

Food Giants & Fertiliser Risk

A call for greater corporate disclosure



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Executive Summary

Fertiliser-related environmental risks are growing. The most significant of these risks is eutrophication of freshwater and marine ecosystems, where fertiliser run-off from farmland causes nutrients such as nitrogen and phosphorus to build up in waterways, leading to algal blooms and excessive plant growth which can destroy aquatic ecosystems. Synthetic fertiliser production and use is also responsible for approximately 5% of global greenhouse gas (GHG) emissions, and fertiliser misuse on farms leads to nitrous oxide (N₂O) air pollution causing acid rain and smog.

Synthetic fertilisers helped power the 'green' revolution, which began in the 1960s, combined with the use of new high yield varieties of wheat and rice and increased use of irrigation and pesticides among other techniques. This dramatically increased crop yields and food availability, reducing food prices and helping to alleviate poverty in many parts of the world.

However, this intensive approach to agriculture has driven the widespread misuse of synthetic fertilisers in many regions, leading to a rise in the fertiliser-related environmental risks listed above. Fertilisers can be applied at the wrong time, in the wrong form and in the wrong quantity and the world is using at least twice the amount of fertiliser than is theoretically needed to produce enough food. As a result, the planetary boundary (or global environmental limit) for nitrogen is being exceeded by 2 to 3 times each year,¹ driven in a large part by the misuse of these fertilisers in crop production - particularly wheat, maize and rice.

New techniques are required to stop the misuse of synthetic fertiliser if the food system is to provide healthy, nutritious food for everyone while tackling the interlinked nature, climate and health crises.^a

Planet Tracker's '*Fixing Nitrogen*' report highlights the environmental damage caused by nitrogen fertilisers, the resulting risks to financial institutions, and potential solutions that governments, companies, and financial institutions can invest in to reduce synthetic fertiliser misuse while continuing to feed a growing population.

In this report, Planet Tracker searched the company filings of 45 of the largest food system companies globally (with aggregate revenues of USD 2.6 trillion) for evidence that food producers (upstream), manufacturers (midstream), and food retailers (downstream) are highlighting fertiliser-related risks to investors and other stakeholders.

This analysis used natural language processing (NLP) to search 5,165 documents including regulatory filings, investor meeting transcripts, annual reports and sustainability reports over a six-year period (2018-23).

^a This is part of the wider problem of an unsustainable food system that is discussed in more detail in the *Financial Markets Roadmap for Transforming the Global Food System*, which provides a framework for financial institutions to use to protect their portfolios from these emerging threats and reallocate capital to support the shift to a sustainable food system.

Key findings

Overall, this report found that a third of companies are failing to acknowledge fertiliser risks at all. However, there is some evidence that a greater number of companies are now providing more information than in the past. Given the quantities of fertiliser being used and the resulting environmental impact, this trend is encouraging, but still a long way off achieving sustainable fertiliser use across the food system.

Many risk disclosures are still superficial, and more companies need to provide evidence that they assess the risks associated with fertiliser misuse in their own operations and value chains, such as the potential financial cost and declining agricultural yields from fertiliser overuse.

More food manufacturers are providing a greater number of disclosures on the risks of fertiliser production and misuse than food producers which are direct users of fertiliser. However, the food producers that are providing disclosures on fertiliser risks are offering more information than their food manufacturing peers. Food retailers lag behind their peers in terms of fertiliser-related disclosures, which may be because they face indirect exposure to fertiliser risk through their supply chains.

Consistency is lacking

Very few companies consistently publish fertiliser risk disclosures across the six years analysed in this report.

Only two companies (**Golden Agri-Resources** and **Wilmar International**, both upstream food producers) have consistently published relevant risk disclosures across all six years. **Anheuser-Busch Inbev** (midstream manufacturer) has published across five years starting in 2019, with a significant increase in the number of disclosures in 2023.

PepsiCo (midstream) and **Walmart** (downstream) published an above-average number of disclosures in 2018 (12 and 7 respectively) but only published disclosures in 2 and 3 of the relevant periods respectively with no relevant disclosures in 2023.

Olam Group (upstream) is at the other extreme, with no relevant disclosures in earlier years (2018-2021), but 19 in 2022 and 18 in 2023.

Environmental risks are referenced the most frequently

The most common risk category covered across all company disclosures was the environmental risks related to the impact that fertiliser production and/or use has on external stakeholders. This indicates many companies have understood the general environmental risks associated with fertiliser, but fewer companies disclosed how this could impact their own operations and supply chains.

The second most frequent risk disclosure category was regarding the mitigating actions companies were taking to manage environmental risks, highlighting that companies at least recognise that action is needed. More research is needed to understand how effective companies' fertiliser risk mitigation strategies are.

Companies are beginning to understand key fertiliser risks

When disclosures are analysed by theme: reducing pollution (including eutrophication) is discussed by 53% of companies, 39% discuss improving agricultural practices (including tackling fertiliser overuse), while 30% discuss GHG emissions in the context of fertiliser risks.

This indicates that companies are beginning to understand the key risks and impacts associated with fertiliser misuse, but that significant progress still needs to be made in improving overall company fertiliser risk disclosures and communicating the potential financial impact of fertiliser misuse to investors.

More action is needed to tackle fertiliser misuse

Nearly half of disclosures on the theme of improving agricultural practices discussed 'optimising fertiliser use', which indicates that some companies are trying to improve the efficiency of fertiliser use and tackle overuse.

Around one third of disclosures in the same category mentioned organic fertiliser and only 12% reference regenerative agriculture, highlighting that there is a long way to go in terms of deploying solutions to fertiliser misuse and developing more environmentally sustainable agricultural production.



Planet Tracker call to action

Financial institutions (FIs) have a crucial role to play in encouraging food system companies to address the harms associated with excessive synthetic fertiliser use. Doing so will increase the resilience of the food system as a whole.

Characterising the problem

The problem	Why	Timeline
Fertiliser production and use contributes 5% of humanity's GHG emissions and causes N ₂ O pollution and eutrophication which threatens human health and biodiversity.	The global food system is threatened by climate change, nature loss and negative human health outcomes. These impacts, in turn, increase risks for the financial institutions funding the system.	The Kunming-Montreal Global Biodiversity Framework (GBF), target 7, aims to 'Reduce pollution risks and the negative impact of pollution ... by 2030... by reducing excess nutrients lost to the environment by at least half'. Synthetic fertiliser use could be reduced by 70% by 2050 if key actions were taken now and over the next few years through to 2030.

What can be done?

Who	What	When
Financial institutions	Ask food producers to publish plans for reducing synthetic fertiliser use by 70% by 2050.	Fertiliser reduction plans should be published by 2026.
	Request food producers to disclose progress on reducing synthetic fertiliser use and investment in alternatives production methods.	Disclosure of progress against fertiliser reduction plans should be published in 2027.
	Request midstream and downstream food companies to disclose the progress made in their supply chains regarding synthetic fertiliser use and the support they are providing to their suppliers in transitioning to alternative agricultural production methods.	Improved Scope 3 reporting should be achieved by 2026.
	Require all food system companies to provide Scope 3 disclosures detailing fertiliser-related GHG emissions.	Improved Scope 3 reporting should be achieved by 2026.

How

Financial institutions can encourage (and fund) a shift to regenerative/agroecological food production methods (since these approaches include a reduced reliance on inputs including synthetic fertilisers).

Food system companies can engage with their supply chains to establish contractual mechanisms to support the transition away from the extensive use of synthetic fertilisers.

The Science Based Targets initiative (SBTi) has provided guidance for companies when setting fertiliser reduction targets:

Forest, Land and Agriculture Science-Based Target-Setting Guidance (FLAG) – provides a framework for companies in land-intensive sectors to set science-based targets that include land-based emissions reductions and removals.

Three reports set out methods for reducing synthetic fertiliser use by up to 70% by 2050:

- *Greenhouse gas emissions from nitrogen fertilisers could be reduced by up to one-fifth of current levels by 2050 with combined interventions*, Yunhu Gao, André Cabrera Serrenho, 2023.
- *Reducing Emissions from Fertiliser Use*, Systemiq and the International Fertiliser Association, 2022.
- *Agriculture and climate change - reducing agriculture emissions through improved farming practices*, McKinsey, 2020.

The objective of our risk analysis

The risk analysis described in this report is designed to examine disclosures being published by a range of large, public companies from across the food system - upstream (food production companies), midstream (food manufacturing companies), and downstream (food retail companies).

Our survey excluded companies actually manufacturing and supplying fertiliser ('Input Providers') to ensure that our analysis focused on the companies driving the demand for fertilisers directly (the upstream segment) and those indirectly responsible for this demand (the midstream and downstream segments) Figure 1.

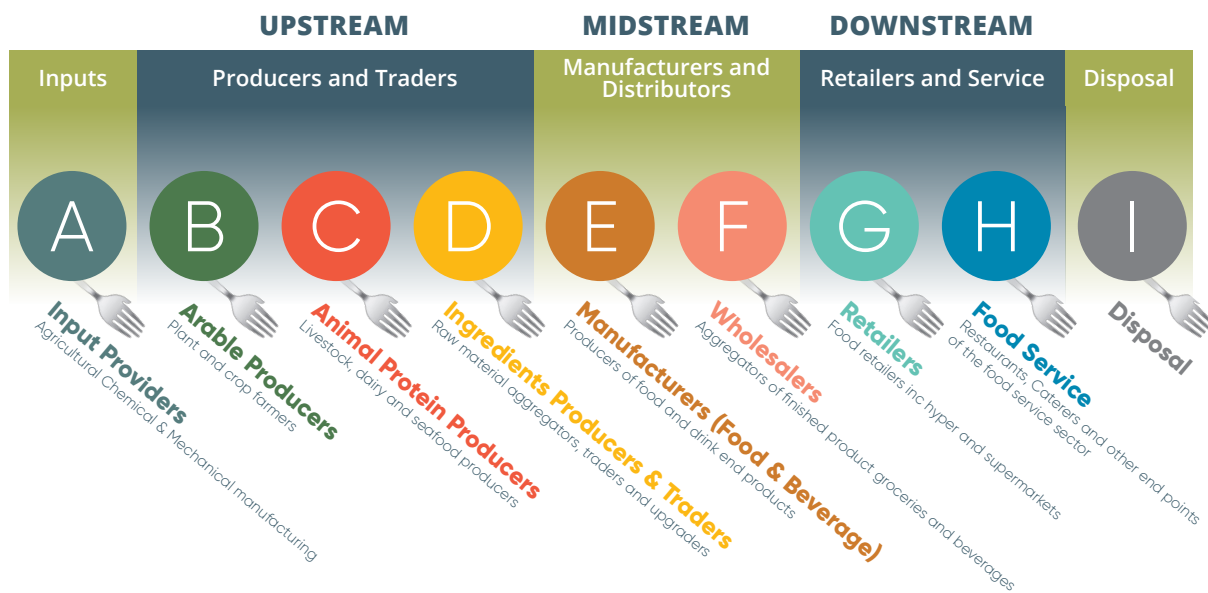


Figure 1: Food system Segments and Nodes (Source: Planet Tracker)

Given the significant environmental risks associated with excessive synthetic fertiliser use as well as the significant GHG emissions associated with its production, we analysed the extent to which food system companies using or benefiting from the use of fertilisers are a) recognising these risks, and b) taking actions to mitigate them.

Refer to [Appendix 7](#) for more details on the methodology underpinning this analysis.

Fertiliser risks

Fertilisers can be produced chemically (synthetic nitrogen), mined (phosphorous and potassium) or produced from organic processes (such as manure or compost).

The environmental risks associated with fertilisers are principally water pollution and eutrophication, the generation of significant amounts of GHGs during fertiliser production and use (accounting for approximately 5% of global GHG emissions),² and nitrous oxide air pollution that causes acid rain, smog and ground-level ozone.

In particular, the Haber-Bosch process used to produce synthetic nitrogen fertilisers requires significant amounts of energy and so generates significant quantities of carbon dioxide (CO₂).

When nitrogen fertilisers are used the natural processes involved in utilising the nitrogen release strong nitrous oxide (N₂O) – a GHG with a global warming potential 273 times higher than carbon dioxide.³

Nitrogen application also results in the release of nitric oxide and nitrogen dioxide (collectively, 'NO_x') and ammonia (NH₃) which collectively result in particulate pollution, smog and acid rain, as well as the formation of ground-level ozone, all of which are harmful to humans.

Finally, nitrogen fertiliser (and other types) are often applied inefficiently resulting in direct run-off or leaching from the soil into fresh water courses causing eutrophication^b - see Figure 2.

