Investor guide to agrochemicals

Accelerating biodiversity stewardship and industry transition

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1. Introduction

Pesticides and synthetic fertilisers, referred to as agricultural chemicals or agrochemicals, are a major driver of biodiversity loss. Although the development of these chemicals has enabled the industrialisation of agriculture to feed a growing population, the immense scale of their use has negatively impacted biodiversity, climate and community health. There is a global consensus on the need for an urgent transition to sustainable agriculture practices, with the Kunming-Montréal Global Biodiversity Framework (GBF) agreeing to reduce nutrient loss to the environment and the risk of pesticides to biodiversity by half by 2030.[1]

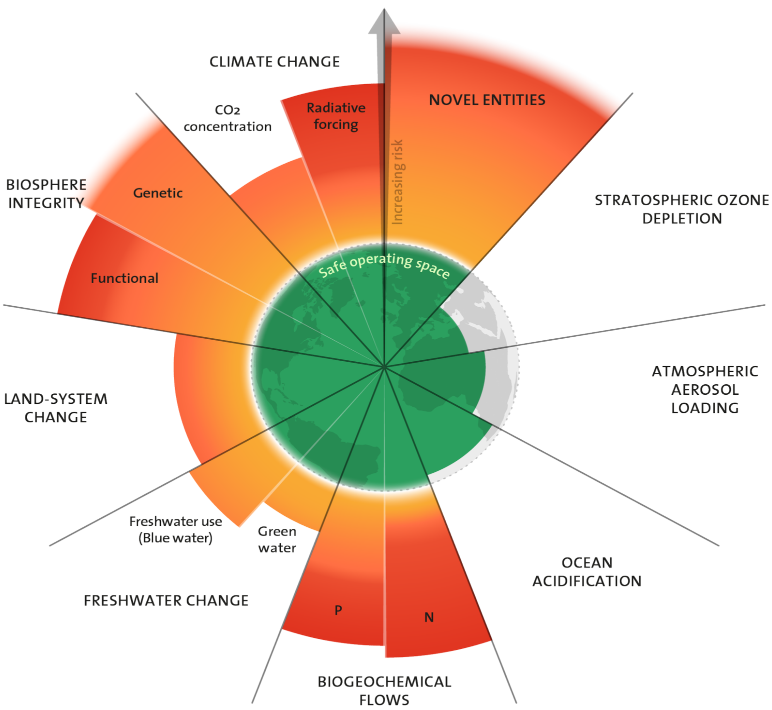

Figure 1: Phosphorous and nitrogen lost to the environment have far transgressed the biogeochemical flows planetary boundary. Novel entities – including chemicals – have also exceeded their boundary. The pollution of natural environments and ecosystems, such as soils, with pesticides contributes to land use change - Stockholm Resilience Center.

This short brief, based on research conducted by the FAIRR Initiative and ShareAction, will illustrate how agrochemicals drive biodiversity loss and how investor engagement can accelerate the industry's transition toward low-impact business models supportive of sustainable food systems. Specifically, this brief presents the following:

- **An overview of the sector, key listed companies, and market information**
- **A summary of impacts and dependencies on nature, as well as financial materiality**
- **Key areas of improvement for companies, including risk and impact assessments, strategy and targets, and product stewardship**
- **Examples of potential opportunities for the sector**
- **Engagement recommendations based on FAIRR and ShareAction ongoing initiatives**
- **Collaborative engagement opportunities, where key companies are in scope**

2. Sector overview: quick facts

The agrochemicals industry is highly consolidated, with six pesticide companies holding 80 percent share of the market by revenue and six publicly listed fertiliser companies capturing around 38 percent. Therefore, any improvement among key companies will result in significant progress towards reducing biodiversity loss from nutrient and pesticide pollution. Investors should prioritise these companies in their stewardship efforts with the sector.

Pesticide and fertiliser companies, while rarely integrated under a single business, are interconnected, as the use of one product usually necessitates the use of the other.

