Roadmap to Nature Positive: Foundations for the agri-food system

*Row crop commodities subsector*

# → *Deep dive: Corn production in the Upper Midwest, USA*

World Business Council *for Sustainable Development*

# Contents

# Introduction: *Landscape deep dives*

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# *Landscape deep dives*

**To support the journey of agri-food companies to nature-positive system transformation, WBCSD has developed a Roadmap to Nature Positive: Foundations for the agri-food system for the row crop commodities subsector ("row crops summary" hereafter). This deep dive is one in a series of landscape studies linked to the Roadmap.**

The Roadmap provides how-to guidance on applying High-level Business Actions on Nature in value chains, assessing and disclosing material risks and opportunities (aligned with the Taskforce on Nature-related Financial Disclosures (TNFD)) and preparing to set science-based targets for nature (aligned with the Science Based Targets Network (SBTN)).

The Roadmap is designed for use along the complete agri-food value chain and across all stages of the corporate nature maturity journey. The initial focus is on row crop commodities as a subsector of the broader agri-food system. WBCSD addresses cross-sector framing, concepts and definitions in the Roadmaps to Nature Positive: Foundations for all Businesses ("foundations guidance" hereafter). These publications form a single package intended for joint use.

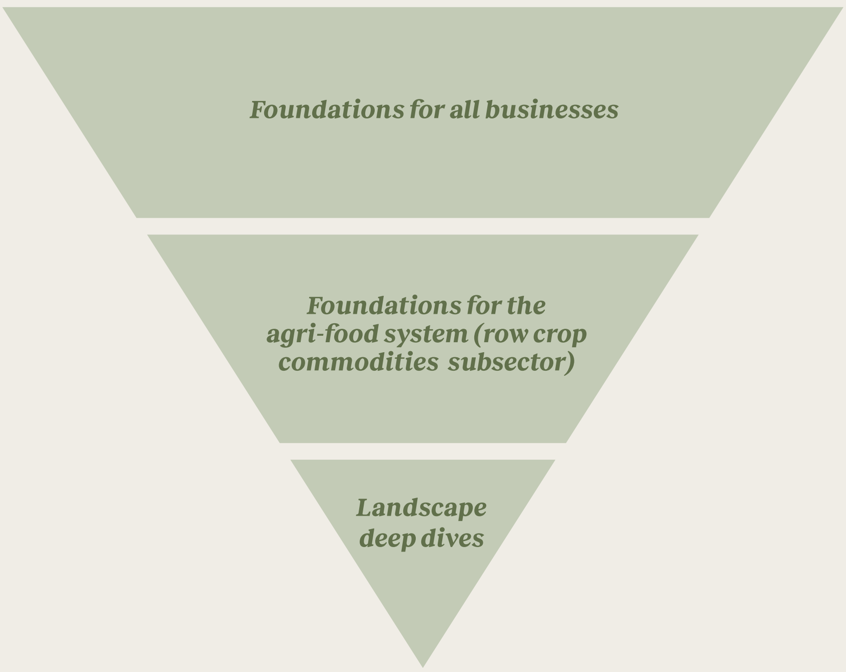
Nature-related dependencies, impacts, risks and opportunities (DIROs) are highly local and actions to address them are distinct from climate change mitigation, which generally includes more global considerations. Recognizing the inherent link between agriculture and the land, WBCSD has undertaken an initial series of nature-positive deep dives into distinct production landscapes.

WBCSD member companies consider these sub-national regions – characterized by growing agricultural production/intensification or containing biodiversity hotspots – as high-priority operating/sourcing regions. In other words, an agri-food company with global exposure would likely determine that these landscapes, if part of its value chain, require specific nature-related assessment, commitment and action.

Each deep dive explores key nature-positive questions for agri-food companies, aligned with the LEAP risk and opportunity assessment approach recommended by the TNFD:

- → **Scope and locate:** Where should I focus, both in my value chain and geographically?
- → **Evaluate materiality:** What should I focus on, considering both nature-related dependencies and impacts?
- → **Assess risks and opportunities:** Why does this matter for my business and key stakeholders?
- → **Prepare to respond and report:** What actions should my company be taking, individually and collectively with others? What barriers and trade-offs do I need to consider? How should I approach nature-related disclosures?

**Figure 1: WBCSD's initial nature-positive guidance for agri-food companies includes three supporting deep dive assessments**

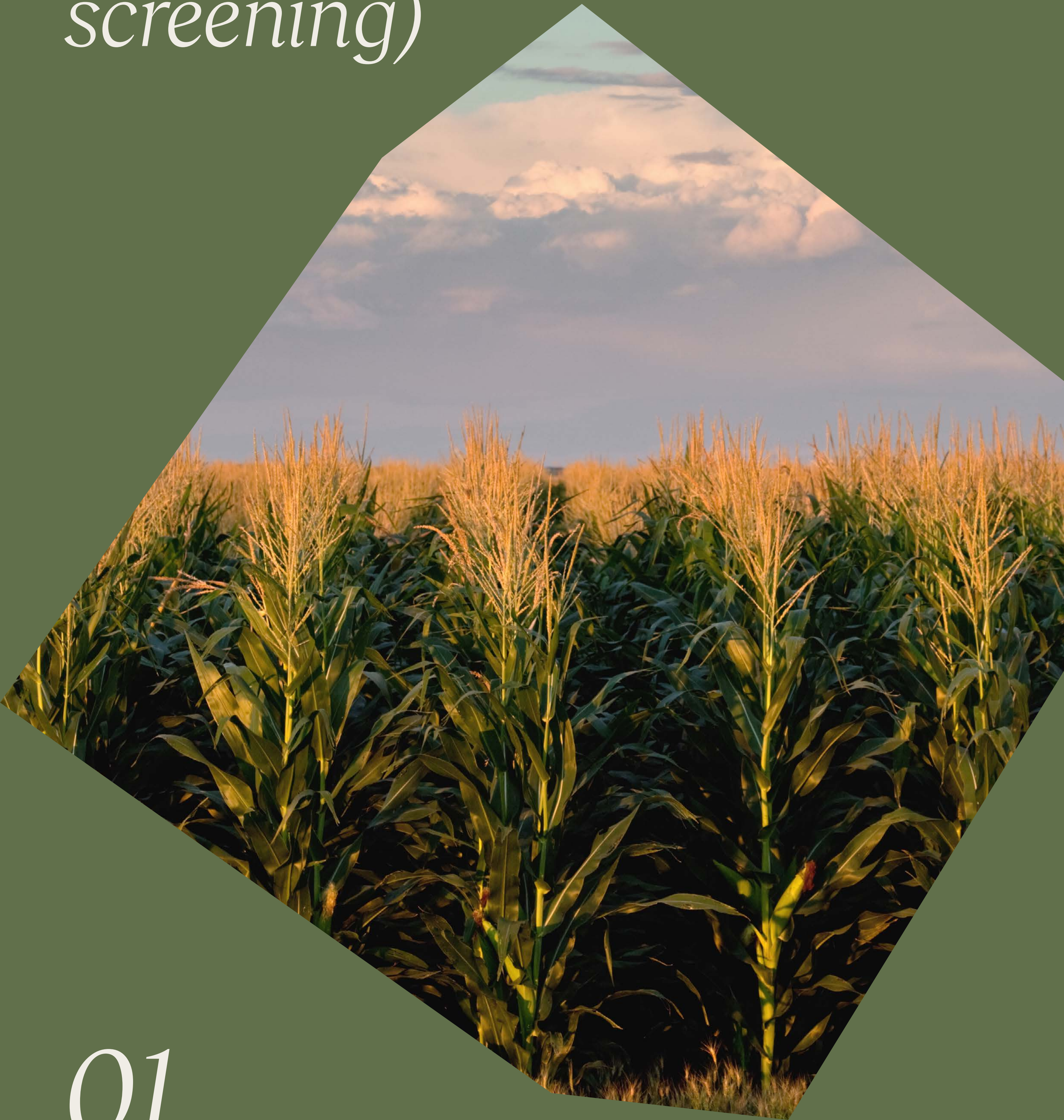


The deep dives explore nature-related DIROs, leading practices, context-specific resources, and unresolved challenges for three of the commodity crops that largely underpin the global food system: soy, corn and rice.[1] These crops are conventionally farmed under intensive methods in a small number of 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."[2] These crops are among those with the largest land-use footprint in areas of high conservation value, posing the greatest nature-related risk.[3] 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.