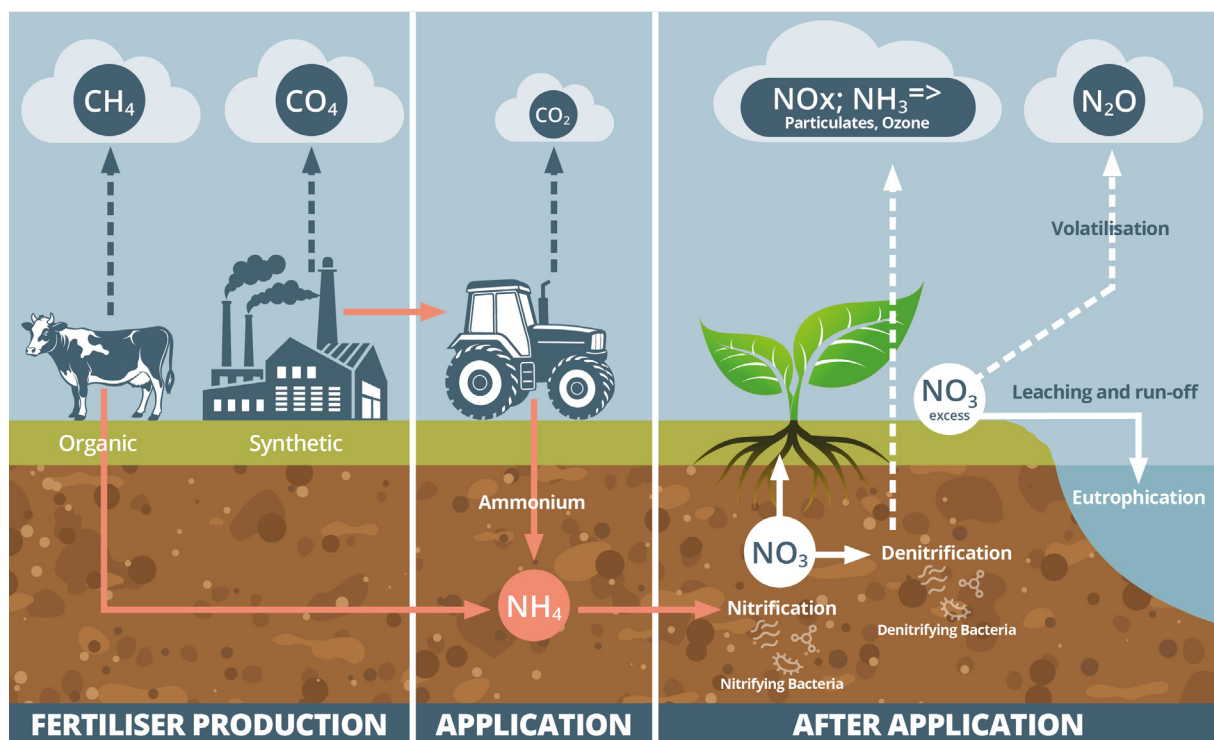


Figure 2: GHG emissions and pollution risks resulting from fertiliser production and use. Source: Planet Tracker.

Planet Tracker's *'Fixing Nitrogen'* report discusses the environmental harms caused by nitrogen fertilisers, the resulting risks to financial institutions, and potential solutions that governments, companies, and financial institutions can invest in to reduce synthetic fertiliser use while continuing to feed a growing population.

^b An excess of nutrients in the water leads to the growth of algae ('algal bloom') and other microorganisms that use up the available oxygen killing the fish and degrading the water course.

Company universe

The survey universe consisted of 45 companies, with 16 companies from the upstream and midstream segments of the food system value chain, and 13 companies from the downstream segment.

When comparing different food system segments the results have been adjusted to equalise the weights of each segment between upstream (x15/16), midstream (x15/16), and downstream (x15/13).

Geographic distribution (headquarters)

The survey universe was deliberately structured to allow for a wide geographic spread.

As Figure 3 shows, US-headquartered companies still dominated the list, accounting for 22% (10 companies). Companies headquartered in the UK, Brazil and China accounted for a further 27% (4 companies from each country). In total there were 19 countries represented.

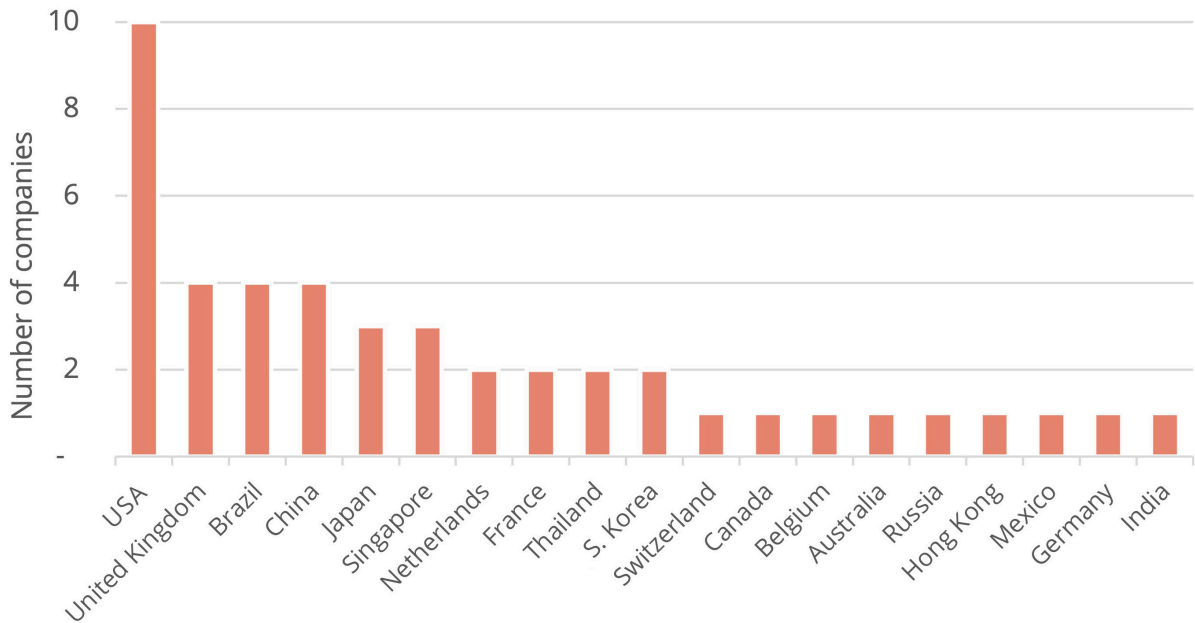


Figure 3: Survey universe - distribution of company HQs. Source: Planet Tracker.

Distribution based on revenues

In spite of our efforts to structure the list to avoid it being dominated by US-headquartered companies, the sheer size in revenue terms of the US companies that were selected means that they account for nearly half of the survey universe revenues, with no other country representing more than 7%.

Companies – results overview

We assessed companies as ‘indicating risk awareness’ if they published one or more disclosures showing some awareness of the risks relating to synthetic fertilisers during the six year period covered by the survey.^c

14 companies (32%^d) failed to acknowledge any fertiliser-related risks at any point in the six years covered by our analysis.

31 companies (68%) indicated some risk awareness suggesting that the broad issues relating to synthetic fertiliser production and use are understood by a majority of food system companies.

Given their proximity to the issue, one might expect more upstream companies to indicate awareness than companies further downstream. However, this was not the case:

69% of upstream companies published at least one report over the six year period surveyed containing a disclosure indicating awareness of the risks.

81% of midstream companies published at least one disclosure in six years indicating awareness of the risks.

54% of downstream companies published at least one disclosure in six years indicating awareness of the risks.

There is a clear size-bias – the companies disclosing tend to be larger (average revenues: USD 69 billion) than the companies that are failing to disclose (average revenues: USD 39 billion), and this difference applies across the value chain segments, with the exception of upstream companies where companies failing to disclose are marginally larger in terms of their revenues – see Figure 4.

c Arguably, this is a very low threshold that any of the companies in our survey should have been able to beat if fertiliser risk was something they wished to discuss with stakeholders at any point during that period. Using one mention over the six years as a basic measure of risk awareness has the benefit of simplicity but means that it would be unwise to view the results of our survey as showing strong evidence that food system companies are providing sufficient information to their stakeholders regarding this particular environmental issue.

d After scaling to equalize the number of companies in each of the three value chain segments.

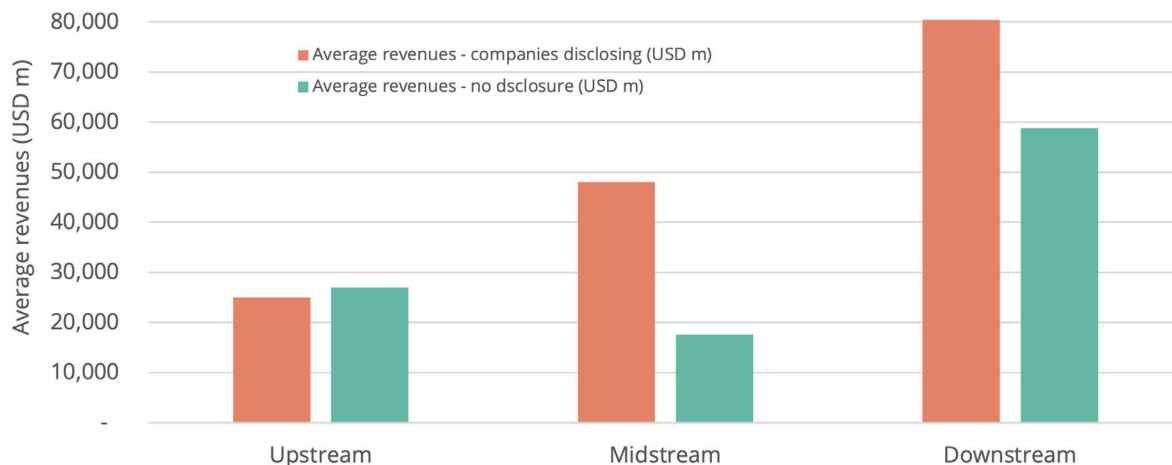


Figure 4: Average revenues (USD m) for companies disclosing fertiliser risks vs companies not disclosing. NB Walmart has been excluded from the Downstream companies disclosing to avoid distorting the average and provide a clearer comparison. Source: Planet Tracker analysis.

In total 5,165 documents were analysed, covering a six-year period (2018-2023) containing a total of 2,350 text extracts. Following the application of the NLP Model and then a second stage, intensive manual review of the text extracts, 242 relevant, unique, text extracts were identified from 134 separate reports across 31 companies (see [Appendix 7](#) for a detailed discussion of the survey methodology) – an average of 1.8 text extracts per report and 7.8 text extracts per company (among those disclosing) – see Table 1.

Table 1: Summary of reports and disclosures by value chain segment. Source: Planet Tracker.

Value chain segment	Proportion of universe disclosing risks	Average text extracts per report	Average text extracts per company
Upstream	23%	1.63	9.45
Midstream	27%	1.58	8.00
Downstream	18%	1.49	4.86
All companies	68%	1.81	7.81

Initial conclusions – risk awareness

Publishing at least one fertiliser risk disclosure over a six-year period is a soft target and one that 32% of our sample failed to meet. In the context of the quantities of fertiliser being used and the serious environmental harms that are resulting, this is disappointing.

However, 68% succeeded in passing the simple disclosure test demonstrating that a wide variety of companies do have some awareness of the risks and suggesting that greater disclosure (and more importantly, mitigating actions) are clearly possible.

When assessed based on publishing at least one relevant disclosure indicating awareness of the risks relating to synthetic fertilisers, more midstream companies demonstrate some awareness of the risks than is the case with upstream companies or downstream companies.

A similar pattern is detected when companies are looked at vs their value chain peers based on the number of reports containing relevant disclosures.

However, when judged based on the number of distinct disclosures by companies across all the reports published a different pattern emerges. Slightly fewer upstream companies are including the risks in their reports than midstream companies but those that do report, provide more information, as indicated by the number of relevant disclosures per company - as shown in Table 1 on page 11.

In overall terms, more midstream companies are demonstrating awareness of the risks relating to fertiliser production and use than upstream companies, but the upstream companies that are aware are providing more information than their midstream peers.

Time series – publication of reports

There is some evidence that the number of companies publishing reports including relevant risk disclosures is increasing, however the series is volatile.

Downstream companies appear to be demonstrating a lower recognition of the risks than in 2018; and the increasing trend of recognising risks is most evident among midstream companies – see Figure 5 and Table 2.

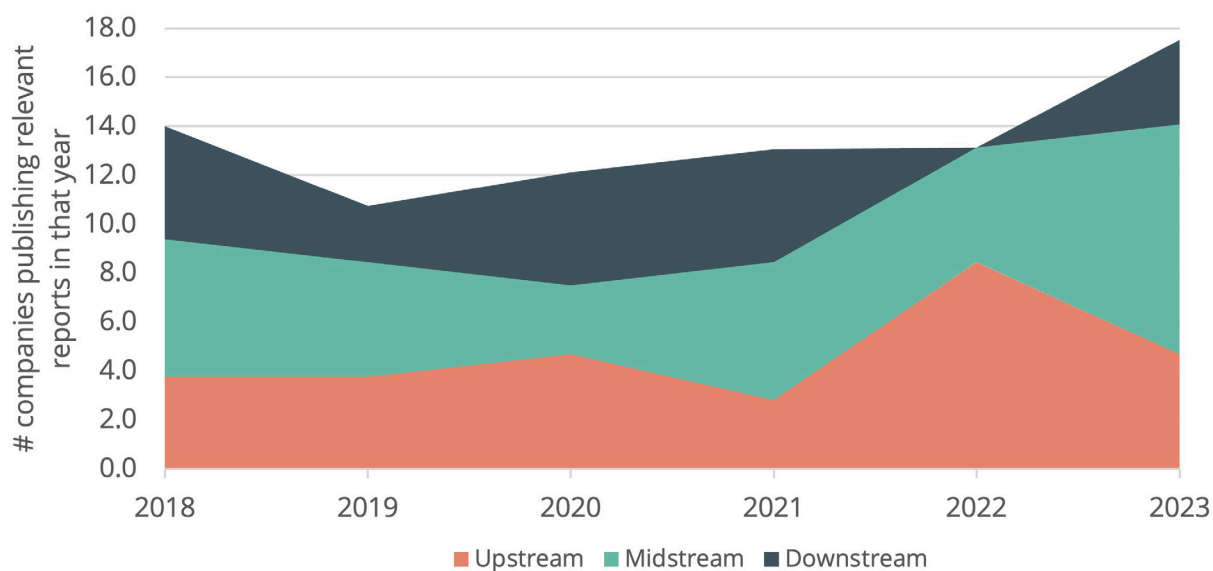


Figure 5: Number of companies publishing relevant disclosures in the past six years. Source: Planet Tracker.