Pesticides enable intensive monocropping systems, which degrade soil organic matter and nutrients, and attract pests and disease due to a lack of crop diversity. Farmland then needs fertilisers to restore nutrient availability, which they can provide without crop rotation or diversification. The absence of more holistic practices means soil is less resilient to disease and functional wildlife areas are not present to control pest outbreaks. As a result, a higher incidence of disease or pest outbreaks that require pesticides is likely.[2]

Table 1: Key listed companies and products in the agrochemicals sector

	Fertilisers (synthetic)	Pesticides[i]
2022 industry revenues	$207 billion[3]	$69.3 billion[4]
Top import markets[ii]	1. Brazil (44m tonnes) 2. United States (33m tonnes) 3. India (30m tonnes) 4. China (10m tonnes) 5. Indonesia (10m tonnes)	1. Brazil (445k tonnes) 2. United States (409k tonnes) 3. Canada (204k tonnes) 4. France (281k tonnes) 5. Australia (275k tonnes)
Top 6 publically listed companies by market share[iii]	1. Nutrien (Canada) 2. The Mosaic Company (USA) 3. CF Industries (USA) 4. Yara (Norway) 5. OCI Global (Netherlands) 6. K+S (Germany)[iv]	1. Syngenta (Switzerland/ China) 2. Bayer (Germany) 3. Corteva (USA) 4. BASF (Germany) 5. FMC Corporation (USA) 6. UPL (India)[5]
High-risk products	While concentrated products pose higher risks of misuse, the risk level generally varies depending on soil type, temperature, weather conditions, and existing soil nitrogen/phosphorous balance. Application rates, timing and the type of application are also determinant factors. **Urea,** the most concentrated nitrogen fertiliser (46% N) **Mono Ammonium Phosphate (MAP) fertiliser,** the most concentrated phosphorous fertiliser (52% P) **Slurries and manure** have highly variable N and P contents, which tend to lead to imbalances[6] Organic fertilisers sold by agrochemical companies are composted and treated for pathogens. They are generally considered low risk compared to untreated manure and meat processing waste.	**Highly Hazardous Pesticides** (HHPs)[7] , which present acute or chronic hazards to the environment or human health **Neonicotinoids,** the residues of which are found in pollen, nectar, soil, plant tissues and plant surfaces and are toxic to bees[8] **Glyphosate,** which negatively impacts soil microorganisms[9] and is carcinogenic to humans[10] **Systemic pesticides,** which are broadly toxic to all life rather than specific pests **Pesticide-coated seeds**[v], which contaminate soils,[11] release airborne dust, and are eaten by farm-dwelling species[12]

i. Includes insecticides, herbicides and fungicide.
ii. This only includes marketed organic and synthetic fertilisers. Much manure and slurry are exchanged informally between livestock producers and local arable farmers.
iii. Based on 2022 product sales and industry revenue
iv. Data from Bloomberg
v. Neonicotinoids are the most common pesticide coating for coated seeds

3. Biodiversity impacts and dependencies of the agrochemical industry

The agrochemicals industry contributes significantly to air, soil and water pollution, which drives more than ten percent of biodiversity loss according to the IPBES.[13] While most agrochemical inputs disrupt ecosystems to some extent, the most significant effects result from their misuse, overuse or use of high-risk products.

<u>Table 2: Key drivers of agrochemical loss to the environment and of impacts to biodiversity</u>

Fertilisers	Pesticides
• Exclusively using manure or synthetic fertilisers, leading to pooler soil health and efficiency • Use of untreated slurry or processing wastewater containing pathogens, heavy metals, and other pollutants as fertiliser[14] • Overapplication due to lack of: o precision application equipment such as direct soil injection, variable rate application o real-time nutrient measurement equipment[15] • Proximity to water bodies and lack of riparian buffers (vegetated area between a field and water body)[16] • Changes in rain patterns[17]	• High-risk products, including Highly Hazardous Pesticides[18], broad spectrum pesticides, and coated seeds • Overapplication, including non-precision application or use in excessive volumes[19] • Lack of riparian buffers/use near waterways, which can spread pesticides throughout entire watersheds and catchment areas[20] • Use within or near vulnerable ecosystems, including areas of biodiversity importance[vi21]

