Goldman Sachs

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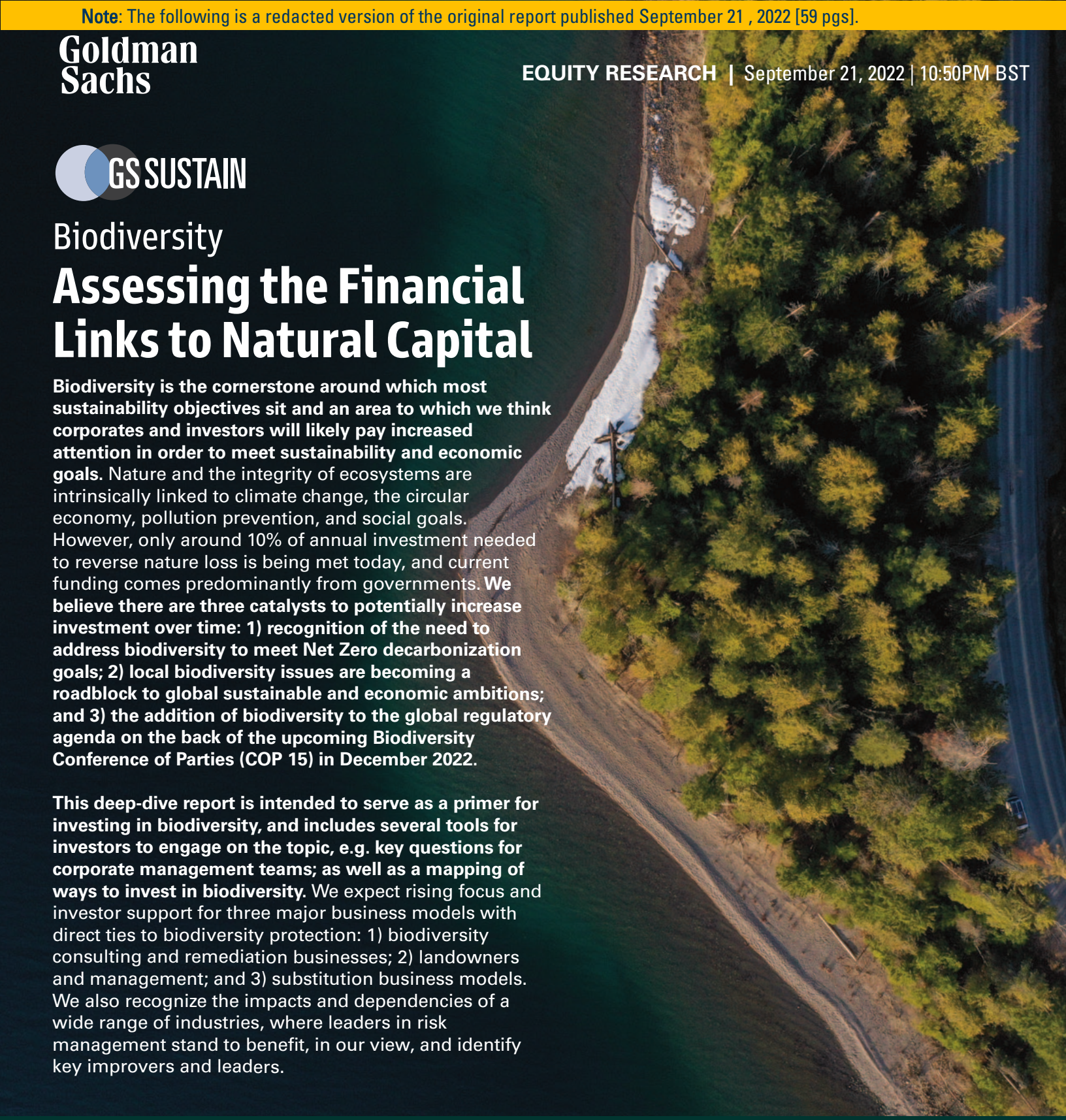
GS SUSTAIN

Biodiversity

Assessing the Financial Links to Natural Capital

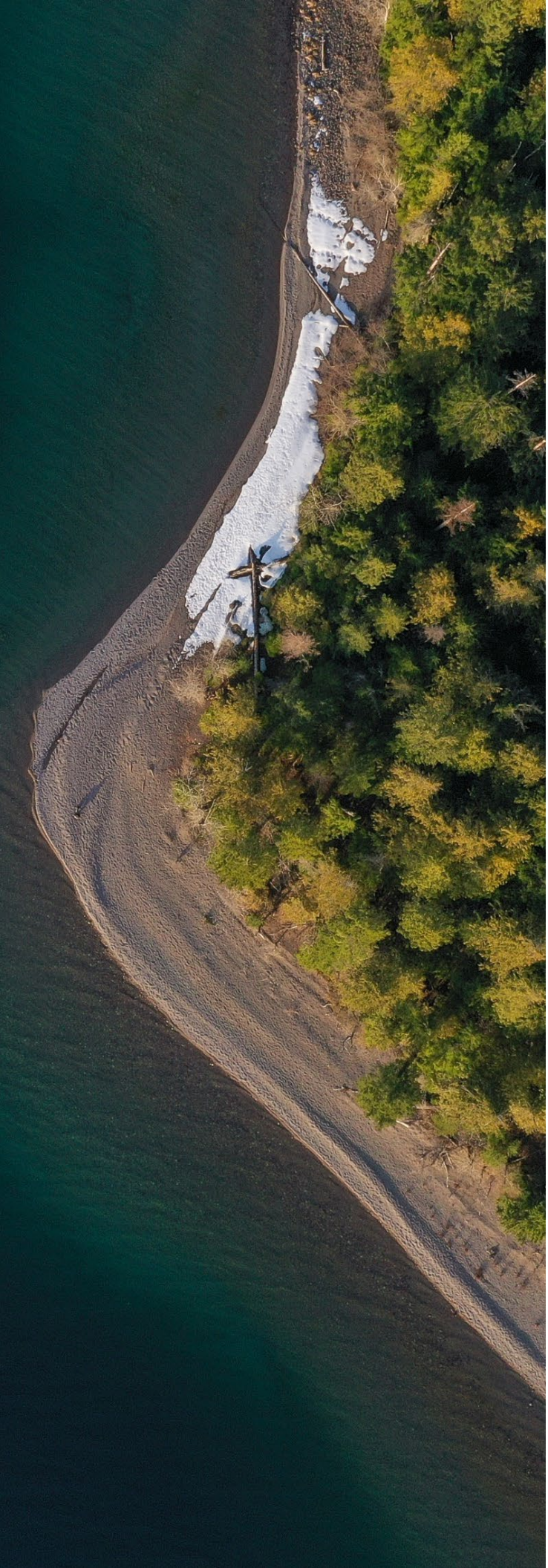


Biodiversity is the cornerstone around which most sustainability objectives sit and an area to which we think corporates and investors will likely pay increased attention in order to meet sustainability and economic goals. Nature and the integrity of ecosystems are intrinsically linked to climate change, the circular economy, pollution prevention, and social goals. However, only around 10% of annual investment needed to reverse nature loss is being met today, and current funding comes predominantly from governments. **We believe there are three catalysts to potentially increase investment over time: 1) recognition of the need to address biodiversity to meet Net Zero decarbonization goals; 2) local biodiversity issues are becoming a roadblock to global sustainable and economic ambitions; and 3) the addition of biodiversity to the global regulatory agenda on the back of the upcoming Biodiversity Conference of Parties (COP 15) in December 2022.**

This deep-dive report is intended to serve as a primer for investing in biodiversity, and includes several tools for investors to engage on the topic, e.g. key questions for corporate management teams; as well as a mapping of ways to invest in biodiversity. We expect rising focus and investor support for three major business models with direct ties to biodiversity protection: 1) biodiversity consulting and remediation businesses; 2) landowners and management; and 3) substitution business models. We also recognize the impacts and dependencies of a wide range of industries, where leaders in risk management stand to benefit, in our view, and identify key improvers and leaders.

The Goldman Sachs Group, Inc.

For the full list of authors, see inside.



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BIODIVERSITY in numbers

Humans depend on nature and its services for more than half of the world's GDP, **US $44 trillion**.

Up to **US $1.0 tn** in investment per year is needed to protect and conserve biodiversity.

Current financing for biodiversity conservation and remediation represent less than **10%** of the need.

An incremental **US $0.6 - $0.9 trillion** is needed per year to improve biodiversity on the path to fully thriving nature.

Three catalysts why investors/corporates will pay closer attention:

1) Recognition of the need to address biodiversity and reverse losses to meet Net Zero and other decarbonisation goals
2) Local biodiversity issues are becoming a roadblock to global sustainable and economic ambitions
3) The addition of biodiversity to the global regulatory agenda on the back of the upcoming Biodiversity Conference of Parties (COP 15) in December 2022.

Business lines that may benefit

We see **2** ways to invest in biodiversity:
1) solutions business models and
2) risk management.

We highlight **3** business models contributing to biodiversity protection & restoration:
1) Biodiversity consulting and remediation;
2) Land owners and management;
3) Substitution.

We highlight 15 covered companies and 13 uncovered companies exposed to biodiversity through solutions providers and risk management leaders and improvers.

Sources: World Economics Forum, OECD, Paulson Institute, BIOFIN, Business for Nature, Earth Track, World Bank, Goldman Sachs Global Investment Research

Executive Summary

Biodiversity is defined in this report as the biological variety and variability of life on Earth at all levels, from genetic variety within species to variability of species within ecosystems.

Natural capital is defined in this report as the sum of natural assets and resources used or available to provide valuable goods and services to people. Natural assets include geology, soil, air, water and all living things, according to the World Forum on Natural Capital.

Net nature positive refers to strategies and activities where humans positively impact nature and allow for an increase in biodiversity headed towards full recovery of thriving nature (to levels before human-inflicted destruction).

Biodiversity is the cornerstone around which most sustainability objectives sit and an area to which we think corporates and investors will likely pay increased attention in order to meet sustainability goals. We believe there are three catalysts to potentially increase investment over time: 1) recognition of the need to address biodiversity to meet Net Zero decarbonization goals; 2) local biodiversity issues are becoming a roadblock to global sustainable and economic ambitions; and 3) the addition of biodiversity to the global regulatory agenda on the back of the upcoming Biodiversity Conference of Parties (COP 15) in December 2022.

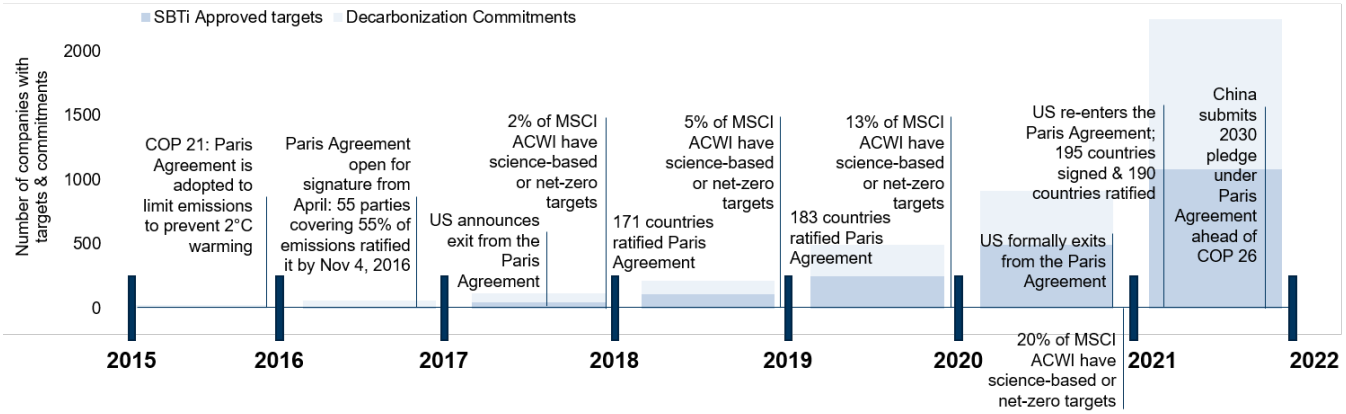
Biodiversity connects the 'E' in ESG to the 'S' through the role of natural capital feeding, housing and clothing the global population. Biodiversity is also closely linked to decarbonization goals, as deforestation and land conversation account for around 25% of global GHG emissions, according to the World Bank. **Yet, global emissions reduction goals can run up against local biodiversity issues,** as the extraction of resources required for the green transition can put stress on local biodiversity. Ultimately, the protection of biodiversity and path towards net nature positive will require complex solutions that allow the green transition to work hand in hand with the protection of terrestrial and oceanic carbon sinks as well as species that are pivotal to sustainable growth for the global population.

Local biodiversity issues are becoming a complicating factor to global sustainable and economic ambitions: Examples include an EV factory in Germany, which has now been indefinitely delayed by the local authorities over biodiversity concerns, or **withdrawals or delays of licensing** for new construction and mining operations critical to copper supply — threatening projects' economic viability and broader global sustainability goals (decarbonization, energy transition). While these examples focus on biodiversity *impacts* from company operations, we also see financial implications and risks in the long term for sectors that are *dependent* on depleting natural capital.

Investment needed to protect and conserve biodiversity is significant — $0.7-$1.0 trillion annually, according to the Paulson Institute. Spending thus far appears to be insufficient, with current global financing for biodiversity conservation and remediation representing only around 10% of annual needs, according to BIOFIN, the OECD and Paulson Institute estimates. While cost-benefit ratios of biodiversity projects can vary widely, based on a number of location-specific factors, each dollar invested in biodiversity may yield up to $30 in net societal benefits (Camelo et al., 2017). Current funding comes predominantly from governments, but we expect this to change over the next decade, as corporations and investors recognize the intrinsic links between biodiversity protection, climate change and other environmental objectives required for sustainable growth.

Catalyzing engagement on the topic, the stated aim of the fifteenth Conference of the Parties on Biodiversity at the end of 2022 is to establish long- and medium-term global biodiversity goals to articulate the materiality of nature-related risks for stakeholders. **COP 15 on Biodiversity aims to match the Paris Agreement in ambition and support to create the Post-2020 Global Biodiversity Framework, with stakeholder buy-in on global limits for biodiversity loss and targets for protection and restoration.** The Paris Agreement, penned in 2015 at the COP 21 conference, committed to limit the rise in the global average temperature to well-below 2°C above preindustrial levels, in pursuit of 1.5°C, requiring net zero emissions be achieved by 2050 or sooner. Leading up to the Agreement, countries were asked to establish "nationally determined contributions" and strengthen efforts in the years ahead, with check-ins every five years to assess collective progress. The Paris Agreement kicked off a chain reaction of country-level commitments, regulations, corporate commitments, ESG fund flows and stakeholder focus on climate change. While COP 15 on Biodiversity aims to produce various targets and commitments for nature, we believe it could spur engagement on the topic for a variety of stakeholders, leading slowly but surely to increased company-level biodiversity commitments, investor engagement on the topic, and focus on identifying leading solutions. Country-level announcements from COP 15 could provide an important indicator for the speed at which engagement at the investor and corporate levels as well as in the eyes of the public could move in the next few years.

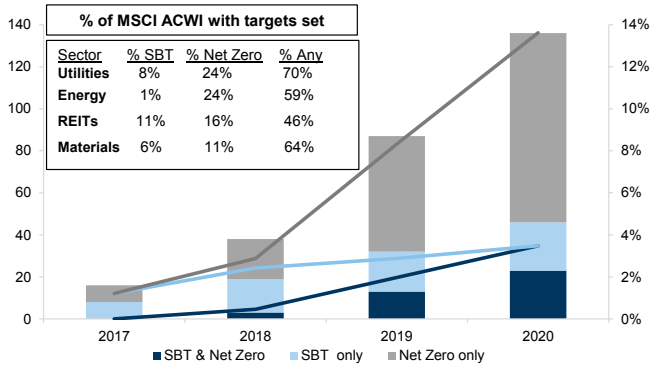
Exhibit 1: The Paris Agreement from COP 21 kicked off country and company commitments to decarbonize, leading to a jump in investment in the green transition; we believe the coming COP 15 on Biodiversity can be a catalyst to kickstart over time greater corporate and investor focus towards solutions to biodiversity challenges



Source: SBTi, Bloomberg, Goldman Sachs Global Investment Research

Exhibit 2: Net-zero emissions targets have taken off in recent years among industries with heavier emissions; we believe there will be increased recognition of the need to address biodiversity challenges to meet Net Zero targets

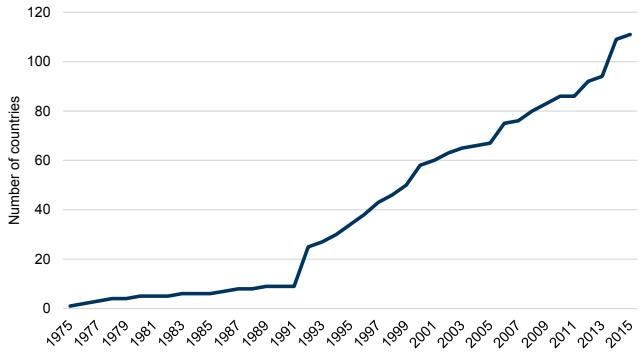
Count and % of companies with some combination of net-zero and science-based emissions targets in four emissions-intensive sectors (MSCI ACWI)



Source: Bloomberg, Goldman Sachs Global Investment Research

Exhibit 3: Government discussions around biodiversity policies and regulations have taken off since the 1970s

Number of countries that have, are developing, or are starting to discuss national government policies that require, encourage, guide, suggest, or enable the use of biodiversity offsets



Source: Global Inventory of Biodiversity Offset Policies

TCFD: Taskforce on Climate-Related Financial Disclosures

COP 15 also aims to guide the currently-in-development risk management and disclosure framework from the Taskforce on Nature-Related Financial Disclosures (TNFD) for companies to report and act on evolving biodiversity risks. TNFD has released a draft framework this year, following on the progress by TCFD on climate disclosures. In addition, the EU Taxonomy includes biodiversity as one of six environmental objectives through which companies will begin reporting green revenue and capex in the coming years. Progress on global targets may provide a starting point for investors to coalesce around frameworks that will guide corporate disclosures, identify key numeric metrics to assess performance, and increase data availability around biodiversity protection and restoration. ***In this report, we assess a number of frameworks for corporates and investors, including the TNFD and the EU Taxonomy, that can act as a starting point to analyze and frame biodiversity dependencies, impacts and risks.***

Investing in Nature and Biodiversity

We see two ways to invest in biodiversity, as 1) products and service providers can directly contribute to conservation and restoration efforts through the three avenues outlined below, while 2) other companies have risk exposures, where investor support may grow for leaders in risk management or where investors may reduce exposure to companies not managing risk well.

Within products and service providers that can directly contribute to conservation and restoration efforts, we highlight three business models: biodiversity consulting and remediation businesses; landowners and land/ocean management; and substitution business models. We see long-term opportunities in these business models with a growing addressable market and an increasingly sophisticated B2B consumer base focused on this space over the next decade. We would also expect ESG funds to increase focus on these themes in the coming years with continued and further high relative ownership.

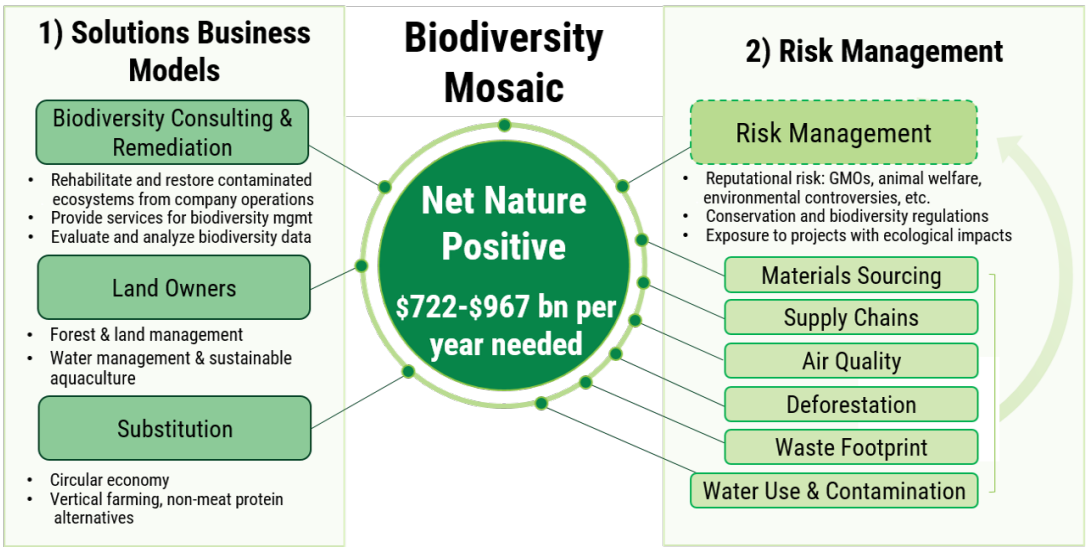
1) Biodiversity consulting and remediation businesses rehabilitate ecosystems or provide services to help organizations analyze biodiversity risks and dependencies, build strategies to minimize risks, and carry out net nature positive action plans.

2) Landowners and management include sustainable forestry, sustainable seafood production, and other land or water management activities that support a variety of species, protect natural habitats, and maintain carbon sinks.

3) Substitution business models replace extractive business models with new structures that require fewer natural raw materials or reduce physical footprint.

We highlight 22 companies within these three areas that we view as potential beneficiaries of the growing spotlight on biodiversity and natural capital.

