Roadmap to Nature Positive

→ *Foundations for the agri-food system*

row crop commodities subsector

World Business Council *for Sustainable Development*

Table *of contents*

01. Nature Action: *a business imperative*

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Nature matters for business

Nature is the backbone of the world economy: all businesses depend on nature. Societies cannot survive, let alone thrive, without the essential functions that the natural world provides: clean air, water, food and a stable earth system to exist within. And yet, humanity is using double the resources that the Earth can regenerate each year.[1]

Nature loss is already impacting business. Industry value chains that are highly and moderately dependent on nature (relying heavily on direct extraction of resources from land, freshwater and ocean realms) generate over half of global GDP; every industry has some degree of direct and indirect dependency on nature.[2]

Furthermore, addressing the climate crisis, restoring nature and protecting biodiversity are mutually supporting goals. Climate change cannot be mitigated without taking action to repair and restore natural systems, returning them to healthy and resilient states.

The solutions needed are not incremental tweaks to current business models: achieving **Vision 2050** and creating a world in which more than 9 billion people can live well, within planetary boundaries[3] requires the transformation of societies and economies.

Nature risks have shifted global policy

Nature has rapidly risen up the agenda, both within the real economy and for the financial services industry and investors. There is no escaping rising nature-related risks – driving policymakers, regulators, investors, businesses, consumers and citizens to collectively call for rapid change.

Governments have sent a particularly strong signal. The 15th **United Nations Biodiversity Conference** (CBD COP15) took place in December 2022 and culminated with the adoption of the **Kunming-Montreal Global Biodiversity Framework** (GBF) – setting a global ambition to halt and reverse biodiversity loss by 2030.

This is a key milestone for nature action, the equivalent of a "Paris Agreement" for nature, raising nature to the same level as climate on the global political agenda. The GBF's 23 targets detail the plan to address nature loss for all actors: governments, businesses and civil society.

A corporate performance and accountability system is also emerging to support and catalyze credible and impactful business action on nature, building on a similar system for climate. Organizations and governments are putting both voluntary and mandatory accountability mechanisms into place.

On the voluntary side, 2023 sees the release of the initial set of science-based targets for freshwater and land (beta) by the **Science Based Targets Network** (SBTN) and the **Taskforce on Nature-related Financial Disclosures** (TNFD) v1.0 recommendations for nature-related financial disclosures. Mandatory requirements are of immediate relevance to companies, such as the European Sustainability Reporting Standards (ESRS) under the **Corporate Sustainability Reporting Directive**[4] (CSRD) that will impact all companies operating in the European Union. Similarly, regulators in a number of jurisdictions have indicated they will adopt the still voluntary standards from the International Sustainability Standards Board (ISSB) and make them mandatory in the near future, including **General Requirements for Disclosure of Sustainability-related Financial Information** (International Financial Reporting Standards (IFRS S-1) and **Climate-related Disclosures** (IFRS S-2).[5]

→ ***See the* Roadmaps to Nature Positive: Foundations for all businesses** to learn more about the emerging voluntary and mandatory accountability mechanisms, and how key stakeholders, including regulators, investors, standard setters, consumers and employees, are all raising their expectations of business.

Nature positive and current business approaches

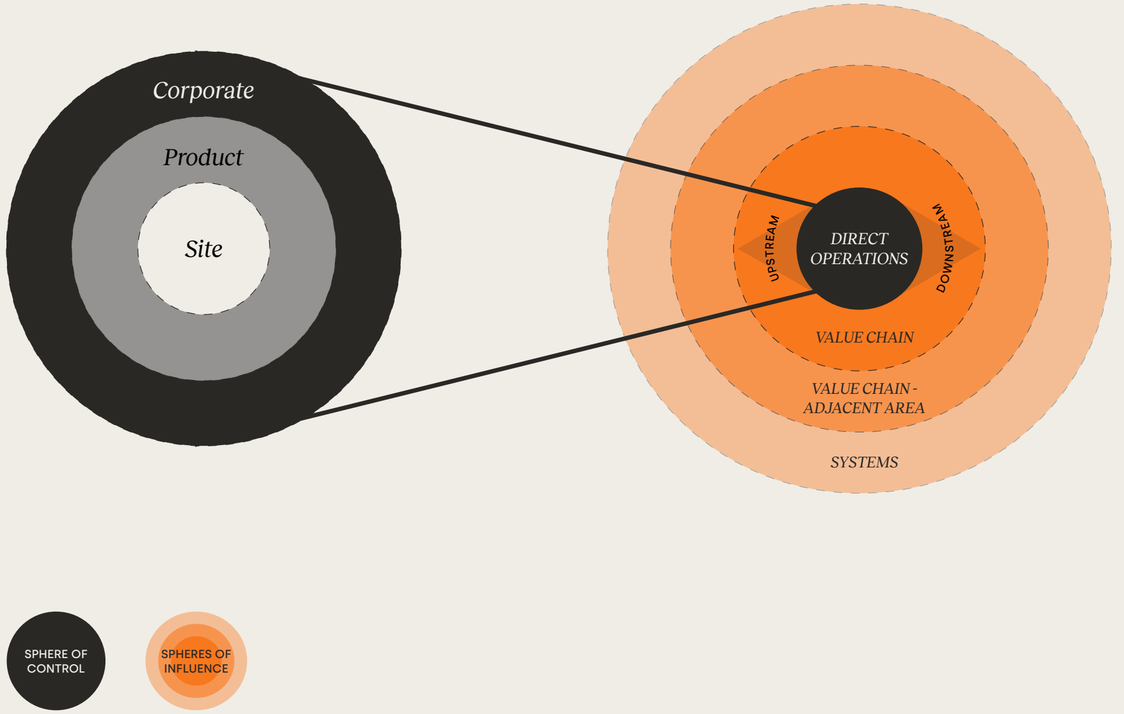
Stakeholders widely acknowledge the term "nature positive" as a global goal to halt and reverse nature loss by 2030 and achieve full recovery by 2050, as captured in the mission statement of the Kunming-Montreal Global Biodiversity Framework.[6]

Individual companies can contribute to this shared goal by adopting an approach to nature positive across their spheres of control and influence, including in their direct operations, across value chains and in priority locations for nature-related value or stress (see Figure 1).

To help guide business action on nature, WBCSD, SBTN, TNFD, the World Economic Forum and Capitals Coalition collaborated to provide business with a consistent approach: the **high-level business actions on nature to Assess, Commit, Transform and Disclose (ACT-D)**.
The key elements of the high-level actions come together as the basis for an ambitious, credible, and strategic approach to contributing to nature positive (see Figure 2).

The ACT-D framework is necessarily ambitious but there is no expectation that companies will implement it in one go. Companies enter nature journeys at different stages of readiness and maturity. To address this, WBCSD has defined maturity levels (starting, developing, advanced and leading), informed by an analysis of public corporate disclosures on nature,[7] helping companies understand where they are on their nature journey and how to advance.

Figure 1: Sphere of control and spheres of influence relevant for corporate target-setting



Source: Adapted from Science Based Targets Network (2020). **Science-Based Targets for Nature Initial Guidance for Business**

→ ***See the*** **Roadmaps to Nature Positive: Foundations for all businesses** to learn more about maturity levels.

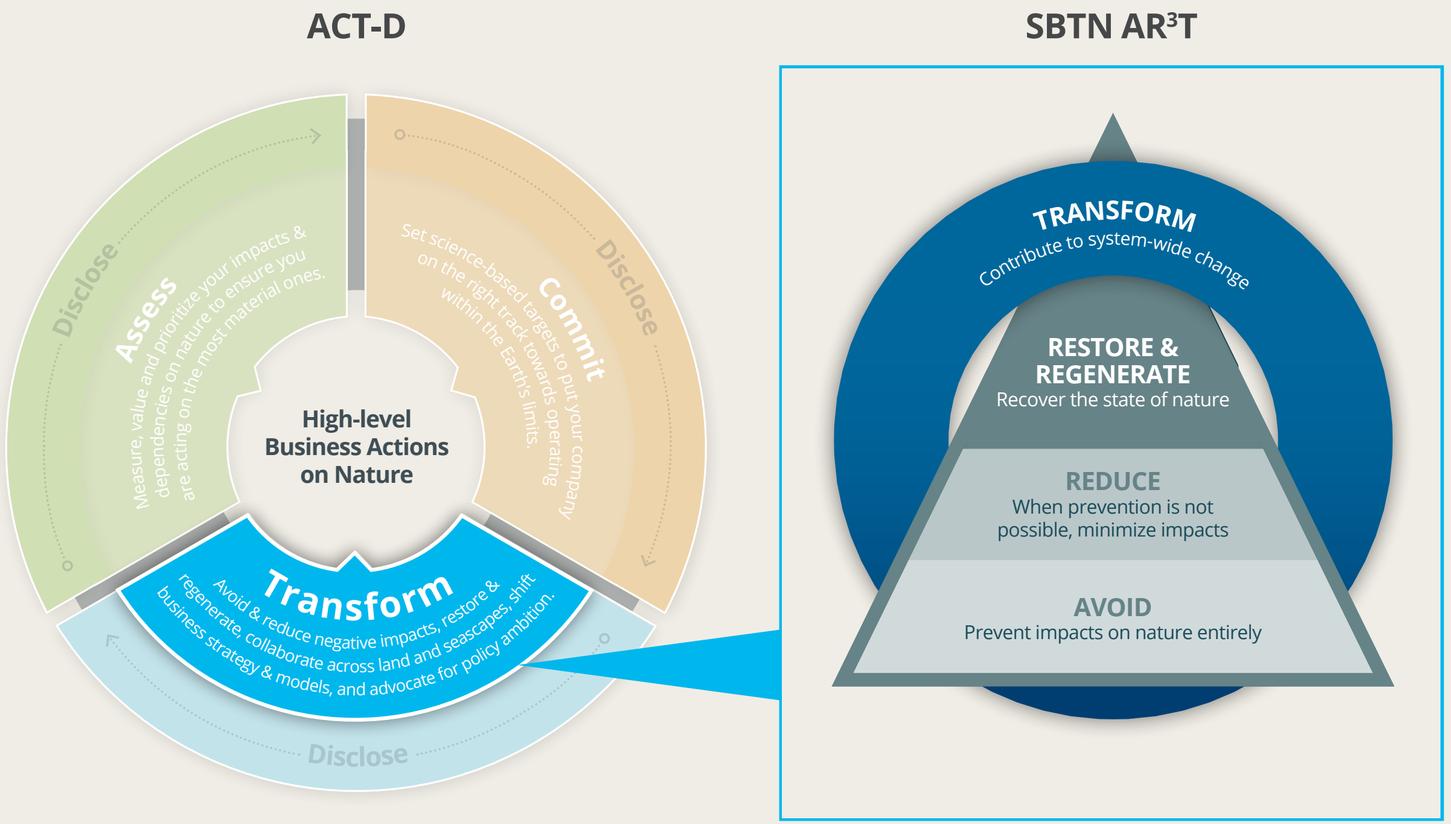
WBCSD approach to nature positive for business

Nature positive is gaining traction in the business community, yet lack of consensus around the term remains the subject of confusion. WBCSD's approach toward nature positive is based on key principles shared by leading organizations in this space, including SBTN, TNFD, Business for Nature and others.

In addition to understanding the company's relationship with nature, to set commitments that credibly contribute to nature positive, the collective impacts from regenerative and restorative business actions (doing "more good") must outweigh those from avoiding and reducing nature loss (doing "less harm") as guided by SBTN's Avoid, Reduce, Restore & Regenerate, Transform (AR3T) Action Framework (see Figure 2). This means that individual companies must urgently accelerate action to halt nature loss while simultaneously bringing back more nature. Actions that reduce harm will help to collectively reverse nature loss by 2030, while restorative, regenerative and transformative actions are critical to achieving full recovery by 2050.

In summary, companies should be holistic and transparent in the approach they take to assess, commit, transform and disclose, and in doing so highlight their contributions towards a nature positive future - rather than claiming to be nature positive themselves.[8]

Figure 2: SBTN's Action Framework (AR3T) defines the hierarchy of actions that companies can put in place as part of the "Transform" stage of ACT-D



Source: Business for Nature (2023). Priority actions towards a nature-positive future

Catalyzing critical business action in support of nature positive

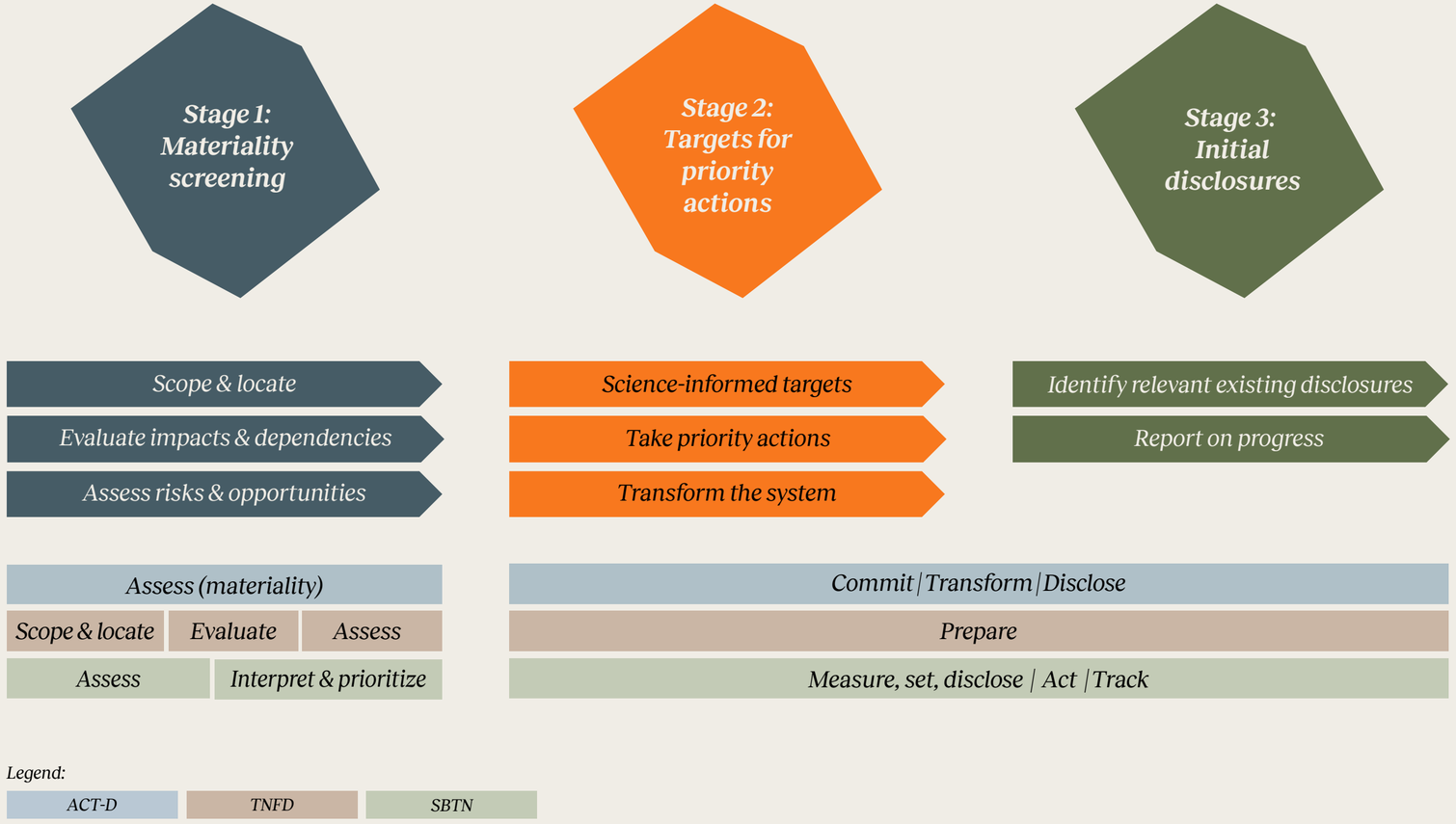
While the case for companies to contribute to nature positive is evident, this agenda can still be a blind spot. Ahead of CBD COP15, McKinsey found that while 83% of Fortune Global 500 companies have climate change targets, only 25% have freshwater consumption targets and a mere 5% have set targets related to biodiversity loss. Only 5% have assessed their impacts on nature and less than 1% understand their nature dependencies.[9]

WBCSD is working with **Business for Nature** and the **World Economic Forum** to develop guidance to support companies on their nature journeys: understanding their impacts, dependencies, risks and opportunities in order to prioritize actions that contribute to nature positive.

In addition, WBCSD is developing **Roadmaps to Nature Positive** that offer companies deep guidance and support on their nature journeys across maturity levels. The Roadmaps provide in-depth analysis and guidance relevant for all businesses, as well as specific guidance for four high-impact systems:[10] land use (including the agri-food and forest sectors), built environment and energy.

This initial guidance, covering the foundations of nature action, helps companies: define and improve their nature strategies based on value chain materiality screening; identify priority actions to systematically avoid and reduce negative impacts; determine the best restoration and regeneration approaches; prepare for initial voluntary and required disclosures. It provides a strong foundation to help business make progress towards achieving the shared goal of a nature-positive world by 2030.

Figure 3: Roadmaps to Nature Positive – a common approach for credible strategic action on nature



→ *See the* **Roadmaps to Nature Positive: Foundations for all businesses** to learn more about the approach followed for this work. Additional guidance is available for deeper support to prepare for TNFD, see WBCSD's **TNFD pilot - Lessons from TNFD piloting with 23 global companies**.

02. Introducing the Roadmap *for the agri-food system*

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Context: importance of nature to the agri-food system

"There is no business on a dead planet."

This rings particularly true for the global agri-food system, where the most fundamental dependencies and impacts inherently tie to the land – soil, water, climate stability, biodiversity – and the human beings who steward it. Indeed, the global agri-food system is both nature's biggest threat and humanity's greatest opportunity to halt and reverse nature loss.[11]

WBCSD's **Vision 2050** is for a world in which more than 9 billion people are able to live well, within planetary boundaries, by mid-century. Simply put, this vision is unachievable without a massive transformation of the agri-food system that sustains humanity.

All stakeholders need to move in the same direction and much, much faster. As outlined in our **Food & Agriculture Roadmap**, "collaboration, coalition building, and collective action across and beyond the sector will be critical" for true transformation. This guidance presents a foundation for alignment within the agri-food system to drive collaboration at the speed and scale needed for a nature-positive future.

The design of the conventional agri-food system of the 20th and 21st centuries aimed to maximize production to meet the growing demand for food.* The green revolution massively increased crop yields and global food security but the system has also helped push the limits of scientifically-established planetary boundaries: the latest research shows we are well-past many sustainable thresholds and dangerously close on those that remain.

* In this guidance, we follow the United Nations Food and Agriculture Organization's (FAO) broad definition of conventional agriculture: *"an industrialized form of farming characterized by mechanization, monocultures, and the use of synthetic inputs such as chemical fertilizers, pesticides and genetically modified organisms (GMOs), with an emphasis on maximizing productivity and profitability and treating the farm produce as a commodity."*

This is a generic base-case to start from, while recognizing the broad range and combinations of practices on the ground across different farms and regions.

Source: FAO, Making climate-sensitive investments in agriculture – Approaches, tools and selected experiences

See Annex 6 for the full glossary of sector-specific terms.

Figure 4: **WBCSD's Vision 2050 for Food**

Vision 2050 outlines system-level transitions and business action areas across nine transformation pathways. Each pathway includes a vision of the way the scoietal need will be met in 2050.

Source: WBCSD, **Vision 2050: Time to transform**

Looking ahead, the picture only gets more complicated; according to the World Resources Institute (WRI), humanity must simultaneously:

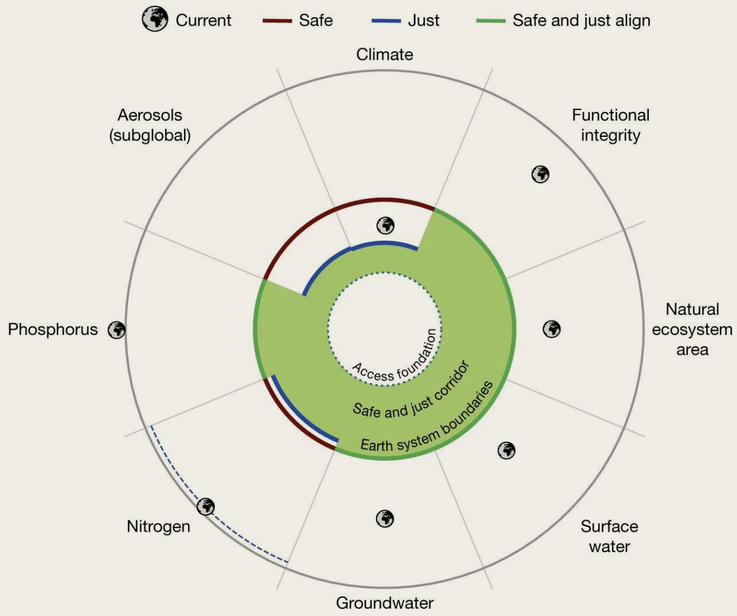
- → Produce more food, feed and fiber on existing agricultural lands and some working forests;
- → Protect remaining natural and semi-natural ecosystems from conversion and degradation;
- → Reduce projected growth in demand for land-intensive goods, particularly by high consumers;
- → Restore degraded ecosystems and marginal agricultural land.[12]

Fortunately, the agri-food system also provides the best chance for a nature-positive transformation. Nowhere are the fundamental connections across nature, climate and people clearer than on the farm, where all three must align to produce abundant, nutritious food to feed the world. Climate *is* nature; thriving ecosystems and photosynthesis underpin the stable climate system that enables life. Likewise, people *are* nature; humans are a living part of the world's interconnected biophysical systems. The Sustainable Development Goals (SDGs) and the Kunming-Montreal Global Biodiversity Framework (GBF) clearly identify these linkages, which are a core focus of leading nature-related frameworks for corporate assessment, target-setting and disclosures, and global and jurisdictional policies.[13]

These nature-climate-people interconnections present powerful feedback loops that today are spiraling downward. Climate change is already dramatically reducing the functioning of ecosystems around the world; in turn, biodiversity loss reduces the resilience of ecosystems and their ability to regulate temperature, water availability and greenhouse gases (GHGs), ultimately driving further climate change.[14] As stewards of the land, the world's roughly 500 million farmers are on the front lines of these changes and their know-how and passion are critical for system transformation. But often they lack the support – financial, technical, socio-cultural – to invest in practices to adapt to and mitigate the nature and climate impacts affecting them (and the rest of the planet) today and into the future.

Figure 5: Earth system boundaries

Visualization of safe Earth system boundaries (dark red), just Earth system boundaries (blue), cases where safe and just boundaries align (green) and current global states (Earth icons).



Source: Rockström, J., Gupta, J., Qin, D. et al., **Safe and just Earth system boundaries**, Nature.

We can still reverse these trends – there are multiple environmental, social and economic reasons to believe so. But the nature-positive system transformation will require an unprecedented scale of global coordination and local action across the public, private and civil spheres.

Table 1: The agri-food system & three global imperatives[15,16,17,18,19,20,21,22]

The agri-food system - across its fundamental relationship with nature, climate and social equity - can be a key driver, victim of and solution to the global crises facing humanity and the planetary system

Agri-food as a leading...	*Driver*	*Victim*	*Solution*
...of/to shared societal crises...			
Climate	→ One-third of global GHG emissions → Nearly half of all methane (CH_4) and three-quarters of nitrous oxide (N_2O) emissions	→ Climate-driven yield losses of up to 12% by 2050 (up to 50% in some regions) and up to 25% by 2100	→ Nature absorbs roughly half of annual anthropogenic GHGs → Nature-based solutions offer over 35% of climate mitigation potential → Est. US $3.5 trillion business opportunity in food-/land-/ocean-use change by 2030 → >15% farmer return on investment (ROI) achievable by transitioning to regenerative agriculture → 200 million full-time jobs possible in sustainable agriculture by 2050
Nature	→ Largest driver of nature pressures: 70% of terrestrial and 50% of freshwater biodiversity loss → 70% of global freshwater withdrawals → Over one-third of habitable land and half of all wetlands converted for agriculture	→ 50% of global agricultural lands are moderately to severely degraded → US $6 trillion annual cost of deforestation and land degradation effects; up to US $23 trillion by 2050	
Equity	→ Global poverty rate = 10% → Some 800 million people are undernourished, while 2.5 billion are overweight → Precarious farmer livelihoods are a barrier to adopting nature & climate-positive practices → Up to 50% projected growth in global food demand by 2050 (with regional differences)		

Scope of the roadmap

We have developed this guidance for business action and implementation through engagement and input from 19 WBCSD member companies and over a dozen partner organizations. Subsequent developments of the Roadmaps to Nature Positive will build on these foundations, focusing on performance and accountability. We will primarily work with members to implement aligned measurement methods to support more granular assessments, including for the agri-food system.