Table 2: Number of companies publishing relevant disclosures from 2018 to 2023. Source: Planet Tracker.

Value chain segment	2018	2019	2020	2021	2022	2023
Upstream	4	4	5	3	8	5
Midstream	6	5	3	6	5	10
Downstream	4	2	4	4	0	3
Total companies reporting	14	11	12	13	13	18

Although the trend of the number of companies reporting is volatile, there is clear evidence that the level of information being provided is increasing – see Figure 6.

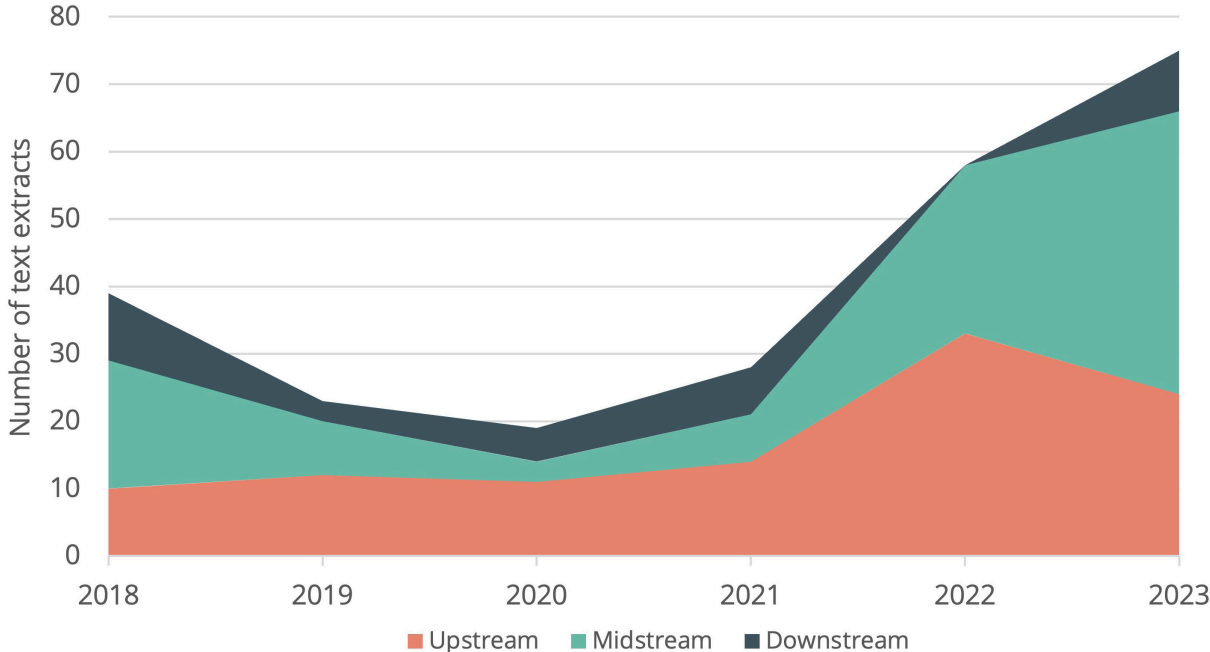


Figure 6: Total number of relevant text extracts (disclosures) published per year. Source: Planet Tracker.

Not only has the absolute number of disclosures^e increased from 2018 - 2023 but the total level of disclosures per company has increased in every year since 2020, suggesting that the companies that are publishing information regarding fertiliser risks are providing more information as time goes on – see Figure 7.

^e In this section 'disclosure' is used to refer to 'text extracts' which totalled 242 over the six-year period.

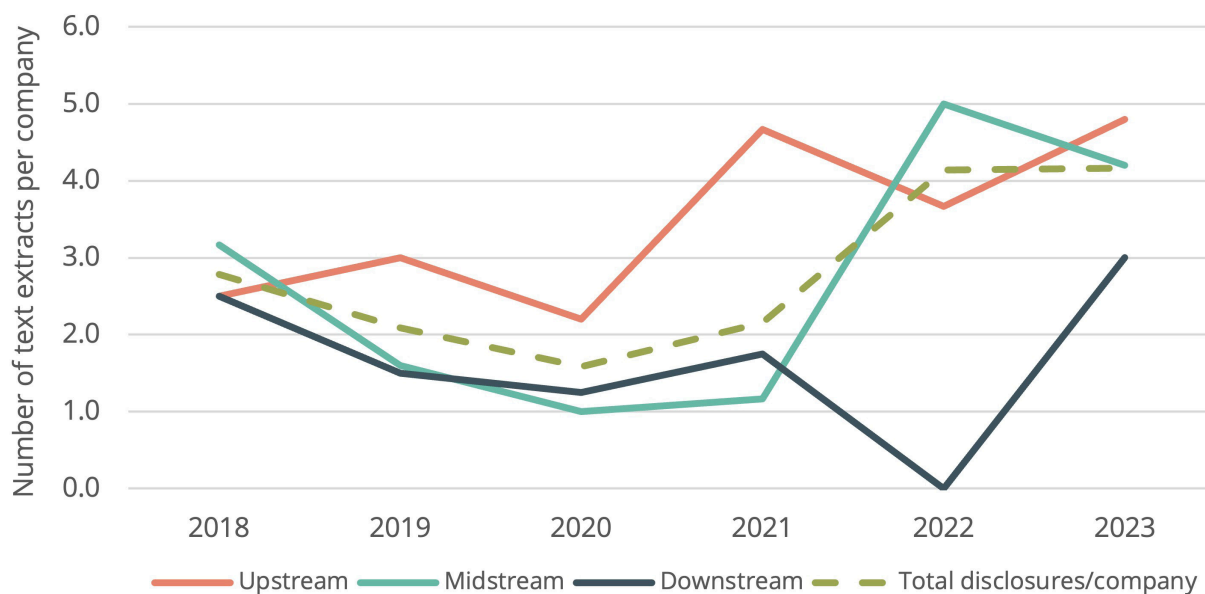


Figure 7: Disclosures per company from 2018 to 2023. Source: Planet Tracker.

The compound annual growth in disclosures per company from 2018 to 2023 has increased 7% overall.

However, in spite of the positive overall trend it is important to note that very few companies have consistently published relevant risk disclosures across the six years surveyed (2018-2023).

Only two companies (**Golden Agri-Resources** and **Wilmar International**, both upstream) have consistently published relevant risk disclosures across all six years.

Anheuser-Busch Inbev (midstream) has published across five years starting in 2019, with a significant increase in the number of disclosures in 2023.

Although the other 28 companies that have published relevant risk disclosures in one or more of the time periods surveyed have often matched the trend to publish more information in recent periods, their publication patterns have been inconsistent – see Table 3.

Table 3: Companies publishing relevant disclosures analysed by year. Source: Planet Tracker.

Rank	Company Name (ticker)	Value chain position	2018	2019	2020	2021	2022	2023	Total relevant reporting periods
1	Golden Agri-Resources Ltd (GGR)	upstream	Y	Y	Y	Y	Y	Y	6
1	Wilmar International Ltd (WIL)	upstream	Y	Y	Y	Y	Y	Y	6
3	Anheuser-Busch Inbev SA (ABI)	midstream		Y	Y	Y	Y	Y	5
4	General Mills Inc (GIS)	midstream	Y	Y		Y		Y	4
4	Mondelez International Inc (MDLZ)	midstream	Y	Y			Y	Y	4
4	Nestle SA (NESN)	midstream	Y	Y			Y	Y	4
4	Tesco PLC (TSCO)	downstream	Y		Y	Y		Y	4
4	Tyson Foods Inc (TSN)	upstream	Y	Y			Y	Y	4
9	Archer-Daniels-Midland Co (ADM)	midstream			Y	Y		Y	3
9	Carrefour SA (CA)	downstream	Y			Y		Y	3
9	Danone SA (BN)	midstream	Y			Y		Y	3
9	Koninklijke Ahold Delhaize NV (AD)	downstream			Y	Y		Y	3
9	Walmart Inc (WMT)	downstream	Y	Y	Y				3
9	WH Group Ltd (288)	upstream		Y	Y	Y			3
15	Asahi Group Holdings Ltd (2502)	midstream	Y					Y	2
15	BRF SA (BRFS3)	upstream					Y	Y	2
15	Charoen Pokphand Foods PCL (CPF)	upstream			Y		Y		2
15	Coca-Cola Co (KO)	midstream		Y			Y		2
15	Diageo PLC (DGE)	midstream				Y		Y	2
15	Heineken NV (HEIA)	midstream			Y			Y	2
15	J Sainsbury PLC (SBRY)	downstream		Y		Y			2
15	Olam Group Ltd (OLAM)	upstream					Y	Y	2
15	PepsiCo Inc (PEP)	midstream	Y				Y		2
15	Suedzucker AG (SZU)	upstream			Y		Y		2
25	Adani Wilmar Ltd (ADANI)	upstream					Y		1
25	CJ Corp (001040)	midstream						Y	1
25	CP All PCL (CPALL)	downstream			Y				1
25	Grupo Bimbo SAB de CV (BIMBOA)	midstream				Y			1
25	Kroger Co (KR)	downstream	Y						1
25	Muyuan Foods Co Ltd (002714)	upstream					Y		1
25	Pilgrims Pride Corp (PPC)	upstream	Y						1

The level of detail in company disclosures has not been consistent in many cases.

PepsiCo (midstream) and **Walmart** (downstream) are two examples of companies that published an above average number of disclosures in 2018 (12 and 7 respectively) but only published disclosures in 2 and 3 of the relevant periods respectively with no relevant disclosures in 2023.

Olam Group (upstream) is at the other extreme, with no relevant disclosures in early years (2018-2021), but 19 in 2022 and 18 in 2023.

14 companies out of the 45 surveyed (32%) did not publish reports with relevant disclosures in any of the years considered – the highest proportion of companies not disclosing risks was among the downstream segment.

- Upstream – proportion of upstream companies not discussing risks: 31%
- Midstream – proportion of midstream companies not discussing risks: 19%
- Downstream – proportion of downstream companies not discussing risks: 46%

Figure 8 summarises the results of this analysis.

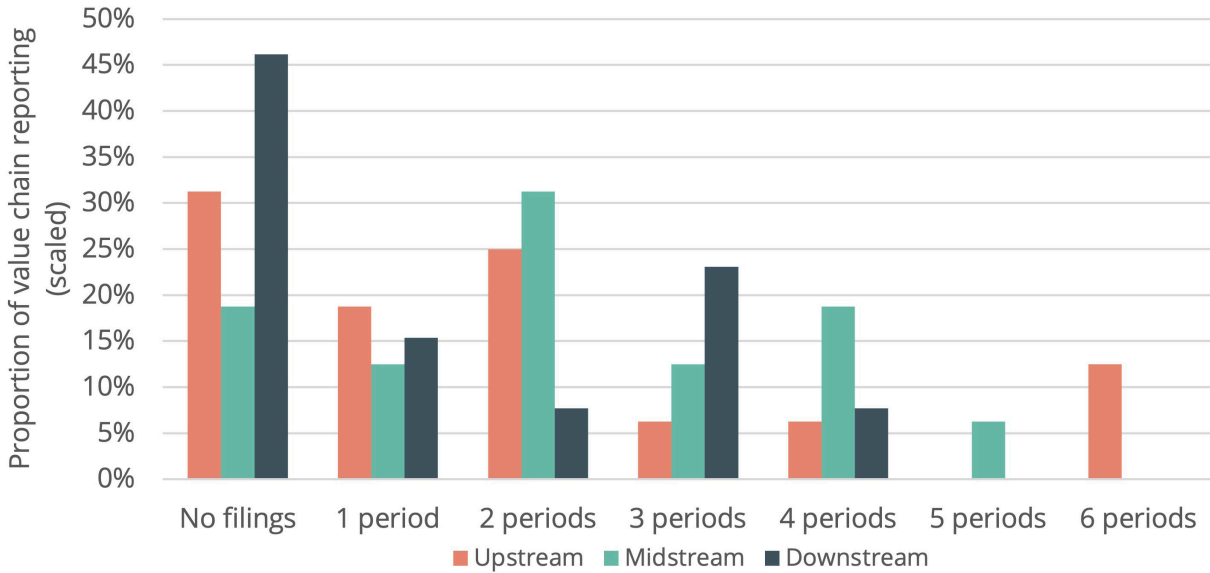


Figure 8: Proportion of value chain segment reporting risks analysed by number of reporting periods covered. Source: Planet Tracker.

Table 13 in *Appendix 9* summarises the number of relevant disclosures published by companies over the six years surveyed and lists the 14 companies that did not publish anything.

Detailed analysis of the disclosures

In addition to simply assessing if a particular company was discussing fertiliser-related risks in its filings and/or discussions with investors and shareholders, we also assessed the nature of the risks being discussed and the themes covered by the disclosures.

A single disclosure could be categorised as discussing more than one risk category and also more than one theme.

Analysis of risk disclosures – five categories

Disclosures were evaluated as falling into one or more of five risk-related categories:

- Recognising business risks relating to **fertiliser-related input costs** rising in the future due to environmental issues.
- Recognising business risks arising from **environmental harms** relating to fertiliser production and/or use.
- Recognising environmental risks relating to **fertiliser production and/or use** (impacting other stakeholders rather than directly impacting the business).
- Providing evidence that the **business was assessing environmental risks** relating to fertiliser production and/or use.
- Providing evidence of **actions being taken to mitigate potential harms** relating to fertiliser production and/or use.