In addition to biodiversity-related business models, a number of key sectors have sizable impacts, risks and exposures to biodiversity loss, where we expect greater attention to the concept of doing no significant harm. We identify key sectors with high impacts, dependencies and risks, take stock of current policies and practices, walk through current and forward-looking best practices, and identify six improvers and leaders in risk management.



Source: Paulson Institute, Goldman Sachs Global Investment Research

Exhibit 4: Summary of 28 companies exposed to Biodiversity consulting/remediation, land management, substitution or risk management

Exposure	Company Name	Region	GS SUSTAIN Sector	Market Cap ($ bn)	Covering Analyst	GS SUSTAIN Operational E&S Score	% Underweight/ Overweight in ESG Funds
Biodiversity Consulting & Remediation Services	**AECOM**	N. America	Engineering & Construction	10.2	-	74%	278%
	Agilent Technologies Inc	N. America	Med Tech	38.3	Matt Sykes	84%	335%
	Arcadis NV	W. Europe	Engineering & Construction	2.9	-	97%	755%
	Montrose Environmental Group	N. America	Multi-industry Services	1.2	-	75%	115%
	Planet Labs PBC	N. America	Professional Services	1.5	Noah Poponak	40%	-70%
	Stantec Inc	N. America	Professional Services	5.3	-	95%	810%
	Tetra Tech Inc	N. America	Multi-industry Services	7.3	-	75%	974%
	Trimble Inc	N. America	Tech Hardware	15.8	Jerry Revich	77%	501%
	Clean Harbors	N. America	Multi-industry Services	6.4	Jerry Revich	26%	380%
	Perpetua Resources Corp	N. America	Mining & Metals	0.1	-	77%	-98%
	Republic Services Inc	N. America	Multi-industry Services	45.4	Jerry Revich	13%	321%
	Waste Management Inc	N. America	Multi-industry Services	70.6	Jerry Revich	46%	224%
Land Management	**Klabin SA**	LatAm	Paper & Packaging	2.6	Marcio Farid	61%	81%
	Rayonier Inc	N. America	Paper & Packaging	5.2	-	64%	252%
	Stora Enso Oyj	W. Europe	Paper & Packaging	11.8	-	70%	378%
	Suzano SA	LatAm	Paper & Packaging	11.8	Marcio Farid	29%	54%
	Weyerhaeuser Co	W. Europe	Paper & Packaging	25.2	Susan Maklari	66%	55%
Substitution	**AppHarvest Inc**	N. America	Food & Beverage	0.3	-	19%	893%
	Azek Company Inc	N. America	Capital Goods	2.8	Susan Maklari	8%	292%
	GFL Environmental Inc	N. America	Multi-industry Services	10.7	-	10%	162%
	Hydrofarm Holdings Group	N. America	Capital Goods	0.2	-	26%	324%
	Tomra Systems ASA	W. Europe	Multi-industry Services	6.8	-	36%	633%
Risk Management	**Adani Ports and SEZ**	Asia ex Japan	Transport Infrastructure	22.4	Pulkit Patni	58%	-77%
	Electricite de France SA	W. Europe	Utilities - Electric	46.3	Ajay Patel	75%	-49%
	IGO Ltd	Asia ex Japan	Mining & Metals	7.0	-	90%	-20%
	Nestle SA	W. Europe	Food & Beverage	316.1	John Ennis	90%	-13%
	Spirax-Sarco Engineering	W. Europe	Capital Goods	9.3	William Turner	87%	287%
	Thai Union Group PCL	Asia ex Japan	Food & Beverage	2.2	-	61%	10%

Source: FactSet, Bloomberg, Refinitiv Eikon, Morningstar, Goldman Sachs Global Investment Research

Humans and nature: Symbiosis and impacts

Humans depend on nature and its services to a moderate or high degree for more than half ($44tn) of the world's GDP, according to the World Economic Forum. Food, fiber, housing, medicine, and fuel, among other daily necessities, rely on sustainable agriculture, pollinators, a healthy ocean, and genetic diversity of plants and animals to support the growing population.

Biodiversity hotspots: Around 30 areas, identified by biologists, that are particularly rich in endemic species and threatened by human activities.

More than one-fifth of the global population lives in biodiversity hot spots and tropical wilderness areas, with population growth in those areas currently above average (Williams, 2013)[1]. While the global population has doubled and GDP per capita has more than doubled since 1970, according to the World Bank, the OECD found that the abundance of vertebrates globally has decreased by 60% and insects by 40% over the same time period. Over the last three centuries, humans have altered well over half of the Earth's land mass, from 95% wild or semi-natural total land (minor use for agriculture or settlements) to only 45% (Ellis et al., 2010)[2]. This has resulted in a loss of species up to 1,000 times the natural rate (Pimm et al., 2014)[3], along with changes in water and other chemical cycles necessary to sustain them.

These changes are not without material economic impact: The Economics of Land Degradation Initiative estimates that up to $6 - $11 trillion per year is lost due to land use change and land degradation (over 7% of global GDP.) These economic risks and losses span from food crop output and damaged grazing areas to job creation. The up to 75% of food crops that are dependent on animal pollination are at risk, according to a report by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). One in 45 jobs in the US is directly dependent on the oceans and Great Lakes, and a healthy ocean is set to contribute up to $3tn to the economy per year by 2030 through fishing, tourism, aquaculture and energy production, according to the OECD. Globally, the ocean economy feeds billions of people, with fish making up 17%+ of animal protein consumed globally and over 50% in some countries in Asia and Africa, per the FAO. Declining fish stock levels could negatively impact the traditional fishing industry, which employs around 35 million people globally, according to the International Labour Organization.

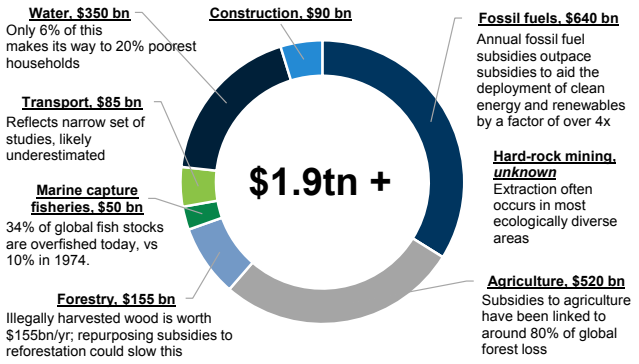
[1] Williams JN (2013) Humans and biodiversity: population and demographic trends in the hotspots. Popul Environ 34:510-523. https://doi.org/10.1007/s11111-012-0175-3

[2] Ellis, E.C., Klein Goldewijk, K., Siebert, S., Lightman, D. & Ramankutty, N. (2010) Anthropogenic transformation of the biomes, 1700 to 2000. Global Ecology and Biogeography, 19, 589– 606. https://doi.org/10.1111/j.1466-8238.2010.00540.x

[3] S. L. Pimm, C. N. Jenkins, R. Abell, T. M. Brooks, J. L. Gittleman, L. N. Joppa, P. H. Raven, C. M. Roberts, J. O. Sexton, The biodiversity of species and their rates of extinction, distribution, and protection. Science. 344, 1246752 (2014). DOI: 10.1126/science.1246752

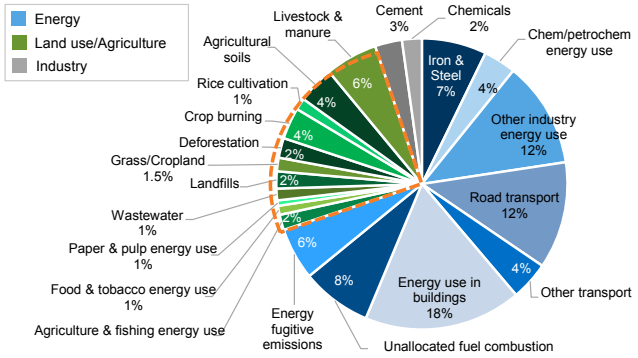
We see a growing recognition that the loss of biodiversity and ecosystem services presents systemic risks to human well-being, sustainability goals and economic growth and stability; however, biodiversity often competes with a host of other sustainable development goals globally. The world spends the equivalent of 2% of global GDP ($1.9 tn) annually on subsidies that are connected to biodiversity loss (according to Business for Nature, the OECD, Earth Track), but less than $150 billion/year is spent on biodiversity conservation (Paulson Institute). The subsidies identified by the Earth Track contribute to other social, economic or sustainability goals, highlighting the possible conflicts between local biodiversity issues and some global sustainable development goals. Despite these conflicts, biodiversity adds value to a number of social and environmental goals, particularly decarbonization efforts.

Exhibit 5: Business for Nature sees nearly $2 tn invested in activities connected to biodiversity loss
Breakdown of global annual environmentally harmful subsidies estimates, 2021



Source: Earth Track, OECD, IEA, UN Food and Agriculture Organization, World Bank

Exhibit 6: Deforestation, land use change and other biodiversity-dependent and impacting areas make up around 1/4 of global GHG emissions
Global greenhouse gas emissions by sector, 2016



Source: World Resources Institute, Goldman Sachs Global Investment Research

Biodiversity and Decarbonization

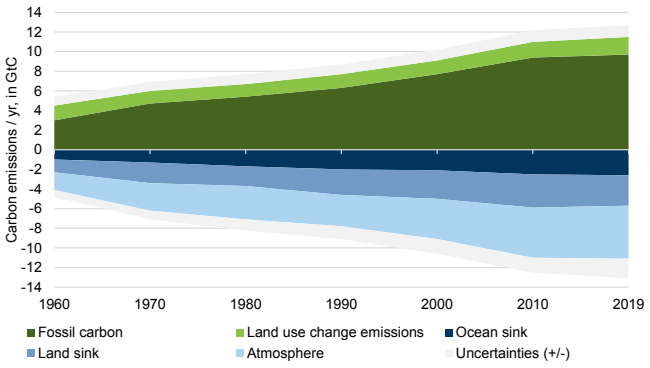
No-net loss nature strategies contribute to reversing the current decline of biodiversity to lead to **net nature positive** recovery, where human impacts allow for an increase in biodiversity headed towards full recovery of thriving nature (to levels before human-inflicted destruction).

The transition to "net nature positive" is pivotal to sustainable growth and climate change mitigation goals, in our view. Deforestation and land conversion account for around 25% of global GHG emissions according to the World Bank, and forests are estimated by the Global Forest Watch to provide a net carbon sink of close to 8 billion tonnes of CO2e per year, close to the entire transport sector's emissions in 2018. Air pollution removal from trees and forests were found to provide health benefits valued at around $380 per tonne of pollution removed (Nowak, 2020)[4]. According to Circle Economy, a business-as-usual scenario is on track for 2.4°C global warming by 2050, with a 19-23Gt emissions gap towards a 1.5°C scenario. In our view, biodiversity is an important input to close this gap, and companies will need to deploy capital towards conservation and restoration as net zero deadlines inch closer. We outline three key aspects of biodiversity that we think can play a part closing the emissions reduction gap below.

[4] Nowak, David J. 2020. Urban trees, air quality and human health. In: Gallis, Christos; Shin, Won Sop, eds. Forests for public health. Newcastle Upon Tyne: Cambridge Scholars Publishing: 31-55.

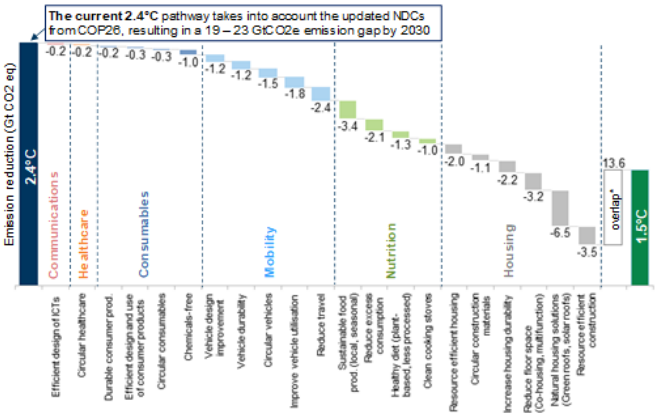
1. **Forest carbon sinks:** Research from the Global Forest Watch and NASA satellites shows that **forests globally absorbed 15.6Gt of CO2 per year** between 2001 and 2019, while deforestation and fires released 8.1Gt of CO2 per year, on average, making forests a net carbon sink, absorbing 7.6Gt of CO2 per year. While eliminating wildfires completely is implausible, reforestation and forest management to reduce wildfires can help increase net carbon absorption from forests.
2. **Ocean carbon sinks:** A 2020 study assessed anthropogenic CO2 emissions and their redistribution into the atmosphere, ocean and land, and found that the **ocean removes around 25% of anthropogenic emissions** generated per year (Friedlingstein et al., 2020)[5].
3. **Circularity minimizing carbon sources: The circular economy drives second derivative benefits for biodiversity by reducing need for virgin materials.** In ***The evolution towards a Circular Economy***, we outline **21 circular solutions across various sectors of the economy that can collectively contribute to a 22.8Gt CO2e emissions reduction**, including natural housing solutions, resource-efficient construction, sustainable food production and reducing travel, all which can positively impact biodiversity protection.

Exhibit 7: The ocean and forests/other wilderness areas provide significant carbon sinks to offset emissions from fossil fuels and land use change
Average carbon emissions per year, by decade; sources vs. sinks, in Gigatons of CO2



Source: Global Carbon Budget 2020, Data compiled by Goldman Sachs Global Investment Research

Exhibit 8: Circular solutions can help reduce global emissions by 39% (from 2019 levels), helping to bridge the gap left by new COP 26 Paris Commitments towards a 1.5 degree scenario by 2050
Emission reduction of 21 key circular solutions, Gt CO2 eq based on 2019 levels, assuming NDCs are met by 2032



*Some solutions' emissions reduction overlap with other solutions.

Source: Circle Economy, Data compiled by Goldman Sachs Global Investment Research

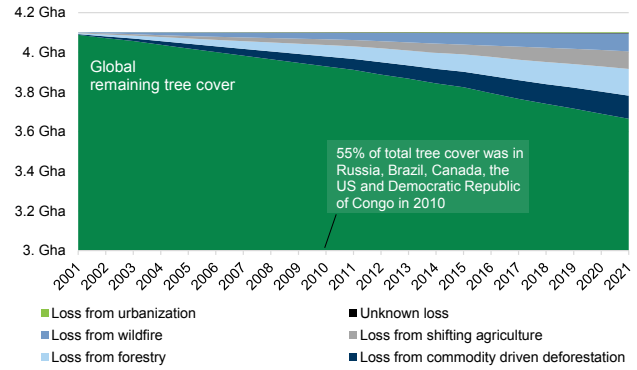
The emissions benefits from biodiversity are at increasing risk, as carbon loss from tropical deforestation doubled between the first five years of the century and 2015-2019 (Feng et al. 2022)[6], posing a challenge, in our view, to the Declaration on Forests and Land Use, where 141 countries covering over 90% of global forests pledged to conserve forests and other terrestrial ecosystems and accelerate their restoration. Over the last century, half of wetlands, 40% of forests and 35% of mangroves have been lost

[5] Friedlingstein, P. et al. 2020. Global Carbon Budget 2020. Earth System Science Data, 12(4), 3269-3340. https://doi.org/10.5194/essd-12-3269-2020

[6] Feng, Y., Zeng, Z., Searchinger, T.D. et al. Doubling of annual forest carbon loss over the tropics during the early twenty-first century. Nat Sustain 5, 444–451 (2022). https://doi.org/10.1038/s41893-022-00854-3

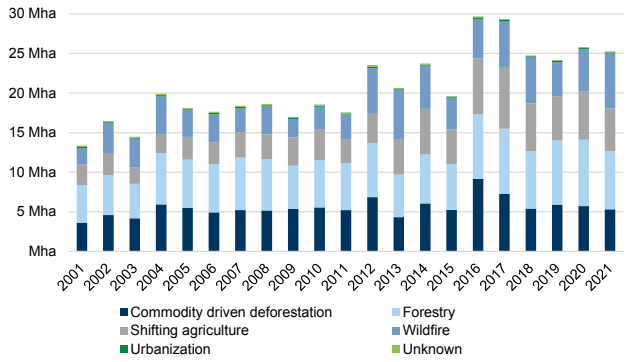
around the world, according to the OECD, with a 10% loss in global tree cover since 2000 alone, according to Global Forest Watch. Deforestation is driven by commodity extraction, agriculture and forestry and can threaten air pollution removal and important carbon sinks.

Exhibit 9: 10% of tree cover (437 Mha) has been lost since 2000, falling to 26% of global land in 2021
Global remaining tree cover, along with cumulative loss in tree cover by driver, 2001 - 2021, in Gigahectares



Source: Global Forest Watch, Goldman Sachs Global Investment Research

Exhibit 10: Between 2001 and 2021, nearly 60% of global tree cover loss was due to forestry and commodity driven deforestation
Global annual tree cover loss by dominant driver, 2001 - 2021



Source: Global Forest Watch

IPBES, established in 2012 by nearly 100 governments (growing to nearly 140 governments since), facilitates collaboration between the scientific community and policymakers on the sustainable use of biodiversity and ecosystem services through assessment reports, policy support, building capacity & knowledge, and communication & outreach.

While climate change mitigation commentary and commitments have largely coalesced around GHG emissions and decarbonization to limit global warming to 1.5°C or below 2°C, the world has not yet found the equivalent succinct target or clear metrics to measure progress on net-nature positive goals. In this vein, identifying the 'global limits' associated with biodiversity loss remain even more elusive than setting the established upper limit to prevent catastrophic impacts of global warming (2°C), though one study by PBL Netherlands Environmental Assessment Agency set the global limit for species abundance loss at 28% to avoid abrupt or irreversible environmental change. This level has long been surpassed, with species abundance standing at only 63% in 2018 (where 100% represents an undisturbed pristine ecosystem), per CDC Biodiversité, reflecting a significant loss in biodiversity and prevalence of wildlife in the world. As a result, we think a deeper understanding of species abundance loss and biodiversity destruction limits will be required in order to develop global, national and company-level targets. **COP 15 on Biodiversity aims to use the Post-2020 Global Biodiversity Framework to establish consensus on biodiversity loss limits and associated medium- and long-term targets on conservation and restoration.**

On our estimates, the actual value of ecosystem services and risks of biodiversity loss are often underestimated, with costs and consequences not evenly distributed, often impacting emerging countries disproportionately. The complicated nature of interdependencies between ecosystems and traditional valuation methods means that impacts and risks can be difficult to estimate. The IPBES released a report in July 2022 stressing the undervalued nature of biodiversity, finding that even when market-based, material biodiversity outcomes (food, medicine, etc.) are fully valued, only 5% of valuation studies find their way into public policy. The World Bank estimates damage from crimes related to natural resources exceed $70 billion per year through lost income, lost resources and degradation of the environment, while simultaneously showing links to corruption and instability. Thus, we think that closing the biodiversity financing gap could lead to an increase in natural capital, especially for developing countries, where illicit resource extraction leaves local communities vulnerable to unsustainable exploitation of the resources they depend on and reduced resilience against the impacts of biodiversity loss and climate change. We recognize that balancing biodiversity protection with sustainable growth may sometimes require trade-offs, and complex solutions will be required in order to allow the protection of biodiversity to work hand in hand with social goals rather than hinder growth opportunities.

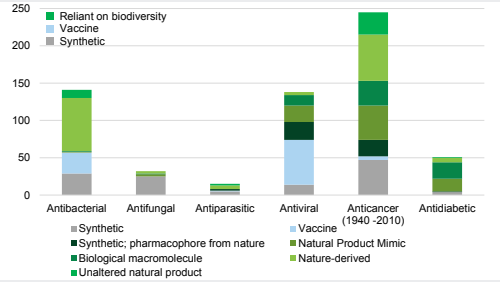
Other Considerations for Biodiversity

Nature and Medicine: Biomedical resources and disease prevention

Human health is linked to healthy ecosystems, and biodiversity loss has been linked to a variety of health & medicine risks, including increased risk of disease, reduced resources to create new medicines, destruction of healthy food systems, and others outlined below.

A diverse range of species contribute to pharmaceuticals, with up to one-third of medicine today and 49% of small molecules used to treat cancer derived from plants or nature. Outside of pharmaceuticals, the market for traditional, natural medicines was estimated at $83 billion annually, and 80%+ of the global population relies on natural medicine as part of their primary healthcare. **To date, just a small portion of plants and animals have been explored for medicinal purposes** (estimated 15% of 300,000 plant species), and of these, an even smaller percentage have been evaluated for conservation status (3%). A high rate of species extinction can add to human health risks, in our view and based on the aforementioned research: of the 60,000 species currently thought to be used for medicinal purposes, nearly 40% are threatened with extinction.

Exhibit 11: Many drugs have a high percent of derivation from nature
Anti-infective, anticancer and antidiabetic drugs from 1981 - 2014 (Anticancer drugs from 1940), by source



Source: Newman DJ. Cragg GM. Natural products as sources of new drugs from 1981 to 2014. J Nat Prod. 2016 Feb 7.

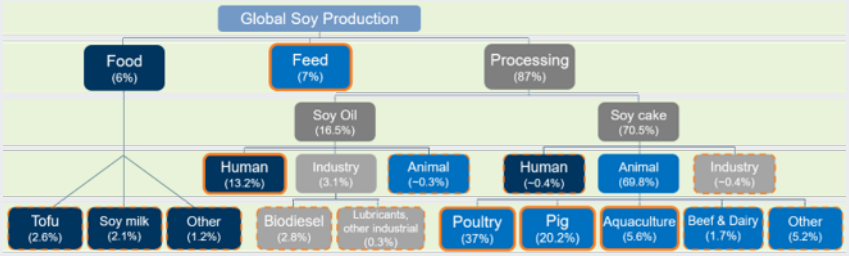
The loss of biodiversity is also thought to contribute to increased risk of disease: 70% of infectious diseases are estimated to be transferred from animals to humans (zoonotic), and many studies have identified a link between zoonotic diseases and natural habitat destruction (Cunningham et al., 2017; Johnson et al., 2020; Shah et al., 2019; Keesing et al., 2010; Plowright et al., 2017; Gibb et al., 2020; Fornace et al., 2019, among others). Species that are more likely to carry disease are often the same animals that thrive in human-dominated landscapes; as natural ecosystems are destroyed, pathogen-carrying species can be pushed closer to humans.