The agri-food value chain

The leading nature frameworks, such as the Taskforce on Nature-related Financial Disclosures (TNFD) and Science Based Targets for Nature (SBTN), guide companies to assess their full value chain, including direct operations and relevant upstream and downstream activities (see **Annex 4** for a list of the leading nature-related frameworks of relevance for land-use companies). This holistic approach is critical for all companies along the agri-food value chain, as nature-related DIROs are often concentrated upstream or downstream from a company's direct operations. This guidance considers six value chain stages, grouped under three broad headings: direct operations, upstream and downstream. The main focus is on the direct operations of row crop commodity production (such as soy, corn and rice) as the primary land-use stage. We have also assessed upstream and downstream activities with a "lighter" touch.

- **Agri-production:** The sector's primary nature-related DIROs center on the farm – including land-clearing, field preparation, planting, growing and harvesting. Downstream and upstream market forces and agriculture policies at national and sub-national levels largely influence these activities.

- **Upstream:** Agri-input providers play a key role in shaping on-farm practices through their products and support services; their production processes can contribute significant nature-related impacts to the embedded environmental footprint of commodities. Input companies may take a biome or regionally-oriented approach to a nature-positive strategy as their products (such as fertilizers and pesticides) spread across large areas of agri-production, often for various crops rather than a single commodity.

- **Downstream:** Trading and distribution, processing and manufacturing, and retail stages of the value chain all contribute to channeling consumer preferences up the value chain; each step also has its own nature-related DIROs. Downstream actors typically take a commodity-centric approach to nature-positive strategy in terms of traceability and target-setting.

Upstream and downstream are relative terms depending on a company's position in the value chain; a company will always have its own upstream and downstream activities to consider, relative to its direct operations. For example, land-use for agri-production is upstream from a trader or manufacturer perspective, while all of these stages are considered downstream for an agrichemical company.

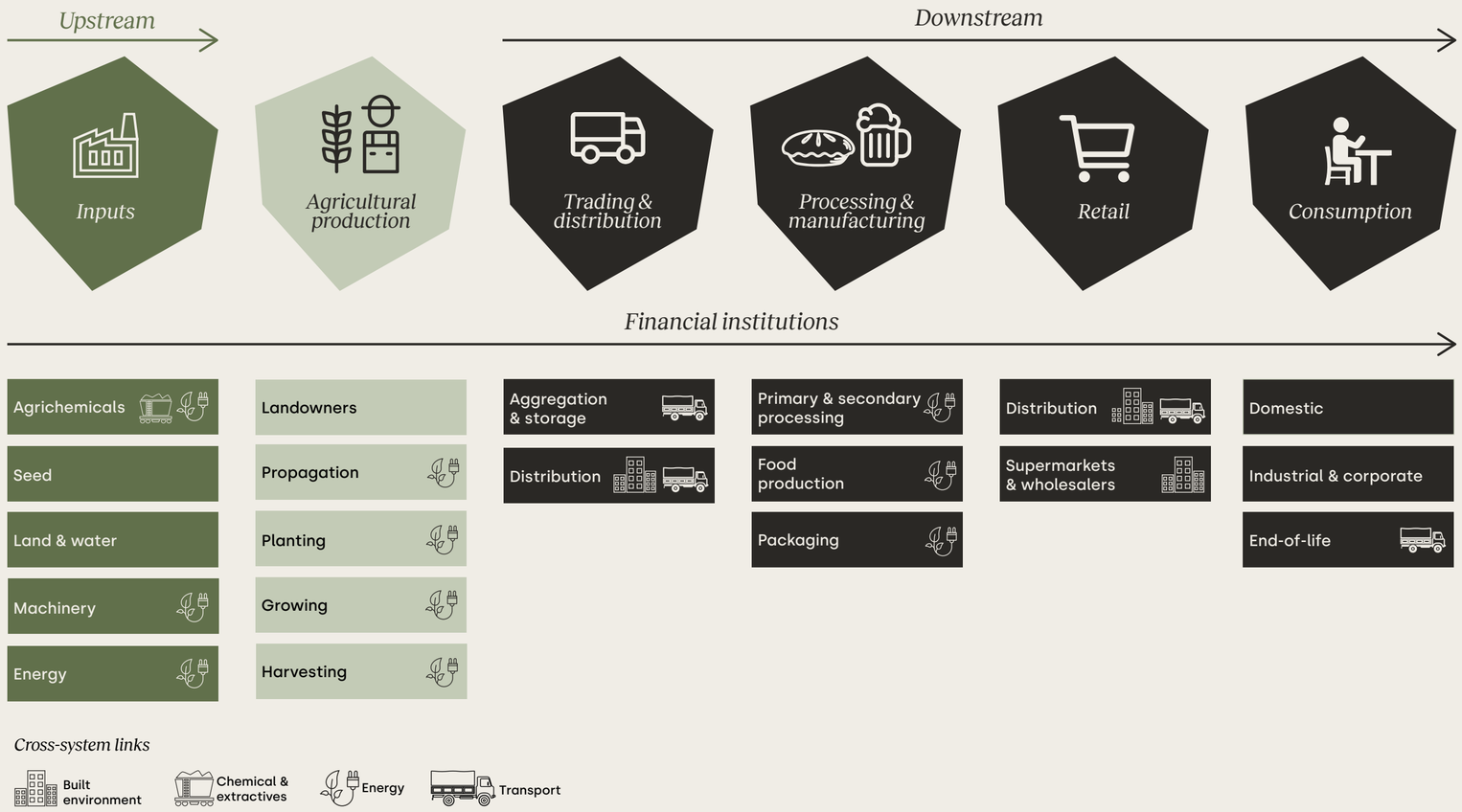
See **Annex 6** for a glossary of terms and **Annex 7** for notes on our methodology. For more detailed guidance, see the **TNFD guidance** on value chains.

→ **Financial institutions and landowners:** Investors, lenders, insurers and landowners all play critical roles throughout the value chain; their engagement, with farmers in particular, is a key lever for nature-positive system transformation, as discussed in **Stage 2.3** of this guidance.

The agri-food value chain includes a number of important cross-system links; we have indicated four major systems overlapping with the activities outlined here. Please see parallel guidance for the **Forest Sector**, **Energy** and **Built Environment** systems for more detailed information.

Figure 6: The basic agri-food value chain

This Roadmap and associated "deep dives" focus primarily on the agricultural production of row crop commodities.



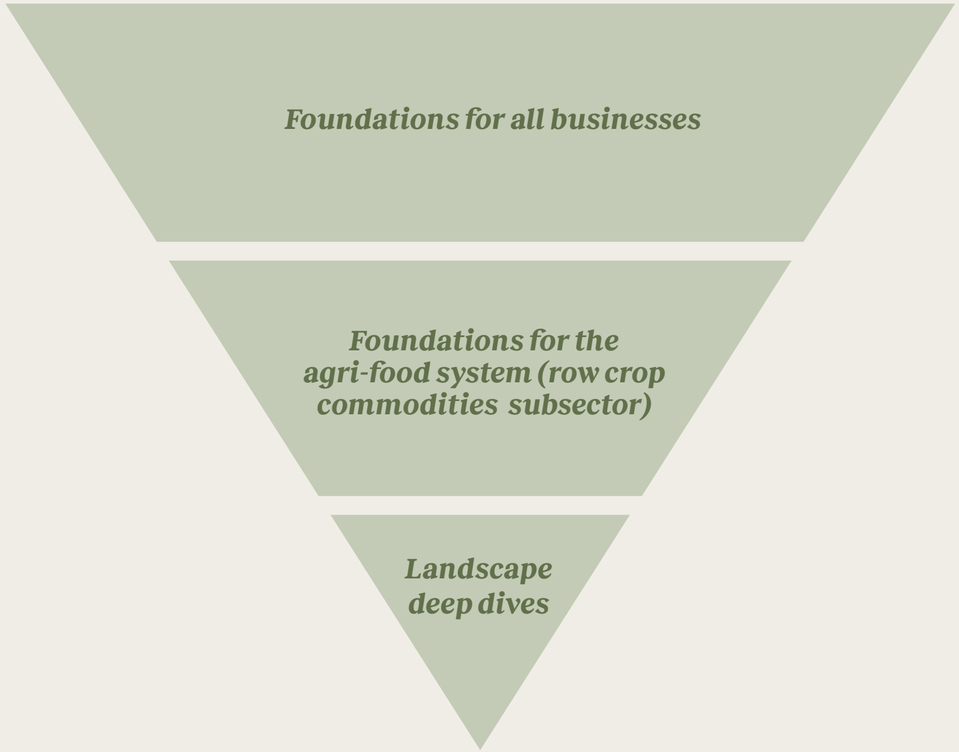
Landscape deep dives

Nature-related DIROs are highly local and are distinct from climate change mitigation, which generally includes more global considerations. Because of the inherent link between agriculture and the land, this guidance includes an initial series of "deep dives" into three distinct productive landscapes. WBCSD member companies consider these landscapes – characterized by growing agricultural production/intensification and biodiversity hotspots – as high-priority operating/sourcing regions. In other words, a company with global exposure would likely determine that these landscapes - if part of their value chain - require specific nature-related assessment, commitment and action.

The **landscape deep dives** explore nature-related DIROs, leading practices, context-specific resources, and unresolved challenges for three of the commodity crops that largely underpin the global food system.[23] Farmers grow these crops conventionally under intensive methods in a small number of global breadbasket regions. The SBTN considers them high-impact commodities, meaning "raw and value-added materials used in economic activities with material links to the key drivers of biodiversity loss, resource depletion and ecosystem degradation."[24] Indeed these crops are among those with the largest land-use footprint in areas of high conservation priority, posing the greatest conservation risk.[25]

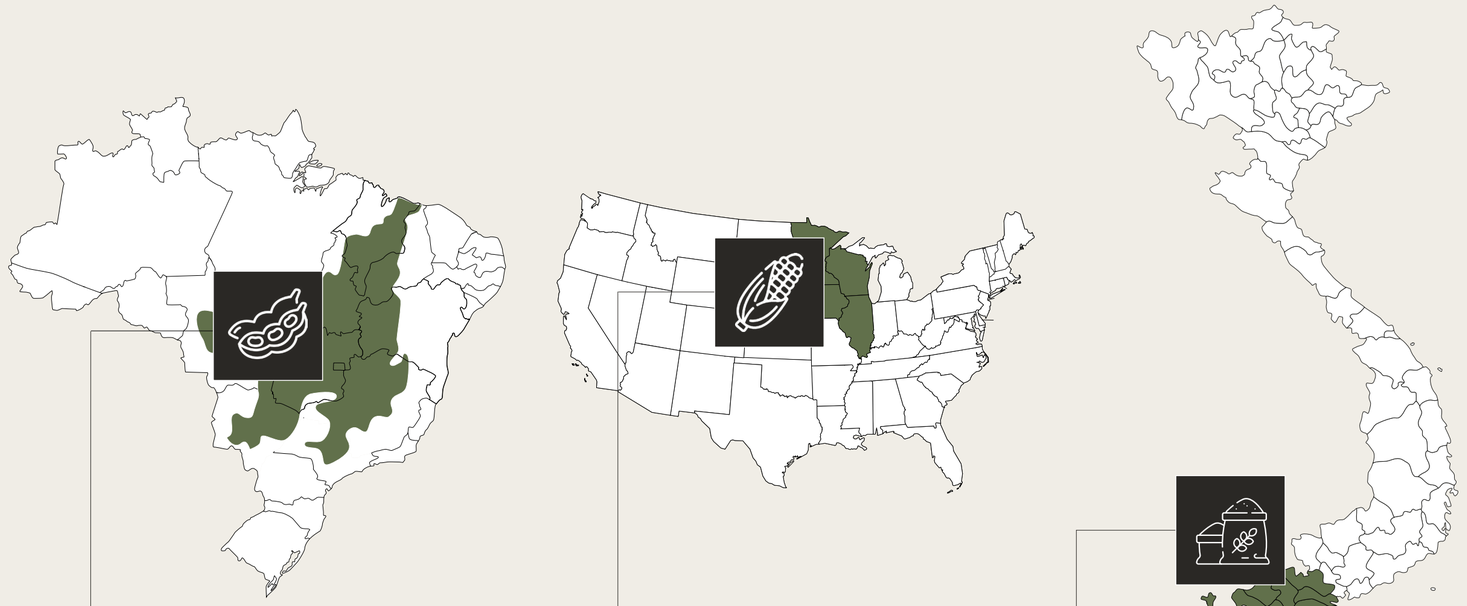
Figure 7: WBCSD's Roadmaps to Nature Positive & Agri-food system resources

The initial agri-food guidance is on row crop commodities, based on three "deep dive" assessments - these resources should be used together.



Each deep dive centers on a single commodity but includes a representative annual crop rotation to reflect a holistic understanding of, and approach to, year-round land use. We may add further deep dives in subsequent phases of work to expand the illustrative portfolio of diverse crops and global landscapes.

Figure 8: The three high-priority global productive landscapes that form the basis for this report



03. Foundations *for the agri-food system*

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→ *Stage 1: Assess (materiality screening)*

Materiality screening is at the heart of an impactful nature journey as it enables a business to identify the most material nature-related issues that credible targets need to cover, including associated actions to address those issues. Companies should conduct a materiality screening as a participatory process with experts and stakeholders from within and outside the company.

Assess: Foundations – System materiality screening

A materiality screening based on typical system impacts and dependencies can help identify and prioritize the parts of the business with the highest potential risks and opportunities. By making dependencies, impacts, risks and opportunities (DIROs) more explicit, the business case for action on nature (with benefits for the business, communities and other stakeholders) becomes more straightforward.

A materiality screening should take place at the beginning of the corporate nature journey to identify priority issues for further, more detailed, assessment. More advanced companies can also use such a screening to check that they have covered their priority issues. This step is feasible regardless of system, geographic location or level of sustainability experience. Major frameworks – including CSRD, SBTN and TNFD – require it.

The foundational steps to "Assess" include:

1. **Scope and locate:** Identify the company's main sectors, sub-sectors and parts of the value chain and where they are located;
2. **Evaluate impacts and dependencies:** Prioritize potentially high impacts and dependencies on nature typical for the business and associated value chains for further assessment;
3. **Assess risks and opportunities:** Assess associated risks and opportunities for the business and for key stakeholders in order to prioritize further action.

Together, these steps can feed into a corporate materiality assessment and help prioritize those areas that require deeper analysis.

Stage 1.1 – Scope and locate

Identify the company's main sectors and sub-sectors and key parts of the value chain and their location.

Why do this:

For many companies, the main impacts and dependencies on nature will come from direct operations (sourcing of raw materials, production processes and sites) and the use of produced goods and services. The company needs to identify and address the value chain components that represent the greatest potential risks and opportunities in order to have a credible and impactful approach to nature, even if these components may not be under the company's direct control.

What to do:

→ Identify sectors and sub-sectors that represent the company's activities and key components throughout the value chain. This is necessary to extract typical impacts and dependencies from relevant tools (for example, if the company lists aluminium packaging as a key component, it should identify the aluminium mining sector as a relevant sector);

→ Identify direct operations or parts of the system where these typical impacts and dependencies are present.

This is a critical step for companies in the agri-food sector, as agriculture links intimately with the conditions and ecosystem services particular to each region and landscape. Climate and weather, soil conditions, water availability and quality can vary widely across landscapes, even within close geographic proximity. Companies should first consult the **TNFD Food & Agriculture guidance**, as well as **SBTN step 1 and 2 guidance** to develop a credible approach that will inform their materiality assessment, actions and commitments. These resources cover key questions and considerations, data needs, and recommended tools and resources.

→ ***See the*** **Roadmaps to Nature Positive: Foundations for all businesses** to learn more about maturity levels.

Stage 1.2 – Evaluate impacts and dependencies

Prioritize potentially high impacts and dependencies on nature typical for the business and associated value chains for further assessment.

Why do this:

The starting point for materiality assessments on nature should not be subjective but informed by what data and science indicate are typical impacts and dependencies for a given sector. A company can then refine this within its risk assessment processes. In this way, it can identify and address strategically important issues and reduce exposure to accusations of greenwashing.

What to do:

→ Carry out a system materiality screening:

- Develop a list of typical nature-related impacts and dependencies based on existing materiality screening tools, in addition to expertise from the business and its partners;
- Prioritize impacts and dependencies rated as potentially "high" or "very high" risk for further analysis and action.

In general, agri-food value chains are highly dependent on the key functions of nature ("ecosystem services") that enable crop production; in turn, the sector has a high impact (positive and negative) on these services.

Agri-food value chains are long and complex, often involving many commodities and hundreds or even thousands of suppliers. The specific dependencies and impacts, and their degree of materiality to a company and other stakeholders, can vary widely depending on the local context. See the **TNFD Food & Agriculture guidance**, **SBTN Step 1 and Step 2 Technical Guidance**, and the **TEEBAgri-Food Operational Guidelines** for more information.

Table 2 and Table 3 below illustrate a materiality screening aggregated for the three crop rotations and landscapes considered. Companies can generally extrapolate this information for similar row crop systems globally. This is a generalized assessment, highlighting only those dependencies and impacts that were evaluated to have potentially high or very high materiality (according to **ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure) definitions)**, with the rationale that these are the most likely to require further risk and opportunity evaluation and to inform the development of priority actions and targets. Arrows indicate our ratings relative to the sector-level screening for agricultural products available in the **TNFD Food and Agriculture sector guidance**, meaning the specific differences we note for this subsector of row crop commodities. For example, these crops are typically self-pollinating so the corresponding dependency is rated relatively lower here compared to the broader sector where insect pollination is considered; similarly, water pollutants have a relatively higher impact here considering the heavy and often over-use of agrichemicals for row crop production and resulting runoff into water systems.

This screening aims to be a starting point for company refinement within any specific productive landscape. As companies advance on their nature journey, they should progressively refine their materiality assessments through additional layers of granularity, leveraging existing resources specific to the landscape, company inter-departmental expertise (i.e., technical experts, procurement, risk management) and stakeholder input (i.e., academia, NGOs, communities and others as appropriate). See **Annex 1** for a fuller discussion of material impacts and dependencies and **Annex 7** for notes on methodology.

Table 2: Key nature-related dependencies identified for row crop commodities

Value chain stages	*Dependencies*																		
	Direct physical inputs					**Enable production processes**					**Mitigate direct impacts**				**Protect from disruption**					
	Animal-based energy	**Fibres & other materials**	**Genetic materials**	**Ground-water**	**Surface water**	**Pollination**	**Soil quality**	**Water flow maintenance**	**Water quality**	**Ventilation**	**Bio-remediation**	**Dilution by atmosphere & ecosystems**	**Filtration**	**Mediation of sensory impacts**	**Buffering**	**Climate regulation**	**Disease control**	**Flood & storm protection**	**Mass stabilization & erosion control**	**Pest control**
Inputs									Important for operations & product quality		Mitigate pollution from operations	Mitigate pollution from operations	Mitigate pollution from operations			Operations affected by temperatures				
Agri-production (irrigated)	↓			Where irrigated (secondary source today) ↓	Where irrigated (primary source today)	↓	Essential for crop health & yield	Replenish surface & groundwater	↓		Mitigate pollution from farm operations ↑	Mitigate pollution from farm operations ↑	Mitigate pollution from farm operations		Replenish eroded soil & support soil health	Crop health & yield affected by temperatures	Natural crop protection ↓	Natural barriers & root systems ↓	Essential to maintain soil structure	Natural crop protection ↓
Agri-production (rainfed)	↓			↓	↓	↓	Essential for crop health & yield	Replenish surface & groundwater	↓		Mitigate pollution from farm operations ↑	Mitigate pollution from farm operations ↑	Mitigate pollution from farm operations		Replenish eroded soil & support soil health	Crop health & yield affected by temperatures	Natural crop protection ↓	Natural barriers & root systems ↓	Essential to maintain soil structure	Natural crop protection ↓
Trading & distribution																Operations affected by temperatures		Transport corridors exposure to weather		
Processing & manufacturing				Needed for operations ↓	Needed for operations ↓				Important for operations & product quality							Operations affected by temperatures		Facilities exposure to weather		
Retail																				

High materiality **Very High materiality** ↑ ↓ **Rating difference vs TNFD sector guidance, if any**

Link to the table

Table 3: Key nature-related impacts identified for row crop commodities

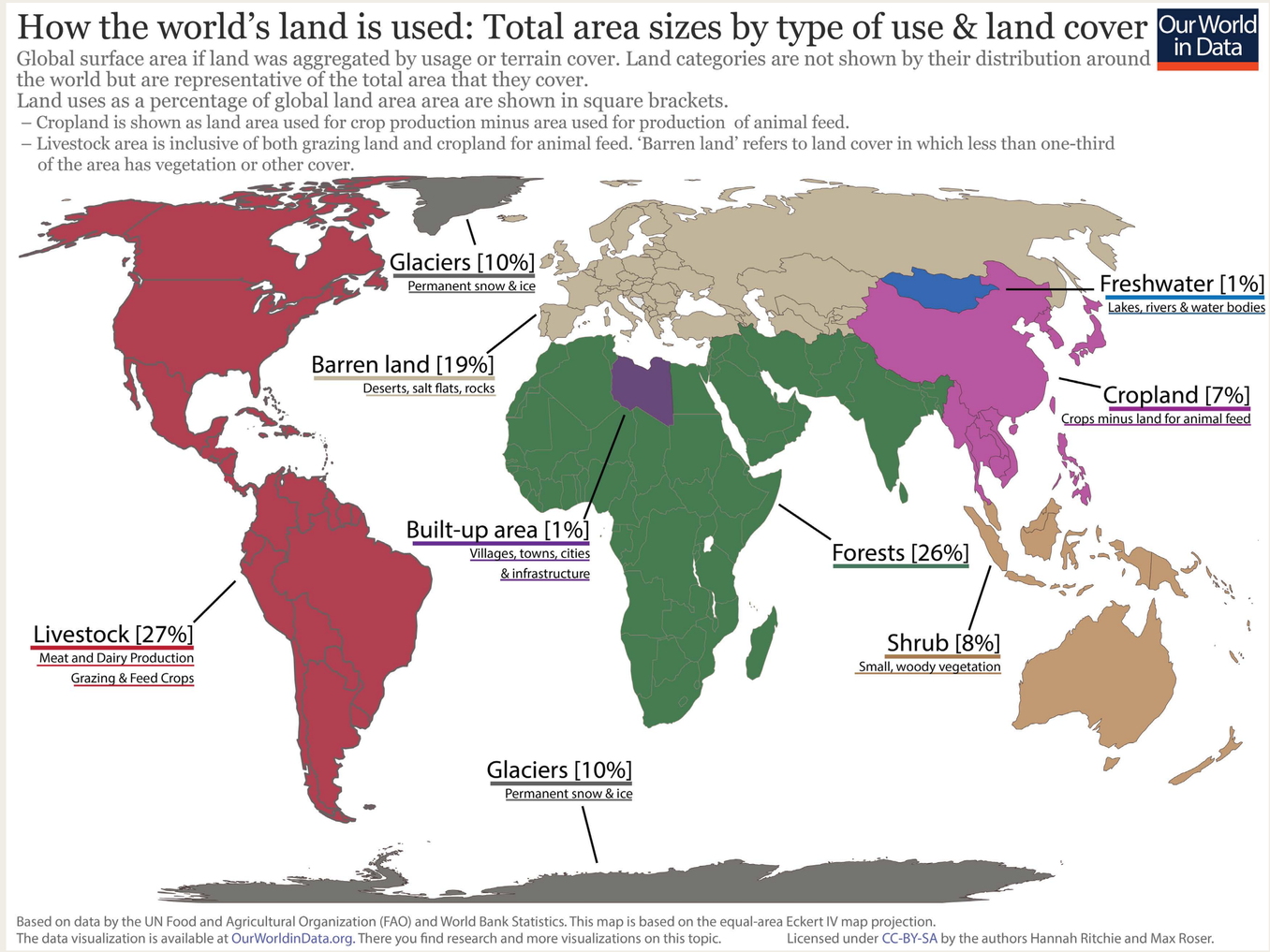
Value chain stages	*Impacts*											
	Land-/water-/sea-use change			**Resource exploitation**		**Climate change**	**Pollution**				**Invasive species & others**	
	Terrestrial ecosystem use	Freshwater ecosystem use	Marine ecosystem use	Water use	Other resource use	GHG emissions	Non-GHG air pollutants	Water pollutants	Soil pollutants	Solid waste	Disturbance	Biological alterations/ interferences
Inputs	Land-use in mining operations			Mining & industrial processes	Mining of minerals	Mining & industrial processes	Mining & industrial processes		Mining & industrial processes		Noise & light pollution	
Agri-production (irrigated)	Land-use change & soil loss	↓		For irrigation		Land-use change & farm operations ↑	Fuel use & agrichemical emissions/ drift	Agrichemical run-off & leaching ↑	From agrichemicals			From GMOs
Agri-production (rainfed)	Land-use change & soil loss	↓		↓		Land-use change & farm operations ↑	Fuel use & agrichemical emissions/ drift	Agrichemical run-off & leaching ↑	From agrichemicals			From GMOs
Trading & distribution	Land clearing for transport infrastructure		Ocean transport & port construction			Fuel use in transport	Fuel use in transport				Noise & light pollution	Spread of disease & invasive species
Processing & manufacturing				Industrial processes & in products		Industrial processes	Industrial processes	Industrial processes	↓			
Retail						Distribution & waste						

High materiality **Very High materiality** ↑ ↓ **Rating difference vs TNFD sector guidance, if any**

Link to the table

Figure 9: Land use worldwide

The agri-food system (cropland and livestock combined) makes up over one-third of global land use.



