uncertainty around consumer acceptance and challenges around scaling up the production of cultivated meat.

Funding Need: High

We rate the philanthropic funding need of policy and innovation support for alt proteins as high for several reasons:

1. Government R&D spending on alt proteins is still low in comparison to other environmental funding and not sufficient to unlock the full benefits of alt proteins.⁴⁸ While EU countries and institutions have spent several hundred million euros on alternative protein innovation over the last few years, this amount is still dwarfed by the €112 billion in contributions to biodiversity in the current six-year EU budget, or even the €6.9 billion for biodiversity-related R&D.⁴⁹ According to a funding need analysis by Climateworks, global spending on alternative protein R&D and commercialization needs to increase to \$4.4 billion and \$5.7 billion, respectively, per year.⁵⁰
2. Alt protein progress cannot be funded through existing biodiversity funding mechanisms, such as REDD+ and the Global Environment Facility, because it is out-of-scope.
3. While private funding for alt protein innovation exists, public or philanthropic funding for R&D can have a higher impact because the results and developed methods can be used by all researchers and companies.
4. Progress on policies to reduce demand for conventional livestock products is challenged by incumbent interests of the meat and dairy sector. This sector delays, distracts, and derails action on food system transformation and has convinced

fetal bovine serum replacement, and the inconsistencies of muscle formation in vitro." [Lee & Hur, 2025](#)

⁴⁵ Market approval: [Coyne, 2025](#); Bans: [BBC, 2023](#)

⁴⁶ Europe: [Vegconomist, 2024](#); United States: [GFI, 2025](#)

⁴⁷ "The PTC [price, taste, convenience] hypothesis and premise are both likely false. A majority of current consumers would continue eating primarily animal-based meat even if plant-based meats were PTC-competitive. PTC do not mainly determine food choices of current consumers; social and psychological factors also play important roles." [Peacock, 2023](#)

⁴⁸ As a comparison, governments worldwide have spent more than 63 times as much on electric car subsidies than on support for alt proteins in 2022. [Von Koeller et al, 2024](#)

⁴⁹ Alt protein funding: [GFI Europe, n.d.](#); EU budget: [European Commission, 2025](#)

⁵⁰ [Climateworks, 2021](#)

policymakers to exempt them from climate action goals (agricultural exceptionalism).⁵¹ However, the incumbent interests from meat and dairy can also be seen as evidence of lower feasibility. Biodiversity and environmental philanthropy has the opportunity to counter the interests of the agricultural lobby.

Philanthropists have made recent pledges for alternative proteins, including a \$100 million pledge from the Bezos Earth Fund. Nonetheless, we think that the alternative protein ecosystem is able to effectively absorb additional philanthropic funding.⁵²

Co-benefits: climate change and animal welfare

In addition to its biodiversity benefits, we think that funding alternative protein policy and research has several co-benefits:

- For climate change: livestock farming is the largest source of food system emissions. [Giving Green's strategy on food systems emissions](#) recommends alternative protein policy advocacy and research as one of the most promising strategies to tackle climate change.
- For farmed animal welfare: Reducing the number of farmed animals also reduces the total amount of suffering.

Increasing Agricultural Yields in Sub-Saharan Africa

Scale	●●● High
Feasibility	●●○ Medium
Funding need	●●○ Medium

Global food demand is projected to increase. An analysis of different modeling studies predicts an increase between 35% to 56% between 2010 and 2050, largely because of population and income growth.⁵³ The increase in food demand is – to some extent – the result of global progress against early mortality, food insecurity, and poverty, but is also one of the leading causes of habitat loss. Agricultural expansion is projected to lead to substantial habitat losses, especially in Sub-Saharan Africa,⁵⁴ where both agricultural yields and productivity growth are lowest (**Figure 11**). Increasing the yields per hectare of land reduces the amount of land needed to grow food, which allows other land to be spared from conversion to agriculture.

⁵¹Our investigation reveals that the industry has largely succeeded in convincing policymakers of agricultural exceptionalism, getting a number of concessions, exemptions and delays to climate action in the sector. [Changing Markets Foundation, 2024](#)

⁵²See our [strategy report on reducing food system emissions](#) for an overview of philanthropic pledges.

⁵³This is a 95% confidence interval from a meta-analysis ([Van Dijk et al., 2021](#)) of global scenarios and projects to assess long-term food security.

⁵⁴Modeled point estimates from [Williams et al., 2020](#)

Cereal yield

Our World
in Data

Yields are measured in tonnes per hectare. Cereals include wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains.

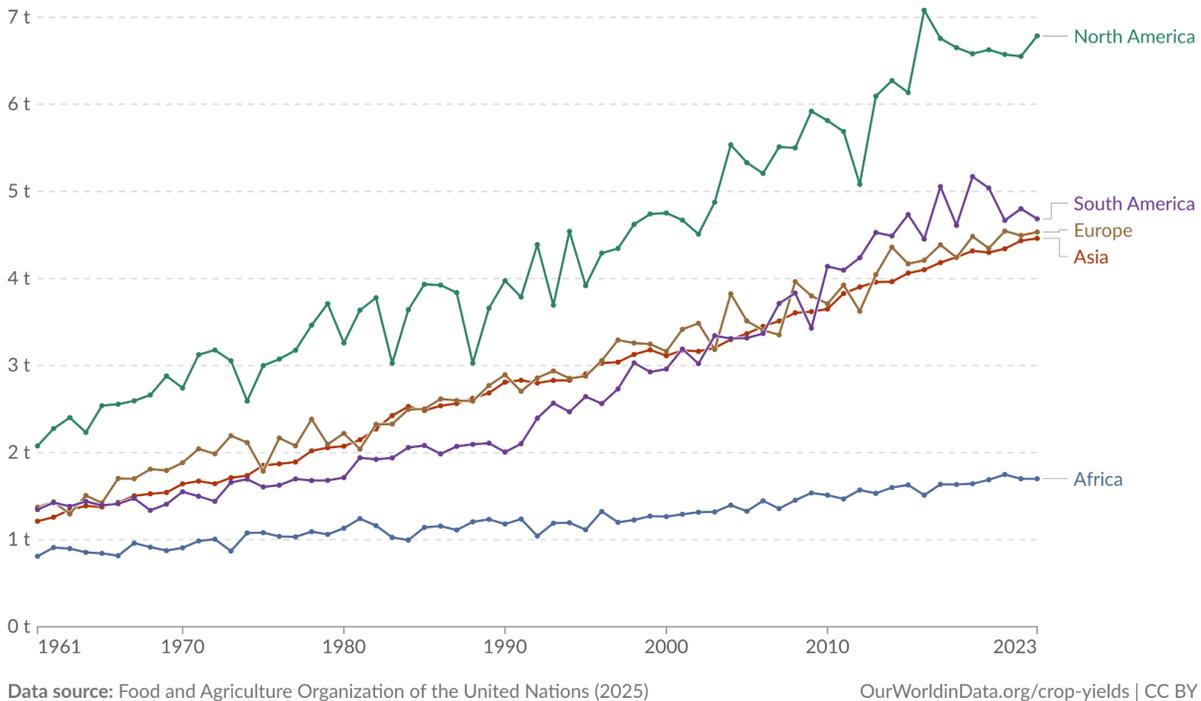


Figure 11: Cereal yields per hectare since 1961 per continent⁵⁵

Scale: High

Under a business-as-usual scenario, Sub-Saharan Africa will see the largest relative expansion in cropland out of any world region. Assuming that population growth will be in line with medium UN estimates, crop yields continue to improve at historical rates, and dietary changes are in line with increases in income, most countries in Africa will see at least a doubling of cropland areas by 2050. As a result, Sub-Saharan Africa is expected to see an animal habitat decrease of 12.7% – the largest of any world region (Figure 12).⁵⁶

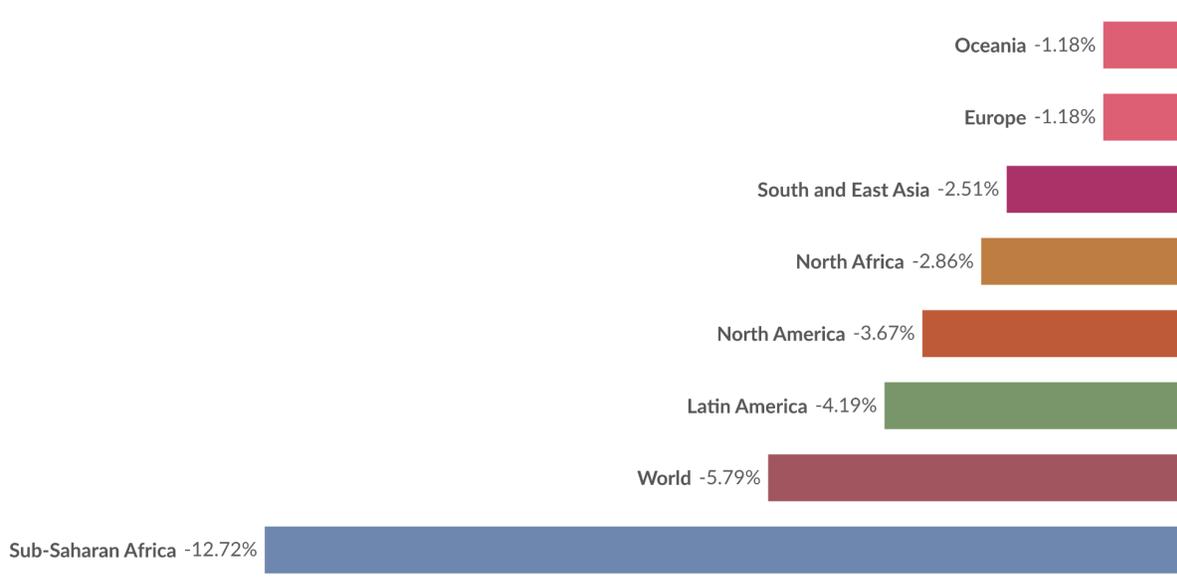
⁵⁵ [Our World in Data, n.d.](#)

⁵⁶ [Ritchie, 2021](#); [Williams et al., 2021](#)

Projected habitat loss for all species in 2050: Business-as-usual



Projected habitat loss for mammal, bird and amphibian species by 2050 under a business-as-usual scenario. This assumes population growth from UN medium projections; crop yield increases in line with historical rates of improvement; and dietary changes in line with projected rises in income.



Data source: Williams, Clark, Buchanan, Ficetola, Rondinini, & Tilman (2021). Proactive conservation to prevent habitat losses to agricultural expansion. Nature Sustainability.

CC BY

Figure 12: Projected habitat loss for all species in 2050: business as usual⁵⁷

Closing agricultural yield gaps is one of the largest levers to reduce global habitat loss. If yields would increase to 80% of their maximum potential by 2050 with currently existing technologies, most countries in Sub-Saharan Africa would see a habitat gain of up to 5%, with some countries in West Africa seeing habitat losses substantially reduced (<5% loss of habitat by 2050).⁵⁸

Feasibility: Medium

The technologies and historical precedence for increasing agricultural yields exist. As visible in Figure 9, all major world regions except for Sub-Saharan Africa have more than tripled their agricultural yields since the 1960s.

