

# Opportunity Blossoms

## The Business of Curbing Nature Loss

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BloombergNEF

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## Section 1. Executive summary

### 12

Number of case studies included in this research note

### \$5 trillion

Total financial flows into activities directly harmful to nature in 2022

### 92%

Loss of biodiversity and ecosystem services caused by the five direct drivers examined in this report

The quest to halt and reverse biodiversity loss creates new impetus for companies that sell goods and services that mitigate the drivers of nature loss. A range of business opportunities are beginning to blossom, from companies manufacturing advanced agricultural machinery to startups commercializing environmental DNA. The flourishing of profitable businesses that reduce harm is the key to raising the trillions of dollars needed to avoid ecosystem collapse – and redirecting the trillions more that are currently spent on activities with direct negative impacts on nature.

- Meeting the goals of the Global Biodiversity Framework will require over \$1 trillion of investment each year in the sectors that are most responsible for nature loss. Much of this amount needs to flow into the real economy, to enable companies to dramatically reduce their environmental footprint and address the five direct drivers of nature loss: land- and sea-use change, resource over-exploitation, climate change, pollution and invasive alien species.
- There are already a host of established business models – such as recycling – that do this, however they have typically not been associated with nature-related investments. Businesses that are commercializing new ways to produce the goods and services that drive the most nature loss are also emerging. Both groups provide attractive opportunities to investors seeking to drive immediate and scalable nature impact. In the broadest terms, mobilizing investment toward less harmful modes of production may be the most meaningful, immediate and scalable form of intervention available to corporations and financial institutions.
- This white paper profiles 12 companies that provide scalable solutions to address the five major drivers of nature loss across the agri-food, materials, industrials, consumer discretionary and data services industries. These range from multi-billion-dollar publicly listed enterprises to small-scale startups completing early rounds of fundraising.
- Several of the cases focus on mitigating land-use change. US-headquartered startup Perfect Day reached a \$1.6 billion valuation with an animal-free whey protein that eliminates the need for land-intensive livestock in dairy production. Australian wood fiber producer Forico turned around the assets of a failed traditional forester with a poor track record by setting aside half of its plantations for biodiversity conservation and carbon sequestration.
- Water use is a key issue. Ecolab sells equipment and services to optimize industrial water use and drive resource efficiency gains, helping to reduce the over-exploitation of resources and generating \$4 billion in annual revenue. Gradiant Corp. secured \$500 million in orders for its wastewater treatment systems that recover wastewater and reduce energy consumption.
- Companies operating in the circular economy play a key role. Indian startup Phool collects floral waste from temples to produce incense burners and a proprietary bio-leather, tapping into India's \$3.2 billion home fragrance market while diverting waste from the Ganges. Italian mid-cap Aquafil produces a fossil-fuel-free, infinitely regenerative nylon which it sells to apparel and rug manufacturers, earning €263 million in 2023. Redwood Materials reached a

\$4.5 billion valuation as a lithium-ion battery recycling company and battery material producer that avoids many of the impacts of conventional battery production.

- Agriculture and food feature prominently in the cohort. PTx Trimble, a joint venture between two industry giants, sells technology enabling far more precise pesticide application that boosted its majority owner's annual revenue by \$600 million. Danish coffee grower Slow employs regenerative agriculture practices in its Asia plantations, while Wilder Harrier, a small Canadian startup, is tackling an invasive species of carp to produce dog food.
- Israeli startup EConcrete's patented admixture, texture agents and mold designs together reduce emissions and encourage biodiversity uplift, cutting into the \$178 billion marine infrastructure market. UK-headquartered NatureMetrics uses environmental DNA technology to offer cost-effective monitoring of biodiversity, doubling revenue over the last two years.
- This series of case studies highlights a series of opportunities within the nature transition. It follows on from *When the Bee Stings: Counting the Cost of Nature-Related Risks*, a series of 10 case studies exploring companies that mismanaged their interactions with nature.

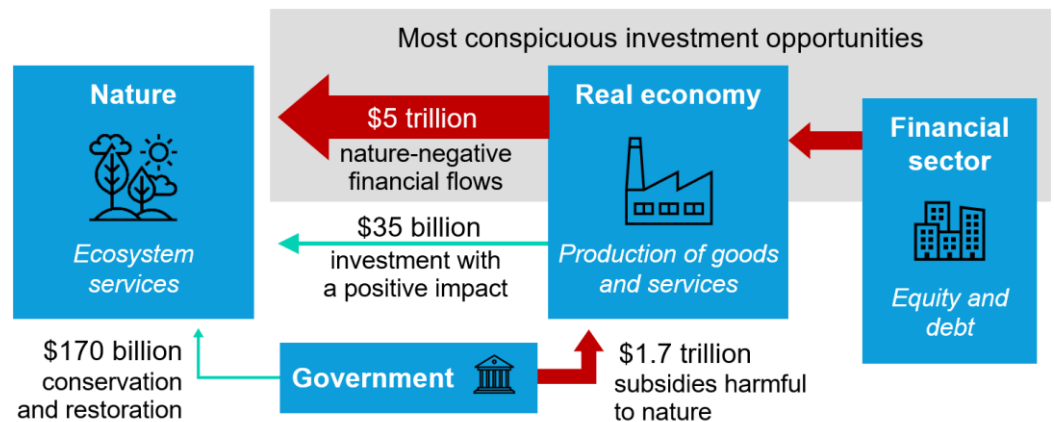
## Section 2. A framework for identifying nature-related opportunities

Shifting the financial flows of the real economy away from activities that are damaging to nature and toward less harmful alternatives presents the most promising and immediate avenue for nature-related investment.

Around \$5 trillion in private finance flows went to activities with direct negative impacts on nature in 2022 (Figure 1). This is 25 times more than the combined public and private investment with a positive impact and over 140 times private flows alone, which reached just \$35 billion. Slow growth in those figures means the gap between current biodiversity finance and future needs is currently widening.

The investment case for channeling biodiversity finance into activities that protect and restore nature can be challenging. Yet there is a compelling thesis for investing in businesses and technologies that reduce harm in existing sectors, and channeling finance toward these activities can contribute vast sums to the \$1.15 trillion per annum needed by 2030 to prevent ecosystem collapse.

**Figure 1: Nature-related investments in the real economy need to repurpose financial flows away from the most harmful activities and into alternatives**



Source: BloombergNEF, United Nations Environment Programme.

While direct investment into nature protection, conservation and restoration plays a key role in achieving global targets, its lack of financial return ensures it will remain largely the preserve of government and philanthropic contributors. Efforts to create novel and exotic financial instruments for this purpose have also produced some small-scale results, but have again lacked scale.<sup>1</sup>

This report reframes nature-related investment in the real economy as financial flows that reduce the rate of biodiversity and ecosystem loss while also generating some form of return. It does not attempt to draw explicit distinction between impact mitigation and purely ‘nature-positive’ investments.<sup>2</sup> Instead, the research highlights opportunities to redirect the flows of capital causing

<sup>1</sup> See Appendix C for more detail on biodiversity-related financial instruments.

<sup>2</sup> Many organizations have attempted to define ‘nature positive’. This report largely eschews the term. Financial flows dedicated to ‘mainstreaming’ nature and biodiversity also sit outside its scope.

harm in the real economy toward companies and technologies that cause less damage. Such interventions do not necessarily imply an improvement in the overall condition of nature: many merely lead to dramatically less damage than in incumbent systems.

Several groups of interventions discussed below are not new, nor have they typically been associated with nature-related investments, instead fitting in with broader and more generic sustainability themes. They are particularly attractive opportunities to a class of investors seeking to drive immediate and scalable nature impact, however, as beyond enabling cost savings, increasing efficiency or boosting productivity, they also mitigate the main contributors to nature loss in various industries. 2.1 further explores what constitutes nature-related investment.

Other interventions are more novel, exploring entirely new ways to produce end products analogous to those associated with nature loss. Again, these opportunities mitigate harm caused to nature by incumbent supply chains, but do not necessarily improve the state of nature.

## 2.1. Mitigating the drivers of nature loss

Many factors contribute to nature loss. Its indirect drivers are broad, including demographic and sociocultural shifts, economic and technological development, institutional change, conflicts and epidemics.<sup>3</sup> These factors dictate human activities, which in turn form the direct drivers of nature loss, with land- and sea-use change, natural resource exploitation, climate change, pollution and invasive alien species together accounting for 90% of global declines in biodiversity and ecosystem services (Figure 2).

**Figure 2: Direct drivers of biodiversity and ecosystem change**

Land- and sea-use change	Natural resource exploitation	Climate change	Pollution	Invasive alien species
The conversion of land cover, changes in ecosystem management or changes in the spatial configuration of a landscape	The extraction of living and non-living resources, including as wildlife, water and minerals	Changes in climate and weather patterns impact ecosystem function, induce population migration and reduce resiliency	Non-GHG pollutants directly impact all biomes. Nitrogen deposition in terrestrial and marine habitats impedes many aspects of ecosystem functions.	Organisms that establish themselves in an environment different from their natural habitat and outcompete the native species

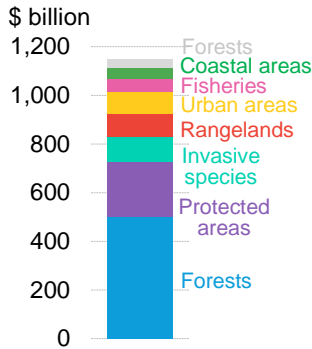
Source: BloombergNEF, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Note: ‘GHG’ refers to greenhouse gas.

Direct drivers – also known as ‘pressures’ – are those “that unequivocally influence biodiversity and ecosystem processes”, according to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (Ipbes).<sup>4</sup> While a long tail of other drivers exists, this report is concerned only with the leading five.

<sup>3</sup> Addressing the indirect drivers is critical to achieving the targets and goals of the Global Biodiversity Framework. Doing so primarily falls under the remit of policymakers.

<sup>4</sup> Ipbes is an intergovernmental organization that assesses the state of biodiversity and nature’s contributions to human life and activities. It fulfills an equivalent role for biodiversity as the Intergovernmental Panel on Climate Change (IPCC) does for climate.

**Figure 3: Annual biodiversity investment needed by 2030**



Source: BloombergNEF, Paulson Report (2020).

The real economy is where human activities impose pressure on the natural world. A handful of major industries – agriculture, energy, metals and mining, materials, and transportation – are responsible for much of the impact on nature, though every industry contributes to some extent. These sectors operate within the land- and seascapes most in need of biodiversity investment (Figure 3).

Table 1 highlights the commodities, products and services where these direct drivers are most readily identified. Several industries have large, multifaceted impacts. For instance, the agri-food system exerts substantial pressure through all five direct drivers, annually accounting for 80% of global land-use change (largely through forest clearance), 70% of global freshwater withdrawals (for irrigation), 32% of global greenhouse gas emissions, 40 million metric tons of plastic waste, 3.5 million tons of pesticides and 195 million tons of fertilizer, and is often responsible for introducing or hastening the spread of invasive species.

The direct drivers also influence one another through various mechanisms, such that addressing one driver may in turn mitigate others. This underlines the importance of addressing the most harmful activities to effect the largest overall impact.

At an operational level, almost every real-economy company has a direct or indirect impact on the environment. The production of goods entails resource extraction, processing and distribution, which together deplete or degrade natural capital. Given cost and technological constraints, it is not currently feasible to reform these supply chains such that they achieve a net uplift in biodiversity and ecosystem services.<sup>5</sup>

**Table 1: Industries whose commodities, products and services drive the largest shares of nature loss present the most prominent opportunities for investment**

Direct driver	Share of nature loss	Industries	Commodities, products and services with the most impact
<b>Land- and sea-use change</b>	30%	<b>Agri-food</b> (drives 80% of land-use change), <b>forestry, fishing</b> , mining, energy, materials, urban development	<b>Beef</b> (drives 41% of forest clearance), <b>palm oil</b> and <b>soybeans</b> (18%), <b>timber</b> (13%), rubber, pulp and paper, <b>seafood</b> (covering at least 55% of oceans), coal, oil and gas, iron ore, infrastructure
<b>Natural resource exploitation</b>	23%	<b>Agri-food, metals</b> , non-metallic minerals, materials, chemicals, <b>energy</b> , fishing, forestry	<b>Crops, beef</b> and <b>dairy</b> , timber and fisheries (26% of material extraction), <b>coal</b> , oil and gas (16%), iron and non-ferrous metals (10%), non-metallic minerals (48%). Agricultural products account for 85% of water stress and 70% of freshwater extraction
<b>Climate change</b>	14%	<b>Energy, agri-food, materials, chemicals, transportation</b>	<b>Coal</b> (31% of GHG), <b>oil</b> (22%), <b>gas</b> (15%), <b>beef</b> (9%, including deforestation) cement, steel, aviation, automotives
<b>Pollution</b>	14%	<b>Agri-food, materials, chemicals, energy</b>	<b>Crops</b> (pesticides, 3.5 million metric tons in 2021 and fertilizers, 195 million tons), 350 million tons of plastic waste in 2021, from <b>packaging</b> (46%), <b>textiles</b> (15%), consumer products (12%) and transportation (6%)
<b>Invasive alien species</b>	11%	<b>Tourism, agri-food, forestry</b>	<b>Shipping, aviation, tourism</b> , exotic plants and animals, pets. Individual commodity data unknown

Source: BloombergNEF, Ipbes (2019), Ipbes (2023), Statista (2023), UNEP (2019), Our World in Data (2019), Chatham House (2021), Campbell et al. (2017). **Bold** denotes most significant industries, commodities, products and services. \*Greenhouse gases excluded from pollution as they are included under climate change. Figures in metric tons.

<sup>5</sup> For most supply chains. A positive overall impact is possible for some processes, though difficult to measure and verify.

### Nature-related risk and its role in opportunities

Deriving value by mitigating harmful nature impacts is a boon for corporate balance sheets, but doing so also reduces exposure to nature-related risks. Companies whose actions are misaligned with shifting regulation, consumer and market expectations, and technological developments place cashflows at risk. Conversely, investing in innovations that reduce harmful nature impacts better align production processes with the shifting market and policy landscape, reducing the likelihood of incurring costs in the future.

For more BNEF research on nature-risk, see: *When the Bee Stings: Counting the Cost of Nature-Related Risks* ([web](#) | [terminal](#)).

## 2.2. Channeling investment toward loss mitigation

Mobilizing investment toward less harmful modes of production may be the most meaningful, immediate and scalable form of intervention available to corporations and financial institutions. Provision of debt, equity, and capital or operating expenses that generates value and reduces any of the direct drivers of nature loss – while not substantially increasing the others – constitutes nature-related investment. Four examples illustrate this point.

- **A financial institution issues a bond to enable capex for an alternative protein facility.** While the construction and operation of the plant in isolation may still negatively impact nature, its existence reduces the overall impact of the agri-food sector. Shifting the production of dairy from livestock to a bioreactor-grown replacement is likely to entail a reduction in land-use change (no need to produce animal feed), less water withdrawal (no irrigation), and lower climate change and pollution (no biogenic methane emissions or agricultural chemical use) than a business-as-usual scenario.
- **The manufacturer of wastewater treatment equipment raises equity to expand its operations in a new market.** Its technology would thus be deployed in more factories, reducing their discharge of polluted water into proximate watercourses and, if accompanied by recycling facilities, decreasing freshwater withdrawals for production processes.
- **A plastics producer invests 3% of its annual revenue into research and development to create a new, fully biodegradable material to supplement or replace its existing offering.** By substituting recycled plant fibers for oil derivatives, the company is able to substantially reduce its contribution to climate change (no oil extraction) and pollution (a lower volume of persistent plastic materials enter the natural environment).
- **A soft drink manufacturer elects to use recycled aluminum to manufacture soda cans, in place of sourcing from an extractive company.** Doing so can reduce its use of virgin natural resources, pollution and emissions, while also saving material costs.

Each of these cases are simplifications, but nonetheless illustrate the rationale behind nature-based investment in the real economy. None of the investment cases originate in the need to protect or restore nature, but each activity results in an improved state of nature compared with a situation in which no such investment is made.



Technologies to mitigate environmental damage can also achieve cost savings and productivity improvements for firms

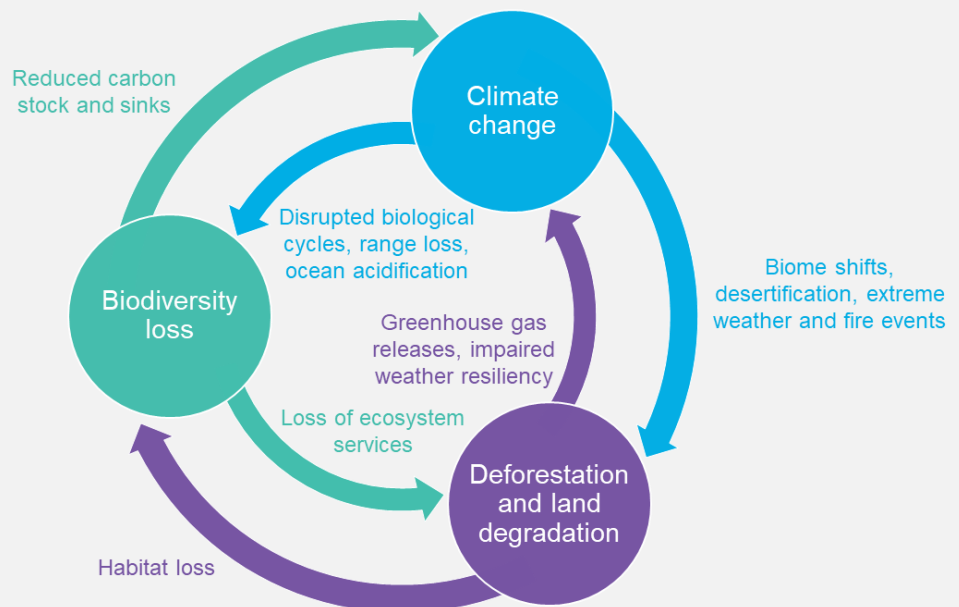
Many interventions to reduce the drivers of nature loss also produce cost savings and productivity improvements that can improve the competitiveness and market positioning of the firm deploying them. This logic underpins much of the circular economy, where conventional resource extraction is replaced by recycling or reuse. Likewise, capex spent on resource efficiency can significantly lower opex requirements, increasing the longer-term profitability of a company or production process. For companies operating in industries with tight margins, even small opex savings can be meaningful for the bottom line.

The type of intervention taken, and the source of finance, can both be drawn from a wide range of options. There clearly exist marginal cases where the replacement process or technology reduces some direct drivers while increasing others by an almost equal amount, though these are not in line with the conceptual point made in this report.

**Nature loss and climate change**

Nature and climate are interlinked, though they are not “two sides of the same coin”. Rather, climate change is one of numerous phenomena that contribute to the health and resilience (or lack thereof) of the natural world. As noted above, rising temperatures hasten the decline of nature. Land- and sea-use change, the primary driver of nature loss, also contributes significantly to climate change, reducing the resiliency of the biosphere and exacerbating further impacts. Likewise, deforestation and habitat loss release stored carbon that amplifies temperature increases. Investments into climate change mitigation technologies or practices can be considered part of broader nature-related investments.

**Figure 4: Relationship between nature loss and climate change**



Source: BloombergNEF, United Nations Environment Programme. Note: Figure shows simplified depiction of the relationship.

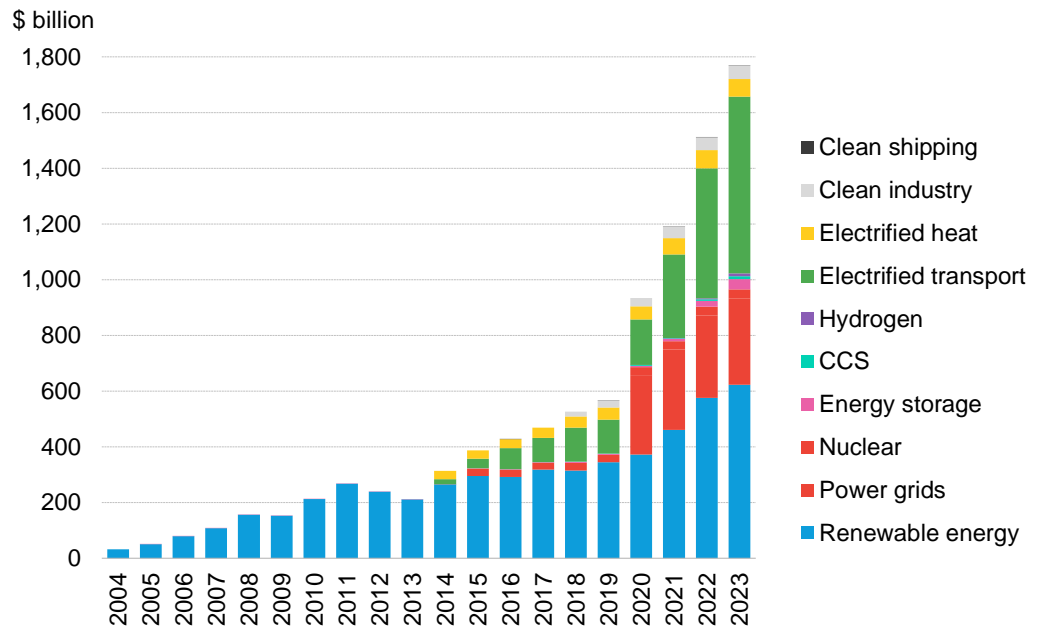
**2.3. We’ve been here(ish) before**

Much of the investment thesis outlined above echoes arguments made throughout the unfolding of the energy transition. In the late 20th century, growing awareness of the energy sector’s impact

on the climate spurred a large-scale push to find solutions, opening opportunities for investors in the new millennium. The move away from the most heavily emitting energy sources – fossil fuels – would lead to them being supplanted by cleaner alternatives. Total investment into the energy transition has increased to almost \$1.8 trillion in 2023, from around \$200 billion in 2010 (Figure 5). Note that early efforts to bring temperature rises in line with the (then unsigned) Paris Agreement did not require investment in removal technology, but in abatement. Each of the technologies deployed, including renewables, electrified heat and transport, nuclear, hydrogen, storage, and clean industry and shipping is still a contributor to overall emissions.