Impacts

For both organic and chemical fertilisers, a delicate balance must be reached of applying the right product at the right place and time to avoid loss to the environment or a distorted nitrogen/ phosphorus balance, causing air and water pollution detrimental to biodiversity and people. Around 65 percent of nitrogen and 55 percent of phosphorus fertilisers are lost to the environment – around 100 million tonnes per year globally.[22,23,24] Chemical products that use inhibitors or slow-release mechanisms help reduce human factors, as do composted and treated manures.

For pesticides, the use of high volumes and high-risk products, including highly hazardous pesticides, present the most significant risks to biodiversity. These effects result from damage to non-target species, bioaccumulation in soils and wildlife species, and loss to the environment such as waterways.

In both cases, the improper or overuse of products negatively impacts nature, especially in or near biodiverse or vulnerable areas, causing the loss of ecosystem services.

vi Areas of biodiversity importance are areas that have been identified as especially biodiversity-rich or sensitive. These areas include, but are not limited to, Ramsar Sites, Key Biodiversity Areas (KBA), Natura 2000 sites (EU), IUCN Protected Areas, World Heritage Sites and Alliance for Zero Extinction sites.

Table 3: Biodiversity impacts of agrochemicals

	Fertilisers	Pesticides	Example of financial materiality
Terrestrial impacts	• Acidification of soil pH • Increased pest attacks on crops • Decreased soil organic carbon and useful organisms such as nitrogen cycling bacteria for example • Stunted crop growth and yield from improper application[25]	• Reduction in population size and health[26,vii] of on-farm non-target species, especially birds[27] and pollinators[28,viii] • Reduction in abundance and diversity of soil microorganisms[29] (resulting in loss of quality and functionality of soils) • Damage to off-farm wildlife species through pesticide drift and bioaccumulation[ix],[30] • Damage to species habitat, food and nesting sources (through loss of insects and weeds)[31] • Reduction of predators, which serve as natural pest control[32]	Land degradation, in large part resulting from intensive agriculture,[33] poses significant financial risks, as crop failures are more likely to result from pests, diseases, unproductive soils, and extreme weather events.[34] In England and Wales alone soil degradation is estimated to cost £1.2 billion per year.[35]
Freshwater impacts[x]	• Eutrophication (algal blooms causing the depletion of oxygen in surface waters) • Contamination of drinking water with pathogens from nitrates and manure or algal growth[36]	• Reduction in population size and health of freshwater species, including amphibians and fish[37],[38] • Contamination of species throughout waterways due to bioaccumulation along the food chain, including in seafood[39],[40] • Contamination of entire watersheds due to movement of pesticides and degraded byproducts downstream, resulting in contamination of drinking water[41],[42]	Excess nitrogen from U.S. Midwest cropland running off into the Mississippi river and ultimately into the Gulf of Mexico has an estimated annual economic impact of $2.4 billion from lost fisheries and other activities dependent on marine habitats.[43]
Upstream impacts	• Nitrogen fertiliser production is responsible for around two percent of global GHG emissions (plus another three percent from its use downstream)[44] • Phosphorous and Potash fertilisers are mined, exposing them to extractive industries and associated risks[45] • More than half of organic fertilisers come from animal wastes,[46] exposing them to the intensive livestock value chain and associated risks	• Biodiversity loss and negative climate impacts result from the use and extraction of fossil fuel and genetic material, which are used as pesticide feedstocks[47]	70 to 80 percent of the cost of ammonia manufacturing is from natural gas, making the industry heavily exposed to potential carbon taxes.[49] The EU will begin to phase out free carbon allowances for fertilisers from 2025. The EU Emissions Trading System (ETS) cost of carbon has varied between 60 and 100 euros per tonne, and Yara, for example, created 15.6 million tonnes of scope 1 and 2 emissions in 2023[48].