Disclosures were also assessed to identify the key theme(s) being discussed in the disclosure notes.^f

Table 4 lists the themes and underlying topics, ranked in order of the number of companies discussing a particular theme in their disclosures (most common theme first).

^f Initially, disclosures were tagged as discussing one or more of 14 'topics' relating to synthetic fertiliser. Once this tagging was complete these topics were grouped into 'themes' to facilitate comparative analysis of our universe and to provide further clarity regarding the extent to which particular issues are being discussed by different value chain segments.

Table 4: Topics and themes identified from analysis of the food company disclosures. Source: Planet Tracker.

Overall rank of theme across all companies	Theme	Topic
1	Reduce pollution	Minimise pollution risk Reduced chemical fertiliser use
2	Supplier engagement	Supplier engagement
3	GHG emissions	GHG emissions from fertiliser Reduced nitrogen emissions
4	Improve agriculture	Optimise fertiliser use Organic fertiliser (by-product) Organic fertiliser (purchased) Regenerative agriculture
5	Environmental efficiency	Waste management Water management
6	Costs	Increased fertiliser costs
7	ESG topic (investors)	Fertiliser = ESG topic
7	Social action	Social action

As before, a single disclosure could cover more than one theme. Refer to Appendix 1-6 for detailed descriptions of the issues discussed under each of the topics.

Combining the eight themes with the five risk categories

Table 5 shows the overlap between the eight themes and the five risk categories based on the number of disclosures.

Table 5: Proportion of a particular theme discussed in the context of one of the five risk categories (rows may not sum to 100% due to rounding). Source: Planet Tracker.

Themes	Business risks (costs)	Business risks (environmental harms)	External environmental risks	Assessing environmental risks	Mitigating environmental risks
Reduce pollution	6%	8%	41%	11%	33%
Improve agriculture	7%	10%	37%	11%	36%
GHG emissions	7%	7%	42%	18%	25%
Supplier engagement	7%	8%	37%	13%	35%
Environmental efficiency	6%	9%	39%	9%	36%
Costs	50%	10%	20%	10%	10%
ESG topic (investors)	0%	67%	33%	0%	0%
Social action	0%	0%	100%	0%	0%

Analysis of risk disclosures

When analysing the disclosures with respect to risk categories, 'awareness of risks' across the three value chain segments was assessed based on both the number of companies publishing disclosures as well as the number of items being disclosed.

BREADTH: When assessing risk awareness based on the number of companies publishing we refer to 'breadth of awareness'.

DEPTH: When assessing risk awareness based on the number of disclosures (overall and per company) we refer to 'depth of knowledge'.

In general, the midstream segment of the food system demonstrates the greatest breadth of fertiliser risk awareness and the upstream segment demonstrates the greatest depth of fertiliser risk awareness.

Breadth of awareness

Midstream companies have published more reports covering these risks than upstream or downstream companies and thus this segment is demonstrating a greater breadth of risk awareness.

This is true across all the 'Risk Recognition and/or Action' categories – see Table 6.

Table 6: Distribution of disclosures covering a specific risk category by value chain segments (assessed by number of companies reporting). Source: Planet Tracker.

Value chain segment	Recognition			Action	
	Recognising business risks (from input cost rises)	Recognising business risks (from environmental harm)	Recognising environmental risks	Assessing environmental risks	Mitigating environmental actions specified
Upstream	39%	22%	29%	22%	33%
Midstream	53%	50%	42%	57%	40%
Downstream	8%	27%	28%	21%	27%
	100%	100%	100%	100%	100%

Somewhat surprisingly, fewer upstream companies have published disclosures indicating awareness of the business risks arising from environmental harms than either midstream or downstream companies.

Downstream companies lag behind their upstream and midstream peers across all the 'Risk Recognition and/or Action' categories suggesting a lower level of risk awareness across this section of the value chain – see Figure 9.

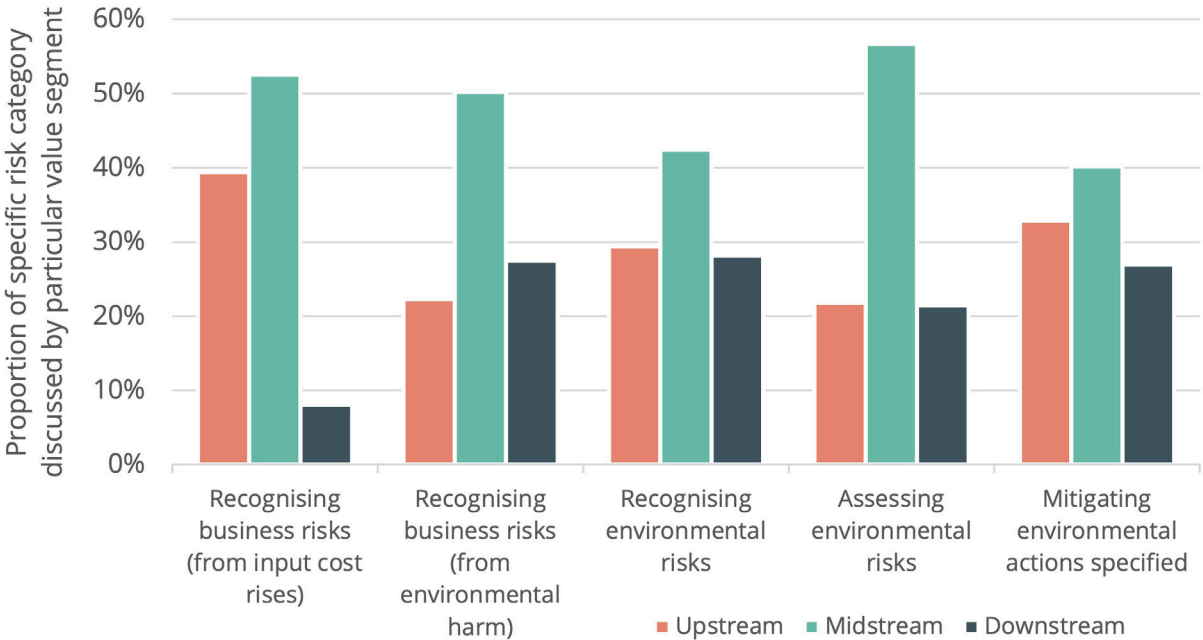


Figure 9: Proportion of specific risk category discussed by particular value segment (assessed by number of companies reporting). Source: Planet Tracker.

Depth of knowledge

Planet Tracker also analysed the number of disclosures per company as a proxy for depth of knowledge (based on the assumption that companies with a deeper understanding of the risks will provide more disclosures than their peers).

The upstream companies that have published reports with one or more relevant disclosures have provided more information (based on the average number of disclosures per company) than their peers in midstream and downstream segments.

This is true across all the 'Risk Recognition and/or Action' categories.

Downstream companies lag behind their food system peers significantly with respect to all 'Risk Recognition and/or Action' categories except 'Recognising business risks (from rising input costs)', suggesting a lack of awareness regarding the environmental footprint that their demands on their suppliers are imposing on the planet – see Table 7.

Table 7: Disclosures of risks per company - comparison of value chain segments. Source: Planet Tracker.

Value chain segment	Recognising business risks (from input cost rises)	Recognising business risks (from environmental harm)	Recognising environmental risks	Assessing environmental risks	Mitigating environmental actions specified
Upstream	3.2	4.5	10.2	5.2	7.0
Midstream	2.3	2.3	7.8	3.4	6.9
Downstream	2.0	1.0	4.9	2.3	3.5
Average disclosures per company (all)	2.6	2.5	7.7	3.5	6.0

On average, the greatest number of disclosures per company relates to 'Recognising environmental risks'.

The second most common risk disclosure per company relates to specifying the mitigating actions being taken to alleviate environmental risks and the third relates to assessing the environmental risks.

35% of the 'Risk Recognition and/or Action' disclosures relate to 'Recognising environmental risks' when assessed on a per company basis, across all companies.

By contrast, recognising business risks relating to rising input costs or environmental harms falls far behind at only 12% and 11% respectively across all companies.

Only 7% of the disclosures per downstream company relate to business risks arising from environmental harms highlighting significantly less depth of knowledge in that area – see Figure 10.

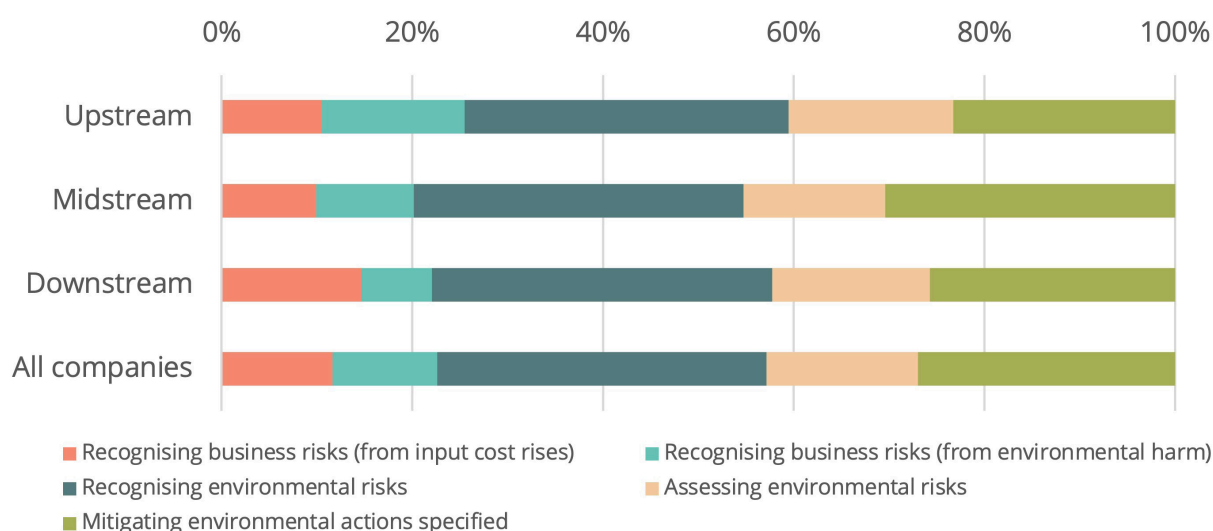


Figure 10: Distribution of risk category disclosures by value chain segment. Source: Planet Tracker.

Analysis of disclosures by themes

Refer to Table 4 on page 19 for a list of the eight themes and the underlying topics.

When topics are grouped by theme the dominance of midstream companies in terms of the number of companies covering a particular theme in their disclosures is clear – see Figure 11.

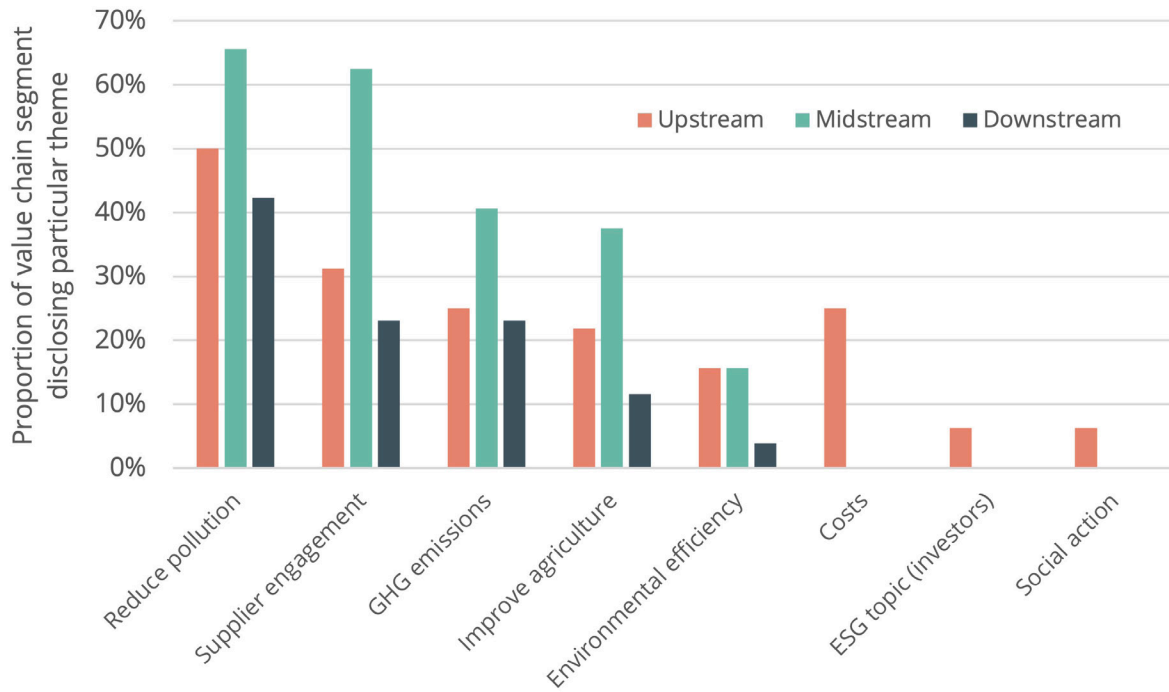


Figure 11: Proportion of value chain segment discussing a particular theme in disclosures. Source: Planet Tracker.

Each theme is covered by a higher proportion of midstream companies than upstream or downstream except for Costs, ESG topic, and Social action. These three themes were only covered by upstream companies, and in the case of the latter two themes only by very few.

However, it is notable that when the number of disclosures per company is taken into account, it is clear that when upstream companies cover a particular theme they publish more disclosures discussing that theme – see Table 8.