Source: Our World in Data, **Land Use**

"On the face of it there is a trade-off. How can we possibly produce more food, on less land without unsustainable forms of agricultural intensification (such as overuse of fertilizers and chemical inputs) that further degrade land and reduce its productivity in the long-term? Science tells us that it is both possible and necessary. We do not have a choice between protecting the environment or human wellbeing. The two can and must go together."

Janez Potočnik, in the foreword of the Science Based Targets Network's **Step 3: Measure, Set, Disclose: Land guidance (beta)**

Stage 1.3 - Assess risks and opportunities

Prioritize further action based on risks and opportunities for the business and stakeholders.

Why do this:

Increasing numbers of businesses are making the connection between the health of ecosystems and their bottom line. Risks and opportunities originate from business impacts on nature and associated impacts on stakeholders, as well as corporate and societal dependencies on ecosystem services. Risks, as defined by the TNFD, can be physical risks (typically linked to material nature-related dependencies), transition risks (linked to nature-related impacts that an organization may face in the changing regulatory, policy or societal landscape) and systemic risks (arising from the breakdown of the entire system, rather than the failure of individual parts). Annex 1 provides more information on nature-related risks. Opportunities can result from avoided risks, and from innovation and market strategies arising from an approach that contributes to nature positive.

What to do:

- → Refine the list of prioritized impacts and dependencies by scoring for potential risks and opportunities based on likelihood versus magnitude of risks and other relevant criteria;
- → Engage with stakeholders to refine the list of issues;
- → Carry out a further qualitative assessment by considering how DIRO may evolve in the future; TNFD provides different scenarios for consideration.[26]

The TNFD Food & Agriculture sector guidance contains detailed "how-to" instructions for assessing nature-related risk and opportunity for agri-food companies, including considerations of likelihood, magnitude, speed of onset and other factors; use of nature-related scenarios; and illustrative examples for several stages of the value chain. The Natural Capital Protocol Food & Beverage Sector Guide and TEEBAgri-Food Operational Guidelines outline this process within a broader "capitals" framing, including natural, human and social considerations that go beyond the business-oriented lens of this guidance. For more on so-called "double" (i.e., both financial and environmental/social) materiality see the EU Corporate Sustainability Reporting Directive (CSRD) and EU Sustainability Reporting Standards (ESRS).

Major nature-related risks and opportunities for row crop commodity value chains derive from the material dependencies and impacts identified in the prior step. Key considerations for conventionally grown row crops include those listed below (refer to Annex 2 for the full risks and opportunities table, structured by agri-food value chain stages):

Physical risks

Chronic risks at the farm level include soil degradation and loss, water stress and climate change (both global and microclimate-driven), all of which lower crop quality and reduce yields, thus increasing the need for intensive agri-inputs use and increasing farm operating costs. These risks and costs can cascade from agri-producers to downstream and upstream actors.

Acute risks are often linked to these chronic risks, such as increased erosion from soil degradation and lack of off-season ground cover, leaving crops more vulnerable to damage or loss from storms, flooding and drought – which are all intensifying with climate change. These acute risks can affect crop yield and quality, causing supply disruptions and therefore lost sales and increased costs for supply substitution.

Crop systems that rely on smallholder farmers – such as rice from Vietnam's Mekong River Delta – present further risk of supply chain disruption to both downstream and upstream value chain players, especially as the effects of climate change threaten their livelihoods and ability to produce.

> Global land and soil degradation "costs are projected to reach US $23T by 2050 if no action is taken. These costs are significantly higher than the investment requirements... meaning that the economic return is more than five times the cost. Disregarding the warning signs of degrading landscapes will therefore increase costs within a company's supply chain in the long term."
>
> *International Union for Conservation of Nature (IUCN) and Food and Land Use Coalition (FOLU)* Guide to investing in landscape restoration to sustain agrifood supply chains

Transition risks

Transition risks can include lower sales and profits, and increased operating costs as domestic and trade-based nature-positive and deforestation and conversion-free (DCF) policies come into force and if retailers, consumers and financial institutions choose not to purchase from and invest in companies and regions linked to negative environmental issues. Similarly, agri-input companies may lose business if they do not adapt their products and services for nature-positive systems. Both physical and transition risks can also put at risk a company's global reputation and social license to operate in a specific landscape.

The transition to nature-positive practices itself also presents risks to farmers (and therefore to agri-food companies). For example, transitioning a conventional large-scale farm to regenerative agriculture (regen-ag) – while ultimately beneficial for nature and business – can bring lower yields in the short-term and the possibility of farmers losing financing and crop insurance coverage for novel crops and farming practices. These risks may cause disruptions or increased costs within agri-food supply chains, with potential impact on food prices and regional food security.

Commodity-specific carbon footprints are increasingly well-understood, presenting both transition risk (such as carbon border adjustments) and opportunities (e.g., nature-based solutions' (NbS) market development).

Physical assets including land holdings and facilities are likely to be at risk; for example, a company with a strategy based on forestland expansion could face asset stranding or depreciation as DCF policies are implemented at scale.

Agri-food companies (beginning especially with large, publicly-traded firms) are likely to face increased reporting burdens and costs in the coming years in order to comply with emerging required and voluntary disclosures on nature.

Systemic risks

If current nature loss rates continue, some ecosystems may cross irreversible tipping points, with far-reaching economic and social impacts. The combination of several tipping points may produce cascading interactions between physical and transition risks, which stop systems from recovering their equilibrium.[27] Examples for the agri-food system include desertification of tropical forests and savannahs, or loss of keystone species causing ecosystem collapse.

Business opportunities

Opportunities include planning and investment to avoid these nature-related risks; increasing revenue, profitability and financing options up and down the value chain through improved farming practices (DCF, precision and regenerative) and shifting business models to meet changing consumer and stakeholder demands.

Agri-input companies have a growing opportunity to develop and scale bio-based alternatives to conventional agrichemicals and expand farm-level services, and monitoring, reporting and verification (MRV) technologies.

There are also opportunities for value-creation throughout the value chain from NbS, including for soil-carbon. Yet farmer trust, MRV capabilities, market standardization and capital flows remain significant barriers to scaling these opportunities.

Biodiversity – the variability among living organisms – is a key feature of nature and cuts across all other dimensions. All impact drivers can contribute directly or indirectly to biodiversity outcomes. In turn, the state of local biodiversity affects the quality of many critical ecosystem services upon which agri-production relies.

Figure 10: The interconnections between key dependencies and impacts (following ENCORE and IPBES classifications) related to conventional row crop production and resulting risks to agri-food companies

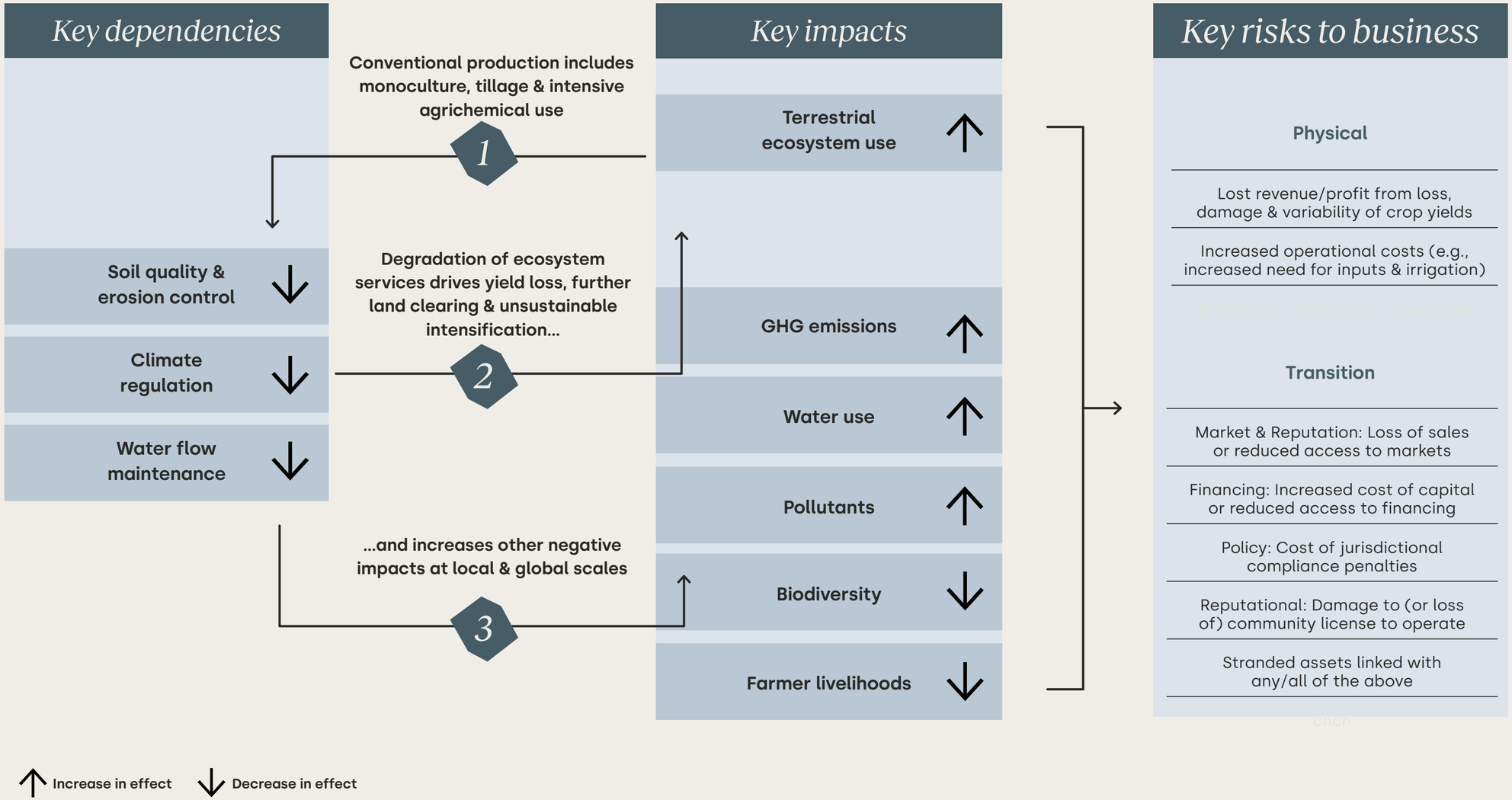
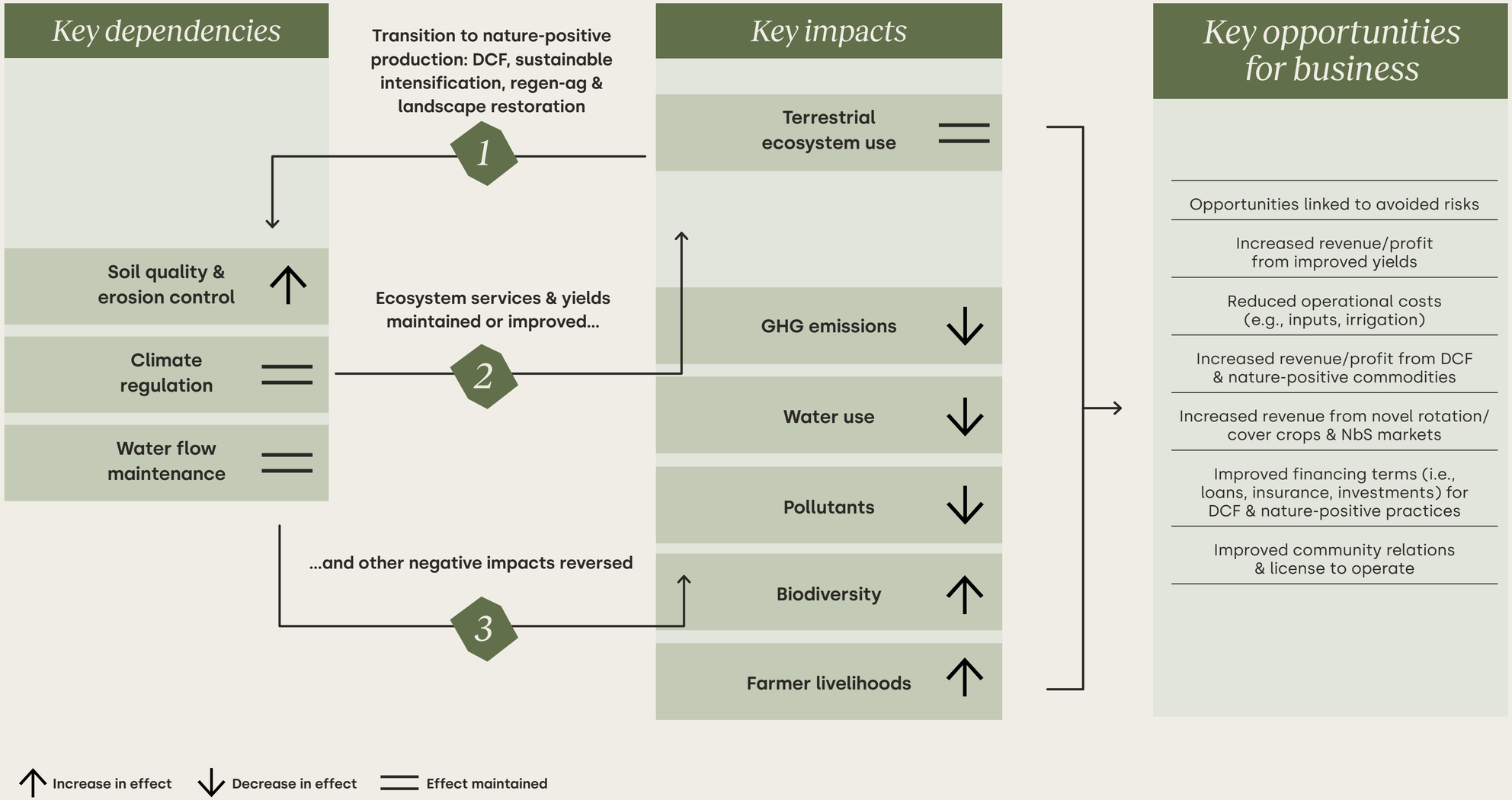


Figure 11: The interconnections between key dependencies and impacts (following ENCORE and IPBES classifications) in a more nature-positive system and resulting opportunities for agri-food companies



→ *Stage 2: Commit and Transform (targets for priority actions)*

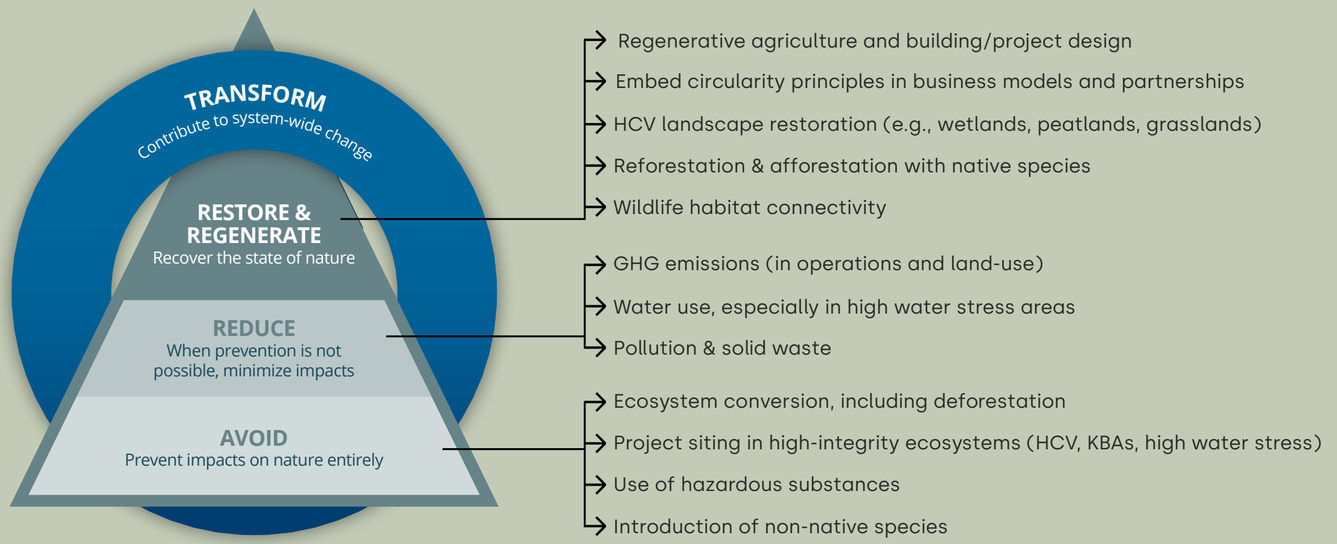
Having completed an initial materiality screening, companies should prioritize the impacts and dependencies that play a key role in informing their commitments and actions.

Credible, realistic and impactful nature commitments (including their associated targets) require a company to understand the actions it can take to address its priority impacts and dependencies on nature.

The foundational steps to "Commit and transform" include:

1. **Set science-informed targets:** Set time-bound, specific science-informed corporate-level targets and linked indicators to track progress on reducing priority impact drivers on nature;
2. **Take priority actions:** Identify existing and additional priority actions needed to avoid and reduce negative impacts, and promote opportunities to restore and regenerate;
3. **Transform the system:** Identify additional actions needed that transform business models and business activities to address barriers and improve the enabling environment (policy, financing, technology, infrastructure).

Figure 12: SBTN's Action Framework with examples of actions



Source: Adapted from WBCSD (2021). What does nature-positive mean for business?

Stage 2.1 - Set science-informed targets

Set time-bound, specific science-informed corporate-level targets and linked indicators to track progress on reducing priority impact drivers on nature.

Why do this:

Companies need to set targets according to a scientific assessment of where their main sectors' general impact drivers on nature are. They can then strengthen science-informed targets and add to them over time on the journey to science-based targets, which they articulate at a local level.

What to do:

- → Consider the activities throughout the value chain that typically cause the priority impact drivers and the actions the company is already taking to avoid and reduce these negative impacts (or could take in the near future);
- → Set targets, either at the impact driver level or the company response level. Identify priority land-, sea- and freshwater-scapes in direct operations to set baselines for impact drivers and eventual science-based targets;
- → Build on what the company has done so far, set targets accordingly, and always be transparent regarding methodology.

Stage 2.2 - Take priority actions

Identify existing and additional priority actions needed to avoid and reduce negative impacts and promote opportunities to restore and regenerate nature.

Why do this:

Companies need to take action to address priority impact drivers of nature loss. Companies often have actions in place that are already addressing some of the impact drivers, but which may not have been evaluated against the materiality assessment.

What to do:

→ Map existing actions against the impact drivers prioritized through the materiality assessment and course-correct: understand what actions the company is already undertaking and should continue, which ones can be deprioritized, and which ones need to be put in place;

→ These actions should align with the emerging ambition for target-setting (even if the methodology for science-based approach is not yet finalized);

→ For any action, systematically consider and apply the principles of the action framework to avoid and reduce negative impacts and have positive contributions through restoration and regeneration and wider system transformation (see Figure 12);

→ Consider these actions where the company has direct control and in areas where it has influence, including with suppliers and customers and the broader landscapes within which they operate.

Actions should be considered across three main levels:

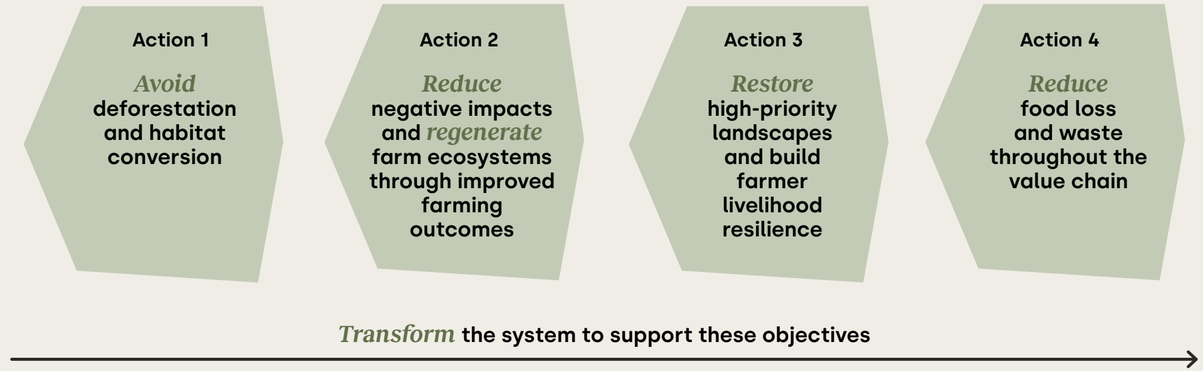
1. Corporate
2. Operations and priority value chains
3. Broader system change (see **Stage 2.3 – Transform the system**)

Among the many nature-related pressures that the global agri-food system both causes and is impacted by, several action areas emerge that businesses should prioritize to accelerate the nature-positive system transformation, following the SBTN's Action Framework.

This is not a menu of options to choose from but rather a set of complementary core objectives, all of which are likely to be relevant for agri-food companies up and down the value chain. In general, agri-food companies should follow landscape approaches as a guiding theme in their nature-positive strategies and actions (see the **landscape approaches section**).

See **Annex 3** for the full set of priority actions organized by value chain stages and including illustrative indicators, framework alignment and key resources. Note that the next iteration of the Roadmaps will focus on establishing key nature-positive metrics and indicators for the sector.

Figure 13: Priority action areas for agri-food companies, aligned with the "AR3T" steps of the SBTN Action Framework



These objectives align with the **Sustainable Development Goals**, the **GBF** and the SBTN's **Land (beta)** and **Freshwater** targets.

"We all want data that's scientifically accurate and is also practical for the business to act on. But do not delay action while waiting for perfection or for the science to mature; take no regret actions by addressing your material nature impacts."

GSK 2022, **Understanding impact and dependencies on nature**

Action 1: Avoid deforestation and habitat conversion

Avoid and reduce: We will not achieve a sustainable agri-food system operating within planetary boundaries without seriously curbing land-clearing practices. Agriculture drives 90% of tropical deforestation.[28] According to the SBTN, "land-use change and direct exploitation of resources on land are the main causes of human-induced loss of nature in all terrestrial regions globally. These pressures are precursors to each of the remaining drivers, including climate change, invasive alien species, and pollution."[29] Land clearing is a significant driver of GHG emissions, as trees, native vegetation and soil release stored carbon, and lose their ability to sequester and store carbon in the future. And habitat destruction and modification are primary drivers of biodiversity loss.[30]

Agri-food companies must adopt and adhere to rigorous DCF policies and practices in line with biome-specific guidelines and cutoff dates in order to "avoid the wholesale change of natural ecosystems to another land use, or a profound change in natural ecosystem species composition, structure, or function."[31] This is especially urgent for ecosystems with high conservation and carbon storage value. Corporate DCF commitments, procurement requirements, verification and transparent reporting must follow science-driven approaches, which may mean going above and beyond practices permitted under current jurisdictional laws.

However, corporate requirements are only the first step; agri-food companies, policymakers and financial institutions must support growers and all value chain stakeholders on the DCF path – through financing, technical support and collaboration. Otherwise, DCF requirements can lead to unsustainable intensification on existing crop lands (i.e., overuse of agri-inputs and water), leakage (land-clearing practices simply moving to other areas) and harm to farmer livelihoods (noting that smallholder farmers – often with few other means – are responsible for over 70% of agriculture-driven global deforestation).[32]

The DCF imperative aligns with SDGs 2, 13 & 15, GBF targets 1 & 2 and SBTN Land target 1 (beta) and is the main focus of the deep dive on soy production in the Cerrado For more, see the Transforming Agriculture chapter of WBCSD's Food & Agriculture Roadmap, the Accountability Framework initiative, and the GHG Protocol Land Sector and Removals Guidance draft.

Leading practice: Louis Dreyfus Company (LDC), a leading global commodity trader, has developed a Soy Sustainability Policy that transparently sets out its principles and ambitions for all soybean-related activities in its supply chain, aligned with leading global imperatives including eliminating deforestation and conversion, and following ILO human rights conventions. It includes landscape-specific plans for improving practices and stakeholder engagement, such as for the Cerrado region of Brazil (a high-priority landscape for sustainable soy production and biodiversity conservation).