vii Pesticides can disrupt species health in multiple ways, including reproductive success, migration patterns, foraging activity or growth rates.
viii Through exposure and reduced food supply
ix Bioaccumulation results when pesticide contaminated species, including animals and plants, are eaten by species higher in the food chain, resulting in contamination of their population.
x Resulting from agricultural runoff or product use near freshwater

Dependencies

Both fertiliser and pesticide manufacturers depend on nature to provide clean water and feedstocks (water, minerals, genetic materials and fossil fuels) and to mitigate the downstream impacts of their products on biodiversity, farm workers and local communities. For example, natural vegetation like hedgerows surrounding crops helps reduce the loss of chemicals to water and air, mitigating downstream impacts of chemicals on wildlife and communities.

Agrochemicals and financial materiality

Agrochemical companies are exposed to growing financial, legal and regulatory risks, resulting from the negative impacts their products create for people and the environment. For pesticides at least, Bayer's legal battles over its glyphosate-based products in the United States are costing the company around $10 billion[50] every year, signalling that manufacturers are being held accountable for the use-phase impacts of their products. Agrochemical companies, including Bayer, focus heavily on user training or instructions to mitigate product-related risks, emphasising user responsibility above product redesign. However, **companies must address the hazards of their products in the design phase, as the use of high-risk formulas continues to expose companies to financial costs and reputational damage.**

The agrochemicals industry is also exposed to transition risk. To meet global goals on pesticide and nutrient pollution, the use of chemical inputs needs to be reduced, which could negatively impact industry revenues. If integrated into regulatory frameworks, it will limit the ability of farm operators to address soil degradation and pest problems with chemical inputs. Low-impact alternatives will be necessary, offering an opportunity for forward-thinking agrochemical companies to develop agronomic services, circularity in product design/use and nature-based solutions.

4. Priority areas of improvement

In the near-term, companies can mitigate these risks by removing highly hazardous pesticides, reformulating existing fertilisers to integrate circular sources, and restricting the sale of products in certain locations based on a thorough life cycle assessment of biodiversity impacts that includes the use-phase.

Based on FAIRR and ShareAction assessments, the largest listed agrochemical companies have yet to fully assess and adopt holistic measures to prevent the effects their products and practices have on biodiversity.[xi] Amidst growing disclosure demands including from frameworks like TNFD, companies will need to improve their approach to addressing these issues, including through strategies, targets and stewardship plans.

Note: for full analysis of how key agrochemical companies perform on biodiversity, see ShareAction[51] and FAIR[52] analysis.

Assessment of risks, impacts and dependencies

Few companies in the sector disclose any assessment of the impacts their products have on biodiversity, or methods to do so, and almost none appear to assess their dependencies or

xi This conclusion is based on assessments conducted by ShareAction and FAIRR using publicly available disclosure.

risks[53] When they do, there is a significant blind spot downstream: **companies initially assess how hazardous a product may be based on lab testing but fail to consider how the product is affecting biodiversity when and after it is used** (in different locations, volumes, or in conjunction with other agrochemical products, for example).

Companies should undertake impact, dependency, risk and opportunity assessments that include all activities in their value chains, which will provide them with essential information about which activities pose the highest risks to biodiversity. This should follow a materiality screening process[xii] to identify priority locations or products.[54] Companies should also use agreed standards for this process, such as the TNFD framework, and disclose assessment findings.