However, Sub-Saharan Africa may be a unique case where solutions that worked on other continents may not necessarily apply. No single constraint explains the stagnation of technology adoption and productivity increases in Sub-Saharan Africa. The region exhibits a large variance in soil types, moisture, and quality, altitude, temperatures, topography, solar energy access, and economic conditions. This affects where and when agricultural technologies are profitable and, by extension, which technologies get created

⁵⁷ [Ritchie, 2021](#)

⁵⁸ [Ritchie, 2021, Fig. 5, bottom left](#)

and adopted. Such heterogeneity reduces the feasibility of addressing the yield gap by limiting the geographical scope of different strategies.⁵⁹

One promising and more scalable strategy could be reducing the costs of agricultural inputs like fertilizer by encouraging local production or improving infrastructure for distribution. The costs of agricultural inputs like fertilizer in Sub-Saharan Africa are high, because of a lack of infrastructure and a dependency on imports.⁶⁰

Funding need: Medium

We are uncertain whether additional environmental philanthropy is well-positioned to close the yield gap in Sub-Saharan Africa. While we do not have access to an overview of grants related to agriculture and nature, our overall impression is that grants related to sustainable agriculture focus on land-sharing measures rather than increasing agricultural yields as a land-sparing strategy.⁶¹

On the other hand, agricultural productivity benefits poverty alleviation and food security (as discussed below). This makes it an interesting strategy for donors and grantmakers who are interested in increasing food security and reducing poverty. For example, the Gates Foundation runs a major agricultural development program which includes a focus on farm productivity.⁶² According to OECD data, the sum of total agricultural philanthropic grants for African countries (\$562 million in 2023, including North Africa) is seven times higher than the sum of environment-related grants in the same countries (\$76 million in 2023), although not all of that funding will have gone to productivity increases.⁶³ Because agricultural productivity is getting substantial funding from donors interested in global development, we expect that the value of additional environmental philanthropy for increasing yields is likely smaller than other land-sparing strategies. In addition, agricultural productivity is a point of focus for country governments and multilateral aid agencies, who typically have larger budgets than non-profits.

This, however, is not sufficient evidence to conclude that increasing agricultural productivity does not have room for more funding. It is possible that some approaches to increasing agricultural yields are effective but underfunded, even considering that donors focused on poverty alleviation and food security are interested in this impact strategy. In particular, improving access to widely applicable technologies like fertilizers could be a scalable solution that itself is underfunded.⁶⁴ Agricultural productivity is a broad philanthropic field with many different approaches to fund. We are open to revising our rating of *funding need* if promising yet under-funded approaches to increasing agricultural productivity arise with future research.

⁵⁹ [Suri et al., 2024](#)

⁶⁰ [Suri et al., 2024](#)

⁶¹ For example, in 2023, twenty leading philanthropic funders announced an initiative to scale up agroecology and regenerative farming practices. [GAFF, 2023](#)

NB: These are not necessarily exclusive strategies. Agroecology and regenerative farming can also increase yields.

⁶² [Gates Foundation, n.d.](#)

⁶³ [OECD, 2024](#)

⁶⁴ [Suri et al., 2024](#)

Co-benefits: Food security and poverty alleviation

Increasing agricultural yields can contribute to meeting global increased food demands and meeting food security goals. According to the FAO, addressing low agricultural productivity can increase food security by reducing food prices and rising incomes, provided that there is sufficient diversification of crops to meet nutritional needs.⁶⁵ However, the social and political system around creating co-benefits needs to support its benefits for food security. In the United Kingdom, agricultural policies forced people of the land into industry-oriented cities when yields went up, resulting in an increase in poverty and food insecurity for several generations.⁶⁶ Present-day efforts to increase agricultural productivity also face criticism because of seed laws that criminalize traditional seed-sharing practices and increase debt.⁶⁷

Reducing Food Loss and Waste

Scale ●●● High
Feasibility ●●○ Medium
Funding need ●○○ Low

About one-third of the world's food production does not get consumed. Globally, 13% of produced food is lost between harvest and sale because of poor stage and handling, lack of refrigeration, and spoilage in transport and processing. 17% of all produced food is wasted domestically or in food services.⁶⁸ Reducing food loss and waste would reduce the amount of land needed per unit of consumed food, and could therefore reduce agricultural land use.

Scale: High

We rate the scale of this strategy as high. Scenario modeling in Williams et al. (2020) predicts that halving food loss and waste would reduce cropland expansion by 18 percentage points relative to the baseline scenario, an order of magnitude similar to plant-rich diets and increasing yields. The total scale of this strategy could be even higher if food loss and waste reductions beyond 50% are possible.

Feasibility: Medium

In line with our [strategy report on reducing food system emissions](#), we rate the feasibility of this strategy as medium. We believe there is a strong financial and humanitarian

⁶⁵ [FAO et al., 2020](#)

⁶⁶ "However, any technology exists within a social and political system. The way that this British agricultural surplus was generated, controlled and distributed under the restrictive Enclosure Acts forced most of the rural population off the land to serve as industrial labour. The result was high food insecurity and a structural form of urban poverty [...] the costs paid in human suffering by three or four generations of impoverished families were considerable." [FAO, 2004](#)

⁶⁷ "From seed laws that criminalise traditional practices to corporate partnerships with agribusiness giants such as Monsanto and Syngenta, we explore how a well-funded green revolution has led to rising debt, loss of biodiversity and deepening food insecurity across the continent." [Tailor et al., 2025](#)

⁶⁸ "One-third of the world's food is disposed of, with 13 % lost between harvest and the supply chain and 17 % wasted domestically and in food services" [Olabode, 2025](#)

incentive to reduce food loss and waste (FLW), and these combined benefits could make the issue more prominent compared to initiatives focused solely on climate mitigation. Moreover, implementing FLW reduction strategies does not require additional technological innovation.⁶⁹ Several countries and major corporations have already achieved significant reductions in FLW. For example, the United Kingdom achieved a 27% reduction in consumer food waste, and the Ingka Group, which owns IKEA, reduced FLW by 54% in its restaurants.⁷⁰

Reducing food loss and waste is generally politically neutral or supported, as shown by its inclusion in the United Nations Sustainable Development Goal (SDG) 12.3, which aims to halve FLW from 2016 to 2030. However, substantial progress toward this goal has not yet been achieved.⁷¹ Annual reporting on SDG 12.3 indicates that rapid progress is possible when institutions are motivated to take coordinated action. In high-income countries with well-developed supply chains, nonprofits can play a key role by raising awareness, advocating for FLW initiatives, and supporting their implementation. There are likely some low-hanging fruit in reducing FLW, and achieving quick wins in certain contexts could be highly feasible.⁷²

However, significant barriers remain to reducing food loss and waste (FLW) at scale, mainly because of missing data on (a) food loss and waste, (b) the benefits and costs of interventions and (c) interactions between supply chain stages.⁷³

Funding Need: Low

We assess the additional philanthropic funding needed for reducing FLW as low compared to other interventions we have examined. While an analysis by food waste NGO ReFED found that only \$180 million in philanthropic funding has gone to food waste solutions over a ten year timeframe, we do see considerable interest in food waste solutions from the private sector and recognition of the challenge in international organizations (as discussed above).⁷⁴ Given that market actors and individuals already

⁶⁹ [Snel, 2022](#)

⁷⁰ "Reductions in food loss and waste achieved by corporations: Ingka Group (IKEA) 54%; Tesco 45%; Kellogg's 42%; Campbells Soup Company 36%; Ahold Delhaize 33%." "We have seen that it is possible to make meaningful, sustained reductions in FLW. For example: the Netherlands reduced its food waste by 23%; South Korea has achieved a 95% reduction in consumer food waste; Japan reduced its FLW 12%; and the United Kingdom has decreased edible FLW by 27% since 2007" [Lipinski, 2023](#)

⁷¹ 2011 FLW was one-third: "The results of the study suggest that roughly one-third of food produced for human consumption is lost or wasted globally" [Gustavsson et al, 2011](#)

⁷² "This report shows that efforts to reduce food loss and waste can produce results – and quickly." [Lipinski, 2023](#)

⁷³ "The five challenges identified are: (i) measuring and monitoring FLW, (ii) assessing benefits and costs of FLW reduction and the tradeoffs involved, (iii) designing FLW-related policies and interventions under limited information, (iv) understanding how interactions between stages along food value chain and across countries affect outcomes of FLW reduction efforts, (v) preparing for income transitions and the shifting relative importance of losses and waste as economies develop." [Cattaneo et al., 2020](#)

⁷⁴ "In total, at least \$10B in direct private funding and \$180M in philanthropic funding has gone to food waste solutions over the last 10 years – approximately \$1B private and \$20M philanthropic per year on average." [ReFED, 2023](#)

have strong incentives to reduce food waste, we think that additional opportunities for philanthropists are limited. Overall, we think other strategies to reduce land use change are even more neglected, especially because there is a financial and humanitarian incentive to reduce FWL.⁷⁵

Developing Technical Alternatives to Soybean Meal

Scale ●●● High

Feasibility ●○○ Low

Funding need ●●● High

In the long term, we think that novel feed sources such as single-cell proteins (SCPs) and algae might become viable alternatives to soybean meal, reducing the need for croplands. The most logical first market for novel feed sources, however, is replacements for fish meal and fish oil. Therefore, we discuss this [substrategy in the next chapter](#).

Protecting Select Vulnerable Habitats, Such as Wetlands

Scale ●●○ Medium

Feasibility ●●○ Medium

Funding need ●●● High

While alternative proteins and agricultural productivity improvements address the dominant economic drivers of habitat loss, both strategies are not specific as to which biomes and ecosystems are being halted from conversion. As a result, these strategies can address large parts of land conversion for agriculture, but not per se those ecosystems that deliver very high ecosystem services or host unique biodiversity. Since we expect that both accelerating alternative proteins and increasing agricultural productivity are long-term strategies, we think that coupling these strategies with a shorter-term strategy of protecting ecosystems that are exceptionally unique or valuable is a promising hedge against the possibility of alternative proteins or yield increases failing to reduce land pressures.

Wetlands, such as peatlands and mangroves, are of considerable interest in this context. While wetlands account for approximately 10% of the total global land surface, up to 40% of the world's species live and breed in wetlands.⁷⁶ The relative rate of wetland cover loss

⁷⁵ Funding opportunities: "This issue is ripe for more funding, and this Roadmap outlines more than \$300 million in philanthropic investments ready today to reduce FLW in a set of priority countries and across geographies." [Susan Bell & Associates, 2023](#);

"As discussed in our 2022 progress report, very few countries are implementing targets, measuring food loss and waste, or taking systematic action to address the issue" [Lipinski, 2023](#).