The studies on the links between biodiversity destruction with both loss of future medicinal breakthroughs and increased disease spread highlight the utility of biodiversity and the need for increased conservation efforts, in our view.

Soy's Impact on Biodiversity

Soybean production quantity has increased more than ten-fold in the last 60 years, catalyzed by positive factors for supply (non-perishable, zero-tillage farming, herbicide resistance) and increased demand for animal feed (75% of production). Human food makes up only 6% of end use cases, but soy is now the fourth largest global crop by production area.

Exhibit 12: Around 75% of global soy production ends up as animal feed rather than consumed directly by humans
End use case estimates for global soy production in recent years



Source: Food Climate Research Network, USDA, United Soybeans Board, USB, Goldman Sachs Global Investment Research

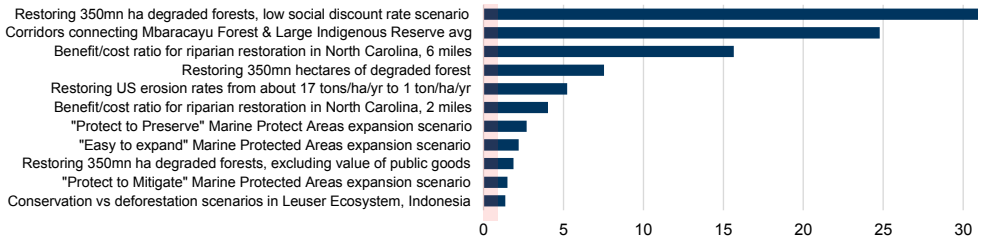
The surge in soy production, however, is contributing to the loss of natural ecosystems to agriculture, whose impacts differ based on production location, imports and exports, consumption, etc. Around 5% of the continental US is used for soy, according to the USDA (~90 mn acres), though land use change from soy is not as significant an issue in the US as in South America. Deforestation in South America is largely driven by cattle ranching, later sold to soy producers, and a study found that between 2006-17, 2-5mn acres/yr of soy were planted on recently deforested land in Brazil. Deforestation and associated fires have been linked to biodiversity loss, with one study finding up to 64% of >14,500 plant and vertebrate species in the Amazon Basin have been impacted by deforestation and fires.

The *Soy Moratorium*, a zero deforestation commitment (ZDC) by the soy production chain, was established in 2006 and is linked to a decline in soy-associated deforestation in the Amazon. ZDC coverage, however, lags in the Cerrado, a tropical savanna ecoregion that produces 60% of Brazilian soy and houses 5% of global species. Only 8% of the Cerrado is protected, and 2021 reported the highest levels of deforestation since 2015, when 8,531 km² were lost. At the same time, the government of Brazil weakened environmental protections, reduced protection enforcement, and the monitoring agency INPE (Brazilian space agency) announced it may run out of deforestation tracking funding. The 'Funding for Soy Farmers in the Cerrado' initiative intends to raise $250mn to limit soy production to existing agricultural land. **Considerations for soy-associated deforestation accompany concerns around land use change in the entire agricultural sector. In our view, the Cerrado case highlights the necessity of location-specific biodiversity analysis on a project level and deep into the supply chain for companies.**

The investment opportunity for conservation and restoration

The gap between what is needed and what is spent to halt biodiversity loss is wide. The Paulson Institute estimates the annual investment needed to stop the decline in global biodiversity at up to $967 billion. Various studies estimate that global financing for biodiversity may represent less than 10% of the need, from $78 billion (OECD) to $124 - $143 billion (Paulson Institute). **Nonetheless, we think the need for biodiversity protection and remediation offers significant opportunity for investment**, as many studies show that benefits exceed costs in a variety of different restoration and conservation efforts (Exhibit 13). Public investment in restoration is estimated to support 126,000 jobs in the United States, according to the OECD, and is estimated to provide employment for up to 500,000 additional workers in Europe, according to the Institute for European Environmental Policy.

Exhibit 13: Benefit-cost ratios of biodiversity conservation and restoration projects vary dramatically, depending on local considerations, but many show benefits exceeding costs
Benefit/cost ratios identified in a variety of conservation and restoration studies



Source: Beukering et al. (2003), Brander et al. (2020), Naja et al. (2017), Holmes et al. (2004), Pimental et al. (1995), Naidoo and Ricketts (2006), Camelo et al. (2017), Data compiled by Goldman Sachs Global Investment Research

Local biodiversity issues are already becoming a roadblock to global sustainable and economic ambitions. Despite under-investment on both the public and private side, biodiversity protection is increasingly becoming a significant factor in project approvals for natural resource-intensive sectors. New construction and mining operations are seeing delays and withdrawals of approval based on environmental and impact assessments, which we think could be a contributing factor to commodity inflation. This is a trend that is likely to continue expanding across all sectors, in our view, on the back of growing concern for biodiversity conservation by environmental groups and indigenous communities.

Current funding for biodiversity comes predominantly from governments, representing up to 60% of total biodiversity funding at present, according to the Paulson Institute. But we expect businesses and investors to give greater focus to the value potential of biodiversity conservation, remediation and restoration over the next decade, as a result of linkages to decarbonization goals, increasing financial risks of negative biodiversity impacts on project approvals, and pressure from investors and other stakeholders on the back of engagement on the topic around COP 15. In the long-term, we see new revenue opportunities in solutions business models to support future government and corporate commitments/goals to protect and restore biodiversity and natural ecosystems.

The Biodiversity Investment Mosaic

We see two key pillars through which investors can approach investment in biodiversity: 1) Solutions business models, and 2) Risk Management. Within solutions business models, we have identified three critical components of biodiversity conservation, remediation and restoration business activities to lead to net nature positive outcomes through regenerative land and water management:

1) Biodiversity consulting and remediation businesses - rehabilitation of contaminated ecosystems damaged from company operations, or services to help organizations analyze biodiversity risks, impacts and opportunities, build strategies to minimize risks and restore existing damage, and carry out action plans to maximize natural capital alongside business operations.

2) Landowners and management - sustainable forestry and other land / ocean management that supports a variety of species, protects natural habitats, and maintains carbon sinks through regeneration, replanting, and other sustainable management strategies; sustainable seafood production that prioritizes marine ecosystems and maintains health levels of biodiversity.

3) Substitution business models - replacement of extractive business models to new structures that require fewer natural raw materials or reduce land use footprint throughout the entire value chain.

In addition, a key aspect to biodiversity protection, conservation, remediation and restoration involves *risk management* from companies most exposed to potentially harmful business activities. To avoid significant harm, companies with biodiversity exposures must consider the impacts of materials sourcing, supply chains, product use, deforestation, waste, water use, wastewater contamination and air quality on local ecosystems and wildlife. While a wide variety of business models have the potential to impact biodiversity, we view the following 22 sectors as having the most direct exposure and requiring the most thorough analysis of risks and action plans:

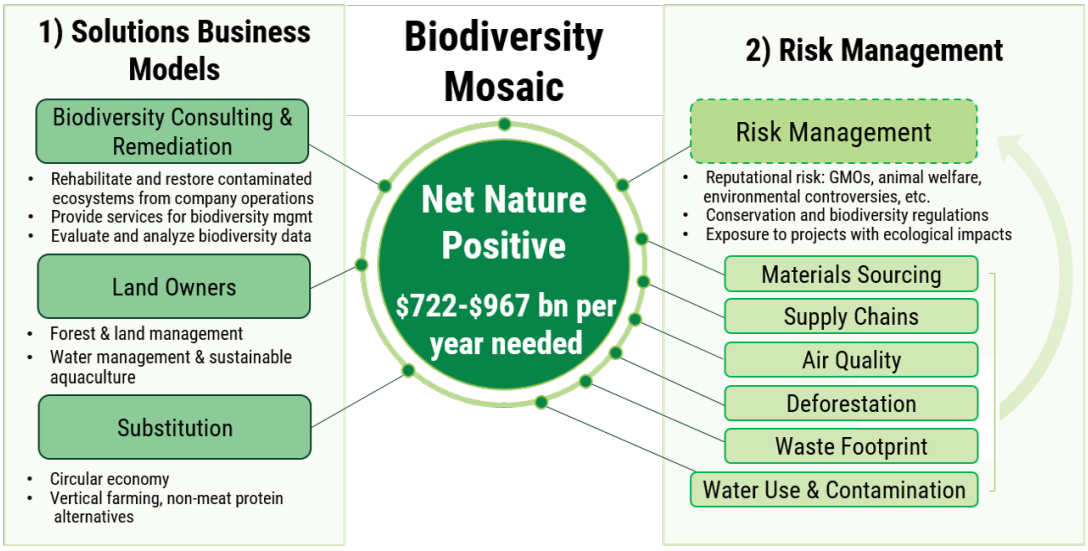
Oil & Gas Producers; Oil Refiners; Mining & Metals; Construction Materials; Steel; Paper & Packaging; Chemicals; Consumer Durables; Household & Personal Care; Food & Beverage; Logistics & Shipping; Marine Shipping; Engineering & Construction; Oil Services; Oil & Gas Midstream; Retail - Staples; Hospitality; Real Estate; Electric Utilities; Multi Utilities; Gas Utilities; and Water Utilities.

Exhibit 14: These sectors have a wide range of exposures to various elements of biodiversity protection and restoration

Mapping of exposures based on Sustainability Accounting Standards Board (SASB) disclosure recommendations

	Ecological Impacts	Water & Wastewater Mgmt	Waste & Hazardous Waste Mgmt	Critical Incident Risk Mgmt	Air Quality	Supply Chain Mgmt	Materials Sourcing & Efficiency
Electric Utilities	■	■	■	■	■		■
Paper & Packaging	■	■	■		■	■	
Mining & Metals	■	■	■	■	■		
Construction Materials	■	■	■		■	■	
Food & Beverage	■	■	■			■	■
Oil & Gas Producers	■	■		■	■		
Oil Refiners		■	■	■	■		
Steel		■	■		■	■	
Chemicals		■	■	■	■		
Oil Services	■	■	■	■			
Oil & Gas Midstream	■			■	■		
Retail - Staples			■			■	■
Hospitality	■	■	■				
Consumer Durables			■			■	■
Logistics & Shipping				■	■	■	
Marine Shipping	■			■	■		
Household & Personal Care		■				■	
Multi Utilities				■			■
Water Utilities		■					■
Gas Utilities				■			
Engineering & Construction	■						
Real Estate		■					

Source: SASB, Goldman Sachs Global Investment Research



Source: Paulson Institute, Goldman Sachs Global Investment Research

Select Companies exposed to Biodiversity Protection

We highlight 11 companies across our coverage (Republic Services, Waste Management, Clean Harbors, Planet Labs, Trimble, Agilent, Weyerhaeuser, GFL Environmental, Azek, Suzano and Klabin) and a further 11 Not Covered companies that we see as aligned to the three key components of Biodiversity: 1) Biodiversity Consulting and Remediation; 2) Landowners and ecosystem managers; and 3) Substitution business models.

Exhibit 15: Select companies mapped to Biodiversity solutions: Conservation and Remediation Project Managers

Theme	Why it's important	Company name	Relevance for the theme
Biodiversity Consulting & Remediation Services	**Remediation services** can conserve and rebuild damaged ecosystems and habitats to their natural state before exploitation. Remediation services also help ecosystems recover in the event of damage from spills or other environmental disasters.	Perpetua Resources	**Perpetua**'s Stibnite Gold Project seeks site restoration alongside a functioning mining operation in order to improve water quality, restore fish migration, and improve habitats. The project plans to remove 325,000 tons of legacy mine waste away from the river and to divert three streams away from historical mine waste.
		Waste Management	**Waste Managemen**t has partnered with the Wildlife Habitat Council to rehabilitate and renovate landfills into certified wildlife habitat, protecting over 20,000 acres for preserving endangered species.
		Republic Services	**Republic Services**' environmental solutions include chemical cleaning, excavation (hydro, air machine), remediation and chemical disposal. The company uses treatment wetlands and phytoremediation in their bioremediation process at the 124 closed landfills for which they have responsibility.
		Clean Harbors	**Clean Harbors'** business lines include hazardous waste management, leak detection and repair, tank cleaning, decontamination, remediation and spill cleanup services for companies.
	Service providers evaluate and analyze biodiversity data and provide direct resources for biodiversity and natural ecosystem management, protection, conservation, remediation and restoration while maximizing use of natural capital.	Planet Labs	**Planet Labs'** data products help measure climate risks, urban growth, monitor biodiversity hotspots and supply chains, and measure efficacy of sustainable agriculture to help tackle sustainability challenges.
		Tetra Tech	**Tetra Tech** provides environmental consulting, engineering, management and technical services, offering models for biodiversity conservation best practices and managing critical policy and governance factors.
		Arcadis NV	**Arcadis** provides engineering, design and environmental consulting for natural and built assets, with services including biodiversity footprint assessments with quantitative measurements, helping develop biodiversity targets and strategies, advisory services for restoration efforts.
		Stantec	**Stantec** is a professional service provider that helps create and manage development projects with a focus on nature. The company designed a green bridge to mitigate habitat fragmentation (Arborfield Cross Relief Road) that was awarded at the 2021 CIRIA Big Biodiversity Challenge Awards.
		Montrose Environmental Group	**Montrose** uses ecosystem service valuation concepts to help companies make informed decisions about how their operations impact local ecosystems and biodiversity.
		AECOM	**AECOM** offers a full suite of ecology surveys, mitigation design, supervision and delivery of mitigation and construction plans, and long term planning to deliver biodiversity net gains.
		Trimble	**Trimble**'s Mobile Builder platform offers land, forest and fibre management solutions used for soil, water and biodiversity protection through geospatial technologies that can help reforestation efforts, map threatened species, classify plants and animals through high-resolution mapping, etc.
		Agilent Technologies	**Agilent**'s instruments for laboratory workflow include tools to find / remove microplastics from ecosystems, analyze water samples for pesticides and pollutants and test for toxic PFAs and foreign nanoparticles.

Source: Goldman Sachs Global Investment Research, Company data

Remediation services and biodiversity service providers (above) include biodiversity preservation directly in their business model as a key target of business activities, while other components including land and water management (below) align to the theme through management of resources being used for revenue generation (i.e. timber businesses, regardless of reforestation strategy, have a primary goal that requires the use of natural capital and resource extraction). While the primary business activity may be resource extraction, these companies require restoration and regeneration in a way that protects ecosystems in order to sustain their business.

Exhibit 16: Select companies mapped to Biodiversity solutions: landowners and management

Theme	Why it's important	Company name	Relevance for the theme
Land and Ocean Management	Managing land sustainably can protect endangered species, prolong carbon storage of natural plants, and maintain healthy ecosystems despite extraction of resources.	Weyerhaeuser Co	**Weyerhaeuser** grows more trees than they harvest each year, leaves forest buffers around waterways to protect aquatic species habitats, and has all forests certified to SFI's Forest Management Standard. They report extensively on ecosystem services and raw material data and outline conservation plans for threatened species in their forests.
		Stora Enso Oyj	**Stora Enso Oyj** has a net-positive biodiversity in its own forests and plantations by 2050 target, with a detailed set of actions towards 2030. The company ensures forests they harvest from are regenerated, and 100% of the wood they use for packaging, biomaterials, paper, etc. is from sustainable sources.
		Rayonier	**Rayonier** incorporates sustainability into their timber and real estate businesses, with 96% of forests third-party certified, analysis on sustainable harvest yield range, and various initiatives to protect biodiversity and threatened species. Their Wildlight Real Estate development conserves 47% of total land as protected forests and wetlands.
		Suzano	**Suzano** uses the Environmental Profit & Loss methodology to quantify costs and benefits of forestry and operations on natural capital and has set a target to connect 500k ha of priority areas for conservation in the Cerrado, Atlantic Forest and Amazon. The company has ~1mn ha set aside for environmental conservation (40% of total area).
		Klabin	**Klabin** maps and monitors species to prioritize conservation efforts, allocating 42% of forests to biodiversity protection and using a mosaic approach to forest management that forms ecological corridors to connect habitats.
			While many companies engaged in seafood manufacturing have risk mgmt strategies that promote sustainable fishing, most pure play sustainable aquaculture companies are private, including data monitoring & analytics (Jala, Ecto, Aquabyte) and alternative methods of manufacturing, including cell-cultured seafood (BlueNalu, Shiok Meats).

Source: Goldman Sachs Global Investment Research, Company data

Substitution business models reduce demand for extraction of raw materials which can threaten biodiversity, or develop alternative methods of production that limit biodiversity risk. This can come in the form of circular economy-related companies that focus on material efficiency, eco-design, durability and utilization or recycling & composting, or it can include business models that reduce land use through vertical farming, meat-alternatives, or aquaculture methods that reduce bottom trawling or other unsustainable fishing methods with excessive bycatch and other negative side effects.

Exhibit 17: Select companies mapped to Biodiversity: Substitution

Theme	Why it's important	Company name	Relevance for the theme
Substitution	Limiting demand for disruptive raw material extraction and reduces landfill waste (with an acute focus on open dumping) that can disturb ecosystems and habitats.	GFL Environmental	**GFL**'s recycling facilities remediate contaminated soils for reuse in development projects, and their wood recycling facilities recover and reprocess wood waste to produce a range of products.
		Tomra Systems	**Tomra** provides waste collection and sorting technology solutions, with advanced sorting systems that optimize resource recovery to minimize waste sent to landfill.
		Azek Company Inc	**Azek** designs and manufactures outdoor living products out of recycled materials, substituting traditional materials with scrap to reduce virgin demand and increase durability through increased weatherproofing.
		Appharvest	**Appharvest** operates large high-tech indoor farms, which the company reports use up to 90% less water with yields up to 30x that of traditional open-field growing on the same amount of land.
		Hydrofarm Holdings	**Hydrofarm Holdings** manufactures controlled environment agriculture equipment and supplies, including lighting, atmospheric control and hydroponics for vertical farming, which can save land and resources compared to traditional agriculture.

Source: Goldman Sachs Global Investment Research, Company data

Risk Management Leaders

We also highlight four covered companies (Adani Ports, Nestle, Spirax-Sarco and EDF) and two uncovered companies (IGO Ltd., Thai Union Group) that are **exposed to biodiversity impacts from their businesses and manage risks well (or have demonstrated significant improvement in risk exposure and management) through robust assessments, action plans and targets.** Best practices for biodiversity risk management may include but are not limited to: supply chain tracing and transparency; disclosures on material, quantifiable operational metrics; biodiversity assessments audited by third-party organization with associated action plans; "no net loss" and/or "net nature positive" biodiversity commitments with clear timelines, metrics and intermediary goals; avoiding land conversion from natural ecosystems in operations and supply chain; investing in restoration; and following all relevant regulation that aims to protect biodiversity, species and ecosystems.

Exhibit 18: Select companies mapped to Biodiversity solutions: Risk Management leaders or improvers

Theme	Why it's important	Company name	Relevance for the theme
Risk Management	Many companies, especially those extractive in nature, are exposed to biodiversity risks from their operations and supply chains. Managing these risks to prevent biodiversity loss can help prevent environmental disasters and any associated fines, limit negative news flow and maintain positive consumer and public sentiment for companies.	Adani Ports & Special Economic Zone Ltd	**Adani Ports** develops and operates port-related infrastructure facilities, afforesting 500ha of mangroves (25% growth) over same time period as increasing cargo handling 85 MMT (155% growth), with target to afforest 5,000 ha by 2025.
		IGO Ltd	**IGO**'s mine sites each have an Environmental Management Plan. The company completes ongoing biodiversity impact monitoring and has reported land disturbance and land rehabilitated since FY18.
		EDF	**EDF** works to restore the natural environment of decommissioned facilities, screens 100% of projects for risks related to biodiversity, and prioritizes existing manmade sites for new industrial developments. A desalination unit produces demineralized water to reduce freshwater resources required for operations.
		Thai Union Group	**Thai Union** manufactures seafood, launching SLLs and SLBs linked to "Blue Finance" with ocean benefits targets. The company is pioneering supply-chain transparency, reporting detailed sourcing information. Thai Union has initiatives related to abandoned fishing gear, aquaculture to protect sensitive habitats, and fishery improvement projects, and invests in cell-based seafood and biotech to improve animal health in aquaculture.
		Spirax-Sarco Engineering	**Spirax-Sarco** is an industrial engineering group with a net nature positive commitment to achieve a 10% biodiversity net gain by 2025 through biodiversity offsets equivalent to 5x the footprint of operations by 2025 and delivering a biodiversity net gain of 10%+ on all new sites and facilities.
		Nestle	**Nestle**'s primary meat, palm oil, pulp & paper, soya and sugar supply chains were 97.2% deforestation free in 2021, with a goal for 50% of key ingredients to be sourced through regenerative agricultural methods by 2030.

Biodiversity offsets are still being established and developed and have not been sufficiently explored for credibility. Spirax-Sarco's offset project of choice charges £100 to "buy an acre" of land to protect it in perpetuity. We make no judgement here on the credibility of this project or if biodiversity offsets can be deployed effectively for impact.