**WBCSD has worked with a diverse group of agri-food and professional services companies and gathered input from key local and global stakeholders to create an approach that is both scientifically rigorous and practical for business implementation. Looking ahead, WBCSD will continue to engage with leading voices from the private sector and civil society. In the next phase, the Roadmaps to Nature Positive will provide deeper guidance on metrics and indicators and the target-setting and reporting processes. This may also include additional deep dives and case studies to expand the illustrative portfolio of diverse crops and global landscapes.**

→ ***Note that this deep dive relies on concepts and methods explained in the*** **Foundations guidance** and **row crops summary**. Please refer to these resources for detailed supporting guidance

# Stage 1: *Assess (materiality screening)*



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# Stage 1:
# *Assess (materiality screening)*

→ ***Note*** that each stage of the deep dive begins with a high-level statement linking to the **Foundations guidance**.

## Stage 1.1 - Scope & locate

**Agri-food businesses (meaning any company engaged in this value chain) should first identify their main sectors, sub-sectors and parts of the value chain and where they are located. If a company sources, supplies, or finances corn from the Upper Midwest region, this would be a priority location in its nature-positive strategy and this guidance will be relevant.** Certain aspects of this guidance may also be relevant for row crop commodity production in other landscapes but it is important to assess each location independently. See Annex 1 for further detail on this location and tools supporting this stage.

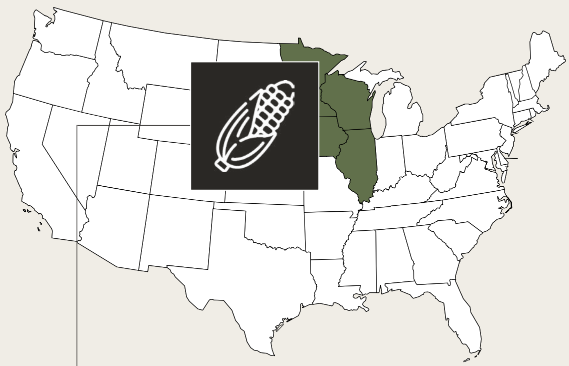
### *The Upper Midwest*

The US Midwest is an agricultural powerhouse, producing around one-third of the world's corn and soybeans annually,[4] among many other crops. This study focuses on the Upper Midwest subregion, including the states of Illinois, Iowa, Minnesota, Wisconsin and adjacent areas.

Prior to European settlement, the region's dominant vegetation was tallgrass prairie, with some savanna and woodlands. Recent decades have marked a shift from "continuous (corn) under conventional tillage to a two-year (corn) and soybean rotation under some form of conservation tillage."[5] Other cropping systems include two years of corn followed by one year of soybean, corn grown continuously and less-commonly, the addition of a third crop such as oats or wheat.

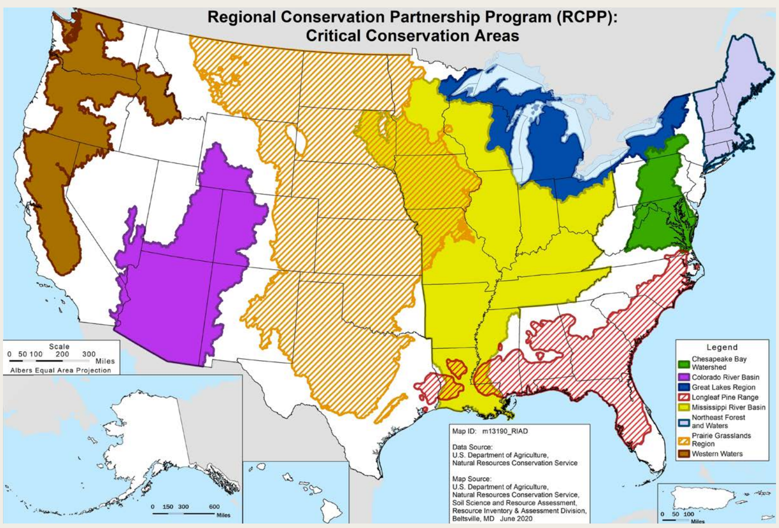
Midwestern soils were historically deep and fertile, yet intensive conventional agriculture has contributed to the mass removal of native vegetation and resulting soil degradation, local and downstream water pollution, significant greenhouse gas (GHG) emissions, and overall ecological degradation. The region forms part of the broader Mississippi River Basin (MRB), which is denoted as a US Department of Agriculture (USDA) Critical Conservation Area presenting "an opportunity for many stakeholders to come together at a regional level to address common natural resource goals while maintaining or improving agricultural productivity."[6] This includes nature-related considerations in the region and downstream in the MRB and beyond – in particular agriculture-driven water pollution and associated challenges.[7]

**Figure 2: The Upper Midwest is a key corn- and soy-producing region in the broader Mississippi River Basin**



*Upper Midwest, USA*
Corn (+soy)

**Figure 3: Critical Conservation Areas as designated by USDA. The Upper Midwest is part of the broader Mississippi River Basin and overlaps with the Prairie Grasslands Region**

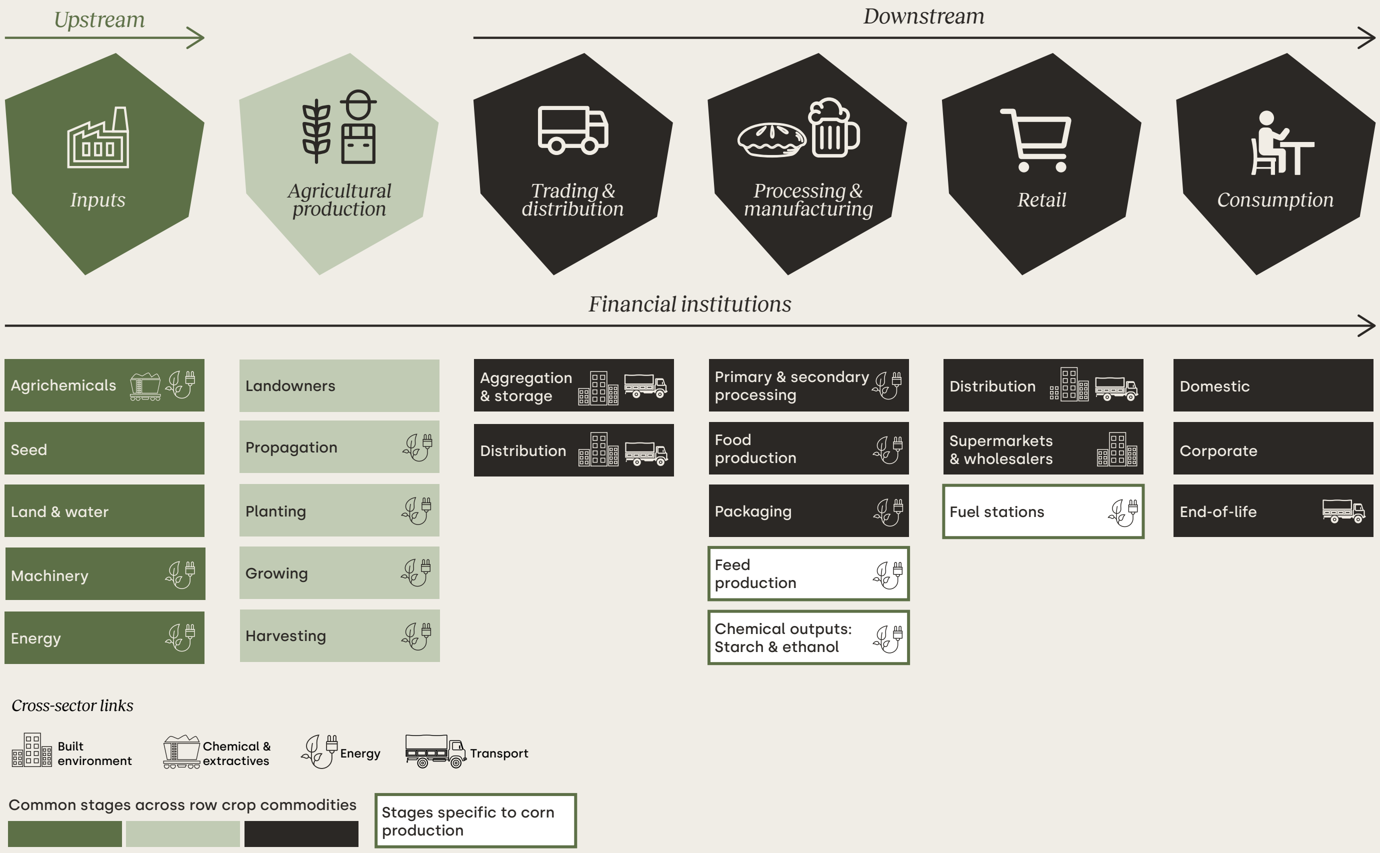



Source: USDA - **Critical Conservation Areas**

## *The corn value chain*

In alignment with TNFD and SBTN guidance, companies should assess their complete value chain, including direct operations and relevant upstream and downstream activities. This Roadmap considers six value chain stages, grouped under three broad headings. The main focus is on agricultural production as the primary land-use stage, though upstream and downstream activities have also been assessed with a lighter touch. The main crop assessed in this deep dive is corn but it also includes soy as a typical rotational crop in the region. The two crops have been assessed together, except where there are specific points related to one or the other.