Our **Roadmaps to Nature Positive: Foundations for all businesses** includes the foundational concept of a corporate maturity progression, from starting to developing, advancing and ultimately leading. A set of criteria, aligned with the ACT-D **High-level Business Actions on Nature**, define each stage. The intent is to meet companies where they are today and support them in advancing their nature positive journeys. The general progression, aligned with the **SBTN Action Framework**, is from "do no harm" to "do more good" to "transform the system."

Table 4 illustrates this progression for the key issue of DCF production and sourcing of soy as a high-impact commodity, complementing both the full priority actions table in **Annex 3**, as well as context-specific progressions on this topic and others in each landscape deep dive.

Table 4: Illustrative corporate maturity progression on DCF

		Corporate nature maturity levels		
		Starting ***"Do no harm"***	***Developing/advancing*** ***"Do more good"***	***Leading*** ***"Transform the system"***
Value chain stages	**Upstream (inputs)**	Support legal compliance with forest protection laws & DCF practices at farm-level	Drive corporate strategy & set science-based targets in support of DCF practices at farm-level	Deliver & scale programs for farm-level monitoring of deforestation & conversion practices & traceability of associated inputs use; advance public policy in support of DCF practices
	Agri-producers & downstream actors: traders, distributors, manufacturers/brands, retail			
Key levers for transformation	Policy & stakeholder engagement	Comply with legal requirements, including forest protection laws in all soy origins	Participate in pre-competitive coordination to support sector-level transformation	Lead pre-competitive coordination, civil society partnerships, trade associations & policy advocacy to catalyze food system-level transformation
	Business strategy	General commitment to DCF practices & sourcing in direct operations & supply chain. Improve traceability of direct & indirect supply	Time-bound, quantitative commitment to DCF practices & sourcing for all volumes, with regular progress reporting. Investments in farmer incentives for DCF practices & outcomes	Time-bound, quantitative, verifiable commitment to DCF practices & sourcing for all volumes, in line with science-driven target dates, with clear & accepted cutoff dates prior to the commitment's issuance & with regular progress reporting
	Illustrative commitments	Work to eliminate deforestation & conversion activities in our direct supply chain & engage indirect supply chain to implement traceability & DCF practicesPublish our full soy suppliers list by 2024. Achieve at least 90% RTRS certified soy sourcing by 2024 & 100% by 2025	Eliminate deforestation from soy production in [sourcing region X] by 2025; support the protection of non-forest ecosystems in compliance with relevant local legislation. By the end of 2023, develop sector definition(s) that can enable the implementation of no-conversion policies	Eliminate deforestation by 2025 with a 2020 cutoff, and conversion by [year X] with a cutoff date of [year Y] in our direct & indirect supply chains, with credible third-party verification
	Key references	Jurisdictional policies in countries of origin; **Brazilian Forest Code regulation**; **EU Deforestation Free Regulation**; **Round Table on Responsible Soy certification**	**Agriculture Sector Roadmap to 1.5°C**	**Accountability Framework initiative**; **CGF Forest Positive Coalition - Soy Roadmap**; **SBTi-FLAG targets**; **SBTN-Land targets**

Action 2: Reduce negative impacts and regenerate farm ecosystems through improved farming outcomes

Agri-food companies should deploy and support a complementary set of actions on and around farms (meaning at the landscape level) in order to reduce and ultimately end nature-negative outcomes and restore healthy farming ecosystems. Stakeholders use numerous concepts and terms today; in this guidance we consider sustainable intensification (primarily as a means to reduce negative impacts), regen-ag (as a means of improving on-farm natural ecosystems), and agroecology (as an overarching concept which also incorporates critical social considerations). See **Annex 5** for key resources and **Annex 6** for a full glossary.

Avoid and reduce: Sustainable intensification refers to production systems that "increase productivity without adverse effect on natural resources, enhancing climate change resilience and input-use efficiency."[33] This includes well-proven precision agriculture practices such as improving irrigation efficiency, 4R (right source, right rate, right time, right place) nutrient stewardship[34] and integrated pest management (IPM).[35] Sustainable intensification is an essential component of the nature-positive transformation. In order to halt land-clearing, restore landscapes and sustainably meet regional food security needs, it is vital to produce "more with less": less use of land, water and energy; more efficient use of fertilizers and reduced risk from hazardous pesticides; and reduced overall negative pressure on nature and climate.

Regenerate: The One Planet Business for Biodiversity (OP2B) partnership defines regen-ag by linking agroecological principles with climate and social imperatives in "a holistic, outcome-based farming approach with measurable net-positive impacts at farm and landscape level on soil health, biodiversity, climate, water resources, and farming livelihoods. It aims to simultaneously promote above- and below-ground carbon sequestration, reduction of greenhouse gas emissions, biodiversity protection and enhancement in and around farms, improved water retention in soil, reduced pesticide risk, improved nutrient use efficiency, and improved farming livelihoods."[36]

Thus regen-ag is both a climate mitigation and adaptation strategy, by increasing farm-level carbon storage while improving crop and farmer resilience to an increasingly extreme and unpredictable climate. Common practices gaining momentum across regions and crop systems include conservation tillage or no-till, diverse crop rotation, cover cropping, integrated crop-livestock-forestry systems (ICLFS) and using bio-based agri-inputs.[37]

Agri-food companies should support sustainable intensification and regen-ag implementation as they aim for holistic nature-positive outcomes, which typically require a multi-year transition at the farm-level. Specific practices must be highly context-oriented, and high-quality technical support is critical; certain activities appropriate for some landscapes (such as specific cover crops), will be ineffective or even ecologically damaging in others.

Trade-offs & watch outs: This space is evolving quickly, with terms and concepts used disparate ways. Companies should aim for nature-positive, context-appropriate *outcomes*, regardless of terminology. However, incentivizing specific *practices* may also be necessary, as farmers cannot control all outcomes year-to-year at the farm-level. And the transition to regen-ag specifically can bring lower yields and higher costs in the initial years, before ultimately leading to improved outcomes in both areas (see **new research** from OP2B and BCG). All stakeholders – agri-food companies, financial institutions, policymakers and technical specialists – must collaborate to support farmers in the transition.

"4R Nutrient Stewardship (is) promoted in different parts of the world as a set of nutrient management guidelines that seek to be more efficient and site-specific about what form and how, when, where, etc., nutrients are applied. They offer a potential win-win situation of greater agricultural productivity and efficiency combined with decreasing negative environmental responses, through less percolation into ground water, run-off into waterbodies, drift into nearby ecosystems, and so on."

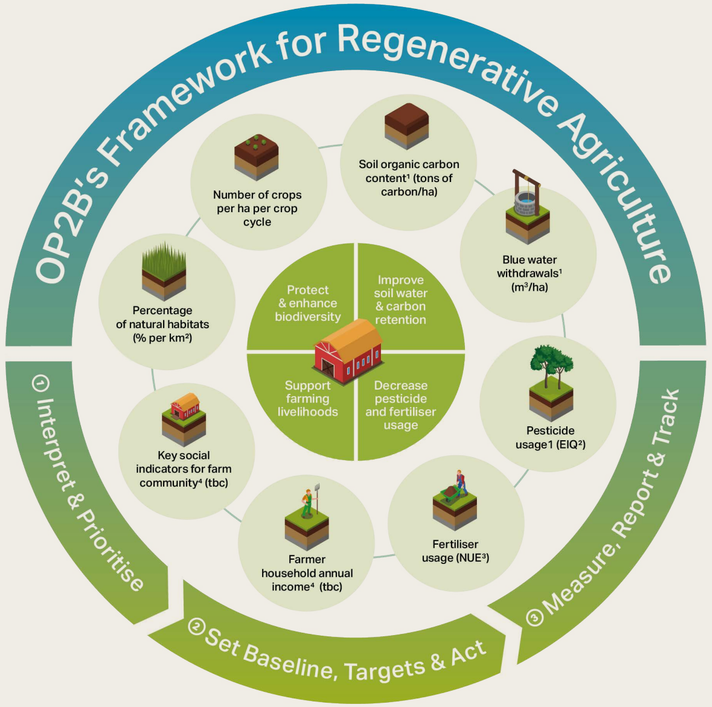
Scientific Panel on Responsible Plant Nutrition, Achieving nature-positive plant nutrition: fertilizers and biodiversity

Improving farming practices aligns with SDGs 2, 6, 13, 14 & 15, GBF targets 1 & 2, SBTN Land targets 2 and 3 (beta), SBTN Freshwater targets on water quantity and water quality. This topic is also the main focus of this Roadmap's deep dive on corn production in the Upper Midwest region of the US.

"Regenerative farming is not an exact science. The right practice on farm varies from field to field and day to day, let alone from region to region and crop to crop. Creating a clear, costed, business case is challenging. As a result, we must accept ambiguity and make decisions based on the balance of evidence, not precise costs and valuations. If not, progress will remain slow."

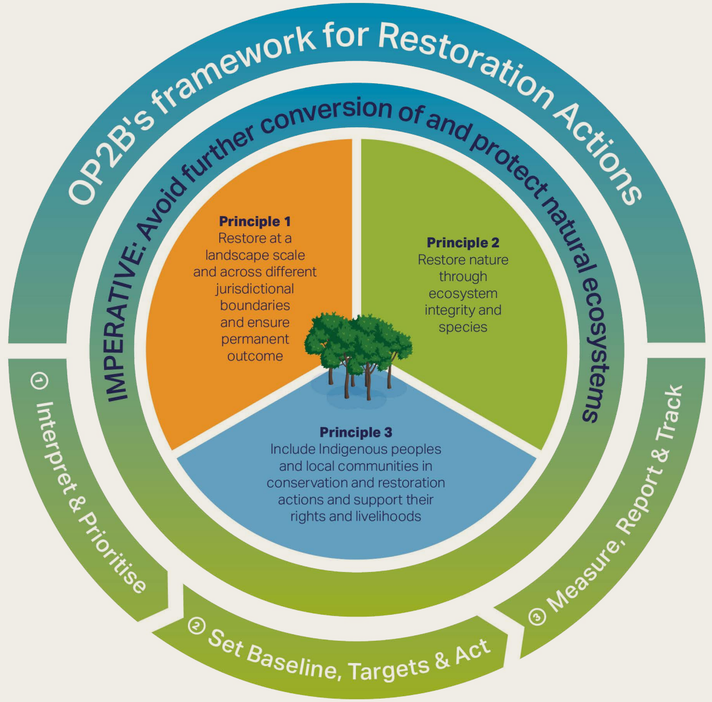
Sustainable Markets Initiative (SMI) Agribusiness Task Force report

Figure 14: A regenerative agriculture framework including outcomes, metrics and process steps



Source: One Planet Business for Biodiversity (OP2B), Regenerative Agriculture framework

Figure 15: An agricultural restoration framework that includes core principles and process steps



Source: One Planet Business for Biodiversity (OP2B), Framework for Restoration Actions

→ ***For more, see*** the Transforming Agriculture chapter of WBCSD's Food & Agriculture Roadmap, the Food and Agriculture Organization of the United Nations (FAO) Agroecology Knowledge Hub and the OP2B Regenerative Agriculture framework.

Action 3: Restore high-priority landscapes and build farmer livelihood resilience

As defined by the SBTN, a landscape approach implies "collaboration of stakeholders within a defined natural or social geography, such as watershed, biome, or company sourcing area, [seeking to] reconcile competing social, economic, and environmental goals [by building] consensus across different sectors."[38] This reflects an understanding of farms as an active part of local ecosystems, communities and cultures, recognizing they both rely on critical ecosystem services (such as water supply and nutrient cycling) and create impacts (such as water and air pollution) beyond the farm boundary. Agri-food companies should embed landscape approaches as a guiding theme in their nature-positive strategies.

Restore: Specifically, companies can invest in landscape protection and restoration projects within and beyond their value chains, with a particular focus on areas of high conservation value. According to OP2B, "restoration focuses on halting and reversing ecosystem degradation and recovering biodiversity. Restoration and regeneration are not mutually exclusive and can take place in the same project."[39] Common practices include restoring peatlands and wetlands, native species reforestation and connecting critical wildlife habitats. This can include setting aside a portion of farmland for natural vegetation (so-called "land sparing"), as well as collaborative projects in farm-adjacent areas (see Figure 16).

Importantly, landscape approaches include the socio-cultural aspects linked with and affected by agri-production. Consultation and collaboration with Indigenous Peoples and local communities (IPLCs), including farmers, is critical to ensuring outcomes that are ecologically beneficial and socially equitable.

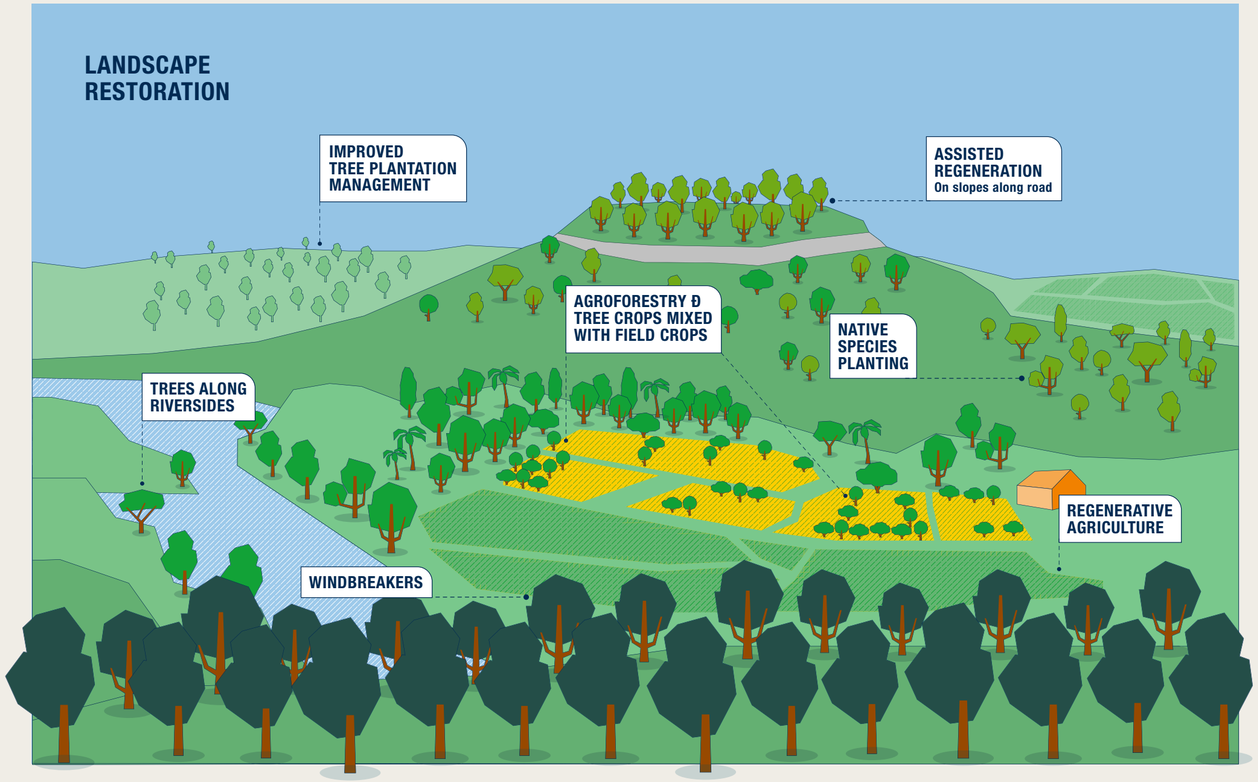
Landscape approaches align with SDGs 2, 13 & 15, GBF targets 1 & 2, SBTN Land targets 2 and 3 (beta) and link to farmer livelihoods, the main focus of this Roadmap's deep dive on rice production in the Mekong Delta region of Vietnam.

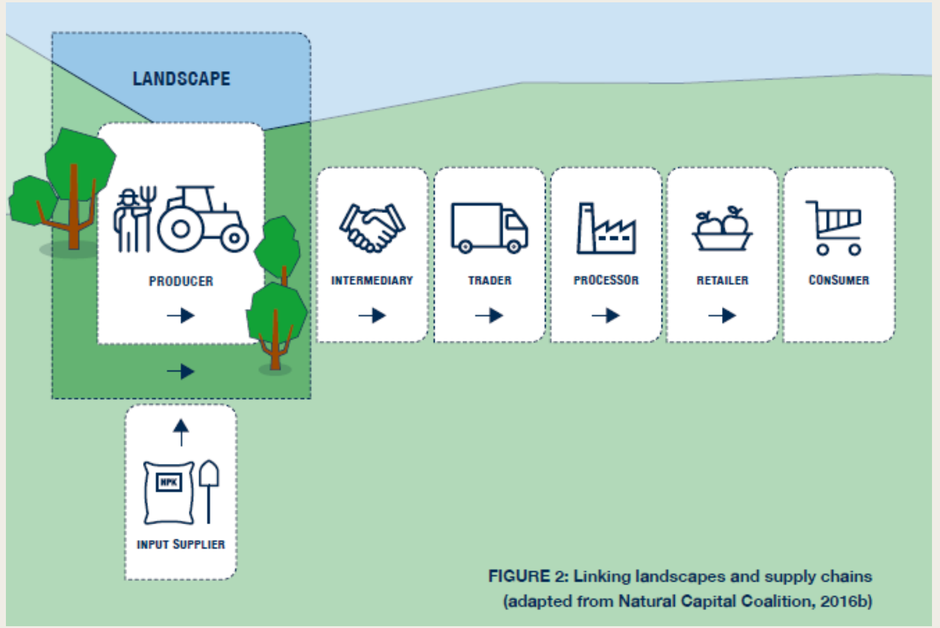
For more, see the UN Decade on Ecosystem Restoration, the International Union for Conservation of Nature (IUCN) and Food and Land Use Coalition (FOLU) Guide to investing in landscape restoration to sustain agrifood supply chains, the Equitable Livelihoods chapter of WBCSD's Food & Agriculture Roadmap, and the Indigenous Knowledge Circle's Beyond Conservation: A Toolkit for Respectful Collaboration with Indigenous Peoples.

Leading practice: The Consumer Goods Forum's Forest Positive Coalition of Action has developed a portfolio of landscape projects for priority investment by its global corporate members and partners, with the objectives of taking action and collaborating with stakeholders in areas equivalent to the coalition's combined production base footprint and using their influence to catalyze the wider transformation. The portfolio includes objectives for regenerative agriculture, habitat restoration and advancing human rights in high-priority global landscapes for deforestation risk, and includes annual progress reporting for continual learning and improvement over time.

Trade-offs & watch outs: Landscapes are complex interconnected systems; initiatives can require significant time, and resource investment and outcomes may take years to materialize. Further, impact measurement and attribution can be challenges, especially for projects beyond the farm level. Landscape engagement must not be a "tick-the-box" exercise; it requires a considered, careful approach in partnership with technical experts and farmer and community voices to deliver nature-positive outcomes and avoid greenwashing risk to companies.

Figure 16: Landscape restoration practices in IUCN and FOLU investment and implementation guidance





Source: IUCN-FOLU, Guide to investing in landscape restoration to sustain agrifood supply chains

→ ***For more information, see key resources from the*** Food Loss + Waste Protocol, WWF and the Ellen MacArthur Foundation.

Action 4: Reduce food loss and waste throughout the value chain

Reducing food loss and waste represents a massive opportunity for the agri-food sector to reduce pressures on nature. Today, roughly one-third of food production is lost or wasted along the value chain, accounting for some 8% of global GHG emissions and around one-quarter of the water used in agriculture. Crop-land greater than the size of China is used to produce food that is lost or wasted. This situation results in nearly one trillion US in economic losses each year.

Reducing food loss and waste, according to The Food Loss + Waste Protocol, "can generate a 'triple win': it can help feed more people; it can alleviate pressure on water, land, and climate; and it can save money for farmers, companies, and households."[40] The Protocol points to analysis of 1,200 business sites across 17 countries, which found that 99% saved money by reducing food loss and waste, with half achieving a 14-fold or greater financial return on investment.[41] Indeed, new scenario modeling shows how efforts could reduce food loss and waste (with an emphasis on the consumption end of the value chain) by 23% by 2050.[42]

As outlined by the Ellen Macarthur Foundation, agri-food companies up and down the value chain should lead through a variety of actions, including:

- → Reducing post-harvest on-farm losses and repurposing waste streams (e.g., for organic fertilizers);
- → Matching food volumes to demand and preventing edible food waste through improved logistics and infrastructure;
- → Redistributing surplus edible food – including through direct farm-to-consumer channels;
- → Redesigning manufacturing to use edible byproducts from food production and making use of "ugly" produce as ingredients.[43]

Companies can also leverage their significant marketing power to educate consumers and stakeholders on ways to prevent and reduce food loss and waste through their shopping, consumption, and waste management habits.

Reducing food loss and waste aligns with SDG 12, GBF target 16, and SBTN Land target 2 (beta).

Leading practice: In 2022, IKEA cut food waste by 54% across all restaurants globally by using artificial intelligence technology to address waste points in operations and making surplus food available for discount. This is equivalent to more than 20 million meals, avoids 36,000 tons of GHG emissions annually and saves IKEA an estimated US $37 million each year.

Stage 2.3 - Transform the system

Identify further actions to transform the system

Why do this:

Individual company actions alone will not deliver nature-positive outcomes. Therefore, companies should also consider what further actions they can take in their value chains, priority landscapes and in the broader enabling environment to encourage collaboration with other stakeholders, and transform the parts of the system that they are embedded in.

What to do:

→ Consider what the key barriers to speed and scale up action are (such as a lack of supporting government policies, financing, technology);

→ Consider trade-offs (such as balancing conservation priorities against regional food security needs) and what collaborative actions can be taken to address these;

→ Identify who needs to do what to address the systemic barriers and plan to engage with stakeholders, such as peers in the sector, suppliers, those in operational or priority sourcing landscapes;

→ Advocate for a supportive enabling environment, such as publicly demonstrating support for key policies and financing for infrastructure, institutions and technology.

Creating a nature-positive agri-food system is a massive undertaking, requiring an unprecedented level of collaboration. Agri-food companies must evolve their own strategies and partner across spheres of influence to drive system transformation. Five key levers and two enabling themes can advance this transformation:

Lever 1: Farmer engagement – Build trust, develop attractive incentives and deliver high-quality technical support to de-risk the transition for farmers.

Lever 2: Business strategy and market development – Rethink business models to drive nature-positive outcomes that promote soil health, recover biodiversity and support farmers' livelihoods.

Lever 3: Financing – Develop flexible and inclusive financing approaches to catalyze agri-food system transformation, particularly focused on farmer needs.

Lever 4: Public policy – Advance local, national and global public policies and regulations to transform the agri-food system toward nature-positive outcomes and ensure alignment with the GBF and Paris Agreement.

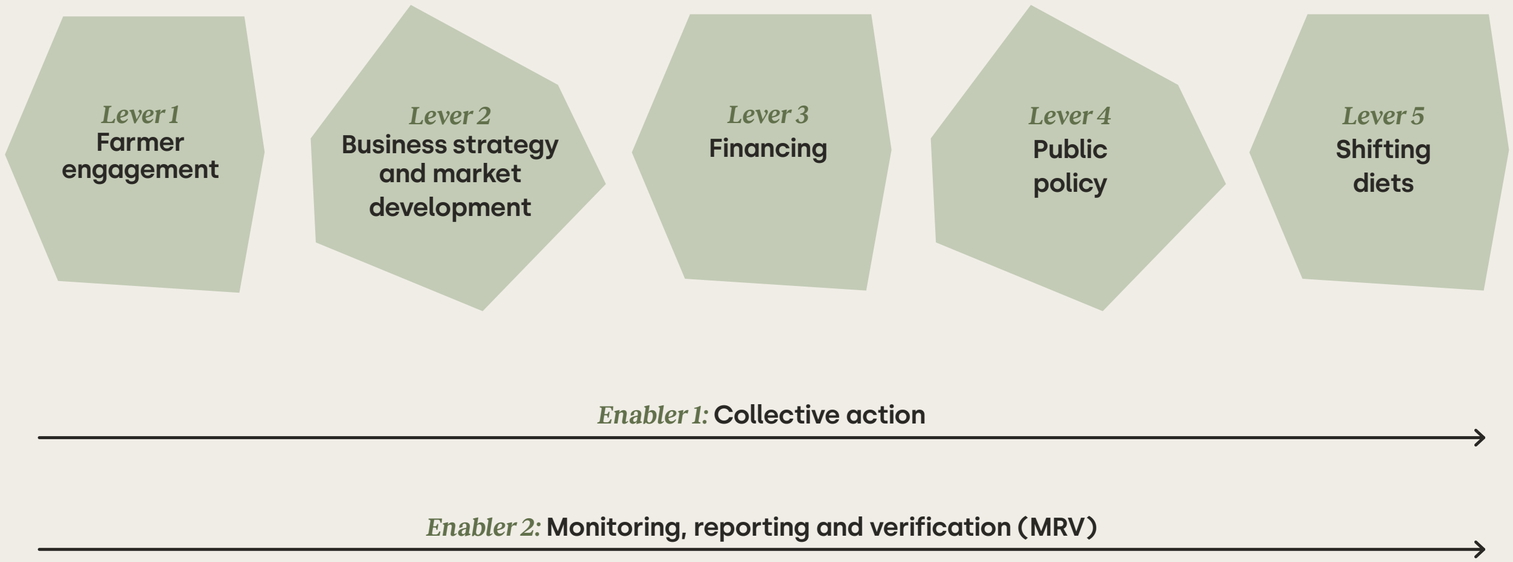
Lever 5: Shifting diets – Promote and enable nutritious, sustainable diets.