Table 8: Disclosures per company discussing particular themes (heatmap highlights value chain segment ranking). Source: Planet Tracker.

Distribution of disclosures per company	Upstream	Midstream	Downstream	Overall
Reduce pollution	11.8	9.9	4.8	9.0
Improve agriculture	6.7	8.0	6.7	8.3
GHG emissions	9.6	4.7	4.6	6.0
Supplier engagement	5.4	4.5	7.0	5.2
Environmental efficiency	2.5	2.5	1.0	2.7
ESG topic (investors)	2.0	0.0	0.0	2.0
Costs	1.5	0.0	0.0	1.5
Social action	1.0	0.0	0.0	1.0

In other words, the upstream companies that do publish disclosures are covering the issues in more depth than their midstream and downstream food system peers, with a couple of exceptions – see Figure 12.

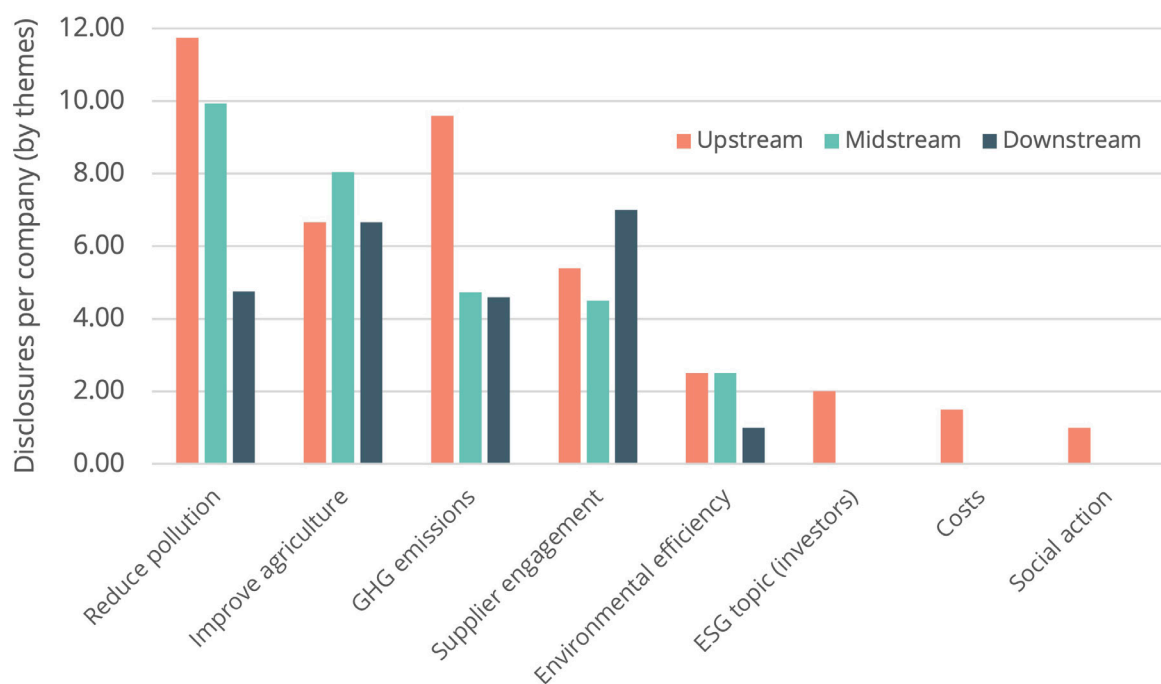


Figure 12: Disclosures per company (by theme). Source: Planet Tracker.

We discuss the results of analysing the published disclosures by theme in more detail in the appendices, however, the key findings are summarised on next page.

Analysis by themes – key findings

The four themes that were discussed most frequently are summarised below. More details regarding our analysis of each of the themes are provided in the appendices.

Reducing pollution

This is the most popular theme across all three value chain segments. Downstream companies focus more on ‘minimising pollution risk’ rather than discussing ‘reduced chemical fertiliser use’, potentially indicating a general concern about reputational risks from pollution incidents as opposed to a specific focus on ways to mitigate this risk (midstream companies show the opposite tendency).

Unsurprisingly, this theme is discussed by upstream companies more frequently (and in more depth) than their downstream peers.

It is noteworthy how infrequently ‘Reducing pollution’ is linked to business risks, suggesting that (in general) food companies do not regard pollution from fertilisers as an issue that is likely to harm their profitability.

Supplier engagement

This is the only theme where downstream companies have published more disclosures per company than their upstream or midstream peers. This may reflect the fact that these companies need to engage with midstream and upstream supply chain companies to assess and manage fertiliser risk.

Midstream companies mention this theme more frequently than their upstream or downstream peers. The fact that upstream companies do not often mention engaging with their suppliers in the context of tackling fertiliser risks may be because they don’t refer to smaller farmers that they outsource some of their production to as ‘suppliers’ but refer to them by alternative terms such as ‘partners’ (in which case our survey methodology would have missed this disclosure). Upstream companies may also regard the problem as more within their direct control rather than something they need to engage with their suppliers about. Our analysis of their disclosures did not provide a conclusive answer to this question.

GHG emissions

Only 30% of companies discussed fertiliser-related GHG emissions, which is disappointing given the significant fertiliser-related GHG footprint. Unsurprisingly, upstream companies show a greater tendency to refer specifically to nitrogen fertiliser as a primary source of GHG emissions and discuss the topic in more depth than their peers, whereas the discussion among midstream and downstream companies is more general.

When this theme is assessed against the five risk categories it is notable that only 20% of disclosures discussing environmental risks also cover the theme of GHG emissions implying that many companies are still failing to link climate and nature.

Improve agriculture

Midstream companies published more disclosures on this theme than their upstream or downstream peers, and showed a greater depth of knowledge (indicated by more disclosures per company).

However, more detailed analysis reveals that 49% of the disclosures covering this theme discussed 'optimising fertiliser use' which is rather weak language to use in a situation where the most obvious action to mitigate fertiliser-related harms is to reduce the use of synthetic fertiliser. In contrast, reducing chemical fertiliser use was usually discussed in the context of reducing pollution, suggesting that food system companies may be failing to factor in an additional benefit from the adopting more sustainable food production methods (or at least are not highlighting this benefit to their stakeholders).

Regenerative agriculture is frequently referenced by food system companies but our analysis shows this is not the case when considering fertiliser-related risks and mitigating actions. Only 12% of the 'Improving agriculture' disclosures discussed regenerative agriculture, raising the concern that companies are failing to link a key driver of food system harms with one of the main mitigating actions.

However, given that upstream companies did not mention regenerative agriculture in this context at all, but did discuss organic fertiliser, it is also possible that they are avoiding using a cover-all term like regenerative agriculture in favour of more precise terminology to better describe the mitigating actions they are taking.



Conclusions

The fact that 32% of our sample failed to publish at least one fertiliser risk disclosure over a six-year period is disappointing given the quantities of fertiliser being used and the serious environmental harms it is causing.

However, 68% succeeded in passing this simple test, demonstrates that a wide variety of food system companies do have some awareness of the risks. This suggests that greater disclosure is possible which is key to developing meaningful action to tackle fertiliser risks.

Midstream (food manufacturing) companies are leading when it comes to disclosures. Given their size, resources, and influence on the wider food system this is encouraging. However, the fact that a number of upstream (food production) companies are lagging behind their midstream peers when it comes to disclosing the risks they are directly exposed to is something we believe financial institutions should be questioning.

Similarly, downstream companies (food retailers) can claim to be far removed from the risks associated with fertilisers but they have a key role to play in encouraging the transformation of the food system away from an extractive model based on a high level of expensive inputs and a high level of resulting pollution towards one that is less dependent on synthetic fertilisers.

The fact that the companies that have failed to disclose any fertiliser risks over the six-year period are smaller on average in revenue terms than those companies that have disclosed may not be a surprise. However, it should be remembered that they are among the largest food system companies globally with average revenues of USD 38 billion, implying that they have the resources to provide better information to their stakeholders.

The analysis of disclosures over time gives some grounds for optimism, suggesting that more companies are discussing fertiliser risks than was the case in the past, demonstrating that those companies that are currently failing to do so should be able to catch up.

More research needs to be undertaken to understand the quality of food system companies' fertiliser risk disclosure, and to assess firms' mitigation strategies.

Fertiliser risks are only one factor in a range of risks that food system companies should be disclosing and mitigating. However, claims by companies that they are focusing on 'regenerative' or 'sustainable' food production directly or in their supply chains will be significantly more credible when backed by details on key topics such as fertilisers.

Overall, the findings of this report demonstrate that there is still significant work needed to improve disclosure and action on fertiliser risks across food system companies.

Appendix 1: Analysis of disclosures – Reducing pollution

Breadth of knowledge (analysis based on number of companies disclosing)

'Reducing pollution' is the most common theme across all three value chain segments, commented on by

- 50% of upstream companies
- 66% of midstream companies, and
- 42% of downstream companies

Within this theme, more downstream companies mention the topic of 'Minimising pollution risk' (54%) than discuss 'Reduced chemical fertiliser use' (31%). This might suggest that downstream companies are keen to avoid the reputational risks of being associated with pollution but less focused on how such a risk might be mitigated (including by changing agricultural methods to avoid using chemical fertiliser).

In contrast, slightly more midstream companies mention 'Reduced chemical fertiliser use' (69%) than mention 'Minimising pollution risk' (63%). In the case of upstream companies there is no difference (both topics are mentioned by 50% of upstream companies).

Depth of knowledge (analysis based on number of disclosures)

When the total number of disclosures that include 'Minimising pollution risk' or 'Reduced chemical fertiliser use' is considered (as a proxy for the depth of knowledge demonstrated by the value chain segment), the downstream segment has far fewer mentions.

- 'Minimising pollution risk' - upstream companies published 43% of the disclosures that discussed this topic as did their midstream peers, whereas downstream companies only accounted for 14% of the occurrences.
- 'Reduced chemical fertiliser use' – midstream companies accounted for the largest proportion of disclosures covering this topic (48% of disclosures). Upstream companies published 39% of the disclosures and downstream only published 13%.

When examining the number of disclosures per company (as another proxy for depth of knowledge on a particular theme), 'Reducing pollution' ranks as the theme with the highest number of disclosures per company, demonstrating that across the value chain segments this is the theme that companies discuss most often (when they publish relevant disclosures) - see Table 8 on page 24.

This view of the data also demonstrates the extent to which the upstream companies that discuss the theme devote significant attention to it relative to their peers in the other value chain segments:

- 11.8 for upstream companies,
- 10.0 for midstream, and
- 4.8 for downstream

This potentially implies that upstream companies have more detailed knowledge and experience on the topic of fertiliser pollution than their midstream or downstream peers.

Combining 'Reducing pollution' with the five Risk Categories

When the 'Reducing pollution' theme is examined in the context of the five Risk Categories it is clear that most often the context for discussions of this theme is disclosures discussing environmental risks (41% of total mentions) and then in connection with actions being taken to mitigate environmental risks (33%) – see Table 5 on page 19.

This pattern is broadly consistent across value chain segments. It is noteworthy how infrequently 'Reducing pollution' is linked to 'Business risks' (particularly among downstream companies where no disclosures covering this theme were linked to 'Business risks (costs)', suggesting that (in general) food companies do not regard pollution from fertiliser as an issue that is likely to harm their profitability – see Figure 13

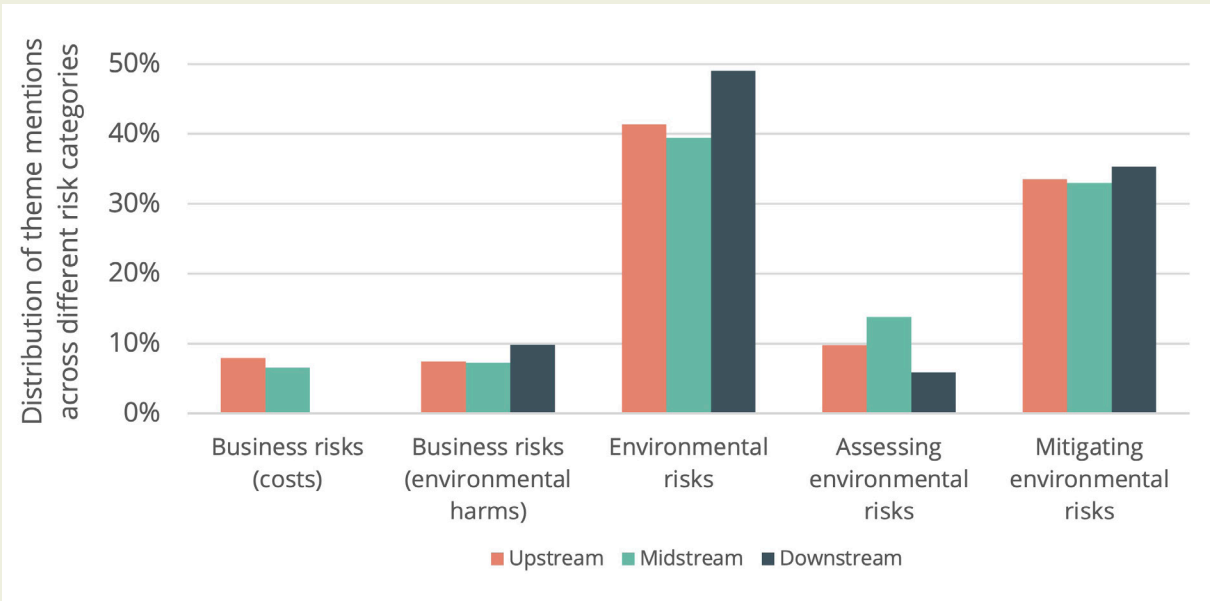


Figure 13: Proportion of disclosures discussing 'Reducing pollution' in the context of one of the five risk categories. Source: Planet Tracker.