**Figure 4: The generic corn value chain, including key cross-sector links**



## Stage 1.2 - Evaluate impacts & dependencies

**Agri-food companies should next prioritize potentially high impacts and dependencies on nature typical for the business and associated value chains for further assessment. This section summarizes the process and key findings of WBCSD's landscape assessment, based on desk research and interviews with key local stakeholders across the private, public and civil society sectors.** The process outlined here – and in further detail in the row crops summary – is applicable for any agri-food company evaluating nature-related materiality in its operating or sourcing regions, while the specific findings below are relevant for those engaged directly or indirectly in row crop production in the Upper Midwest. See the materiality matrixes (tables 1 and 2) for the primary outputs of this materiality screening, aligned with the structure and methods of the leading nature-related assessment tools and frameworks.

### *Agri-production*

#### *Soil degradation & erosion*

Large expanses of monoculture with high agrichemical use (fertilizers and pesticides) and low diversity of plant species dominate corn and soy production in the Upper Midwest. Conventional tilling has eroded Midwestern soils considerably since the mid-1800s; recent research indicates an historical average annual loss well above the rate considered sustainable by the USDA.[8] Today, conservation tillage – leaving at least 30% of soil surface covered by biomass and thus helping to maintain organic content – is used on roughly two-thirds of corn and soy crops in the region.[9] Yet fields left with minimal or no plant cover after harvest continue to contribute to the loss of soil organic matter. Shallow root systems and a lack of off-season ground cover can accelerate erosion, leaving crops increasingly vulnerable to storm damage, droughts and flooding, which are intensifying with climate change.

#### *Water use*

These are largely rainfed production systems relying on regular seasonal precipitation, though certain areas (particularly in the region's western edge) do rely on groundwater for irrigation. This can lead to aquifer drawdown and is likely to bring water shortages for human and agricultural use in the coming decades (without improved practices). However, water pollution is the more significant driver of nature-related pressures in the region, both locally and in downstream ecosystems.

#### *Pollution & GHG emissions*

Corn is a nutrient-hungry crop, which in conventional production has required intensive mineral fertilizer use (namely nitrogen, phosphorous and potassium or "NPK"), along with chemical pesticides to protect plants from weeds, pests and disease that tend to proliferate in monocropping systems. The most severe nature-related impacts are related to local soil degradation and downstream water pollution, with resulting effects on biodiversity and overall ecosystem health. This production system is also a significant source of GHG emissions as a result of soil carbon loss under conventional tillage and emissions from farm operations such as diesel-fueled tractors.

**Fertilizers:** Healthy soils can typically provide half or more of the nitrogen needs of a corn plant; the remainder comes from mineral or organic (such as manure) fertilizers.[10] However, misuse and overfertilization are common globally and in this region. Nitrogen-related emissions from soil (in the form of $N_2O$, NOx and $NO_3$) are major contributors to negative environmental impacts, including GHG emissions, soil acidification and water pollution.[11]

> "For freshwater and coastal species in the Midwest, it is particularly important to recognize the interaction between climate change, changes in land cover, and changes in hydrology. When vegetation is removed, or experiences a major change in composition or structure, these balances tend to shift in ways that increase run-off and promote flooding, both of which contribute to stressors that put sensitive species and habitats at risk (very likely)."
>
> *Great Lakes Project,* **Climate Change in the Midwest: Impacts on Biodiversity and Ecosystems**

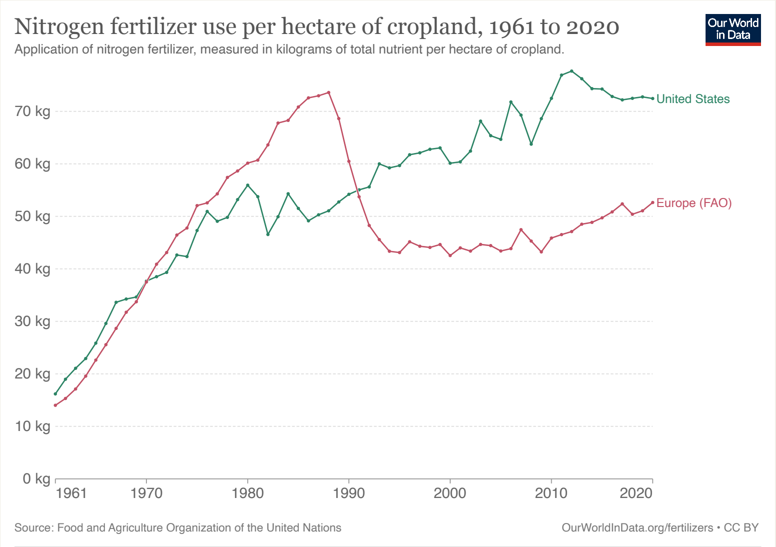
→ *See the* row crops summary for more detail on generalized practices and impacts related to conventional row crop production

→ GHGs: Nitrogen fertilizers are a significant source of GHG emissions, nitrous oxide ($N_2O$) being a powerful GHG that escapes from agricultural soils, especially when overapplied. Fertilizer manufacturing also has a significant carbon footprint (see section below on upstream impacts and dependencies). Globally, fertilizers (including production, transportation and use of mineral and organic fertilizers) contribute some 5% to 6% of all GHG emissions, equating to 14% to 18% of agricultural GHGs (with mineral nitrogen fertilizer contributing roughly half of this).[12,13] Life-cycle assessment data show nitrogen fertilizers contribute over 30% of the total fossil energy associated with biomass production in the region.[14]

→ Water pollution: Many waterways in the region show high levels of nitrate pollution linked to fertilizer runoff from farm fields, affecting local drinking water quality (in both groundwater and surface bodies including the Great Lakes, on which some 40 million people depend) and contributing significantly to downstream eutrophication. Corn and soybean production in the MRB contributes over 50% of the nitrogen pollution entering the Gulf of Mexico each year, creating a large seasonal dead zone with damaging ecosystem and economic effects (estimated at up to US $2.4 billion in costs to Gulf fisheries and marine habitat annually beginning in the 1980s).[15] Factors impacting nitrate pollution severity include climate (particularly precipitation patterns), other soil attributes (including soil organic carbon, particularly as affected by tillage) and the prevalence (or lack) of cover cropping.

→ Excessive fertilizer use also creates unnecessary input costs for producers, which estimates show are over US $400 million annually in the MRB.[16] Fortunately, recent research indicates significant opportunities for improvements in fertilizer use efficiency (for example, as measured through the nitrogen use efficiency (NUE) metric).[17]

**Figure 5: Across the US, nitrogen fertilizer use per unit of cropland increased dramatically throughout the 20th century but has levelled off in recent years**



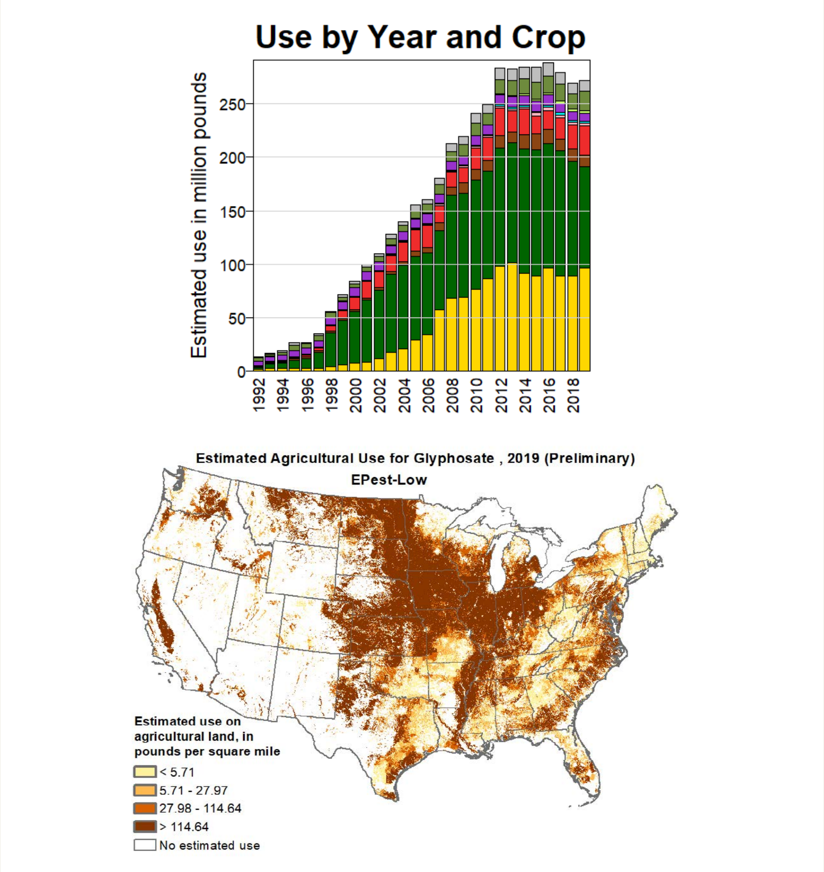

Source: Food and Agriculture Organization of the United Nations, Our World in Data – Fertilizer