⁷⁶ Wetland cover percentage: We took the area estimates of (semi-)terrestrial and (semi-)freshwater wetland categories from the [Global Wetland Outlook, 2025, Table 1](#): estuarine waters, salt marshes, mangroves, tidal flats, lakes, rivers and streams, inland marshes and swamps, and peatlands. This amounts to 14 million km² of wetlands. We divided this by the total

is three times faster than that of forests. Freshwater wildlife populations, which are sustained by wetlands, have shrunk the most out of all three realms of biodiversity.⁷⁷

Wetlands also provide valuable ecosystem services, such as water regulation, waste treatment, air quality, and bequest values. According to the Ecosystem Services Valuation Database, inland waters and inland wetlands provide the highest value of ecosystem services per hectare per year out of all major natural biomes (see **Table 2**).⁷⁸ Wetlands also store vast amounts of carbon: peatlands cover approximately 2.8% of global land, yet store around one-fifth of all the carbon in the terrestrial biosphere.⁷⁹

Table 2: Comparison between different terrestrial and freshwater biomes.⁸⁰

Biome	Ecosystem services (\$/ha/year)	Rate of loss (Mha/year)	Estimated value lost due to land cover change (billion \$/year)
Inland wetlands	\$108,841	5.2	\$566 billion
Rivers and lakes	\$188,125	2.5	\$470 billion
Tropical and subtropical forests	\$9,848	10.2	\$100 billion
Temperate forests and woodland	\$23,696	0.62	\$15 billion
Boreal forest and woodland	\$11,032	0.13	\$1 billion

surface of Earth's land (141 million km²). 14 Mkm² / 141 Mkm² ≈ 10%.

Species percentage: "Up to 40% of the world's species live and breed in wetlands" [UN Climate Change News, 2018](#)

⁷⁷ Rate of loss: "Wetlands, amongst the world's most economically valuable ecosystems and essential regulators of the global climate, are disappearing three times faster than forests." [UN Climate Change News, 2018](#)

Population decline since 1970: "Freshwater populations have suffered the heaviest declines, falling by 85%, followed by terrestrial (69%) and marine populations (56%)" [WWF Living Planet Report, 2024](#)

⁷⁸ Estimates in the Ecosystem Services Valuation Database ([ESVD](#)) as of June 2025.

⁷⁹ Land cover: "We estimate total global peatland area to be 4.23 million km², approximately 2.84% of the world land area" [Xu et al. 2018](#)

Carbon storage: Peatlands store more than 600 GtC ([Yu et al., 2013](#)) and total carbon in terrestrial ecosystems is estimated at around 3,170 GtC ([EC JRC, n.d.](#)). 600/3170≈0.19.

⁸⁰ Ecosystem services: Estimates in the [Ecosystem Services Valuation Database](#) as of June 2025. Estimates of ecosystem services are compiled across multiple studies which differ in methods and scope, and therefore should only be seen as a rough indication of the monetary value of different biomes rather than an exact comparison.

Rate of loss: [Global Wetland Outlook, 2025](#); [FAO, 2025](#)

Unfortunately, we did not find sufficiently granular data for coastal wetlands, such as mangroves. Prices are in international dollars at 2020 price levels.

Scale: Medium

Based on the rate of land cover change of inland wetlands, we estimate that this biome represents the biggest loss in ecosystem services per year (\$566 billion/year), as shown in **Table 2**. This is driven by both the relatively high rate of loss of inland wetlands (5.2 million ha per year) and the high value of wetlands per hectare (\$108,841/ha).⁸¹ However, since wetlands cover only a small percentage of the Earth's land surface, their total ecosystem services as compared to other ecosystem services are quite low as compared to, for example, forests. We therefore rate the scale of wetland protection as medium.

Feasibility: Medium

We have previously evaluated the feasibility of restoring and protecting wetlands from a climate change mitigation angle in our strategy report on [restoring and protecting wetlands](#).⁸² Most of these findings translate to our work on biodiversity.

We think it is likely that donations to wetland conservation initiatives will result in at least some preservation. We expect the effectiveness of initiatives to differ. For example, projects that involve local stakeholders are more likely to result in conservation success.⁸³ Additionally, because inland wetlands are important from a climate angle, too, we think that this builds additional political and social support for wetland conservation.

To address the conservation of wetlands at scale, however, we think that leveraged approaches are needed to improve wetlands governance and reduce the economic pressures on wetlands (such as agriculture and urbanization), while meeting the social and economic needs of local communities.⁸⁴ Using philanthropic funding to advocate for policy change and resources to enforce wetland protection can reach a wider scale than by focusing on individual projects. Recent policy wins, such as the [EU's Nature Restoration Regulation](#)'s goals for wetland conservation, are an example of leveraging the powers of government for conservation.

Leakage risks are a challenge to the feasibility of wetland conservation. Efforts to protect specific sections of ecosystems can lead to development pressures to move to a different (section of) an ecosystem, resulting in a lower or no net conservation effect. To minimize leakage risks, we recommend funding peatland or wetland conservation programs that:

- Undertake conservation activities at the scale of one entire ecosystem, or larger.
- Protect the most sensitive or important areas of a landscape, so that development is displaced to less important areas.⁸⁵
- Engage regional or national governments to set peatland protection goals.

Funding need: High

Globally, 89% of inland wetlands are not protected, especially in Asia (92% unprotected),

⁸¹ Latest estimates in the Ecosystem Services Valuation Database ([ESVD](#)) as of June 2025.

⁸² [Giving Green, 2025](#)

⁸³ [Nabuurs et al., 2022](#), as also cited in our previous report on *Restoring and Protecting Wetlands*.

⁸⁴ "Global results indicate that agriculture (25%), urbanization (16.8%), aquaculture (10.7%), and industry (7.6%) are incident factors that promote wetlands effective loss affecting continental wetlands more than coastal and marine ones." [Ballut-Dajud et al., 2022](#)

⁸⁵ [Founders Pledge, 2024](#). For example, protecting coasts against agricultural expansion can lead agriculture to expand more inland.

which contains the largest wetland area of the world.⁸⁶ Given the relatively small surface area of (inland) wetlands, we expect that additional funding for policy advocacy for improved regulations or establishing protected areas can effectively be used to expand global protection for this biome. In addition, we think that wetland conservation has a higher need than forests, because the international financing mechanism REDD+ does not typically cover wetlands.

We expect that funding wetland and peatland conservation is especially a good option for donors who are constrained by funding the protection of specific ecosystems or biomes, or for donors who prefer funding conservation options that are lower-risk than other strategies covered in this report.

Strategies That We Prioritize

Based on our evaluation of these approaches, we decide to focus our efforts to reduce land use change on alternative proteins and protecting vulnerable habitats such as wetlands. We think that advocating for alternative protein policy and research is a promising approach to reduce future agricultural expansion, and see protecting select vulnerable habitats, such as wetlands, as a promising and more short-term hedge until alternative proteins, high-yield agriculture, and reduced food waste become mainstream.

⁸⁶Reis et al. ([2017](#))

Marine Biodiversity: Reducing Ecosystem Damage from Fishing

Key ideas: Giving Green's approach to reducing marine biodiversity loss

- **Neglect of marine biodiversity:** Life below water is the least-funded Sustainable Development Goal. Marine biodiversity only receives about 0.56% of all philanthropic funding. This highlights the funding need of protecting marine biodiversity.
- **Importance of fishing:** The “direct exploitation” of marine organisms through overfishing, bycatch, and seabed contact is—along with climate change—the most dominant driver of marine biodiversity loss. It is also the most common threat to endangered and vulnerable marine species.
- **Reducing bycatch:** We think that philanthropy can play an important role in reducing global bycatch, which is the unintended capture of non-target species such as dolphins or seabirds. Donors can support the innovation and adoption of bycatch reduction devices by partnering with fishers, the seafood sector, and governments.
- **Alternatives to fish meal and fish oil:** Approximately 13% (by weight) or 50% (by number of fish) of wild fish catch is used for producing fish meal and fish oil, which are feed ingredients in the livestock and aquaculture sectors. We think that donors can contribute to reducing overfishing by accelerating and promoting alternatives to fish meal and fish oil, such as algae and single-cell proteins.

Marine biodiversity tends to receive less attention than terrestrial biodiversity. Sustainable Development Goal 14 (Life below Water) is by far the least funded global goal, receiving only 0.01% of development finance funding and 0.56% of philanthropic

funding.⁸⁷ Oceans receive around one-tenth of environmental grantmaking in the U.S.⁸⁸ According to an analysis by the Environmental Funders Network, work for protecting coastal and marine ecosystems received nearly five times less foundation funding from UK donors than terrestrial ecosystems and land use.⁸⁹

Despite their relative neglect, the oceans host a wide diversity of life and are responsible for valuable ecosystem services. While it is difficult to make a reliable comparison of the importance of marine ecosystems compared to terrestrial ones, marine ecosystems fulfill globally important ecosystem services, such as providing food, carbon sequestration, coastal protection, and recreation. Coasts and open oceans are among the natural biomes with the highest ecosystem service rating per hectare, trumped only by inland water systems and glacial/polar systems.⁹⁰

Why Do We Focus on Fishing?

Fishing (direct exploitation) is the most dominant driver of biodiversity loss in the oceans. Based on a meta-analysis of studies comparing the importance of drivers of biodiversity loss, “direct exploitation” has a dominance score of 2.82 on a 0–4 score in the marine realm, meaning it often outranked other drivers in weighted comparisons.⁹¹ We visualize the relative dominance of direct drivers of marine biodiversity loss in **Figure 13**. While direct exploitation has the highest dominance score, it was not statistically significantly dominant over climate change. In this report, we focus on fishing since it receives less attention than climate change.

⁸⁷ [Economist Impact, 2022](#). The data point for development finance is up to 2019, and philanthropic funding between 2016 and 2021. The data source is the OECD.

⁸⁸ While precise overviews of philanthropic funding for biodiversity do not exist, oceans received 7% of US philanthropic environmental funding in 2015. We do not expect that this proportion has changed substantially since. [Gruby et al., 2021](#)

⁸⁹ Calculation: $71.7/14.5 \approx 4.9$. [Cracknell et al., 2024, chart 2](#)

⁹⁰ Latest estimates in the Ecosystem Services Valuation Database ([ESVD](#)) as of June 2025.