Appendix 2: Analysis of disclosures – Supplier engagement

Breadth of knowledge (analysis based on number of companies disclosing)

'Supplier engagement' is the second most common theme across all three value chain segments, after reducing pollution, commented on by

- 31% of upstream companies
- 63% of midstream companies, and
- 23% of downstream companies

Depth of knowledge (analysis based on number of disclosures)

When the total number of disclosures is considered (as a proxy for the depth of knowledge demonstrated by the value chain segment), the midstream segment has the most mentions with 46% of the total. In contrast, upstream companies only published 28% of the disclosures mentioning 'Supplier engagement', and downstream companies accounted for a similar proportion (26% of the total mentions).

This would seem to suggest that midstream companies are more concerned about engaging with their suppliers to address the risks relating to fertilisers than their upstream or downstream food system peers.

It is somewhat surprising that more upstream companies don't mention engaging with their suppliers in the context of tackling fertiliser risks but this may be because they don't refer to smaller farmers that they outsource some of their production to as 'suppliers' but refer to them by alternative terms such as 'partners' (in which case our survey methodology would have missed this disclosure), or that they regard the problem as more within their direct control rather than something they need to engage with their suppliers about. Our analysis of their disclosures did not provide a conclusive answer to this question.

Combining 'Supplier engagement' with the five Risk Categories

When the 'Supplier engagement' theme is examined in the context of the five Risk Categories it is clear that most often the context is disclosures discussing environmental risks (37% of total mentions) but that mentions in connection with actions being taken to mitigate environmental risks come a close second (35%) – see Table 5 on page 19.

When the results across the different value chain segments are compared it can be seen that upstream and midstream companies are marginally more likely to associate 'Supplier engagement' with business risks than their downstream peers, and tend to mention this theme in the context of mitigating actions more often than downstream companies do (although again, the differences are marginal) – see Figure 14.

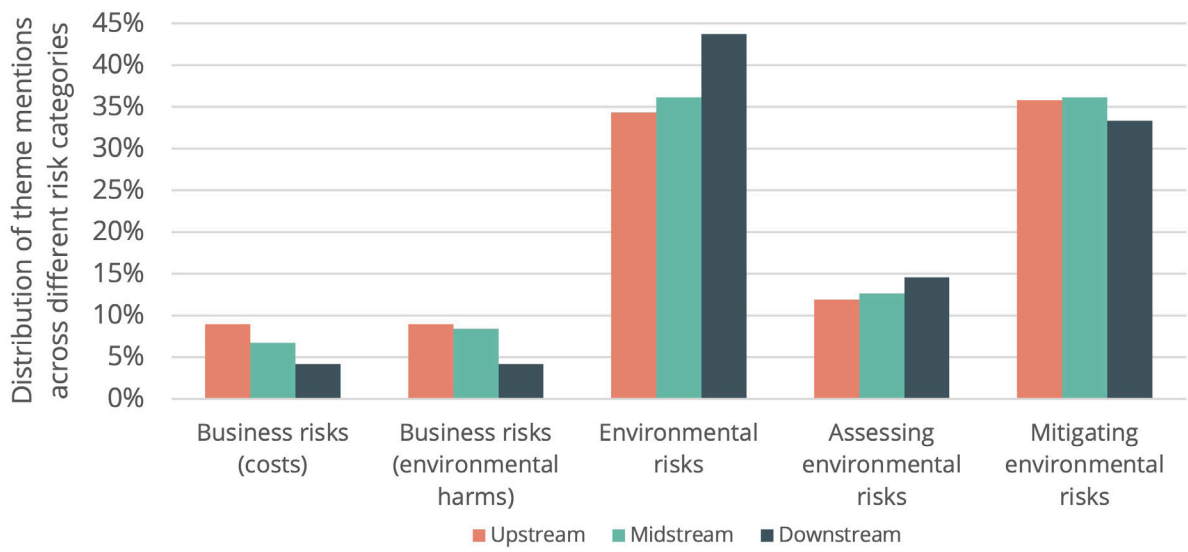


Figure 14: Proportion of disclosures discussing 'Supplier engagement' in the context of one of the five risk categories. Source: Planet Tracker.

Appendix 3: Analysis of disclosures – GHG emissions

Breadth of knowledge (analysis based on number of companies disclosing)

Somewhat surprisingly, 'GHG emissions' is only the third most common fertiliser-related theme across all three value chain segments, after reducing pollution and supplier engagement, commented on by only 30% of the 45 companies surveyed:

- 25% of upstream companies
- 41% of midstream companies, and
- 23% of downstream companies

Two topics are covered by this theme, 'GHG emissions from fertiliser' and 'Reduced nitrogen emissions'. The latter topic label refers to disclosures where nitrogen emissions were specifically mentioned (as opposed to more general terms such as 'greenhouse gases' or 'CO₂ equivalent emissions').

19% of upstream companies referred specifically to nitrogen in their disclosures over the period surveyed, whereas only 13% of midstream and 8% of downstream companies did so, illustrating the more technical detail being provided by upstream companies.

In contrast, 69% of midstream companies published disclosures referring to more general 'GHG-related' emissions, compared to only 31% of upstream companies and even fewer downstream companies (23%).

Depth of knowledge (analysis based on number of disclosures)

When the total number of disclosures is considered (as a proxy for the depth of knowledge demonstrated by the value chain segment), the focus of upstream companies on nitrogen emissions (as opposed to more general terms) becomes even clearer:

- Upstream companies published 65% of the disclosures mentioning nitrogen emissions.
- In contrast, midstream companies accounted for only 22% of the mentions, and
- Downstream companies only accounted for 13% of the mentions.

The distribution of more general discussions of GHG emissions is slightly weighted towards midstream companies:

- Upstream companies published 38% of the disclosures mentioning GHG emissions.
- Midstream companies accounted for 41% of the mentions, and
- Downstream companies accounted for 22% of the mentions.

Calculating the number of times the theme of GHG emissions is mentioned by companies within a particular value chain segment reveals the extent to which the issue is a concern to upstream companies:

- Upstream companies published 9.6 disclosures per company discussing the theme of GHG emissions.
- Midstream companies only published 4.7 disclosures per company and downstream companies were similarly muted, publishing 4.6 disclosures per company - see Table 8 on page 24.

Combining 'GHG emissions' with the five Risk Categories

When the 'GHG emissions' theme is examined in the context of the five Risk Categories it is perhaps unsurprising to find that it is most commonly associated with disclosures discussing environmental risks (42% of total mentions of GHG emissions).

It can also be seen that upstream and midstream companies are marginally more likely to associate GHG emissions with business risks than their downstream peers – see Figure 15.

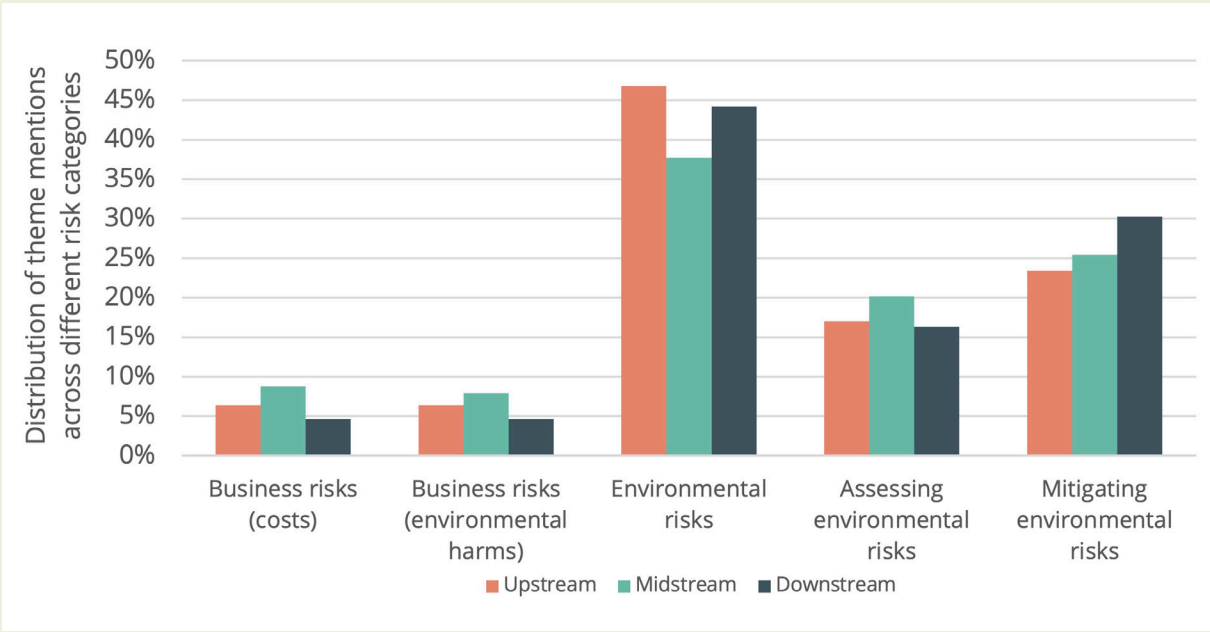
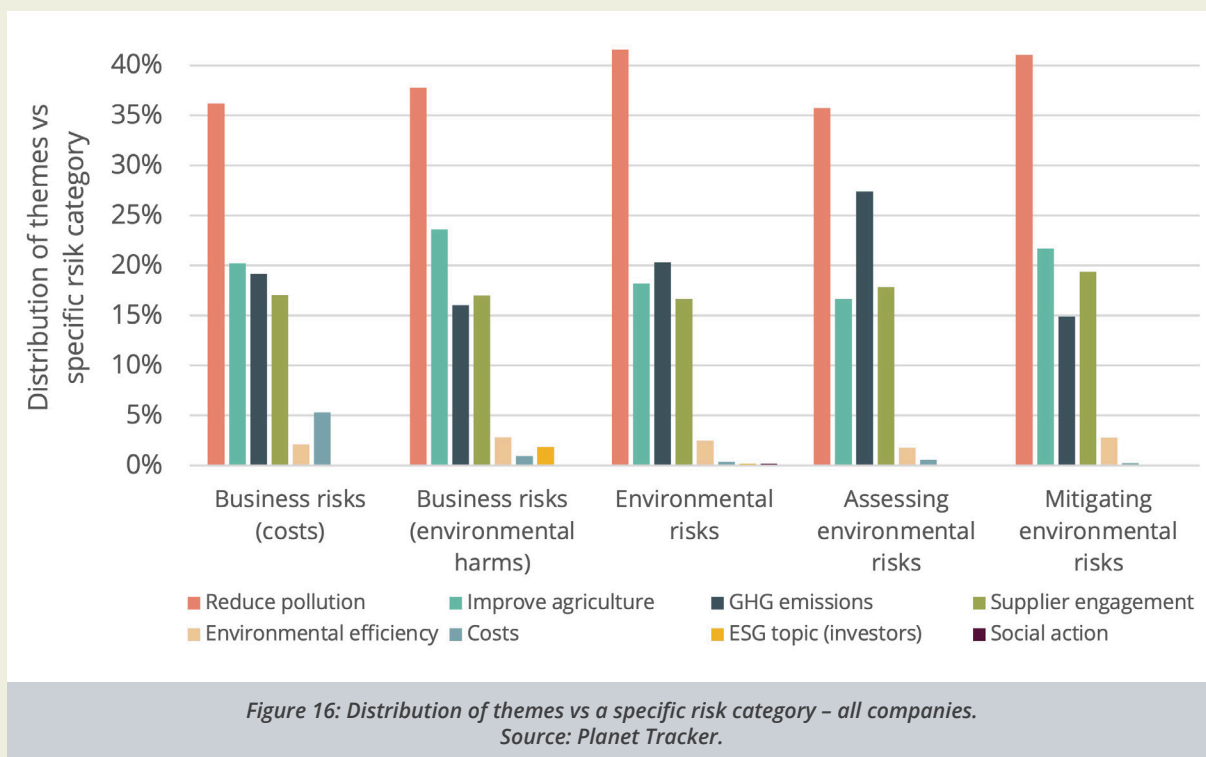


Figure 15: Proportion of disclosures discussing 'GHG emissions' in the context of one of the five risk categories. Source: Planet Tracker.

However, when assessed against the other themes in the context of environmental risks, disclosures discussing GHG emissions come a distant second behind 'Reducing pollution' (only 20% of disclosures relating to environmental risks discuss GHG emissions, whereas 42% discuss reducing pollution) suggesting that companies do not regard GHG emissions as pollution as such, failing to link climate and nature – see Figure 16.



This view is supported by the fact that, when examined in the context of disclosures discussing assessing environmental risks, the GHG emissions theme is more common. 27% of disclosures discussing ‘Assessment’ include references to GHG emissions (although this is still less common than the theme of ‘reducing pollution’ which accounts for 36% of the related disclosures).

This pattern is largely replicated when individual value chain segments are considered, with the exception of the downstream segment.

Among downstream companies, ‘Reducing pollution’ only constitutes 13% of the theme mentions in the context of ‘Assessing environmental risks’ whereas the theme of GHG emissions accounts for 29% of the disclosures in that context. One potential explanation for this bias towards assessing GHG emissions as opposed to assessing reducing pollution is that the protocol for measuring scope 3 GHG emissions is well established (and investors expect companies to discuss this issue) whereas the methodology for assessing pollution further up the supply chain is not so clearly defined and so downstream companies are focusing on the easier-to-assess risks relating to fertiliser rather than discussing the assessment of pollution impacts and/or steps to reduce this.