Enabler 1: Collective action – Convene and align stakeholders across the private, public and civil sectors for maximum impact.

Enabler 2: Monitoring, reporting and verification (MRV) – Align on metrics and methods, accelerate measurement and reporting technologies.

Figure 17: Key levers and enablers for system transformation

Farmer engagement must underpin a nature positive agri-food system



Lever 1: Farmer engagement

Build trust, develop attractive incentives and deliver high-quality technical support to de-risk the transition for farmers

As custodians of productive lands, the world's roughly 500 million farmers are on the front lines of nature-related pressures and opportunities. Farmers are the essential link between policy- and market-driven commitments and investments and real change on the ground; their livelihoods are inherently tied to nature and the ecosystem services outlined in this guidance. Improving farmer livelihoods is a moral imperative – especially for smallholder and subsistence farmers (we explore improving smallholder livelihoods more fully in the deep dive on rice production in the Mekong Delta region of Vietnam) – but also critical for driving nature-positive outcomes at the farm level. Farming is an inherently risky business, with many factors outside the control of farmers; without the means and know-how to improve practices, stakeholders cannot expect farmers to change the mindsets and behaviors that have been in place for generations, overnight.

Agri-food companies up and down the value chain must recenter their efforts on farmers as partners and changemakers. As outlined by OP2B, "These risks cannot be borne exclusively by farmers. We must find new and better ways to support farmers through consolidated financial, technical, and educational support systems that both de-risk farmers' efforts to move toward more regenerative landscapes and secure the longevity of these impacts on our ecosystems."[44]

- → Financial: Famers need financial incentives aligned with the costs and risks borne at the farm level in order to adopt nature-positive practices. Companies can support farmers through improved business practices (such as sourcing and contracting mechanisms, innovative inputs and monitoring services, and more). Financial institutions – lenders, insurers and investors – also play a critical role (see following sections).
- → Structural: Land tenure can be a major barrier – or enabler – for improving practices at the farm level. In the US Upper Midwest for example, nearly half of corn and soy farmers today are non-owning tenants, often with limited ability to adapt their practices without landowner support. This can disproportionately affect historically marginalized groups (i.e., women and racial minority farmers) who also face a history of discrimination in public lending programs.[45]
- → Technical: Businesses, public agencies and other experts must collaborate to deliver high-quality technical training to address the knowledge gap so that nature-positive practices can be scaled beyond a relatively small group of leading producers today.
- → Trust: None of these tactics will move the needle unless farmers trust the institutions and methods behind them. Critically, farmers across landscapes express that they often learn best *from each other*. Business can facilitate peer learning opportunities to build a movement to nature-positive farming that is based on science and locallz supported.

"A lot of it comes down to cash. We need incentives to enter into unpredictable practices, either by supporting additional equipment and/or the input difference."

***US farmer, as quoted in the Sustainable Markets Initiative Agribusiness Task Force's* Scaling Regenerative Farming: An Action Plan report**

Leading practice: ADM's **Midwest Cover Crop program**, in partnership with USDA Natural Resources Conservation Service and National Fish and Wildlife Foundation, catalyzes the adoption of cover crops by corn and soybean farmers in the US Midwest. In its first year the initiative has awarded over US $2.5 million for targeted outreach and technical assistance to farmers, supporting the development of four-year contracts with farmers for cover crop plantings and monitoring and reporting environmental and economic outcomes.

"Businesses need to be supporting enabling environments for farmers to transition management practices – one of the big missing pieces is direct regional investment in technical assistance, whether through extension services, local NGOs, or shared positions with ag-retail/ ag-co-ops."

Regen-ag expert in Minnesota

→ ***For further reading,*** see the Equitable Livelihoods chapter of **WBCSD's Food & Agriculture Roadmap**, the **Just Rural Transition's Principles for Just Food System Transitions**, the SMI Agribusiness Task Force's **Scaling Regenerative Farming: An Action Plan** report, and the **World Farmers Organisation**.

Lever 2: Business strategy and market development

Rethink business models to drive nature-positive outcomes that promote soil health, recover biodiversity and support farmers' livelihoods.

The global agri-food system has massive market power, with over US $3.5 trillion in annual value-add, comprising around 4% of global GDP.[46] Planet Tracker estimates that six priority actions in land-based agri-food supply chains can provide over US $1.5 trillion in economic benefits.[47]

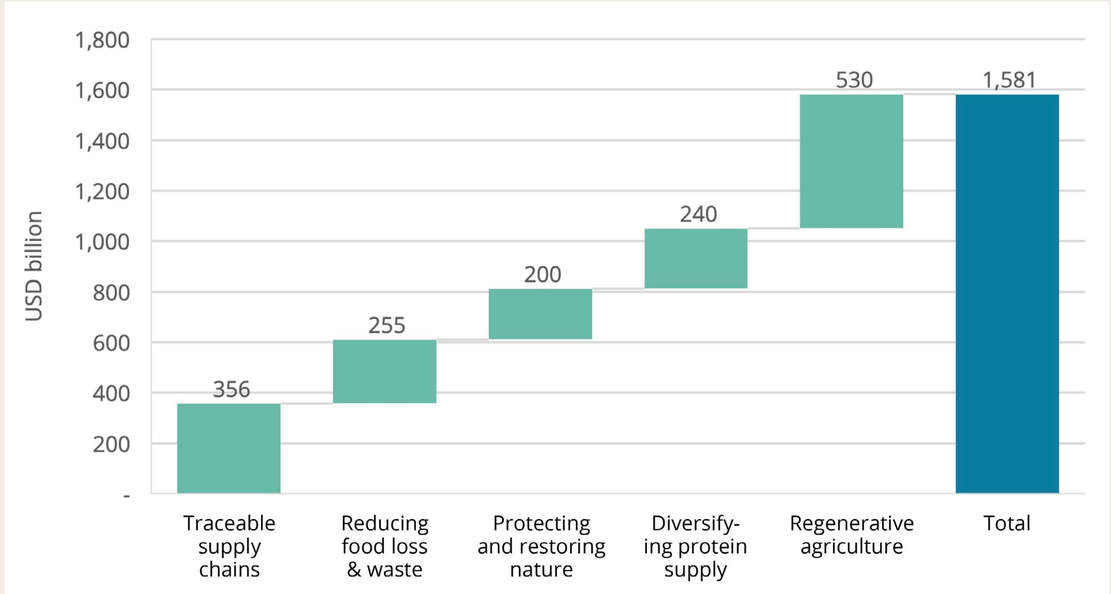
Specifically, companies up and down the agri-food value chain can lead by:

- → Advancing nature-positive and farmer-centered business strategies, including paying premiums for verified (DCF, regenerative) nature-positive crops, developing longer-term, flexible contracting mechanisms and providing innovative inputs and support services for improved farming practices;
- → Collaborating with private-sector peers, public agencies and research universities to deliver high-quality technical assistance through extension service programs and demo farms;
- → Supporting the development of technologies to improve farm-level data monitoring, reporting and verification (MRV) and supply chain traceability;
- → Supporting the development of robust, credible and transparent markets for NbS;
- → Influencing customers and end-consumers towards nature-positive products, plant-based dietary shifts and food waste reduction.

There are already many examples of such practices, but it is imperative to scale them massively in the coming years. This will require more than simply investing: it will require a fundamental pivot in business strategies to align with long-term nature-positive objectives. This means shifting how companies create, deliver and capture value: from research and development, to marketing, to sourcing practices, to governance and accounting structures and principles.

Figure 18: The economic benefits of priority actions in land-based agri-food supply chains

Planet Tracker estimates that six priority actions can provide over US $1.5 trillion in economic benefits



Source: Planet Tracker, Financial Markets Roadmap for Transforming the Global Food System

→ ***For more, see the section on*** Farmer engagement and other complementary sections of this guidance and Annex 3 for the full matrix of recommended priority actions, organized by value chain stages and including illustrative indicators and trade-offs/barriers.

Leading practice: Global food leaders and OP2B members **Danone**, **Nestlé** and **Unilever** have each developed extensive guidance and sourcing protocols to support improved farming practices. **PepsiCo** has committed to scaling regen-ag across seven million acres by 2030, equivalent to its entire agricultural footprint – through investments, partnerships and direct farmer engagement. And **Bayer CropScience** aims to drive regen-ag on more than 400 million acres over the next decade – through bio-based seeds and inputs, on-farm services and more.

Leading practice: **The Ellen MacArthur Foundation's Big Food Redesign** examines the role consumer goods companies and food retailers can play in creating a food system with significant positive impacts for business, people, and the environment. It explores the ways in which food products can be designed in closer collaboration with farmers, for nature. It applies the principles of the circular economy and across all dimensions of food design - from product concept, through ingredient selection and sourcing, to packaging.

Nature-based solutions

Nature-based solutions (NbS), broadly defined as "actions to protect, conserve, restore, sustainably use and manage natural or modified ecosystems, which address social, economic and environmental challenges,"[48] are an emerging tool that agri-food companies can use to advance their commitments. To achieve our Vision 2050, "NbS need to become integral parts of every company's strategies for climate, nature, and addressing inequality – reflecting their status as one set of solutions that delivers impact across all three imperatives."[49]

Agri-food companies can leverage NbS to take leading action within their spheres of control and influence in line with the outcomes of their materiality assessments – as a key means of empowering and incentivizing farmers and other value chain actors towards nature-positive farming, landscape restoration, avoided deforestation/conversion and more, both within and beyond a company's value chain. In this way, NbS incorporates many of the approaches within this guidance.

Ultimately farmers must be at the center; current schemes (such as on soil carbon compensation) can be insufficient to cover implementation and MRV costs, leaving most farmers out of the picture and damaging the reputation and future potential of NbS programs. Further reputational damage stems from allegations of corporate greenwashing. Companies, financial institutions and regulators all have interconnecting roles to play to ensure an effective, science-driven and equitable NbS landscape in the coming years.

Trade-offs & watch outs: Several enabling mechanisms and financial options are emerging, such as insetting and voluntary markets. These are developing rapidly and companies should proceed with caution, following best practices for implementation (particularly for market-based engagement).

"The rapid emergence of voluntary carbon markets operating at different (temporal and geographic) scales [has] focused on the demand side and the interests of buyers. There has been limited consideration of the supply side and the interests of farmers. This imbalance has presented farmers across the world with uncertainty regarding the range of risks and opportunities."

World Farmers' Organisation Position on Carbon Markets

Figure 19: Co-benefits stemming from natural climate solutions

Natural climate solutions - as a prominent subset of NbS - present substantial climate mitigation potential, often bringing co-benefits for ecosystems and communities.

Source: Griscom, B. et al. (2019) We need both natural and energy solutions to stabilize our climate, Global Change Biology.

→ ***For more,*** see the IUCN Global Standard for Nature-based Solutions, WBCSD's The role of NbS in strategies for Net Zero, Nature Positive and addressing Inequality and the Natural Climate Solutions Alliance.

Lever 3: Financing

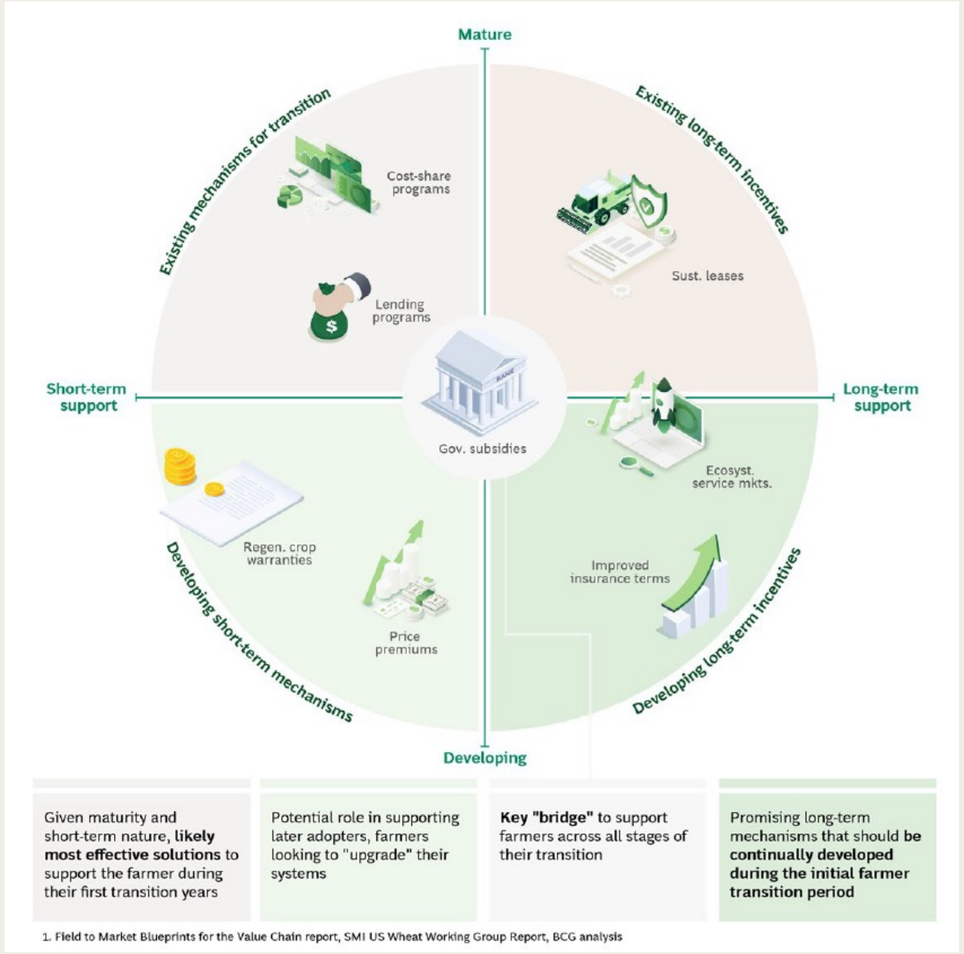
Develop flexible and inclusive approaches to catalyze agri-food system transformation, particularly focused on farmer needs

Financial institutions have "a major role to play in supporting and driving the required transformation of the food system," with nearly US $9 trillion of private finance currently invested, and capacity for another US $630 billion annually.[50] This presents a significant opportunity to contribute to the more than US $200 billion estimated to be needed to meet the GBF 2030 targets.[51]

As financial institutions are corporate actors themselves, they must transform their own strategies and practices to catalyze system transformation. In general, there is a need for better understanding of, and commitment to, farmer realities on the ground on the part of the finance sector. There are distinct considerations for different types of financial institutions:

→ Lenders and insurers should develop farmer-oriented products that incentivize nature-positive practices. These may include flexible financing and blended finance mechanisms, crop warranty programs and improved insurance terms that support the transition to regen-ag.

Figure 20: The spectrum of actions for financial players to accelerate the regen-ag system transformation



Source: OP2B and BCG, Cultivating farmer prosperity: Investing in regenerative agriculture

→ ***For more,***
see the Financial Markets Roadmap for transforming the Global Food System from Planet Tracker, the UN Environment Programme Finance Initiative (UNEP-FI), the UN Principles for Responsible Investment (PRI) and the Partnership for Biodiversity Accounting Financials (PBAF).

- → Investors can influence practices by shifting capital – both debt and equity – to companies and landowners leading the transition. Investors also have a broader societal role to play in influencing consumer behaviors toward nature-positive investment practices and portfolios.
- → Landowners (whether farmers themselves, other persons or corporate entities) ultimately decide what happens on the land and thus are a critical stakeholder in the financial considerations for system transformation.

The **TNFD** plays a key supporting role by standardizing finance-oriented disclosures on nature-related topics, including sector-specific guidance.

Leading practice: Global agri-business lender **Rabobank's Carbon Farming partnership** supports farmers in the transition to a future-proof food production system by paying them for regen-ag outcomes. The bank and its client farmers set up a regenerative farming plan, monitor practices and soil carbon levels over time, and monetize the carbon credits to provide a new revenue stream to the farmer. Linking farmers directly to carbon markets can help accelerate the transition to regenerative farming at scale. Pilots are underway today with US row crop farmers, with plans to scale in the coming years.

Lever 4: Public policy

Advance local, national and global public policies and regulations to transform the agri-food system toward nature-positive outcomes

The global agri-food sector receives over US $700 billion in public support each year, but most of this funding does not address the global nature, climate and nutrition crises.[52] Agri-food companies are massively influential, spending hundreds of millions of dollars annually on lobbying activities. Businesses and trade associations must channel this power to advocate for nature-positive outcomes: improved land-use and farming practices, slashing pollution, reducing supply chain GHGs, reducing loss and waste throughout the system and more. Key levers can take the form of science-driven regulations, green subsidies, tax schemes, public-private partnerships and public-funded research. As the Nature Conservancy notes, "by realigning incentives, the public sector can change the economics that drive change."[53]

Global level

The GBF, agreed at 15th United Nations Biodiversity Conference (COP15) in 2022, established the global direction of travel, including several targets of particular relevance for the agri-food sector related to sustainable production, the protection of 30% of land and water, reducing environmentally harmful subsidies, and reducing by at least half pollution risks from excess nutrients, pesticides and highly hazardous chemicals.

National level

The GBF will drive implementation at the national level – mainly through National Biodiversity Strategies and Action Plans (NBSAPs) – which should seek alignment with Nationally Determined Contributions (NDCs) for climate and national food system transformation pathways. Major nature-positive policies are under development and implementation, including:

- EU: European Green Deal, Biodiversity Strategy, Farm to Fork Strategy, Nature Restoration Law, Deforestation Regulation, Soil Health Law, Corporate Sustainability Reporting Directive (CSRD)
- US: Inflation Reduction Act, United States Department of Agriculture (USDA) Partnerships for Climate Smart Commodities
- Brazil: Native Vegetation Protection Law ("Forest Code") & Cadastro Ambiental Rural (CAR) - Brazil's Rural Environmental Registry
- Vietnam: Resolution 120 – Adapting to Nature, One Million Rice hectares scheme

It will be critical that jurisdictional policies align around common objectives and approaches, as otherwise any impact will remain limited to country borders and bilateral trade arrangements (at best), and likely cause confusion and market fragmentation rather than nature-positive outcomes. Furthermore, producer countries with high coverage of natural ecosystems will require compensation for the opportunity cost of exploiting them (i.e., under DCF policies), particularly when going beyond legal requirements.

Local level

Global and national policies have local implications. It is essential to structure the approaches described above to support farmers in meeting strict requirements or accessing new types of incentives. Corporate actors should also advocate for public investment in local agricultural extension services, and contribute their knowledge and resources to help deliver high-quality technical assistance to farmers in order to support the nature-positive transition.

Companies should advocate at all levels for better and more consistent enforcement of existing environmental regulations and standards, particularly in jurisdictions where this is lacking. Corporate leadership is also critical for the advancement and consolidation of nature-related voluntary frameworks establishing norms on concepts, definitions, methodologies (such as for alignment on regen-ag metrics and DCF baselines and cutoff dates) and reporting. See Annex 4 for a table of the leading nature-related frameworks of relevance for land-use companies.

Leading practice: Business for Nature and its partners have mobilized hundreds of leading companies in recent years to successfully advocate for transformational policies like the Global Biodiversity Framework and the EU Nature Restoration Law.

→ ***For more, see the*** Policy Recommendations chapter of WBCSD's Food & Agriculture Roadmap, Just Rural Transition's Case for Repurposing Public Support to Agriculture, and the Food Systems Partnership. The landscape deep dives linked to this guidance include further exploration of context-specific policy levers.

Lever 5: Shifting diets

Promote and enable nutritious, sustainable diets

The science is clear that food consumption habits must shift dramatically in order to bring about a nature-positive system. As outlined in the EAT-Lancet Commission's findings, "achieving planetary and human health by 2050 will require more than doubling the consumption of plant-based foods such as fruits, vegetables, legumes and nuts, and a greater than 50% reduction in global consumption of added sugars and red meat."[54]

Over three-quarters of agricultural land globally is used to produce meat, dairy and other animal-based foods, including both pasture land for grazing and cropland for growing ingredients for animal feeds.[55] Row crop commodities, including soy and corn, are primary ingredients in feed for cattle, poultry and other animals raised for meat; thus an overall reduction in meat consumption is a key lever for improving the environmental footprint of these crops and also for opening up more lands for nature restoration – in alignment with the **GBF** and **SBTN-Land targets (beta)**. However, the transition must take into account key regional differences: industrialized countries consume the lion's share of meat and dairy,[56] while nutrient deficiency continues to hamper many developing nations.[57]

Agri-food companies have an opportunity to shift their business models and practices towards nutritious and sustainable diets through product development, marketing and partnerships. This links directly to delivering incentives to farmers for crop diversification and cover cropping, such as with nitrogen-fixing legumes.

Examples include:

- → Increasing consumption of whole foods, including whole grains and legumes as essential protein sources;
- → Further innovation and scaling of plant-based meat alternatives and lab-grown meats, building on significant growth in the early 21st century;[58]
- → Partnering with chefs and influencers to scale new, sustainable food trends.

It will be critical that jurisdictional policies align around common objectives and approaches, as otherwise any impact will remain limited to country borders and bilateral trade arrangements (at best), and likely cause confusion and market fragmentation rather than nature-positive outcomes. Furthermore, producer countries with high coverage of natural ecosystems will require compensation for the opportunity cost of exploiting them (i.e., under DCF policies), particularly when going beyond legal requirements.

Leading practice: **Beans is How** is a multistakeholder campaign to "fix the future by doubling global bean consumption by 2028." It partners with food companies, chefs and other influencers to shift the mindset on beans as a delicious, nutritious and planet-friendly dietary staple.

Figure 21: The planetary health plate

The planetary health plate should consist of mainly plant-based foods.

Source: EAT-Lancet Commission, **EAT-Lancet Commission Summary Report**

→ ***For more,*** see WBCSD's Healthy & Sustainable Diets workstream and its **Shifting behaviors toward plant-forward foods: A toolkit for food businesses**.

Enabler 1: Collective action

As outlined in WBCSD's **CEO Guide to Food System Transformation**, "transformational leadership beyond your own business is increasingly important; champions are needed to help other businesses, as well as governments, raise ambitions and take action." Companies bring massive technological know-how and financial power to scale solutions but they cannot act in isolation – systemic challenges require solutions built on a foundation of collective action.

Agri-food companies should promote landscape approaches as the unifying theme around which stakeholders from the private, public and civil sectors can align objectives and efforts. IUCN and FOLU note that landscape approaches aim to "regain an integrated landscape that balances the trade-offs between productive versus protected functions and the provision of different ecosystem services."[59] This holistic approach must be the foundation for advancing the global objectives of the GBF with context-appropriate commitments and actions.

Collective action may take the form of location-based multistakeholder initiatives (such as to protect and jointly manage a collective water resource) but the principle also applies to supply chain collaboration (for example, among seed companies, farmers and commodity traders), policy advocacy, research efforts and more.

Leading practice: The Consumer Goods Forum's **Forest Positive Coalition of Action** drives collective, transformative change to remove deforestation, forest conversion and degradation from key commodity supply chains and support forest-positive businesses. The group includes 21 of the world's largest brand-owners and retailers and engages with more than 150 stakeholder groups. The coalition's commodity-specific approach facilitates collaboration with partnerships like the Tropical Forest Alliance (TFA) and the Soft Commodities Forum whose members have developed an **Agriculture Sector Roadmap to 1.5°C** with landscape-specific recommendations and commitments for soy production in the Cerrado, Brazil, among other high-priority global landscapes.

Enabler 2: Monitoring, reporting and verification (MRV)

As the saying goes, "You can't manage what you can't measure." This rings especially true in the nature-positive space, with multiple varied and overlapping dimensions of natural, human and other forms of capital. An inherent challenge is the lack of a single fungible unit for nature – unlike for climate, where accounting protocols are aligned on the concept of a CO_2-equivalent (for more on nature metrics generally, see the **Capitals Coalition** and the **EU ALIGN project**).

Monitoring, reporting and verification (MRV) typically refers to tracking the climate-related impacts of land-use activities, including on-farm soil carbon storage effects of regenerative practices, for example. In recent years the concept has expanded to encompass broader benefits for nature and livelihoods but much work remains to align stakeholders on principles, metrics, methods and technologies. Note that a next phase of this guidance will align with various WBCSD workstreams on defining and harmonizing metrics for critical action areas, including regen-ag and DCF (see **Annex 3** for the full priority actions matrix, organized by value chain stages and including illustrative indicators).