⁹¹ Point estimate of the dominance of direct exploitation in the marine realm: 2.82/4.00 (95% confidence interval: 2.61-3.14, n=58 studies). We explain dominance scores in more detail in the chapter on land use change. Climate change is the next most dominant driver with a dominance score of 2.51/4.00 (95% confidence interval: 1.82-2.75). Direct exploitation was not significantly ($p > 0.05$) dominant over climate change. [Jaureguiberry et al., 2022, Fig. 1B](#)

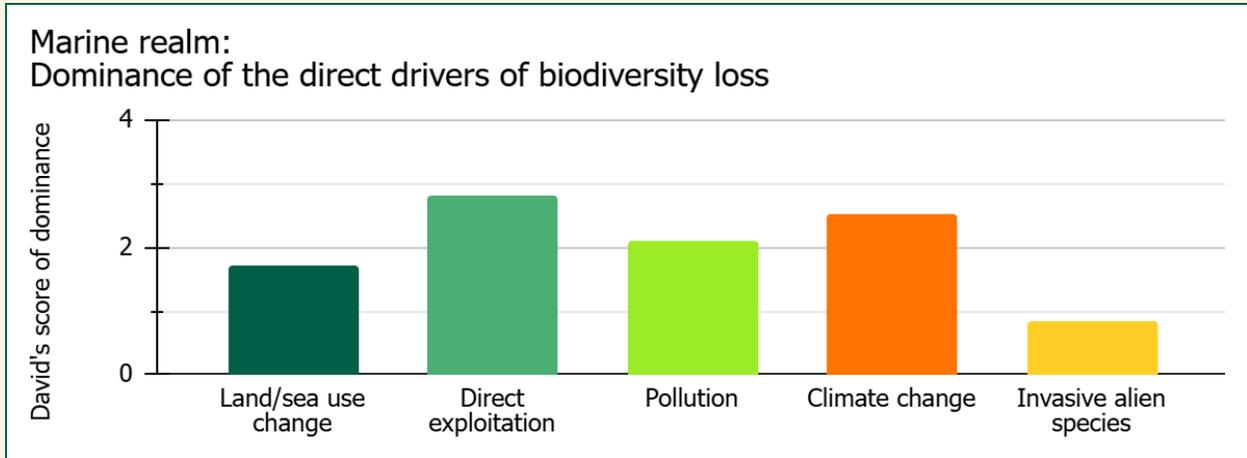


Figure 13: Relative dominance of direct drivers of biodiversity loss across locations in marine ecosystems, based on pairwise comparisons between drivers.⁹²

In addition, overexploitation is by far the most common threat to marine species at risk of extinction.⁹³ Based on our analysis of species on the [IUCN Red List](#), 72% of endangered or vulnerable species that live in marine ecosystems are threatened by overexploitation, making it by far the most common extinction threat in this realm. As shown in Figure 14, overexploitation is followed by habitat destruction, which affects 61% of threatened or vulnerable species.⁹⁴

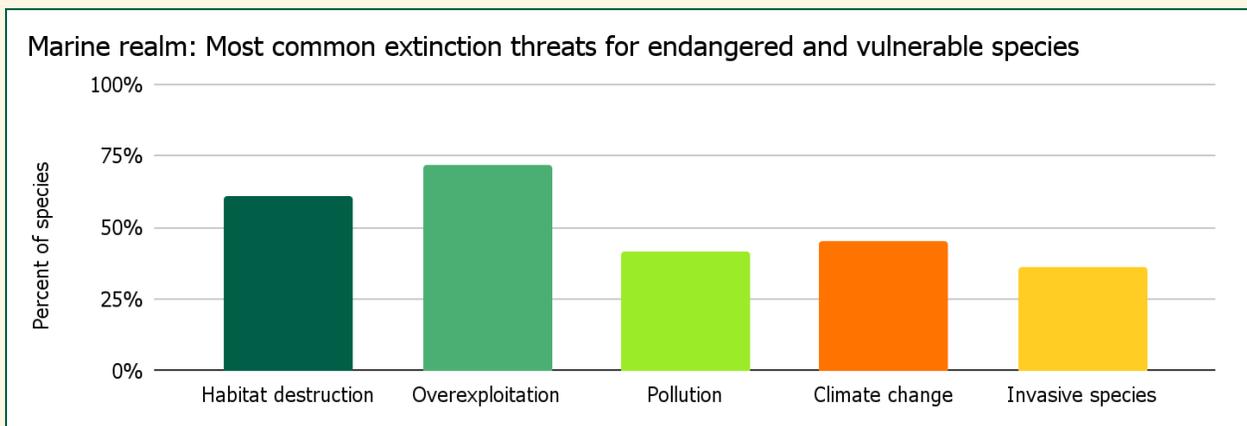


Figure 14: Most common extinction threats for endangered and vulnerable marine species.⁹⁵

⁹² Data: [Jaureguiberry et al., 2022, Fig. 1B](#). Figure: Giving Green

⁹³ Land use change describes how people repurpose land. Habitat destruction describes how those changes (and other pressures) harm the living systems on that land. For the purposes of this report, they can be considered interchangeable.

⁹⁴ We retrieved data from the [IUCN Red List of Threatened Species](#) in October 2025 and filtered for species that are critically endangered (CR), endangered (EN), or vulnerable (VU) and live—at least partially—in marine ecosystems (n=1685 species). See Figure 4 for more details on methods.

⁹⁵ Data: [IUCN](#), retrieved October 2025. Processing by Giving Green.

What Are the Most Damaging Impacts from Fishing?

Industrial fishing harms marine ecosystems in three main ways:⁹⁶

1. **Overfishing:** large-scale fishing has led to some species being overfished to the point of (near) extinction. When fish are removed from the ocean faster than the rate at which the species can reproduce naturally, this leads to underpopulation or even a collapse of the fish population. This, in turn, affects the greater ecosystem, including these species' predators, competitors, and prey.
2. **Bycatch:** Fishing practices often unintentionally catch other species like dolphins, rays, sharks, and birds, which in turn has consequences in the food web.
3. **Seabed contact:** Some fishing practices, such as bottom trawling and dredging, churn up ocean sediments and thereby destroy seabed ecosystems, such as seagrasses.

To a lesser extent, ocean ecosystems are affected by:⁹⁷

4. **Ghost fishing:** Abandoned, lost, or otherwise disposed of fishing gear (ALDFGs) continue to trap marine life even when they are no longer in use by fisheries.
5. **Pollution:** Fishing vessels contribute to marine pollution through oil and fuel spills, noise, chemical runoff, wastewater, and litter.

Strategies to Reduce the Environmental Damage from Fishing

We evaluated five substrategies to reduce the environmental damages of fishing. As there exists no scale indicator to objectively compare the scale of different substrategies (unlike, for example, greenhouse gas emissions in our climate change reports), we selected these strategies based on whether the substrategy can address at least one of the largest environmental damages of fishing (numbers 1 to 3 in [the list above](#)) at a large geographical scale through, for example, technological spillovers. In addition, we evaluated bottom trawling bans in Marine Protected areas and capacity-building to enforce fishing regulations at the recommendations of other grantmakers.

⁹⁶ [European Environment Agency, 2024](#); [Hill, n.d.](#)

⁹⁷ [European Environment Agency, 2024](#); [Hill, n.d.](#)

Table 3: Philanthropic sub-strategies that could reduce the ecosystem damages of fishing

Sub-strategy	Scale	Feasibility	Funding need	Notes
Supporting implementation and innovation of improved fishing gear	High	Medium	High	Changes to fishing gear can reduce the environmental impacts of fishing, such as bycatch and bottom contact. We think that philanthropy can play an important role in piloting, implementing, and regulating improved fishing gear, such as anti-bycatch devices.
Developing technical alternatives to fish meal and fish oil	High	High	Medium	Approximately 13% of wild fish catch by weight is used for producing fish meal and fish oil (FMFO). We think that philanthropy can accelerate the innovation in and adoption of technical alternatives to FMFO, thereby reducing the total demand for reduction fishing. In the long-term, feed alternatives to soybean meal may be commercialized, too.
Capacity-building to monitor illegal fishing and enforce regulations	High	Medium	Low	Illegal, unreported, and unregulated (IUU) fishing accounts for approximately one-fifth of the global fish catch. This is of particular concern in West Africa, where 40% of (semi-)industrial IUU vessels are located and where this affects food security. We think that capacity-building using information technology is a viable way to reduce IUU fishing, but we already see an influx in funding in this space from non-philanthropic sources.
Stopping bottom trawling in Marine Protected Areas	High	Low	Medium	Bottom trawling is among the most widespread and destructive fishing practices. Out of the total global marine fisheries catch, 26% is caught using bottom trawling. Because bans can cause economic losses, require strong political will-power, can cause leakage, can be reverted, and are unlikely to cause geographical spillovers, we rate the feasibility of this strategy as low.

Sub-strategy	Scale	Feasibility	Funding need	Notes
Advocating for alternative seafood policy and research	High	Medium	High	Alternative seafood products are made to resemble the taste, texture, and cooking method of conventional seafood, but without any fish. We discuss this strategy in more detail in the chapter on land use change.

Supporting Implementation and Innovation of Improved Fishing Gear

Scale ●●● High

Feasibility ●●○ Medium

Funding need ●●● High

Modern fishing technologies aim to reduce the environmental damages of fishing while maintaining the efficiency of commercial fishing using innovative hardware and software. Some examples of precision fishing technologies are:⁹⁸

- Smart nets can provide escape hatches for larger marine mammals or juvenile fish.
- LED-illuminated nets can reduce bycatch by deterring non-target species, such as turtles and cetaceans.
- Acoustic Deterrent Devices (ADDs) or “pingers” deter marine mammals away from fishing operations.
- Software can be used to analyze catch and automatically release bycatch as well as targeting fish schools with minimal bycatch, juvenile fish, or low stock health.
- Automatic net height adjustment reduces the need for seabed contact while harvesting the target species.⁹⁹

Some activities that fall under this strategy are advocacy for research and development funding, funding early-stage innovation, advocacy for implementation, and further research in the field.

While we are aware that these technologies have different Technology Readiness Levels (TRLs)¹⁰⁰, require different supportive activities, and target different aspects of biodiversity loss, we choose to approach this as one philanthropic strategy since we expect that non-profits likely work on multiple technologies at the same time.

Scale: High

We rate the scale of this strategy as high because of the size of the environmental problems it addresses and the potential for global rollouts.

Firstly, precision fishing technologies can address, in decreasing order of potential: bycatch, seafloor contact, and overfishing.

- Anti-bycatch devices—which are among the precision fishing technologies with the highest TRL—have shown to yield substantial reductions in bycatch in experimental settings. While no systematic review of the effects of anti-bycatch devices exists as of yet, field-trials show reductions in turtle bycatch between 40%

⁹⁸ [Singh, 2025](#)

⁹⁹ [Katchi Precision Fish Harvesting, n.d.](#)

¹⁰⁰ Technology Readiness Levels (TRLs) are a standardized system used to assess and describe the maturity of a particular technology, ranging from basic scientific research (TRL 1) to fully operational and proven systems in real-world conditions (TRL 9).

to 93%¹⁰¹ and reductions in shark and pelagic stingray bycatch of 91.3% and 71.3%, respectively.¹⁰²

- Automated fishing systems—which are currently entering pilots—would result in trawling without seafloor contact.¹⁰³
- Catch monitoring technologies—which span across multiple TRLs—would enable governments to regulate overfishing and illegal fishing, but the reach of this technology depends on government enforcement.¹⁰⁴

Secondly, many precision fishing technologies provide solutions that can be implemented on a wide scale. Since our research is concerned with global biodiversity loss, developing solutions that are not specific to certain locations ranks highly because the geographic scope is larger. An example of a geographical spillover from fishing technology is the [FloMo](#), a net alternative that reduces bycatch and juvenile catch. While initially developed in New Zealand, the technology is now being trialed in the Netherlands flatfish beam trawl fishery while being scaled up in New Zealand.

Feasibility: Medium

We rank the feasibility of this strategy as medium, but expect a wide range in the feasibility of specific precision fishing technologies.