**Pesticides:** Most corn and soy planted in the US today is genetically modified to be herbicide-tolerant or insect-resistant. This has allowed for widespread improvements in conservation tillage and decreased the use of insecticides. But it has also brought increased use of herbicides to combat increasingly resistant weeds; in large doses, these herbicides – such as glyphosate and dicamba – contribute to water and air pollution, with harmful effects on aquatic invertebrates, pollinating insects and birds. This has particularly strong effects in and around wetland areas.[18] Pesticide application for cropland in the US in 2020 was 2.54 kg/hectare on average (for comparison, lower than Brazil but comparable with most of Europe).[19] United States Geological Service (USGS) data indicate pesticide use intensity is greatest in the Midwest, detecting an average of 25 pesticides per site assessed.[20]

*Biodiversity*

Although the Upper Midwest is not considered amongst the top global biodiversity hotspots today, it does contain key biodiversity areas (KBAs) and an extensive variety of habitats and flora and fauna. This includes hundreds of species of plants, insects, birds, amphibians, fish and mammals – many of them threatened or endangered. For example, as recently as the mid-nineteenth century the region contained a significant American bison herd but the species was driven nearly to extinction and now exists only in small, isolated pockets. As elsewhere, wetlands conversion for agriculture and development has been a major driver of biodiversity loss; around half of Wisconsin's wetlands have been drained, and only about 10% remain in Illinois.[21] Research shows climate impacts to be a serious threat to Midwestern biodiversity; the region's plant and animal species may have a particularly hard time migrating to adapt to higher temperatures due to the flat topography, lack of natural land cover and barriers to habitat connectivity.[22] Beyond the region itself, as described above, fertilizer runoff from conventional row crop production is a major driver of downstream freshwater and marine ecosystem impacts including eutrophication causing the seasonal dead zone in the Gulf of Mexico.

**Figure 6: Total pesticides by crop used in the US and glyphosate concentration mapped across US states**




Source: U.S. Department of the Interior, U.S. Geological Survey (2019) Estimated Annual Agricultural Pesticide Use

Biodiversity – the variability among living organisms – is a key feature of nature, cutting across all other dimensions. All nature-related impact drivers can contribute directly or indirectly to biodiversity outcomes and, in turn, biodiversity affects the quality of many critical ecosystem services upon which agricultural production relies (such as soil health, bioremediation, etc.). See Annex 1 for further biodiversity screening data on this landscape.

*Links to socio-economic issues*

Effective farmer engagement is essential for nature-positive system transformation. Thus, social inequalities – especially as related to historically marginalized farmer groups – matter for companies up and down the agri-food value chain, both from a social equity perspective and as part of their nature-positive strategies. Without the financial stability and technical know-how needed to adapt their practices farmers are unlikely to participate at the speed and scale of change that is needed.

In general, access to financial and technical support remains a barrier for all marginalized groups, including Black, Native American and women farmers. According to the USDA, its own "lending process, for the last century, is not set up to support nontraditional growers including the farmers of color who face high rejection and withdrawal rates as a result."[23]

Land tenure is another key factor in farmers' ability to implement new practices on the ground. Depending on the terms of tenant farming contracts, it can often be difficult or impossible to change conventional practices. Today, tenant farmers manage some 46% of Midwest farmland and the region has the country's largest percentage of land owned by non-operating landlords.[24] Short-term contracts (often for a single season or year) and informal contracting practices mean that farmers often are unable to invest on longer cycles. These issues can disproportionately affect marginalized farmer groups with generally lower bargaining power.[25]

## Upstream

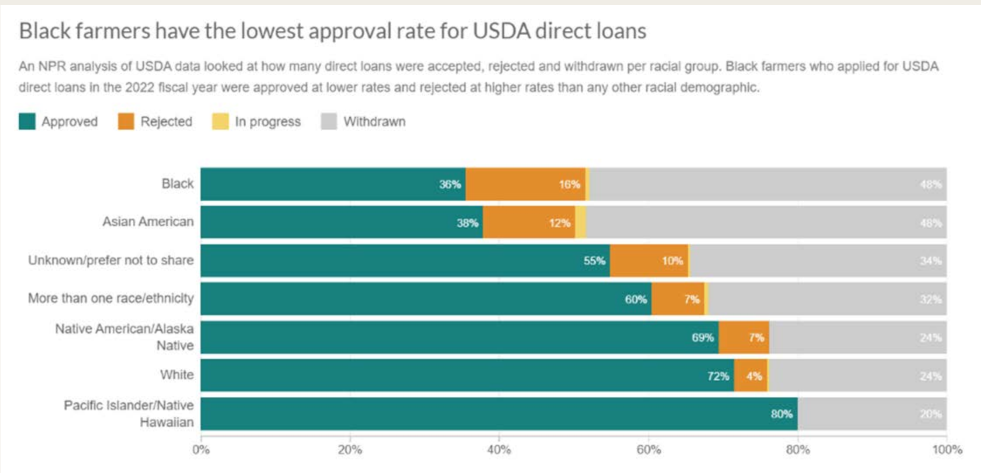
Agri-input companies – which provide seed, fertilizers and crop protection products – play a key role in shaping on-farm practices across the spectrum from conventional to regenerative. At the same time, their own production processes can contribute significantly to the embedded environmental footprint of row crop commodities. Notably, the Haber-Bosch process to produce mineral nitrogen fertilizer is an energy-intensive activity, accounting for about 1% of all global energy use and around 1% of total $CO_2$ emissions.[26] The chemical process of calcination in lime production also generates significant GHG emissions (although lime for agricultural use represents only a small portion of global production).[27] The mining of minerals for fertilizers – namely potash for potassium and phosphate for phosphorous – can have local and downstream environmental impacts related to construction, extraction, beneficiation and waste disposal,[28] although they are generally considered lower risk compared to the mining of metals.

## Downstream

The corn production system in the Upper Midwest currently serves two primary markets – biofuels and animal feed – with the remainder used for seed, industrial applications and human consumption (one-third of which becomes high-fructose corn syrup).[29] Because corn is a high-yielding commodity and a widely-used ingredient in food products, a wide range of actors are part of the corn value chain. Corn is the largest component of the global trade of feed grains, generally accounting for about 80% of the total volume over the past decade; it forms over half of the diet composition of US livestock and poultry.

Corn is also processed into a variety of food and industrial products, including starch, sweeteners, corn oil, beverage and industrial alcohols.[30] Many meat products are produced with animal feed that includes corn-based ingredients. Restaurants are also heavy users of corn-derived ingredients in many products, from cooking oil to bakery items.[31] Trading and distribution activities can contribute significantly to the carbon footprint of row crop commodities through the use of fossil

**Figure 7: Black farmers have the lowest approval rate for USDA direct loans of any US farmer demographic**




Source: NPR (2022)

fuels in transportation. Food manufacturing can also have a high GHG impact from fossil-powered operations. This study has not specifically assessed the nature-related pressures of these diverse downstream markets but they are included by reference as key drivers of corn production trends. In general, these are resource-intensive sectors with important nature-related dependencies and impacts; however, their biggest impact is as primary drivers of the nature-related pressures occurring in agri-production.