Source: Goldman Sachs Global Investment Research, Company data

We note that while these risk management practices represent disclosures of thoughtful processes relative to peers, biodiversity policies are qualitative in nature, and more robust policies, targets and action plans are often representative of larger companies that have existing sustainability resources and initiatives in place. These strategies show beginning stages of biodiversity considerations, though very few are sufficient to fully reverse biodiversity loss of respective full value chains. As public focus increases on biodiversity protection and restoration, we would expect significant improvements in disclosures, especially of targets and quantitative metrics to evaluate impact.

In order to more fully understand these company profiles, we provide a snapshot of GS SUSTAIN ESG pillars in the Appendix (Exhibit 31), where companies may perform well on specific aspects of ESG despite facing challenges or lower performance in other areas.

Using Alternative Data to Assess Biodiversity Performance

A host of institutions have created different lenses through which to view biodiversity impacts and performance of companies. Some of these methods have resulted in tools for companies and asset managers to use to help understand specific risks and impacts. These tools include: FairSupply; Supply Chain: Commitments that Count; Integrated Biodiversity Assessment Tool (IBAT); Species Threat Abatement and Restoration (STAR) map; Deforestation-risk companies; Forests & Finance; IRIS+ by the Global Impact Investing Network; and Climate, Community & Biodiversity Standards, outlined below.

Others don't provide full assessments of biodiversity risks at a company level but can provide insights on location-based risks or how to put together project assessments, these tools include the Global Ocean Health Index country/coastal region scores and the Biodiversity Impact Assessment Guidelines. Other portfolio assessment tools are still in development, including the Global Biodiversity Score.

Exhibit 19: Biodiversity assessment tools that can be used for company evaluations and/or portfolio analytics to look at potential risks or impacts to natural ecosystems

Assessment Tool	Description
FairSupply	Uses supply chain mapping to create a proprietary extinction risk metric that can be applied to a company and/or a portfolio
Supply Chain: Commitments that Count	Outlines commitments related to agriculture supply chains and percent achievement towards these goals over time.
Integrated Biodiversity Assessment Tool	Embeds three different biodiversity datasets to help companies map exposures to key risks and impacts: IUCN Red List of Threatened Species; World Database on Protected Areas; and World Database of Key Biodiversity Areas
Species Threat Abatement and Restoration (STAR)	Allows companies to map their business operations against global data layers on threat abatement and restoration, also using the IUCN Red List of Threatened Species.
Deforestation-risk companies	Looks at companies viewed as the most exposed to deforestation, land grabs and possible other issues, and oulines key risks and reasoning.
IRIS+	IRIS+ by the Global Impact Investing Network includes Biodiversity & Ecosystems metrics as part of their data offering for investment managers
Forests & Finance	Assesses the finance received by companies involved in beef, soy, palm oil, pulp & paper, rubber and timber supply chains whose operations may impact tropical forests in SE Asia, Central and West Africa and South America.

Source: Company data, Goldman Sachs Global Investment Research

Other sources that measure performance on biodiversity metrics or indicators release lists of best performers, often on an annual basis. These include the Forest 500, and a separate list for financial institutions; CDP's Forests "A" List; the Seafood Stewardship Index; the Ecogain Biodiversity Index; Trase's Commodity Trader and Financier rankings; SPOTT; and the Agrobiodiversity Index, outlined below. The French government has also published a risk analysis tool that helps companies identify soy traders associated with less deforestation, a partnership with Trase.

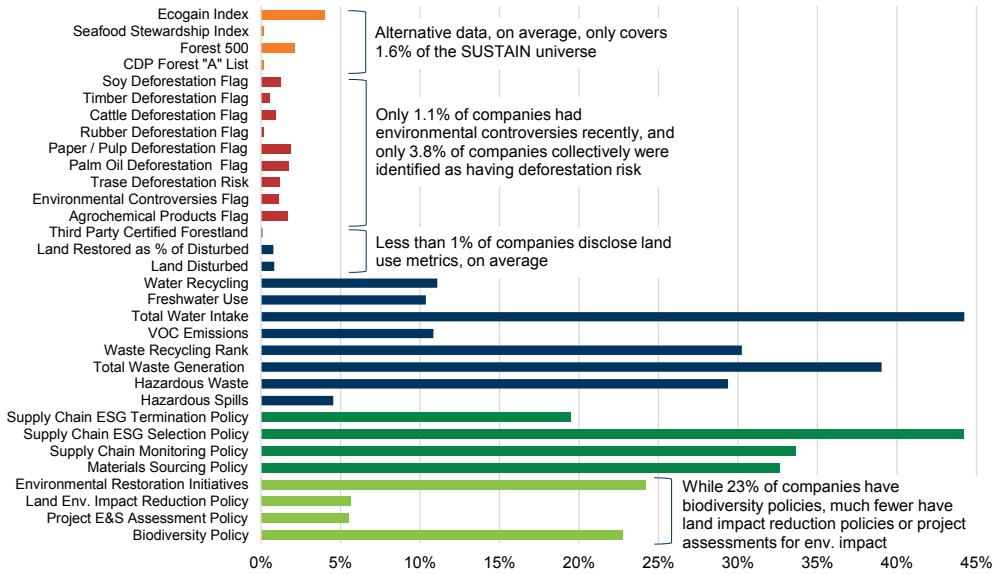
Exhibit 20: Third-party company ranking systems that consider performance on biodiversity protection and restoration

Alternative Data	Description	Scope
Forest 500	Considers forest risk in supply chains, commitments and action to end commodity deforestation.	350 companies
Forest 500 for Financial Institutions	A separate ranking for financial institutions that considers forest risk in supply chains, commitments and actions to end commodity deforestation.	150 companies
CDP's Forests "A" List	Ranks companies they view as leaders on net-zero, nature-positive and equitable future contributions	270 companies; 24 in forests "A" list
Seafood Stewardship Index	Ranks companies based on governance, ecosystems, traceability and social responsibility	30 companies
Ecogain Biodiversity Index	Considers how European businesses perform on setting targets and mitigating biodiversity impact	Nearly 400 of largest European companies; to be expanded to include the US later in 2022
Trase Commodity Trader and Financier Rankings	Benchmarks and ranks traders' production and deforestation risk profile against other traders in the same commodity, along with the largest equity holders in the most exposed public commodity traders.	11 public company commodity traders, 79 public financiers (both with expanded universe of private co's)
SPOTT	Assesses commodity producers, processors and traders on ESG and supply chain data	100 palm oil; 100 timber; 30 rubber producers, processors and manufacturers
Agrobiodiversity Index	Measures biodiversity across nutrition, agriculture and genetic resources at a country level, with company rankings and info coming soon, according to the index.	TBD

Source: Company data, Goldman Sachs Global Investment Research

Biodiversity-related disclosures are significantly lower than other climate or social metrics, with only 23% of companies in the GS SUSTAIN universe disclosing a biodiversity policy, and less than 1% of companies disclosing land-use related numerical metrics, on average. We overview disclosure levels on a select group of biodiversity-related metrics below for reference. **We expect company disclosures on the topic to increase**, and as biodiversity increases in focus, we would expect companies to report further on impacts, including the number of plant and animal species impacted by company operations, disclosure on physical footprint of operations and value chain, details around restoration and remediation work, third-party certified forestland, exposure to biodiversity hotspots, increased transparency on supply chains, value chain physical footprint mapping and further details on what goes into project E&S assessments and how the results are used in the decision-making process.

Exhibit 21: Disclosure levels of select biodiversity-related metrics and alternative data coverage universes



Source: Bloomberg, Refinitiv Eikon, Ecogain Index, Seafood Stewardship Index, Forest 500, CDP, Deforestation risk companies, Trase, Goldman Sachs Global Investment Research

While company-reported numeric data on biodiversity is still in early days, we are starting to see some metrics around land disturbance and restoration. From existing data, around 30% of Mining & Metals companies in the MSCI ACWI report the percentage of land restored by the company relative to the amount of land disturbed by operations, along with 15% of Oil & Gas Midstream and 15% of Construction Materials companies. The scope of restoration projects varies widely between companies, from not restoring disturbed land to conducting restoration projects that exceed disturbances in area. While data coverage for land disturbances and restoration tend to be limited in scope at this point, we expect an increase in data availability on this and other biodiversity-related numeric metrics in the coming years.

Exhibit 22: Land restoration projects vary widely in scope relative to land disturbed by company activities

Company Name	GS ESG Sector	Market Cap ($bn)	Region	Land restored as a % of land disturbed
New Gold Inc	Mining & Metals	0.6	N. America	806%
Eldorado Gold Corp	Mining & Metals	1.1	N. America	656%
IGO Ltd	Mining & Metals	5.8	Aust/NZ	494%
Williams Companies Inc	Oil & Gas Midstream	41.1	N. America	436%
Barrick Gold Corp	Mining & Metals	27.7	N. America	282%
Iluka Resources Ltd	Mining & Metals	2.8	Aust/NZ	259%
Alcoa Corp	Mining & Metals	9.1	N. America	136%
Petra Diamonds Ltd	Mining & Metals	0.2	W. Europe	121%
Vale Indonesia Tbk PT	Mining & Metals	4.1	Asia ex Japan	109%
Adaro Energy Indonesia	Oil & Gas Producers	6.8	Asia ex Japan	100%
Equitrans Midstream Corp	Oil & Gas Midstream	3.4	N. America	100%
Marathon Petroleum Corp	Oil Refiners	48.5	N. America	100%
Whitehaven Coal Ltd	Oil & Gas Producers	4.1	Aust/NZ	94%
Kinder Morgan Inc	Oil & Gas Midstream	40.9	N. America	92%
Glencore PLC	Mining & Metals	70.5	W. Europe	81%
Tronox Holdings PLC	Chemicals	2.5	N. America	79%
Cleveland-Cliffs Inc	Steel	8.9	N. America	77%
OceanaGold Corp	Mining & Metals	1.2	Aust/NZ	58%
Pan American Silver Corp	Mining & Metals	4.2	N. America	52%
South32 Ltd	Mining & Metals	12.3	Aust/NZ	50%
OK Rusal MKPAO	Mining & Metals	6.1	CEEMEA	44%
Aneka Tambang Tbk PT	Mining & Metals	3.2	Asia ex Japan	42%
ACC Ltd	Construction Materials	5.3	Asia ex Japan	41%
Holcim AG	Construction Materials	28.0	W. Europe	41%
Norsk Hydro ASA	Mining & Metals	13.2	W. Europe	39%
China National Building Material	Construction Materials	8.4	Asia ex Japan	36%
NK Rosneft' PAO	Oil & Gas Producers	5.7	CEEMEA	34%
African Rainbow Minerals	Mining & Metals	2.8	CEEMEA	33%
Northern Star Resources	Mining & Metals	6.4	Aust/NZ	30%
Teck Resources Ltd	Mining & Metals	14.7	N. America	25%
Merdeka Copper Gold	Mining & Metals	6.6	Asia ex Japan	24%
AngloGold Ashanti Ltd	Mining & Metals	6.3	CEEMEA	22%
Exxaro Resources Ltd	Oil & Gas Producers	2.9	CEEMEA	21%
Kinross Gold Corp	Mining & Metals	4.4	N. America	17%
BHP Group Ltd	Mining & Metals	136.4	Aust/NZ	16%
Freeport-McMoRan Inc	Mining & Metals	43.2	N. America	16%
Coronado Global Resources	Steel	1.6	Aust/NZ	15%
Rio Tinto Ltd	Mining & Metals	110.4	Aust/NZ	13%
Resolute Mining Ltd	Mining & Metals	0.2	Aust/NZ	13%
Polyus PJSC	Mining & Metals	1.1	CEEMEA	13%
Anglo American PLC	Mining & Metals	47.0	W. Europe	12%
OZ Minerals Ltd	Mining & Metals	4.4	Aust/NZ	11%
Ambuja Cements Ltd	Construction Materials	9.3	Asia ex Japan	10%
Regis Resources Ltd	Mining & Metals	0.9	Aust/NZ	10%
Fortescue Metals Group	Steel	39.3	Aust/NZ	9%
Suncor Energy Inc	Oil & Gas Producers	46.1	N. America	4%
MMG Ltd	Mining & Metals	2.5	Asia ex Japan	3%
Kumba Iron Ore Ltd	Steel	9.3	CEEMEA	2%
Newcrest Mining Ltd	Mining & Metals	12.0	Aust/NZ	2%
Agnico Eagle Mines Ltd	Mining & Metals	10.2	N. America	1%
Evolution Mining Ltd	Mining & Metals	3.4	Aust/NZ	0%
Surgutneftegaz PAO	Oil & Gas Producers	21.0	CEEMEA	0%
Centamin PLC	Mining & Metals	1.2	W. Europe	0%
Sibanye Stillwater Ltd	Mining & Metals	7.0	CEEMEA	0%

Land restoration includes rehabilitation of the soil and ecological landscapes, and reintroduction of wildlife, among other efforts. Numbers over 100% reflect additional restoration projects beyond physical footprint of operations, though we make no assessment here of the quality and impact of projects beyond scope of physical footprint.

Source: Bloomberg, Data compiled by Goldman Sachs Global Investment Research

Key Questions for Management

1. How do you incorporate biodiversity dependencies and impacts into your risk management strategy? What was your process for assessing integrity and importance of ecosystems impacted by the company?
2. Does your biodiversity risk management strategy involve a third-party verified assessment of ecosystems impacted by the physical footprint of the company's value chain?
3. Does your biodiversity risk management assessment consider dependencies on nature and risks to business activities based on levels of biodiversity loss?
4. Describe your approach to supply chain traceability, and do biodiversity targets include the entire company value chain?
5. Do you plan to establish net nature positive or no-net loss biodiversity targets? If so, what KPIs and metrics will be used to measure progress? Does your strategy incorporate offsets, and if so, could you describe your approach to assessing credibility?

Emerging Biodiversity Investor Initiatives

While net-zero commitments from both corporates and investors have rapidly increased in recent years, parallel net-nature positive or no-net loss commitments around biodiversity are still in early days. The Glasgow Financial Alliance for Net-Zero (GFANZ) initiative is associated with over 250 firms and over US $88tn in assets, and the Paris-aligned Investor initiative has over 118 global investor members representing ~$34 trillion in AUM. Biodiversity Net Nature Positive Investor initiatives, on the other hand, have less buy-in and associated AUM. With increased attention on the theme, though, we do expect new commitments and initiatives to bring increased consistency to goals and methodologies. We outline a number of current initiatives below:

- **The Finance for Biodiversity Foundation** currently has 103 signatories to the **Finance for Biodiversity Pledge**, representing around $13 trillion, that have committed to collaborating, engaging, assessing their biodiversity impact, setting targets and reporting on biodiversity by 2024.
- The World Bank has released proposals for **Nature Action 100+**, to follow in the footsteps of Climate Action 100+, with a proposed medium-term goal of net-zero biodiversity loss and a long-term goal for net positive impact on biodiversity. This initiative is not yet finalized.
- The **Natural Capital Finance Alliance** (NFCA) includes 47 financial institution members who acknowledge the importance of natural capital and their role in the reforms needed to create a financial system that sustains natural capital. The Alliance calls for government actions to support and incentivize organizations to value and report on their use of natural capital. The NCFA also has developed the ENCORE tool to help understand portfolio exposure to biodiversity dependency risks.
- The **Investor Initiative for Sustainable Forests** is a working group of the Ceres Investor Network in collaboration with the PRI that aims to raise awareness and foster investor engagement with companies to eliminate deforestation from supply chains, with over 35 investors engaging across soy and cattle value chains.
- The **Partnership for Biodiversity Accounting Financials** includes 38 financial institutions representing close to $9 trillion in lending and investment assets and has developed a standard to assess and disclose impact and dependencies on biodiversity of loans and investments.

Other platforms aggregate corporate commitments or involve other organizations, including:

- Act4nature international verifies biodiversity commitments as SMART (specific, measurable, additional, realistic, time-bound) through their multi-stakeholder committee, with 62 companies committed since 2020.
- The Network for Greening the Financial Systems is a group of 116 Central Banks and Supervisors willing to share best practices and contribute to the development of environmental and climate risk management in the financial sector.

- Nature Commitments Platform showcases area-based conservation efforts around the world and encourages organizations to upload their own commitments.

The Post-2020 Global Biodiversity Framework

Safe operating space represents staying within the planetary boundaries for climate change, biodiversity loss, and other environmental factors, outside of which abrupt global environmental change cannot be avoided and humanity cannot operate safely (Rockstrom et al., 2009).

COP 15, the UN's key nature summit, faced several pandemic-related delays from the original conference meant to take place in Beijing in October 2020.

Investor pledges still require global, high-level direction to understand biodiversity targets that will keep within a sustainable 'safe operating space' for nature, in our view. We think this long-term 2050 vision will likely come out of the 15th Conference of the Parties to the Convention on Biological Diversity (COP 15), taking place in December 2022. COP 15 aims to update the Aichi Targets (Exhibit 39), developed in 2010 by nearly 200 nations to stem loss of life, biodiversity and ecosystems. The new Post-2020 Global Biodiversity Framework should outline specific targets to contribute to the original 2050 long-term goal to live in harmony with nature.

The United Nations' Global Biodiversity Outlook 5 found that between 2011 and 2020, none of the 20 agreed-upon Aichi targets were achieved in full. Based on the level of progress against these original goals, biodiversity will continue to decline and jeopardize achieving other global sustainability goals. Six of the targets were partially achieved (9, 11, 16, 17, 19, 20), and progress towards others could help support 2050 goals to live in harmony with nature, but increased prioritization will be required to meet new targets in the Post-2020 Global Biodiversity Framework, if similar in ambition to the original goals, in our view.

Efforts on the Post-2020 Global Biodiversity Framework seek to further define and refine measurable, quantitative targets that are practical to achieve. The first draft of the Post-2020 Global Biodiversity Framework, released in September 2021, outlines its mission to take urgent action across society to conserve and sustainably use biodiversity and ensure fair and equitable sharing of benefits from the use of genetic resources, to put biodiversity on a path to recovery by 2030 for the benefit of planet and people. **The first draft of the framework includes four long-term goals for 2050 with accompanying 2030 milestone goals: 1) To enhance the integrity of all ecosystems; 2) To value, maintain or enhance nature's contributions to people through conservation and sustainable use; 3) To fairly and equitably share the benefits from the utilization of genetic resources; and 4) To close the gap between available financial and other means of implementation, and those necessary to achieve the 2050 Vision.** Only one of the four long-term goals includes specific, quantitative elements of biodiversity measurement: an increase of 15% in area, connectivity and integrity of natural ecosystems, a tenfold reduction in rate of extinctions, halving the risk of species extinctions, and maintaining 90% of genetic diversity within all species.

As it stands, the Post-2020 Global Biodiversity Framework lacks consensus on many key issues, and negotiators are expected to conduct an additional meeting before COP 15 to try to iron out the remaining points in the text. The fourth meeting of the open-ended working group took place in Kenya in June of this year to discuss the four goals and 23 proposed targets of the framework, though by the end of the conference, only two out of 23 proposed targets were agreed upon by delegates: 19.2

to strengthen resource mobilization, and 12 on green and blue spaces in urban areas. Delegates also agreed on the relationship with the 2030 Agenda for Sustainable Development and laid out a path towards agreement on sharing benefits from digital sequence information on genetic resources.

As COP 15 approaches, we expect biodiversity to gain increased focus from a variety of stakeholders as conversations about the specific targets reveal country-specific positions on the conservation and restoration of ecosystems. We expect to see renewed themes from the UN Climate Change Conference (COP 26) from 2021, including a clear distinction between developed and emerging countries on feasibility and implementation of specific biodiversity goals. This may be especially true for biodiversity vs. climate change, given drastic visible differences between the state of nature today: Only 23% of land (excluding Antarctica) has not been modified by human activities, and five countries host over 70% of the world's remaining wilderness (Australia, the US, Brazil, Russia, Canada). If COP 26 was any indication, COP 15 on Biodiversity may be light on details and may eventually see targets watered down by restraints that emerging nations face balancing economic growth with the protection and conservation of natural ecosystems and land.

Frameworks for Assessing Biodiversity Impacts - Corporates and Investors

We assess a number of frameworks for assessing biodiversity impacts with public backing below, including the Taskforce on Nature-related Financial Disclosure (TNFD), the Sustainability Accounting Standards Board Standards (SASB), the EU Green Taxonomy, the Align Project, and IFC's Biodiversity Finance Reference Guide. We see corporates and investors coalescing around these frameworks to identify dependencies and impacts, along with associated risks and opportunities, and outline key elements of each framework. We believe TNFD has the potential to be the most influential of these frameworks, though all contribute slightly different lenses that may be more or less relevant for various stakeholders, and we walk through the frameworks in order of where we see the most influence in the coming years.

Taskforce on Nature-related Financial Disclosure

The Taskforce on Nature-related Financial Disclosures (TNFD) was announced in July 2020 to address the information gap on evolving nature-related risks to organizations through a comprehensive reporting framework, and to ultimately encourage a shift in global financial flows towards nature-positive outcomes, following the lead of the Taskforce on Climate-related Financial Disclosures (TCFD). The recommendations of the TCFD have become the market and regulator preferred framework for assessing and disclosing climate-related financial risks, addressing areas of Governance, Strategy, Risk Management, and Metrics and Targets. Climate-focused investors are already pushing corporates through engagement to provide TCFD-aligned disclosures, and regulator support for the TCFD reporting framework continues to accelerate, with the US most recently proposing TCFD-aligned mandatory reporting for corporates.