In the case of nature-positive outcomes at the farm-level, there is misalignment over what to measure in the first place. As the SMI Agribusiness Taskforce outlines, "Although there is broad agreement on the principles and desired outcomes, there is no one universally accepted definition of regenerative farming."[60] Aligning on metrics across stakeholder groups will be critical to effective target-setting and monitoring progress, delivering farmer incentives and transparent public disclosures. Commonly used metrics by researchers, businesses and policymakers today include a combination of concepts related to inputs use (for example, nitrogen use efficiency (NUE) and pesticide Environmental Impact Quotient (EIQ)), soil organic carbon (SOC) content, on-farm water use, total area or percentage under regenerative practices, annual farmer incomes, and more (see the **OP2B regen-ag framework**).

For issues linked to deforestation and native vegetation conversion, MRV-related priorities include the need for stakeholder alignment on biome-specific definitions, cutoff dates and baselines, overcoming crop traceability challenges (including the cost of monitoring technologies like remote sensing) and structural barriers including the conventional practice of aggregating crops from differing origins.

Actors throughout the value chain have important roles to play, from technology companies to data scientists to conservation groups, and including the inputs, trading and food companies that have a large influence on farming practices. Social equity considerations must be a priority as this space develops to ensure all farmers can benefit from improving MRV, not only those with the greatest means and know-how.

→ ***For more,*** see the SMI Agribusiness Task Force's **Scaling Regenerative Farming: An Action Plan** report, the **MRV Platform for Agriculture** and the **Soil & Climate Alliance**.

"Access to, and integrity of, data remains a challenge, particularly in a system that includes on many millions of growers and other actors along the value chain."

Wageningen University & Research, **Nature Positive Futures**

Key trade-offs and remaining barriers

Transforming the agri-food system faces a number of trade-offs – across nature, climate and social equity imperatives – and remaining barriers to change. Here we highlight some key themes that actors throughout the value chain must continue working collectively to overcome.

Location: Opportunities to advance the nature-positive system transformation are highly location-specific. Certain practices or species may be appropriate for some landscapes but ineffective or ecologically damaging in others. Even if ecological conditions are favorable, such as for sustainable production on degraded pasture, limitations of existing transport and processing infrastructure can leave certain areas out of reach. These challenges are likely to become even more complicated and dynamic as climate change alters regional production patterns.

Producing more with less: A shift to DCF supply chains means the food system must increase the productivity of existing farmed areas, which could lead to unsustainable intensification and technology-driven displacement of farmers and farmworkers. Research suggests that increasing productivity, if inadequately implemented, can actually increase resource pressure (such as land-clearing risk), driven by increasing economic returns per hectare (known as the Jevons paradox).[61]

Nature vs climate outcomes: Regarding land-use, nature positive and net zero can be highly complementary imperatives, but it is critical to thoughtfully balance specific objectives depending on the landscape context. For example, in a landscape restoration project, maximizing climate benefit could mean introducing fast-growing non-native tree species, but this is likely to lead to poor outcomes for local ecosystems and biodiversity.

Sustainable practices vs livelihoods and food security: The shift to regen-ag, while ultimately beneficial financially and environmentally, can bring higher costs and lower yields in the short-term, with potential to hurt farmer incomes and increase global food prices and food insecurity in hunger-vulnerable regions. More efficient farming technologies may create net farmworker employment loss at local and regional levels, while small and disadvantaged farmers are less likely to benefit from technologies to increase productivity. Demand shifts (such as reduced demand for meat) can bring job losses for specific sub-sectors, even with new jobs being created elsewhere. DCF public policies and business practices can crowd out producers, even entire regions, from accessing global markets, with particularly severe impacts on smallholders.

Food vs fuel: The renewable energy transition continues to drive demand for biofuel feedstocks, creating competition with certain food crops (for instance, corn and soy) and exacerbating existing land-use pressures. There is potential for growth of "novel" biofuel crops, that can integrate with food crops rather than competing with them, but these are relatively small-scale pilots today.

Data and traceability: Misalignment on metrics, poor baseline and real-time data quality (especially in the developing world), and MRV costs and feasibility, remain barriers to speeding and scaling system transformation. Downstream companies often aggregate commodity crops of differing origins together for processing and distribution, complicating traceability efforts which can negate incentives for improved practices, causing a cost-driven "race to the bottom" and worsening nature-related impacts.

Low margins: All of these challenges require financial investment, which can be particularly difficult to attract when considering the generally low margins for row crop commodities.

→ ***Adapted in-part from the*** Principles for Just Food System Transitions from the Just Rural Transition. See Annex 3 for the priority actions matrix, including trade-offs and barriers linked with specific action areas.

→ *Stage 3: Disclose (initial disclosures)*

Nature-related disclosures help companies communicate how they are acting on nature-positive outcomes. Disclosure will directly contribute to the achievement of GBF Target 15, and will increasingly be required by both voluntary and mandatory accountability mechanisms.

Why do this:

Increasingly, companies are expected to monitor their progress and be transparent on the steps taken to advance on their nature journey. When companies disclose this information systematically, for example according to the TNFD Framework, then investors and society are able to make informed decisions about the comparative sustainability performance of companies and sectors.

Investors will judge whether a company is creating additional enterprise value through its management of nature-related risks and opportunities. They will also consider the collective actions of companies to address systemic risks. Other stakeholders may focus on the total impact of a company or sector from the perspective of a social license to operate, including its alignment with societal goals for nature. Disclosures therefore provide an opportunity for a company to highlight its nature-related strategy, the progress made on its delivery and the value it creates.

What to do:

- → Monitor progress and be transparent about the nature journey, to meet increasing expectations from stakeholders.
- → Initial disclosures can include the methodologies and outputs of a company's materiality assessment, value chain mapping, interim target-setting and progress on actions. As a company's nature journey matures, disclosure ambitions and granularity will increase. The structure of the TNFD's reporting framework reflects this reality, providing both "core" and "enhanced" disclosures across the four disclosure framework pillars.

The foundational steps to "Disclose" include:

- → Leverage existing disclosures that are relevant to nature;
- → Report on the foundational "Assess" and "Commit and Transform" stages (methodologies and outputs).

→ ***For further lessons,*** see the PwC/WBCSD joint blog post "Five things you should know about the TNFD." For further guidance and use cases, see WBCSD's TNFD pilot - Lessons from TNFD piloting with 23 global companies.

Leading practice: In 2022 British pharmaceutical leader GSK published an interim report on **Understanding impact and dependencies on nature** that includes initial highlights and lessons learned from progress on the company's nature-positive journey. This type of approach can serve as a transparent precursor to deeper reporting in the future aligned with the leading voluntary and regulatory nature disclosure frameworks.

Trade-offs & watch outs: In the dynamic nature-positive space, there is a risk businesses will commit greenwashing and so-called green "hushing" (understating their commitments and progress for fear of greenwashing backlash). Sticking closely to consensus-driven leading disclosure frameworks will help ensure a credible approach. Broad claims or ambitions related to nature positive at the enterprise level will be extremely difficult to quantify, especially for agri-food companies with many diverse nature-related issues to consider. Rather, we recommend outlining and communicating a structured approach focused on specific material topics and value chain stages.

Lessons from the WBCSD TNFD pilot

WBCSD ran a TNFD pilot for 23 member companies from September 2022 until June 2023, including 11 land-use companies. **Lessons from the TNFD pilot** showed that companies don't need to start from scratch on nature. Key insights for agri-food companies include:

→ "Started is better than perfect" – A credible approach can begin with qualitative, process-oriented disclosures, particularly if risks and opportunities have not yet been quantified or targets established. Many companies have impactful nature-related actions and disclosures underway; an important step is mapping these back against the **ACT-D high level business actions** (Assess, Commit, Transform, Disclose) to spot gaps and develop a more strategic approach. Peer learning through sector-specific forums and case studies can be highly beneficial.

→ Determine the "right" data – Agri-food value chains are long and complex: in order to gather and disclose the right data, it is important to understand what is needed and from which sources. **TNFD guidance** covers value chains and data in detail, including topics such as supply chain tiers and primary vs proxy data considerations. Key questions to consider include: what are stakeholders (financial and others) actually looking for; what is within the company's control to manage and measure; what falls within its broader spheres of influence?

→ Scenarios can be a powerful tool to map out strategy and resilience planning related to possible futures – particularly for the agri-food sector, which links so closely with land and water. While significant progress has been made for climate-related scenarios (see the **Climate Scenarios Catalogue**), nature-related models are less mature today. The TNFD includes detailed guidance on nature scenarios, and there is emerging complementary research to support this approach. For more, see the nature **scenarios published** in 2023 by the Inevitable Policy Response, commissioned by the United Nations Principles for Responsible Investment (PRI).

04. Next steps for the *Roadmaps to Nature Positive*

04. Next steps for the *Roadmaps to Nature Positive*

To support companies as they advance on their nature journeys, subsequent iterations of the Roadmaps to Nature Positive will build on the 2023 Foundations guidance, focusing on performance and accountability.

WBCSD will work with members to implement aligned measurement methods to support more detailed assessments.

The work will support WBCSD members in testing and using commonly agreed indicators for nature disclosures, both general and system-specific, with key pathways. Activities will include mapping core and enhanced **TNFD v1.0 indicators** against current member practices, and identifying and addressing gaps (including metrics for reporting on interim and science-based targets). This work will build on and connect to related indicator work within WBCSD, including **Regenerative Agriculture Metrics**, the **Wastewater Impact Assessment Tool (WIAT) Initiative**, and **Nature-based Solutions** and the **Circular Transition Indicators v4.0 (CTI)**. It will also build on the work of other related initiatives, including the **Align** project (recommendations for a standard on corporate biodiversity measurement and valuation) and the **Transparent project** (standardized natural capital accounting and valuation principles for business in line with the ambition of the **European Green Deal**).

For agri-food companies, the roadmap work going forward will link closely with WBCSD's Regenerative Agriculture Metrics workstream, which aims for widespread industry alignment on common regen-ag metrics, reporting and disclosure in the multi-stakeholder space (with leadership from **Regen10**, **OP2B**, leading businesses and other experts). **SBTN's Land** (beta) and **Freshwater targets** will be a key resource and we will learn from the experience of companies piloting the new framework.

In addition, other emerging work to support the Nature Positive Roadmaps includes:

- → Putting in place science-informed target-setting and supporting companies that are further along on their journey as they prepare to set science-based targets for nature;
- → Mobilizing resources needed for transformative actions;
- → Working with WBCSD's Equity Action imperative to clearly identify when and how to bring stakeholders effectively into corporate and landscape engagements (to be scoped);
- → Working with the WBCSD's Climate Action imperative to build on related work on actions to deliver resilient systems.

Annexes

Annex 1: Materiality assessment details

→ ***See ENCORE tool*** for further guidance on categories and definitions for dependencies assessment

Dependencies

Direct physical inputs

Groundwater and surface water are typically considered highly material inputs for agri-production, given the essential need of water for plant growth. For many row crops, however, rainfed systems are more common than irrigation, meaning less reliance on ground and surface water (see Enabling). Irrigated and flood-reliant crop systems do have very high dependence on water as an input, corresponding to their significant water-related impact. For the commodities assessed, surface water was the more common source for irrigation, although groundwater use is increasing in some regions. Grain processors and food manufacturers can have high dependence on water (often from municipal sources) for industrial operations and in their products.

Enabling

Soil quality has very high materiality for agri-production, as nutrients, fertility, soil structure and other attributes directly impact crop yield and quality. Nutrient cycling by soil-borne organisms such as earthworms is a key contributor to soil health.

Water flow maintenance has very high materiality for agri-production, especially for rainfed commodities. This ecosystem service is closely linked with water as a direct input to production, in that the hydrological cycle recharges groundwater sources and helps maintain surface water flows.

Water quality is not considered highly material for agri-production as compared to other stages of the value chain – such as agri-chemical and food product manufacturing – where industrial operations and health and safety standards require meeting a minimum level of water quality. Other production systems beyond row crops (such as fresh produce) would likely have a higher dependence on this ecosystem service.

Mitigating

Bio-remediation, dilution and filtration are all considered highly material for both agri-production and upstream inputs providers (especially related to mining activities for fertilizer production). These mitigating ecosystem services are provided by both biological (e.g., algae) and geophysical processes (e.g., wind) that dilute, break down, absorb and otherwise mitigate the effects of pollution from human activity.

Protecting

All dependencies in this category are considered to have high or very high materiality for agri-food system functions; this underscores the reliance of row crop systems on critical ecosystem services for protection from natural hazards such as floods, and their vulnerability to climate-driven changes to the basic functioning of these systems.

Climate regulation is "provided by nature through the long-term storage of carbon dioxide in soils, vegetable biomass, and the oceans."[62] This ecosystem service has high materiality for nearly all stages of the agri-food value chain (and very high materiality for agri-production) as most activities rely on a stable climate and safe temperatures, from growing crops to industrial processes to transportation and distribution.

Mass stabilization and erosion control have very high materiality for agri-production, concerning the protecting and stabilizing services that vegetation cover and root systems provide for terrestrial, coastal and marine ecosystems, and preventing avalanches and landslides.[63] Related to erosion control is buffering, referring to the geophysical processes that transport and deposit the sediments that enable soil-building needed for agri-production.

Natural flood and storm protection are closely linked with mass stabilization and erosion and considered highly material for agri-production – as well as for downstream stages including trading/distribution and processing/manufacturing, which are vulnerable to disruption and damage to facilities and assets from storms.

Disease control and pest control have high materiality for row crop agri-production, as "ecosystems play important roles in regulation of diseases…for flora and fauna" and crop pests are controlled by naturally occurring predators and other conditions of a healthy ecosystem.[64]

Impacts

Land-/water-/sea-use change

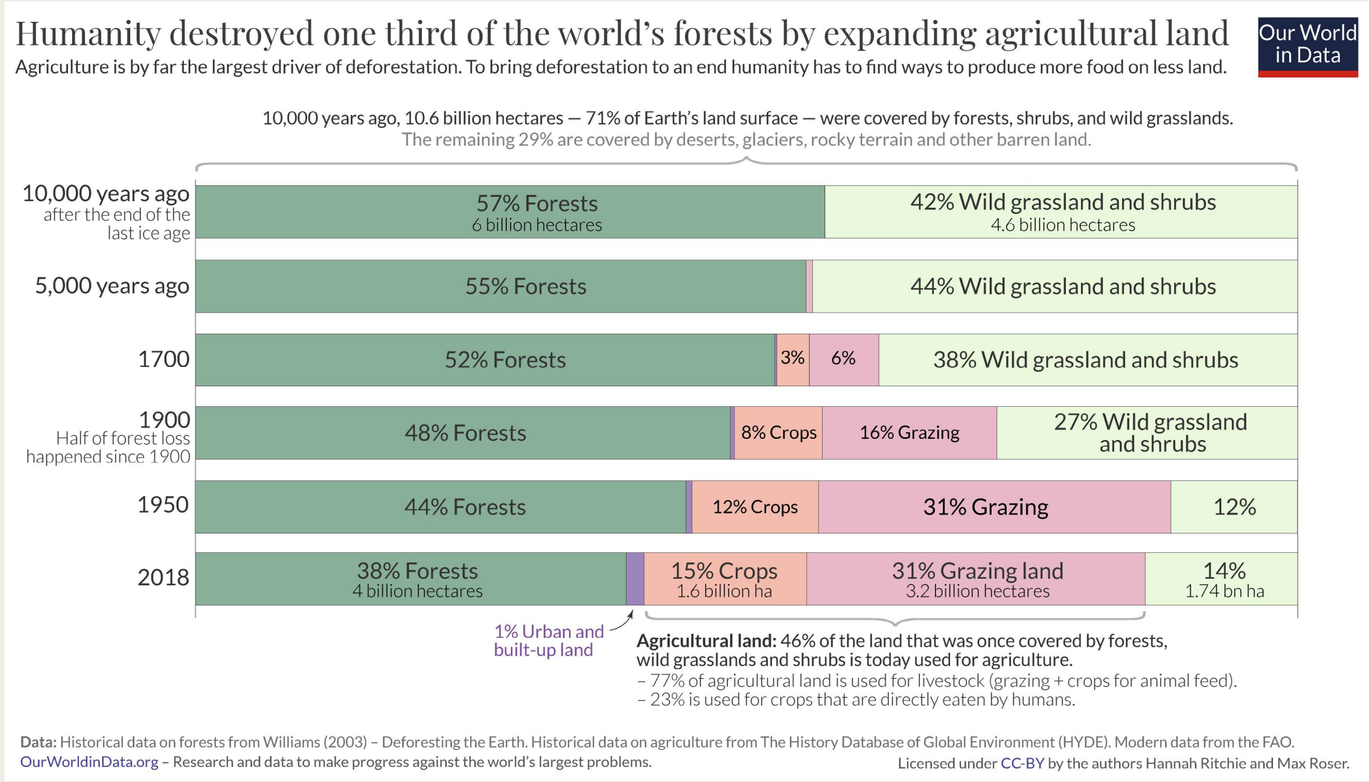
Terrestrial ecosystem use is among the highest impacts of agri-production, specifically due to land-use change (LUC) from one land-use category (e.g., natural forest) to another, often as a result of modification or management of natural environments into human dominated environments, such as settlements, semi-natural and agricultural areas (although LUC does occur naturally, through fire and other natural processes).[65] Deforestation and conversion of natural vegetation are the primary LUC effects of the global agri-food system; globally, agriculture drives some 80% of deforestation.[66] But regional contexts differ significantly; this is a critical issue in tropical regions where farmers are still converting forests and savannahs for large-scale commodity production (for example, in the Cerrado and Amazon regions of Brazil) but less so in areas where farmers have long converted natural ecosystems to agricultural use (e.g., in the Midwest of the US).

Soil loss is another very high-impact consideration in this category, which conventional activities accelerate, including tilling and lack of offseason ground cover, as well as increased and intensified flooding driven by climate impacts.

Upstream activities, including mining for fertilizer production, and downstream activities, including road-building for commodity transportation, can also have high LUC impacts, depending on geographic and ecosystem conditions.

Figure 22: Global forest loss over 10,000 years

Deforestation is a primary nature-related impact of agri-commodity production, particularly in global hotspots such as Brazil



Source: Our World in Data, **Deforestation**

→ ***See*** **SBTN Step 1 guidance** for further guidance on categories and definitions for impacts assessment

Freshwater ecosystem use is a high-impact issue for crop systems – namely rice production – that use flooding practices, whether natural or engineered (in the latter case, human engineering such as for dykes can be highly disruptive to natural ecosystem functions). However this impact driver is less relevant for rainfed and irrigated row crops like soy and corn.

Ocean shipping of agricultural commodities – which are often exported globally – can have high marine ecosystem impacts.

Resource exploitation

Water use is a highly material impact of irrigated crop systems, though many row crop systems are rainfed, making this specific impact category less of a direct concern. However, increasing evidence in some regions – including Brazil's Cerrado – shows that large expanses of converted cropland can impact local microclimates, thereby increasing temperatures, reducing precipitation and ultimately reducing yields. This issue illustrates the fundamental interconnections across nature-related impacts and dependencies. Other value chain stages, including manufacturing of agri-inputs and food products, can have high water-use impacts resulting from operational water use. The degree of water use impact materiality will depend largely on local water availability (i.e., as indicated in **WRI's Aqueduct**, which measures baseline water stress and other similar indicators).

Other resource use can be a high-impact activity for agri-input companies, especially related to mining of minerals for fertilizers – namely potash for potassium and phosphate for phosphorous – which can have local and downstream environmental impacts related to construction, extraction, beneficiation and waste disposal,[67] although generally considered lower-risk compared to mining of metals (see the **Built Environment** system guidance for more on resource extraction considerations).

Climate change

GHG emissions are among the most significant nature-related impacts of the agri-food system, and row crop commodities play a large role; this impact driver has high or very high materiality across the entire value chain. According to the UN FAO, nearly half of the agri-food system's carbon footprint derives from on-farm activities, with the remainder from LUC and supply chain activities, including fertilizer production and food loss and waste.[68] This is important because climate change is both a consequence of unsustainable agri-production practices as well as a major threat to crop systems, and therefore farmer livelihoods and food security.

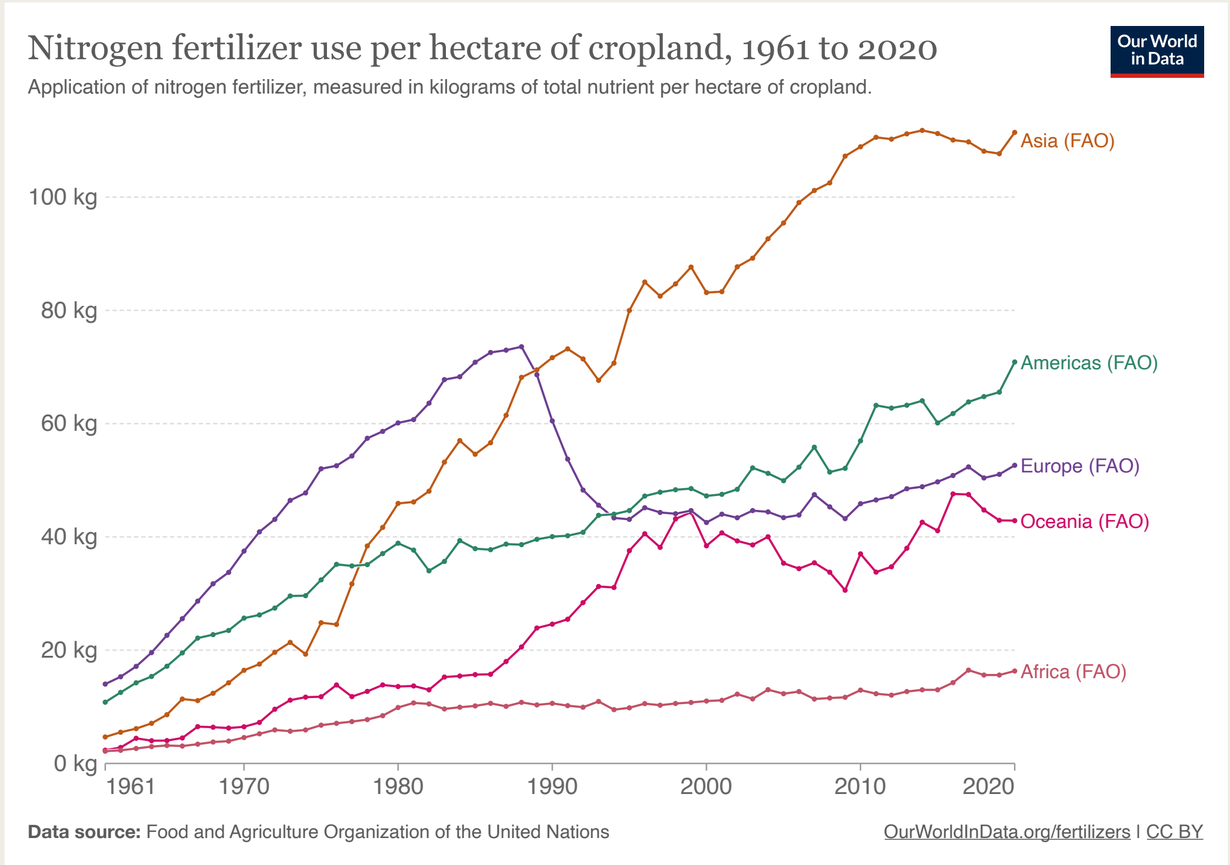
Agri-production: GHG emissions are among the top issues linked to inefficient fertilizer use in conventional row crop systems – namely nitrous oxide (N2O) which enters the air after application. Globally, fertilizers (including production, transportation and usage of both mineral and organics) contribute some 5-6% of all GHG emissions, equating to 14-18% of agricultural GHGs (with mineral nitrogen fertilizer contributing roughly half of this).[69,70] Other key contributors to on-farm GHG emissions include soil carbon loss due to conventional tillage practices and emissions from farm operations such as diesel-fueled tractors.

Upstream: Agrichemical production involves carbon-intensive processes including extraction, processing, manufacturing and transport. For example, the Haber-Bosch process to produce nitrogen fertilizer is an energy-intensive activity accounting for about 1% of all global energy use and around 1% of total CO_2 emissions.[71] The chemical process of calcination in lime production also generates significant GHG emissions (although lime for agricultural use represents only around 3% of global production).[72]

Downstream: Trading and distribution activities can contribute significantly to the carbon footprint of row crop commodities through the use of fossil fuels in transportation. Food manufacturing can also have a high GHG impact from fossil-powered operations.