## *Looking ahead*

As in other global productive landscapes, climate change is accelerating the legacy impacts of conventional row crop production in the Upper Midwest and also creating new ones, as increased absolute humidity and precipitation during the warm season further erode soils, create favorable conditions for pests and pathogens, and degrade the quality of stored grain. Monocropping can intensify the impacts of climate change as crop systems are less resilient to change and therefore more vulnerable to pest infestations, invasive species, droughts and extreme weather; flooding can be particularly damaging by washing away soil particles and nutrients en masse, causing acute episodes of soil carbon loss and increased water pollution. In the last century, changing precipitation patterns (from both global and microclimate effects) have compromised productivity in some areas and increased soil erosion, nitrogen leaching into water resources and nitrous oxide ($N_2O$) release, and altered timing of intra-seasonal water availability. Without significant adaptation measures, climate-driven impacts, including higher average temperatures and increasing soil-moisture, threaten to set Midwestern agricultural productivity levels back several decades, according to the US Government's Fourth National Climate Assessment.[32]

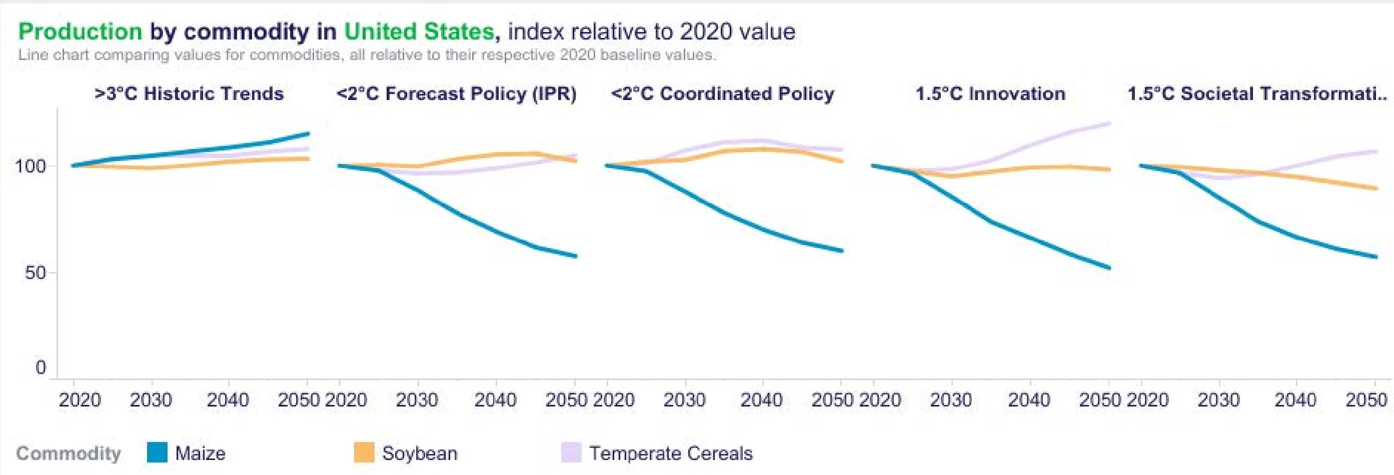
As biofuels (namely corn-derived ethanol) continue to play a significant role in the energy and transport sector transition, pressure on Midwest corn as both food source and fuel feedstock will likely continue. Demand for ever-increasing productivity and intensification can be a promising opportunity to scale nature-positive practices with the right policies and business models in place.

## *Materiality matrixes*

Tables 1 and 2 illustrate the results of the landscape materiality screening conducted, which is intended as a starting point for refinement by any agri-food company engaged in this landscape and crop cycle. This is a generalized assessment, highlighting only those dependencies and impacts evaluated to have potentially high or very high materiality (according to the methods used in the ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure) tool), 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 ratings of nature-related dependencies and impacts relative to the aggregated assessment included in the row crops summary, meaning the major differences to consider at this landscape level compared with a more generalized global screening. The tables align with the classifications available in the ENCORE tool and the Global Assessment Report on Biodiversity and Ecosystem Services by the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES). See the row crops summary for notes on methods followed.

**Figure 8: US production projections for corn, soy and cereals under five different climate transition scenarios**




Source: From WBCSD Climate Scenario Tool

Note: See the row crops summary for more on this tool

## Table 1: Corn & soy in the Upper Midwest – Key dependencies

**Dependencies — Direct physical inputs**

| *Value chain stages* | Animal-based energy | Fibers & other materials | Genetic materials | Groundwater | Surface water |
|---|---|---|---|---|---|
| *Inputs* | | | | | |
| *Agri-production (irrigated)* | | | | Where irrigated (secondary source today) | Where irrigated (primary source today) |
| *Agri-production (rainfed)* | | | | | |
| *Trading & distribution* | | | | | |
| *Processing & manufacturing* | | | | Needed for operations | Needed for operations |
| *Retail* | | | | | |

**Dependencies — Enable production processes**

| *Value chain stages* | Pollination | Soil quality | Water flow maintenance | Water quality | Ventilation |
|---|---|---|---|---|---|
| *Inputs* | | | | Important for operations & product quality | |
| *Agri-production (irrigated)* | | Essential for crop health & yield | Replenish surface & groundwater | | |
| *Agri-production (rainfed)* | | Essential for crop health & yield | Replenish surface & groundwater | | |
| *Trading & distribution* | | | | | |
| *Processing & manufacturing* | | | | Important for operations & product quality | |
| *Retail* | | | | | |

**Dependencies — Mitigate direct impacts**

| *Value chain stages* | Bio-remediation | Dilution by atmosphere & ecosystems | Filtration | Mediation of sensory impacts |
|---|---|---|---|---|
| *Inputs* | Mitigate pollution from operations | Mitigate pollution from operations | Mitigate pollution from operations | |
| *Agri-production (irrigated)* | Mitigate pollution from farm operations | Mitigate pollution from farm operations | Mitigate pollution from farm operations | |
| *Agri-production (rainfed)* | Mitigate pollution from farm operations | Mitigate pollution from farm operations | Mitigate pollution from farm operations | |
| *Trading & distribution* | | | | |
| *Processing & manufacturing* | | | | |
| *Retail* | | | | |

**Dependencies — Protect from disruption**

| *Value chain stages* | Buffering | Climate regulation | Disease control | Flood & storm protection | Mass stabilization & erosion control | Pest control |
|---|---|---|---|---|---|---|
| *Inputs* | | Operations affected by temperatures | | | | |
| *Agri-production (irrigated)* | 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)* | 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* | | Operations affected by temperatures | | Facilities exposure to weather | | |
| *Retail* | | | | | | |

**High materiality** | **Very high materiality** | ↑ ↓ **Rating difference vs row crops summary, if any**

**Table 2: Corn & soy in the Upper Midwest – Key impacts**

| *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 runoff & leaching | From agrichemicals | | | From GMOs ↑ |
| *Agri-production (rainfed)* | Land-use change & soil loss | | | | | Land-use change & farm operations | Fuel use & agrichemical emissions/ drift | Agrichemical runoff & 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 row crops summary, if any

## Stage 1.3 - Assess risks & opportunities

**Agri-food companies should next assess nature-related risks and opportunities for the business and for key stakeholders in order to prioritize further action. The process outlined in the row crops summary will be relevant for any agri-food company in assessing its nature-related risks and opportunities; the summary also contains corresponding findings applicable across global row crop commodities. The findings here will be relevant for those engaged directly or indirectly in corn and soy production in the Upper Midwest.**

Given the significant soil health and water pollution impacts of conventional row crop production in the Upper Midwest, the primary nature-related business risks and opportunities for agri-food companies involved in this landscape largely revolve around these drivers. **Physical risks** include the effects of chronic soil degradation and erosion and, more recently, climate change (both global and microclimate-driven), which in turn can accelerate unsustainable intensification practices at the farm level (including increased irrigation and agrichemical overuse), thus continuing the cycle of ecosystem degradation and escalating operating costs. Acute risks often link to the same pressure drivers, such as erosion leaving crops increasingly vulnerable to damage or loss from storms, flooding and drought – which are all intensifying with climate change. These risks can affect crop yield and quality, disrupting supply and increasing costs.

→ ***See the* row crops summary** for further explanation of nature-related risks and opportunities common across row crop commodities.

**Transition risks** include lost business if retailers, consumers and financial institutions choose not to purchase from or invest in farms, companies or entire regions linked to ecologically damaging practices. This can also lead to increased cost of capital and put at risk a company's legal or community license to operate. The transition to regenerative agriculture (regen-ag) itself can present risks to farmers (and therefore to agri-food companies) including potential for lower yields and higher costs in the short term and the possibility of lost financing or crop insurance coverage for novel farming practices.

Physical and transition risks can cascade from agri-producers to both downstream and upstream actors, causing supply disruption, increased supply chain costs, lost business and depreciated or stranded physical assets such as land holdings and processing facilities.

**Business opportunities** include the benefits of avoiding these risks through careful planning and investment; increasing revenue, profitability and financing options through improved farming practices (such as precision and regenerative) and outcomes; and shifting business models to meet changing consumer and stakeholder demands (including innovation in monitoring, reporting and verification (MRV) systems and food product redesign). Agri-input companies have a growing opportunity to develop and scale bio-based alternatives to traditional agri-chemicals and on-field monitoring systems. There are also opportunities for value-creation throughout the value chain from nature-based solutions (NbS), including for soil-carbon – but farmer trust, MRV capabilities, market standardization and capital flows remain significant barriers to scaling NbS (see the **row crops summary** for further detail).