These abatement technologies are categorized as energy transition investments because they mitigate the impacts of a high emitting incumbent. The same can be expected for the nature transition, though a much wider range of new technologies and interventions will be needed than the concentrated solutions powering the energy transition.

**Figure 5: Global energy transition investment, by sector**



Source: BloombergNEF. Note: Start years differ by sector, but all sectors are present from 2020 onwards; see main report for more detail. Most notably, nuclear figures start in 2015 and power grids in 2020. 'CCS' refers to carbon capture and storage.













**The role of monitoring and data in addressing nature loss**

Evaluating the state of nature is challenging. The lack of cost-effective and accurate measurement and monitoring tools can hinder company-level interventions due to uncertainty surrounding possible impact. Technologies that facilitate better assessment of nature-related impacts therefore play an important role in addressing the direct drivers of nature loss. A suite of innovations has emerged, creating a competitive market spanning satellite-based remote sensing, geospatial analysis, drone-based Lidar (light detection and ranging), genetic testing and acoustic recording devices, among others. While these products and services do not constitute direct nature interventions, they play a supplementary role in halting and reversing nature loss and are therefore considered an avenue for nature-related investment.

## Section 3. Realizing financial opportunities from nature-related interventions

BNEF has profiled 12 instances of companies that are realizing financial gain by mitigating the drivers of nature loss. The cases are diverse, covering a variety of industries, geographies, types of financial return, and drivers of nature loss addressed. Table 2 provides a high-level overview.

Table 2: Case studies included in this report

Company	Sector	Technology or process	Financial opportunity realized	Nature loss driver addressed				
				LSC	RE	CC	P	IAS
 AQUAFIL	Fashion, textiles	Infinitely recyclable regenerated nylon yarn primarily for the fashion industry and carpet manufacture	Generated €263 million (\$284 million) in annual revenue in 2023 with a 7.3% five-year CAGR					
 ECONCRETE	Concrete	Marine concrete admixture, texture agents and mold designs for sealine armoring and seaport construction	Raised \$21 million and earns \$3 million-\$5 million per project					
 ECOLAB	Water use optimization	Industrial water management system with integrated sensors and predictive analytics optimizes water use and emissions	Almost \$4 billion revenue; adjusted earnings growing 35% year-on-year					
 forico <small>future fibre</small>	Forestry	Sustainable eucalyptus forestry for wood fiber; retains natural forests for biodiversity uplift and carbon sequestration	Acquired for \$670 million after nine years; secondary revenue from carbon credits					
 gradient	Water treatment	Custom wastewater treatment systems employ reverse osmosis and carrier gas extraction to minimize water discharge	Surpassed a \$1 billion valuation in 2023; \$500 million of orders in 1Q 2024					
 NATURE METRICS	Biodiversity monitoring	Environmental DNA (eDNA) sampling and analytics service that provides organizations with biodiversity monitoring	Raised \$30.7 million since 2014; estimated \$8 million revenue in 2023					
 Perfect Day	Alternative milk	Dairy-free whey protein produced with precision fermentation, sold to food manufacturers in place of dairy ingredients	\$1.6 billion valuation; raised \$801 million since 2014					
 PHOOL <small>MADE FROM TEMPLE FLOWERS</small>	Fragrance, materials	Upcycles floral waste from temples to produce incense sticks and a mycelium-based bio-leather for the fashion industry	Raised \$11.7 million; on track for \$15 million revenue in 2024					
 PTX Trimble	Pesticides	AI-enabled precision agriculture technology reduces the volume of pesticide required on fields while retaining efficacy	Increased the annual revenue of its majority owner by an estimated \$600 million					
 REDWOOD MATERIALS	Battery storage	Lithium-ion battery recycling and material production using hydrometallurgy process on scrap manufacturing metals	\$4.5 billion valuation, with \$2 billion raised and a \$2 billion US government grant					
 slow <small>OUT OF THE FOREST</small>	Coffee	Converts former monoculture coffee plantations into biodiverse agroforests using regenerative agricultural practices	\$1 million gross profit; secured over \$8 million in contracts					
 wilder harrier	Pet food	Manufactures pet foods from an invasive silver carp species and sustainable insect protein sources	Raised \$3.2 million in seed funding; at least \$370,000 revenue from one product					

Source: BloombergNEF. Note: All revenue and fundraising figures refer to the latest year available unless otherwise stated. Wilder Harrier did not disclose its revenue, so figure is an estimate. Valuation and fundraising information is from Pitchbook. 'LSC' is land and sea use change; 'RE' is natural resource exploitation; 'CC' is climate change; 'P' is pollution; 'IAS' is invasive alien species; 'CAGR' is compound annual growth rate; 'AI' is artificial intelligence.

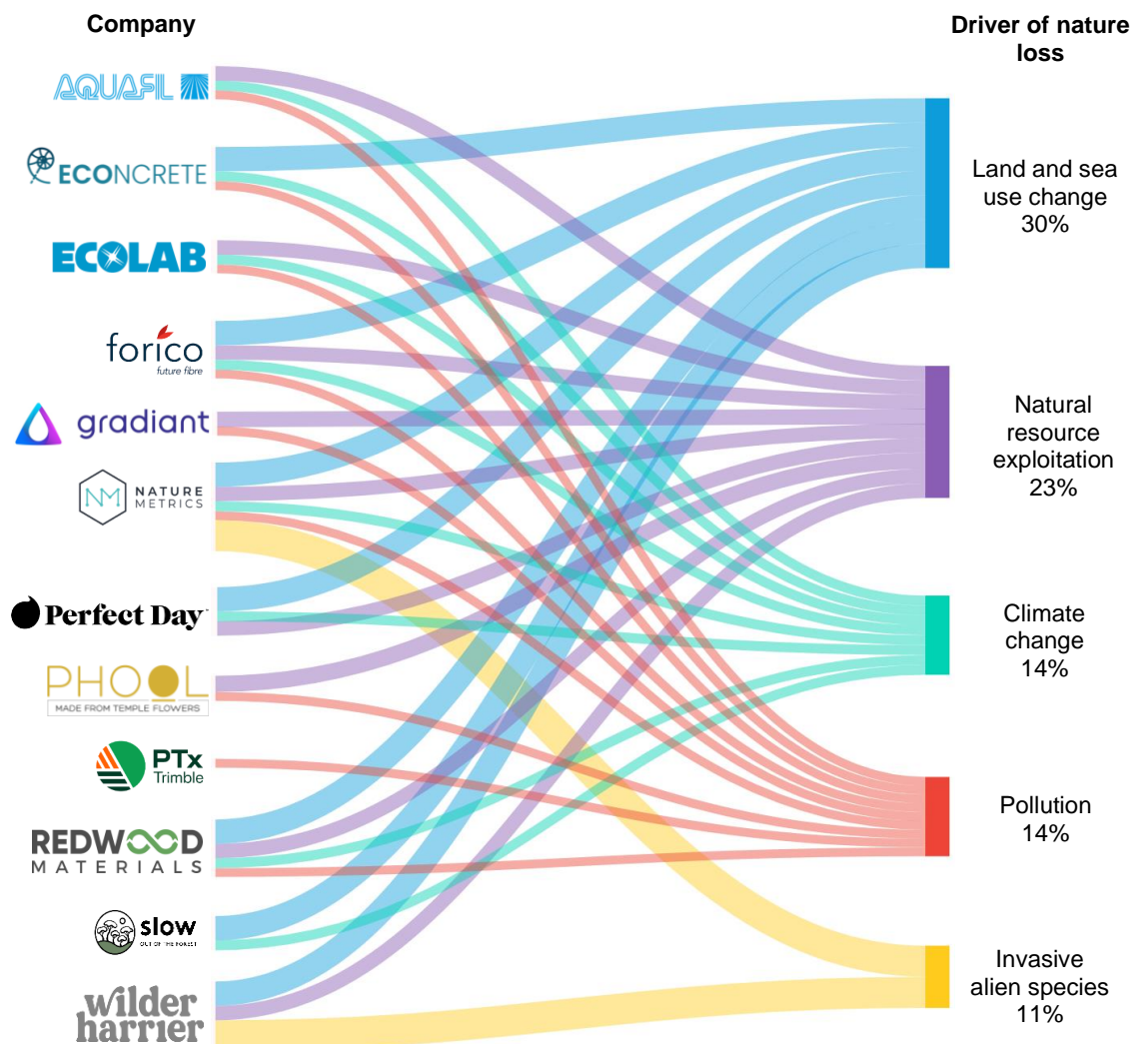
Company comparison

The cases intentionally span a wide range of industries, segments, geographies and ownership structures. However, they are by no means exhaustive of the nature-related investment opportunities that exist, nor are they proportionate to the opportunities' scale or significance.

Each case study follows a similar structure to enable comparison, and includes reference to competitors whose businesses also address the drivers of nature loss (Appendix A).

Reductions in all five of the direct drivers of nature loss are covered among the selected companies, with most business models addressing more than one driver. Figure 6 breaks this down further, capturing each company's role in nature loss mitigation.

**Figure 6: Contribution of profiled companies to the drivers of nature loss, weighted by each driver's overall share of nature loss**



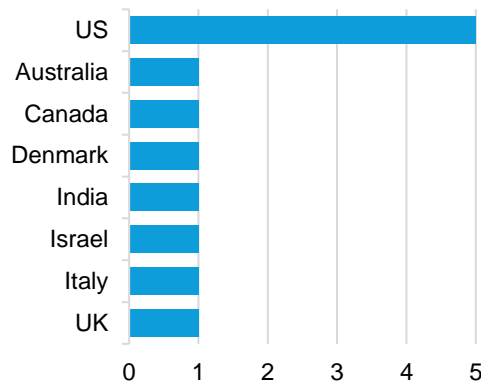
Source: BloombergNEF. Note: Strand thickness reflects the relative overall contribution of each driver to total biodiversity and ecosystem loss.

Pollution is the driver most frequently reduced among the cohort, with nine of the companies reducing the pressure that it exerts on nature loss. Only two companies reduce the spread of

invasive alien species, reflecting the challenges of commercializing control measures. Eight firms mitigate climate change and natural resource exploitation, and eight reduce pressure on land- and sea-use change.

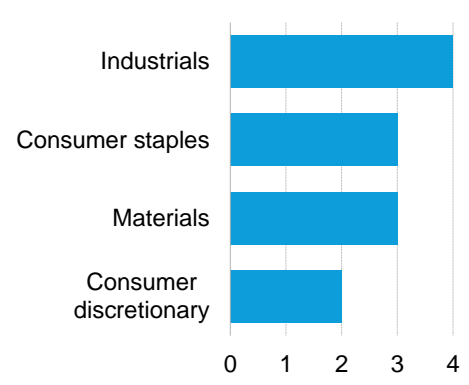
The companies were selected with the aim of showcasing variation in both geography and sector (Figure 7 and Figure 8). While five are headquartered in the US, the remaining seven are each drawn from different regions. All of the US-based companies are international, selling products and services globally.

**Figure 7: Cohort's geographic distribution**



Source: BloombergNEF. Note: By stated headquarter locations.

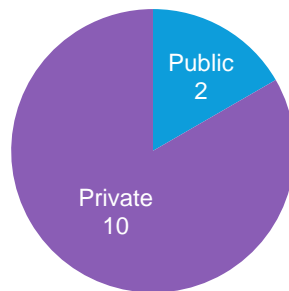
**Figure 8: Cohort's broad industry grouping**



Source: BloombergNEF. Note: According to BICS Level 1 categorization.

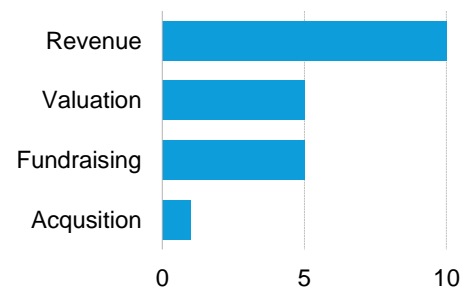
Ten of the companies profiled are privately held, with only two public equities. This is because many of the opportunities examined are emerging technologies still under development by startups. Accordingly, efforts to quantify the size of the realized opportunities are mainly expressed in terms of revenue, valuation or fundraising.

**Figure 9: Most of the profiled companies are privately held**



Source: BloombergNEF

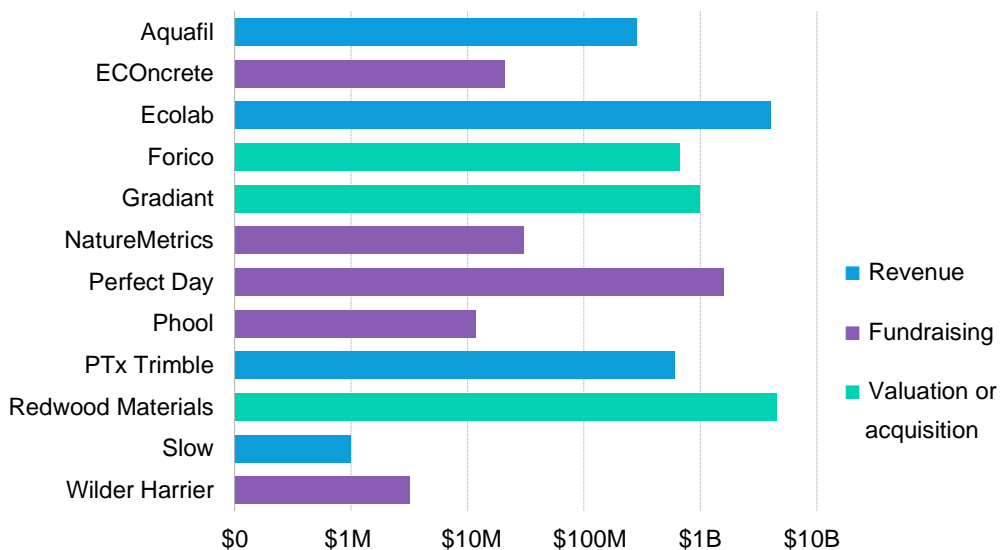
**Figure 10: The types of financial opportunities generated by the cohort**



Source: BloombergNEF. Note: Multiple categories can apply to each company.

Disparate scale of financial opportunity is also evident among the cohort, ranging from multi-billion-dollar company valuations and equity raises, to revenue streams in the single-digit million range and angel investments (Figure 11).

Figure 11: Primary type and size of opportunity realized by each company



Source: BloombergNEF. Note: X-axis is logarithmic; M refers to million; B refers to billion. Only covers the primary (largest) source of financial return for each company.

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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# Aquafil’s Regenerated Nylon Fashions a Revenue Opportunity

Fashion and textiles have multifaceted impacts on our planet. The sector accounts for 10% of worldwide emissions and is the third-largest source of water degradation, causing 20% of global clean water pollution. Around 87% of all textile waste goes to landfill each year, leaching chemicals into groundwater and soil.

Headquartered in the Italian Dolomites, Aquafil is a manufacturer of carpet and clothing yarn. In 2011, it launched a nylon entirely produced from pre- and post-consumer waste that would otherwise go to landfill. The yarn is infinitely regenerable and cuts carbon dioxide emissions up to 90% relative to its oil-derived equivalent. In 2023, the product line accounted for €263 million (\$289 million) of Aquafil’s fiber sales – almost half of the company’s total – with 1,700 brands using it as a production input. As regulatory pressure grows on apparel firms to mitigate environmental impacts, the company is well positioned to unlock further opportunities in a sustainable fashion market estimated to be worth \$33 billion by 2030.

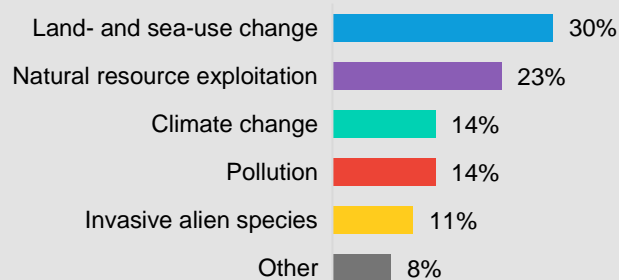
## The nature-friendly product

Founded in 1965, Aquafil produces yarn for clothing and carpets, with the latter used across a wide range of applications, from commercial buildings to vehicles. It developed Econyl, a regenerated nylon derived from plastic waste which is infinitely recyclable and an alternative to emissions-intensive oil-based nylon.

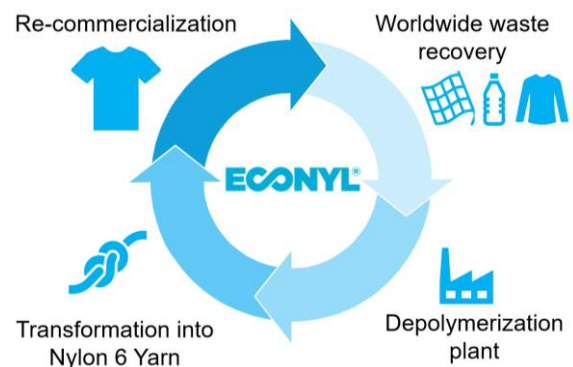
The Econyl ‘regeneration system’ retrieves waste that would otherwise be discarded in landfill or risk entering the environment, including discarded fishing nets, fabric scraps, carpet flooring and industrial plastics. These are then sorted and cleaned to recover all the embedded nylon. A chemical recycling process restores the nylon waste to an as-new condition, retaining the qualities of virgin nylon without the environmental footprint of the conventional material. The reformed synthetic strands are finally spun into yarn or processed into polymers for use in fashion or interior textiles. The recyclability of Econyl means that when products are no longer useful, they can be used as an input for step one of the regeneration process, preventing end-of-life waste.

### Mitigating nature loss

Five drivers account for over 90% of global biodiversity and ecosystem decline. Aquafil addresses resource exploitation, climate change and pollution.



### Econyl regeneration system



Source: Aquafil, BloombergNEF.

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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Aquafil operates on a B2B model, serving clients across multiple industries but primarily selling nylon yarn for the fashion industry and carpet manufacture. Brands are increasingly opting for recycled inputs to help them meet sustainability goals. Multiple luxury car models now feature Econyl nylon in their floor mats and trim, including Jaguar Land Rover, Mercedes Benz, BMW's electric vehicles and Maserati's first fully electric SUV, the Grecale Folgore. Doing so reduces the vehicles' carbon footprint, aids end-of-life circularity and supports sustainable branding efforts.

Flooring also presents an opportunity for buildings to meet sustainability certifications as it provides a way to reduce embodied carbon. More building developers are opting for Econyl-based carpets to earn LEED credits, awarded based on green building practices, including waste reduction and the environmental impact of the materials used.

### Nature impact of regenerated nylon

The Econyl regeneration process enables the production of nylon derived fully from pre-and-post industrial waste. This cuts emissions by up to 90% during production, saving 7 barrels of oil and 6.5 metric tons of CO2e for every ton of Econyl produced. The manufacturing process of nylon is energy intensive and contributes to water pollution through the use of chemical dyes. Scope 3 emissions account for 95% of an apparel firm's carbon footprint, driven by the use of oil-derived synthetic fabrics, such as nylon, in the production of garments.

The use of waste as a feedstock avoids pollution from entering the environment, with over 16,000 metric tons of post-consumer waste collected and converted to Econyl products in 2023, and a target to reach 35,000 tons by 2025. To increase the amount of waste it processes, the company has started or invested in initiatives for end-of-life carpet and rug collection in the US and fishing net recovery in Norway.

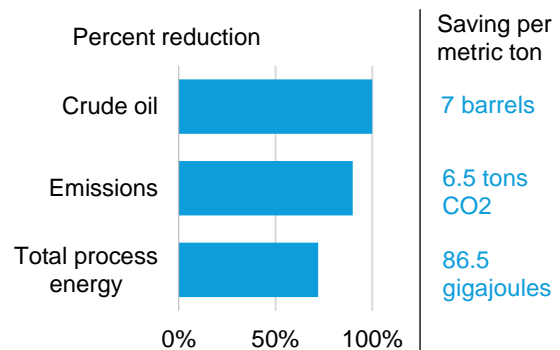
Synthetic fibers, including recycled nylon, contribute to microplastic pollution, with synthetic garments alone accounting for 35% of microplastics released into the

environment where they are particularly harmful to marine species. Aquafil has developed a methodology for measuring microplastics output from textiles as a first step to help designers make more informed textile decisions that reduce pollution, one of the main drivers of nature loss.

Econyl yarn does not use water in its solution dyeing process, eliminating the need to process wastewater and mitigating the product's total water pollution. The broader textiles industry is responsible for 20% of global drinking water pollution, according to the European Environment Agency.

Currently, 98 million metric tons of nonrenewable fashion textiles are generated every year. As Econyl is fully recyclable, clothes made from it can be collected and recycled at end of life, reducing the volume of clothes entering landfills, and thus pollution.

### Econyl harm reduction relative to oil-derived nylon, across energy, emissions and oil



Source: Aquafil, BloombergNEF. Note: Chart shows percentage reduction in crude oil, emissions and energy. Blue numbers are absolute savings for each metric ton of conventional nylon replaced by Econyl.