Figure 23: Nitrogen fertilizer use by global region

Application of nitrogen fertilizer, measured in kilograms of total nutrient per hectare of cropland, 1961 to 2020



Source: Our World in Data, Fertilizers

Pollution

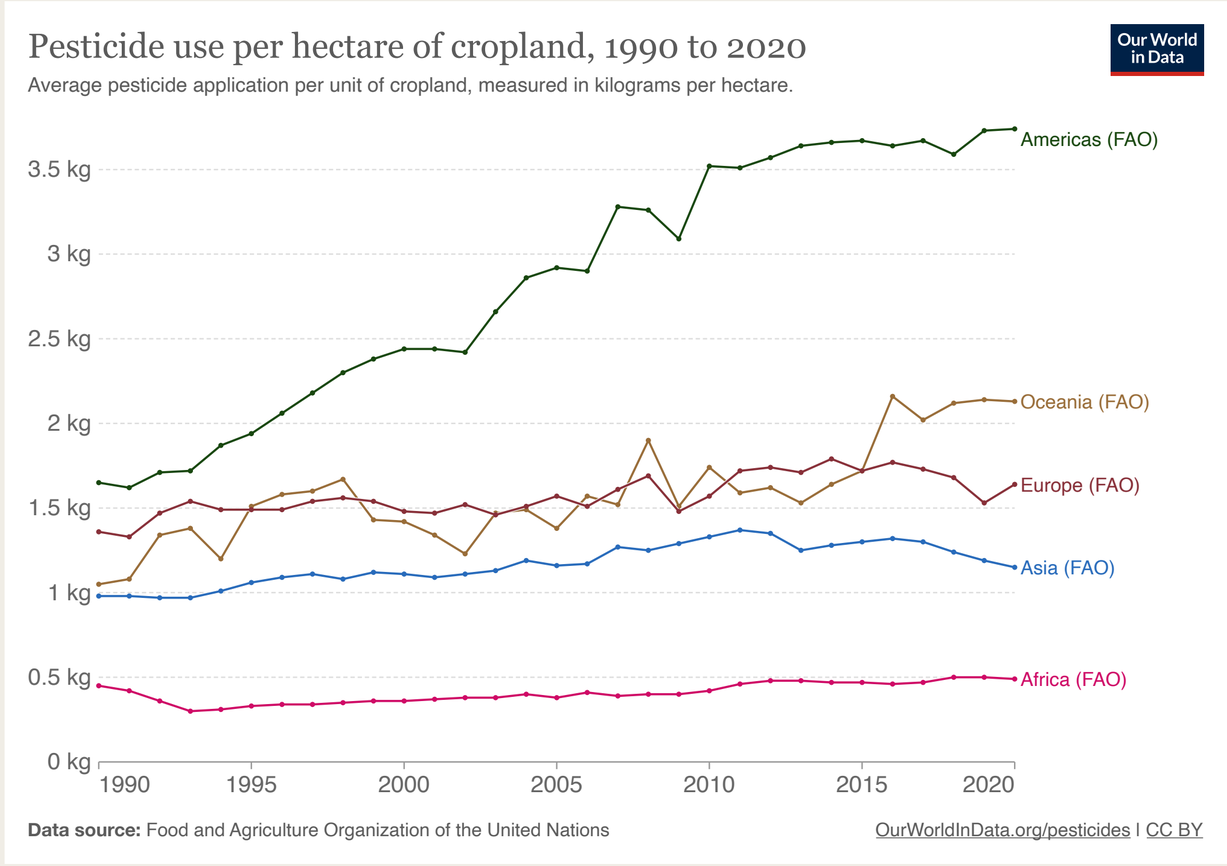
Water pollutants are a very high impact area for row crop production, due to runoff from inefficient use of fertilizers and pesticides. For example, on average plants take up just 40-60% of applied fertilizer with the remainder lost to the environment, often contributing to local groundwater contamination and causing downstream eutrophication effects.[73] Excessive use of pesticides – including insecticides, herbicides, fungicides and other pest-specific chemicals – is a significant contributor to biodiversity loss including effects on aquatic invertebrates and insects, with ripple effects up the food chain including bird species decline.[74,75,76] Increased climate-driven flooding is exacerbating these runoff impacts.

These effects are highly context-specific, depending on on-farm practices and baseline environmental conditions. Impacts can vary widely by region, e.g., nitrate pollution from the US Midwest is a major cause of annual hypoxic dead zones in the Gulf of Mexico,[77] while overuse of hazardous pesticides for rice production in the Mekong Delta of Vietnam (where agri-chemicals are largely under-regulated) can have damaging ecosystem and human health effects.

Additionally, there is disproportionate access to and use of agrichemicals among industrialized and developing countries. For example, industrialized nations account for at least one-third of the global nitrogen and phosphorus surpluses, despite claiming just 10% of global cropland.[78]

Figure 24: Pesticide use by global region

Aberage pesticide application per unit of cropland, measured in kilograms per hectare



Source: Our World in Data, **Pesticides**

Soil pollutants are considered high-impact due to the same activities, though typically less severe than water-related impacts.

Non-GHG air pollutants are considered high-impact for most value chain stages, resulting from the same activities described here under **climate change**.[79] Agri-production activities are estimated to produce roughly as much air pollution (measured as PM2.5) as all other human activities combined.[80]

Invasive species & others

This category includes biological alterations/ interferences which can be high-impact for row crops production, particularly regarding the effects of GMOs, which can affect ecosystem health and complexity by diminishing biodiversity.[81] Trading and distribution activities can also have a high impact in this area by accidentally introducing non-native species through transportation activities.

Disturbances are a high-impact consideration for upstream activities (namely mining of minerals for fertilizer production) and downstream stages (namely trading and distribution) in which noise and light pollution can be significant sources of disturbance to local ecosystems.

Note that biodiversity – the variability among living organisms – is a key feature of nature and cuts across all other dimensions. As outlined in the TNFD guidance on nature impact drivers (building on IPBES classifications), "biological alterations" is one specific means of understanding impacts on biodiversity. But, in fact, all impact drivers contribute directly or indirectly to biodiversity outcomes. In turn, the state of local biodiversity affects the quality of many critical ecosystem services upon which agri-production relies (soil health, bioremediation, etc.).

Annex 2: Risk and opportunity matrix

	Risks				Opportunities		
	Physical		Transition				
	Acute	Chronic	Markets & reputational	Policy & legal	Avoided risks	Resource efficiency & resilience	Markets & reputational
Upstream	Lost revenues & repair costs from increased frequency/intensity of storm damage to production sites & transportation infrastructure	Increased operating costs from climate-related impacts (i.e., higher industrial cooling costs under increasing temperatures)	Potential for lost revenue from reduced demand for conventional fertilizers & pesticides	Costs of compliance with jurisdictional policy requirements	Opportunities linked to avoided risks		Increased/novel revenue streams from nature-positive products (e.g., bio-based inputs)
		Loss or reduction in water supply & increased operating costs due to increasing drought frequency & intensity	Potential downstream reputational/market risk (e.g., GMO perception)	Costs of jurisdictional penalties/ litigation for activities linked to negative environmental impacts			Increased/novel revenue streams from digital technology development (i.e., on-farm impact MRV tools) & services
			Increased cost of capital or reduced access to financing if activities linked to negative environmental impacts				
			Increased due diligence & reporting costs to comply with nature-related disclosure frameworks				
Agricultural production	Seasonal crop loss due to storms, floods, & droughts worsened by soil loss	Loss & variability in volume & quality of yield due to soil degradation	Loss of revenue or reduced access to markets if activities linked to negative environmental impacts	Costs of compliance with jurisdictional policy requirements	Opportunities linked to avoided risks	Increased revenue from improved yields & reduced input costs from precision ag practices (short-term)	Increased revenue/margins from DCF, regenerative & nature-positive commodities
		Loss or reduction in water supply & increased operating costs due to increasing drought frequency & intensity	Increased cost of capital or reduced access to financing (debt & equity) if activities linked to negative environmental impacts	Costs of jurisdictional penalties/ litigation for activities linked to negative environmental impacts		Increased revenue from improved yields, crop resilience & reduced input costs from regen-ag practices & landscape restoration (mid-long term)	Improved terms (i.e., loans, insurance) for DCF, regenerative & nature-positive practices
		Increased costs from greater need for inputs & ops adjustments in response to soil degradation	Loss of revenue from dietary shifts (i.e., towards plant-based) & food waste reduction			Land asset appreciation due to ecosystem services (e.g., soil health) improvement	Increased revenue from sales of novel rotation/ cover crops
		Increased irrigation costs due to changing microclimate (reduced precipitation)	Increased inputs & ops costs due to potential lower yields (short-term) in transition to regen-ag				Increased revenue from NbS markets participation (e.g., carbon & biodiversity credits)
			Increased cost of climate hazard insurance due to loss of climate regulating ecosystem services				
			Loss or increased cost of crop insurance coverage & financing for new farming practices				
			Increased cost of land & production loss from "land-sparing" policies & commitments				
			Land asset depreciation due to productivity decline from soil degradation				
			Loss of community license to operate due to local or downstream environmentalironmental degradation				
			Increased due diligence & reporting costs to comply with nature-related disclosure frameworks				
Downstream	Lost revenues & repair costs from increased frequency/intensity of storm damage to production sites & transportation infrastructure	Increased operating costs from climate-related impacts (i.e., higher industrial cooling costs under i ncreasing temperatures)	Reduced supply & increased cost of commodities due to DCF & "land-sparing" policies & commitments	Costs of compliance with jurisdictional policy requirements	Opportunities linked to avoided risks		Increased revenue/margins from DCF, regenerative & nature-positive commodities
		Loss or reduction in water supply & increased operating costs due to increasing drought frequency & intensity	Reduced supply & increased cost of food commodities due to competition with bioeconomy & biofuel demands	Costs of jurisdictional penalties/ litigation for activities linked to negative environmental impacts			New business opportunities in novel rotation/cover crops
			Write-offs & early retirement of existing assets (i.e., "stranded assets") if activities linked to negative environmental impacts	Missed business opportunities due to legal limitations on uses of commodities (e.g., non-food use)			
			Increased due diligence & reporting costs to comply with nature-related disclosure frameworks				

Link to the table

Annex 3: Priority actions matrix

	Priority actions	IPBES Drivers of Change					SBTN Action Framework (AR3T)				Global framework alignment	Indicators & metrics (illustrative)	Trade-offs & barriers	Key resources
		Land-/ water-/ sea-use change	Resource exploitation	Climate change	Pollution	Invasive species & others	Avoid	Reduce	Regenerate	Restore				
Upstream stages	Develop & deploy agri-inputs (e.g., bio-based materials), technologies (e.g., improved MRV) & services to drive sustainable intensification & regen-ag outcomes		X	X	X		X	X	X		GBF – Targets 7 & 10 SDGs – Goals 2, 6, 13, 14	Leading: R&D spend, sales of sustainable products/services, regen-ag & SI practices (ha) Lagging: NUE, EIQ, SOC, water withdrawals/ha, water pollution, CO2e (scopes 1, 2 & 3)	Requires strategy shift & retraining sales and technical teams; downstream traceability & MRV challenges (data availability & quality)	International Fertilizer Association, Scientific Panel on Responsible Plant Nutrition, UN FAO – International Code of Conduct on Pesticide Management
	Reduce operational GHG emissions (e.g., green ammonia), water use (especially in water-stressed areas) & water pollution from mining & industrial processes		X	X	X			X			GBF – Targets 7 & 11 SDGs – Goals 2, 6, 13, 14	Leading: Capex & opex invested Lagging: CO2e (scopes 1, 2 & 3), total water withdrawals	Requires significant capex & opex	SBTi, SBTN-Freshwater targets, IEA Ammonia Technology Roadmap, AWS standard, UN CEO Water Mandate, WBCSD Freshwater Accountability Navigator & Wastewater Impact Assessment Tool
Agri-Production	Commit to & implement DCF production practices, in line with biome-specific guidelines & cutoff dates	X		X		X	X	X			GBF – Targets 1 & 2 SDGs – Goals 2, 13, 15	Leading: Science-informed, biome-specific DCF commitments Lagging: Deforestation/conversion from cutoff date (ha)	Lack of farmer incentives; crop aggregation from multiple sources; traceability & MRV challenges; risk of unsustainable intensification; potential for negative impact on producer livelihoods	AFi, SBTi-FLAG, SBTN-Land target 1 (beta), Agriculture Sector Roadmap to 1.5C, CGF Forest Positive Coalition of Action, commodity standards/ certifications (e.g., RTRS, SRP); EU Deforestation Free Regulation
	Implement sustainable intensification to optimize agrichemicals & water use and reduce GHG emissions (e.g., 4R Nutrient Stewardship, IPM, efficient irrigation)		X	X	X	X	X	X			GBF – Targets 7 & 10 SDGs – Goals 2, 6, 13, 14	Leading: Improved practices (ha) Lagging: NUE, EIQ, SOC, water withdrawals/ha, water pollution, CO2e (scopes 1 & 2)	Requires significant capex & opex and farmer behavior change	International Fertilizer Association, Scientific Panel on Responsible Plant Nutrition, UN FAO – International Code of Conduct on Pesticide Management
	Transition to regen-ag to improve soil health, biodiversity & carbon sequestration (e.g., crop rotation, cover crops, low/no-till, bio-based inputs, ICLFS)		X	X	X	X			X		GBF – Target 10 SDGs – Goals 2, 13, 15	Leading: Regen-ag practices (ha) Lagging: NUE, EIQ, SOC, water withdrawals/ha, water pollution, CO2e (scopes 1 & 2)	Potential for negative impact on yields, producer l ivelihoods & food security (short-term); food vs fuel trade-offs; MRV challenges (data availability & quality); requires significant training & farmer behavior change	OP2B Regen-Ag framework, SAI Platform, Sustainable Markets Initiative, SBTN-Land target 3 (beta), Wageningen University & Research
	Expand sustainable production on degraded lands (e.g., degraded pasture)	X		X		X			X		GBF – Target 2 SDGs – Goals 2, 12, 15	Leading: Sustainable expansion (ha) Lagging: Sustainable expansion (ha)	Location-specific opportunities; requires multi-stakeholder collaboration (IPLC engagement & FPIC)	OP2B Regen-Ag framework, SAI Platform, Sustainable Markets Initiative, SBTN-Land target 3 (beta), Wageningen University & Research
	Conserve & restore HCV landscapes within operations & adjacent areas	X		X		X				X	GBF – Target 3 SDGs – Goal 15	Leading: HCV landscapes restored (ha) Lagging: Ecosystem indicators over time (e.g., MSA, EII)	Requires significant project funding & multi-stakeholder collaboration (IPLC engagement & FPIC); climate & nature values may differ; attribution & MRV challenges; outcomes may take years to materialize	OP2B Restoration framework, FOLU, SBTN-Land target 3 (beta), Wageningen University & Research, EU Nature Restoration Law
Downstream stages	Support & incentivize DCF production in sourcing locations, in line with biome-specific guidelines & cutoff dates	X		X		X	X	X			GBF – Targets 1 & 2 SDGs – Goals 2, 13, 15	Leading: Science-informed, biome-specific DCF commitments & investment in DCF practices & sourcing processes Lagging: Verified sourcing (volumes)	Requires significant opex (e.g., for farmer premiums) & value chain collaboration (e.g., with input providers & farmers); upstream traceability & MRV challenges (data availability & quality)	AFi, SBTi-FLAG, SBTN-Land target 1 (beta), Agriculture Sector Roadmap to 1.5C, CGF Forest Positive Coalition of Action, commodity standards/ certifications (e.g., RTRS, SRP); EU Deforestation Free Regulation
	Support & incentivize sustainable intensification outcomes in sourcing locations		X	X	X	X	X	X			GBF – Targets 7 & 10 SDGs – Goals 2, 6, 13, 14	Leading: Commitments to & investment in improved practices & sourcing processes Lagging: Verified sourcing (volumes or ha)	Requires significant opex (e.g., for farmer premiums) & value chain collaboration (e.g., with input providers & farmers)	International Fertilizer Association, Scientific Panel on Responsible Plant Nutrition, UN FAO – International Code of Conduct on Pesticide Management
	Support & incentivize regen-ag outcomes in sourcing locations		X	X	X	X			X		GBF – Target 10 SDGs – Goal 15	Leading: Commitments to & investment in regen-ag practices & sourcing processes Lagging: Verified sourcing (volumes or ha)	Requires significant opex & value chain collaboration; food vs fuel trade-offs; upstream traceability & MRV challenges; potential yield reductions (short-term)	OP2B Regen-Ag framework, SAI Platform, Sustainable Markets Initiative, SBTN-Land target 3 (beta), Wageningen University & Research
	Support & incentivize conservation/restoration projects in HCV landscapes within, adjacent to & beyond operations & sourcing locations	X		X		X				X	GBF – Target 3 SDGs – Goal 15	Leading: Commitments to & investment in HCV landscape restoration Lagging: HCV landscapes restored (ha)	Requires significant project funding & multi-stakeholder collaboration (IPLC engagement & FPIC); climate & nature values may differ; attribution & MRV challenges; outcomes may take years to materialize	OP2B Restoration framework, FOLU, SBTN-Land target 3 (beta), Wageningen University & Research, EU Nature Restoration Law
	Reduce operational GHG emissions, water use (especially in water-stressed areas) & water pollution from processing & food manufacturing		X	X	X			X			GBF – Targets 7 & 11 SDGs – Goals 2, 6, 13, 14	Leading: Capex & opex invested Lagging: CO2e (scopes 1, 2 & 3), total water withdrawals & pollution	Requires significant capex & opex	SBTi, SBTN-Freshwater targets, AWS standard, UN CEO Water Mandate, WBCSD Wastewater Impact Assessment Tool & Freshwater Accountability Navigator
	Reduce GHG emissions & environmental impacts of road, rail & ocean freight operations (e.g., fleet electrification)	X		X	X	X		X			GBF – Targets 7 SDGs – Goals 13, 14, 15	Leading: Capex & opex invested Lagging: CO2e (scopes 1, 2 & 3)	Requires significant capex & opex; infrastructure needs dependent upon public investment	SBTi, Alliance for Logistic Innovation & Collaboration in Europe
	Reduce food loss & waste throughout the value chain (e.g., on-farm, retail & restaurants, consumer habits)	X	X	X	X	X		X			GBF – Targets 16 SDGs – Goal 12	Leading: Capex & opex invested Lagging: % landfilled (on-farm & supply chain), % food waste (retail & consumer)	Requires capex & opex; upstream & downstream traceability & MRV challenges	Food Loss + Waste Protocol, WWF, Ellen MacArthur Foundation
	Develop nature-positive ingredients, products & campagins (i.e., DCF, regenerative, organic, plant-based, etc.)	X	X	X	X	X	X	X	X	X	GBF – Targets 1, 2 & 10 SDGs – Goals 2 & 12	Leading: R&D & promotional spend Lagging: Sales of certified sustainable products & services	Consumer willingness to pay & potential for confusion about product claims	Commodity standards/certifications (e.g., RTRS, SRP), EMF Big Food Redesign

Link to the table

Annex 4: Key nature-related frameworks for land-use companies

CDP: Global ESG disclosure and ratings system for investors, companies, cities, states and regions to measure and manage their risks and opportunities on climate change, water security and deforestation.

EU Sustainability Reporting Standards (ESRS) & Corporate Sustainability Reporting Directive (CSRD): The CSRD sets out ESG reporting requirements for EU companies, while the ESRS provide the framework and methodology for compliance. Both the CSRD and ESRS are legally binding, will apply to most companies operating in the Eurozone, and will come into effect for the 2024 reporting year.

EU Taxonomy Regulation: A market transparency tool that helps direct investments to economic activities most needed for the climate transition, in line with the European Green Deal objectives. It is a classification system that defines criteria for economic activities aligned with a net zero trajectory by 2050 and the broader environmental goals beyond climate.

GHG Protocol Land Sector and Removals Guidance: Explains how companies should account for and report GHG emissions and removals from land management, land-use change, biogenic products, carbon dioxide removal technologies, and related activities in GHG inventories, building on the Corporate Standard and Scope 3 Standard. The guidance is being developed through a global, inclusive multi-stakeholder development process, and will be finalized and published in early 2024.

Global Reporting Initiative (GRI): International independent standards organization that helps businesses, governments and other organizations understand and communicate their impacts on issues such as climate change, human rights and corruption.

GRI 13: Agriculture, Aquaculture and Fishing Sectors 2022 supports advancement and comparability of sustainability information for all organizations involved in crop cultivation, animal production, aquaculture, or fishing.

International Sustainability Standards Board (ISSB): A standard-setting body under the IFRS Foundation, whose mandate is the creation and development of sustainability-related financial reporting standards to meet investor needs for sustainability reporting. IFRS S1 and S2, available as of July 2023, set out general ESG-related and specific climate-related disclosures respectively, with further standards to come.

Natural Capital Protocol: Decision-making framework that enables organizations to identify, measure and value their direct and indirect impacts and dependencies on natural capital. The framework guides companies at integrating the value of natural capital into organizational processes.

Science Based Targets Network (SBTN): A collaboration of over 80 organizations, established to help businesses and cities operate within the Earth's limits while meeting society's needs through the setting of science-based targets (SBTs), to transform their impact and create an equitable, nature positive, net-zero future. To help companies adopt a roadmap for integrated action on nature and climate, SBTN compliments, and builds upon, SBTs for climate (Science Based Targets initiative), focusing on freshwater, land, biodiversity and the ocean.

Science-Based Targets initiative Forest, Land and Agriculture (FLAG) Guidance: Provides the world's first standard method for companies in land-intensive sectors to set science-based targets that include land-based emissions reductions and removals.

Taskforce for Nature-Related Financial Disclosures (TNFD): A market-led, science-based framework that enables companies and financial institutions to integrate nature into decision-making. The goal of the TNFD is to provide a framework for organizations to report on risks from biodiversity loss and ecosystem degradation. Sector- and biome-specific guidance is available to guide companies – including in the agri-food sector – through the framework.

Annex 5: Further reading

Agri-food system transformation

FAO SDG 2.4.1: Sustainable Development Goal that includes indicators for agriculture across social, environmental, and governance spheres.

FOLU Growing Better: Ten Critical Transitions to Transform Food and Land Use: Report which proposes a reform agenda – centered around ten critical transitions – of actionable, science-based solutions to unlock collective, ambitious action to ensure food and land use systems play their part in delivering the SDGs and achieving Paris Agreement targets.

Natural Capital Protocol Food & Beverage Sector Guide: Guide designed to accompany the Natural Capital Protocol and enables food and beverage businesses to identify, measure and value their impacts and dependencies on natural capital to inform their decision-making.

New Food Order: Podcast exploring the business of tackling our climate and social crises through food and agriculture, from Food+Tech Connect and AgFunder.

Planet Tracker – Financial Markets Roadmap For Transforming The Global Food System: Extensive report on the role of financial institutions in agri-food systems transformation.

TNFD Food & Agriculture sector guidance: Additional guidance for the LEAP approach for organizations operating in the following sectors: Agricultural products; meat, poultry and dairy; processed foods; food retailers and distributors; restaurants.

WBCSD Food and Agriculture Roadmap: Implementation plan of the CEO Guide to Food System Transformation. It builds on the work carried out by WBCSD's Agriculture & Food and Policy teams, and draws from a wide body of research from academic, governmental, and non-profit organizations.

Deforestation & conversion

Accountability Framework initiative: Framework and corporate guidance focused on deforestation, ecosystem conversion and human rights, including the rights of Indigenous Peoples, local communities and workers. AFi is incorporated in several key nature frameworks including CDP, GHG Protocol LSR Guidance, SBTN and SBTI-FLAG.

Agriculture Sector Roadmap to 1.5°: Roadmap by the Tropical Forest Alliance with support from WBCSD, aiming to accelerate existing action by the agri-commodity sector on deforestation to align with global climate goals, in a way that contributes to food security, economic development and farmer livelihoods. Includes detailed guidance for specific commodities including soy, palm oil, cocoa and cattle.

Forest Positive Coalition of Action: Coalition led by the Consumer Goods Forum, whose mission is to drive collective, transformative change to remove deforestation, forest conversion and degradation from key commodity supply chains and support forest positive businesses. The group includes 21 of the world's largest brand-owners and retailers and engages with more than 150 stakeholder organizations from civil society, across the supply chain, production landscapes and multiple levels of government.

Regenerative agriculture

One Planet Business for Biodiversity (OP2B): An international cross-sectorial, action-oriented business coalition working on restoring and regenerating biodiversity in agricultural systems, hosted by WBCSD.

OP2B – Cultivating farmer prosperity: Investing in regenerative agriculture: WBCSD OP2B/BCG research on return on investment when transitioning to regenerative farming practices. Report brings forward the farmer perspective through the lens of a Kansas wheat farmer transitioning to regen-ag.

SAI Platform Farm Sustainability Assessment: Enables food and drink businesses to assess, improve, and validate on-farm sustainability in their supply chains. Built around a simple set of questions to farmers, the FSA standardizes farm assessment.

Regen10: Collective action plan to scale regenerative food production systems, worldwide, in a decade. Regen10 will develop, through a highly consultative process, the principles, metrics and framework needed to build an inclusive, productive and regenerative food system, create the enabling environment for scaling, and identify landscape initiatives.

Sustainable Markets Initiative – Scaling Regenerative Agriculture Action Plan: Action plan by the SMI Agribusiness Task force of companies and stakeholders, focused on how to scale regenerative farming through its "Big 5 recommendations." Task force is set to continue its work and drive implementation of recommendations.