Arguments in support of feasibility of this strategy:

- **Political feasibility:** We expect that developing technological solutions is currently a more feasible strategy to reduce bycatch and bottom trawling because of the high economic costs resulting from government regulations without technological alternatives. Regulators are more likely to ban bottom trawling altogether or put stringent limitations on bycatch if this comes at a low cost to fishing companies and employment because of technical alternatives.¹⁰⁵
- **Economic feasibility:** In some cases, we expect to see growth of high-TRL precision fishing technologies without the need for government regulations when use of the technology results in lower costs or higher revenue for fishers. Reducing bycatch in, for example, long-lining can reduce the fishing effort needed per target fish caught, and alternatives to bottom trawling can reduce fuel costs to fishers.
- **Technical feasibility:** Some higher-TRL precision fishing technologies around reducing bycatch have shown promising results. Field-trials show reductions in

¹⁰¹ [FishTek Marine, n.d.](#)

¹⁰² "Hooks fitted with SharkGuard significantly reduced catch rates of blue sharks and pelagic stingrays (blue shark GLMM, $\chi^2_1 = 62.20$, $p = <0.001$; pelagic stingray GLMM, $\chi^2_1 = 87.61$, $p = <0.001$), decreasing standardised catch per unit effort (CPUE; individuals per 1000 hooks) by an average 91.3% and 71.3%, respectively [...]. Mean standardised CPUE of blue sharks was 6.1 ± 1.2 sharks per 1000 control hooks compared with 0.5 ± 1.6 sharks per 1000 SharkGuard hooks. Mean standardised CPUE of pelagic stingrays was 7.0 ± 1.5 rays per 1000 control hooks compared with 2.0 ± 1.5 rays per 1000 SharkGuard hooks." [Doherty et al., 2022](#)

¹⁰³ [Katchi, n.d.](#)

¹⁰⁴ [Environmental Defense Fund, n.d.](#)

¹⁰⁵ We base this argument on conversations we have had with ocean grantmakers and NGOs.

turtle bycatch between 40% to 93%¹⁰⁶ and reductions in shark and pelagic stingray bycatch of 91.3% and 71.3%, respectively.¹⁰⁷

Arguments against the feasibility of this strategy:

- **Epistemic feasibility:** As an investor, government, donor, grantmaker, or charity evaluator, it is difficult to know which solutions are likely to be implemented at scale. Many financing actors do not have the technical expertise to understand important factors such as expected regulatory support, support from fishers, and corrosion resistance. This adds a risk of funding solutions that appear great on paper but are unlikely to succeed in practice, especially when funding low-TRL solutions. Solutions to this challenge include developing fishing technology expertise at non-profits or using pull-funding mechanisms.¹⁰⁸
- **Requirement for policy support:** In some cases, we expect that government support for better fishing should go beyond public investment and promote adoption. For example, bycatch landing obligations—such as in the EU—create an incentive for fishers to reduce bycatch. If technologies can increase bycatch survival rates, then adjustments to these policies can be made.¹⁰⁹
- **Rebound effects:** Precision fishing technologies that reduce the costs of fishing efforts can make fishing a more profitable industry, leading to an increased total fishing effort, and therefore more overfishing. We think that this risk can be negated in areas with enforced quotas for target species. Overall, we expect that a small increase in fishing effort is acceptable when overall ecosystem health is better due to reduced bottom contact and bycatch.
- **Social feasibility:** Technologies need to be socialized and have buy-in from fishers. To achieve success, we recommend actively working with fishers and supporting innovations that fishers are interested in.

Funding need: High

We rate the funding need of this strategy as 'high' because we see a clear role for philanthropic support and notice that this space is underfunded compared to its scale. However, we also acknowledge that most actors in this space are private companies that cannot be easily funded using philanthropy.

Currently, there is little interest in fishing hardware from private and venture investors because the time to return on investment is long, the fishing sector has low profit margins,

¹⁰⁶ [FishTek Marine, n.d.](#)

¹⁰⁷ Same quote as above from [Doherty et al. 2022](#)

¹⁰⁸ Pull funding is when funders commit resources but only release them once implementers demonstrate measurable demand, results, or progress, shifting initiative and risk to those closest to the problem.

¹⁰⁹ Bycatch incentive: "Since 2015 fishermen have to land their entire catch. Unwanted bycatch, referred to as discards, may not be thrown back into the sea. Most discards are unsellable, undersized fish or fish for which the fisherman has no quota. Nearly all discarded fish die. The landing obligation aims to put an end to this waste. Better fishing gear and better vessels can reduce bycatch significantly." [Government of the Netherlands, n.d.](#)

Bycatch rule exception: "If a species has a good chance of survival as bycatch, for instance, and can be successfully released, an exception can be made to the so-called landing obligation." [WUR, 2022](#)

and the risk of failure is high. Therefore, we see the role of philanthropy in this space as creating an enabling environment for investments, thought leadership, and advocacy for government and policy support.

- Philanthropy can de-risk the space for public and private investments by funding pilot studies which show whether technologies work in practice, and by supporting the creation and sharing of knowledge about which solutions are most needed and likely to succeed.
- Philanthropy can support advocacy for public research and development funding into precision fishing.
- For non-profitable but low-cost solutions, philanthropy can support policy advocacy for mandating the implementation of technologies.
- Philanthropy can support early-stage innovation initiatives that public and private investors consider too risky.

As a result of the innovation-heavy approach of this philanthropic strategy, most activity in this space happens in private companies. This makes supporting this strategy with philanthropy difficult, as philanthropy is typically not set up to finance start-ups. Many donors are constrained to giving to organizations with charitable status to enable tax deductions.¹¹⁰ Grantmakers in the ocean technology space often fund for-profit organizations or support university research programs through restricted grants.

We think that this strategy has more room for funding, as the philanthropic support for ocean technology remains relatively small. While we do not know the total extent of philanthropic precision fishing-related grantmaking, only three out of the top 20 marine philanthropic funders support precision fishing or marine conservation technologies as one of their programmatic activities.¹¹¹

Developing Technical Alternatives to Fishmeal and Fish Oil

Scale ●●● High
Feasibility ●●● High
Funding need ●●○ Medium

Fishmeal and fish oil (FMFO) are feed ingredients made mostly from small wild-caught fish (like anchoveta and menhaden), bycatch, and fish by-products. FMFO is widely used in aquaculture because they provide highly digestible protein and fatty acids like EPA and DHA that are mainly required by carnivorous farmed fish such as salmon. Aquaculture's reliance on wild-caught FMFO raises biodiversity concerns, since diverting forage fish from marine food webs into aquaculture feed can compete with natural predators and local communities that depend on healthy fish stocks.

¹¹⁰ For example, 501(c)3 status in the United States and ANBI status in the Netherlands.

¹¹¹ [Our Shared Seas, 2023](#). We counted Oceankind, Eric and Wendy Schmidt, and the Builders Initiative as grantmakers interested in advancing precision fishing technologies. For each of these organizations, total precision fishing grantmaking is only one of multiple programmatic activities. These organizations have a combined grantmaking of approximately \$185 million per year, while ocean philanthropy in total exceeds \$1 billion per year.

Some feed alternatives for FMFO exist or are in development, such as single-cell proteins (SCPs) derived from microorganisms, macroalgae (seaweed), microalgae, and processed plant-based feeds.¹¹² As protein feed, we expect that SCPs and—to a lesser extent—fermented plant proteins are the most promising feed alternatives. We expect microalgae to be the most viable successor to fish oil.¹¹³

Scale: High

We rate the scale of this strategy as high because of the extent of forage fishing for FMFO, the environmental impacts of forage fishing, and the implications for ecosystem services, particularly food security.¹¹⁴

- **Extent of forage fishing for FMFO:** Approximately 13% of wild fish catch by weight is used for producing FMFO.¹¹⁵ In terms of individual fish, catch for FMFO represents 45% to 50% of the total global fish catch.¹¹⁶ While the quantity of FMFO needed to produce one kilogram of fish from aquaculture has declined steeply, the overall catch of forage fish for FMFO production has declined only slowly since peaking in 1994. This is because total aquaculture production has increased rapidly in recent decades.¹¹⁷
- **Forage fishing accounts for the majority of FMFO production.** 71.0% of fishmeal and 73.9% of fish oil is made from forage catch, with the remainder from fish processing waste.¹¹⁸
- **Future growth:** The Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization of the United Nations (FAO) expect global capture fisheries for FMFO to increase modestly over the next decade.¹¹⁹ Even if all forage fish catches are at the maximum sustainable yield, demand for forage fish approaches the ecological bounds of stocks by 2037 under

¹¹² "Examples of novel feed ingredients are: Macroalgae ..., Plant-based proteins ..., Single-cell proteins ..., Microalgae ..." [Centre for Feed Innovation, n.d.](#)

¹¹³ We base this on conversations that we have had with experts working in this field.

¹¹⁴ Forage fishing is the catching of small schooling species like anchovies, sardines, and herring that are key food for larger fish, seabirds, and marine mammals, often used for fishmeal and animal feed.

¹¹⁵ Calculation: $14.5/109.3 \approx 0.13$. Data year: 2015. [FishStat via Our World in Data, n.d.](#)

¹¹⁶ Calculation for lower bound: $(490 \times 109)/(1100 \times 109) \approx 0.45$. Calculation for upper bound: $(1100 \times 109)/(2200 \times 109) = 0.50$. [Mood & Brooke, 2024](#)

¹¹⁷ "[A]quaculture production increased by 250% between 2000 and 2015. Meanwhile, fish caught for feed actually declined. Aquaculture's reliance on wild fish has been weakening." [Ritchie & Roser, 2024](#)

¹¹⁸ "Aquaculture feeds require a major portion of the global supply of fishmeal and fish oil. An estimated 71.0% of fishmeal and 73.9% of fish oil are made from the catch with the rest coming from aquatic animal processing waste." [Boyd et al., 2022, abstract](#)

¹¹⁹ "Over the next decade, the quantity of capture fisheries production that is reduced to fishmeal and fish oil is projected to show an upward trend compared to the previous decade, while fluctuating between 15.2 Mt in El Niño years and 17.1 Mt during peak fishing years. However, this remains well below the levels of the 1990s, when around 26 Mt of wild fish were used for fishmeal and fish oil production." [OECD & FAO, 2025, Section 7.3.2](#)

current aquaculture growth.¹²⁰ Fishing forage fish when populations are in decline leads to more severe and frequent stock collapses.¹²¹

- **Disincentive for bycatch reduction:** High demand for FMFO makes bycatch a profitable commodity that provides an incentive to fish more and less selectively.¹²²
- **Environmental impacts of forage fisheries:** Forage fish play an important role in the food web, with many fish, mammals, and birds depending on forage fish abundance.¹²³
- **Effects on ecosystem services:** Forage fisheries divert a valuable source of protein away from human consumption to aquaculture. For example, industrial forage fisheries in West Africa exacerbate food insecurity, unemployment, and income security of small-scale fishers.¹²⁴

Speculatively, we think that this strategy could reach an even higher scale if it can target these two sectors:

- **Krill harvesting:** The fish feed industry is increasingly using wild-caught Antarctic krill as an alternative to FMFO, affecting ecosystem health in Antarctica.¹²⁵
- **Soybean meal replacement:** Some novel feeds, such as bacterial SCP, have the technical potential to replace soybean meal in cattle, which would reduce the amount of croplands needed for animal feed. However, SCP is currently not economically viable as a soybean meal substitute because of the low costs of conventional feed. Feed substitutes are more likely to grow in the aquaculture sector, first.¹²⁶