### Financial performance

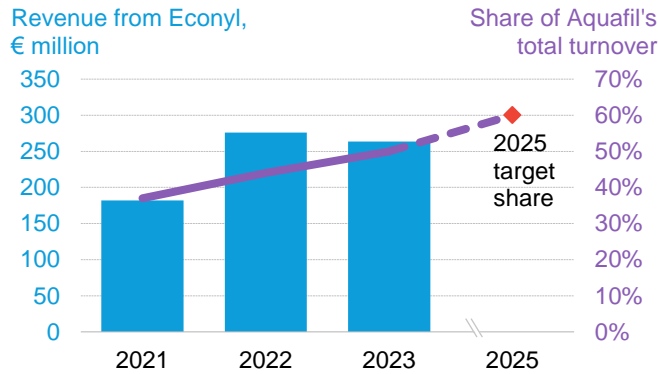
Demand for Econyl has driven Aquafil Group turnover in the past five years, with revenue from the recycled product line growing at a compound annual rate of 7.3% over 2018-2023, versus a 3.3% annual decline across the company's other fibers. The material accounted for 50% of total fiber revenue in 2023, at €263 million, an increase from 37% in 2021. The company targets a 60% revenue share for Econyl by



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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2025, with overall volumes set to grow 15-20% over 2024-25.

### Aquafil's revenue from Econyl



Source: Company reports, BloombergNEF.

The Milan-listed company completed a €40 million equity raise earlier in 2024 to drive growth of regenerated and Econyl-branded products to boost its market share in the US. In 2023, Aquafil invested €10.7 million in R&D to develop technologies and circular products to reduce environmental impacts, including plant-based nylon.

### Broader opportunities within the sector

Industries from apparel to autos are under pressure to reduce their environmental footprint as policymakers begin to tighten regulation on the nature impacts of textiles. Under the EU's Strategy for Sustainable and Circular Textiles, the European Commission will set design rules requiring that textiles are easier to repair and recycle and have a minimum recycled content.

In response, apparel companies have set targets on recycled content, in addition to emissions reduction. Aquafil's more sustainable offering helps companies covered by these regulations to meet targets without compromising quality. Bloomberg Intelligence has identified at least 1,700 partnerships between Aquafil and brands including Gucci, Prada and H&M.

The sustainable fashion market is forecast to reach \$33 billion by 2030, presenting a substantial opportunity for companies offering recycled nylon. The global recycled nylon market was worth \$423 million in 2022 and is projected to reach \$958 million by 2032, a

compound annual growth rate of 8.5%. Three further prominent producers of sustainable and circular materials are profiled in the table below.

### Notable Aquafil competitors

Company	Description	Financial gain
<b>Lenzing</b>	Austria-headquartered public company producing wood-based fibers for use in clothing and home textiles. It employs technologies to preserve resources and reduce environmental impact.	€2,521 million in revenue in 2023.
<b>Geno</b>	Startup using bioengineering to produce plant-based nylon and sustainable materials for a variety of industries.	\$388 million raised, including investment from Lululemon.
<b>Bolt Threads</b>	California-based public material solutions company selling bio-based leather and silk fibers for fashion and beauty.	Merger with Golden Arrow valued the company at \$346 million.

### Analyst take

Econyl is a growing portion of Aquafil's fiber sales and is on track to account for 60% by 2025. As nature and climate regulations tighten on the company's client industries, the regenerated nylon yarn offers a solution to meet sustainability targets and mandates. Corporate sustainability targets, including the use of recycled materials and circular design, will raise demand for sustainable material solutions over the next five years. While the company's capital raise discounted shares this year, the €40 million equity generation is set to drive growth of Econyl products, cost rationalization and innovation, positioning the firm to capture a bigger share of the sustainable textiles market.

#### More from Bloomberg Intelligence:

This case was authored by Bloomberg Intelligence. For related research from BI, see: [Nature Is in Fashion: Supply-Chain Oversight Key \(terminal\)](#) and [Unlocking Nature's Value: Enablers' \\$10 Trillion Opportunity \(terminal\)](#)

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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# ECONcrete Harbors Sealife on Critical Marine Structures

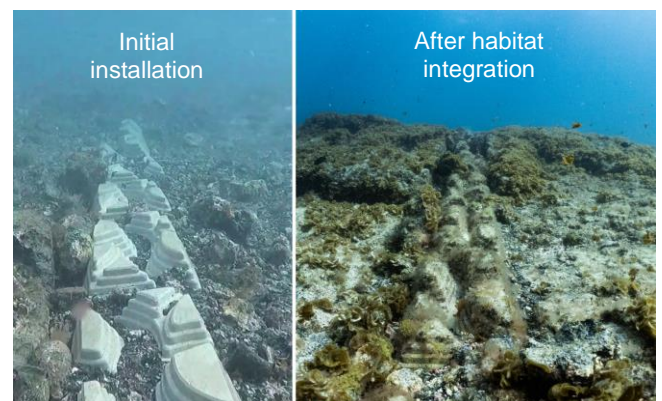
Concrete is the most widely used material in coastal and marine infrastructure, on account of its versatility, durability and cost-effectiveness. However, concrete installations reduce biodiversity in local ecosystems as they replace natural substrata with artificial structures that are less able to support life, while their high-pH composition impedes organisms on the water’s surface. Producing concrete also accounts for around 4% of global carbon dioxide emissions.

Israeli-founded ECONcrete redresses much of conventional marine concrete’s nature impact. Marine infrastructure companies employ its patented admixture, texture agents and mold designs to produce materials with a significantly lower environmental footprint for public and private developments. As of October 2024, ECONcrete’s technology has facilitated the delivery of materials for 40 shoreline armoring and seaport construction projects, tapping into a market worth \$178 billion in 2023 and raising \$21 million from 21 investors, including a grant from the European Innovation Council’s Accelerator.

## The nature-friendly product

Established in 2012 by two marine biologists with expertise in ecological engineering, ECONcrete produces technology enabling the manufacture of concrete products for use in coastal and marine infrastructure projects. To achieve a lower biodiversity footprint relative to conventional concrete, the company developed a proprietary admix – a substance added to a concrete mixture to alter its properties. This comprises 10% of the final material, reducing its pH and the amount of cement required. The concrete is then shaped to form ecological niches and a complex surface texture, which encourages biodiversity uplift by replicating the conditions of undisturbed marine habitats. This process is an example of biomimicry – the imitation of natural phenomena in human inventions – which has led to technological improvements in many products, including Velcro, trains, wind turbines and architecture.

## ECONcrete technology deployed for submarine cable protection in the Canary Islands

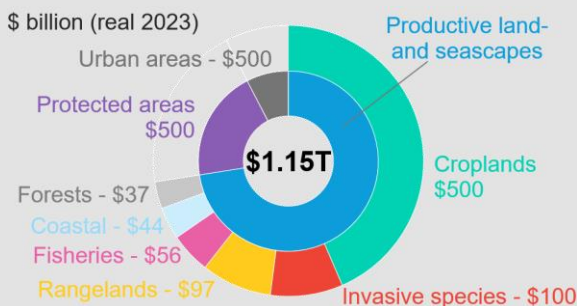


Source: ECONcrete. Note: Images taken in May 2022 and March 2023, between Lanzarote and Fuerteventura.

The creation of more hospitable habitats for marine life offers several benefits to customers, which ECONcrete

### Mitigating nature loss

Biodiversity finance has to rise to an annual \$1.15 trillion by 2030. Marine infrastructure providers such as ECONcrete mitigate coastal biodiversity loss.



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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asserts justifies the 10-15% price premium over conventional concrete. The decreased environmental impact reduces costs incurred from possible environmental penalties, shortens project permitting time and cuts maintenance. As organisms grow on the material's surface, their combined biomass adds weight and increases the stability of the marine structure, also providing defense against chloride penetration and boosting the concrete's compressive strength.

ECONcrete's products vary in form and function, including articulated concrete mattresses, erosion control structures, cabling protection and tide pools, while deployment is typically in conjunction with governments seeking to replace existing marine infrastructure. Several notable examples from across the company's 40-strong project portfolio include:

- Living Breakwaters: A large-scale application of ECONcrete in the construction of eight breakwaters protecting New York and Long Island after Hurricane Sandy (2021-2024).
- Supplying ecologically engineered subsea cable protection mattresses for a US-based 800-megawatt offshore wind farm (2024).
- Protection of a 132 kilovolt submarine high-voltage cable running 14.5 kilometers between the Canary Islands (2023).
- Port of Cala Ratjada, Spain: Ecologically enhanced breakwater (2022).

## Biodiversity benefit of ECONcrete

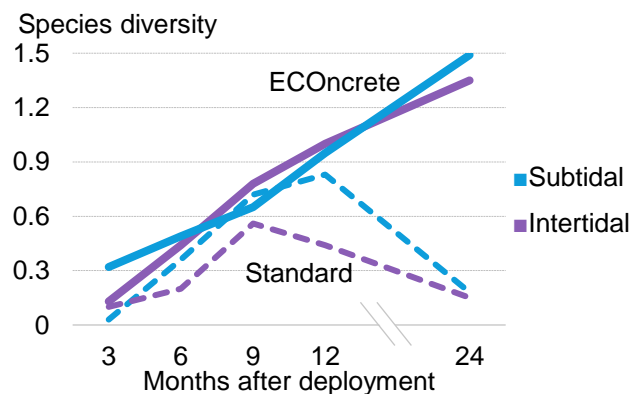
Conventional concrete typically comprises 10-15% Portland cement, 15-20% water, and aggregates such as gravel, sand or crushed stone, with the mixture cast into the requisite form and then cured. The surface of the final product is usually designed to be as slick as possible, aiding water flow and reducing the potential for residue build up, but creating a less hospitable environment for organisms.

Products comprising ECONcrete's technologies do the opposite. Each is specifically designed for the marine environment where it is deployed, cast to form niches

for endangered species or nurseries for local fauna. For instance, the company's coastline barriers are shaped to allow pools to naturally form, providing a habitat for crabs, starfish and sea anemones. The concrete is also finished with a complex surface texture to mimic natural rocks and encourage biogenic growth. As calcium carbonate accumulates in the exoskeletons of calcitic species growing on this surface, it creates a barrier preventing the release of harmful chemicals from the concrete and enhancing the strength and durability of the structure.

Projects using ECONcrete technologies typically see substantial biodiversity uplift relative to conventional concrete installations. In the first 12 months following deployment, the two are comparable. But beyond this, species diversity and richness are considerably higher for ECONcrete in both subtidal and intertidal environments.

## Biodiversity on ECONcrete blocks relative to standard concrete



Source: *Integrated Environmental Assessment and Management, Vol. 18, BloombergNEF*. Note: Species diversity calculated using the Shannon-Weiner Index.

The company's production methods also mitigate climate impacts – another driver of nature loss. By encouraging the formation of a biological crust on the products, it prevents some carbon dioxide from being released into the atmosphere. For every kilogram of calcium carbonate created by the marine organisms, 120 grams of CO<sub>2</sub> are captured, which ECONcrete says is equivalent to the carbon sequestration of 100 adult trees for one kilometer of its seven-meter-high

seawall. This is in addition to the emissions savings from the use of an admix that uses ‘supplementary cementitious materials’ (SCMs) such as by-products and recycled materials in place of Portland cement.

## Financial performance

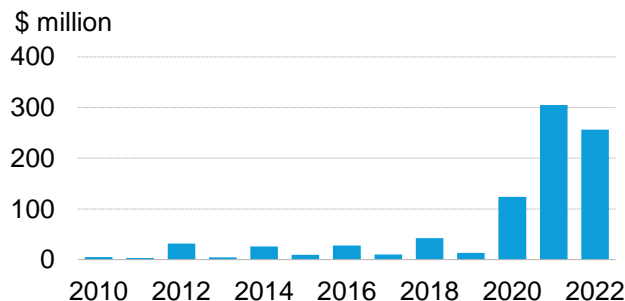
Since being established in 2012, ECONcrete has raised approximately \$21 million from 21 investors, according to PitchBook data. This includes €2.5 million (\$2.7 million) from the European Union’s Horizon 2020 SME Instrument, with other notable investments made through Barclays’ Sustainable Impact Capital, Bridges Israel, and a North American family office with an interest in ocean health.

The company has yet to disclose its revenue, although confirmed to BNEF it earns \$3 million to \$5 million for larger projects. Several venture capital and private equity research houses estimate the firm’s revenue is in the mid-single-million dollars, while the increasing number of projects it has undertaken in recent years implies a robust compound annual growth rate.

## Broader opportunities within the sector

The number of companies developing cement with lower emissions or a reduced biodiversity impact is growing, as is investor interest in the sector. Low-carbon cement companies tracked by BNEF have raised over \$900 million since 2010.

### Investments and grants in low-carbon cement companies



Source: BloombergNEF, PitchBook, company reports.

The challenges of decarbonizing the production of one of the highest emitting materials are manifold, likely

requiring a stack of solutions. Three ‘sustainable’ cement and concrete producers are profiled below.

### Leading sustainable concrete companies

Company	Description	Funding
<b><u>Betolar</u></b>	Finnish pre-cast concrete startup that uses fly ash and slag instead of cement. Its Geoprime product emits 80% less CO2 than conventional concrete.	Raised \$55 million and listed on the Helsinki Nasdaq, reaching a valuation of \$25.2 million as of October 2024.
<b><u>Brimstone</u></b>	US-based company replaces limestone calcination by leaching calcium silicate rock and also yields SCMs and magnesium byproduct that absorbs CO2.	Raised \$62 million from investors including Breakthrough Energy. <u>Awarded</u> up to \$189 million grant from US Department of Energy.
<b><u>Biomason</u></b>	Produces ‘biocement’ by combining calcium and CO2 with bacteria. Recycled aggregate is added to make tiles. Requires less energy and is carbon neutral.	Raised \$97 million, including a \$64 million Series C led by 2015 and supported by investors including Celesta Capital and Hartree Partners.

Source: BloombergNEF, companies’ websites, Pitchbook.

### Analyst take

Concrete companies are increasingly unlocking value from sustainable product portfolios. The Global Cement and Concrete Association, which represents 80% of the global cement industry by volume outside of China, recommends its members adopt specific water and biodiversity policies. Concrete can offer both climate adaptation and mitigation services through the manner of its production and deployment of infrastructure. ECONcrete does so while also reducing additional direct drivers of biodiversity loss.

#### More from BNEF:

*Tech Radar: Low-Carbon Cement* ([web](#) | [terminal](#))

*Industry Decarbonization Market Outlook 1H 2024* ([web](#) | [terminal](#))

Note: ECONcrete was one of 12 startups chosen as winners in BNEF’s 2021 Pioneers competition.

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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# Ecolab Cleans Up Billions With Water Efficiency Solutions

Water scarcity is a growing global issue amplified by overconsumption, poor resource management and the escalating effects of climate change. By 2050, \$70 trillion of global GDP could face high water stress, exacerbating nature loss through reduced freshwater availability, habitat destruction and pollution. Public health (a 30% rise in population by 2050), food security (56% more food required) and climate change (47% rise in energy demand) are straining availability further.

Minnesota-headquartered Ecolab Inc. offers a range of solutions to improve resource efficiency and minimize environmental impact throughout a product’s lifecycle. Its ‘3D Trasar’ water management system monitors and optimizes water use in real time by integrating sensors, chemistry and predictive analytics in production processes. Initially developed for cooling systems, it is now used in wastewater, boiler and process water systems to control corrosion, scale and microbial fouling, and to enhance efficiency. The resource-optimization technology drives cost savings for clients by saving water, reducing energy consumption and curbing GHG emissions; Ecolab’s industrial business generated \$7.2 billion in 2023.

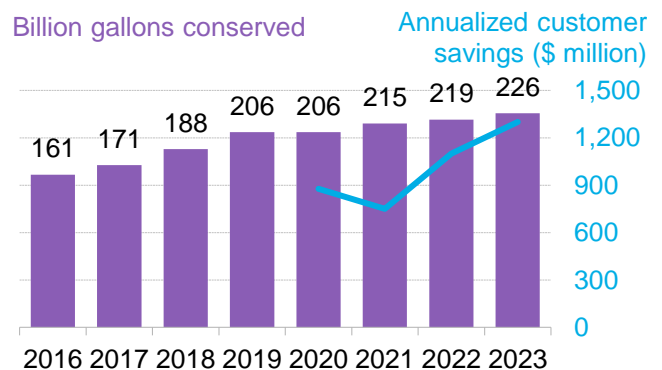
## The nature-friendly product

Founded in 1923, Economics Laboratory – now Ecolab (NYSE: ECL) – sold cleaning products to hotels and restaurants, later expanding to cover water, hygiene and infection-prevention solutions. Over the years, it has diversified its offerings to address critical resource challenges, serving over 40 industries in 170 countries.

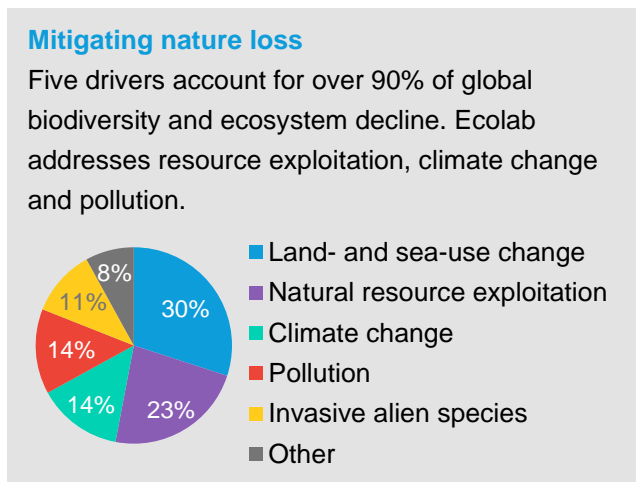
Its flagship technology, 3D Trasar, uses a series of interconnected sensors and controllers to monitor water flows and chemistry, automate water management in industrial processes, and provide insights on water quality and usage. It is particularly effective in power generation, healthcare and petrochemicals. In 2023, its clients saved over 226 billion gallons of water and cut GHG emissions by 3.8 million metric tons; Ecolab is targeting annual savings of 300 billion gallons of water by 2030.

3D Trasar is also mitigating ecosystem degradation from wastewater, thereby aiding compliance with environmental regulations by enhancing wastewater treatment, lowering discharge volumes and minimizing contamination risks.

## 3D Trasar customer water and cost savings



Source: BloombergNEF.



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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Ecolab’s development of resource-efficiency technology began in the early 2000s, in response to global concerns over water scarcity and climate change. By 2008, it had launched 3D Trasar following testing and optimization through collaborations with industrial clients. As of 2024, the technology has been adapted for commercialization across multiple sectors.

The company has expanded its portfolio through strategic partnerships with large manufacturers and industrial producers, including [Lotte Chemical](#) and [Nestlé](#).

Ecolab plans to expand its environmental sustainability offerings, announcing its intent to scale the firm’s water and energy efficiency technologies further. It publishes an annual industry study on water conservation and has formed new partnerships to drive global sustainability goals. The latter includes an extended collaboration with [Microsoft](#), employing AI and cloud-based solutions to enhance water monitoring and improve visibility of water consumption data.

## Nature impact of resource efficiency

Industrial water consumption places immense pressure on freshwater resources, driving the depletion of water bodies, degrading ecosystems and altering the water cycle at the local, regional and global level.

The World Resources Institute [expects](#) water scarcity to become increasingly more severe, raising the water risk that companies are exposed to and requiring more stringent mitigation and adaptation. In 2020, the non-profit [projected](#) a 56% global deficit in water supply relative to demand by 2030.

Ecolab’s solutions address critical nature-related challenges, particularly water use and greenhouse gas emissions. Industry accounts for nearly [20%](#) of global water use, with water-intensive processes in manufacturing, energy and mining exacerbating shortages. These sectors are also responsible for significant carbon emissions and ecosystem degradation.

Ecolab’s products support industrial processes to operate more efficiently, alleviating water stress and the associated nature loss. The company uses a proprietary exponential return on investment (eROI) approach to measure the value of improved business performance, operational efficiency and environmental impact. For instance, in a partnership with food manufacturer [Kraft Heinz](#), Ecolab notes the deployment of 3D Trasar in 2021 resulted in 51 million gallons of water saved, 1.3 billion British thermal units (BTU) of energy reduced, and 170 metric tons of CO2 equivalent avoided, with \$1.2 million in resource efficiency gains.

Another notable client, agricultural wholesaler Archer-Daniels-Midland, [cut](#) energy consumption at its ethanol facility by 60 billion BTU and 6.1 million gallons of water through Ecolab’s clean-in-place technology, delivering \$1.6 million in combined financial and operational efficiencies over one year.

The use of several Ecolab technologies [unlocked](#) \$627,000 of eROI for Marriott Vacations Worldwide. This was through several technologies that led to 46,000 pounds of waste reduced, 23.4 million gallons of water saved, 12 billion BTU of energy lowered and 1,400 metric tons of CO2 equivalent avoided.

In comparison to industry incumbents, Ecolab stands out for its targeted technological innovations that showcase a focused approach to resource efficiency across water, waste, GHG emissions and energy.

## Financial performance

Ecolab has seen significant financial gains in recent years, driven by the growing demand for sustainable solutions. Its global industrial business, where its patented 3D Trasar technology is material, represented 43% of total sales in 2023. In 2Q 2024, Ecolab reported a 7% increase in revenue, reaching \$3.95 billion, with adjusted earnings per share (EPS) growing 35% year-over-year. Revenue growth was driven by the industrial and institutional segments, which saw significant demand for water management

and hygiene solutions. As of September 2024, Ecolab's stock reached an all-time high of \$255.