**Figure 9: Interconnections between key dependencies and impacts related to conventional corn and soy production in the Upper Midwest and the resulting risks for agri-food companies**

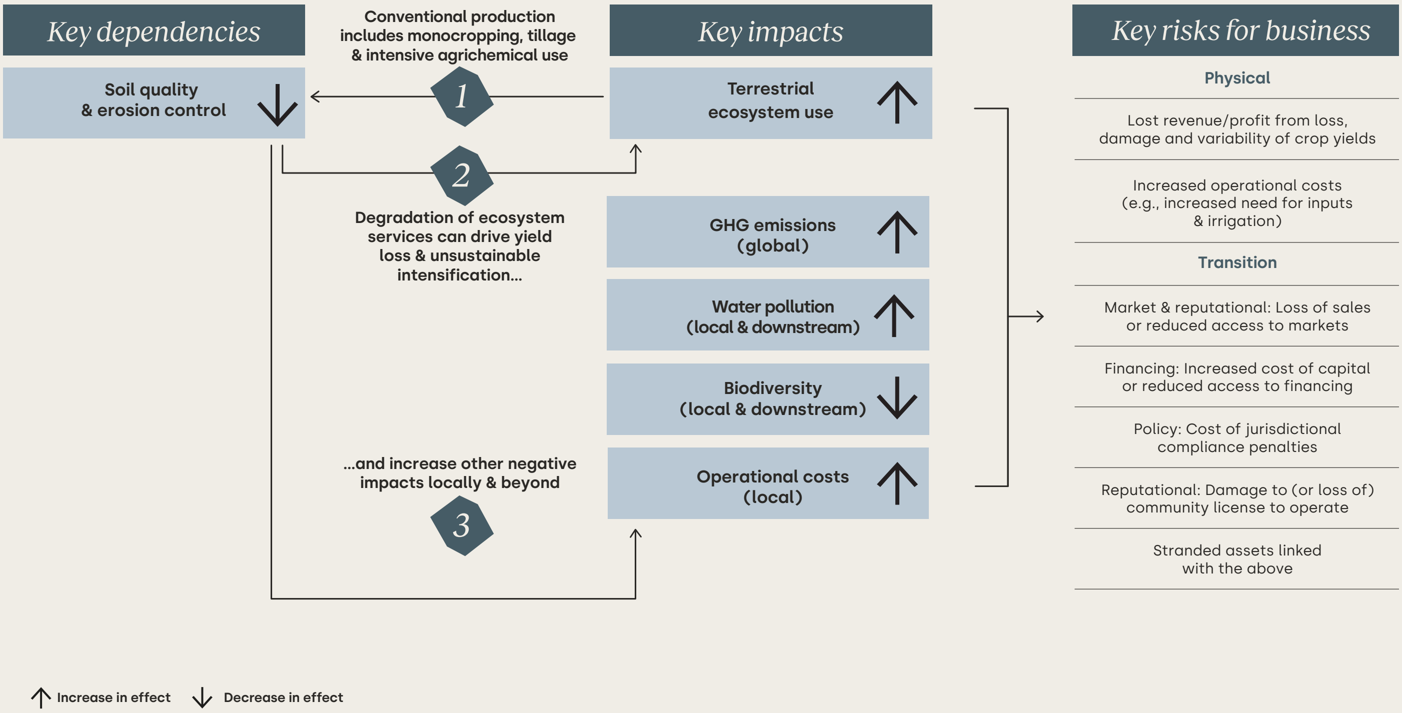
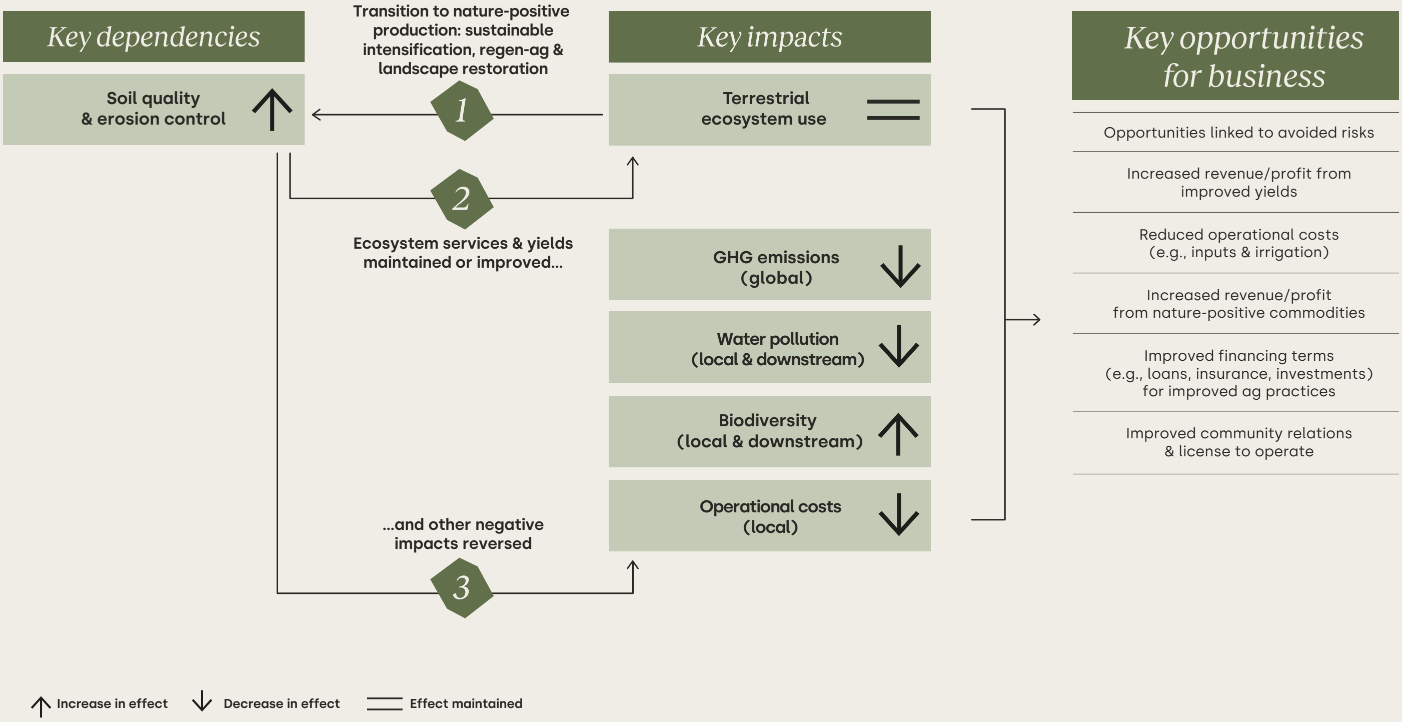



**Figure 10: Interconnections between key dependencies and impacts in a more nature-positive corn and soy production system and the resulting opportunities for agri-food companies**



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

*02.*

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

### Stages 2.1 & 2.2 - Set science-informed targets and take priority actions

**Based on the materiality screening, agri-food companies should identify the existing and additional priority actions needed to avoid and reduce negative impacts and promote opportunities to restore and regenerate nature. Companies should set time-bound, specific, science-informed corporate-level targets and linked indicators to track progress on reducing priority impact drivers on nature.**

**Many interconnected issues affect farmers' ability to change their practices; this requires systemic change and support from the whole value chain, plus the public sector and civil society. Regen-ag and landscape restoration are shown to improve ecosystem health, crop yields and farmer incomes in the medium-to-long terms; but in the short-term (first 2-5 years), the transition can bring about lower yields and higher costs.[33] Midwestern farmers cannot deliver the landscape-level and market-based changes needed by themselves; they need significant financial and technical support to transform the system at scale.[34]**

### *Improve agricultural practices*

Agri-food companies should support farmers to adopt and scale complementary nature-positive practices on and around farms (i.e., at the landscape level) to reduce and ultimately halt nature damage and loss and restore healthy farming ecosystems. This aligns directly with targets 7 and 10 of the **Global Biodiversity Framework** (GBF).

Scaling regen-ag has great potential for advancing a nature-positive corn-soy system in the Upper Midwest. The most common regenerative practices promoted and implemented in the region today include:[35]

- Crop rotation diversification (such as integrating winter oats with corn and soy);
- Cover crops (such as nitrogen-fixers like red clover and novel grains like **Kernza**);
- Conservation tillage and no-till;
- Integrating prairie strips and buffer zones;
- Integrated crop-livestock-forestry systems (ICLFS);
- Using bio-based inputs (e.g., seed coatings and organic fertilizers).

Sustainable intensification and precision agriculture can effectively complement regen-ag, especially during the multi-year transition from conventional production. This may include:

- Crop variety selection and breeding for disease, pest and climate resilience;
- 4R (right source, right rate, right time, right place) nutrient stewardship[36] and advanced fertilizer technology and application techniques;
- Integrated Pest Management (IPM) planning;
- Improving irrigation efficiency.