¹²⁰ "We calculate MSY for 401 stocks that comprise 99% of global forage fish catch and find the average forage fish catch could increase by 30% from 2012 levels [...]. Even with this improvement, however, forage fish demand quickly approaches the ecological bounds of the stocks by 2037 (2024–2047, MSY quantiles) under the BAU aquaculture scenario," [Froelich et al., 2018](#)

¹²¹ "[W]e show that the magnitude and frequency of collapses are greater than expected from natural productivity characteristics and therefore, likely attributed to fishing. The durations of collapses, however, were not different from those expected based on natural productivity shifts." [Essington et al., 2015, abstract](#)

¹²² "[B]ycatch [...] has now become increasingly marketable, being sold for local consumption, and as fish meal to supply the region's rapidly growing poultry industry." [Lobo et al., 2010](#)

¹²³ "Forage fish play a critical role in several large marine ecosystems, where other wild species, such as salmon, killer whales and seabirds, depend on the presence and certain abundance of the small pelagic fishes for survival." [Froelich et al., 2018, p. 301, citing other sources](#)

¹²⁴ [Changing Markets Foundation & Greenpeace Africa, 2021, Section 2](#)

¹²⁵ "At the same time, the fish-feed industry, frantically searching for alternative protein sources to fishmeal and fish oil from wild fish, has become keenly interested in Antarctic krill. Multiple aquaculture feed industry representatives consulted for this story confirmed that the industry is increasingly using krill as a replacement for fishmeal and fish oil. [...] Krüger and Cárdenas say the growing krill fishery puts additional pressure on krill populations, especially near the Antarctic Peninsula." [De Augustinis, 2023](#)

¹²⁶ "SCP has been produced in the past as feed for livestock, but large-scale production of soybean meal and blending of amino acids with crop feed has made conventionally produced SCP uneconomical for livestock feed. The most promising near-term pathway for SCP use is aquaculture." [Gundupalli, 2024](#)

A cost scenario under variable renewable electricity predicts SCP costs at €2.2/kg by 2050. [Fasihi](#)

Feasibility: High¹²⁷

Compared to alt proteins for human consumption, technical alternatives to FMFO offer several feasibility advantages.

- More permissive regulatory frameworks: Regulations for novel animal feeds tend to be more permissible than those for human food, which provides a more secure path to market.¹²⁸
- Taste matters less: While palatability of feed alternatives is a research priority for FMFO substitutes, in general, matching the taste and texture to consumer preferences is a lower concern.¹²⁹
- Technical feasibility: Feed substitutes are often nutritionally proper alternatives to conventional FMFO. For example, SCP can reach 80% protein content and has an amino acid profile similar to fishmeal.¹³⁰
- Reliable production quantity: Most FMFO substitutes can be produced year-round regardless of weather, season, or ecosystem health. This makes them a more reliable input than forage fish, which see natural fluctuations and stock collapses exacerbated by overfishing.¹³¹
- Historical precedent: Humanity has already made progress to reduce the fish input requirements of aquaculture through efficiency gains and plant-based feeds.¹³²

A major challenge for implementing FMFO substitutes at scale is meeting price parity to conventional feeds. Novel feeds can become an affordable solution by adding additional value to the product (for example, by offering animal health benefits) or by reducing the costs of production through economies of scale, reducing input costs, or addressing

[et al., 2050](#). At the time of writing, soybean meal was about €307/metric ton ([IndexMundi](#)). That means that, roughly, a single-order of magnitude cost improvement is necessary to make SCP competitive with soybean meal, assuming equal product quality.

¹²⁷ We are considering downgrading this ranking of feasibility to 'medium' if we find out that the remaining innovation and scalability challenges are larger than we expect or larger than previous ones. We are planning additional conversations with experts in this field when we evaluate non-profits organizations working on this strategy.

¹²⁸ [Gundupalli et al. 2024, section 2.3](#)

¹²⁹ Research priority: "Good quality fishmeal and fish oil are known to be very palatable for fish, but many alternative ingredients are less so." [Glencross et al., 2024, p. 406](#)

¹³⁰ [Li et al., 2024](#)

¹³¹ "However, disentangling the contributions of fishing vs. natural processes on population dynamics [of forage fish] has been difficult because of the sensitivity of these stocks to environmental conditions. [...] Finally, we show that the magnitude and frequency of collapses are greater than expected from natural productivity characteristics and therefore, likely attributed to fishing." [Essington et al., 2015, abstract](#)

¹³² "In 1997, aquaculture used fish feed very inefficiently. The overall ratio was 1.9, meaning almost two fish were required as inputs to produce one fish in return. This has improved massively in the decades since then. In 2017, this ratio was 0.28: we got three fish back from one fish used as input. This improvement came from efficiency gains, as well as a switch to other plant-based feed blends." [Ritchie & Roser, 2024](#)

up-front capital costs.¹³³ We think that these barriers to growth can be overcome with additional investment, research, and government support.

Funding Need: Medium

We rate the funding need of this strategy as medium, because we see limited philanthropic and NGO support for feed innovation, but also recognize that innovation in this sector is supported by private investors.

Based on our understanding of the feed innovation landscape and conversations with experts, we expect that philanthropy can be most impactful in this sector if it focuses on:

- De-risking innovations for the private sector: Our understanding of the feed innovation landscape is that early-stage research does not get funded because of risk and patient capital requirements. Philanthropy can support early-stage research and help build the evidence-base by funding pilot projects and tests.
- Expertise and feasibility studies: Philanthropy can support initiatives that deliver expertise to investors, governments, and companies about the promise and investment needs of different feed alternatives.
- Corporate engagement and steering investment: Philanthropy can support non-profit initiatives that catalyze public and private investments into FMFO alternatives with the highest investment need and work with aquaculture companies to accelerate adoption.
- Open science and innovation: Philanthropy can support non-patented feed solutions that the wider sector can use without intellectual property restrictions. In particular, we think that this challenge lends itself well to pull funding, such as prizes and advance market commitments (AMCs).¹³⁴
- Avoiding a further expansion of krill fishing: Philanthropy can support advocacy efforts to reduce the probability of krill fishing being the most likely future growth strategy of the animal feed sector.

Nonetheless, we see increased private investments into FMFO replacements. The fish meal alternative market is expected to grow from \$2.2 billion in 2025 to 4.4 billion by

¹³³ "Many of these issues related [sic] to the current TRL that the sector is placed at, where it still needs to develop further. The use of capital-intensive fermentation systems allows significant control over the production process for these resources, but clearly requires a large up-front capital investment. The need for critical inputs into the process, like the various carbon and/or nitrogen resources (among other things) are likely to add to the costs (both financial and environmental) and there needs to be a continued push to identify ways of reducing those input costs, without compromising qualities and productivity." [Glencross et al., 2024, p. 422-433](#)

¹³⁴ Innovation prizes are commitments to prize money for actors that solve a problem, regardless of the way they solve it. They are useful when we know the problem that we want to solve (e.g. fish-free feed), when the solution (e.g. a feed formula) can easily be copied by others, and we do not need an incentive to scale (e.g. because we expect that market forces will help scale). An AMC is a promise to buy a product in the future when it is invented. It is useful when actors who can develop a solution are blocked by uncertainty of market demand (e.g. competition from FMFO and other alternatives), we can at least partly describe the end product (e.g. fish-free feed), further incentives are needed to bridge the gap to a long-term market (e.g. guaranteed funding for scaling up production). [Ransohoff, 2024](#)

2035 at a compound annual growth rate of 7.1%. We therefore rate the funding need of this strategy as 'medium' rather than 'high'.¹³⁵

Capacity-Building to Monitor Illegal Fishing and Enforce Regulations

Scale ●●● High
Feasibility ●●○ Medium
Funding need ●○○ Low

Illegal, unreported, and unregulated (IUU) fishing encompasses activities that violate national, regional, or international fishing regulations. IUU fishing is a particular concern on the African continent. Because of lower state capacity to enforce fishing regulations, 40% of industrial and semi-industrial vessels involved in IUU fishing are concentrated in West Africa. The foreign fleet of China is the largest source of IUU fishing on the continent.¹³⁶

Scale: High

IUU fishing accounts for one-fifth of global fish catch.¹³⁷ Fishing vessels operating illegally, such as foreign industrial vessels, frequently use locally prohibited techniques such as bottom trawling, explosives, lights, or fish in protected or closed areas.¹³⁸ The resulting unhealthy fish stocks cause food prices to rise, exacerbating food insecurity and unemployment, especially in places where IUU fishing by foreign fleets is high and communities depend on fish, such as in West Africa.¹³⁹

Feasibility: Medium

We rate the feasibility of this strategy as 'medium' because we think that this approach can address many of the conventional barriers to making progress on IUU fishing, but have concerns about its impact if high demand for seafood remains, especially in jurisdictions prone to corruption.

Weak enforcement capacity and deterrence, flags of convenience, poor information sharing, and financial and legal opacity are listed among the key drivers and enabling conditions of IUU fishing, according to a review by [Liddick \(2014\)](#).¹⁴⁰ Innovations in

¹³⁵ "The fish meal alternative market is anticipated to grow from USD 2.2 billion in 2025 to USD 4.4 billion by 2035, at a CAGR of 7.1%." [FMI, 2025](#)

¹³⁶ [Financial Transparency Coalition 2022](#)

¹³⁷ [Financial Transparency Coalition 2022](#)

¹³⁸ "The trawlers employ illegal fishing practices, such as bottom trawling, which destroys ecosystems critical to the survival of marine life. They also fish with lights and explosives, and fish in prohibited areas and during closed seasons." [ADF, 2024](#)

¹³⁹ "However, 90% of Ghanaians surveyed by Harvard researchers said they do not believe their children will be able to depend on fishing or related trades in the future. Similar sentiments were expressed in Côte d'Ivoire and Nigeria. This is mainly because Ghana and other West African nations have for decades been victimized by industrial fishing trawlers, many from China, which engage in a variety of illegal, unreported and unregulated (IUU) fishing. [...] Decimated fish stocks around West Africa cause prices to soar and drive food insecurity." [ADF, 2025](#)

¹⁴⁰ [Liddick, 2014](#)

information technology, such as cross-checking data on port calls, location history, and authorization, have made it possible to address these drivers and enablers by remotely tracking fishing activity, (automated) data sharing, and improving transparency. Many of these tools however, are not used for enforcement in countries where enforcement capacity is lacking and IUU fishing is common. We expect that improving the development and use of such technologies, providing data and analysis, providing technical assistance for enforcement, and facilitating data sharing within and between governments can worsen the expected payoff for IUU fishing.