### Ecolab Inc.'s share price, 2014-2024



Source: Bloomberg Terminal.

By expanding into sectors with lofty sustainability goals including life sciences, technology and data centers, Ecolab grew its total addressable market opportunities from \$32 billion in 2000 to \$152 billion today.

Ecolab estimates that efficient water management in data centers can help lower use by up to one-third even under a growth in usage requirements, based on modeling of 14 data centers. The company aims to showcase this value in priority markets — data centers, and food and beverage manufacturing — while accelerating future growth opportunities.

### Broader opportunities within the sector

The industrial water management and institutional hygiene sector is witnessing significant growth. Estimated to be worth \$323 billion in 2023, the global water treatment market is projected to reach \$617 billion by 2032, driven by heightened awareness of water scarcity and the need for more efficient resource management. This represents a sizable addressable market for resource-efficiency technology and service providers to capture.

Water management solutions are a fragmented market. Three large providers of resource efficiency technologies and solutions are introduced below.

### Notable resource efficiency technology providers

Company	Description	Financial gain
<u><a href="#">Siemens</a></u>	Siemens offers a range of solutions focused on operational efficiency, including energy management, waste reduction, and resource optimization across various sectors, emphasizing carbon footprint reduction.	In 2023, Siemens generated €72 billion in revenue, with significant contributions from its digital industries and smart infrastructure segments.
<u><a href="#">Schneider Electric</a></u>	Schneider specializes in energy management and automation solutions, enhancing efficiency and reducing energy consumption and greenhouse gas emissions.	Schneider Electric reported €34 billion in revenue for 2023, driven by strong demand for its energy efficiency tools.
<u><a href="#">DuPont</a></u>	DuPont is a global leader in chemical and material science solutions. It provides water filtration and purification technologies, and serves sectors including electronics, industrial processes and clean energy.	In 2023, DuPont reported \$12 billion in revenue, with \$5.6 billion tied to its Water & Protection segment.

### Analyst take

Technologies such as Ecolab's 3D Trasar systems provide a way for industrial companies to reduce costs while cutting water use and emissions. In particular, Ecolab is well-positioned to address the 8% annual growth rate in data centers through 2029, with its flagship technology capable of reducing water use in these facilities by up to one-third. Its focus on efficiency aligns with tightening environmental regulations, suggesting that it will see more opportunities for revenue growth and margin expansion in priority markets, including data centers.

#### More Bloomberg Intelligence:

This case was authored by Bloomberg Intelligence. For related research from BI, see:

*Innovations Are About to Transform Waste Across Many Industries* ([terminal](#))

*Adidas, Lululemon, Nike Push to Save Water Amid Scarcity* ([terminal](#))

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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# Forico Harvests \$670 Million with Sustainable Forestry

Forests cover 30% of the Earth’s terrestrial surface, occupying almost 4 billion hectares and hosting 80% of global biodiversity. Economic growth has driven a rapid depletion of this coverage, with one-third of global forest cover lost over the last 10,000 years. Agricultural commodities – such as beef, soy, palm oil and wood – are the primary culprits. Sustainable forest management plays a critical role in halting and reversing this loss.

Forico, Tasmania’s largest private forestry manager, is an exemplar of sustainable land management and ecological stewardship. The company divides its land into plantations and natural forests, deriving revenue from wood fiber harvested from the former, while conserving the latter. Together, these practices provide the managed region with biodiversity uplift and increased carbon sequestration, from which Forico generates carbon credits that serve as a secondary revenue stream.

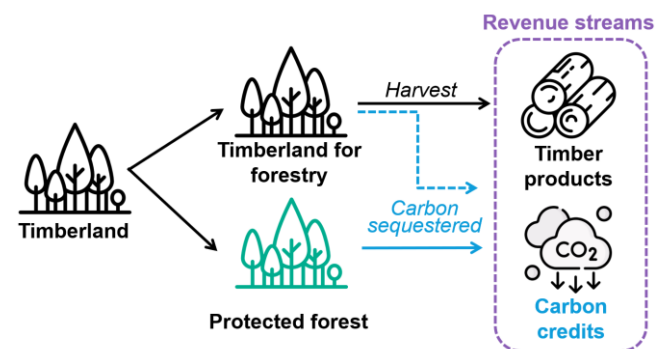
After its foundation by New Forests in 2014, the company rapidly increased in value, before being acquired by three pension funds for more than A\$1 billion (\$670 million) in late 2023.

## The nature-friendly product

Founded by nature-based investment manager New Forests in 2014, Forico Pty Ltd. is one of Australia’s largest private forest and land asset managers. It was created to manage the estate acquired from Gunns Ltd., a Tasmanian forestry enterprise that entered receivership two years before. Gunns faced repeated clashes with environmental groups due to its logging of old growth forests, use of poison to deter native wildlife and a proposed A\$1.5 billion pulp mill, which would have been the largest in the world if completed.

Forico oversees a Tasmanian estate of 173,000 hectares, an area more than twice as large Ohs Singapore. This includes 89,000 hectares of plantation dedicated to wood fiber production and 77,000 hectares set aside for managed conservation. The company is vertically integrated, owning land, forestry operations and supporting infrastructure, including processing mills and export facilities. Through these facilities, it generates revenue from hardwood – primarily eucalyptus – processed into woodchips for applications including packaging and paper.

## Forico’s revenue streams

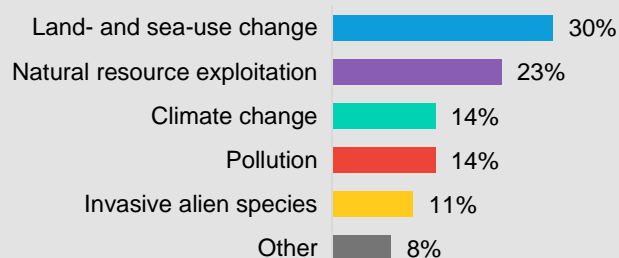


Source: BloombergNEF, Forico.

Forico is notable for integrating sustainable forest management practices and environmental stewardship

### Mitigating nature loss

Five drivers account for over 90% of global biodiversity and ecosystem decline. Forico addresses land-use change, resource exploitation, climate change and pollution.





Nature-loss drivers addressed:

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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into its operations. Some of the silviculture techniques it employs on its timber plantations include:

- **Precision forestry** using controlled-release fertilizer tablets at the time of planting to minimize later chemical application
- **Tree breeding programs**, entailing marker-assisted selection in its eucalyptus and pine trees to indirectly select for desirable traits
- **Regular plant thinning** to improve tree growth and enhance plantation productivity
- A **containerized forest nursery** to boost sapling viability and extend the planting season

Together, these practices increase plantation health and productivity, in turn boosting the amount of carbon that can be sequestered. Supplementing this with the introduction of longer rotation softwood plantations, Forico generates Australian Carbon Credit Units, known as ACCUs, through the government's Emissions Reduction Fund [Plantation Methodology](#).

### Nature benefit of Forico's forestry management

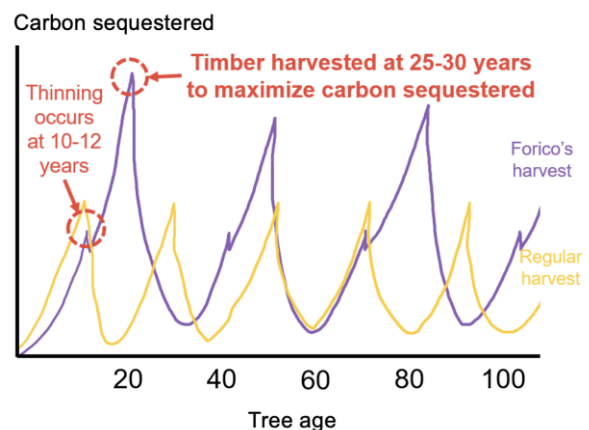
Maintaining biodiversity in forests is essential for ecosystem stability and the provision of clean air, water and climate regulation. To ensure it is doing so, Forico undertakes biodiversity baselining, with periodic assessments to monitor environmental changes. The company also promotes biodiversity uplift in its timber plantations by integrating 20% to 30% native tree species alongside commercial species. These trees support a wider range of flora and fauna, helping to sustain ecosystems and promote resilience against pests and diseases.

To protect sensitive areas from the impacts of logging and other activities, Forico establishes buffer zones around waterways and important habitats. These zones filter pollutants, limit erosion and provide corridors for wildlife, thereby promoting healthy ecosystems and preserving biodiversity. Practices such as selective logging and reduced impact harvesting are employed to minimize environmental disturbance. This approach helps maintain soil health,

water quality and habitat integrity, ensuring timber production and ecological functions can co-exist sustainably. Selective thinning, where 30% to 40% of the trees are judiciously removed, lowers competition for light and nutrients, encouraging the growth of flora in the understory, particularly saplings, shrubs and flowering plants.

Sustainable forest management also plays an important role in mitigating climate change by reducing atmospheric carbon dioxide levels, increasing resilience to natural disasters and slowing the rate of biodiversity decline. As trees progress through a longer 25 to 30 year growth cycle, they create diverse habitats, including nesting sites for birds and other wildlife, while fallen logs and deadwood contribute to soil health. More mature trees can also sequester significant amounts of carbon, absorbing CO2 and storing it in biomass and soil. Forico estimates that as of 2023, its plantations and natural forests had sequestered a total of 39.6 million metric tons of carbon, roughly equivalent to Portugal's annual CO2 emissions.

### Carbon sequestration in Forico's forests versus a regular baseline harvest



Source: BloombergNEF, Forico. Note: Chart modeled after Forico's Little Wattlebird Plantation Forestry [project](#) registered in the government's Emissions Reduction Fund.

### Financial performance

In October 2023, Australia's UniSuper, the UK's Pension Protection Fund, and the Netherlands' APG

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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Asset Management made a strategic move to acquire Forico, each securing a 33% stake in the venture. This valued the company at over A\$1 billion, a more than tripling in the nine years since its founding for roughly A\$300 million in 2014.

Forico's cashflows are derived from two revenue streams, each resulting from practices that minimize the nature impacts of commercial forest management. The company ensures a consistent supply of high-quality timber, which can command premium prices in both domestic and international markets. Customers are able to verify the sustainability credentials of the products through their receipt of certifications from two internationally recognized forest management schemes: the Forest Stewardship Council (FSC) Certification Scheme, including Ecosystem Services and the Responsible Wood Certification Scheme.

Meanwhile, ACCUs generated through its carbon sequestration are purchased by businesses looking to offset their emissions, creating an additional revenue stream. The spot price for one unit – which represents one metric ton of carbon dioxide removed – was A\$36.80 as of September 30. By the end of the second quarter of 2024, Forico's two projects registered under the government's methodology had yielded a total of 26,984 ACCUs.

### Broader opportunities within the sector

Sustainably managed forestry investments are emerging as an attractive asset for investors, particularly with increasing demand for sustainable wood products and rising awareness around climate change. The global forest sector generates over \$622 billion in total annual revenue according to Bloomberg data, highlighting the scale of the industry.

While most investment to date has been in the US, the sustainable forestry sector is steadily expanding into other regions. Three examples of Forico's competitors are briefly examined in the table below.

### Notable Forico competitors

Company	Description	Financial gain
<u>Svenska Cellulosa Aktiebolaget (SCA)</u>	The Swedish forestry manager owns forests in Northern Sweden and the Baltics. It created a digital forestry planning tool that utilizes data from forest laser scans, harvesters and artificial intelligence.	SCA generates over €1 billion (\$1.1 billion) in annual <u>revenue</u> , primarily from its forestry operations.
<u>One Forty One</u>	A vertically integrated forestry management company managing assets across Australia and New Zealand. Forests in both countries have globally recognized certifications for its sustainable practices.	Campbell Global (acquired by JPMorgan in 2021) invested over A\$26.5 million in 2022.
<u>New Forests</u>	New Forests, which runs Forico projects, manages 1.3 million hectares of land, with 15% dedicated to conservation efforts. It emphasizes a focus on natural capital strategies.	Majority-owned by Mitsui and Nomura, it raised A\$450 million in 2023 for its sustainable forestry fund.

### Analyst take

Forico is an archetype of a forestry manager integrating sustainable land management into its operations, generating financial returns while positively impacting the drivers of biodiversity loss. Its acquisition in 2023 further underscores its value as a significant asset in the growing market for nature-based investments. Although Forico's approach to forestry is not groundbreaking, it serves as an example for others to follow and reflects a broader strategy of mitigating nature-related transition risks that many investors and companies are increasingly prioritizing in today's market. As environmental concerns become more pressing, integrating sustainable practices into forestry operations is key for long-term viability and profitability.

#### More from BNEF:

*Australian Carbon Credit Units: Supply Primer* ([web](#) | [terminal](#))

*Carbon Offset Methodologies 101: Nature-Based Projects* ([web](#) | [terminal](#))

# Gradiant’s Treatment Tech Draws Water-Stressed Industrials

Industrial use accounts for around 20% of annual freshwater withdrawals globally. About half of large companies are bringing water-related concerns to discussions with their supply chain, as access to water becomes an increasingly salient nature risk. Firms that use water intensively face supply disruptions that could impact their operations and revenue, while wastewater discharge poses hazards to aquatic ecosystems. Wastewater treatment and recycling systems can alleviate both of these risks.

US-based Gradiant Corp. designs and builds custom wastewater treatment systems that lower industrial customers' operating expenses by recovering water and using less energy, and decrease capital expenses by keeping pressure low enough to avoid specialized equipment. In turn, companies withdraw less freshwater and limit pollution from discharged water. Demand for Gradiant’s products has been strong, leading to it securing \$500 million in new orders in the first half of 2024. The company surpassed a valuation of \$1 billion when it closed its Series D round in 2023.

## The nature-friendly product

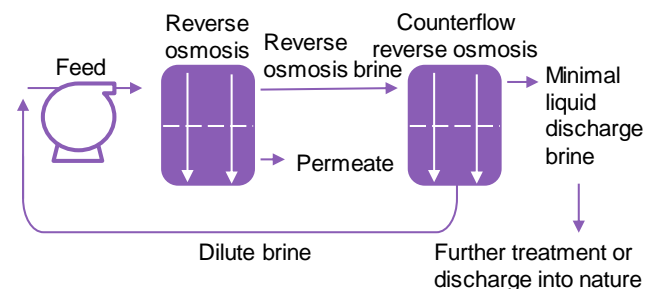
Founded in 2013, Gradiant is a spinout from the Massachusetts Institute of Technology. It built its first US plant to treat and recycle industrial wastewater in 2014, before expanding into China and India in 2017.

Industrial wastewater treatment is difficult and costly. Each stream requires custom solutions to remove contaminants and to reach the level of purity required for the water to be reused in an industrial process or discharged to the environment.

Gradiant’s wastewater systems employ several technologies depending on customer needs.

Counterflow reverse osmosis (CFRO), for example, improves on existing reverse osmosis technology. Reverse osmosis uses pressure to push brine through a membrane, drawing clean water through and leaving more contaminants behind. CFRO improves on this process by circulating a diluted salt solution to lower the concentration differential across the membranes. This in turn lowers the pressure required to move water through the membranes. CFRO has lower capex and opex than an analogous ultra-high-pressure system, lowering costs by 44% for the same recovery rate and brine concentration.

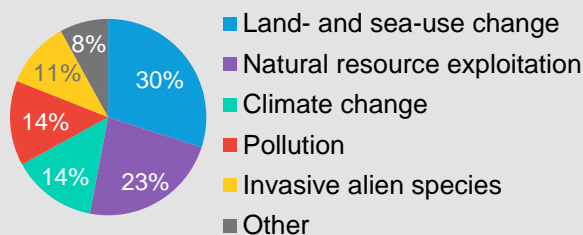
## Process flow diagram for Gradiant’s RO Infinity product



Source: BloombergNEF, Gradiant.

### Mitigating nature loss

Five drivers account for over 90% of global biodiversity and ecosystem decline. Gradiant’s technology addresses natural resource exploitation and pollution.



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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Gradiant’s customers include semiconductor makers and pharmaceutical and mining companies, all of which need reliable sources of freshwater – and all of which can negatively impact natural resources through their discharge. In addition to design and building work, Gradiant offers two further project financing models, affording clients flexibility in terms of the plant’s operation, maintenance and ownership.

Gradiant has recently expanded into different markets, highlighted by its acquisitions of [WaterPark Environmental](#) and [H+E Group](#) in 2022 and 2023, respectively, both of which sell services to the semiconductor industry.

### Nature impact of industrial water usage

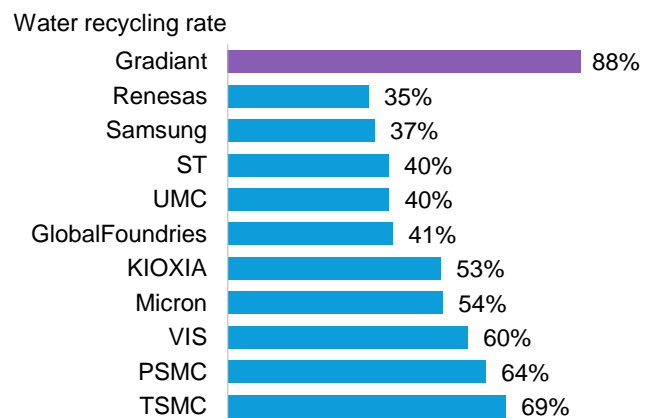
The large volume of water required by industrial processes can contribute to local water supply stress. The **\$527 billion** semiconductor industry is a particularly intensive user, requiring ultrapure water with low amounts of contaminants to clean the silicon wafers.

Water risk in the sector is becoming more pronounced. In response to a severe drought, Taiwan – which accounts for **92%** of advanced chip manufacturing capacity globally – in 2021 restricted water supply to some industrial users by **15%**, including a semiconductor manufacturing hub. Taiwan Semiconductor Manufacturing Company (TSMC) [plans](#) to open three chip manufacturing facilities in Arizona, a region in the United States that faces persistent [droughts](#).

The wastewater produced by industrial sources can have [negative impacts on local aquatic ecosystems](#). Industrial wastewater discharge can reduce the concentration of dissolved oxygen, affecting the disease immunity of fish and impede their swimming ability. Wastewater that is significantly different in temperature to that of aquatic systems can directly harm wildlife, and discharge with suspended solids can limit penetration of sunlight to the detriment of various ecological processes, particularly those involving photosynthesis.

To improve their resilience to water scarcity and comply with environmental regulations, semiconductor companies employ wastewater recycling, reuse and treatment. Recycling and reuse of wastewater reduces freshwater withdrawals, while treatment reduces the pollutants present in wastewater before it is discharged to the environment. A few semiconductor manufacturers have water recycling rates above 50%, but **most do not**. Gradiant’s technology can recycle as much as 88% of water for some semiconductor processes, and its deployment could improve the wastewater recycling rate for semiconductor firms.

### Water recycling rates of select semiconductor companies and Gradiant’s technology



Source: BloombergNEF, [Wang et al.](#), Gradiant. Note: The Gradiant datapoint shows local scrubber reclaim system recovery rate at a semiconductor plant in Singapore. Recycling includes reuse for different purposes. TSMC refers to Taiwan Semiconductor Manufacturing Company. PSMC is Powerchip Semiconductor Manufacturing Corporation. VIS is Vanguard International Semiconductor Corporation. Micron is Micron Technology. UMC is United Microelectronics Corporation. ST is STMicroelectronics.

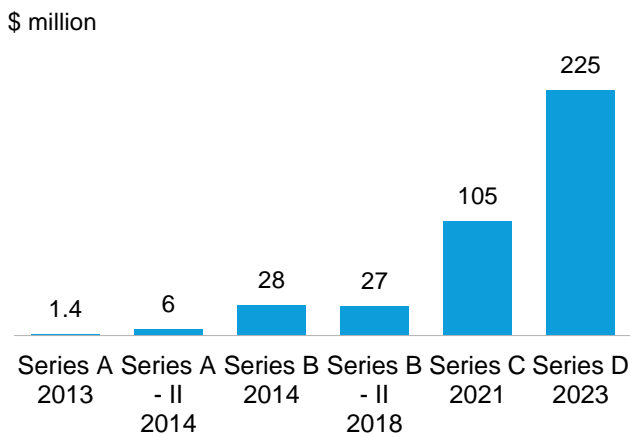
### Financial performance

Gradiant has successfully grown its business over the past decade, reflecting industrial demand for solutions that save both money and scarce resources. The company has **doubled** its annual sales in each of the past five years. In the first half of 2024, it closed more than \$500 million in new orders from giants including

Micron, AB InBev, STMicroelectronics, Coca-Cola and Rio Tinto. The clients' water treatment and wastewater recycling plants will be built in the US, Europe, Middle East, Africa and Asia, highlighting global demand for improved water processing.

Gradiant has raised over \$400 million from investors including SLB, BoltRock Holdings and Centaurus Capital. The company was valued at \$1 billion in May 2023 when it closed a \$225 million Series D round. Gradiant plans to use its latest funding for additional research and development, and expansion into new geographies.

### Gradiant's publicly disclosed equity funding rounds



Source: BloombergNEF, CB Insights.

### Broader opportunities within the sector

The water treatment industry is large, with several established companies providing services and earning billions of dollars in annual revenue.

The semiconductor industry is not alone in trying to minimize its freshwater withdrawals and environmental impacts. Agriculture, textiles and mining are among those sectors most dependent on water for their operations. Each is likely to grow as a result of rising population, increased computing needs and heightened demand for critical minerals.