Leading practice: Assessment practices

Pesticides	Fertilisers[xiii]
Bayer's impact assessment methodology – Crop Protection Environmental Impact Reduction (CP EIR) – assesses the impact of 270 active ingredients on the environment, though only freshwater ecosystems are in scope at present.[55]CP EIR results enable tracking of progress against Bayer's impact reduction target. This methodology could be improved by assessing impact on biomes beyond freshwater, assessing downstream impacts beyond field level use and estimating impact in locations where products are used.	Yara has completed a Fertilizer Environmental Footprinting pilot. The company is working to assess the life cycle impacts of mineral and organic fertilisers. The company mentions that the results from its footprinting exercise will support its Climate and Nature roadmap[56] Yara also mentions it is currently conducting a downstream risk assessment. Nutrien has achieved its target to complete risk evaluation profiles of NPK manufactured products by 2024. The company also mentions it plans to complete the assessment of its operational footprint for its operating entities and develop processes to assess downstream nature risks and opportunities in 2024.[57]

Strategy and targets

Few agrochemical companies have comprehensive biodiversity-related strategies that include relevant commitments and targets, such as phasing out high-risk products, reducing the impact of products, or replacing riskier products with low-risk alternatives or reformulations.

Companies should set biodiversity targets aligned with the Kunming-Montréal Global Biodiversity Framework. Target setting should also follow standardised and agreed principles such as those established by the Science Based Targets Network and have transparent methods to measure and report against progress toward meeting their targets.

xii Without this essential step, companies may assess and set targets or initiatives around products or business operations that are not primary sources of negative impact.

xiii FAIRR has not been able to identify a single company that could be highlighted as best practice. The below example has been selected to highlight one of the different practices that, in addition to others, are considered leading practices.

Leading practice: strategy and targets

Pesticides	Fertilisers
Bayer has set a target to reduce the environmental impact of its pesticide products by 30 percent by 2030. While this is a good start, it can be improved by aligning with GBF Target 7 to reduce risk by half by 2030.[xiv]	In 2022, Yara had a target to increase revenue to $1.5 billion USD from its New Business Models segment by 2025. This segment included organic fertilisers, although the percentage of the revenue target allocated to such circular products was unclear.

Product stewardship

Better product stewardship is necessary to ensure that companies are responding proportionately to the risks created by their products, as different products have different risk profiles. Companies whose products have known severe or chronic impacts on biodiversity and human health still lack effective management plans to reduce product risks. For example, there have been few efforts to phase out highly hazardous pesticides.[58] As a matter of priority, these pesticides should be phased out and replaced with low-impact alternatives and agronomic services or nature-based solutions that aim to prevent pest issues.

Better risk assessments would enable both pesticide and fertiliser manufacturers to improve their understanding of which areas might be more at risk from chemical pollution. As a result, they could react appropriately by restricting or prohibiting the sale of specific formulations to farms in high-risk areas or retailers supplying those locations. Marketing could also be refocused to location-appropriate products, working with local farmers and organisations in at-risk areas, minimising on-site risks, and, in the case of fertilisers, recycling the nutrient already in circulation.

xiv See pages 25 and 26 of ShareAction's assessment of pesticide companies for a discussion of impact and risk.

Leading practice: product stewardship

Pesticides	Fertilisers
FMC Corporation has stated that it aims to identify HHPs in its product portfolio and phase them out where alternatives exist.[59] As part of FMC's Sustainability Assessment Tool (SAT), which is used to identify sustainability issues with products in development, the company aims to replace benchmark products with those that perform better on certain sustainability metrics.[60] FMC states that it undertakes risk assessment and product stewardship programmes for HHP products in its portfolio in specific countries.[61] FMC could improve its approach by phasing out all HHPs in its portfolio (which currently number 27) and ensuring that new products outperform benchmark products on the 'Environmental Consciousness' category of the SAT.	Overall, fertiliser companies are slow to integrate circularity into their processes to leverage the excess nutrient in animal wastes, crop residues or food waste. Yara has expanded its range of organic-based fertilisers in recent years through partnerships and the acquisitions of Ecolan, a recycled fertiliser producer, and Agribios, an organic fertiliser producer. The company also acquired a majority share in the organic-based fertiliser producer Grønn Gjødsel. The company is also conducting R&D activities at its research centres in Germany and Finland. However, the company has not stated any intention to restrict the sale of certain formulations to farms in high-risk areas or retailers supplying those locations.[62] Companies including Nutrien[63] make fertilisers that reduce the loss of nutrients to the environment compared to standard urea or ammonia products.