However, we expect that capacity-building is not a one-size-fits-all solution because it is less able to adequately address some macro-level drivers of IUU fishing, as identified in [Liddick \(2014\)](#). These include:

- High demand for seafood: IUU fishing takes place because there is a large market for seafood. Building monitoring and enforcement capacity does not directly address the price or the demand of seafood, other than through reduced supply. However, enforcing fishing regulations helps state capacity to cut fishing in protected areas and spawning grounds and using illegal or destructive gear. Leakage of fishing efforts to other jurisdictions presents a risk, but improving data sharing between countries could partly mitigate this issue.
- Corruption and vested interests: Corruption is a central enabler of IUU fishing through bribery and conflicts of interests with licensing, quotas, monitoring, and access agreements for foreign fleets. Building enforcement capacity for fishing crimes first and foremost requires the willingness of relevant government authorities to take action on this issue. In general, we think that corruption is only a moderate concern to the feasibility of this strategy for three main reasons:
 1. IUU fishing corruption issues highlighted in Liddick (2014) primarily take place among actors that do not set overall strategy, and therefore do not decide on cooperation with organizations that work on capacity-building.
 2. We expect that improved data availability and transparency reduces the opportunities for low-level corruption.
 3. Countries with low IUU fishing enforcement stand to gain economically and in terms of food security from combatting IUU fishing, as much of IUU catch happens by foreign fleets. [A study from 2017](#) predicted that the lost revenue because of IUU fishing in six West African countries alone is \$2.3 billion per year.¹⁴¹

¹⁴¹ "The catch, the economic loss and the amount recovered through Monitoring, Control, and Surveillance (MCS) are calculated based on a reconstruction method, and the information made available through national MCS units, between 2010 and 2016 in an effort to assess the effectiveness of surveillance efforts in the region. Results show considerable loss of revenues for Mauritania, Senegal, The Gambia, Guinea Bissau, Guinea, and Sierra Leone, estimated at 2.3 billion USD annually, while a minimal amount of 13 million USD is recovered through MCS." [Doumbouya et al., 2017](#)

NB: This also opens up the possibility of home countries of foreign fleets paying national governments to allow (over)fishing by foreign fleets. For example, the government of Somalia granted fishing licenses to Chinese vessels to fish near its shores. [Quartz, 2022](#)

According to a 2016 [report by the African Union Development Agency \(AUDA-NEPAD\)](#), African countries have made progress against IUU fishing through improved community surveillance, increased deterrence, strengthening cooperation between agencies, tightening controls, and strengthening court systems. The report concluded that capacity-building and increasing cooperation are priorities for making progress.¹⁴² This contributes to our view that it is possible to make progress using capacity-building initiatives.

Funding need: Low

We rate the funding need of this strategy as 'low' because we already see substantial support to end IUU fishing from philanthropic organizations, in overseas development assistance (ODA), and international organizations.

- Philanthropy: Several large grantmakers or philanthropists are supporting action on IUU, including Pew Charitable Trusts and the Packard Foundation.¹⁴³
- ODA: The World Trade Organization, based on data of the OECD, identified 28 ODA projects that specifically cited controlling IUU fishing as a project objective between 2010 and 2022.¹⁴⁴
- International organizations: International organizations target IUU fishing as part of their priorities. The FAO has a [program on enhancing national capacities against IUU fishing](#). The need to end IUU fishing is enshrined in the Sustainable Development Goals (SDGs) of the United Nations.¹⁴⁵

We would be open to revising our assessment of *funding need* if there are organizations that take an uniquely promising approach to capacity-building to enforce fishing regulations, yet have considerable room for more funding.

¹⁴² "Despite these challenges, African countries have demonstrated that they can stop illegal fishing and take control of their inland, coastal, and off-shore waters. Some examples of these successes are (i) Community surveillance; (ii) Increasing deterrence through successful prosecutions; (iii) Strengthening national level inter-agency cooperation; (iv) Trade, market and consumer initiatives assist to tighten controls; and (v) Strengthening court systems." [AUDA-NEPAD, 2016](#)

¹⁴³ Pew Charitable Trusts: "For more than 12 years, Pew has focused on building a global system to combat illegal fishing by working with governments, fisheries management bodies, enforcement authorities, and the seafood industry to adopt and implement international agreements and regulations and to form multi-State coalitions that will safeguard and protect their waters." [Pew, n.d.](#)

¹⁴⁴ [World Trade Organization 2024, p. 22](#)

¹⁴⁵ Target 14.4: "By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics" Target 14.6: "By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation." [United Nations, n.d.](#)

Stopping Bottom Trawling in Marine Protected Areas

Scale ●●● High

Feasibility ●○○ Low

Funding need ●●○ Medium

Bottom trawling is a fishing practice where a weighted net is dragged along the seafloor to catch fish and other marine organisms that live near or on the bottom. Philanthropy can help reduce the environmental impacts by advocating for improved regulations, enforcement, and trawling techniques.

Scale: High

Bottom trawling is among the most widespread and destructive fishing practices. Out of the total global marine fisheries catch, 26% is caught using bottom trawling (**Figure 15**).¹⁴⁶ This is approximately equal to the total catch by artisanal fishers. Geographically, bottom trawling is most common in Asia: more than half (62%) of the total bottom trawling catch by weight is caught in Asia.¹⁴⁷ The environmental impacts of bottom trawling are uniquely damaging, as it is the only fishing method responsible for large-scale overfishing, high bycatch rates, and seabed contact.¹⁴⁸

In addition to its ecosystem damage, bottom trawling is also responsible for approximately 1-3% of global CO₂e emissions. The top of this estimate ranks roughly equivalent to the emissions from the aviation sector. The practice requires fuel and releases carbon stored in the seabed.¹⁴⁹

¹⁴⁶ Calculation based on Figure 11. Data source: [Steadman et al., 2021](#)

¹⁴⁷ Calculation based on Figure 11. Data source: [Steadman et al., 2021](#)

¹⁴⁸ [Steadman et al., 2021](#)

¹⁴⁹ Estimates of the greenhouse gas emissions from bottom trawling diverge. [Sala et al., 2021](#) combine data of bottom trawling activity the the global average of carbon accumulation and sedimentation and find that the practice releases between 0.6 and 1.5 Gt CO₂e per year. [Atwood et al., 2024](#) models that about 0.34 to 0.37 Gt CO₂e per year of the released CO₂e likely enters the atmosphere.

Figure 6 Global catch by gear type (within EEZs)

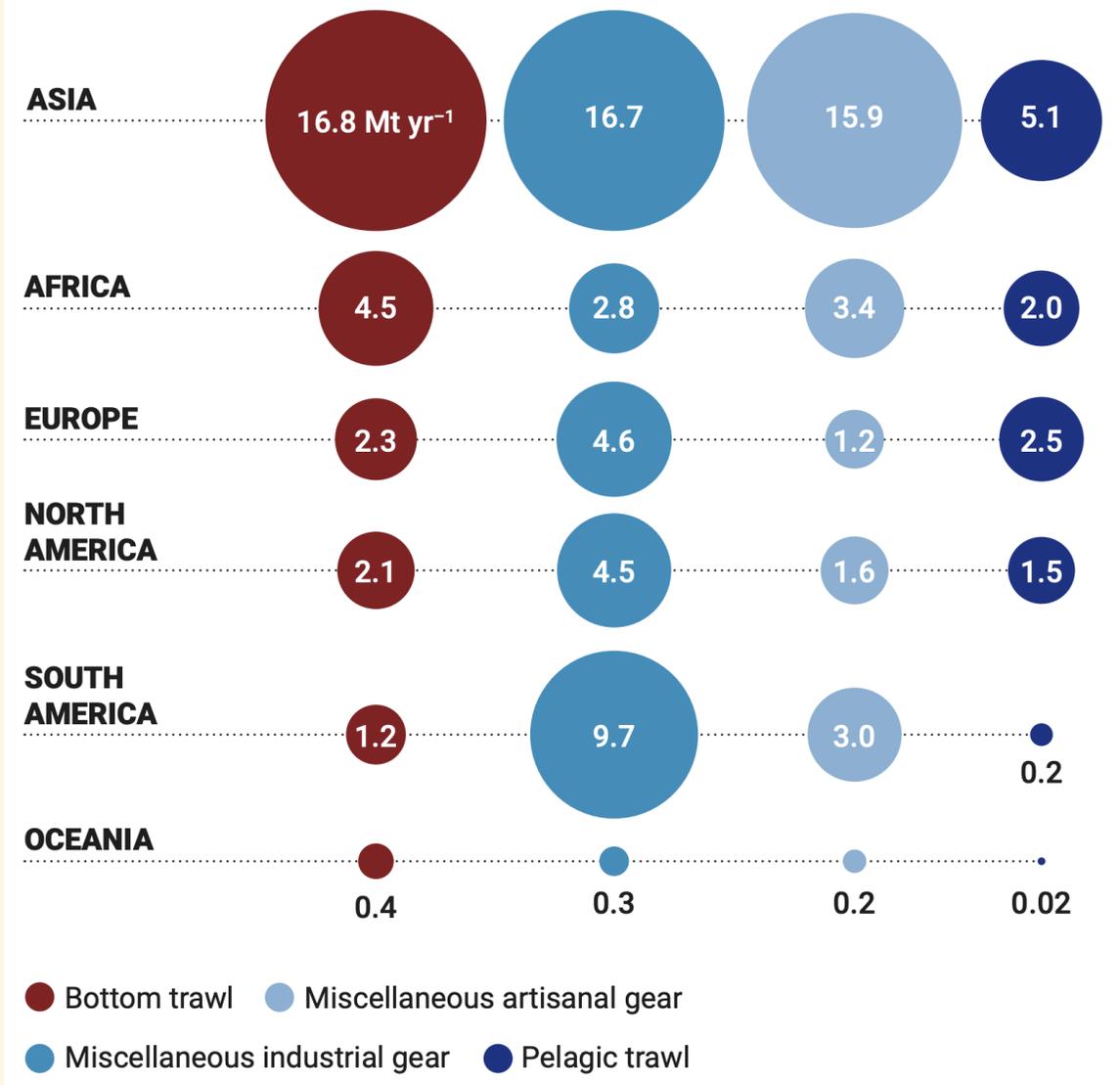


Figure 15: Global catch by gear type and world region (within exclusive economic zones).¹⁵⁰

Feasibility: Low

In the past few decades, several countries and regions have taken action to ban or limit bottom trawling in marine protected areas (MPAs) and beyond, including Greece, Sweden, the UK, the EU, Belize, Madagascar, India (during monsoons), Sri Lanka, Hong Kong, and Cambodia. These actions can be seen as evidence for the feasibility of regulating bottom trawling.

¹⁵⁰ [Steadman et al., 2021](#)

While the evidence-base around the effectiveness of bottom trawling regulation is limited, eliminating the practice entirely in certain areas (e.g. nation-wide bans) appears to be more effective than reducing trawling efforts over a larger area through output and effort controls. The latter option has been linked to a recovery of target species, but not a recovery of overall ecosystem health.¹⁵¹

Overall bans, however, can be less feasible to implement because it can create social conflict and economic losses in the fishing sector.¹⁵² We expect that the high economic costs of banning bottom trawling with limited technological alternatives makes large scale bottom trawling bans less feasible.¹⁵³

Some of our other feasibility concerns are:

- Leakage: Restricting bottom trawling in one area can lead to increased trawling activity in another area.
- Permanence: Restricting bottom trawling does not remove an economic incentive, which creates pressure to reverse the policy during economic downturns or new political leadership.
- Lack of geographical spillover: Contrary to some other strategies discussed in this report, bottom trawling bans require going from MPA to MPA or from country to country, which reduces the geographical scope of the strategy.
- Epistemic feasibility: Most bottom trawling takes place in Asia, and we do not know sufficiently about locally viable political strategies to reduce the practice.