However, when discussing GHG emissions, downstream companies focus more of their attention on discussing mitigating environmental risks than they do on discussing assessing them. 30% of the disclosures published by downstream companies on this theme link to mitigating environmental risks compared to only 16% linked to assessing environmental risks.

Their mid and upstream peers tend to have more of a balance between assessing and mitigating when it comes to discussing the GHG emissions theme:

- Upstream companies – 17% of disclosures concerning the GHG emissions theme link to assessing environmental risks, whereas 23% link to mitigating environmental risks.
- Midstream companies – 20% link to assessing and 25% link to mitigating.

Appendix 4: Analysis of disclosures – Improve agriculture

Breadth of knowledge (analysis based on number of companies disclosing)

Comments by companies regarding their investment and/or support for regenerative agriculture are becoming increasingly common. However, in the context of discussions regarding fertiliser, our survey found that the theme of 'Improve agriculture' (including the topic of 'Regenerative agriculture') only ranked fourth when counting the number of companies that featured this theme in their disclosures (24% of our universe).

As with the other themes discussed previously, more midstream companies have publishing disclosures covering this theme than is the case with their upstream or downstream peers:

- 22% of upstream companies published disclosures discussing the 'Improve agriculture' theme, compared to
- 38% of midstream companies, and only
- 12% of downstream companies.

Depth of knowledge (analysis based on number of disclosures)

When the number of disclosures is examined as a proportion of the total disclosures within that segment of the value chain (as opposed to counting the number of companies publishing a relevant disclosure), a different pattern emerges - disclosures from downstream companies make up a higher proportion within that segment and a lower proportion within the upstream segment:

- Only 16% of disclosures by upstream companies covered the 'Improve agriculture' theme, compared to
- 20% of disclosures by midstream companies, and
- 20% of disclosures by downstream companies.

Combining the number of companies with the number of disclosures to calculate the number of times the 'Improve agriculture' theme is mentioned by companies within a particular value chain segment reveals the surprising result that among the companies discussing this theme, the disclosures per company figure is the same for upstream and downstream companies, whereas the midstream companies that discuss the issue do so to a greater extent:

- Upstream and downstream companies published 6.7 disclosures per company discussing the 'Improve agriculture' theme, whereas
- Midstream companies published 8.1 disclosures per company (see Table 8 on page 24).

Analysing the topics within the 'Improve agriculture' theme

Four topics identified in our survey have been grouped under the theme of 'Improve agriculture' (refer to the Appendix for more details of what is discussed in relation to each topic):

- Optimise fertiliser use - 49% of the topic mentions included within the theme of 'Improve agriculture'.
- Organic fertiliser (by-product) - 31% of the topic mentions.
- Organic fertiliser(purchased) - 9% of the topic mentions.
- Regenerative agriculture - 12% of the topic mentions.

When individual topics are analysed, it is noteworthy that upstream companies do not mention 'regenerative agriculture' at all in connection with fertiliser(our survey did not look for instances where it was discussed outside the context of discussions of fertiliser.

Midstream companies are responsible for 90% of the mentions of 'Regenerative agriculture' with downstream companies publishing the remaining 10%.

Given the obvious link between reducing the use of synthetic fertilisers, increasing the use of biological substitutes, and adopting regenerative agricultural practices, the fact that upstream companies (who would be putting these measures into practice on the ground) do not mention this topic at all is surprising.

One potential explanation for this surprising result is that upstream companies tend to use more precise terms for the fertiliser-related actions they are taking. When the 'Optimise fertiliser use' topic is examined we found that 41% of the mentions were by upstream companies, 33% by midstream and 26% by downstream companies, a result that would seem to support this theory.

However, discussions regarding purchasing organic fertiliser were strongly biased towards midstream companies (responsible for 60% of the mentions), whereas upstream companies were only responsible for 25% of the mentions. A possible explanation for this difference is that more upstream companies have direct access to organic by-products (and so do not need to purchase them) and our analysis provided some support for this theory.

56% of the mentions of organic fertiliser produced as a by-product of a production process were published by the upstream companies responsible for the activity with the other 44% of mentions published by midstream companies. This was not a topic that downstream companies referred to at all – see Table 9.

Table 9: Distribution of 'Improve agriculture' topic disclosures across the value chain. Source: Planet Tracker.

Distribution of disclosures across value chain	Upstream	Midstream	Downstream	Total
Optimise fertiliser use	41%	33%	26%	100%
Organic fertiliser (by-product)	56%	44%	0%	100%
Organic fertiliser (purchased)	25%	60%	15%	100%
Regenerative agriculture	0%	90%	10%	100%

Combining 'Improve agriculture' with the five Risk Categories

When the 'Improve agriculture' theme is examined in the context of the five Risk Categories it is interesting to note that (similar to the 'Supplier engagement' theme) it is most commonly linked to disclosures discussing environmental risks (37% of total mentions of this theme) but that mentions in the context of mitigating actions are almost as frequent (36% of the total) illustrating the extent to which companies are recognising actions taken to improve agricultural practices as important in the context of mitigating the negative effects of synthetic fertiliser use – see Table 5 on page 19.

In the context of environmental risks, disclosures discussing the 'Improve agriculture' theme rank third when assessed against the other themes making up a similar proportion of mentions in this context (18%) compared to GHG emissions (20%) and supplier engagement (17%) – see Table 10.

Table 10: Analysis of themes discussed in the context of specific risks. Source: Planet Tracker.

Themes	Business risks (costs)	Business risks (environmental harms)	Environmental risks	Assessing environmental risks	Mitigating environmental risks
Reduce pollution	36%	38%	42%	36%	41%
Improve agriculture	20%	24%	18%	17%	22%
GHG emissions	19%	16%	20%	27%	15%
Supplier engagement	17%	17%	17%	18%	19%
Environmental efficiency	2%	3%	2%	2%	3%
Costs	5%	1%	0%	1%	0%
ESG topic (investors)	0%	2%	0%	0%	0%
Social action	0%	0%	0%	0%	0%
	100%	100%	100%	100%	100%

When the mitigating environmental risks category is considered, our survey results provide some support for the view that companies see the need to link negative impacts with the positive actions required to avoid them. In this context, the 'Improve agriculture' theme accounts for 22% of the disclosures linked to this risk category, a long way behind the 'Reduce pollution' theme (41%) but still in second place just ahead of supplier engagement (19%).

This pattern is largely replicated when individual value chain segments are considered

When the 'Improve agriculture' theme is examined across the different value chain segments in the context of the five risk categories upstream and midstream companies are marginally more likely to associate this theme with business risks than their downstream peers.

However, downstream companies focus more of their attention on assessing environmental risks when discussing the 'Improve agriculture' theme than their mid and upstream peers, although for all of the companies that published relevant disclosures the 'Improve agriculture' theme is mainly linked to environmental risks and mitigating actions as noted earlier – see Figure 17.

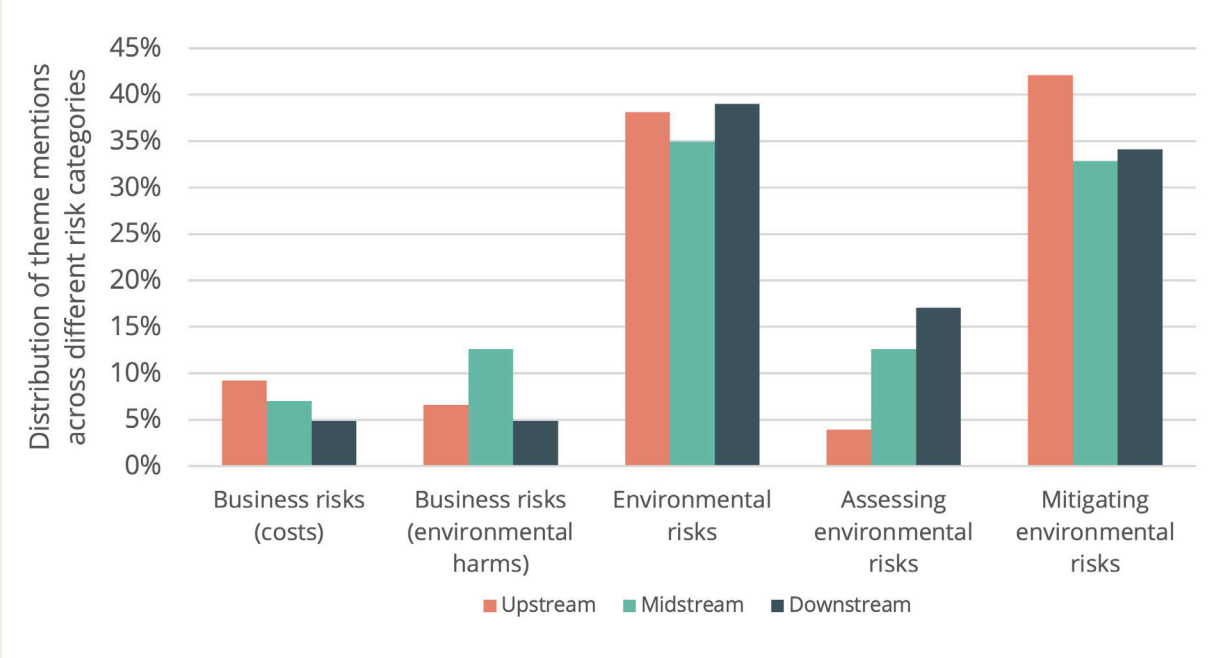


Figure 17: Proportion of disclosures discussing 'Improve agriculture' in the context of one of the five risk categories. Source: Planet Tracker.

Appendix 5: Analysis of disclosures – ‘Environmental efficiency’

The ‘Environmental efficiency’ theme covers two topics:

- Water management – disclosures discussing improvements to the use of water (direct operations and/or suppliers), and
- Waste management – disclosures discussing improvements to the management of organic waste (direct operations and/or suppliers).

Most of the disclosures discussing this theme that were captured in our initial data sweep were rejected as not relating to fertiliser use^g. The remaining mentions of these two topics that did link to discussions regarding fertiliser risks only amounted to 3% of the 547 total thematic disclosures counted.

In overall terms, this theme was mentioned by 11 of the companies across our universe but none of them devoted much time to it as highlighted by the number of topic mentions per company:

- 2.5 per upstream and midstream company, and only
- 1.0 per downstream company.

Within this theme, upstream companies focused on waste management (4 companies published disclosures including this topic) usually in the context of converting organic waste into fertiliser, whereas the midstream companies mainly focused on water management (4 companies), frequently in conjunction with a discussion of pollution risks and/or controls, or measures to reduce water use connected with better fertiliser use. One downstream company covered this theme (discussing water management).

^g For example, several food retailers referred to recycling food waste to be used (among other things) for fertiliser. This was picked up by our initial NLP search but then rejected as not discussing the risks relating to fertiliser use. In contrast, some upstream companies referred to repurposing organic waste to use as fertiliser as a means to reduce chemical fertiliser use. These disclosures were included as relevant.

Appendix 6: Analysis of disclosures – 'upstream-only topics'

Three topics/themes are only discussed by upstream companies:

- Costs - only discussed by four upstream companies.
- ESG topic (investors) – only discussed by one upstream company.
- Social action – only discussed by one upstream company.

Given the impact of increased fertiliser costs over recent years, it might seem surprising that the topic was not discussed more frequently. However, our survey methodology was looking for situations in which rising costs were being discussed as a future risk to the business linking to the underlying cost drivers of using synthetic fertiliser (as opposed to statements regarding the impact of price rises in the recent past), and such discussions were rare.

The majority of cost-related discussions focused on describing events in the reporting period in question or prior periods and so were excluded from our analysis.

Appendix 7: Survey methodology

Summary

In total 5,165 documents were analysed, containing a total of 2,350 text extracts. Following the application of the NLP Model and then a second stage, intensive manual review of the text extracts, 242 text extracts were identified. These text extracts were categorised according to risk (recognition or mitigation) and theme to produce a final dataset of 547 individual 'disclosures' – see Figure 18.

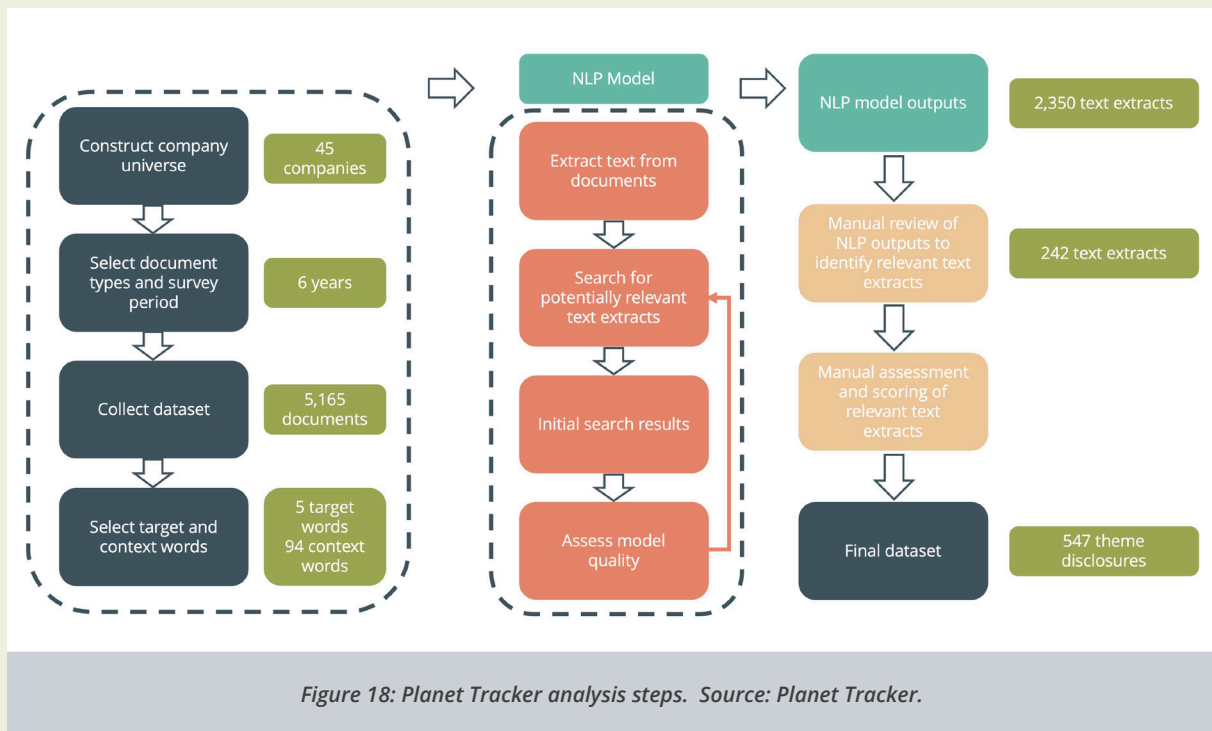


Figure 18: Planet Tracker analysis steps. Source: Planet Tracker.