*According to the* **Scientific Panel on Responsible Plant Nutrition**, *4R nutrient stewardship practices that industry and producers alike widely endorse "offer a potential win-win situation of greater agricultural productivity and efficiency combined with decreasing negative environmental responses, by reducing leaching into groundwater, run-off into waterbodies, drift into nearby ecosystems and so on. Each of the 4Rs (Right source, Right rate, Right time and Right place) have implications for biodiversity and can have on- and offsite biodiversity elements incorporated into them."[37]*

**Stakeholders use numerous concepts and terms today with reference to sustainable agriculture. This guidance considers 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 that also incorporates critical social considerations). See the row crops summary for further detail on these topics.**

→ ***See the*** illustrative **maturity progression** on regen-ag for more detail. See the **row crops summary** for further guidance on priority actions relevant across row crop commodities.

Systems change requires an "all-hands" approach – public, private and civil society sectors – and must center on the farmers who are at the heart of the transition. Leading collaboration examples include:

→ The **Midwest Rowcrop Collaborative** is a multistakeholder partnership focused on supporting and accelerating sustainable solutions that address the environmental impacts of farming in the region, with a goal to support at least 30,000 Midwestern farm operations in the transition to regen-ag. Members include leading companies from up and down the agri-food value chain.

→ **Farmers for Soil Health** is a collaboration in partnership with the Soy Checkoff and Pork Checkoff programs and National Corn Growers Association to create a farmer-led cover crop program that advances the use of soil health practices, meets sustainability goals and improves farmer profitability. The program engages farmers to proactively drive sustainability improvements - for example to expand adoption of cover crops to 30 million acres by 2030 - while building critical support from industry and supply chain partners.

## *Landscapes & restoration*

Taking a landscape approach reflects an understanding of farms as an active part of local ecosystems, communities and cultures, recognizing they both rely on critical ecosystem services and create impacts beyond the farm boundary. Agri-food companies should embed landscape approaches as a guiding theme in their nature-positive strategies – including investing in landscape protection and restoration projects within and beyond their value chains, with a particular focus on areas of high conservation value (HCV). Actions may include native species restoration on degraded agricultural or pasture land, wetlands restoration, watershed conservation programs and more. Leading regional examples include:

→ The USDA's Farm Service Agency **Conservation Reserve Program** incentivizes farmers to protect environmentally sensitive land by providing long-term rental payments and cost-sharing for planting resource-conserving native plant and tree species to control soil erosion, improve water quality and develop wildlife habitat.

→ The National Fish and Wildlife Foundation's (NFWF) **Sustain Our Great Lakes** is a public–private partnership designed to sustain, restore and protect fish, wildlife and habitat in the region by leveraging funding, building conservation capacity, and focusing partners and resources toward key ecological issues. The program awards direct grants to local partners for on-the-ground habitat restoration and enhancement.

→ The Nature Conservancy facilitates multistakeholder **conservation programs** in priority landscapes throughout the broader MRB region.

## Stage 2.3 - Transform the system

**Agri-food companies should identify additional actions needed to transform business models and business activities. These actions should address barriers and improve the enabling environment (policy, financing, technology, infrastructure). Companies should consider both direct operations and their wider sphere of influence (such as priority upstream and downstream value chains and landscape-specific stakeholders and customers).**

### *Business strategy, market development & financing*

Regenerative agriculture increases overall farm output in the medium-to-long term, but can require significant up-front investment and as the land undergoes significant change in the initial years the transition can bring higher costs and lower yields. Agri-food companies can play an essential role in supporting farmers on this journey, particularly by developing markets for regeneratively grown crops. This should include long-term purchasing contracts and investments, not only for one or two seasons. As one regen-ag expert (and farmer himself) noted, referring to farmers as practical businesspeople: *"If we build [the markets], they'll grow the crops!"*

There is growing market awareness of the environmental impacts of conventional corn and soy production and consciousness that market players – traders, food companies, retailers and finance institutions – are critically influential on these issues. Indeed, some major value chain actors have created farmer-focused programs to improve practices, for instance by promoting 4R Nutrient Stewardship, cover cropping and grass-fed livestock. The next step is to massively scale these efforts for system-wide impact.

→ ***The*** **row crops summary** outlines generalized nature-positive priority actions for agri-food companies engaged with row crop commodities

"There is no 'one-size-fits-all' (financing) solution, but the core principles remain true: variety, flexibility, simplicity – and importantly, security."

**BCG, One Planet Business for Biodiversity (OP2B) & WBCSD (2023)**

*Spotlight on ADM: In partnership with the USDA Natural Resources Conservation Service (NRCS) and NFWF, global commodities trader ADM launched the* **Midwest Cover Crop program** *in February 2022 to catalyze the adoption of cover crops by corn and soybean farmers in the Midwest. The initiative awarded approximately US $2.6 million to grants that conduct targeted outreach and provide technical assistance to farmers, support the development of four-year contracts for cover crop plantings, and monitor and report environmental and economic outcomes. The grants will accelerate the adoption of this practice and ensure the beneficial outcomes from cover cropping (improving soil retention, enhancing soil heath, reducing GHGs and improving water resources) are secured over the long term. Participating farmers may also see improvements in long-term profitability through reduced input costs and higher yields.*

Downstream from the farm, food companies, restaurants and retailers – as the direct links to consumers – are critical to driving systems change. These companies can influence production practices and supplier standards within their supply chains towards nature-positive outcomes. They play a key role in shaping market trends and consumer preferences, for example towards plant-based product offerings and to reduce food loss and waste.

Similarly, upstream players – namely agri-input companies – have a major influence on practices at the farm level. Namely, they can adapt their products and technical services to improve the use of fertilizers and pesticides to increase plant uptake and reduce runoff. They also have opportunities to develop greener manufacturing practices (such as recent investments by Yara and OCP into green hydrogen production) and to develop and scale bio-based input offerings.

*Spotlight on Nutrien: With a direct relationship with 500,000 growers globally, Nutrien is in a unique position to increase productivity while protecting natural resources and enhancing grower resilience. As an upstream actor in the agri-food value chain, the company approaches its downstream impact by addressing the nature pressures of greatest concern. For example, regarding marine habitat degradation in the Gulf of Mexico due to nutrient pollution in the Midwest, Nutrien's best opportunity for impact is to promote good agronomy practices that support productive, profitable and resilient farms in the MRB, reducing nutrient runoff at the source. To achieve its 2030 commitment to "enable growers to adopt sustainable and productive agricultural products and practices on 75 million acres globally," Nutrien provides growers with "whole-acre" solutions including environmental farm plans, leveraging 4R Nutrient Stewardship and IPM planning, conservation tillage or no-till, cover crops and crop rotation. Nutrien's* **Sustainable Nitrogen Outcomes program** *launched in 2022 offers growers a financial incentive to reduce nitrogen-based carbon emissions at the field-level. The program aims to reduce nitrogen-driven GHG emissions through farm solutions that enable growers to reduce application rates while managing for increased yields. In addition to lowering emissions, the program enables improved soil and water outcomes, increasing resilience across landscapes.*

Adequate low-risk, long-term, flexible and inclusive financing is crucial for the systemic shift to happen without negatively impacting farmer livelihoods. All players in the financial system have a role – investors, crop insurance providers and agri-lenders – and should work together to better understand and meet the needs of farmers on the ground, especially regarding the transition to regenerative practices. Current models are often incompatible with farmer needs to invest for long-term nature- and climate-positive operations. Furthermore, current crop insurance models can financially insulate farmers and supply chains from the worsening impacts of climate change and nature loss, thus slowing efforts to adapt and improve practices. Recent research by One Planet Business for Biodiversity (OP2B) and partners highlights specific solutions to scale, including cost-sharing programs, longer-term loans and adjusted crop insurance and warranty models.[38]

## Public policy

Public policy must underpin the agri-food system nature-positive transformation at the global, federal and state/local levels. US federal policies should align with the objectives of the **GBF** and **Sustainable Development Goals (SDGs)** to advance sustainable agriculture across the country, including the Midwest. With around 17% of total US corn production exported each year, it is important that jurisdictional policies of trading partner countries also align around common objectives and approaches, as otherwise any benefits may remain limited by country borders and bilateral trade arrangements. Businesses and their trade groups can support policies that advance sustainable agriculture and safeguard farmer livelihoods. They can also lead in creating public-private partnerships to scale-up nature-positive practices and outcomes at the farm-level. Some examples include:

→ Aligning subsidies and incentive programs towards nature-positive outcomes (aligned with GBF target 18):

- The US $369 billion in climate funding under the Inflation Reduction Act of 2022 includes nearly US $20 billion to improve the environmental footprint of US agriculture by helping farmers store more carbon in the soil, create habitat for pollinators and make farms more resilient in the face of extreme weather.[39]
- The USDA's Environmental Quality Incentives Program provides more than US $100 million in incentives for cover crop adoption each year.[40]
- The US has joined the **High Ambition Coalition (HAC) for Nature and People**, a group of more than 90 countries encouraging the adoption of the global "30x30" conservation target aligned with **GBF target 3**. The Biden Administration has endorsed the 30% land conservation goal for the US and made it a core principle of this plan.[41]

→ Public-private partnerships, for long-term, low-risk funding for sustainable agriculture (aligned with SDG 17):

- The USDA's **Partnerships for Climate Smart Commodities** represents the first significant step-up in funding for sustainable agriculture in the US, providing over US $3 billion in public investment and incentives for developing commodity supply chains that can verify that crop production uses a suite of climate-smart agricultural practices.[42]

→ Regulation and enforcement: Rigorous, science-based regulation and monitoring for environmental outcomes, with context-specific targets for soil, water and biodiversity; enforcement of the Clean Water Act, Waters of the United States (WOTUS) and other longstanding regulations.