For these reasons, we rate the overall feasibility as 'low', although we think that there may be more leveraged and underfunded opportunities that we are not aware of.

Funding need: Medium

While marine conservation is an underfunded field in general, we expect that non-profits working on bottom trawling can fundraise more easily than non-profits working on other impact strategies since their theory of change is more common and well-accepted and would fall within the remit of mainstream conservation grantmakers. In addition, the establishment and enforcement of MPAs would fall under global targets to protect 30% of the world's terrestrial, inland water, and marine areas by 2030 ("30x30").¹⁵⁴ We expect that this increases the likelihood of this strategy obtaining funding as part of overseas development assistance or by international organizations.

¹⁵¹ "Conventional fisheries management approaches – particularly those addressing capacity (i.e., effort and output controls) – have seen declines in bottom-trawled target species reversed in some temperate trawl fisheries. However, whether changes in trawl fishing effort drive improvements at an ecosystem level has not been conclusively demonstrated." [Steadman et al., 2021](#)

¹⁵² [Steadman et al., 2021](#)

¹⁵³ We base this on conversations that we have had with researchers and grantmakers in the ocean biodiversity space.

¹⁵⁴ "Ensure and enable that by 2030 at least 30 per cent of terrestrial and inland water areas, and of marine and coastal areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed [...]" [CBD, n.d.](#)

Advocating for Alternative Seafood Policy and Research

Scale ●●● High

Feasibility ●●○ Medium

Funding need ●●● High

We expect that advocating for alternative seafood can be a promising strategy to reduce marine biodiversity loss, for the same reasons that we discussed in the section about advocating for alternative protein policy and research in the chapter on halting land use change.

Strategies that We Prioritize

Based on our analysis of the scale, feasibility, and funding need of strategies to reduce the ecological damage of fishing, we decide to focus our efforts on the implementation and innovation of improved fishing gear and developing technical alternatives to fish meal and fish oil. These strategies can address a large part of global ecological damage of fishing at scale, are reasonably feasible to make progress on, and can use additional philanthropic funding.

Addressing Climate Change as a Biodiversity Loss Driver

Climate change is a mid-level driver of biodiversity loss. Globally, across realms and biodiversity indicators, climate change is the fourth-most dominant direct driver. In the marine realm, however, it is the second-largest driver when aggregating many pairwise comparisons of drivers.¹⁵⁵ By some definitions, however, climate change is already the largest source of negative impacts in marine ecosystems.¹⁵⁶ Climate change affects

¹⁵⁵ Point estimate of the dominance of climate change across all three realms: 1.53/4.00 (95% confidence interval: 1.11-2.01, n=154 studies).

Point estimate of the dominance of climate change in the marine realm: 2.51/4.00 (95% confidence interval: 1.82-2.75, n=58 studies).

We explain dominance scores in more detail in the chapter on land use change. [Jaureguiberry et al., 2022, Fig. 1B](#)

¹⁵⁶ For example, [Halpern et al. 2019, Figure 4a-b](#) found that sea surface extremes, ocean acidification, and sea level rise have the largest cumulative impacts on marine ecosystems globally and are responsible for most of the recent increases in impacts. [O'Hara et al. 2024, Figure 1D](#) found that these three stressors are responsible for more than half of the cumulative impact of most studied taxa.

ecosystems loss through, for example, changed precipitation regimes, sea level rise flooding ecosystems, and ocean acidification inhibiting shell-forming in marine species.¹⁵⁷

Over time, the negative impact of climate change on biodiversity is set to increase. As the Earth heats up, climate change will do more damage to ecosystems. Because the relationship between global warming and damage to the biosphere is quadratic, an additional 0.1 °C increase in global warming will result in more biodiversity loss at 3 °C warming than at 2 °C warming. This will make climate change a larger driver of biodiversity loss in the future.¹⁵⁸

Nonetheless, we think that donors who primarily care about halting biodiversity loss and protecting ecosystems should fund impact strategies other than tackling climate change. Overall, climate philanthropy is three to five times larger than biodiversity philanthropy, implying that biodiversity is a less crowded field, which could lead to a higher marginal impact per dollar donated.¹⁵⁹ There is less available infrastructure and advice for biodiversity donors to donate to high-impact systemic solutions in biodiversity, adding to the overall argument of additional donations to high-impact biodiversity charities. Overall, this leads us to expect that additional impact-oriented donations to land use change and fishing impacts will lead to more biodiversity benefits than a donations to climate change.

We think that donating to high-impact [climate change mitigation charities](#) could still be an interesting option for donors who care about both climate change and biodiversity loss. For this group of donors, we especially recommend funding solutions that reduce the extent of animal agriculture, as this sector is a large driver of both habitat loss and climate change. Both this report and Giving Green's [research report on food system emissions](#) identified alternative protein policy and research as promising impact strategies for donors.

¹⁵⁷ Section 2.1.17 of the IPBES Assessment Report describes the impacts of climate change on biodiversity. [IPBES, 2019, p. 126](#)

¹⁵⁸ "The relationship between global temperature rise and species extinction rates is best described by a quadratic biosphere damage function, indicating that the rate of biodiversity loss accelerates as temperatures increase." [Thor, 2024](#)

"Results suggest that extinction risks will accelerate with future global temperatures, threatening up to one in six species under current policies." [Urban, 2015](#)

¹⁵⁹ Climate change: "The report analyzes overall philanthropic funding from individuals and over 90 foundations in 2023, revealing that \$9.3 billion to \$15.8 billion was directed toward mitigating climate change." [ClimateWorks, 2024](#)

Biodiversity: See figure 1.

Conclusion

We think that donations to reduce biodiversity loss are most impactful when they focus on systems change interventions, such as policies, innovations, and new markets, that cannot get funding from the public and private sectors.

For terrestrial biodiversity, reducing conversion of land to agriculture stands out as one of the most important biodiversity challenges. We predict that future conversion of natural habitat for agriculture because of population growth, consumption growth, and increased meat consumption is the leading cause of biodiversity loss in the next few decades. We recommend alternative protein advocacy and research as the most promising philanthropic strategy to reduce land use change. Increasing agricultural yields and reducing food waste stand out as important solutions, too, but we have some concerns about the feasibility and funding need compared to alternative proteins. Since these solutions are long-term bets, philanthropy can mitigate short-term biodiversity loss by focusing on protecting the most sensitive and unique habitats, such as wetlands.

The ecosystem damages from fishing, such as overfishing, bycatch, and seafloor contact, stand out as the main driver of biodiversity loss in the oceans. We expect that philanthropy can be most impactful by supporting the implementation and development of better fishing gear and by developing technical alternatives of fish meal and fish oil. Alternative seafood development can be a promising way to reduce overall fish consumption, akin to our strategy for alternative protein development for halting land use change. We also think that capacity-building for reducing illegal fishing and stopping bottom trawling are interesting strategies, but we have some concerns around their funding need and feasibility, respectively.

Climate change is a mid-level driver of biodiversity loss, but is increasing in importance over time. Donating to [climate change mitigation](#) can be an interesting option for donors who care about both biodiversity and climate. For these donors, donating to advance [food system solutions](#), such as alternative proteins, is an especially promising strategy, since they address both emissions and habitat loss.

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Appendix A: Uncertainties and Open Questions

While we take pride in our evidence-based approach to high-impact biodiversity philanthropy, it is in line with our value of [humility](#) to acknowledge our limitations.

- **Strategy aggregation problem:** We identified land use change and fishing impacts as two broad areas that are high in scale, relatively feasible to address, and with a clear funding need. We think our approach to first prioritizing these broader areas is justified, as the lack of an operationable scale indicator for biodiversity makes it challenging to fairly compare many smaller (disaggregated) strategies. However, this approach does open up the possibility of missing opportunities within non-prioritized drivers of biodiversity loss (such as pollution) that are smaller in scale, but exceptionally feasible and with a high funding need.
- **Importance of climate change as a driver of biodiversity loss:** While climate change currently ranks as a mid-level driver of biodiversity loss, its importance is set to increase over time, and it is already the main driver of marine biodiversity loss according to some studies, as covered in our chapter on climate change. At the same time, climate change mitigation receives more philanthropic funding than biodiversity. We are unsure about under which conditions funding climate change mitigation becomes the most promising (marine) biodiversity strategy.
- **Freshwater biodiversity:** We did not create a separate chapter on freshwater biodiversity because our main source found that the drivers of freshwater biodiversity loss have the same relative importance as those for terrestrial biodiversity. However, we did not assess the rate of change in the drivers of freshwater biodiversity loss, and are unsure whether the land use change strategies that we specified are also the best for freshwater ecosystems. It is possible that other land use change strategies specific to freshwater, such as removing unused dams, could be more impactful for freshwater biodiversity specifically.
- **Relative importance of realms:** We did not assess the relative importance of terrestrial, marine, and freshwater biodiversity loss.
- **Quality vs quantity of habitat:** We are unsure to weigh the total extent of habitat loss against the quality or importance of habitat lost. While there is no one straight-forward answer to this question, we think that future research in this area can help make a more informed weighing between reducing land use change (e.g. through alternative protein policy) and steering land use change towards less important areas (e.g. protecting wetlands).
- **Measuring marine biodiversity loss:** Our list of strategies to reduce the environmental impacts of fishing is based on our understanding of the overall

marine biodiversity philanthropy field. Since there is no straight-forward approach to assess the scale of fishing impacts, it is possible that there are strategies that are high in scale that we did not identify for our evaluation.

Appendix B: Previous Biodiversity Philanthropy Prioritization Reports

We are grateful to the authors of the following reports that previously evaluated the impact of philanthropic strategies for biodiversity.

- **EIshafie & Schellhase (2025).** [Priorities for Strategic Climate and Environmental Philanthropy.](#) Milken Institute.
- **Schienze (2024).** [The dual climate & biodiversity crises: A perspective for donors.](#) Effektiv Spenden.
- **Thor (2024).** [The most effective ways to protect, preserve, and rebuild ecosystems.](#) Founders Pledge.
- **Thor (2023).** [Reducing land use and returning agricultural land to nature.](#) Founders Pledge.
- **Scherer et al. (2020).** [Global priorities of environmental issues to combat food insecurity and biodiversity loss.](#) *Science of The Total Environment.*



Giving Green was founded to help donors cut through the complexity of climate philanthropy and direct their resources for maximum impact.

Our founder, Dan Stein, Ph.D., spent 15 years developing evidence-based strategies in global philanthropy. He saw people eager to fight climate change but paralyzed by its scale. In 2019, with support from IDinsight, he launched Giving Green to rigorously evaluate solutions and share clear guidance.

What began as a side project is now a team directing tens of millions of dollars to high-impact initiatives. Our success is shared—with donors ranging from kids donating allowances to retirees investing in a better future. We believe anyone can start small and still make a huge difference.

Thank you for joining us on the path to net zero.
Together, we keep moving forward.