5. Transitioning to sustainable solutions

There is an opportunity for forward-thinking agrochemical companies to employ their skills, expertise and resources to become crucial players in the transition towards more sustainable food production systems. Developing innovative and circular sustainable solutions, products and services could create a competitive advantage as policy instruments emerge to support the implementation of the Paris Agreement and Global Biodiversity Framework.

Table 4 presents innovative products or services that could be developed by the agrochemicals industry, given its expertise. Farmers using methods like agroecology, diversified crop production, agroforestry and restoration of wildlife areas and riparian buffers require fewer agrochemical products but could be users of agronomic expertise and technology. Several of these solutions already exist but they lack scale and accessibility to small and medium-sized farms.

Table 4: Products and services to enable industry transition

Pesticides		Fertiliser	
Product/service	**Description**	**Product/service**	**Description**
Precision technologies and associated products or services	Precision technologies can be used to deliver pesticides[xv] only to crops that need them, while sparing adjacent crops and soil areas from the chemicals.[64] Technologies, combined with products and the pest, crop or biodiversity data and insights they can collect, are viable solutions for agrochemical companies to invest in.	**Precision technologies and associated products or services**	Targeted fertiliser application can increase nutrient uptake in crops and increase yields with less fertiliser, offering operating cost savings for farmers though at a high capital cost[65] It can involve precision application and real-time nutrient monitoring. It can also reduce emissions from agricultural soils and upstream emissions from fertiliser production.[66]
Mechanical solutions	Technologies such as automated traps or field robots can remove weeds and pests in the field without using insecticides or herbicides.[67]	**Biobased fertilisers**	Biobased fertilisers can be created from waste biomass from agricultural, food industry and biological activities, such as biochar or compost. These are treated and applied to soils to increase nitrates, phosphates and carbon in soils.[68]
Disease-resistant crop varieties	Traditional and modern breeding techniques can create crop varieties that are resistant to diseases borne from bacteria, viruses or fungi (rather than pests or weeds) therefore lowering the need for fumigant or fungicide use.[69xvi]	**Nitrogen and urease inhibitors[70]**	Inhibitors are a compound added to a nitrogen-based fertiliser to reduce losses when the fertiliser has been applied to the crop.[71] Applying nitrification and urease inhibitors on crop and pastureland can also reduce emissions from application of synthetic fertilisers and animal manure.[72]
Natural enemies	The natural enemies technique involves releasing predators of crop pests to control pest populations.[73] This reduces the need for insecticides and can be enabled by expanding functional wildlife areas both on and near farms.[74]	**Data collection and insight services**	These technologies and services, including real-time monitoring of crops and in-person support programmes, can assist farmers with optimising their fertiliser use.
Biological solutions and biopesticides	Most biological solutions, such as pheromone traps,[75] and biopesticides, which are derived from natural materials, are effective in controlling diseases, pests and weeds. They generally pose far lower risks to biodiversity than conventional pesticides. Most of these are also approved for use in organic production.[76]		

xv Nano-pesticides are often used in precision applications and are more toxic than non-nano analogues. Use of these products with precision technologies poses high risks to biodiversity.

xvi Narrowing the genetic pool of crops risks losing crops that have genetic resilience to future diseases or weather events. Additionally, the patenting of seeds can result in high costs for farmers and risks to farmer sovereignty. Companies should consider these factors and employ risk mitigation if pursuing this solution

FAIRR and ShareAction have developed the following asks specifically for manufacturers of pesticides and fertilisers, which would support companies moving towards leading practices for impact, dependency and risk assessment, strategy and targets, and product stewardship as detailed in section 3.