Governments are also investing in water infrastructure as climate change's impacts on water supply become

more pressing. Taiwan's Water Resources Agency, awarded a contract for a \$545 million desalination plant that can produce 100,000 cubic meters of drinking water per day.

### Notable water treatment competitors

Company	Description	Financial gain
<b>Veolia</b>	France-based Veolia (PAR: VIE) provides water, waste and energy management services, of which water has been the largest revenue driver for the past decade. The company provides technologies for clarification, purification, disinfection and desalination.	\$18 billion in revenue in 2023 attributed to its water segment, 41% of its total revenue.
<b>Xylem</b>	Xylem (NYSE: XYL) is an equipment manufacturer and service provider for water and wastewater applications. Xylem acquired Evoqua, a water treatment company, at a valuation of about \$7.5 billion in 2023.	\$7.4 billion in revenue in 2023, in part driven through its acquisition of Evoqua.
<b>Suez</b>	Suez provides drinking water and sanitation services globally, including leak detection, water production plants and wastewater treatment.	€8.9 billion (\$9.4 billion) in revenue in 2023, a 30% increase from the previous year.

### Analyst take

Companies such as Gradiant have realized an opportunity to commercialize technologies that minimize water use and preserve water quality. A growing number of venture capital investors have an interest in this market, with Cycle Capital, Burnt Island Ventures and Natural Ventures all closing funds in the past few years. Indeed, water and ocean technologies have become a larger part of investment theses; however, larger funds are struggling with a lack of investment opportunities in the sector.

#### More from BNEF:

[Climate-Tech Investment Radar 2Q 2024: Funds Remain Steady \(web | terminal\)](#)

[Climate-Tech VC/PE Investment Database \(web | terminal\)](#)

# NatureMetrics Raises Funding with Environmental DNA Tech

Around 1 million species worldwide – representing 25 percent of known animal and plant groups – are today threatened with extinction. The challenge of measuring how biodiversity – the variety of living organisms in a habitat – changes in response to human interventions is a barrier to deploying the resources needed to protect, manage and restore it. Traditional monitoring techniques are labor intensive and costly. More economic and scalable technologies are therefore a key enabler of more effective interventions.

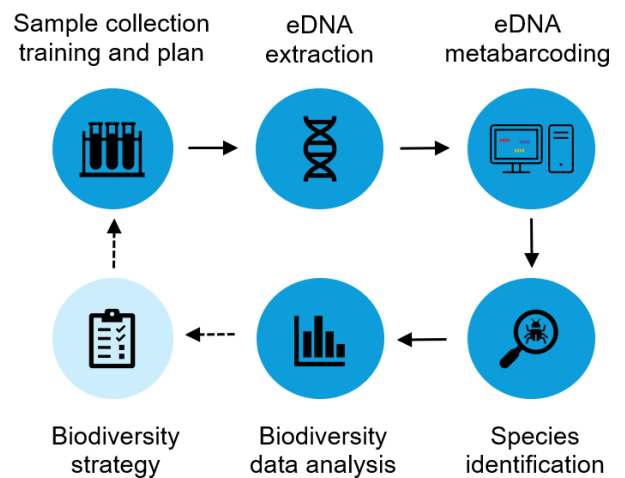
UK-headquartered NatureMetrics uses environmental DNA (eDNA) sampling to provide organizations with biodiversity monitoring services. The company is the market leader in an increasingly competitive sector, raising \$30.7 million since 2014, and supporting clients including Nestle and Anglo American to better understand the biodiversity impacts and dependencies of their operations. As pressure mounts on businesses and governments to gather data on their interactions with nature, services such as those offered by NatureMetrics are becoming increasingly important.

## The nature-friendly service

Founded in 2014, NatureMetrics sells a sampling kit for collecting genetic information in situ. With a device from the kit, users gather environmental DNA (traces of DNA that organisms have shed through excrement and cell loss) from water, soil or sediment. The sample undergoes metabarcoding in the company’s labs to extract and amplify the eDNA, which is then compared against an in-house reference library of known genomes. The results show the distribution and relative abundance of species in the original sample location, which then informs a broader biodiversity analysis.

Clients can purchase individual sampling kits and collect data directly, enter a multi-year partnership for ongoing biodiversity monitoring with NatureMetrics, or work with its consultancy service to create a long-term biodiversity strategy.

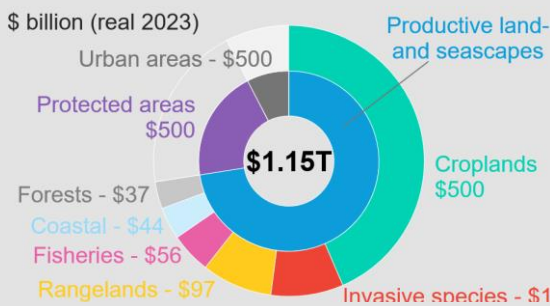
## NatureMetrics monitoring service



Source: BloombergNEF, NatureMetrics. Note: Darker blue shows the company’s core offering.

### Mitigating nature loss

Biodiversity finance has to rise to an annual \$1.15 trillion by 2030. Data provided by companies such as NatureMetrics is key to ensuring effective spending.



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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## Nature benefit of eDNA biodiversity analysis

More comprehensive biodiversity surveying allows firms to better understand ecosystems and achieve better results from their interventions. This can range from implementing tailored and more nuanced strategies when restoring habitats, to mitigating biodiversity loss when building a project, to developing better fertilizers.

For instance, NatureMetrics collaborated with engineering consultancy Jacobs on a road-widening project, using eDNA to quantify how ecologically similar newly created woodland was to the area lost. As a result, soil from the road excavation was transferred to the restoration site rather than being discarded.

EDF Renewables and KIMAenergy, an Australian wind developer, piloted NatureMetrics' eDNA service when undertaking environmental impact assessments at offshore wind projects, where it proved more comprehensive, less invasive and faster than typical sea-trawling methods. This identified 70% more fish species than traditional trawling was able to at the EDF site, while eDNA analysis at KIMAenergy's site identified two threatened marine species, which the project developers monitored to minimize disturbance. Nestle Purina PetCare has entered a multi-year partnership with NatureMetrics to assess the impact of seaweed-based biological stimulants on crops and soil health, aiming for dual emissions and biodiversity benefits.

In situ ecological surveys are the conventional method for assessing biodiversity in a habitat. They often fail to identify species with lower abundance and are susceptible to observer bias, expensive, time-consuming and invasive. [Research](#) suggests eDNA sampling can reliably detect invasive species in aquatic habitats in hours, rather than the weeks required by ecological surveys.

A [study](#) on amphibians found eDNA has higher reliability in detecting the presence of species with lower abundance in a habitat, which are at risk of being overlooked by ecological surveyors. The use of eDNA

strengthens results of environmental surveys through quicker detection of species which are harder to visually identify.

## Detection rate of amphibian species using ecological surveys and eDNA sampling

Species	Ecological surveys	eDNA	Surveys and eDNA
Pacific chorus frog	100%	80%	100%
Western toad	75%	60%	75%
California newt	55%	55%	65%
California tiger salamander	15%	30%	40%
American bullfrog	35%	35%	35%
California red-legged frog	30%	35%	35%

*Darker shading indicates an improvement in detection rate when using a combination of eDNA and surveys over surveys alone. Species listed in order of increasing rarity. Results from 20 pond samples.*

## Financial performance

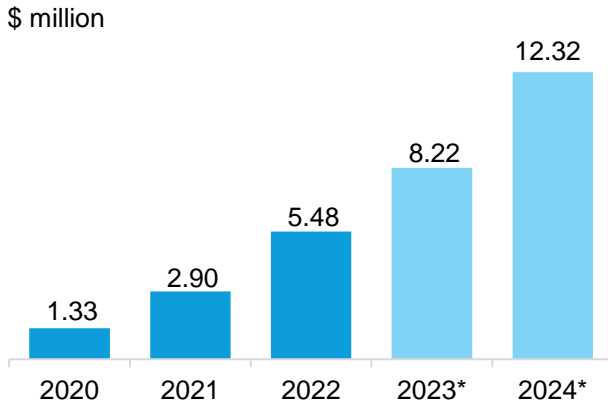
NatureMetrics had raised \$30.7 million as of September 2024, including a \$15 million Series B round in 2022. Notable investors include BNP Paribas, Systemiq, 2150 and Ananda Impact Ventures, reflecting the credibility of its founders and viability of eDNA technology.

The company had turnover of £4.8 million in 2022 (\$5.48 million), according to Companies House and disclosed to BNEF they have seen 50% revenue growth over the last two years.

With a growing client base, including more than 600 organizations across 110 countries and long-term service agreements, NatureMetrics and its investors have successfully identified a nature-related opportunity and generated cashflow from it. Major clients include Unilever, Nestle, Anglo American, MSC Cruises and Tesco. The diverse client base highlights both the versatility of the technology and future revenue generating potential of the company.

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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## NatureMetrics' current and estimated future revenue



Source: BloombergNEF, Companies House, NatureMetrics.

Note: Figures for 2023 and 2024 are estimates.

## Broader opportunities within the sector

The biodiversity monitoring, reporting and verification market has grown rapidly in recent years. In 2023, early-stage startups received \$204 million in funding. While none has achieved the same scale as NatureMetrics, three are introduced below.

### Notable competitors of NatureMetrics

Company	Description	Funding
<b>PivOtal</b>	Offers a biodiversity data platform using AI with primary data from satellite monitoring and acoustic data. It does not indicate use of eDNA sampling.	Closed a <u>\$6.5m</u> seed round, with funding from Octopus Ventures and AENU.
<b>Nala</b>	Nature consulting service and biodiversity monitoring platform. It does not offer eDNA sampling services. Partners include BASF.	<u>\$1.7 million</u> in pre-seed funding.
<b>SpyGen</b>	French company using eDNA to monitor biodiversity. It does not provide biodiversity consultancy services. Corporate partners include the WWF and EDF.	No funding information available.

Upcoming regulation on biodiversity reporting and increased uptake of voluntary disclosure are leading more corporates to start quantifying their biodiversity impact and create strategies to mitigate harm. The EU's Corporate Sustainability Reporting Directive

(CSRD) requires companies to report on how they impact biodiversity and levies financial penalties if firms fail to do so. From 2025, firms based in the EU with over 500 employees must disclose. By 2029, around 50,000 companies will report biodiversity data under the CSRD, all of which serve as potential future clients for biodiversity data providers.

The rise of voluntary disclosure of nature-related impacts and dependencies has also driven demand for biodiversity data service companies. The Taskforce on Nature-related Disclosures (TNFD) in 2023 released its 14 recommended nature-related disclosures as part of its push to encourage reporting. NatureMetrics claims it can deliver 50% of these disclosures through its services alone. As of September 2024, over 450 companies have committed to adopting the TNFD's recommendations. Multinational pharmaceuticals firm GSK and cosmetics producer L'Oreal have set targets to restore and enhance biodiversity, which will require them to measure biodiversity change over time.

## Analyst take

Commercial scale eDNA assessment, such as that provided by NatureMetrics, supports companies seeking to make credible claims about their biodiversity impacts and dependencies by monitoring how their operations affect species abundance over time. Currently, there are few standards dictating how companies should quantify biodiversity. However, the mandatory reporting covered by the CSRD and voluntary initiatives such as the TNFD increase the need for rigorous, auditable and scalable biodiversity data, and have presented opportunities for investors.

### More from BNEF:

*Climate-Tech Companies to Watch 2024: BNEF Pioneers* ([web](#) | [terminal](#))

*TNFD Release Puts Nature at Heart of Financial Disclosure* ([web](#) | [terminal](#))

*NatureMetrics was a winner of BNEF's 2024 Pioneers Competition, competing under the Wildcards category.*



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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# Perfect Day Milks Millions in Animal-Free Dairy Market

The dairy industry has a significant impact on nature. Globally, it occupies 7% of habitable land, accounts for 4% of freshwater use and is responsible for an estimated 4.7% of greenhouse gas emissions. A promising avenue to reduce this impact is the production of molecularly identical, dairy-free products and ingredients.

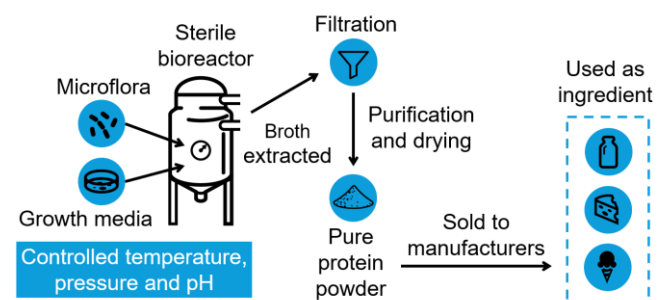
California-headquartered Perfect Day utilizes precision fermentation to create dairy-free whey protein that food and beverage manufacturers use as an ingredient across a diverse range of products, in place of conventional whey. The company leads in the increasingly competitive US alternative dairy market, raising \$801 million in funding since 2014 and attaining a valuation in excess of \$1.6 billion. Contracts with large consumer packaged goods firms suggest that alternative dairy, made well, will continue to offer investment opportunities in disrupting the global \$827 billion conventional dairy industry.

## The nature-friendly product

Founded in 2014, food-tech startup Perfect Day Inc has developed animal-free protein ingredients which food companies use in place of animal dairy in products such as milk, cheese and ice cream. Perfect Day obtained intellectual property around the production of beta-lactoglobulin, a major whey protein present in cow and sheep’s milk which possesses functional and nutritional characteristics that render it a versatile ingredient in food manufacturing applications.

The company creates whey protein nutritionally identical to that made by cows, using precision fermentation to engineer microorganisms and produce high-value compounds. According to a 2019 submission to the US Food and Drug Administration, a genetically modified fungus strain and sugary liquid media are placed into a sterile bioreactor under conditions that trigger the microbes to secrete the desired whey protein. The mixture is then filtered, pH-adjusted and spray dried, yielding an off-white powder comprised of around 97% whey protein. This final product is used in food production in the same manner as animal dairy, acting as an emulsifier, texturizer or high-quality protein source.

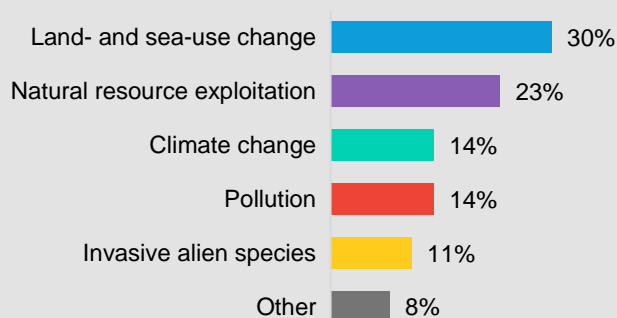
## Precision fermentation process



Source: BloombergNEF, Perfect Day.

### Mitigating nature loss

Five drivers account for over 90% of global biodiversity and ecosystem decline. By eliminating livestock from the production of dairy protein, Perfect Day addresses land- and sea-use change, natural resource exploitation and climate change.



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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Perfect Day operates on a B2B model, having offloaded its consumer goods arm, The Urgent Company, in 2023. The company’s co-founder [said](#) that this earlier B2C approach was to demonstrate the commercial viability of fermentation-derived whey protein to big food manufacturers. Perfect Day has engaged in a series of partnerships, leading to pilot trials with Nestle and Mars on animal-free milk beverages and chocolate bars.

The first full-scale product release was in February 2024 – a range of animal-free ice cream produced in collaboration with Unilever, as part of its Breyers line. BloombergNEF has identified at least nine other brands that Perfect Day is now partnering with, supplying whey proteins for products spanning milk, cheese, ice cream and nutritional supplements, for sale in thousands of retail stores across the US.

### Nature benefit of animal-free whey protein

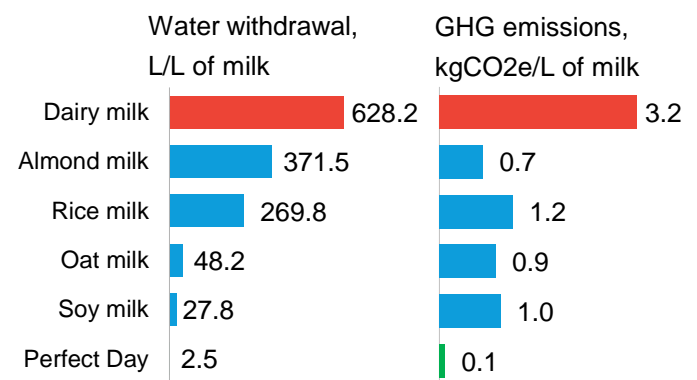
Dairy milk is among the food products with the most significant impacts on nature: its combined greenhouse gas emissions, freshwater use and land use requirements per unit of production are behind only beef, lamb and a handful of other foods. This is on account of the inefficiencies inherent in cows converting feed and forage into the protein component of milk, and amplified by the global scale of the dairy market. The cultivation and processing of cattle feed (entailing chemical fertilizer production and application), emissions from enteric fermentation, manure, and a host of other gate-to-retail emissions each contribute to the 3.15kg of CO<sub>2</sub>-equivalent released per liter of milk (11.92kg/gal), on average. Over 600 liters of freshwater is required to produce one liter of milk, while grazing and feed cultivation require more than 9 square meters of land for each liter of milk produced (440sq-ft/gal).

Perfect Day’s whey protein has a substantially more modest environmental footprint. According to an LCA analysis, by eliminating the cow – and the attendant feed demands – the company produces sufficient [protein](#) for a liter of milk with 96% lower GHG emissions, 99% less freshwater withdrawals and

smaller land requirement (the relative size of which depends on both the manner of raising the dairy cow and the lifespan and scale of the company’s production facilities).

Even in comparison to plant-based milk alternatives, including almond, rice and soy, Perfect Day’s product is still able to achieve noteworthy [reductions](#) across these key drivers of nature loss.

### Environmental impacts of Perfect Day’s whey protein relative to protein in other milks



Source: BloombergNEF, [Poore and Nemeck \(2018\)](#), [Perfect Day ISO-conformant report](#), [OurWorldInData](#). Note: Precision fermentation figures are emissions and water use required to produce the amount of whey protein contained in standard 3.3% protein content dairy milk.

### Financial performance

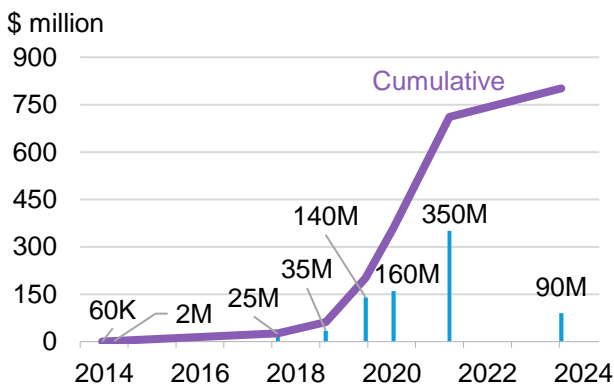
As of October 2024, Perfect Day has raised a total of \$801 million over eight rounds from 16 different investors, valuing the company at \$1.6 billion. While funding over its initial seven years was unexceptional, it began to attract significant capital from a December 2019 Series C, raising \$140 million, supplemented by an additional \$160 million eight months later, and a \$350 million Series D in 3Q 2023. A \$90 million Series E in January 2024 is its most recent infusion. Notable investors span VC (Temasek, ICONIQ), CVC (ADM Ventures), and various angels and family offices.

In an August 2023 [interview](#) with AgFunder, its co-founder stated that it was not yet clear whether the company’s end game was an IPO or acquisition. In 2020, it [reported](#) being margin positive, having

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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achieved production cost milestones through scale, while several whey protein powders containing its product sell at cost parity to animal-based equivalents. To strengthen growth, the company now needs to finish construction of new production facilities in India and secure further CPG contracts. Key to both is the resolution of a legal dispute with a former contract manufacturing partner (both sides deny wrongdoing).

### Perfect Day has raised over \$800 million since 2014



Source: BloombergNEF, Crunchbase.

### Broader opportunities within the sector

Manufacturers, investors and consumers have started to react to the transition underway in agri-food systems, increasingly recognizing the need for change in dairy supply chains. Many large FMCGs have committed to climate and nature targets; asset managers and financiers seek to minimize environmental risks, and the preferences of some consumers have shifted. This market atmosphere prompted an uptick in investment seeking to capitalize on technologies enabling the production of alternatives that alleviate the nature impacts of dairy products, starting in late 2019, several years after a similar movement in alternative meat.

The global dairy market was worth \$827 billion in 2022 and is projected to surpass \$1.3 trillion by 2030. This represents a sizeable addressable market for alternative dairy technologies to capture, including three Perfect Day competitors, below.

### Notable Perfect Day competitors

Company	Description	Funding
<b>Remilk</b>	The Israel-headquartered alternative dairy company <u>announced</u> plans to construct the world's largest precision fermentation facility, having obtained regulatory go-ahead to sell in Israel and Canada. Work has since paused on the megafactory.	\$131 million raised over four rounds, including a \$134 million Series B in 2022.
<b>Oatly</b>	Oatly Group AB (Nasdaq: OTLY) produces oat-based alternatives to cow milk and other dairy products. After raising \$1.4 billion in a May 2021 IPO, the company approached \$800 million in revenue in 2023, though has seen its market cap fall significantly since going public.	\$666 million raised over five rounds, including \$425 million post-IPO.
<b>Alpro</b>	Belgium-based Alpro distributes soya-based dairy alternatives. Founded in 1980, it was acquired by Dean Foods for \$455 million in 2009, spun-off with another part of Dean's business in 2013, before being part of a \$10.4 billion purchase by Danone in 2017.	The firm was established as the subsidiary of another Belgium company.