Landscapes

IUCN-FOLU Landscape Restoration Guidance: Guidance for agribusinesses to engage in nature-positive business practices and how landscape restoration is an effective solution to issues related to degradation of landscapes and natural capital on which agribusinesses depend.

ISEAL Alliance - Making Credible Jurisdictional Claims Good Practice Guide v1.1: Good practice guidance to help ensure that sustainability claims made by jurisdictions, landscape initiatives, and the companies that source from or support them, are credible and transparent.

Proceedings of the National Academy of Sciences (PNAS): Mapping potential conflicts between global agriculture and terrestrial conservation: Academic study focused on mapping global conservation priority areas against crop production.

The Nature Conservancy Foodscapes: Mapping of landscapes for food production and assessment of their current conditions, threats they face and opportunities that exist through NbS to transition to a sustainable food system. Includes examination of what the transition could look like in 10 specific foodscapes.

Biodiversity

EU Business & Biodiversity Platform: Platform for nature and biodiversity for EU companies and stakeholders. The platform engages directly with its members, including small and medium-sized enterprises (SMEs), financial institutions and business networks to co-create solutions and turn risks into opportunities.

WWF Water and Biodiversity Risk Filter: Suite of screening tools to enable companies and investors to assess and respond to nature-related risks to strengthen resilience. Uses multiple databases, including data from ENCORE, the Integrated Biodiversity Assessment Tool (IBAT), Key Biodiversity Areas (KBAs), the SBTN, and World Resources Institute (WRI) Aqueduct.

Water stewardship

Alliance for Water Stewardship: Global membership collaboration comprising businesses, NGOs and the public sector. Members contribute to the sustainability of local water-resources through their adoption and promotion of a universal framework for the sustainable use of water – the International Water Stewardship Standard – that drives, recognizes and rewards good water stewardship performance.

CEO Water Mandate Contextual Water Targets Guidance: Commitment platform for businesses to advance water stewardship. Companies that endorse the CEO Water Mandate commit to action in six areas of water stewardship and to report annually on progress.

WBCSD – Wastewater Impact Assessment Tool: Allows for site-level assessment of pressures resulting from industrial wastewater to help users understand changes to state of nature and resulting impacts on climate, biodiversity and water security. Uses site-level data to calculate impact and levers of action for three key indicators: water quality, water availability and GHG emissions from wastewater treatment.

WBCSD – Freshwater Accountability Navigator: Guidance for companies to navigate the emerging accountability system for water, by providing a high-level overview of the existing frameworks, guidelines and tools categorized within the ACT-D steps. Launching by end of 2023.

Food loss & waste

Champions 12.3: Coalition of executives from governments, businesses, international organizations, research institutions, farmer groups, and civil society dedicated to inspiring ambition, mobilizing action, and accelerating progress toward achieving Sustainable Development Goal Target 12.3 by 2030.

Food Loss and Waste Protocol: Multi-stakeholder partnership which has developed the global Food Loss and Waste Accounting and Reporting Standard (FLW Standard). The Protocol's mission is to ensure wide adoption of the FLW Standard, so companies, governments, cities and others are better informed about food loss and waste and motivated to curb this inefficiency.

Shifting diets

Big Food Redesign: Study by Ellen MacArthur Foundation which looks at the role fast-moving consumer goods companies and food retailers can play to move towards a food system with significant positive impacts for business, people, and the environment. It explores the ways in which food products can be designed in closer collaboration with farmers, for nature, and investigates the crucial enabling role of policies and incentives.

EAT-Lancet report: The first full scientific review of what constitutes a healthy diet from a sustainable food system and which actions can support and speed up food system transformation.

Social impact

FAO FPIC Toolkit & resources: Resources for organizations and project managers upholding core principles such as self-determined development, respect for Indigenous Peoples' knowledge, cultures and traditional practices and free, prior and informed consent.

IPCA Knowledge Basket – Beyond Conservation: A Toolkit for Respectful Collaboration with Indigenous People: Best-practice toolkit for engaging with IPLCs to support individuals and organizations seeking to do things differently, avoid repeating the mistakes of the past, and embed reconciliation into conservation and stewardship work. Includes guiding principles, practical resources and more.

Just Rural Transition – Principles for Just Food System Transitions: Report lays out 10 guiding principles for achieving just food system transitions and explores their implications in terms of desired outcomes, planning and decision-making processes, systemic changes that may be needed, and tensions that must be managed.

Sustainable Food Lab Living Income report: Guide for companies seeking to address poverty and economic viability with smallholder farmers in their supply chains. By using this guide, companies can integrate living incomes into their sourcing practices and sustainability programs.

WBCSD – Reducing inequalities for food security and nutrition – Business Brief: Summarizes the findings of the report by the High-Level Panel of Experts on Food Security and Nutrition (HLPE – FSN) and provides information for businesses, including identifying opportunities for business to tackle inequalities in food and related systems to strengthen food and nutrition security.

Nature-based solutions

IUCN Global Standard for Nature-based Solutions: Self-assessment that consists of eight criteria and associated indicators, which address the pillars of sustainable development (biodiversity, economy and society) and resilient project management.

Natural Climate Solutions Alliance: Focuses on identifying opportunities and barriers to investment in the natural climate solutions (NCS) voluntary carbon market and also serves as a forum for knowledge sharing and technical capacity building to ensure natural climate solutions reach their full potential in abating climate change.

WBCSD – The role of Nature-based Solutions in strategies for Net Zero, Nature Positive and addressing Inequality: Report presents the role of company action on NbS and how this can be leveraged to deliver against the three imperatives areas of climate, nature and equity; a deep dive into the role of NbS in net zero, with supporting issue briefs for companies engaging from a climate perspective; and insights on the direction of travel for NbS in corporate sustainability action.

Nature-related scenarios

FPS + Nature scenarios: First integrated climate and nature scenarios for investors, developed by the Inevitable Policy Response (IPR) under the UN Principles for Responsible Investment (PRI). It analyses forceful responses to both climate change and nature loss out to 2030 and 2050, grounded in existing and emerging policy action. It provides investors and policy makers with a credible, high conviction base demonstrating how the effects of both nature and climate policies could shape the future of land use.

WBCSD – TCFD reference scenarios tool: A climate transition scenario tool for land-use companies developed by WBCSD and Vivid Economics in 2021 at the request of the Task Force on Climate-related Financial Disclosures (TCFD). This produced a new set of sector-relevant scenarios to support company assessment of strategic resilience to climate risk. The scenarios focus on climate transition risk – exploring the technological, political, legal, market and economic changes required to reach a particular temperature outcome – and the associated risks and opportunities. Specific factors include policy and consumption-driven projections for dietary changes, biofuel growth and the implementation of conservation targets – under different types of possible economic and societal transitions.

We reference the tool in this roadmap and associated landscape deep dives to illustrate potential considerations for nature-related assessments and strategy development vis-à-vis specific commodities and regions, e.g., for commodities in regions where production is expected to grow, nature-related pressures (and opportunities) could be expected to increase accordingly. Yield growth projections can inform planning around the implementation of sustainable intensification and regen-ag.

Agri-chemicals

FAO International Code of Conduct on Pesticide Management: Science-based decision-making process that combines tools and strategies to identify and manage pests. It combines biological, chemical, physical and crop specific (cultural) management strategies and practices to grow healthy crops and minimize the use of pesticides, reducing or minimizing risks posed by pesticides to human health and the environment for sustainable pest management.

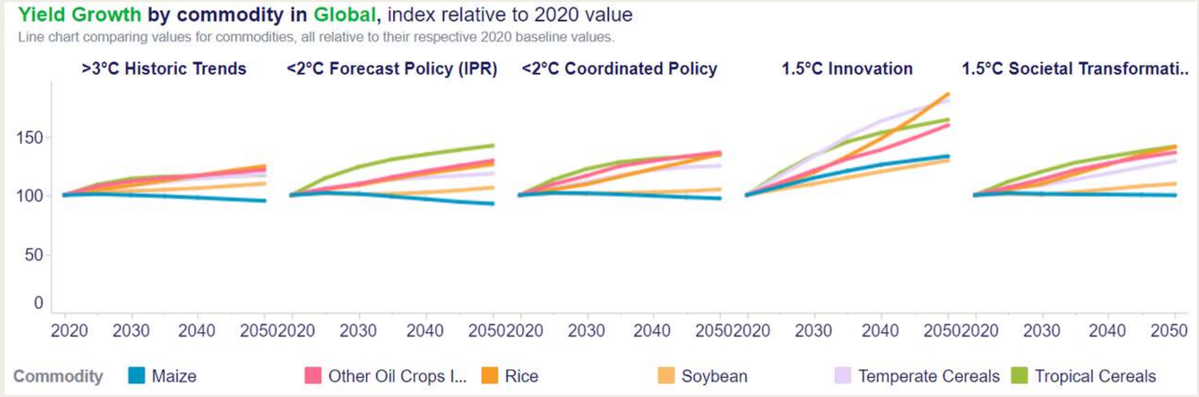
IEA Ammonia Technology Roadmap: Roadmap uses scenario analysis to explore three possible futures for ammonia production, and outlines emissions reduction strategies.

Scientific Panel on Responsible Plant Nutrition – Achieving Nature-Positive Plant Nutrition: Fertilizers and Biodiversity: Resource outlines sustainable fertilizer pathway and how to optimally manage nutrient inputs for biodiversity, food, nutrition and other outcomes.

Transport and distribution

Roadmap Towards Zero Emissions Logistics 2050: Guidance for achieving zero emissions by 2050 in the freight transport and logistics industry by the Alliance for Logistic Innovation and Collaboration in Europe (ALICE).

Figure 25: Yield projections for row crop commodities under five different climate transition scenarios



Source: WBCSD, Climate Scenario Tool

Annex 6: Glossary

→ ***Note that this list only includes terms specific to agri-food value chains.***
We address general terms and concepts in the **Roadmaps to Nature Positive: Foundations for all businesses**.

Agroecology – A holistic and integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of sustainable agriculture and food systems.[82]

Conventional agriculture – An industrialized form of farming characterized by mechanization, monocultures and the use of synthetic inputs such as mineral fertilizers, pesticides and genetically modified organisms (GMOs), with an emphasis on maximizing productivity and profitability and treating the farm produce as a commodity.[83]

Deforestation and conversion-free (DCF) – Achievement of no-deforestation and no-conversion in supply chains. Deforestation is defined as the loss of natural forest as a result of conversion to agriculture or other non-forest land use; conversion to a plantation; or severe or sustained degradation. Conversion is defined as change of a natural ecosystem to another land use or profound change in the natural ecosystem's species composition, structure, or function.[84]

Farmer – A person who runs a farm or agricultural holding, either as tenant or owner; a person whose occupation or business is cultivating crops, raising livestock, producing animal products, etc., for food or for sale.[85]

High Conservation Value (HCV) – Biological, ecological, social or cultural values of outstanding significance at a national, regional or global level or of critical importance at local level. There are 6 categories of HCVs: species diversity; landscape level ecosystems; ecosystems and habitats; ecosystem services; community needs; cultural values.[86]

Land-use change (LUC) – Change in the purpose for which humans use land (e.g., between cropland, grassland, forestland, wetland, industrial land).[87]

Landscape – A socio-ecological system that consists of natural and human-modified ecosystems and which distinct ecological, historical, economic and socio-cultural processes and activities influence.[88]

Monitoring, reporting and verification (MRV) – Typically refers to tracking the climate-related benefits of improved land-use activities, including for example on-farm soil carbon storage effects of regenerative practices. In recent years the term has expanded to include broader benefits for nature and livelihoods.[89]

Monoculture – An agri-production system in which single/similar plant species are grown across large areas with minimum or no rotation.[90]

Nature-based solutions (NbS) – Actions to protect, conserve, restore, sustainably use and manage natural or modified ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits.[91]

Regenerative agriculture (regen-ag) – Related to agroecological evidence and principles, regenerative agriculture is a holistic, outcome-based farming approach that generates agricultural products while measurably having net-positive impacts at farm and landscape level on soil health, biodiversity, climate, water resources and farming livelihoods. It aims to simultaneously promote: above- and below-ground carbon sequestration, GHG emissions reductions, biodiversity protection and enhancement in and around farms, improved water retention in soil, reduced pesticide risk, improved nutrient-use efficiency, and improved farming livelihoods.[92]

Row crop – Broadly refers to crops harvested annually and replanted and produced on a large scale with the aid of machinery (typically a row planter and combine harvester). Row crops may include a wide variety of crops, including corn, soybeans, cereal grains, roots and tubers, legumes, and non-food crops like fibers or oilseeds.[93]

Sustainable intensification – Agri-production systems that increase productivity without adverse effect on natural resources, enhancing climate change resilience and input-use efficiency, and creating enabling an environment so farmers can competitively participate in markets.[94]

Annex 7: Notes on methodology

In general we have aligned our approach with the structures, definitions and guidance of leading nature-related frameworks and screening tools, namely: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) **Global Assessment Report on Biodiversity and Ecosystem Services**, the **ENCORE** tool by the Natural Capital Finance Alliance, **SBTN's materiality screening tool (MST), TNFD guidance** including food & agriculture sector guidance, and the **WWF Biodiversity Risk Filter**. For more, please see the **Roadmaps to Nature Positive: Foundations for all businesses**.

Deep dives & subsector aggregation

The research for this roadmap has followed an iterative, two-tiered approach:

The three **landscape deep dives** carried out over the course of several months in 2023 form the basis for our findings. This process included extensive literature review as well as one-to-one interviews and feedback with a variety of context-specific stakeholders and experts at global and local levels (i.e., leading academics, NGOs, producer groups, government agencies and others). We have sought to illustrate a typical crop rotation for each region (e.g., soy-corn-cotton in the Cerrado, Brazil), but note that this is necessarily a limited scope and should not be considered an exhaustive study of all possible rotations. The deep dive outputs – namely materiality, risks and opportunities and priority actions – were then aggregated and complemented with desk research to form a subsector-level summary assessment relevant for row crop commodities more broadly. Consistent input from the WBCSD members engaged and expert stakeholders has supported this process, informing and validating our process and findings along the way.

Stage 1: Assess (materiality screening)

Scope and locate

We have assessed the full value chain, with a focus on agri-production and a "lighter" touch on upstream and downstream stages. Note that companies should evaluate their own operations and value chains to determine which stage(s) are most relevant, meaning those with potentially material nature-related impact drivers. For example, a commodity trader likely also has additional upstream and downstream activities to consider, namely in the agri-production, distribution, manufacturing and retail stages.

We have identified the primary activities per value chain stage according to ENCORE (for dependencies) and SBTN's MST (for impacts), and matched activities across these two foundational tools to develop materiality ratings:

→ For example: In assessing soy, for the agri-production stage we considered "Large-scale irrigated/ rainfed arable crops" from ENCORE; in SBTN's MST we considered the primary activity to be "Growing of cereals (except rice), leguminous crops and oil seeds," while also considering more qualitatively the materiality ratings for auxiliary activities like "Support activities for crop production".

→ For simplicity, we have also assumed a primary position within the value chain for each activity category, e.g., in SBTN's MST, we considered all activities related to seeds as pertaining to inputs (upstream from agri-production) although we recognize that seed collection may take place on-farm and in downstream stages.

→ For simplicity, we have limited the materiality assessment to the major direct inputs (upstream) and set a "cut-off" at the generalized retail stage (downstream). Thus, activities farther upstream (e.g., mining of ore for farm equipment) and differentiated downstream channels (e.g., livestock production using soy- and corn-based feed) are out of scope for this assessment (note that for agri-inputs we did consider resource extraction for fertilizers, given the material land-use DIROs linked to those activities).

Evaluate impacts and dependencies

To understand the most material dependencies and impacts of row crop commodities, we first assessed the main activities within each value chain stage; the initial screening was based on ENCORE and SBTN's MST to identify potentially material nature-related pressures and associated business activities.

We tested and refined these findings through the landscape deep dives, which yielded differing results depending on the context. We identified dependencies and impacts considered to have high or very high materiality with the rationale that these are the most likely to require further risk and opportunity evaluation and to inform the development of priority actions for each landscape. We then aggregated these findings at the subsector level.

→ Dependencies: We have followed the structure and categories presented in ENCORE (e.g., "Direct physical inputs – Groundwater")

→ Impacts: We have followed classifications for drivers of change categories (e.g., "Land-use change") and impact drivers (e.g., "Terrestrial ecosystem use") from IPBES and used in SBTN's MST

Note that materiality ratings for each impact driver, while data-driven, are largely a qualitative assessment. We have followed the **ENCORE methodology**, which defines materiality ratings as follows:

→ Dependencies: Based on assessment of the significance of functionality loss and financial loss in the production process if the ecosystem service is disrupted

→ Impacts: Based on assessment of frequency, speed, and severity of potential impacts on nature from the production process

There are challenges associated with comparability of materiality levels within a full value chain analysis. Note that:

→ Our materiality approach is oriented primarily within each value chain stage rather than across stages. For example, a very high rating for activity "A" within the upstream/inputs stage indicates a higher level of materiality as compared with a high rating for activity "B" within the same stage, but is not intended to be weighed directly against activity ratings in downstream stages. We have worked to directionally harmonize ratings across stages where possible.

→ Similarly, when comparing commodities across global landscapes, materiality ratings are directionally comparable but not intended for direct comparison.

→ We recognize these methods and data sets continue to evolve (via frameworks like the TNFD and the SBTN) and that other researchers may take different approaches. This analysis can be refreshed as standards and leading practices mature with further market testing and feedback.

Assess risks and opportunities

The risks and opportunities included in each deep dive and in the subsector summary flow from the identified "high" and "very high" material nature-related impacts and dependencies; we developed these for each landscape deep dive based on existing literature, takeaways from expert interviews, WBCSD members' input and the evolving TNFD guidance. The latter was also an instructive resource as we aggregated common themes in the generalized row crops subsector summary.

Note that we have not explicitly followed the TNFD's recommended approach for prioritizing risks and opportunities (i.e., quantitatively evaluating magnitude x likelihood x speed of onset, vulnerability and other relevant criteria) but consider this a critical step for any company performing its own assessment.

Stage 2: Commit and transform (targets for priority actions)

We have developed a set of roughly 15 high-level priority actions up and down the value chain, based on the materiality steps described in Stage 1 and using desk research and consultation with experts and WBCSD members. These actions are relevant at the row crops subsector level, and each deep dive contains further contextual detail with a focus on a smaller number of priority issues for the specific landscape. We used the SBTN Land targets (beta) as a foundational starting point (in particular its initial "no-regret actions" list, subsequently incorporated into its "target benefits" table), and leveraged other issue-specific resources for further context and detail (see the Further reading section).

The Priority actions matrix includes the actions broken down by value chain stages and includes links to the IPBES Drivers of Change, SBTN Action Framework categories (i.e., "AR3T"), GBF targets and SDGs; illustrative indicators (leading and lagging) and metrics; barriers and trade-offs; and key resources. Indicators and metrics will be further explored in our next phase of work on Performance and Accountability.

In aggregating these actions at the row crops subsector level, key imperatives emerged which are reflected in the corresponding section in this guidance, aligned with the SBTN Action Framework categories. Several transformative levers also emerged, which are outlined in a following section.

We used WBCSD's corporate maturity concept (as presented in the **Roadmaps to Nature Positive: Foundations for all businesses**) to map priority action areas for each deep dive, demonstrating a path to leading practice on DCF (for the soy study), regen-ag (for the corn study), and farmer engagement (for the rice study). These are not intended to be prescriptive, but rather as illustrative pathways to support companies wherever they are on the nature positive journey. The subsector summary includes a globally-generalized version of the DCF pathway.

Acronyms and abbreviations

ACT-D	Assess, Commit, Transform, Disclose
AR3T	avoid, reduce, regenerate, restore, transform
AWS	Alliance for Water Stewardship
CAR	Cadastro Ambiental Rural - Brazil's Rural Environmental Registry
CO2e	carbon dioxide equivalent
CSRD	Corporate Sustainability Reporting Directive
DCF	deforestation and conversion free
DIROs	dependencies, impacts, risks and opportunities
EII	Ecosystem Integrity Index
EIQ	Environmental Impact Quotient
ESG	environmental, social and governance
FAO	Food and Agriculture Organization of the United Nations
FOLU	Food and Land Use Coalition
FPIC	free, prior and informed consent
GBF	Kunming-Montreal Global Biodiversity Framework
GHG	greenhouse gas
GMO	genetically modified organism
HCV	high conservation value
HLPE – FSN	High-Level Panel of Experts on Food Security and Nutrition
ICLFS	integrated crop-livestock-forestry systems
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCA	Indigenous Protected and Conserved Areas
IPLC	Indigenous Peoples and local communities
LUC	Land-use change
MRV	monitoring, reporting and verification
MSA	Mean Species Abundance
NbS	nature-based solutions
NBSAP	national biodiversity strategies and action plans
NDC	nationally determined contributions
NUE	nitrogen use efficiency
OP2B	One Planet Business for Biodiversity
PRI	UN Principles for Responsible Investment
SBTN	Science Based Targets Network
SBTs	science-based targets
SDGs	Sustainable Development Goals
SICS	Sustainable Industry Classification System
SMI	Sustainable Markets Initiative
SOC	soil organic carbon
SRP	Sustainable Rice Platform
TCFD	Taskforce on Climate-related Financial Disclosures
TEEB	The Economics of Ecosystems and Biodiversity
TNFD	Taskforce on Nature-related Financial Disclosures
USDA	United States Department of Agriculture
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute
WWF	World Wide Fund for Nature (formerly World Wildlife Fund)

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Acknowledgements

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This publication has been developed in the name of WBCSD. Like other WBCSD publications, it is the result of collaborative efforts by representatives from member companies and external experts. A wide range of member companies reviewed drafts, thereby ensuring that the document broadly represents the perspective of WBCSD membership. Input and feedback from stakeholders listed above was incorporated in a balanced way. This does not mean, however, that every member company or stakeholder agrees with every word.

The report has been prepared for general informational purposes only and is not intended to be relied upon as accounting, tax, legal or other professional advice.

Acknowledgements

Research partner: Olab

WBCSD would like to thank the following organizations for providing their insights and collaboration:

WBCSD Members engaged: ADM, Arup, BASF, Bayer CropScience, Corteva, DSM, Indigo Ag, Neste, Nestlé, Louis Dreyfus Company, Manulife Investment Management, Nutrien, OCP, Olam, Philip Morris International, PwC, Rabobank, Sonae, Yara

Stakeholders: Row crops summary: Business for Nature, Capitals Coalition, CDP, CERES, FAIRR Initiative, Flora & Fauna International (FFI), One Planet Business for Biodiversity (OP2B), Organisation for Economic Co-operation and Development (OECD), Regen10, Science Based Targets Network (SBTN) Land Hub, The Nature Conservancy (TNC), Taskforce for Nature-related Financial Disclosures (TNFD)/Global Canopy, UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), Wageningen University & Research (WUR), World Economic Forum (WEF), World Farmers' Organisation, World Wide Fund for Nature (WWF)

Experts & stakeholders consulted: Soy deep dive (Cerrado, Brazil):
Producer organizations: ABIOVE, SLCAgricola S/A

NGOs: Proforest, Rainforest Alliance, The Nature Conservancy (TNC), Trase, World Wildlife Fund (WWF)

Private sector: Associação Brasileira das Indústrias de Óleos Vegetais (ABIOVE), Bayer CropScience, Conselho Empresarial Brasileiro para o Desenvolvimento Sustentável (CEBDS), Louis Dreyfus Company

Experts & stakeholders consulted: Corn deep dive (Upper Midwest, USA):
Producer organizations: Minnesota Farmers Union, Practical Farmers of Iowa

NGOs: Clean River Partners, Practical Farmers of Iowa, The Nature Conservancy (TNC), Sustainable Foods Lab

Private sector: ADM, Manulife Investment Management, Nutrien, Neste

Public sector: Stearns County Soil and Water Conservation District, Minnesota

Academia: University of Wisconsin - Dept of Agronomy

Experts & stakeholders consulted: Rice deep dive (Mekong Delta, Vietnam):
NGOs: International Rice Research Institute (IRRI), SNV, Sustainable Rice Platform (SRP), Sustainable Rice Landscapes Initiative (SRLI)

Private sector: Corteva, Norinchukin Research Institute Co., Ltd., The PAN Group

Public sector: Food and Agriculture Organization (FAO) Regional Office for Asia and the Pacific – Climate Change and Bioenergy, Institute of Policy and Strategy for Agriculture & Rural Development (IPSARD), Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE)

Academia: Can Tho University - Mekong Delta Development Research Institute (MDI)

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We accelerate value chain transformation across key sectors and reshape the financial system to reward sustainable leadership and action through a lower cost of capital. Through the exchange of best practices, improving performance, accessing education, forming partnerships, and shaping the policy agenda, we drive progress in businesses and sharpen the accountability of their performance.

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