The TNFD's beta framework seeks to assess risk against the same four pillars as the TCFD: (1) Governance; (2) Strategy; (3) Risk Management; and (4) Metrics and Targets. The second version of this beta framework was released in June 2022 for public commentary. Draft disclosure recommendations are outlined under each of the four pillars, with qualitative descriptions recommended under Governance, Strategy and Risk Management.

Nature-related disclosures are in early days relative to Metrics and Targets related to climate change with likely years of fine-tuning in the search for consensus. In its current form, the Metrics and Targets pillar asks companies to disclose *which metrics* the organization uses to assess material nature-related risks and opportunities and the *thought process behind those decisions*. Further guidance on the Metrics and Targets pillar, including guidance on how to frame impact (land use, over-exploitation of resources, pollution prevention, climate change, invasive species) and dependencies, is expected in future beta releases of the framework as a result of over 500 pieces of topical feedback between beta v0.1 and beta v0.2. Past feedback centered around more specific guidance, further development of technical aspects of the framework (including disclosure recommendations) and expanded outreach to bring in diverse thought leadership for further development.

TNFD, in addition to their four-pillared approach to disclosures, has released a Nature Risk Assessment framework, LEAP, to help companies understand and respond to nature-related risks and opportunities. This assessment process can support the disclosure recommendations and help inform decisions and strategies under the four pillars. The LEAP approach is defined as follows:

- **Locate** your interface with nature;
- **Evaluate** your dependencies and impacts;
- **Assess** your risks and opportunities; and
- **Prepare** to respond to nature-related risks and opportunities and report.

In addition, the latest draft release includes an extended **LEAP approach for financial institutions (LEAP-FI) to help instruct the assessment of nature-related risks and opportunities in relation to financed activities**, focusing more on banks, insurance companies, asset managers, asset owners and development finance institutions as users and beneficiaries. This sets out scoping questions to help assessment efforts of financial portfolios with three core entry points: sector/geography; asset class; and biome/ecosystem.

The current draft release of TNFD's framework is open for market consultation, with two further iterations expected in November 2022 and February 2023. **The final release of the framework is expected in September 2023, which companies can begin using to report on both qualitative, process-oriented disclosures, and any final quantitative metrics included in the final framework.**

Exhibit 23: TNFD draft disclosure recommendations and accompanying LEAP approach for corporates to assess nature-related risks and opportunities

Governance	Strategy
Disclose governance around nature-related risks and opportunities.	Disclose how organization identifies, assesses and manages nature-related risks.
a) Describe ***board's oversight*** of nature-related risks and opportunities	a) Describe processes for ***identifying and assessing*** nature-related risks.
b) Describe ***management's role in assessing and managing*** nature-related risks and opportunities	b) Describe the organization's processes for ***managing*** nature-related risks.
	c) Describe how identifying, assessing, and managing nature-related risks are ***integrated into overall risk management***.

Strategy	Metrics and Targets
Disclose actual and potential impacts of nature-related risks and opportunities on business, strategy and financial planning.	Disclose the metrics and targets used to assess and manage relevant nature-related risks and opportunities.
a) ***Describe nature-related risks and opportunities*** the organization has identified over the short, medium, and long term.	a) Disclose ***metrics used to assess*** nature-related risks and opportunities in line with strategy and risk management process.
b) Describe nature-related risks and opportunities' ***impacts on business, strategy, and financial planning.***	b) Disclose Scope 1, Scope 2 and Scope 3 GHG ***emissions, and related risks***. **Adaptation under consideration by TNFD.*
c) Describe the ***resilience of the organization's strategy***, taking into consideration different climate and nature-related scenarios.	c) Describe the ***targets*** used to manage nature-related risks and opportunities and performance against targets.
d) Describe ***interactions with low integrity ecosystems,*** high importance ecosystems or areas of water stress.	

LEAP: for nature-related risks and opportunities assessment

Locate	Evaluate	Assess	Prepare
Business footprint: Where are direct assets and operations and related value chain?	**ID of relevant environmental assets and ecosystem services:** What environmental assets and ecosystem services does company depend on at each priority location?	**Risk ID & Assessment:** What are corresponding risks for organization?	**Strategy & resource allocation:** What strategy and resource allocation decisions should be made as a result of analysis?
Nature interface: With which biomes and ecosystems do activities interface? What is integrity and importance of ecosystems at each location?	**ID of dependencies and impacts:** What nature-related dependencies and impacts exist at each priority location?	**Existing risks mitigation & management:** What existing risk mitigation and mgmt approaches are already being applied?	**Performance measurement:** How will company set targets and define / measure progress?
Priority location identification: At which locations are ecosystems assessed as low integrity, high biodiversity importance or areas of water stress?	**Dependency analysis:** What is the size and scale of dependencies on nature in each priority location?	**Additional risks mitigation & management:** What additional risk mitigation and mgmt actions should be considered?	**Reporting:** What will company disclose in line with TNFD disclosure recommendations?
Sector identification: What sectors, business units, value chains or asset classes are interfacing with nature at priority locations?	**Impact analysis:** What is size and scale of nature impacts in each priority location?	**Materiality assessment:** Which risks are material & should be disclosed in line with TNFD disclosure recommendations?	**Presentation:** Where and how will company present their nature-related disclosures?
		Opportunity identification & assessment: What nature-related opportunities does this assessment identify?	

Source: TNFD

As draft releases of the TNFD framework become increasingly finalized, we expect the framework to increase prioritization of biodiversity and nature as a thematic focus for a wide variety of organizations, including ESG investors, corporations and global regulators. We expect TNFD to lead corporate disclosure efforts and transparency, increasing data availability for investors looking to incorporate net nature-positive goals into their portfolios.

TNFD is prioritizing eight thematic sectors, where it sees higher potential for financial impact due to dependencies and impact on nature. These include: 1) food & beverage; 2) renewable resource and alternative energy; 3) infrastructure; 4) extractives and mineral processing; 5) health care; 6) resource transformation; 7) consumer goods; and 8) transportation. While some of these sectors have long been a focus of ESG investors

and stakeholders due to their carbon intensity, others, such as food & beverage, health care and consumer goods, are coming into ever-increasing scope as TNFD and other global efforts spotlight nature-positive goals alongside decarbonization efforts.

Sustainability Accounting Standards Board

Where TNFD seeks to provide additional guidance on metrics & targets in further drafts of the framework, the Sustainability Accounting Standards Board (SASB) has already outlined recommended disclosures for companies on a variety of environmental, social and governance themes, including those related to biodiversity. We view seven of these disclosure themes as having potential impacts on biodiversity, both direct and indirect: ecological impacts; material sourcing; water management; waste management; supply chain management; critical incident risk management; and air quality. A wide range of industries and business models fall into scope when looking at disclosure recommendations in these categories.

Exhibit 24: Mapping of industries with biodiversity-related disclosure recommendations split into seven sub-themes

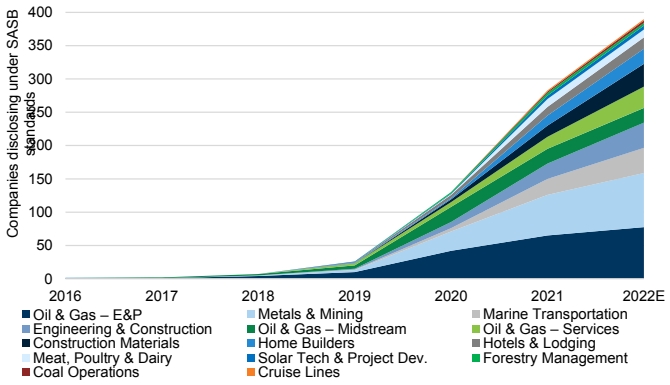
Ecological Impacts	Water & Wastewater Mgmt	Waste & Hazardous Mgmt	Supply Chain Management
Coal Operations	Household & Personal Products	Coal Operations	Apparel, Accessories & Footwear
Construction Materials	Coal Operations	Construction Materials	Building Products & Furnishings
Metals & Mining	Construction Materials	Iron & Steel Producers	Household & Personal Products
Oil & Gas Exploration & Production	Iron & Steel Producers	Metals & Mining	Toys & Sporting Goods
Oil & Gas Midstream	Metals & Mining	Oil & Gas Refining & Marketing	Iron & Steel Producers
Oil & Gas Services	Oil & Gas Exploration & Production	Oil & Gas Services	Agricultural Products
Meat, Poultry & Dairy	Oil & Gas Refining & Marketing	Food Retailers & Distributors	Alcoholic Beverages
Engineering & Construction Services	Oil & Gas Services	Restaurants	Food Retailers & Distributors
Home Builders	Agricultural Products	Health Care Delivery	Meat, Poultry & Dairy
Forestry Management	Alcoholic Beverages	Electric Utilities & Power Generators	Non-Alcoholic Beverages
Solar Technology & Project Developers	Meat, Poultry & Dairy	Waste Management	Processed Foods
Hotels & Lodging	Non-Alcoholic Beverages	Solar Technology & Project Developers	Restaurants
Cruise Lines	Processed Foods	Aerospace & Defense	Biotechnology & Pharmaceuticals
Marine Transportation	Restaurants	Chemicals	Medical Equipment & Supplies
	Electric Utilities & Power Generators	Containers & Packaging	Biofuels
	Real Estate	Electrical & Electronic Equipment	Pulp & Paper Products
	Water Utilities & Services	Semiconductors	Containers & Packaging
Materials Sourcing & Efficiency	Biofuels	Auto Parts	Hardware
Electronic & OD Manufacturing Svcs	Electronic & OD Manufacturing Svcs	Electronic & OD Manufacturing Svcs	Air Freight & Logistics
Apparel, Accessories & Footwear	Pulp & Paper Products		**Air Quality**
Agricultural Products	Solar Technology & Project Developers	**Critical Incident Risk Mgmt**	Construction Materials
Alcoholic Beverages	Chemicals	Coal Operations	Iron & Steel Producers
Meat, Poultry & Dairy	Containers & Packaging	Metals & Mining	Metals & Mining
Non-Alcoholic Beverages	Hotels & Lodging	Oil & Gas Exploration & Production	Oil & Gas Exploration & Production
Processed Foods	Semiconductors	Oil & Gas Midstream	Oil & Gas Midstream
Water Utilities & Services		Oil & Gas Refining & Marketing	Oil & Gas Refining & Marketing
Fuel Cells & Industrial Batteries		Oil & Gas Services	Electric Utilities & Power Generators
Solar Technology & Project Developers		Electric Utilities & Power Generators	Waste Management
Wind Technology & Project Developers		Gas Utilities & Distributors	Biofuels
Aerospace & Defense		Biofuels	Pulp & Paper Products
Electrical & Electronic Equipment		Chemicals	Chemicals
Industrial Machinery & Goods		Air Freight & Logistics	Containers & Packaging
Hardware		Airlines	Air Freight & Logistics
Semiconductors		Cruise Lines	Cruise Lines
Telecommunication Svcs		Marine Transportation	Marine Transportation
Auto Parts		Rail Transportation	Rail Transportation
Automobiles		Road Transportation	Road Transportation

Source: SASB

Disclosure on SASB metrics has exploded in recent years amongst companies that are recommended to report on ecological impacts. Amongst the sub-industries with disclosure recommendations related to ecological impacts in extractives & minerals processing, infrastructure, transportation, renewable resources & alternative energy, food & beverage and services, the list of companies confirmed by SASB to be reporting under their Standards has increased from 2 in 2017 to nearly 300 in 2021.

We expect the biodiversity-related SASB Standards to inform further guidance on the metrics & targets pillar in TNFD's framework. Increased reporting under these Standards in the last few years and further momentum moving forward will offer investors increased company-level data related to biodiversity and ecological impacts moving forward. Specific biodiversity-related metrics are outlined further in the Appendix (Exhibit 33).

Exhibit 25: Incorporating SASB Standards into ESG reporting has exploded for sectors with ecological impact disclosure recommendations
Number of companies confirmed by SASB to report with their Standards, by industry, 2016 - 2022E



Source: SASB, Data compiled by Goldman Sachs Global Investment Research

Biodiversity in the EU Taxonomy

The Platform on Sustainable Finance released its final report on the next four environmental objectives of the EU Taxonomy, covering 56 activities under water, waste & the circular economy, pollution prevention and control, and biodiversity. Biodiversity captures 8 of the 56 newly outlined activities (Exhibit 26), with these new additions covering relatively limited activities in agriculture, forestry, food & beverage, fishing and restoration & remediation. **Mining operations are noticeably absent from the current Biodiversity Taxonomy proposal, given difficulty in establishing consistent performance criteria currently. Mining is expected to be included at a later stage. The majority of company linkages to Biodiversity under the Taxonomy will come in the form of the 'Do No Significant Harm' requirements for other Environmental Objectives, such as Climate Change Mitigation (CCM).** The biodiversity DNSH requirements for CCM include:

- *An Environmental Impact Assessment (EIA) or screening has been completed in accordance with Directive 2011/92/EU334.*

- *Where an EIA has been carried out, the required mitigation and compensation measures for protecting the environment are implemented.*
- *For sites/operations located in or near biodiversity-sensitive areas (including the Natura 2000 network of protected areas, UNESCO World Heritage sites and Key Biodiversity Areas, as well as other protected areas), an appropriate assessment, where applicable, has been conducted and based on its conclusions the necessary mitigation measures are implemented.*

New biodiversity activities have the potential to expand coverage of the existing Taxonomy after expanded disclosures, but data remains sparse for measuring alignment to the biodiversity technical screening criteria. We expect increased investor focus and corporate disclosure in coming years with increased disclosure on risks, externalities and impacts, in part due to nature's inclusion in the Taxonomy. ***At this stage, we do not incorporate Taxonomy Eligibility and Alignment estimates in our EU Taxonomy tool.***

Exhibit 26: Biodiversity captures 8 of the 56 newly outlined activities

	Taxonomy activity eligible under biodiversity
1) Agriculture, Forestry and Fishing	Animal Production
2) Agriculture, Forestry and Fishing	Crop Production
3) Agriculture, Forestry and Fishing	Fishing
4) Manufacturing	Manufacture of food products and beverages (making a substantial contribution to biodiversity)
5) Energy	Environmental refurbishment of electricity generation facilities that produce electricity from hydropower
6) Restoration, Remediation	Conservation of habitats and ecosystems
7) Restoration, Remediation	Restoration of biodiversity and ecosystems
8) Restoration, Remediation	Remediation activities enabling the protection and restoration of biodiversity and ecosystems

General DNSH Criteria for Biodiversity in the Taxonomy

- Is the measure expected to be: i) significantly detrimental to the good condition or resilience of ecosystems or ii) detrimental to the conservation status of habitats and species, including those of Union interest?

Supporting elements of evidence:

- An environmental impact assessment has been carried out and the conclusions have been implemented
- The measure respects the mitigation hierarchy and other requirements under the Habitats and Birds Directives

Source: EU Commission, Goldman Sachs Global Investment Research

GS SUSTAIN EU Green Taxonomy Mapping Tool

As part of our assessment of the EU Commissions Green Taxonomy, we have mapped global companies' revenues to Taxonomy-defined climate change activities to determine companies' potential Taxonomy-eligible revenue, and now their alignment, for select activities based on technical screening checks where data exists, and we have established a disclosure check against the 'Do No Significant Harm' (DNSH) and 'Minimum Social Safeguards' (MSS) criteria. **We see the Taxonomy leading to significant implications for capital flows, cheaper cost of capital and higher valuations for companies that fit into the Taxonomy — which will have significance to global ESG and generalist investors -** See *Progress on the Journey to Alignment*.

Details for our Taxonomy-Eligibility & Alignment tool for select activities covering 7,000+ global companies and further background on the EU Taxonomy can be seen in:

EU Taxonomy: First review of corporate Taxonomy reporting - rise of a new green standard (Aug 29, 2022)

EU Taxonomy: Social Taxonomy likely a 'no go' and eyes on upcoming Nuclear & Gas Taxonomy inclusion vote (May 27, 2022)

The evolution towards a Circular Economy (May 3, 2022)

The Next Four Environmental Objectives - initial read (Mar 31, 2022)

The EU Green Taxonomy: Progress on the Journey to Alignment (Feb 1, 2022)

EU Taxonomy Update - Inclusion of Natural Gas and Nuclear (Jan 4, 2022)

The EU Taxonomy - Finalised and primed for adoption (Dec 9, 2021)

EU ESG Regulation Updates (Q3 '21): EU Taxonomy, SFDR, and MiFID II Sustainability Preferences (Aug 31, 2021)

The EU Green Taxonomy: Navigating the Journey to Alignment (April 8, 2021)

EU Taxonomy - Green fleet assessment of global courier service companies (July 20, 2021)

EU Taxonomy and Green Aluminium - a case study on Norsk Hydro (June 14, 2021)

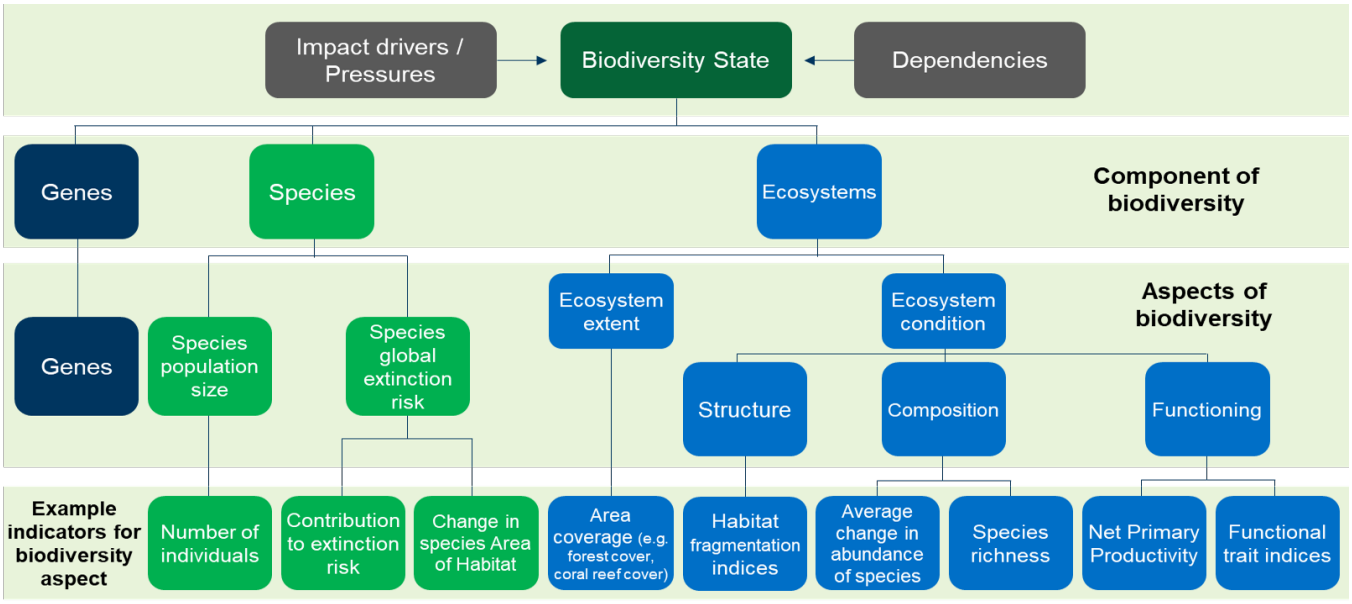
Mapping stocks to the EU Green Taxonomy (June 15, 2020)

The Align Project: Aligning Accounting Approaches for Nature

Align, funded by the European Commission and launched in March 2021, seeks to develop recommendations towards a common standard for biodiversity measurements and valuation. The v0 draft of the Recommendations for a standard on biodiversity measurement and valuation was released on 25 May, 2022 and was open for public feedback from 22 July 2022 before further revisions are to be made. The draft document focuses on the following core recommendations: double materiality consideration; focus on measurement methods; ecosystem condition indicators; spatial precision, accuracy, responsiveness to change and feasibility in measurement approach selection; reporting on both dependencies and impacts; clarity on the types of biodiversity values included and excluded from reporting; and formalized accounting approaches to biodiversity to help facilitate accurate tracking of gains and losses.

The draft recommendations include examples for indicators and metrics to be included in a biodiversity impact and dependency analysis and report, outlined below. While the recommended metrics under the Align project are some of the most detailed and specific recommendations to come from current or draft frameworks for assessing biodiversity, we recognize that most companies do not have the biodiversity expertise to accurately collect and report relevant data at this point. As formalized accounting approaches to biodiversity slowly mature, we expect this to gradually change, following the path of climate expertise.

Exhibit 27: Components of biodiversity and example measurement indicators



Source: Align, Goldman Sachs Global Investment Research

These recommendations are meant to support other efforts under development, including CSRD, IFRS, GRI's revision of its biodiversity indicators, TNFD, SBTN, and the Transparent project, **and are built based on existing work under the EU Business@Biodiversity Platform**. Align has invited businesses and stakeholders into the community of interest, community of practice, and technical hub to support the efforts and refine the recommendations, currently focusing on companies and financial institutions in Europe with a goal to expand project impacts globally.

IFC Biodiversity Finance for Green Bonds & Loans

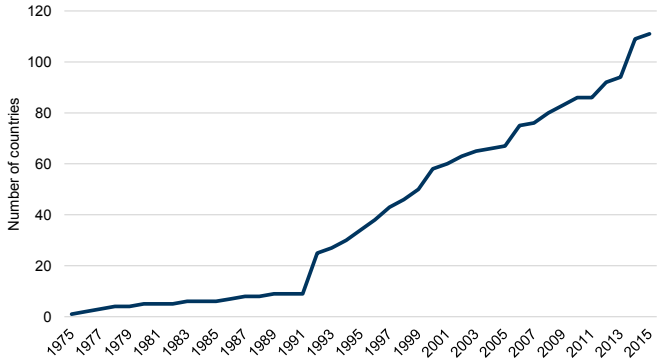
On the back of increasing interest from investors and issuers, the International Finance Corporation, a sister organization of the World Bank, released a draft document building on the Green Bond Principles and Green Loan Principles in order to begin defining biodiversity finance. The reference guide outlines potential eligible use of proceeds for biodiversity. The organization sought feedback from the public in June and July 2022 to inform the final upcoming guide.