### Analyst take

Perfect Day attained a valuation of \$1.6 billion, strongly backed by credible investors, intellectual property and regulatory approval in the US, and is now emboldened by a clear path to exit. It represents a prime example of a successful startup with operations predicated on a reduction in the drivers of nature loss. Unlike alternative meat companies, it offers a product identical in structure and taste to an animal-based equivalent, assuaging consumer and investor concerns. As the precision fermentation industry matures, additional financial opportunities will emerge – at the cost of animal-reliant incumbents, but to the benefit of the natural world.

#### More from BNEF:

*Tech Radar: Decarbonizing Beef and Dairy Production* ([web](#) | [terminal](#))

*Milking Crops Not Cows: A Primer on Plant-Based Dairy* ([web](#) | [terminal](#))

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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# Phool Cleans Up with Upcycled Incense and Bio-leather

Water pollution as a major cause of biodiversity loss in terrestrial and freshwater ecosystems. In India, approximately 800 million metric tons of flowers are offered in temples and mosques each year, with much of the resulting pesticide-laden waste entering the country’s water bodies, exacerbating pollution, disease and water stress. The Ganges, which traverses the northeast of the country, has borne the brunt of these impacts, becoming the world’s most polluted river and undergoing marked biodiversity loss.

Identifying a circular-economy opportunity, Phool has commercialized this floral waste through innovative upcycling practices. Operating in Kanpur, a city on the banks of the Ganges, the company collects discarded flowers from temples and transforms them into a range of products. These include incense sticks, organic compost and biomaterials such as compostable packaging and mycelium-based bio-leather.

As of October 2024, Phool has raised at least \$11.7 million and bagged a partnership with PVH Corp., parent of Tommy Hilfiger and Calvin Klein, to launch a product line using its bio-leather.

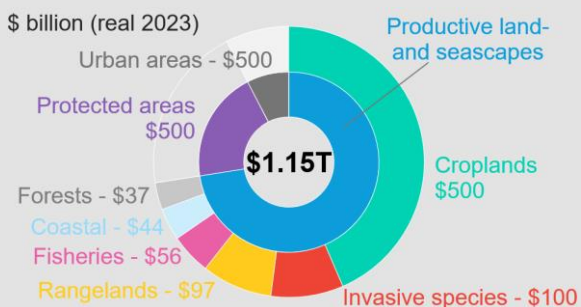
## The nature-friendly product

Phool, which means ‘flower’ in Hindi, was founded in 2017 by two engineers aiming to reduce the amount of floral waste dumped into India’s rivers. It partners with local temples to collect flowers used in religious ceremonies, which are then segregated, cleaned and dried, before being processed into the firm’s primary offerings: charcoal-free incense sticks and organic agricultural compost. Biofilms – thin layers of microorganisms – and enzymes remediate the harmful pesticide components before cleaning.

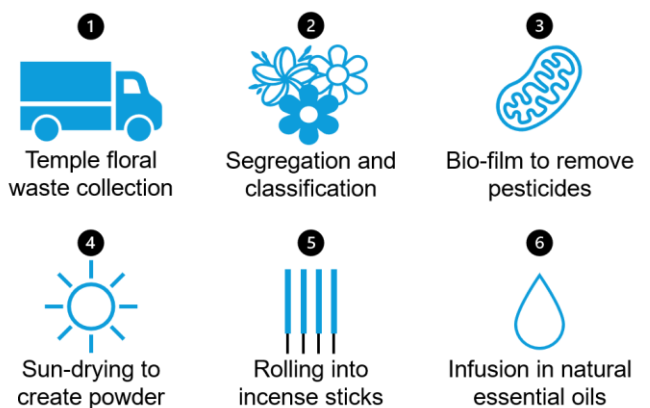
With backing from the Indian Institute of Technology since the ideation stage, Phool has undertaken research and development to discover novel ways to repurpose floral waste. The team discovered that under humid conditions, the waste acts as an effective feed culture, prompting growth of fungal mycelium networks and resulting in the creation of thick fibrous sheets. Experimentation with various microbial strains, temperatures and humidity levels led to the development of a bio-based compostable packaging foam, followed by a ‘bio-leather’, in 2021.

### Mitigating nature loss

Biodiversity finance has to rise to an annual \$1.15 trillion by 2030. Phool’s upcycling of temple floral waste mitigates resource exploitation and pollution.



### Upcycling floral waste into incense sticks



Source: Phool, BloombergNEF.

Nature-loss drivers addressed:

Land and sea use change

Resource exploitation

Climate change

Pollution

Invasive alien species

The process of creating the bio-leather begins with boiling floral waste to extract cellulose and lignin, then feeding the liquid to microbes in flasks. Once the solution reaches a slurry-like consistency, it is transferred to trays to rest and grow into long sheets. These sheets are dried, tanned using tree-bark powder and embossed to create an animal-leather-like look and feel. Properties including insulation, tensile strength and elasticity can be tweaked based on the desired end-product requirements. Unlike other plant-based leathers, Phool’s production process does not require the use of polymer binders, making it fully compostable in around 90 days once buried in soil.

Phool has developed several products using bio-leather, including bags, wallets and shoes, although primarily markets it as an input to other companies.

## Nature benefit of flower waste recovery

India’s rivers are some of the most biodiverse ecosystems in the world, with approximately 50% of all aquatic plants found in the subcontinent. The river Ganges alone is home to over 2,000 plant and animal species, including the endangered Gharial and Ganges River Dolphin. The freshwater ecosystems also hold social and economic significance.

Untreated sewage, agricultural run-off and industrial waste enter the river daily. Another major source of pollution is waste, including flowers, from cremations and religious offerings, with 8 million tons of floral waste dumped into the Ganges annually. Phool founder Ankit Agarwal views the diversion of floral waste as the “lowest-hanging fruit” to alleviate the region’s water pollution and water stress problems.

Through upcycling flowers, Phool stops harmful chemicals used in pesticides, such as lead and arsenic, from leaching into the river. As of 2023, it had upcycled over 35,000 tons of floral waste and diverted 3,500 kilograms of chemical residues from rivers. Its biomaterial offerings also provide an alternative to plastic packaging and conventional animal leather, which is linked to deforestation and pollution.

Studies have found concerning levels of pesticide-

linked heavy metal contamination throughout the Ganges. Notably, in Kanpur, elevated levels of heavy metals associated with the city’s leather industry have been recorded.

## Heavy metal contaminants in Ganges sediment at Kanpur and permissible limits (milligrams per liter)

Heavy metal	WHO limit	Concentration at Kanpur site	Percentage relative to limit
Arsenic	0.05	0.25	500%
Cadmium	0.005	2.5-6.0	50,000-120,000%
Lead	0.05	2.5	5,000%
Mercury	0.001	85-254	8,500,000-25,400,000%

Source: Paul (2017). Note: WHO is the World Health Organization. All four elements are present in pesticides; arsenic, cadmium and lead are effluents from tanneries.

## Financial performance

Phool has raised at least \$11.7 million since its inception in 2017, according to PitchBook data. This includes \$2.5 million in seed rounds from several notable investors, such as IAN Fund, Tata’s Social Alpha (FISE) and IIT-Kanpur. Its most recent round – an \$8 million Series A in 2022 – was led by an investment from Sixth Sense Ventures.

The company told BNEF it is on track to double its annual revenue to \$15 million in 2024, with most sales shipped directly to customers through its website, and also expects this growth rate to continue to 2026. It is expanding geographically and now sources discarded flowers from six temple cities, allowing it to build its consumer-facing business and carve further into India’s \$3.2 billion home fragrance market.

Phool’s sustainability-focused product portfolio has garnered attention from young Indians online, building a strong social media presence and enabling repeat customer rates of over 60%. Reviews point to satisfaction with product quality and the non-toxic credentials of its offerings.

Nature-loss drivers addressed:

Land and sea use change

Resource exploitation

Climate change

Pollution

Invasive alien species

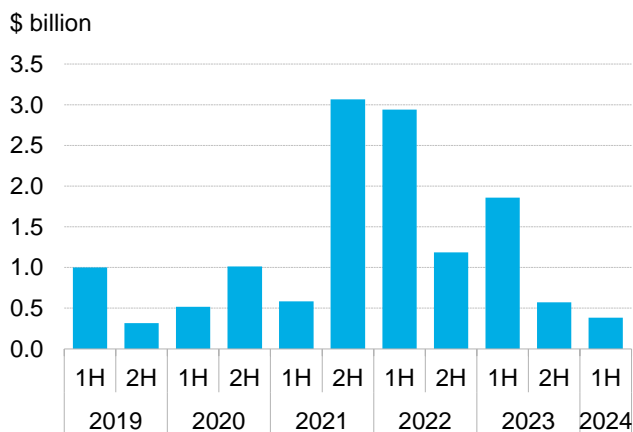
While sales and revenue information are not yet available for the firm’s bio-leather, the material has drawn commercial interest. By operating in Kanpur, India’s leather capital, and with the country playing a key role in the global textile supply chain, Phool is ideally positioned to tap the \$73 billion vegan leather industry. This has enabled it to secure partnerships with international clothing companies, including PVH Corp. (which owns brands including Tommy Hilfiger and Calvin Klein), and Phool says further interest has been expressed by a British carmaker and a US fashion retailer to bring the material into new markets.

Meanwhile, the bio-leather development led to Phool being named a finalist in the 2022 Earthshot Prize, whose committee noted that the material is a notable innovation helping to alleviate the global waste challenge. A December 2022 BBC article further boosted the public profile of the product.

## Broader circular economy opportunities

Circular economy business models address resource scarcity and waste while creating economic opportunities. The global circular economy market was estimated to be worth €148 billion (\$161 billion) in 2020 and is forecast to hit €263 billion by 2030. BNEF estimates venture capital and private equity funding raised by circular economy-related startups totaled around \$385 million in the first half of 2024.

### Venture capital and private equity funding for circular economy startups



Source: BloombergNEF.

The table below profiles three companies with business models that address the problem of waste while creating useful products.

### Notable circular economy startups

Company	Description	Funding
<u>Evrnu</u>	A US-based textile innovation company that chemically recycles textile waste into new fibers. Its technology can replace 90% of virgin fabrics.	\$31 million raised, with \$330 million in purchase commitments and partnerships with notable brands.
<u>UBQ</u>	Israel-headquartered UBQ’s technology converts unsorted household waste into a plastic substitute. It opened an industrial-scale facility in the Netherlands in 2024.	It has raised \$240 million. Its most recent Series D round totaled \$70 million in 2023.
<u>Apeel</u>	Californian startup creating plant-based edible coating for fruits and vegetables that enables them to remain fresh twice as long.	\$635 million raised, including \$250 million in Series E in 2021, pushing its valuation to over \$2 billion.

### Analyst take

According to the Ellen MacArthur Foundation, “waste is the result of design choices” and thus the outcome of production inefficiencies. Circular economy companies such as Phool break away from the incumbent take-make-waste linear economic system, providing a solution to reduce nature impacts, as well as generate economic returns. Phool’s business model takes otherwise harmful waste from ceremonies and upcycles it into a range of commercial products. Its strong revenue growth, innovation and engaged client base position it well for future value creation, while also upskilling over 300 women from marginalized communities who manufacture its products.

### Bloomberg’s nature and biodiversity solutions

*This case was authored by Bloomberg’s ESG Data Team.*

Clients can access Bloomberg’s Nature Solutions by entering {ESG Nature <GO>}.

Case study on Terminal Nature and Biodiversity analysis (terminal).

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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# PTx Trimble Spray Tech Cuts Pesticide Costs and Pollution

Broadcast methods used today to spray pesticides are inefficient, ineffective and lead to ecological harm. Although essential to agricultural production, pesticides are markedly overused: as little as 1% of the volumes applied reach the target pest. The remainder enters ecosystems inflicting various harms upon plant and animal life, including reproductive failure, developmental abnormalities and immune system suppression. This threatens the agricultural system itself: More than 40% of insect pollinator species worldwide are threatened with extinction, driven to the edge predominantly by insecticides.

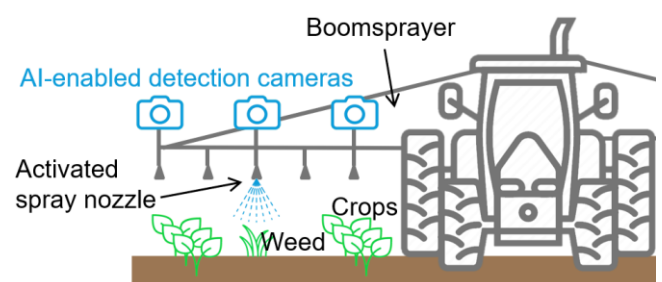
PTx Trimble, a joint venture between American farm machinery and technology giants, produces precision agriculture technology that slashes the amount of pesticide required on crop fields, while retaining efficacy. In doing so, it reduces the level of potential harm to nature and saves both chemical and machinery costs for farmers. Sales of PTx Trimble technology have increased the revenue of its majority owner by an estimated \$600 million per year.

## The nature-friendly product

In April 2024, industrial technology giant Trimble carved out its agricultural business, with farm machinery manufacturer AGCO Corp. taking an 85% stake. The \$2.35 billion joint venture – the largest ever agtech deal – created PTx Trimble, which provides precision agriculture tools and software to farmers.

One of the key components of PTx Trimble's offering is a precision chemical application technology known as optical spot spraying (OSS). PTx's OSS uses artificial intelligence-enabled cameras to detect weeds in active crop fields and deliver a precise dose of herbicide to the target. The technology, dubbed 'green-on-green OSS', is a major upgrade on its predecessor, which was developed by Trimble but only able to identify weeds in bare fields.

## Green-on-green optical spot spraying mechanism

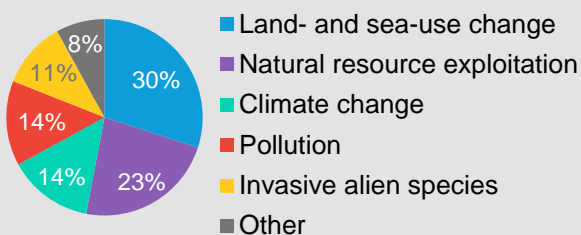


Source: BloombergNEF. Note: AI = artificial intelligence.

The company also produces machinery guidance and connectivity equipment, and plans to launch autonomous vehicle solutions in 2025. This can also result in less over-spraying as autonomous farm vehicles can operate round the clock, without human labor, and switch off when conditions are unsuited to spraying chemicals, such as in high winds or rain.

### Mitigating nature loss

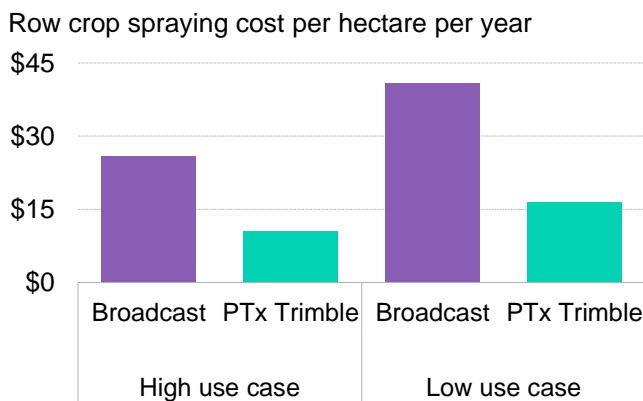
Five drivers account for over 90% of global biodiversity and ecosystem decline. PTx Trimble's technology addresses pollution by reducing the amount of pesticide applied to crop fields.



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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The joint venture catapulted AGCO into direct competition with Deere & Co., whose ‘See and Spray’ factory-fit upgrades previously led the market. PTx predominantly targets the retrofit sales channel, increasing sales volumes as farmers with existing sprayers can upgrade without purchasing a new machine. Prior to the joint venture, a similar Trimble retrofit kit retailed for around \$100,000, plus a fixed \$13,000 annual algorithm fee, well below the near \$1 million asking price and \$4 per acre licensing fee of the closest Deere equivalent. Taking into account the upfront capex and chemical cost savings, the PTx technology is much cheaper than conventional broadcast spraying, saving farmers up to 60% per hectare over the lifetime of the machine.

### Levelized cost of PTx Trimble’s technology versus broadcast spraying



Source: BloombergNEF. Note: Costs in real 2023 US dollars. Calculations do not account for tax. High use case represents a spray regimen in a long fallow period, as in Australia, which requires multiple passes of the sprayer to control weeds. The low use case represents a system such as in Europe, which requires fewer passes per hectare.

### Nature impact of pesticide pollution

Pesticides are ubiquitous in crop production – 3.7 million metric tons of active chemical ingredients were applied to crops in 2022 – and have played a critical part in the growth of agricultural yields since the ‘green revolution’ of the 1960s. Without them, global fruit, vegetable and cereal production would decline by 78%, 54% and 32%, respectively. However, the three

major groups of chemical pesticides – herbicides, insecticides and fungicides – are hazardous to wildlife, with the various formulations responsible for diverse ecological impacts particularly in aquatic environments.

The US Environmental Protection Agency found that atrazine and glyphosate, two of the most commonly used herbicides, each cause harm to over 1,000 native species. More than 40% of insect pollinator species worldwide are threatened with extinction, predominantly driven by insecticides, such as the potent neonicotinoid class. Native bees alone provide \$3 billion worth of pollination services to US fruit producers, and nearly a quarter of these species are at risk of extinction.

Non-target species are typically affected when the toxic chemicals leave the cropping area, typically through the following processes:

- Spray drift – chemicals are picked up by wind and spread to new locations
- Leaching – displacement by the action of water, often rain or irrigation
- Bioaccumulation – the gradual accumulation of toxic compounds in a non-target organism that consumes contaminated prey. Pesticides bioaccumulate all the way up to humans: a recent study found herbicide residues in 80% of US human urine samples.

The solutions provided by PTx allow farmers to deliver an effective dose of herbicide while minimizing losses to the environment. They can reduce the volume of herbicide applied by up to 97.5% while maintaining crop yields. Empirical studies from competitor products have shown between 44-91% reductions in chemical volumes by deploying OSS.

### Financial performance

Cost savings have driven rapid uptake of OSS technology. Australia leads adoption, where 70% of farmers in its northern cropping regions deploy some form of the precision sprayers, with PTx Trimble’s solution seen as a market leader. In the US, adoption of precision spraying technology is much lower,

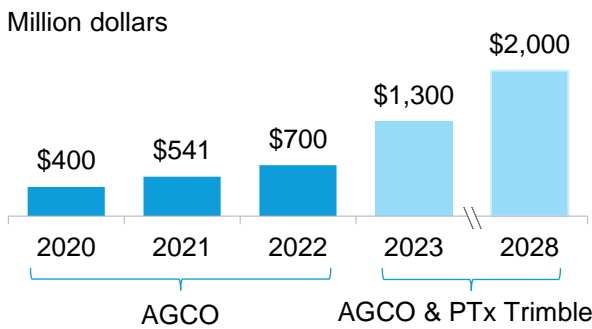


Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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between 7-10%. However, advances in AI technology are improving the product and driving global market penetration.

The \$2 billion joint venture is already proving fruitful for majority owner AGCO. In a second quarter 2024 earnings announcement, the firm projected an additional \$600 million in full-year revenue due to contributions from PTx Trimble. The firm is bullish on the performance of its precision agriculture portfolio, expecting annual revenues to reach \$2 billion by 2028.

### AGCO revenue with PTx Trimble joint venture revenues



Source: BloombergNEF, AGCO. Note: Light blue represents company estimates.

### Broader opportunities within the sector

The precision spraying space is highly competitive, with at least 25 companies and startups working on camera-based solutions. Startups in this cohort have collectively raised almost \$470 million, according to CB Insights and BNEF research.

Crop protection companies have recognized the disruption that OSS presents to the \$80 billion industry. Both BASF and Bayer are developing solutions – the ‘One Smart Spray’ and ‘MagicSprayer’. Syngenta backed the technology through its corporate venture division, joining a \$22 million seed round for startup Greeneye Technology. This Israeli startup is one of the first OSS companies to venture beyond weed control, and plans to launch a fungal pest spot sprayer in late 2024, which it says can reduce fungicide volumes sprayed by up to 40%.

There is also an emerging class of AI-enabled chemical-free weed control technologies. A laser weeder developed by Carbon Robotics had raised \$122.8 million by October 2024 and the backing of Nvidia’s venture wing NVentures, while FarmWise’s AI-enabled mechanical weeder has raised \$84 million.

### Notable PTx Trimble competitors

Company	Description	Financial gain
<b>John Deere</b>	The US-based farm machinery giant recently launched an upgrade kit version of its AI-enabled sprayer. Costing \$25,000 (plus an additional \$4 per acre), it competes directly with PTx’s offering.	Targeting 10% of total firm revenue from recurring per acre” subscriptions by 2030.
<b>Greeneye Technology</b>	The Israeli green-on-green OSS company says it will soon offer sprayers addressing fungicide use, the first with this capability.	\$49.27 million raised to series B.
<b>Carbon Robotics</b>	Developed a weed control unit that uses lasers to eliminate weeds as an alternative to chemicals.	\$122.8 million raised to series C-II.

### Analyst take

PTx Trimble offers an economically viable way for farmers to reduce the nature loss associated with their operations while also minimizing spend on crop protection. The adoption of precision OSS technology will only grow as more pests, like insects and fungi, are able to be detected and controlled. This presents a notable risk to the business models of crop protection companies, whose revenues are intrinsically linked to the volume of harmful chemicals they sell to farmers.