Table 5: Engagement asks

	Assessment	Strategy and targets	Product stewardship
Fertiliser	Assess and disclose biodiversity-related impacts and risks that result from the production and downstream use fertilisers.	Establish and measure progress against commitments and targets that aim to reduce the 50% reduction in excess nitrogen and phosphorus loss to the environment by 2030, in line with the GBF Target 7.	- Increase the % of farmers that receive support programs for the sustainable use of products. - Increase the revenue from products identified as having a lower environmental impact across their life cycle. - Phase out products with a higher environmental impact from areas identified as being at risk from pollution and/or biodiversity. - Diversify fertiliser revenue away from fossil-fuel based nitrogen fertiliser and mined phosphorus, towards circular sources.
Pesticides	Assess and disclose biodiversity-related impacts, dependencies and risks that result from all pesticide products throughout the entire value chain.	Establish and measure progress against commitments and targets that aim to reduce the risks of pesticide products by 50 per cent by 2030, in line with the GBF Target 7, including by phasing out HHPs by 2035.	Develop a transition plan and product stewardship strategy to address the risks that HHPs pose to biodiversity and human health, including phasing out HHPs by 2035.

6. Investor engagement opportunities

Industry engagement is an essential part of stewardship, which includes the topic of biodiversity. By participating in these initiatives, investors can benefit from research on company performance, guidance on key asks and best practices, and engagement opportunities for investors with less advanced or well-resourced stewardship programmes.[xvi]

Collaborative Opportunities

By participating in collaborative engagements, investors can support companies to transition to a low-impact, resilient business model, avoid and reduce nature-related risks as much as possible and capture opportunities that may arise from a wider transition to a sustainable food system.

The following initiatives aim to address biodiversity loss within agrochemical companies using broad and more sector-specific asks: ShareAction and FAIRR's initiatives have the most sector-specific asks, followed by PRI Spring and Nature Action 100.

Table 6: Collaborative engagement initiatives involving agrochemical companies

Opportunity	For who?	Description	Engagement topics	Companies in scope
ShareAction Pesticide Working Group[77]	Asset managers and owners	2-year engagement initiative for investors targeting the world's largest pesticide companies, aiming to significantly reduce the negative impact of their pesticide products on biodiversity.	• Targets and commitments • Assessment of impacts, dependencies and risks • Product stewardship[78]	BASF Bayer Corteva FMC Corporation Syngenta UPL
FAIRR biodiversity, waste and pollution engagement	Asset managers and owners	Investor engagement initiative targeting 10 animal protein producers and two agrochemical companies to minimise the biodiversity, climate and community risks arising from manure management and fertiliser use.	• Risk assessment for own operations and value chain • Risk mitigation • Circularity	BRF CP Foods Cranswick Darling Ingredients Hormel Foods JBS Maple Leaf Muyuan Seaboard Tyson WH Group Yara

xvi Among many commonalities, FAIRR and ShareAction use different tools for investor engagement. FAIRR only conducts collaborative engagements, while ShareAction encourages investors to use escalation in engagements with companies that are failing to enact change within a pre-determined time frame, either determined by the engagement initiative or the investor's engagement policy.

Nature Action 100[79]	Asset managers and owners	Global investor engagement initiative focused on driving greater corporate ambition and action to reverse nature and biodiversity loss within 100 target companies.	• Targets and commitments • Assessment of DIROs[xvii] • Strategy development • Governance • Positive stakeholder engagement[80]	ADM Yara Mosaic BHP Group Sociedad Quimica Y Minera De Chile (SQM) Orica Dow BASF Bayer Corteva FMC Corporation
PRI Spring[81]	Asset managers and owners; service providers	PRI stewardship initiative for nature, convening investors to use their influence to halt and reverse global biodiversity loss by 2030. Prioritising forest loss and land degradation.	• Business operations, strategy and risk management • Supply chain management • Political engagement[82]	ADM BASF Bayer Bunge Clariant

xvii Dependencies, impacts, risks and opportunities

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