The draft report outlines five key drivers of biodiversity loss as a lens through which investment activities can be considered biodiversity-related, originally from the Convention on Biological Diversity and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES): 1) Land use change; 2) Over-exploitation and unsustainable use of nature; 3) Pollution; 4) Climate change; 5) Invasive species. The framework outlines specific investment activities where biodiversity conservation is the primary objective, activities that generate biodiversity co-benefits, or investments in nature-based solutions used to enhance ecosystem services. We expect the final publication to act as a reference to verify credibility of Biodiversity Finance moving forward and to coalesce with other definitions of nature-positive from the EU Taxonomy, TNFD and SASB. The reference guide mapping of biodiversity finance activities can be found in the Appendix (Exhibit 32).

Biodiversity Regulatory Environment

Biodiversity regulation has increased steadily since the first discussions began in the 1970s, and recent efforts highlight the issue as a key priority that is seeing rising influence. We outline a number of biodiversity regulatory efforts that will impact companies, consumers, investors and other stakeholders in the coming years. The Global Inventory of Biodiversity Offset Policies has found that the 22% of countries they track where there is some level of biodiversity remediation required through regulation represent over 70% of global GDP and increasingly represent biodiversity-rich countries. On the back of COP 15, we expect resulting agreements and commitments to instigate further regulatory efforts related to conservation, remediation and investment in biodiversity.

Exhibit 28: Government discussions around biodiversity policies and regulations have taken off since the 1970s
Number of countries that have, are developing or are starting to discuss national government policies that require, encourage, guide, suggest or enable the use of biodiversity offsets



Source: Global Inventory of Biodiversity Offset Policies

CSRD

On June 21, 2022, the Council of the European Union and European Parliament reached a provisional agreement on new reporting rules under the Corporate Sustainability Reporting Directive (CSRD). CSRD sets common European reporting rules for non-financial (ESG/sustainability) data for the first time, aiming to amend the shortcomings of the Non-financial Reporting Directive (NFRD). The latest agreement will significantly expand the scope of covered companies to report detailed and audited sustainability information in a consistent and comparable manner starting in 2024. Most large non-EU companies with revenue and operations in Europe are now confirmed to fall in-scope for CSRD sustainability standards on a global basis, including provisions that will require companies to also report under the EU Taxonomy. This new proposal goes well beyond what has been expected from other sustainability reporting standards and will include disclosure requirements related to biodiversity and ecological impacts.

Details and technical rules will later be specified by the European Financial Reporting Advisory Group (EFRAG) upon establishing the standard. For reference

on proposed standards, see EFRAG's draft proposals on the Sustainability Reporting Standards (currently undergoing consultation). EFRAG took into account TNFD's work in order to compare approaches to biodiversity-related disclosures, which is reflected in the EU Sustainability Reporting Standards Exposure Draft E4 — Biodiversity and ecosystems. Draft requirements include biodiversity action plans, measurable targets, pressure, impact and response metrics, and optional disclosures on biodiversity offsets. For full details see the Appendix (Exhibit 38).

The final text is subject to a formal vote by the EU states and Parliament. Following this, member states will have 18 months to transpose the Directive into national legislation. The draft sets a clear message that the environmental objectives in the EU Taxonomy will be prioritized for company disclosure under CSRD, including climate change, pollution, water and marine resources, *biodiversity and ecosystems*, and resource use and circular economy.

EU Biodiversity Strategy for 2030

As a core part of the European Green Deal, EU's biodiversity strategy for 2030 is designed with the aim to put the region's biodiversity on the path to recovery by 2030. The Strategy currently encompasses the following key action areas, with each containing specific commitments.

1. **Widen the EU's network of protected areas** to cover at least 30% of EU land and 30% of EU sea, up from 26% and 19% today, respectively; Within these areas, 10% of EU land and 10% of EU sea should be strictly protected, up from only 3 % and 1% today.
2. **Establish an EU Restoration Plan**, with granular strategies and targets for each focus area including wetlands, rivers, forests, grasslands, marine ecosystems and species hosted, among others. We note that as part of this plan, the Commission proposed the EU's first Nature Restoration Law on June 22, 2022.
3. **Enable transformative change** through a new governance framework and stepping up implementation and enforcement of EU environmental legislation.
4. **Promote biodiversity collations globally** through trade policies, resource mobilization and beyond.

We highlight key actions and commitments in the EU Biodiversity Strategy for 2030 below.

Exhibit 29: EU Biodiversity Strategy for 2030 - Key Actions and Commitments

Expand EU-wide network of protected areas
Protect **at least 30% of EU's land & sea** areas and integrate ecological corridors
Strictly protect at least 1/3 of the EU's protected areas, including all remaining EU primary and old-growth forests
Effectively manage all protected areas; define clear conservation objectives and measures & monitor appropriately
Establish EU nature restoration plan
Legally binding EU nature restoration targets proposed in 2021: By 2030, restore significant areas of degraded and carbon-rich ecosystems; **conserve habitats and species** with no deterioration in status; and **reach at least a 30% favourable conservation status** / show a positive trend.
Reverse the decline in pollinators
Reduce 50% of the risk and use of chemical pesticides & the use of more hazardous pesticides
At least 10% of agricultural area is under high-diversity landscape features
At least 25% of agricultural land is under organic farming management, and significantly increase uptake of agro-ecological practices
Plant 3 billion new trees in the EU, respecting ecological principles
Make significant progress in the remediation of contaminated soil sites
Restore at least 25,000 km of free-flowing rivers
Reduce by 50% the number of red list species threatened by invasive alien species
Reduce by 50% losses of nutrients from fertilisers, and the use of fertilisers by at least 20%
Have an ambitious **Urban Greening Plan** for cities with at least 20,000 inhabitants
Use no chemical pesticides in sensitive areas such as EU urban green areas
Substantially reduce negative impacts on sensitive species and habitats, including on the seabed (fishing and extraction activities) to achieve good environmental status
Eliminate / reduce by-catch of species to a level that allows species recovery and conservation
Enable transformative change
Implement a new **European Biodiversity governance framework**, monitoring and reviewing a set of agreed indicators
Step up implementation and enforcement of EU environmental legislation
Integrate biodiversity for businesses & investments, **committing 25% of EU budget to biodiversity & nature-based solutions**
Integrate biodiversity into education systems to improve knowledge and skills
Tackle the global biodiversity challenge
Raise level of ambition and commitment globally, including, at a minimum: 1) **By 2050, restore** the world's ecosystems; 2) **Commit globally to the net-gain principle** giving back more to nature than it takes 3) Align ambitious global 2030 targets with EU commitments in the strategy; 4) Have stronger implementation, monitoring and review process; 5) Implement an **enabling framework** (for finance, research, tech etc); 6) share benefits of biodiversity equitably
Promote the EU's ambition through trade policy, resource mobilisation, using external action

Source: European Commission

European Union lawmakers also recently backed a proposal that would ban the sale of agriculture products linked to deforestation, requiring companies and producers to assure that products are deforestation-free. It was also proposed that **banks and financial institutions be covered by the law**, if passed and implemented, to prevent investment in projects linked to deforestation. It has been suggested that this legislation would cover soy, cattle, palm oil, wood, cocoa and coffee, pig meat, sheep and goats, poultry, maize, rubber, charcoal and printed paper products.

UK: 10% biodiversity gain

Originally outlined in 2011, the UK's Biodiversity Strategy was developed with a close link to the "Aichi" Targets and the EU Biodiversity Strategy. The plan includes five focus

areas, each with a number of granular targets: **1) Mainstream biodiversity** to a more integrated, large-scale approach across government and society to address the underlying causes of biodiversity loss; **2) Put people at the heart** of biodiversity policy to engage more stakeholders; 3) **Reduce direct pressures** on biodiversity and safeguard ecosystems, species and genetic diversity; **4) Improve knowledge** through increased data and communication of evidence; and **5) Monitor and report** on indicators to assess delivery of biodiversity strategy.

Developers will need to submit biodiversity gain information including 1) the pre-development biodiversity value; 2) the proposed approach to enhancing biodiversity on-site; and 3) any proposed off-site biodiversity enhancements (including the use of statutory credits) that have been planned or arranged for the development.

More recently, the UK has announced a number of policies and initiatives to tackle biodiversity conservation and restoration, including the **Environment Act 2021,** which requires a new legally binding target to be set to halt the decline in species abundance by 2030. This Act forms the basis for the UK's biodiversity net gain policy, requiring development schemes in England to **achieve and maintain, for at least 30 years, a minimum of 10% biodiversity net gain** using the Biodiversity Metric Tool. Consultation for the detailed proposals of mandatory biodiversity net gain implementation ended earlier this year and the regulation is expected to go live in 2023.

In addition, the **£100 million Biodiverse Landscapes Fund** is set to run from 2022 - 2029 to develop economic opportunities through investment in nature; slow, halt or reverse biodiversity loss in globally significant regions for biodiversity; and reduce GHG emissions and safeguard national carbon sinks. The fund will support 6 biodiversity hotspots across 18 countries through grant awards.

US: National Strategy on natural capital accounting

The US Department of Commerce released a public comment draft on the **National Strategy to Develop Statistics for Environmental-Economic Decisions: A U.S. System of Natural Capital Accounting and Associated Environmental-Economic Statistics** on 18 August 2022. The draft features recommendations to develop statistics to reflect natural assets on the national balance sheet and a framework to identify investment opportunities related to environmental dependencies. Specifically it recommends:

- Natural capital accounts should be integrated into U.S. economic statistical system for use by decision makers at the Federal, State, Tribal and local levels, and by the private sector
- These accounts and statistics related to environmental-economic levels should be tracked over time to measure progress
- The government should work with the international community to aid implementation
- A 15-year phased approach should be initiated to produce new information on a shorter time frame while simultaneously building long-lasting statistical products that are regularly reported.

It is still early days for government strategies for measuring biodiversity levels and creating and implementing action plans, but as countries engage on the topic through COP 15, we expect to see increasing engagement by regulators.

France: Leading on Biodiversity strategies and tools

France's National Biodiversity Strategy was established in 2010 to cover the period 2011-2020, with 20 objectives consistent with the Aichi Targets. In 2016, the country passed a law for the recovery of biodiversity, with highlights including a 'no-net loss' of biodiversity objective and bans on a number of products causing harm to biodiversity, including pesticides containing neonicotinoids, plastic microbeads in cosmetics and cotton swabs with plastic sticks.

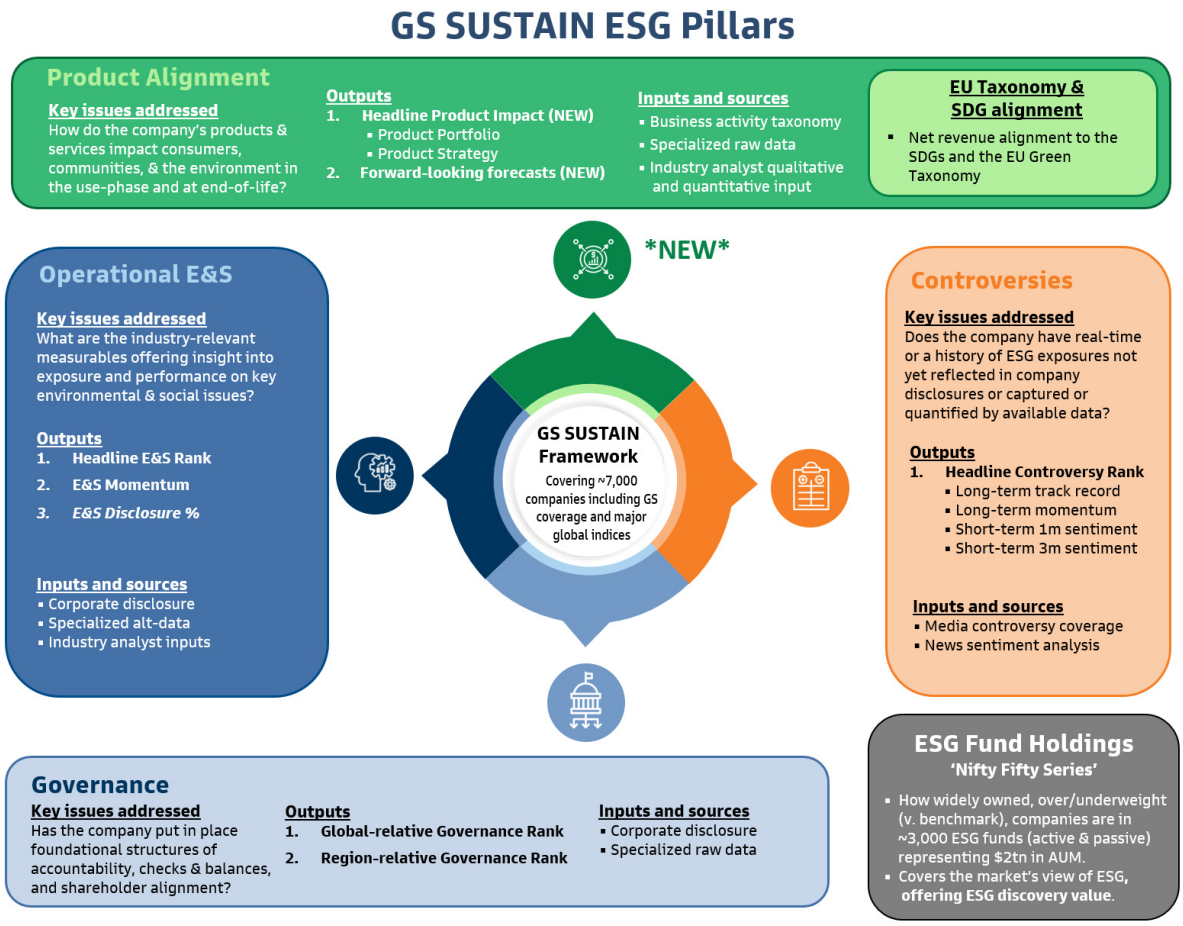
The country's **2019 Law on Climate and Energy** added biodiversity preservation into climate objectives in non-financial reporting by investors, with Article 29 requiring financial institutions to publish information on the portion of their assets complying with the EU Taxonomy, including the biodiversity protection objective. The implementation requires **financial institutions to disclose biodiversity-related risks and climate-related risks, along with their strategy to reduce biodiversity impacts with specific targets and alignment to international biodiversity goals.**

GS SUSTAIN ESG Framework

GS SUSTAIN can provide access to proprietary tools and resources to quantify impact and identify ESG Improvers, enabling greater recognition of underappreciated opportunities across sectors. Our expanded offering of SUSTAIN tools can help investors answer a myriad of ESG questions at the portfolio and security levels, enabling more systematized and quantitative reporting while providing detailed and transparent data sets for idea generation, security selection and corporate engagement.

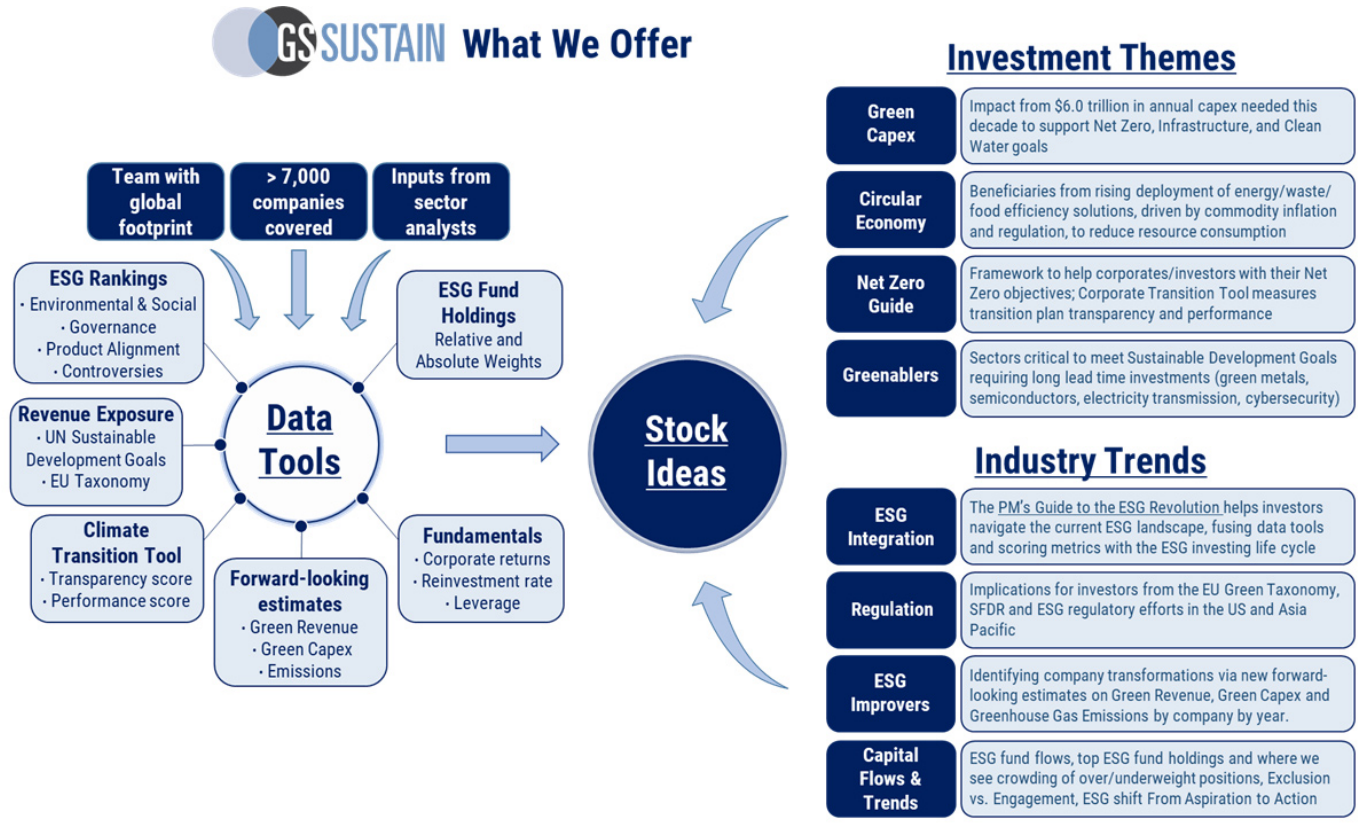
- **Our multi-pronged SUSTAIN scoring framework** can help provide greater granularity and objectivity for asset managers in both security selection and reporting. The framework across >7,000 companies includes our recently introduced Product Alignment framework based on the SDGs, EU Taxonomy and GS analyst views, and can help investors cast a wider net in the search for impact winners aligned to less obvious sustainability themes. Existing pillars detail performance around sector-specific environmental and social operational metrics, governance and controversies.
- **Forward-looking estimates.** Looking ahead, we believe investment performance will be more driven by future change and have taken our first steps toward incorporating forward-looking estimates in our proprietary industry analyst inputs, which now include sustainable product revenue and capex in select industries. Of the more than 3,000 companies under GS coverage, 53% saw a change in net E&S scores as a result of our analyst survey inputs. Furthermore, we have taken the first steps in offering quantitative forecasts of sustainable product revenue/capex for ~650 companies in 19 industries. We now add Scope 1 and 2 greenhouse gas emissions for a smaller segment of companies in 7 sectors.
- **EU Taxonomy revenue alignment.** We see the EU Taxonomy as one of the most seminal regulatory developments driving standardization in reporting for both corporates and asset managers. Our EU Taxonomy alignment tool maps companies' revenues to Taxonomy-defined activities to determine potential Taxonomy-eligible and aligned revenue based on technical screening checks where data exist and "Do No Significant Harm" (DNSH) and "Minimum Social Safegards" (MSS) criteria.
- **SDG revenue alignment.** The UN Sustainable Development Goals (SDGs) have emerged as one of the most commonly used frameworks for taxonomizing impact across a broad set of sustainability challenges. Our SDG alignment tool employs granular revenue data, GS analyst inputs and company metadata to map alignment, exposure and misalignment to ten of the SDGs we deem to be the most investable.
- **ESG fund ownership.** Aggregating fund holdings across a universe of ~3,000 ESG funds, we analyze this pool of ESG assets to better understand trends in ESG ownership at both the sector and company level. The full dataset provides absolute and momentum ESG ownership detail for well over 10,000 securities.
- **ESG fund flows, valuations and performance**. Our ESG Tracker series analyzes the aforementioned ESG fund universe to gauge ESG fund flow momentum and sizing

relative to the broader market, breaking out differences by strategy, fund type and fund style. The tracker also examines valuation and performance across categories.