#### More from BNEF:

*AGCO and Trimble Combine Forces in War on Weeds* ([web](#) | [terminal](#))

*Precision Pesticide Delivery: Booming, to Spray the Least* ([web](#) | [terminal](#))

*Greener Pastures: Crop Protection with Fewer Chemicals* ([web](#) | [terminal](#))

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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# Redwood Materials’ Battery Metals Recovery Cuts Mine Mess

Mining and processing battery metals such as lithium, nickel, manganese and cobalt entails substantial emissions, water and biodiversity impacts. Mines are located in some of the most biodiversity-rich regions, with 14% of land used in producing global raw materials falling within a protected area. Conventional mining methods typically account for over 30% of the environmental footprint of mined battery cathode materials. Mines supplying critical minerals are set to quadruple to 180,000km<sup>2</sup> – an area the size of Uruguay – by 2041 in BNEF’s [Net Zero Scenario](#). An anticipated five-fold increase in lithium-ion battery demand by 2035 could negatively impact natural habitats. However, utilizing scrap or end-of-life battery materials can offset demand for virgin metals and limit the environmental impact of the energy transition.

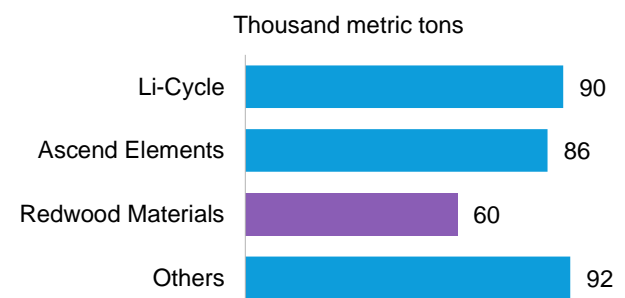
Nevada-based [Redwood Materials](#) is a lithium-ion battery recycling company and battery material producer. Its end-to-end recycling processes have been [assessed](#) to reduce energy use by up to 80%, water use by 80% and produce 70% less carbon dioxide than mined materials. The company has raised \$2 billion in equity and secured a \$2 billion loan commitment from the US Department of Energy.

## The nature-friendly product

Founded in 2017 by Tesla co-founder and ex-CTO JB Straubel, Redwood Materials employs 1,600 people. The company uses a hydrometallurgy process to recycle battery manufacturing scrap into raw nickel, cobalt and a commercial-scale source of lithium. Hydrometallurgical procedures are used by a number of players in battery recycling and involve pretreatment of the spent lithium-ion batteries, a leaching process and then separation of valuable metals from the leaching solution. Redwood uses these metal salts to produce battery materials that can be used in place of virgin materials.

Redwood has recycled hundreds of tons of battery packs. A pilot EV battery recycling program in its first year collected 1,268 battery packs from 19 different EV and hybrid models. The majority were lithium-ion (82%) with the rest nickel metal hydride batteries. More than 95% of the lithium, cobalt, nickel and copper was recovered from the over 200 metric tons of battery packs collected.

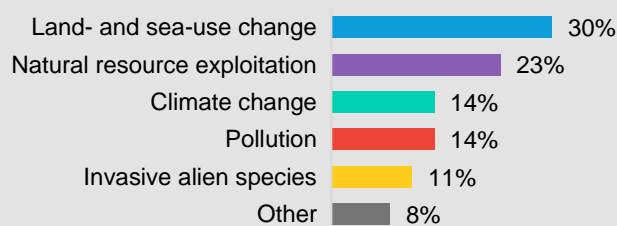
## Total announced battery recycling annual capacity by company in the US



Source: BloombergNEF. Note: ‘Others’ includes capacity from four other companies. Company announcements covering the period to the end of 2025.

### Mitigating nature loss

Five drivers account for over 90% of global biodiversity and ecosystem decline; Redwood’s technologies address the first four of these drivers.



Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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Redwood has built partnerships with several notable players in the US battery market. For example, Panasonic agreed to source Redwood’s cathode material for battery cell production in its new 30GWh Kansas plant, slated to come online in 2025.

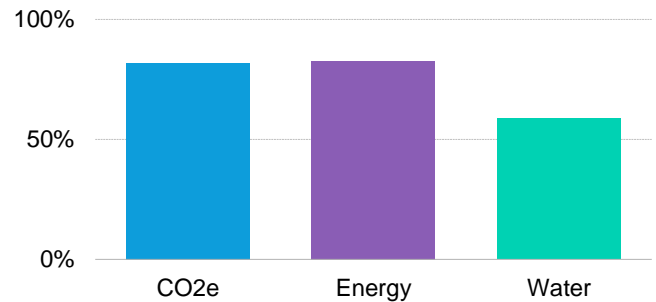
A circular agreement with Envision AESC gives Redwood access to the manufacturing scrap from a plant in Smyrna, Georgia, which Redwood recycles and then sells back to Envision AESC. Toyota has also agreed to source Redwood’s cathode active material and copper foil for its upcoming North Carolina battery manufacturing plant. Redwood is establishing a battery collection network in California, which has been supported by Ford Motor Co. and Volvo, as well as partnering with Volkswagen Group of America to recycle all end-of-life batteries from Volkswagen and Audi electric vehicles.

## Nature impact of battery material production

Transition metal mining has been associated with a wide range of nature issues, from destroying great ape habitat in Africa to water pollution and forest degradation in Papua, to exacerbated water stress in Chile. Approximately 350 mines where energy transition metals are produced – including those used in lithium-ion batteries – are located within sites contributing significantly to the global persistence of biodiversity. Expanding battery recycling reduces the demand for virgin materials sourced from these mines, lessening the attendant biodiversity impacts.

Mining battery metals is also energy- and water-intensive. Producing a metric ton of NCA (lithium-nickel-cobalt-aluminum-oxide) cathode salts – a first step in the process – from conventional methods consumes 73 megawatt-hours of energy, 92,000 liters of water and produces 21 metric tons of carbon dioxide equivalent. Redwood’s processes for producing the material salts for NCA cathodes requires almost 60% less water and uses over 80% less energy than mining and refining virgin materials. The associated emissions are also reduced by over 80%.

## Reduction in carbon dioxide emissions, energy consumption and water use for producing NCA cathode salts for Redwood’s circular methods compared to conventional methods



Source: BloombergNEF, Department of Energy Resources Engineering, Stanford University. Note: Conventional supply chain values reflect dominant global supply chains. The circular supply chain represents recycling of NCA-based battery packs in California as described in the Stanford study. CO2e is carbon dioxide equivalent.

## Financial performance

After six rounds of funding, Redwood has raised almost \$2 billion from investors across the financial and industry sectors including Breakthrough Energy, Capricorn Investment Group, Amazon, Ford, Goldman Sachs Asset Management, Fidelity Investments and Caterpillar Ventures. In February 2023, Redwood also secured a conditional commitment for a \$2 billion loan from the US DOE’s Loan Program Office. The most recent investment round in August 2023 valued Redwood at \$4.25 billion.

The company’s current facilities can process 60,000 metric tons of materials each year, equivalent to around 15GWh of output and enough to manufacture batteries for 190,000 electric vehicles. Redwood aims to increase this capacity to 100GWh of materials which would be able to support the production of 1.25 million new EVs each year, growing the business more than sixfold.

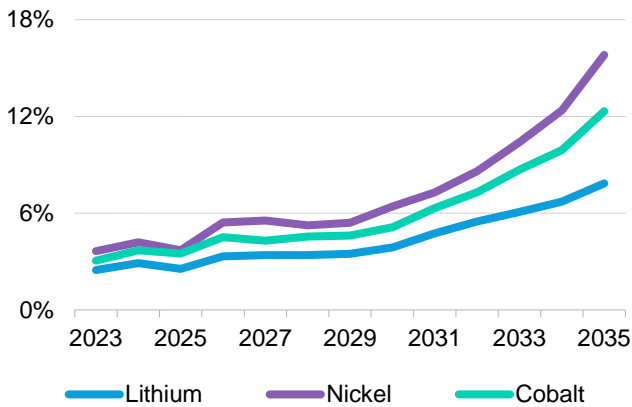
## Broader opportunities within the sector

The amount of battery materials which can be recovered from spent batteries and production scrap is set to surge more than 10-fold in the coming decade. In 2035, the cobalt, nickel and lithium sourced from

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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recycled batteries could account for 7-16% of new demand across passenger EVs, commercial EVs, e-buses, two-/three-wheelers and stationary storage.

## Ratio of recovered material to demand in the US



Source: BloombergNEF. Note: Assumes the metal recovery rate is 80% for lithium, and 95% for cobalt and nickel. The calculations are based on end-of-life batteries and new metal demand across transport and stationary storage sectors.

The US Inflation Reduction Act offers significant financial incentives to early movers in the US clean energy industries, including battery recycling. Production tax credits for critical minerals and battery electrode materials (such as graphite for anodes and NCA for cathodes), provide direct support for the sector, while EV tax credits offer indirect support.

The production tax credits for critical minerals and electrode active materials can be leveraged by recyclers who produce each of these components. To access these tax credits, production – or in this case, recycling – must take place in the US. The 10% production tax credit for manufacturing battery electrode active materials is set to decline from 2030 and will be phased out at the end of 2032.

Battery recycling is a competitive industry. Within the US some of the notable competitors include Li-Cycle and Ascend Elements, both of which have plans to build out over 50,000 metric tons of recycling capacity and have raised hundreds of millions of dollars.

## Notable battery recycling competitors

Company Description	Financial gain
<b>Li-Cycle</b> Glencore-backed battery recycling company which has plans to build facilities across the US. At the end of 2023, however, Li-Cycle paused construction at its 35,000 ton per year black mass battery recycling plant in Rochester, New York.	Went public in November 2020 and has been valued at over \$1.5 billion. However, its valuation as of October 2024 is \$50 million.
<b>Ascend Elements</b> Massachusetts-based battery recycling and engineered-materials company, has a supply agreement for SK Battery America to recycle both cell and module lithium-ion battery manufacturing scrap.	Raised \$1.7 billion through equity, debt and grant funding from public and private sources.

## Analyst take

Redwood Materials is a successful startup with operations predicated on less resource exploitation and energy consumption. It is valued at \$4.25 billion and backed by credible investors. An ecosystem proved by robust pilots and partnerships with both consumers and producers of batteries paves the way for its ongoing expansion, closing the loop for the battery industry in the US and reducing emissions and resource use associated with new clean technologies.

US policy supports the local production of battery materials and taxes battery imports, aiding the local industry. Recycling offers a product competitive with mined material, demonstrated by deals with battery makers, while better for the natural world.

### More from BNEF:

*Lithium-Ion Battery Recycling Availability Model (LIBRA)* ([web](#) | [terminal](#))

*Lithium-Ion Battery Recycling Market Outlook 2024* ([web](#) | [terminal](#))

*Everything EV All at Once: New US Tax Credits Explained* ([web](#) | [terminal](#))

*New US Rules on Foreign EV Batteries Set High Bar to Clear* ([web](#) | [terminal](#)).

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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# Slow Brews Caffeine High from Regenerative Coffee Farms

Coffee is one of the most environmentally destructive soft commodities, responsible for 1.9 million hectares of deforestation between 2001 and 2015. Many coffee producing regions experience economic instability, incentivizing landholders to clear the land and plant coffee trees to supply beans for sale and export. The crop is also highly vulnerable to climate change. Due to changes in temperature and land degradation, the UN Food and Agriculture Organization estimates half of the land where coffee beans are harvested today won't be viable in 2050.

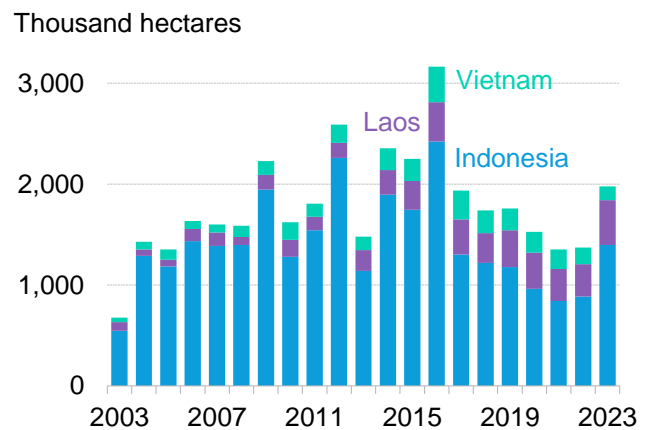
Danish startup Slow is mitigating the nature impacts of coffee production by converting formerly monoculture plantations into biodiverse agroforests. It partners with Southeast Asian farmers to deploy regenerative practices that sequester carbon and limit biodiversity loss. The company's product line consists of predominantly coffee and cocoa, supplemented by ecological byproducts such as honey. Slow has secured at least \$8 million in contracts and generates around \$1 million in annual gross profit.

## The nature-friendly product

Founded in 2018, Slow employs regenerative agroforestry with long-term offtake and supply agreements to purchase and convert low-productivity and degraded coffee plantations across Indonesia, Laos and Vietnam. The company assesses each farm to identify opportunities to improve tree cover, species diversification and soil health, before local farmers plant and harvest coffee between newly established trees, under a cooperative approach. To encourage biodiversity uplift, Slow implements practices including:

- Planting a minimum of 20 tree species per hectare, of which 19 are native to the region
- Retaining 40-50% canopy cover after annual pruning, with shade trees reaching a minimum canopy height of 12 meters to mimic the characteristics of natural forests
- Introducing fruit trees with varying flowering times to encourage pollinators

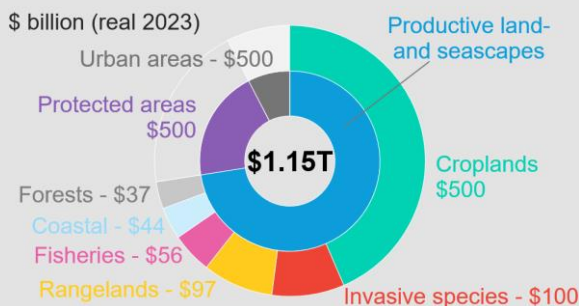
## Tree cover loss in the Southeast Asian countries where Slow operates



Source: Global Forest Watch, BloombergNEF.

## Mitigating nature loss

Biodiversity finance has to rise to an annual \$1.15 trillion by 2030; shifting financial flows to more regenerative soft commodity production is critical.



Slow directly manages the farming operations, processing, roasting, and selling of coffee, removing many of the intermediary steps where value is lost through a typical coffee supply chain. This vertically integrated structure allows Slow to recapture value, create micro-entrepreneurship opportunities for farmers, and trace its value chain. Farmers also benefit by being financially protected from the financial loss associated with major climate events.

While regenerative agroforestry practices can reduce supply chain emissions, they can be costly and require long-term commitments to keep trees unfelled. Slow manages this by entering long-term farm management contracts with growers and supply contracts with their customers.

In 2023, Slow merged with Indonesia's Krakakoa, a chocolate producer with similar agroforestry objectives, to unlock new markets across the region. As of October 2024, the combined company operates 670 hectares of land and engages with 145 farmers across Southeast Asia.

### Nature impact of coffee production

Many coffee farms have resorted to monocropping in pursuit of higher yields and efficiency, resulting in deforestation, biodiversity loss and less resilient crops and communities. By contrast, Slow's plantation management practices redress many of these harmful impacts. The company has planted approximately 177,000 trees across its smallholder farms, maintaining 430 endemic shade trees per acre. These trees provide shade for coffee production, reducing heat exposure and erosion, enhancing soil quality and attracting pollinators and other wildlife.

The trees also act as vital carbon sinks. Slow states that its farms sequester 4.5 kilograms of carbon for every kilogram of roasted coffee produced, in contrast to conventional coffee, which emits 6kgCO<sub>2</sub>e per kilogram of coffee. One cup of coffee (15g) results in approximately 346gCO<sub>2</sub>e of emissions across its value chain.

### Financial performance

While still in its infancy, Slow's financial performance is encouraging given market competitiveness and its comparatively small Nordics consumer base. After five years of sustainable coffee production, it recorded around \$1 million gross profit in 2023. Though it has not disclosed fundraising activity beyond a \$340,000 round in 2022, the company has attracted several notable investors and advisors including Lombard Odier, Systemiq, The Landbanking Group and Palladium. Partnerships with P4G, an impact investor network, and the World Wildlife Foundation, resulted in a \$321,000 grant to conduct feasibility studies for replicating their vertical-integration model in Indonesia, Vietnam, Ethiopia and Laos.

Meeting the growing consumer demand for sustainable coffee, Slow has secured contracts to supply its products to several large Nordic corporations. In 2021, it signed a 7-year deal with Coor – a Danish food and beverage supplier for businesses, hospitals and schools – worth \$8 million. It also signed an offtake agreement with Maersk in 2022 to supply offices with sustainable coffee and reduce its indirect emissions.

In late 2023, the company merged with chocolate producer Krakakoa, retaining Slow's name and branding, to expand regenerative practices into cocoa farming. The company states that a related \$5 million investment from groups including Indika Nature will facilitate this strategic move.

### Broader opportunities within the sector

With soft commodities such as coffee and chocolate closely linked to deforestation and land-use change, Slow's vertically integrated business model, with its focus on biodiversity conservation and uplift, provides a useful reference point for companies operating in the sector. Firms throughout the agri-food value chain are increasingly setting more ambitious targets to reduce their nature impact, including through the use of regenerative practices, although there remains little standardization or even agreement on definitions.

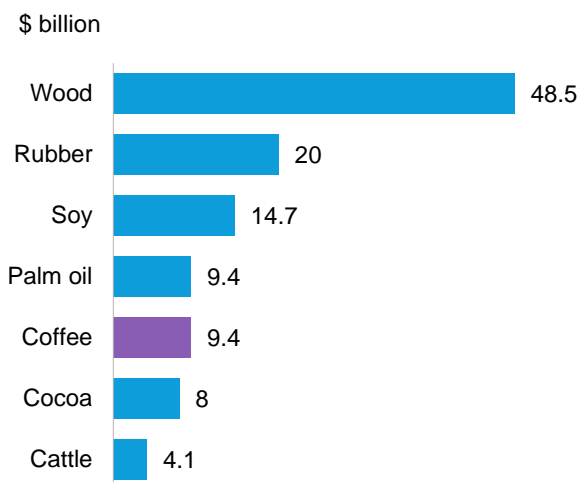
Several global coffee traders have developed their own internal standards and partner with external companies to administer and certify practices. Starbucks and SCS Global Services do so through their CAFÉ Practices program, using 200 indicators to score environmental, social and economic impacts of their supply chain.

Sustainable agroforestry can bring additional revenue streams through the creation of carbon credits.

According to BloombergNEF research, demand for agricultural offsets tripled in 2023, signaling expansion opportunities for nature-based projects. Alternatively, the sequestered carbon could instead be inset against the emissions of the farmer suppliers or customers.

Regulatory shifts are a key driver of investment into sustainable soft commodities, exemplified by the European Union’s Deforestation Regulation. Though implementation of the law is likely to be delayed until the end of 2025, it is slated to prohibit the sale, import or export of seven deforestation-linked soft commodities (cattle, cocoa, coffee, oil palm, rubber, soy and wood, including their derivatives) in the bloc, unless they can be proved to be deforestation-free. Over \$9 billion of EU coffee imports will be subject to the regulations.

### European Union imports of commodities covered by the EU, annual averages 2018-2022



Source: BloombergNEF, UN Comtrade, Bloomberg News.  
Note: Trade totals include raw materials and relevant derivatives.

Large coffee traders Sucafina, Ecom Agroindustrial, Louis Dreyfus and Cofco International have signed deals with deforestation-free coffee suppliers in compliance with the rule.

### Other coffee and chocolate producers with reduced nature impacts

Company	Description	Financial gain
<u>Green Coffee Company</u>	Founded in 2017, the startup is Colombia’s largest coffee producer, with a vertically integrated supply chain to control traceability and nature impacts. Currently controls 45 farms across 4,000 hectares.	Raised \$78.4 million across five rounds, profitable since 2023.
<u>GoodSam</u>	US-based chocolate, coffee and snacks brand manufactures products with ingredients sourced from regenerative farming practices.	At least \$7.4 million in fundraising.
<u>Nestle</u>	The world’s largest coffee company has committed to invest \$1 billion by 2030 to encourage uptake of regenerative farming practices.	The company’s market cap is \$250 billion as of October 2024.

### Analyst take

Integrating regenerative practices into the cultivation of soft commodities can improve on-farm biodiversity but often requires long-term contracts to support the transition. Coffee producers such as Slow derive revenue from less harmful coffee using a variety of agroforestry techniques. It grows crops with climate resiliency by shading coffee trees, limiting heat exposure, enhancing soil quality and attracting various fauna. As regulations on deforestation-linked soft commodities continue to tighten, at-risk companies can learn from Slow’s business model and practices.

#### More from BNEF:

*Carbon Offset Buyers Should Learn From Coffee Connoisseurs* ([web](#) | [terminal](#))

*Sustainable and Regenerative Agriculture: Company Targets* ([web](#) | [terminal](#))

# Wilder Harrier Dog Kibble Exploits Invasive Carp Catch

Organisms introduced into places outside their natural range are notoriously challenging to manage. Invasive alien species cost the global economy at least \$423 billion each year and contribute wholly or in part to 60% of known species extinctions. Over 200 new alien species introductions are recorded each year.

Canadian startup Wilder Harrier produces premium pet food from sustainable protein sources, including farmed insects and invasive fish. Its line of 'Sustainable Fish formula' dog kibble is made from silver carp, a species of non-native fish which has spread throughout the US, getting within 50 miles of the Great Lakes on the US-Canada border. The carp consume plankton so rapidly that they outcompete native juveniles, reducing the populations of multiple commercial fish species and worsening water quality.