Company universe selection

The universe of companies covered by our analysis was selected from among the largest publicly listed food system companies ranked by revenues.

The smallest company had revenues of USD 7 billion (Adani Wilmar) and the largest (Walmart) had revenues of USD 648 billion. The aggregate total revenue figure for the 45 companies was USD 2.6 trillion.

Our survey excluded companies actually manufacturing and supplying fertiliser ('Input providers') since the objective was to analyse the extent to which the food system companies directly or indirectly benefitting from fertiliser use are recognising the risks associated with its production and use.

The selection of the short list to be used in our survey was based on several criteria

- Maximum universe = 45 food system companies covering upstream (food production companies), midstream (food manufacturing companies), and downstream (food retail companies), with a slight bias towards upstream and midstream companies to increase the chance of finding relevant disclosures.
- Aim for a universe of 45 with a broader country mix by restricting the number of US-headquartered companies (and any other countries as necessary for balance).
- Identifying companies that are more likely to be exposed to fertiliser This meant excluding bottling companies, holding (non-trading) companies, and wholesalers.
- Identifying companies that are more likely to discuss the issue. To avoid too many 'nil' results we performed an initial search using the DSCO function on Bloomberg looking for key words in company filings ("fertilizer", "nitrogen", "NPK", "phosphorus"). Companies where the BBG DSCO function did not identify any key words were eliminated.
- Companies identified as not filing any documents in English were eliminated by the initial search.

Stage one – Natural Language Processing

Scope

Planet Tracker searched for text excerpts from company reports and transcripts of company meetings/conference calls to assess their disclosures on fertiliser-related risk.

5,165 documents published by the 45 companies in our survey universe were analysed, spanning six years from January 1st 2018 to December 31st 2023. The types of documents included in the analysis are:

- 1 Reports (8-K, 10-K, 10-Q, 20-F, Annual reports, Corporate Governance reports, Corporate Responsibility reports, and ESG/Sustainability Reports).
- 2 Transcripts (Company Presentations, Earnings Calls, and Shareholder Meetings).

NLP Model

Planet Tracker's Natural Language Processing (NLP) model searched for target words that are found in close proximity to 'context words' chosen by Planet Tracker to characterise various aspects of the risks associated with fertiliser production and use.

Context words are designed to enhance the search process i.e. reduce the likelihood of erroneous results ('false positives'). The NLP algorithm searches for the target words when they feature alongside context words, increasing the chance that the text extract is discussing fertiliser risks (and not, for example, just discussing fertiliser margins).

Target words: Fertiliser, Fertilizer, Nitrogen, NPK, and Phosphorus.

Context words – a total of 94 context words were identified covering seven categories: Environmental General Risks, Environmental Land/Soil Risks, Environmental Water Risks, Environmental Climate Risks, Policy Regulatory Risks, Fertiliser/Fertilizer Types, and Fertiliser/Fertilizer Other.

The model's algorithm then identifies text extracts that span up to 100 words around the target word. Various versions of the model were run to find the optimal size of the text extract. It was found that extracts larger than 100, tended to dilute its meaning, and shorter extracts tended to lack detail on the risk being disclosed.

Stage two - further analysis

The initial NLP search resulted in 2,350 text extracts. These were manually reviewed to identify extracts that were not relevant (i.e. the NLP search process had resulted in a false positive) and where the extract duplicated another extract (to ensure the final analysis focused on unique company disclosures).

Duplicate text extracts were eliminated where they occurred in the same reporting period, including if the repetition was in a different report (e.g. Annual Report and Sustainability Report) to ensure a clearer picture of the extent to which companies are discussing the issues. This narrowed the number of text extracts to be analysed to 242.

Finally, the text extracts^h were assigned to one or more of five risk categories:

- Recognising business risks relating to rising (fertiliser-related) **input costs**
- Recognising business risks arising from **environmental harms** relating to fertiliser production and/or use
- Recognising environmental risks relating to **fertiliser production and/or use** (impacting others rather than directly impacting the business)
- Providing evidence that the business was **assessing environmental risks** relating to fertiliser production and/or use, and/or
- Providing **evidence of actions** being taken to mitigate potential harms relating to fertiliser production and/or use.

The text extracts were also analysed to identify the themes being discussed (for example 'Reducing pollution' or 'Supplier engagement'). The first step in this process was to compile a list of topics that were discussed in multiple text extracts. This resulted in a list of 14 topics (see Appendix). These topics were grouped into eight themes to facilitate analysis.

A single text extract could contain information covering a number of risk categories (e.g. demonstrating awareness of environmental risks as well as setting out mitigating actions), and could also cover a number of themes (e.g. reducing pollution as well as discussing improving agriculture).

Extracting the themes from the 242 text extracts resulted in a set of 547 separate disclosures.

^h We refer to 'text extracts' in the context of the NLP Model and the subsequent manual review. Once the text extracts that were judged to contain relevant information relating to fertiliser risks had been tagged to identify which risk categories and themes they covered and incorporated into the final database they are referred to as 'disclosures'

Appendix 8: Topic descriptions

The 14 topics listed below were identified by analysing the disclosures published by the companies in our survey. A disclosure could obviously cover more than one topic but the survey methodology was structured to limit the number of topics assigned to a disclosure to a maximum of five to ensure that only the key topics discussed in a particular disclosure were included in the analysis. These topics were subsequently grouped into eight themes to aid analysis.

Table 11: Explanation of the issues discussed in relation to a particular topic.

Disclosure topic	Explanation
Minimise pollution risk	Discussion of risks relating to pollution arising from fertiliser use
Reduced chemical fertiliser use	Ambition or targets designed to reduce the quantities of synthetic fertiliser used by the company and/or its suppliers
GHG emissions from fertiliser	Acknowledgement that fertilisers are a significant source of GHG emissions
Supplier engagement	Description of steps being taken to engage suppliers in the company's efforts to reduce the harms arising from fertiliser use
Optimise fertiliser use	Discussion of how fertilisers can be optimised (as opposed to a clear ambition to reduce chemical use)
Organic fertiliser (purchased)	Company actions to find alternative sources of fertiliser for itself or to encourage its suppliers to do so
Regenerative agriculture	Fertiliser usage mentioned alongside statements about moving towards regenerative agricultural techniques
Reduced nitrogen emissions	Acknowledgement that fertiliser causes nitrogen emissions and the need to reduce them
Organic fertiliser (by-product)	Company reconfiguring its processes (or those of its suppliers) to generate organic fertiliser as a by-product of a manufacturing process
Water management	Company discusses improvements to the use of water (direct operations and/or suppliers)
Waste management	Company discusses improvements to the management of organic waste (direct operations and/or suppliers)
Increased fertiliser costs	Acknowledges the impact of increased fertiliser costs driven by environmental factors
Fertiliser = ESG topic	Notes that investors and/or other stakeholders are interested in fertiliser from an ESG / sustainability perspective
Social action	Discusses fertiliser in the context of the company's social action programme

Appendix 9: Company disclosures over time

Table 12 summarises the number of relevant disclosures published by companies over the six years surveyed including the 14 companies that did not disclose during this period.

Table 12: Number of relevant text extracts published by companies in each year. Source: Planet Tracker.

Rank	Company Name (ticker)	Value chain position	2018	2019	2020	2021	2022	2023	Total relevant disclosures published
1	Golden Agri-Resources Ltd (GGR)	upstream	4	8	5	4	2	1	24
1	Wilmar International Ltd (WIL)	upstream	4	2	3	8	2	3	22
3	Anheuser-Busch Inbev SA (ABI)	midstream	0	2	1	1	4	13	21
4	General Mills Inc (GIS)	midstream	1	1	0	2	0	2	6
4	Mondelez International Inc (MDLZ)	midstream	1	2	0	0	7	2	12
4	Nestle SA (NESN)	midstream	2	1	0	0	9	5	17
4	Tesco PLC (TSCO)	downstream	1	0	1	3	0	4	9
4	Tyson Foods Inc (TSN)	upstream	1	1	0	0	4	1	7
9	Archer-Daniels-Midland Co (ADM)	midstream	0	0	1	1	0	6	8
9	Carrefour SA (CA)	downstream	1	0	0	2	0	3	6
9	Danone SA (BN)	midstream	2	0	0	1	0	2	5
9	Koninklijke Ahold Delhaize NV (AD)	downstream	0	0	1	1	0	2	4
9	Walmart Inc (WMT)	downstream	7	2	2	0	0	0	11
9	WH Group Ltd (288)	upstream	0	1	1	2	0	0	4
15	Asahi Group Holdings Ltd (2502)	midstream	1	0	0	0	0	8	9
15	BRF SA (BRFS3)	upstream	0	0	0	0	2	1	3
15	Charoen Pokphand Foods PCL (CPF)	upstream	0	0	1	0	1	0	2
15	Coca-Cola Co (KO)	midstream	0	2	0	0	2	0	4
15	Diageo PLC (DGE)	midstream	0	0	0	1	0	2	3
15	Heineken NV (HEIA)	midstream	0	0	1	0	0	1	2
15	J Sainsbury PLC (SBRY)	downstream	0	1	0	1	0	0	2
15	Olam Group Ltd (OLAM)	upstream	0	0	0	0	19	18	37
15	PepsiCo Inc (PEP)	midstream	12	0	0	0	3	0	15
15	Suedzucker AG (SZU)	upstream	0	0	1	0	1	0	2
25	Adani Wilmar Ltd (ADANI)	upstream	0	0	0	0	1	0	1
25	CJ Corp (001040)	midstream	0	0	0	0	0	1	1
25	CP All PCL (CPALL)	downstream	0	0	1	0	0	0	1
25	Grupo Bimbo SAB de CV (BIMBOA)	midstream	0	0	0	1	0	0	1

25	Kroger Co (KR)	downstream	1	0	0	0	0	0	0	1
25	Muyuan Foods Co Ltd (002714)	upstream	0	0	0	0	1	0	0	1
25	Pilgrims Pride Corp (PPC)	upstream	1	0	0	0	0	0	0	1
32	Albertsons Companies Inc (ACI)	downstream	0	0	0	0	0	0	0	0
32	Alimentation Couche-Tard Inc (ATD)	downstream	0	0	0	0	0	0	0	0
32	Ambev SA (ABEV3)	midstream	0	0	0	0	0	0	0	0
32	Compass Group PLC (CPG)	downstream	0	0	0	0	0	0	0	0
32	Harim Holdings Co Ltd (003380)	upstream	0	0	0	0	0	0	0	0
32	Inner Mongolia Yili Co Ltd (600887)	midstream	0	0	0	0	0	0	0	0
32	JBS SA (JBSS3)	upstream	0	0	0	0	0	0	0	0
32	Kweichow Moutai Co Ltd (600519)	midstream	0	0	0	0	0	0	0	0
32	Marfrig Global Foods SA (MRFG3)	upstream	0	0	0	0	0	0	0	0
32	New Hope Liuhe Co Ltd (000876)	upstream	0	0	0	0	0	0	0	0
32	NH Foods Ltd (2282)	upstream	0	0	0	0	0	0	0	0
32	Seven & i Holdings Co Ltd (3382)	downstream	0	0	0	0	0	0	0	0
32	Woolworths Group Ltd (WOW)	downstream	0	0	0	0	0	0	0	0
32	X5 Retail Group NV (566933Z)	downstream	0	0	0	0	0	0	0	0
			39	23	19	28	58	75		242

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ABOUT PLANET TRACKER

Planet Tracker is an award-winning non-profit financial think tank aligning capital markets with planetary boundaries. Created with the vision of a financial system that is fully aligned with a net-zero, resilient, nature positive and just economy well before 2050, Planet Tracker generates break-through analytics that reveal both the role of capital markets in the degradation of our ecosystem and show the opportunities of transitioning to a zero-carbon, nature positive economy

FOOD AND LAND USE PROGRAMME

Programme goal: to align capital markets with a sustainable global food system. Before 2050, Planet Tracker's Food and Land Use Programme will highlight the investment risks and opportunities associated with the just and equitable transformation of the global food system that eliminates negative externalities with respect to climate, nature, and health so that it is fit to feed the world's growing population within planetary boundaries. By highlighting these risks and opportunities, Planet Tracker's Food and Land Use programme will influence financial markets actors to actively support and fund this transformation..

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