Source: Goldman Sachs Global Investment Research

Exhibit 30:



Source: Goldman Sachs Global Investment Research

Appendix

Exhibit 31: GS SUSTAIN snapshot, biodiversity focus companies

				Governance	GS SUSTAIN - Operational Env & Social			Product Alignment		Controversies	ESG Fund Ownership
GS SUSTAIN ESG Sector	Company Name	Market Cap, $bn	Biodiversity Theme	GS SUSTAIN Governance Rank - Global	Operational Headline E&S Rank	Operational E&S Momentum Rank	Total E&S Disclosure % (Core operations)	Headline Product Alignment Score	EU Taxonomy Potentially Aligned Revenue: Climate Change	GS SUSTAIN Headline Controversy Rank	Relative over/(under) weight
Engineering & Construction	**Arcadis NV**	2.9		99%	97%	89%	68%	-	-	100%	755%
Engineering & Construction	**AECOM**	10.2		81%	74%	89%	37%	neutral / NS	0%	100%	278%
Med Tech	**Agilent Technologies Inc**	38.3		57%	84%	14%	100%	H - pos	0%	100%	335%
Multi-industry Services	**Montrose Env Group**	1.2	Biodiversity	19%	75%	50%	69%	H - pos	46%	65%	115%
Professional Services	**Planet Labs PBC**	1.5	Service Provider	30%	40%	51%	0%	-	-	100%	(70%)
Multi-industry Services	**Tetra Tech Inc**	7.3		81%	75%	72%	69%	H - pos	25%	100%	974%
Professional Services	**Stantec Inc**	5.3		99%	95%	100%	91%	M - pos	0%	100%	810%
Tech Hardware	**Trimble Inc**	15.8		57%	77%	92%	55%	M - pos	25%	100%	501%
Mining & Metals	**Perpetua Resources Corp**	0.1		43%	77%	49%	30%	-	-	100%	(98%)
Multi-industry Services	**Clean Harbors Inc**	6.4	Biodiversity	43%	26%	50%	69%	H - pos	40%	26%	380%
Multi-industry Services	**Waste Management Inc**	70.6	Remediation	97%	46%	72%	88%	H - pos	30%	9%	224%
Multi-industry Services	**Republic Services Inc**	45.4		81%	13%	19%	81%	H - pos	25%	88%	321%
Paper & Packaging	**Stora Enso Oyj**	11.8		57%	70%	22%	100%	neutral / NS	5%	78%	378%
Paper & Packaging	**Weyerhaeuser Co**	25.2	Land	97%	66%	18%	86%	neutral / NS	0%	100%	55%
Paper & Packaging	**Klabin SA**	2.6	Management	30%	61%	100%	90%	neutral / NS	0%	100%	81%
Paper & Packaging	**Rayonier Inc**	5.2		97%	64%	59%	34%	neutral / NS	0%	100%	252%
Paper & Packaging	**Suzano SA**	11.8		6%	29%	92%	86%	neutral / NS	0%	91%	54%
Capital Goods	**Hydrofarm Holdings Group**	0.2		30%	26%	48%	4%	H - pos	0%	100%	324%
Capital Goods	**Azek Company Inc**	2.8		43%	8%	48%	36%	H - pos	60%	100%	292%
Food & Beverage	**AppHarvest Inc**	0.3	Substitution	70%	19%	49%	10%	H - pos	0%	100%	893%
Multi-industry Services	**Tomra Systems ASA**	6.8		70%	36%	50%	63%	-	-	100%	633%
Multi-industry Services	**GFL Environmental Inc**	10.7		30%	10%	50%	44%	H - pos	45%	100%	162%
Mining & Metals	**IGO Ltd**	7.0		70%	90%	13%	74%	H - pos	0%	100%	(20%)
Capital Goods	**Spirax-Sarco Engineering**	9.3		94%	87%	71%	60%	H - pos	0%	100%	287%
Food & Beverage	**Nestle SA**	316.1		57%	90%	70%	97%	L - neg	0%	63%	(13%)
Food & Beverage	**Thai Union Group PCL**	2.2	Risk Management	3%	61%	78%	97%	M - neg	0%	26%	10%
Transport Infrastructure	**Adani Ports and Special Econ**	22.4		6%	58%	48%	91%	neutral / NS	0%	18%	(77%)
Utilities - Electric	**Electricite de France SA**	46.3		6%	75%	42%	92%	M - pos	18%	36%	(49%)

Source: Bloomberg, Refinitiv Eikon, Morningstar, FactSet, Goldman Sachs Global Investment Research

IFC Biodiversity Finance Reference Guide

Exhibit 32: Draft Biodiversity Finance Reference Guide
Mapping of biodiversity finance activities

Activities that generate biodiversity co-benefits, while supporting established business operations	**Productive land use / agriculture** 1) Climate smart agriculture 2) Regenerative agribusiness 3) Investment in certified sustainable crop production 4) Investing in alternative production or production practices	**Freshwater / Marine Sustainable Production** 1) Biodiversity Friendly Fishing 2) Sustainable aquaculture production 3) Improved sustainable fisheries and fishery practices 4) Biodiversity-friendly shipping 5) Waste/plastics management to protect fresh water and marine habitats 6) Manufacturing or retail of ocean and water-friendly household products 7) Reduction of downstream eutrophication through the replacement of phosphate or nitrogen based synthetic fertilizers 8) Prevention of sewer and wastewater runoff into waterways 9) Upgrading wastewater treatment plants	**Forestry and Plantations** 1) Reforestation / Afforestation 2) Reforestation on previously forested land with native or naturalized non-monoculture species adapted to changes in climate 3) Afforestation (plantations) 4) Native non-timber forest products 5) Improved sustainable forest management 6) Sustainable tree-crops production 7) Agroforestry Systems
	Tourism / Ecotourism Services 1) Sustainable or Ecotourism Tourism ventures 2) Tourism concessions and operations inside marine and terrestrial conservation areas 3) Ecotourism ventures and operations outside conservation areas	**Other investments** 1) Projects designed to avoid impact on ecologically sensitive areas in circumstances with weak regulation or enforcement 2) Infrastructure projects opting for 'green' or 'grey' solutions 3) Investment in technology that supports the identification, monitoring and verification of biodiversity and business impacts	
Biodiversity conservation as the primary objective	**Conservation land use / terrestrial habitat conservation** 1) Public private partnership for the conservation of legally protected and internationally recognized areas 2) Investment in land for conservation or restoration to create biodiversity credits 3) Conservation easements / servitudes / right of ways 4) Payments for ecosystem services or investments in mechanism and conservation trust funds that support payment for ecosystem services 5) A public-private partnership mechanism that rewards/reduces tax paid by private landowners 6) Rewilding 7) Fire management / fire risk reduction 8) Investment in REDD+	**Freshwater and Marine Habitat Conservation** 1) Investment in wetland conservation/restoration to create biodiversity credits 2) Investment in conservation / restoration of marine areas 3) Provision of services for restoration of natural habitats 4) Measures that achieve at least 20% reduction of water use per unit of product in areas next to rivers 5) Conservation of critical marine habitats 6) Nutrient credit schemes	
Nature-based solutions where biodiversity is used to preserve, enhance, and restore ecosystem services	**Nature-based Solutions** 1) Natural infrastructure investments 2) Constructed wetlands 3) Watershed management practices 4) Natural infrastructure to reduce water temperatures 5) Natural infrastructure or combination of natural and grey infrastructure for storm water management 6) Conservation or rehabilitation of wetlands to reduce flooding and soil/water salivation 7) Conservation or rehabilitation of mangroves 8) Conservation or rehabilitation of coral reefs 9) Use of forest buffers and agricultural strips 10) Parametric insurance schemes for green/blue infrastructure 11) REDD+ and forestry projects/grassland projects		

Source: International Finance Corporation

SASB accounting metrics related to biodiversity

Exhibit 33: Biodiversity metrics proposed for disclosure by SASB related to risk management and exposure

Topic	Accounting Metric	Industry
Ecological-related risks and problems	Number and duration of project delays related to ecological impacts	Solar Tech & Project Developers
	Total amount of monetary losses as a result of legal proceedings associated with environmental regulations	Home Builders
	Number of incidents of non-compliance with environmental permits, standards, and regulations	Engineering & Construction Services
	Backlog cancellations associated with community or ecological impacts	Wind Tech & Project Developers
Environmental Financial Risk Exposure	Probable Maximum Loss (PML) of insured products from weather-related natural catastrophes	Insurance
	Total amount of monetary losses attributable to insurance payouts from (1) modelled natural catastrophes and (2) non-modelled natural catastrophes, by type of event and geographic segment (net and gross of reinsurance)	Insurance
	Description of approach to incorporation of environmental risks into (1) the underwriting process for individual contracts and (2) the management of firm-level risks and capital adequacy	Insurance
	Total expected loss and Loss Given Default (LGD) attributable to mortgage loan default and delinquency due to weather-related natural catastrophes, by geographic region	Mortgage Finance
	Description of how climate change and other environmental risks are incorporated into mortgage origination and underwriting	Mortgage Finance
Infrastructure Integrity Management	Amount of coal combustion residuals generation; percentage recycled	Electric Utilities & Power Generation
	True number of coal combustion residual impoundments, broken down by hazard potential classification and structural integrity assessment	Electric Utilities & Power Generation
	Number of (1) reportable pipeline incidents, (2) Corrective Action Orders (CAO), and (3) Notices of Probable Violation (NOPV)	Gas Utilities & Distributors
	Percentage of distribution pipeline that is (1) cast and/or wrought iron and (2) unprotected steel	Gas Utilities & Distributors
	Percentage of gas (1) transmission and (2) distribution pipelines inspected	Gas Utilities & Distributors
	Description of efforts to manage the integrity of gas delivery infrastructure, including risks related to safety and emissions	Gas Utilities & Distributors
Reputational Risk: GMOs	Percentage of products by revenue that contain genetically modified organisms (GMOs)	Chemicals
	Discussion of strategies to manage the use of genetically modified organisms (GMOs)	Agricultural Products
Reputational Risk: Animal Welfare	Percentage of animal production that received 1) medically important antibiotics and 2) not medically important antibiotics, by animal type	Meat, Poultry & Dairy
	Animal protein production from concentrated animal feeding operations (CAFOs)	Meat, Poultry & Dairy
	Percentage of pork produced without the use of gestation crates	Meat, Poultry & Dairy
	Percentage of cage-free shell egg sales	Meat, Poultry & Dairy
	Percentage of production certified to a third-party animal welfare standard	Meat, Poultry & Dairy
Harmful substances exposure	(1) % of products that contain Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Category 1 and 2 Health and Environmental Hazardous Substances, (2) % of such products that have undergone a hazard assessment	Chemicals

Source: SASB

Exhibit 34: Biodiversity metrics proposed for disclosure by SASB for waste management

Topic	Accounting Metric	Industry
Waste Management	Amount of hazardous waste generated, percentage recycled	Containers & Packaging; Electrical & Electronic Equipment; Electronic Manufacturing Services & Original Design Manufacturing; Oil & Gas Refining & Marketing; Semiconductors; Solar Tech & Project Developers; Aerospace & Defense
	Number and aggregate quantity of reportable spills, quantity recovered	Electrical & Electronic Equipment; Solar Tech & Project Developers; Aerospace & Defense
	Number of tailings impoundments, broken down by MSHA hazard potential	Coal Operations; Metals & Mining
	Amount of waste generated, percentage hazardous, percentage recycled	Construction Materials; Iron & Steel Producers; Auto Parts;
	Total amount of medical waste, percentage (a) incinerated, (b) recycled or treated, and (c) landfilled	Health Care Delivery
	Total amount of: (1) hazardous and (2) nonhazardous pharmaceutical waste, percentage (a) incinerated, (b) recycled or treated, and (c) landfilled	Health Care Delivery
	Total weight of 1) tailings waste and 2) mineral processing waste; percentage recycled	Metals & Mining
	(1) Number of underground storage tanks (USTs), (2) number of UST releases requiring cleanup, and (3) percentage in states with UST financial assurance funds	Oil & Gas Refining & Marketing
	Total Toxic Release Inventory (TRI) releases, and percentage released to water	Waste Management
	Number of corrective actions implemented for landfill releases	Waste Management
Discharge Management & Ecological Impacts	Total amount of ship waste discharged to the environment, percentage treated prior to discharge	Cruise Lines
	Percentage of fleet implementing ballast water 1) exchange and 2) treatment	Cruise Lines; Marine Transportation
	Cruise/shipping duration in marine protected areas or areas of protected conservation status (in number of travel days)	Cruise Lines; Marine Transportation
	Number of notices of violations received for dumping	Cruise Lines
	1) Number and 2) aggregate volume of spills and releases to the environment	Marine Transportation
Management of Leachate & Hazardous Waste	Number of incidents of non-compliance associated with environmental impacts	Waste Management
	Number and aggregate volume of hydrocarbon spills, volume in Arctic, volume impacting shorelines with ESI rankings 8-10, and volume recovered	Oil & Gas Exploration & Production; Oil & Gas Midstream

Source: SASB

Exhibit 35: Biodiversity metrics proposed for disclosure by SASB for water management

Topic	Accounting Metric	Industry
Water Management	1) Total water withdrawn, 2) total water consumed, percentage of each in regions with High or Extremely High Baseline Water Stress	Chemicals; Containers & Packaging; E-commerce; Electronic Manufacturing Services & Original Design Manufacturing; Electric Utilities & Power Generation; Hotels & Lodging; Household & Personal Products; Internet Media & Services; Meat, Poultry & Dairy; Non-Alcoholic Beverages; Processed Foods; Pulp & Paper Products; Restaurants; Semiconductors; Software & IT Services; Solar Tech & Project Developers; Agricultural Products; Biofuels; Alcoholic Beverages
	1) Total freshwater withdrawn, 2) total water consumed, percentage of each in regions with High or Extremely High Baseline Water Stress	Coal Operations; Construction Materials; Iron & Steel Producers; Metals & Mining; Oil & Gas Exploration & Production; Oil & Gas Refining & Marketing
	(1) Total volume of fresh water handled in operations, (2) percentage recycled	Oil & Gas Services
	Number of incidents of non-compliance associated with water quality permits, standards, and regulations	Chemicals; Coal Operations; Containers & Packaging; Electric Utilities & Power Generation; Meat, Poultry & Dairy; Metals & Mining; Oil & Gas Refining & Marketing; Processed Foods; Agricultural Products; Biofuels
	Description of water management risks and discussion of strategies and practices to mitigate those risks	Chemicals; Containers & Packaging; Electric Utilities & Power Generation; Household & Personal Products; Meat, Poultry & Dairy; Non-Alcoholic Beverages; Processed Foods; Pulp & Paper Products; Real Estate; Solar Tech & Project Developers; Agricultural Products; Biofuels; Alcoholic Beverages
	Volume of produced water and flowback generated; percentage 1) discharged; 2) injected; 3) recycled; hydrocarbon content in discharged water	Oil & Gas Exploration & Production
	Percentage of hydraulically fractured wells for which there is public disclosure of all fracturing fluid chemicals used	Oil & Gas Exploration & Production
	Percentage of hydraulic fracturing sites where ground or surface water quality deteriorated compared to a baseline	Oil & Gas Exploration & Production
	Discussion of strategy or plans to address water consumption and disposal-related risks, opportunities, and impacts	Oil & Gas Services
	Water withdrawal data coverage as a percentage of (1) total floor area and (2) floor area in regions with High or Extremely High Baseline Water Stress, by property subsector	Real Estate
	(1) Total water withdrawn by portfolio area with data coverage and (2) percentage in regions with High or Extremely High Baseline Water Stress, by property subsector	Real Estate
	Like-for-like percentage change in water withdrawn for portfolio area with data coverage, by property subsector	Real Estate
Water Supply Resilience	Total water sourced from regions with High or Extremely High Baseline Water Stress, percentage purchased from a third party	Water Utilities & Services
	Volume of recycled water delivered to customers	Water Utilities & Services
	Discussion of strategies to manage risks associated with the quality and availability of water resources	Water Utilities & Services

Source: SASB

Exhibit 36: Biodiversity metrics proposed for disclosure by SASB related to supply chains and sourcing of materials

Topic	Accounting Metric	Industry
Third-party certification, verification, audits etc. to meet sustainability or ecological performance standards	Percentage of raw materials third-party certified to an environmental and/or social sustainability standard, by standard	Apparel, Accessories & Footwear
	Percentage of wood fiber sourced from (1) third-party certified forestlands and percentage to each standard and (2) meeting other fiber sourcing standards and percentage to each standard	Pulp & Paper Products
	1) Total weight of wood fiber materials purchased, (2) percentage from third-party certified forestlands, (3) percentage by standard, and (4) percentage certified to other wood fiber standards, (5) percentage by standard	Building Products & Furnishings
	Percentage of food purchased that (1) meets environmental and social sourcing standards and (2) is certified to third-party environmental and/or social standards	Restaurants
	Percentage of biofuel production third-party certified to an environmental sustainability standard	Biofuels
	Revenue from products third-party certified to environmental or social sustainability sourcing standard	Food Retailers & Distributors
	Amount of palm oil sourced, percentage certified through the Roundtable on Sustainable Palm Oil (RSPO) supply chains as (a) Identity Preserved, (b) Segregated, (c) Mass Balance, or (d) Book & Claim	Household & Personal Products
	Percentage of food ingredients/agricultural products sourced that are certified to third-party environmental and/or social standards, and percentages by standard	Processed Foods; Agricultural Products
	Percentage of livestock from suppliers implementing the Natural Resources Conservation Service (NRCS) conservation plan criteria or the equivalent	Meat, Poultry & Dairy
	Percentage of supplier and contract production facilities verified to meet animal welfare standards	Meat, Poultry & Dairy
	Suppliers' social and environmental responsibility audit (1) non-conformance rate and (2) associated corrective action rate for (a) major and (b) minor non-conformances	Non-Alcoholic Beverages; Agricultural Products; Processed Foods
Materials Sourcing	Percentage of agricultural products/food or beverage ingredients/animal feed sourced from (contracts with producers located in) regions with High or Extremely High Baseline Water Stress	Agricultural Products; Non-Alcoholic Beverages; Processed Foods; Alcoholic Beverages; Meat, Poultry & Dairy
	List of priority food/beverage ingredients and discussion of sourcing risks due to environmental and social considerations	Non-Alcoholic Beverages; Processed Foods; Alcoholic Beverages
	Description of environmental and social risks associated with sourcing priority raw materials	Apparel, Accessories & Footwear
	Discussion of the process for managing iron ore and/or coking coal sourcing risks arising from environmental and social issues	Iron & Steel Producers
	Description of the management of risks associated with the use of critical materials (polysilicon supply chain for solar tech)	Electrical & Electronic Equipment; Electronic Manufacturing Svcs & Original Design Manufacturing; Hardware; Industrial Machinery & Goods; Semiconductors; Solar and Wind Tech & Project Developers; Aerospace & Defense; Auto Parts; Automobiles; Medical Equipment & Supplies; Fuel Cells & Industrial Batteries
	Percentage of (revenue from for food retailers) (1) eggs that originated from a cage-free environment and (2) pork produced without the use of gestation crates	Food Retailers & Distributors; Restaurants
Supply Chain Management	Description of efforts to maintain traceability within the distribution chain	Medical Equipment & Supplies
	Discussion of strategy to manage environmental and social risks arising from contract growing and commodity sourcing	Agricultural Products
	Percentage of (1) Tier 1 supplier facilities and (2) supplier facilities beyond Tier 1 in compliance with wastewater discharge permits and/or contractual agreement	Apparel, Accessories & Footwear
	Amount of recycled and recovered fiber procured	Pulp & Paper Products
	Discussion of strategy to manage environmental and social risks within the supply chain, including animal welfare / the environmental impacts of feedstock production	Food Retailers & Distributors; Restaurants; Biofuels

Source: SASB

Exhibit 37: Biodiversity metrics proposed for disclosure by SASB related to land management

Topic	Accounting Metric	Industry
Land Use & Ecological Impacts	Area of forestland certified to a third-party forest management standard, percentage certified to each standard	Forestry Management
	Area of forestland with protected conservation status	Forestry Management
	Area of forestland in endangered species habitat	Forestry Management
	Number of 1) lots and 2) homes delivered on redevelopment sites	Home Builders
	Number of 1) lots and 2) homes delivered in regions with High or Extremely High Baseline Water Stress	Home Builders
	Percentage of pasture and grazing land managed to Natural Resources Conservation Service (MRCS) conservation plan criteria	Meat, Poultry & Dairy
	Percentage of mine sites where acid rock drainage is 1) predicted to occur; 2) actively mitigated, and 3) under treatment or remediation	Coal Operations; Metals & Mining
	Percentage of 1) proved and 2) probable reserves in or near sites with protected conservation status or endangered species habitat	Coal Operations; Metals & Mining; Oil & Gas Exploration & Production
	Terrestrial acreage disturbed, percentage of impacted area restored	Construction Materials; Oil & Gas Midstream
	Number of lodging facilities located in or near areas of protected conservation status or endangered species habitat	Hotels & Lodging
	Percentage of land owned, leased, and/or operated within areas of protected conservation status or endangered species habitat	Oil & Gas Midstream
	Average disturbed acreage per (1) oil and (2) gas well site	Oil & Gas Services
Descriptions and discussions of ecosystem and biodiversity-related processes and policies	Description of approach to optimizing opportunities from ecosystem services provided by forestlands	Forestry Management
	Discussion of process to integrate environmental considerations into site selection, site design, and site development and construction	Home Builders
	Description of environmental management policies and practices for active sites/operations	Coal Operations; Construction Materials; Metals & Mining; Oil & Gas Exploration & Production; Oil & Gas Midstream
	Description of environmental management policies and practices to preserve ecosystem services	Hotels & Lodging
	Discussion of strategy or plan to address risks and opportunities related to ecological impacts from core activities	Oil & Gas Services
	Description of efforts in solar energy system project development to address community and ecological impacts	Solar Tech & Project Developers
	Description of efforts to address ecological & community impacts of wind energy production through turbine design	Wind Tech & Project Developers
	Discussion of processes to assess and manage environmental risks associated with project design, siting, and construction	Engineering & Construction Services

Source: SASB

CSRD and Biodiversity:

Exhibit 38: CSRD EU Sustainability Reporting Standards Exposure Draft E4 — Biodiversity and ecosystems

DR E4-1	Transition plan in line with the targets of no net loss by 2030, net gain from 2030 and full recovery by 2050 To provide an understanding of the transition plan of the undertaking and its compatibility with the preservation and restoration of biodiversity and ecosystems in line with the Post-2020 Global Biodiversity Framework and the EU Biodiversity Strategy for 2030
DR E4-2	Policies implemented to manage biodiversity and ecosystems To provide an understanding of the extent to which policies address mitigation or remediation of adverse impacts, protection and restoration of biodiversity and ecosystems, and management of material biodiversity and ecosystems impacts, risks and opportunities
DR E4-3	Measurable targets for biodiversity and ecosystems To provide an understanding of targets adopted to support biodiversity and ecosystems policies and address material related impacts, dependencies, risks and opportunities
DR E4-4	Biodiversity and ecosystems action plans To disclose action plans and allocation of resources towards plans in order to provide transparency on key actions taken and planned to achieve biodiversity and ecosystems-related targets
DR E4-5	Pressure metrics To provide information on material impact drivers that unequivocally influence biodiversity, ecosystem services and underlying ecosystems
DR E4-6	Impact metrics Metrics for material biodiversity and ecosystem-related impacts, by material geographical locations or raw materials, to provide an understanding of progress towards no net loss and net gain, including how offsets may be integrated into approach
DR E4-7	Response metrics To provide an understanding of how material impacts on biodiversity and ecosystems are minimized, rehabilitated or restored, by material geographical location or raw material
DR E4-8	(Optional) Biodiversity-friendly consumption and production metrics To provide an understanding of its consumption and production that qualifies as being biodiversity-friendly
DR E4-9	(Optional) Biodiversity offsets To disclose actions, development and financing of biodiversity mitigation projects (offsets) inside and outside the value chain that compensate for any residual, significant adverse impacts on biodiversity that cannot be avoided
DR E4-10	Financial effects from biodiversity-related impacts, risks and opportunities To provide an understanding of risks and opportunities on ability to create enterprise value

Source: EFRAG

2020 Aichi Targets

Exhibit 39: 2020 Aichi Targets set a baseline from which the Post-2020 Global Biodiversity framework may establish new KPIs

2020 Aichi Targets

Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society
1) By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.
2) By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.
3) By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.
4) By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.
Reduce the direct pressures on biodiversity and promote sustainable use
5) By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation are significantly reduced.
6) By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.
7) By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.
8) By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.
9) By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.
10) By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.
To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity
11) By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.
12) By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.
13) By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.
Enhance the benefits to all from biodiversity and ecosystem services
14) By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.
15) By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15% of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.
16) By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.
Enhance implementation through participatory planning, knowledge management and capacity building
17) By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.
18) By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.
19) By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.
20) By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

Source: Convention on Biological Diversity

Biodiversity Third-Party Data Availability

Exhibit 40: Metrics available through third-party data vendors related to air quality

Biodiversity Related Metrics			
Pillar	**Category**	**Title**	**Description**
Environmental	Air Quality	Hazardous Air Pollutants Emissions	Hazardous air pollutants (HAP) emissions, in thousands of metric tonnes. HAPs are defined by the EPA as pollutants known or suspected to cause serious health effects, such as birth defects, or adverse environmental effects. The scope of disclosure includes air pollutants associated with the entity's activities and sources of emissions, including, but not limited to, stationary and mobile sources, production facilities, office buildings, and transportation fleets.
Environmental	Air Quality	Hydrogen Sulfide (H2S) Emissions	Amount of Hydrogen Sulfide emissions (H2S) emitted by the company, in thousands of metric tonnes.
Environmental	Air Quality	Internal Carbon Price per Tonne	The internal price on carbon per tonne of CO2 equivalent emissions in the reporting currency.
Environmental	Air Quality	Internal Carbon Pricing	Does the company have an internal price on carbon?
Environmental	Air Quality	Nitrogen Oxide Emissions	Total amount of nitrogen oxide (NOx) emitted by the company, in thousands of metric tonnes.
Environmental	Air Quality	Particulate Emissions	Total amount of particulates emitted by the company, in thousands of metric tonnes.
Environmental	Air Quality	Sulphur Oxide Emissions	Total amount of sulphur oxides (SOx) emitted, in thousands of metric tonnes. Includes sulphur dioxide.
Environmental	Air Quality	VOC Emissions	Total amount of volatile organic compounds (VOCs) emitted by the company, in thousands of metric tonnes.

Source: Refinitiv Eikon, Bloomberg, data compiled by Goldman Sachs Global Investment Research

Exhibit 41: Metrics available through third-party data vendors related to ecological impacts

Biodiversity Related Metrics			
Pillar	**Category**	**Title**	**Description**
Environmental	Ecological Impacts	Agrochemical 5 % Revenue	Are the revenues generated by the company from agrochemicals like pesticides, fungicides, or herbicides 5% or more of company sales? (Modern synthetic fertilizers composed mainly of nitrogen, phosphorous, and potassium compounds with secondary nutrients added are also in scope)
Environmental	Ecological Impacts	Agrochemical Products	Does the company produce or distribute agrochemicals like pesticides, insecticides, fungicides or herbicides? - this is sector specific data measure for chemical companies producing agrochemicals for agricultural purposes
Environmental	Ecological Impacts	Animal Testing	Is the company directly or indirectly involved in animal testing? (Testing its products on animals or sourcing raw materials tested on animals, unless solely in cases where required by law) - applicable to pharmaceutical, healthcare sector, cosmetics
Environmental	Ecological Impacts	Animal Testing Reduction	Has the company established a program or an initiative to reduce, phase out or substitute for animal testing? - relevant to pharmaceutical, chemical, cosmetic and food producing companies
Environmental	Ecological Impacts	Animal Welfare Policy	Indicates that the company has a policy that outlines the humane treatment of animals which is audited by third party and/or has received animal welfare certification. This policy is relevant for all industries using animals for food, scientific research and other purposes.
Environmental	Ecological Impacts	Area Forestland Protected Conservation Status	Area of land that had protected conservation status during the reporting period, in hectares. The scope of the status may include land owned, leased and/or managed by the entity. Protected conservation status may include but is not limited to land located within government protected areas. Globally accepted conservation areas include designated United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage sites and Ramsar sites.
Environmental	Ecological Impacts	Area of Forestland in Indigenous Land	Area of forestland owned, leased, and/or managed by the company that is located in areas considered to be indigenous peoples' land, in hectares.
Environmental	Ecological Impacts	Biodiversity Impact Reduction	Does the company report on its impact on biodiversity or on activities to reduce its impact on the native ecosystems and species, as well as the biodiversity of protected and sensitive areas?
Governance	Ecological Impacts	Biodiversity Policy	Indicates whether the company has implemented any initiatives to ensure the protection of biodiversity. This might include trees and vegetation as well as wildlife and endangered species.
Environmental	Ecological Impacts	Environmental Controversies Count	Number of controversies related to the environmental impact of the company's operations on natural resources or local communities.
Environmental	Ecological Impacts	Environmental Partnerships	Does the company report on partnerships or initiatives with specialized NGOs, industry organizations, governmental or supra-governmental organizations, which are focused on improving environmental issues?
Environmental	Ecological Impacts	Environmental Restoration Initiatives	Does the company report or provide information on company-generated initiatives to restore the environment? - any initiatives to restore the environment like restoration, rehabilitation, clean up and remediation activities - company's operation disturbing environment and restoring the same later is not qualified as restoration initiatives
Environmental	Ecological Impacts	GMO Products	Does the company produce or distribute genetically modified organisms (GMO) or seeds? - relevant to agriculture, food products, consumer products, non-cyclical consumer goods & services sector
Environmental	Ecological Impacts	Has Forestry Standard Suspended Terminated FY	Indicates whether the company has had any land (owned, leased or managed) suspended or terminated from a third-party sustainable forest management standard during the reporting period. Sustainable Forest Management standards include ATFS, FSC, PEFC and SFI.
Environmental	Ecological Impacts	Land Disturbed	Amount of land disturbed by the company's activities during the reporting period, in hectares.
Environmental	Ecological Impacts	Land Environmental Impact Reduction	Does the company report on initiatives to reduce the environmental impact on land owned, leased or managed for production activities or extractive use? - relevant to companies involved in agriculture, mining & oil and gas
Environmental	Ecological Impacts	Land Restored	Amount of land previously disturbed by the company's activities that was then restored or rehabilitated during the reporting period, in hectares.
Environmental	Ecological Impacts	Number Sites Environmentally Sensitive Areas	Number of sites or operations the company has in, or in proximity to, environmentally sensitive areas. Environmentally sensitive areas may include but are not limited to Environmentally Sensitive Areas, Unusually Sensitive Areas, protected areas, and national and/or international ecological conservation areas with high biodiversity value. Proximity may be defined by the company or by third-party standards.
Environmental	Ecological Impacts	Offers GMO-Free Alternatives	Indicates that the company offers GMO-free products as an alternative to products with genetically modified organisms.
Environmental	Ecological Impacts	Organic Products Initiatives	Does the company report or show initiatives to produce or promote organic food or other products? - relevant for companies in food industries, agricultural produce, and chemicals (organic fertilizers), textile & apparels (which use biodegradable materials including organic fibres)
Environmental	Ecological Impacts	Percentage of Eggs from Cage Free Sources	Percentage of eggs sold during the reporting period from cage-free sources (cage-free and free-range environments). Usage of cages in egg production is generally accepted as harmful to animal welfare.
Environmental	Ecological Impacts	Percentage of Land Restored	Percentage of land that was restored of the land that was previously disturbed by the company's activities. Land restoration may include rehabilitation of the soil, ecological landscape and reintroduction of wildlife.
Environmental	Ecological Impacts	Percentage of Pork Sold from Gestation Crate Free Sources	Percentage of pork sold from gestation-crate-free sources. A gestation-crate is defined as an enclosure for sow or pigs that does not allow for turning around, typically does not include bedding and with concrete floors and metal stalls.
Environmental	Ecological Impacts	Third Party Certified Forestland	Area of forestland certified to a third-party forest management standard during the reporting period, in hectares. The scope of the standard may include forestlands owned, leased and/or managed by the entity. Third-party forest management standards certify that forests are harvested in a sustainable manner and cover environmental and social criteria. Sustainable Forest Management standards include American Tree Farm System (ATFS), Forest Stewardship Council (FSC), Programme for the Endorsement of Forest Certification (PEFC), Sustainable Forest Initiative (SFI).

Source: Refinitiv Eikon, Bloomberg, data compiled by Goldman Sachs Global Investment Research

Exhibit 42: Metrics available through third-party data vendors related to materials sourcing and supply chain management

Biodiversity Related Metrics			
Pillar	**Category**	**Title**	**Description**
Environmental	Materials Sourcing	Commodity Sourcing ESG Risks Disclosed	Indicates whether company has disclosed ESG risks associated with sourcing raw materials in its supply chain. Such risks could be related to human rights, modern slavery, conflict, environmental degradation, and/or reputational risks.
Environmental	Materials Sourcing	Environmental Materials Sourcing	Does the company claim to use environmental criteria (e.g., life cycle assessment) to source or eliminate materials?
Environmental	Materials Sourcing	Labeled Wood	Does the company claim to produce, source or distribute wood or forest products that are labelled (e.g., FSC)? - relevant to paper industries, publishing companies, wood producers
Environmental	Materials Sourcing	Labeled Wood Percentage	The percentage of labelled wood or forest products (e.g., Forest Stewardship Council) from total wood or forest products. - relevant to publishing companies
Environmental	Materials Sourcing	Percentage of Wood from Certified Sources	Percentage of wood-based raw materials procured during the reporting period that is certified to a responsible sourcing standard.
Environmental	Materials Sourcing	Raw Materials Used	Total amount of raw materials consumed by the company, in thousands of metric tonnes.
Environmental	Materials Sourcing	Total Wood Procured	Total weight of wood-based raw materials procured during the reporting period, in thousands of metric tonnes.
Environmental	Materials Sourcing	Wood from Certified Sources	Amount of wood-based raw materials procured during the reporting period that is certified to a responsible sourcing standard, in thousands of metric tonnes. Responsible sourcing certifications include ATFS, FSC, PEFC and SFI.
Environmental	Supply Chain Management	Env Supply Chain Partnership Termination	Does the company report or show to be ready to end a partnership with a sourcing partner, if environmental criteria are not met?
Environmental	Supply Chain Management	Environmental Supply Chain Management	Does the company use environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners?
Environmental	Supply Chain Management	Environmental Supply Chain Monitoring	Does the company conduct surveys of the environmental performance of its suppliers?
Environmental	Supply Chain Management	Policy Environmental Supply Chain	Does the company have a policy to include its supply chain in the company's efforts to lessen its overall environmental impact?

Source: Refinitiv Eikon, Bloomberg, data compiled by Goldman Sachs Global Investment Research

Exhibit 43: Metrics available through third-party data vendors related to critical incident risk management

Biodiversity Related Metrics			
Pillar	**Category**	**Title**	**Description**
Environmental	Risk Management	Amount of Environmental Fines	Total amount of environmental fines paid by the company in millions of the company's reporting currency, in the reporting period.
Governance	Risk Management	Closure and Remediation Policy	Indicates whether the company has disclosed a management approach to minimizing the environmental and social impacts of mine closures.
Governance	Risk Management	CSR Sustainability External Audit	Does the company have an external auditor of its CSR/H&S/Sustainability report?
Governance	Risk Management	CSR Sustainability External Auditor Name	The name of the external auditor of the sustainability report.
Governance	Risk Management	CSR Sustainability Report Global Activities	Does the company's extra-financial report take into account the global activities of the company?
Governance	Risk Management	CSR Sustainability Reporting	Does the company publish a separate CSR/H&S/Sustainability report or publish a section in its annual report on CSR/H&S/Sustainability?
Environmental	Risk Management	Environment Management Team	Does the company have an environmental management team (any team outside of board committees that performs the functions dedicated to environmental issues)?
Environmental	Risk Management	Environmental Accounting Cost	Cost of environmental conservation and other environmental initiatives undertaken during the normal course of business, in millions of the company's reporting currency, as defined by the company in the reporting period.
Governance	Risk Management	Global Compact Signatory	Has the company signed the UN Global Compact, which is a non-binding united nations pact to encourage businesses worldwide to adopt sustainable and socially responsible policies, and to report on their implementation?
Governance	Risk Management	GRI Report Guidelines	Is the company's CSR report published in accordance with the GRI guidelines? - CSR report or data published within the framework or guidelines of GRI (global reporting initiative) principles
Environmental	Risk Management	Investments in Operational Sustainability	Amount of money spent by the company, in millions of the company's reporting currency, on operational E&S compliance and other internal environmental and social initiatives, as defined by the company. Figure excludes external investment activities related to sustainability such as clean energy project financing.
Environmental	Risk Management	Number of Environmental Fines	Number of environmental fines paid by the company in the period.
Environmental	Risk Management	Number of Significant Environmental Incidents	Number of environmental non-compliance incidents associated with violation of environmental quality permits, standards or regulations. Significant environmental incidents include incidents that are defined by the company as having a significant impact on company operations and/or the environment. The threshold at which an incidents are deemed to be significant/reportable is defined by the company.

Source: Refinitiv Eikon, Bloomberg, data compiled by Goldman Sachs Global Investment Research

Exhibit 44: Metrics available through third-party data vendors related to waste

Biodiversity Related Metrics			
Pillar	**Category**	**Title**	**Description**
Environmental	Waste	Accidental Spills	Direct and accidental oil and other hydrocarbon spills in thousands of barrels. - relevant to companies operating in the oil and gas, marine transportation, utilities and chemicals sector
Environmental	Waste	Amount of Significant Spills	Amount of significant spills of hazardous materials by the company, in thousands of metric tonnes. Significant spills are identified by the company as having a significant impact on company operations or the environment.
Environmental	Waste	Amount of Spills Recovered	Amount of spills of hazardous materials recovered by the company, in thousands of metric tonnes. Hazardous materials include chemicals or oil-based drilling fluids, cuttings that can affect soil, water, biodiversity and human health.
Environmental	Waste	Amount of Waste Composted	Amount of waste composted, in thousands of metric tonnes.
Environmental	Waste	Amount Spills Environmentally Sensitive Areas	Volume of hydrocarbon spills in, or in proximity to, environmentally sensitive areas, in thousands of cubic meters. Environmentally sensitive areas may include but are not limited to ESA, USA, protected areas, and national and/or international ecological conservation areas with high biodiversity value.
Environmental	Waste	Drilling Waste	Total amount of drilling wastes the company produces as a result of exploration and extraction processes, in thousands of metric tonnes. This may include sand, disturbed soil, and rock for the purposes of drilling, or other oily wastes.
Environmental	Waste	Hazardous Waste	Total amount of hazardous waste produced in tonnes.
Environmental	Waste	Hydrocarbon Spills Recovered	Volume of hydrocarbon spills recovered in the reporting period, in thousands of cubic meters.
Environmental	Waste	Mineral Waste	Weight of mineral processing waste generated by the company in the reporting period, in thousands of metric tonnes. Mineral processing waste may include dust, slags, sludges, spent solvents, scrap metal, reject coal, and used oil.
Environmental	Waste	Mining Overburden	Total quantity of waste rock or overburden removed in the process of resource excavation or extraction and which is discarded by the company during the reporting year, in thousands of metric tonnes.
Environmental	Waste	Number Non Accident Releases Rail Transportation	Number of non-accidental releases of hazardous materials from rail transportation in the reporting period, where an accident is defined as a derailment, collision, or other rail-related accident.
Environmental	Waste	Number of Hydrocarbon Spills	Number of hydrocarbon spills by the company in the reporting period.
Environmental	Waste	Number of Spills	Actual number of spills of hazardous materials by the company in the period. Field part of Environmental, Social or Governance (ESG) group of fields.
Environmental	Waste	Total Hazardous Waste To Revenues USD	Total amount of hazardous waste produced in tonnes divided by net sales or revenue in US dollars.
Environmental	Waste	Total Waste	Total amount of waste the company discards, both hazardous and non-hazardous, in thousands of metric tonnes.
Environmental	Waste	Toxic Chemicals Reduction	Does the company report on initiatives to reduce, reuse, substitute or phase out toxic chemicals or substances?

Source: Refinitiv Eikon, Bloomberg, data compiled by Goldman Sachs Global Investment Research

Exhibit 45: Metrics available through third-party data vendors related to water

Biodiversity Related Metrics			
Pillar	**Category**	**Title**	**Description**
Environmental	Water	Freshwater Withdrawals	Amount of freshwater withdrawn by the organization, in thousands of cubic meters.
Environmental	Water	Groundwater Withdrawals	Amount of water withdrawn from underground reservoirs, in thousands of cubic meters. Includes cooling water.
Environmental	Water	Total Water Discharged	Total volume of liquid waste and process water discharged, in thousands of cubic meters. Includes treated and untreated effluents returned to any water source.
Environmental	Water	Total Water Withdrawal	Amount of water diverted for use by the organization from all sources, including but not limited to surface, ground, saltwater, and municipal, in thousands of cubic meters. Includes cooling water.
Environmental	Water	Wastewater Management Policy	Indicates whether the company has implemented any initiatives to safely manage, treat and recycle the wastewater generated during the course of its operations.
Environmental	Water	Water Pollutant Emissions	Total weight of water pollutant emissions in tonnes.
Environmental	Water	Water Pollutant Emissions To Revenues	Total weight of water pollutant emissions in tonnes divided by net sales or revenue in US dollars.
Environmental	Water	Water Use/Withdrawal	Total water use, if available, otherwise total water withdrawal, in millions of cubic meters. This field provides for comparability across companies that report either total water use or total water withdrawal, but not both.

Source: Refinitiv Eikon, Bloomberg, data compiled by Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Madeline Meyer, Evan Tylenda, CFA, Grace Chen, Brian Singer, CFA, Derek R. Bingham, Brendan Corbett, Emma Jones, Keebum Kim and Rachit Aggarwal, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

GS Factor Profile

The Goldman Sachs Factor Profile provides investment context for a stock by comparing key attributes to the market (i.e. our coverage universe) and its sector peers. The four key attributes depicted are: Growth, Financial Returns, Multiple (e.g. valuation) and Integrated (a composite of Growth, Financial Returns and Multiple). Growth, Financial Returns and Multiple are calculated by using normalized ranks for specific metrics for each stock. The normalized ranks for the metrics are then averaged and converted into percentiles for the relevant attribute. The precise calculation of each metric may vary depending on the fiscal year, industry and region, but the standard approach is as follows:

Growth is based on a stock's forward-looking sales growth, EBITDA growth and EPS growth (for financial stocks, only EPS and sales growth), with a higher percentile indicating a higher growth company. **Financial Returns** is based on a stock's forward-looking ROE, ROCE and CROCI (for financial stocks, only ROE), with a higher percentile indicating a company with higher financial returns. **Multiple** is based on a stock's forward-looking P/E, P/B, price/dividend (P/D), EV/EBITDA, EV/FCF and EV/Debt Adjusted Cash Flow (DACF) (for financial stocks, only P/E, P/B and P/D), with a higher percentile indicating a stock trading at a higher multiple. The **Integrated** percentile is calculated as the average of the Growth percentile, Financial Returns percentile and (100% - Multiple percentile).

Financial Returns and Multiple use the Goldman Sachs analyst forecasts at the fiscal year-end at least three quarters in the future. Growth uses inputs for the fiscal year at least seven quarters in the future compared with the year at least three quarters in the future (on a per-share basis for all metrics).

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