Unlocking value from the management of invasive alien species can help solve a costly global problem and deliver new revenue streams.

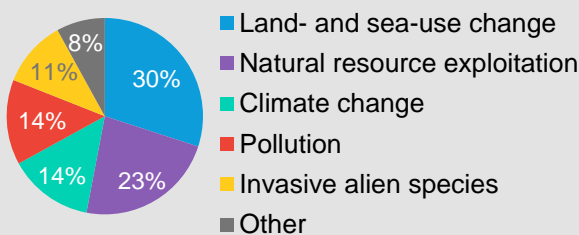
## The nature-friendly product

Founded in 2015, Wilder Harrier produces dog food primarily for the US and Canadian retail markets. The certified B-corporation uses non-standard proteins to reduce the environmental footprint of its products. In 2020, the company developed a line of pet food made from silver carp, a species native to China and eastern Siberia but now rampant in parts of the Mississippi River and its tributaries. The products have two benefits beyond conventional dog food: they contain omega-3 fatty acids that can improve canine skin and coat condition, and the fish harvest helps slow the encroachment of silver carp into Canadian waters.

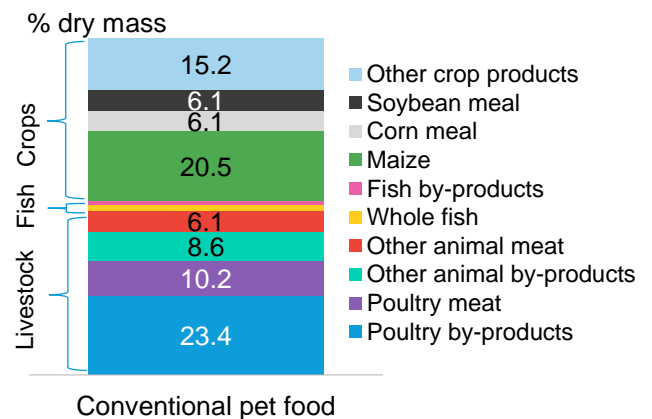
By comparison, conventional pet foods are produced using a range of livestock and crops, with fish comprising less than 4% of ingredients. Several of these ingredients have a detrimental impact on nature, putting pressure of land and water resources and releasing nitrogen and phosphorus into waterways.

### Mitigating nature loss

Five drivers account for over 90% of global biodiversity and ecosystem decline. Wilder Harrier's products, containing alternative sources of animal protein, address land- and sea-use change and resource exploitation, though its use of invasive silver carp is particularly novel.



### Ingredients sourced for conventional pet food globally in 2020, by dry mass



Source: BloombergNEF, Global Environmental Change, The Marine Ingredients Organisation.



Wilder Harrier creatively markets the Sustainable Fish formulas as products it hopes to stop selling. The firm’s marketing director has stated that Wilder Harrier is actively attempting to reduce silver carp populations to prevent the species spreading, and would discontinue the products if invasive populations were eradicated. The company has so far removed around 14,000 silver carp, a tiny share of the total population.

For another product line, the company sources black soldier flies and crickets fed on food waste as the primary ingredients. This substantially cuts its land-use footprint: a kilogram of waste-fed insect protein requires one square meter of land, while the equivalent amount of beef, pork or poultry protein takes between 58% and 96% more. Eliminating livestock from the product’s supply chain also reduces total freshwater consumption and greenhouse gas emissions.

### Nature impact of reducing invasive alien species populations

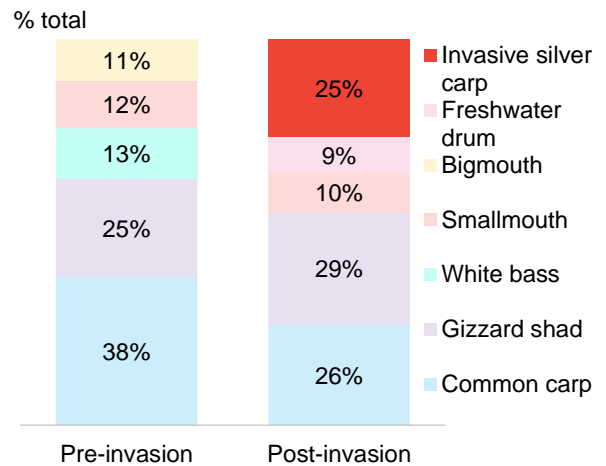
Silver carp are spreading across the US, causing ecological damage to freshwater systems. The fish – native to China and eastern Siberia – were first imported into the US in 1973 for aquaculture and to improve water quality by feeding on phytoplankton. Farmed silver carp escaped into the Mississippi River in the 1990s and have since spread to lakes and rivers across 20 US states. The silver carp population is immense, with one study estimating well over 300,000 specimens in a 130-kilometer (81-mile) stretch of the Illinois River – equating to 2,544 silver carp per river kilometer.

Silver carp have complex and detrimental impacts on the resiliency of freshwater ecosystems. In Illinois, where Wilder Harrier sources silver carp, populations of multiple native fish have fallen since the carp invasion. As these surface filter-feeders consume around 40% of their body weight in plankton each day, they rapidly outcompete other planktivorous species and out-grow predators. In some parts of the Illinois river, invasive carp make up 50% of fish by weight.

Furthermore, dwindling plankton populations increase algal blooms which in turn restricts light penetration to the riverbed. This kills aquatic plants, reducing food availability further and putting pressure on many other species in the freshwater food web.

The Canadian Invasive Species Centre and US National Invasive Species Information Center have programs to reduce US silver carp populations and to prevent the species spreading to Canada.

### Top five most abundant fish species in the Illinois river pre- and post-silver carp invasion



Source: BloombergNEF, West Virginia University. Note: Pre-invasion is the average abundance of the five most common species 1994 -2003. Post-invasion is the average abundance of the five most common species 2004–2021.

Interventions can be effective. Removal efforts have helped reduce carp density in the upper Illinois River by up to 40%, and populations of native species have been observed to rebound following the eradication of invasive carp.

### Financial performance

Wilder Harrier raised at least \$3.2 million in seed funding before entering an accelerator run by US retail giant Target in 2022. In May 2023, the firm stated it had sold over 10,000 two- and five-kilogram bags of dog food made from silver carp, estimated to generate approximately C\$400,000 in revenue. The Sustainable Fish formula is positioned as a premium product line, retailing for C\$69.99 for a five-kilogram bag of kibble

Land and sea use change	Resource exploitation	Climate change	Pollution	Invasive alien species
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(\$51 per 11lb bag). Wilder Harrier products are sold in the US, Canada and South Korea.

In early 2024, the company was acquired for an undisclosed amount by Impact Pet Products Inc., which owns another Canadian sustainable pet-food startup. The company has not disclosed further sales or financial information since the acquisition.

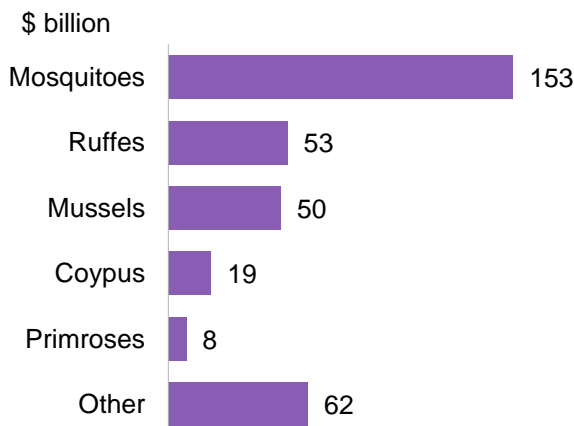
## Other opportunities from invasive species

Utilizing or countering invasive species presents an opportunity for companies sourcing animal products to expand their portfolios while benefiting native biodiversity. Wilder Harrier and competing pet-food brand Chippin diversified their supply chains by incorporating silver carp into products, positively impacting river ecosystems in sourcing regions.

Beyond fish, one biotech firm, Oxitec, has launched commercial solutions to manage malaria and dengue fever carried by invasive mosquitoes.

More than a third of the globally recorded cost of managing invasive alien species involve mosquitoes. This includes the costs of treating disease, deploying mosquito nets and other management strategies, and is likely a gross under-estimate, given only documented costs were included in the study.

## Reported costs of aquatic invasive alien species globally by genus between 1971 and 2021



Source: BloombergNEF, *Science of The Total Environment*.

Note: Genus is the taxonomic rank above species. Ruffes are a fish genus and coypus are an aquatic rodent.

The opportunities for biotechnology companies to reduce insect numbers through genetic engineering will increase as rising temperatures and humidity in temperate zones such as Southern Europe mean invasive disease-carrying mosquitos can establish populations more easily.

## Notable companies utilizing invasive alien species

Company	Description	Financial gain
<u>Oxitec</u>	A UK-headquartered biotechnology company genetically engineering male mosquitoes to reduce populations and limit the spread of disease.	Raised <u>\$26.4 million</u> , including <u>\$18 million</u> from the Bill and Melinda Gates Foundation.
<u>Chippin</u>	A US-based dog food brand also using invasive silver carp and crickets as protein sources and marketed as beneficial for pet allergies.	Raised <u>\$550,000</u> as of last funding round in August 2023.
<u>Inversa</u>	Fashion retailer based in the US creating leather apparel from invasive species including silver carp, lionfish and pythons.	Raised <u>\$250,000</u> as of last funding round in January 2024.

## Analyst take

Harvesting invasive species is a novel way for firms to extract natural resources while benefiting biodiversity. Despite Wilder Harrier's relatively modest scale, it serves as an exemplar for others seeking opportunities in the elimination of harmful flora and fauna. Judicious impact monitoring and disclosure is imperative, as this business model has in other instances been contorted to maintain the invasive species' populations to protect revenue. Alternative sources of ingredients or revenue are thus required if firms are to remain profitable beyond the short term, as Wilder Harrier's secondary product lines containing sustainable insect protein demonstrate.

### More from BNEF:

*Shipper CMA CGM's Ballast Breaches: Nature Risk Case Study* ([web](#) | [terminal](#))

*Hawaiian Airlines' Wings Clipped: Nature Risk Case Study* ([web](#) | [terminal](#))

## Appendices

### Appendix A. Case study structure

Each case follows a similar structure to enable comparison. A nature-related problem is introduced, proceeded by a description of how a company is addressing it, further details on the nature impact, the financial gain realized, and opportunities in the broader sector. Each case concludes with an analyst take and links to additional resources.

### 1 BloombergNEF

**Perfect Day Milks Millions in Animal-Free Dairy Market**

**Overview**

Perfect Day has a significant impact on nature. It has developed a nature-friendly product that has a 99% reduction in freshwater use and 99% lower greenhouse gas emissions compared to conventional dairy. The company leads in the increasingly competitive US alternative dairy market, raising \$801 million in funding since 2014 and attaining a valuation in excess of \$1.6 billion. Contracts with large consumer packaged goods firms suggest that alternative dairy, made well, will continue to offer investment opportunities in disrupting the global \$827 billion conventional dairy industry.

**Nature impacts of Perfect Day protein relative to conventional dairy**

Mitigating nature loss	Perfect Day protein relative to conventional dairy
4% of global freshwater use	99% reduction in freshwater use
4.3% share of global GHG emissions	99% lower emissions
7% of habitable land	Significantly lower but not yet quantified

**Financial information**

- \$801 million raised by Perfect Day since 2014
- \$1.6 billion company valuation as of January 2024
- \$1.2 billion raised value as of January 2020

### 2 BloombergNEF

**Further detail on nature-related impact**

Perfect Day operates on a B2B model, having attracted its consumer goods arm. The largest Company, in 2023. The company's co-founder said that the major B2C approach was to demonstrate the commercial viability of fermentation-derived whey protein to big food manufacturers. Perfect Day has engaged in a series of partnerships, leading to pilot trials with Nestle and Mars on animal-free milk beverages and chocolate bars.

The first full-scale product release was in February 2024 – a range of animal-free ice cream produced in collaboration with Unilever, as part of its Dreyfus line. BloombergNEF has identified at least nine other brands that Perfect Day is now partnering with, supplying whey protein for products spanning milk, cheese, ice cream and nutritional supplements, for sale in thousands of retail stores across the US.

**Nature impact of animal-free whey protein**

Dairy milk is among the food products with the most significant impacts on nature, as combined greenhouse gas emissions, freshwater use and land use requirements per unit of production are highest only in cases of protein component. The production of a liter of dairy milk requires 1,200 liters of water and 12 kg of CO2e. Perfect Day's whey protein has a substantially more modest environmental footprint. According to an LCA analysis, by eliminating the cow – and the attendant feed demands – the company produces sufficient protein for a liter of milk with 99% lower GHG emissions, 99% less freshwater withdrawals and

**Environmental impacts of Perfect Day's whey protein relative to protein in other milks**

Water withdrawal, L/L of milk	GHG emissions, kgCO2e/L of milk
Dairy milk	1,200
Almond milk	371.5
Non-milk	258
Soy milk	44.2
Perfect Day	2.5

**Translating opportunity into financial gain**

Manufacturers, investors and consumers have started to react to the transition underway in agricultural systems, increasingly recognizing the need for change in dairy supply chains. Many large FMCGs have committed to climate and nature targets, and managers and financiers seek to integrate environmental risks, and the potential for nature-related risks, into their investment decisions. This is prompted an uptick in investment in technologies enabling food that alleviates the nature impact starting in late 2019, several years prior to the movement to alternative food.

As of October 2024, Perfect Day has raised a total of \$801 million over eight rounds from 16 different

**The company's intervention**

The nature-friendly product is a genetically modified lactic acid bacteria that produces a whey protein identical to that made by cows, using precision fermentation to engineer microorganisms and produce high-value compounds. According to a 2019 addendum to the US Food and Drug Administration, a genetically modified lactic acid bacteria and sugar feed media are placed into a sterile bioreactor under conditions that trigger the microbes to synthesize the desired whey protein. The mixture is then filtered, pH-adjusted and spray dried, yielding an off-white powder composed of around 80% whey protein. This final product is used in food production in the same manner as animal dairy, acting as an emulsifier, texturizer or high-quality protein source.

**Precision fermentation process**

### 3 BloombergNEF

**Further sector opportunities**

investors, valuing the company at \$1.6 billion. While funding over its initial seven years was unexceptional, it began to attract significant capital from a December 2019 Series C, raising \$140 million, supplemented by an additional \$100 million eight months later, and a \$50 million Series D in 3Q 2023. A \$60 million Series E in January 2024 is its most recent release. Notable investors span VC (Firemuse, ICONIQ, CIVIC, AGM Ventures), and various angels and family offices.

**Figure 3: Perfect Day has raised over \$800 million since 2014**

**Further sector opportunities**

In an August 2023 pitchbook with Agf under, its co-founder stated that it was not just about whether the company's end game was an IPO or acquisition. In 2020, it adopted a long-term vision, having achieved production cost milestones through scale, while several whey protein powders containing its product met all cost parity to animal-based equivalents. To strengthen growth, the company now needs to finish construction of new production facilities in India and secure further CPG contracts. Key to both is the adoption of a former contract partner (both sides deny wrongdoing).

**Opportunities within the sector**

What was worth \$27 billion in 2022 surpasses \$1.3 billion by 2030. This sizeable market for technology to capture, including competitors, below:

**Notable Perfect Day competitors**

Company	Description	Funding
On the Border	The largest fermentation-derived dairy protein producer in the world's largest fermentation facility. The company has a pilot plant in Israel and has secured regulatory approval.	\$110 million
On the Border	On the Border produces animal-free whey protein and milk. The firm was established in 2015. It was acquired by Danone in 2020, spun off with another set of Danone's business in 2021, and later purchased by Danone in 2021.	\$100 million

**BNPEF take**

Perfect Day attained a valuation of \$1.6 billion, strongly backed by credible investors, intellectual property and regulatory approval in the US, and is now emboldened by a clear path to exit. It represents a prime example of a successful startup with operations produced on a reduction in the drivers of nature loss. Unlike alternative food companies, it offers a product identical in structure and taste to an animal-based equivalent, ensuring consumer and investor confidence. As the precision fermentation industry matures, additional financial opportunities will emerge – at the cost of animal-related incumbents, but to the benefit of the natural world.

**Milk from BNEF**

Fresh Rabbit: Decarbonizing Beef and Dairy Production (2023) | Letter to the Editor: Making Creamier Farm Carbon Footprints (2023) | Research

**Financial gain**

As of October 2024, Perfect Day has raised a total of \$801 million over eight rounds from 16 different

## Appendix B. Glossary of terms

The definitions used throughout this report align with those used by the Taskforce on Nature-related Financial Disclosures (TNFD) and are drawn from a range of organizations:

**Table 3: Glossary of nature-related terms used in this report**

Term	Definition	Source
Adaptation	Anticipating the adverse effects of climate change or nature loss and taking appropriate action to prevent or minimize the damage they may cause.	EEA (with additions for nature)
Biodiversity	The variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.	Convention on Biological Diversity
Ecosystem	A dynamic complex of plant, animal and microorganism communities and the non-living environment, interacting as a functional unit.	CBD, Ipbes
Ecosystem service	The contributions of ecosystems to the benefits that are used in economic and other human activity.	UN
Mitigation	Minimizing or avoiding harmful impact. Applies to climate (avoiding or reducing emissions of heat-trapping greenhouse gases) and nature (preventing or reducing the impact of the direct drivers of nature loss).	IPCC (with additions for nature)
Natural capital	The stock of renewable and non-renewable natural resources (eg, plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people.	Capitals Coalition
Nature	The natural world, with an emphasis on the diversity of living organisms (including people) and their interactions among themselves and with their environment.	Ipbes
Resilience	The ability to maintain essential function, identity and structure, and the capacity for transformation. <i>Used throughout to refer to refer to ecological resilience, though also applies to climate change.</i>	IPCC
Risk	Consequences for human or ecological systems. The term is not used as a substitute for probability or chance, nor is it a generic term for something bad.	IPCC

Source: BloombergNEF. Note: 'EEA' is the European Environment Agency; 'Ipbes' is the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services; 'UN' is the United Nations; 'IPCC' is the Intergovernmental Panel on Climate Change.

## Appendix C. Nature-related financial instruments

The past several years have seen the rise of novel financial instruments that attempt to shift financial flows into nature conservation and restoration efforts. While they are gaining mainstream interest and attracting increasing attention from the financial sector, their overall value and impact thus far have been modest. Additionally, many either require blended finance to be attractive investments, or are so poorly regulated as to render them excessively risky.

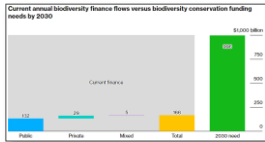
**Table 4: Private sector financial instruments intended to tackle nature and biodiversity loss**

Instrument	Description	Market size
Debt-for-nature swaps	Reducing a developing economy's debt burden in exchange for sovereign commitments on nature protection or restoration. Typically requires blended finance	Completed deals worth some \$4.6 billion since 1989, majority covering six major swaps since 2021
Biodiversity-linked debt	Green and sustainability bond and loan issuance with biodiversity use of proceeds	Bond issuance reached \$250 billion in 2023, though only 3.7% of funds were allocated to biodiversity projects
Biodiversity credits	Tradeable units of biodiversity uplift, generated from conservation or restoration projects	Less than \$1 million of biodiversity credits have been sold as of October 2024
Nature-based carbon offsets	Credits generated from avoided deforestation, sustainable agriculture or reforestation projects that reduce or remove carbon from the atmosphere	Issuance was close to \$80 billion in 2023, a 53% decline since 2021 high

Source: BloombergNEF. Note: List is not exhaustive.

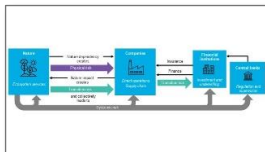
A range of public and public-private instruments exists beyond those detailed above, including payments for ecosystem services and biodiversity offsets, although these are usually part of a compliance market.

## Appendix D. Further BNEF research on nature and biodiversity



### THEME: Scaling Biodiversity Markets and Finance

Biodiversity is the next frontier of environmental, social and corporate governance, but its impacts reach far beyond the boardroom ([web](#) | [terminal](#)).



### THEME: The Financial Impact of Nature-Related Risks

Mismanaging nature-related risk has burned billion-dollar holes in many corporate balance sheets ([web](#) | [terminal](#)).

## Supply chain risk and opportunity

### FLAGSHIP: When the Bee Stings

Quantified exposure to physical, transition and systematic risks arising from a company's impacts and dependencies on the natural world

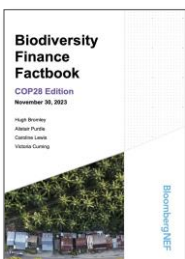


- Corporate nature and deforestation commitments
- Revenue dependency on ecosystem services
- Deforestation traceability in agri-food supply chains
- Asset-level physical exposure to nature loss
- Nature impacts and dependencies of the energy transition
- Nature-related financial disclosure
- Water stress in supply chains
- Credit and investment screening for nature loss
- Deforestation and nature policy tracking
- Nature-related trade barriers and market access

## Finance and environmental markets

### FLAGSHIP: Biodiversity Finance Factbook

Tracking finance flows into the preservation and restoration of nature and framing discussions where funding should be prioritized



- Nature-focused funds and investment
- Labeled finance for nature and biodiversity
- Biodiversity credit and offset markets
- Public investment into nature preservation and restoration
- Nature-based solutions project database
- Data, metrics and frameworks for nature
- Biodiversity preservation funding priorities
- International conventions and policy tracking

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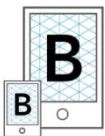
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