→ State & local levels: Increasing technical support through extension services, including partnerships with local universities, businesses and NGOs. Building farmer trust is key to unlocking transformative opportunities – extension agencies play a key role, as does farmer-to-farmer knowledge sharing.

→ Direct support for farmers of color to help address historical and ongoing inequalities: Land regeneration is connected to traditional agricultural practices and collaborative models for land ownership, as in land trusts, and for processing, as in cooperatives. The public sector can support and learn from demographically-oriented efforts working to restore cultural connections to land and farming, such as:

- Iowa State University's **Three Sisters Gardening Project** and **Dream of Wild Health**
- The **National Black Growers Council**, a group of multigenerational producers advocating for the best interests of Black farmers

> "It's exciting to see the convergence of private sector goal-setting and now public sector investment…really in the last year or two, you have a true partner in the Federal government that is resourcing this work…to help accelerate the progress."

**Rod Snyder, Senior Agriculture Advisor to the US Environmental Protection Agency (EPA), as noted in the Innovation Forum podcast (2023)**

## Maturity progression: Improved farming practices & outcomes

WBCSD's **foundations guidance** includes the core concept of a corporate nature maturity progression, from starting to developing, advancing and ultimately leading. The general progression, aligned with the **SBTN Action Framework**, is from "do no harm" to "do more good" to "transform the system." A set of criteria aligned with the **High-level Business Actions on Nature** defines each stage.

The intent is to meet companies where they are today and support their advancement toward leading practices.

The following progression illustrates the highest priority issue for catalyzing nature-positive system transformation in this landscape: **improving agricultural practices and outcomes** through sustainable intensification and regen-ag. The tables address upstream and downstream value chain actors separately, but some companies may be involved in various stages of the value chain.

**Table 3: Illustrative corporate maturity progression on nature-positive row crop production in the Upper Midwest for *upstream actors***

| | | ***Corporate nature maturity levels*** | | |
|---|---|---|---|---|
| | | ***Starting*** ***"Do no harm"*** | ***Developing/advancing*** ***"Do more good"*** | ***Leading*** ***"Transform the system"*** |
| **Key levers for transformation** | Policy & stakeholder engagement | Comply with all jurisdictional regulations on fertilizer & pesticide production and marketing, promote responsible use practices | Follow & promote leading international legal & voluntary standards on fertilizer & pesticide production, marketing and use practices; participate in multi-stakeholder coordination for sector-level transformation | Lead pre-competitive coordination, partnerships development, trade associations & policy advocacy aligned with leading international standards & outcomes on fertilizer & pesticide production, marketing, application & monitoring |
| | Business strategy | General commitment to supporting farm-level sustainable intensification & regen-ag; improve downstream traceability of fertilizer & pesticide distribution & use | Adopt science-driven, time-bound, quantitative commitments to support farm-level sustainable intensification & regen-ag, with regular progress reporting; work to improve monitoring practices/capabilities at farm-level | Set science-based targets to deliver & scale programs for farm-level sustainable intensification & regenerative practices; invest to improve monitoring, reporting & verification (MRV) practices for agri-input use; develop nature-positive agri-inputs, products & supporting technical services |
| | Illustrative commitments | Reduce overall risk from pesticides and highly hazardous chemicals on regional corn/soy farms by at least half by 2030; develop & distribute 4R nutrient stewardship and IPM training content through strategic retailers & online materials | In partnership with extension agencies, reach at least (x) Midwestern corn/soy farmers by 2025 through 4R nutrient stewardship and IPM training programs; directly support at least (y) farmers with implementation & monitoring | Achieve NUE of at least (x) and EIQ of at least (y) on 500,000 acres of Midwestern corn/soy farmland by 2030; target 50% of inputs sales from bio-based alternatives by 2030; invest USD $(z) billion to develop advanced MRV technologies by 2025 to support nature-positive farming outcomes |
| | Key references | US EPA; USDA Office of Pest Management Policy; International Fertilizer Industry Association; FAO International Code of Conduct on Pesticide Management; GBF | Scientific Panel on Responsible Plant Nutrition; OP2B Regenerative Agriculture Framework; Regen10; Sustainable Markets Initiative Agribusiness Action Plan | SBTN Land (beta) & Freshwater targets |

Note: This step-wise approach outlines priority actions, illustrative commitments and key references for agri-input providers, in line with biome-specific guidelines

**Table 4: Illustrative corporate maturity progression on nature-positive row crop production in the Upper Midwest for *agri-producers and downstream actors***

| | | ***Corporate nature maturity levels*** | | |
|---|---|---|---|---|
| | | ***Starting*** ***"Do no harm"*** | ***Developing/advancing*** ***"Do more good"*** | ***Leading*** ***"Transform the system"*** |
| **Key levers for transformation** | Policy & stakeholder engagement | Comply with all jurisdictional regulations on land-use, farming and associated sourcing practices | Follow & promote leading international legal & voluntary standards on sustainable intensification & regen-ag; participate in multi-stakeholder coordination for sector-level transformation | Lead pre-competitive coordination, partnerships development, trade associations & policy advocacy aligned with leading international standards & outcomes on sustainable intensification & regen-ag |
| | Business strategy | General commitment to supporting sustainable intensification & regen-ag, e.g., through sustainable sourcing; improve traceability of direct & indirect supply<br><br>Aim for supplier improvements on:<br><br>→ *either soil health or biodiversity*<br>→ *and farmer livelihoods* | Adopt science-driven, time-bound, quantitative commitments to support sustainable intensification & regen-ag, with regular progress reporting; work to improve monitoring, practices & capabilities at farm-level<br><br>Commit to supplier improvements on:<br><br>→ *soil health and biodiversity*<br>→ *and farmer livelihoods* | Set science-based targets to deliver & scale programs for farm-level sustainable intensification & regen-ag; invest to improve monitoring, reporting & verification (MRV) practices; develop nature-positive ingredients and consumer products; support development of NbS markets, e.g., for soil carbon storage<br><br>Support quantifiable supplier improvements on:<br><br>→ *soil health and biodiversity*<br>→ *and farmer livelihoods*<br>→ *within a landscape-oriented approach* |
| | Illustrative commitments | Introduce regen-ag principles in our corn/soy sourcing process and supplier engagements; implement perennial cover crop trial with 10 farmers across the region | Increase by 50% the volume of Midwest corn/soy sourced from regenerative farms by 2025; develop 3 strategic partnerships to scale-up regen-ag practices & improve monitoring | Source 95% of Midwest corn/soy from regenerative farms by 2030, as verified by a credible third-party; restore one million acres of degraded landscapes in high-priority supply sheds globally, including action plans for high-priority regions |
| | Key references | USDA Sustainability; Midwest Rowcrop Collaborative; Farmers for Soil Health | OP2B Regenerative Agriculture Framework; Regen10; Sustainable Markets Initiative Agribusiness Action Plan | SBTN Land (beta) & Freshwater targets; SBTi-FLAG targets; OP2B Restoration Framework; USDA Climate-Smart Commodities; Banking for Impact on Climate in Agriculture |

Note: This step-wise approach outlines priority actions, illustrative commitments and key references for farmers, traders, distributors, manufacturers/brands and retailers, in line with biome-specific guidelines

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 based in Minnesota**

## Key trade-offs & remaining barriers

Achieving a nature-positive row crop production system in the Upper Midwest involves many important and unresolved trade-offs and barriers. Agri-food companies up and down the value chain should collaborate with the full range of stakeholders to address and resolve these challenges to drive change at the speed and scale needed for the region's nature, people and economy to thrive well into the future.

### *Definitions, metrics & data*

A central challenge remains to identify – and align across stakeholder groups – common definitions and metrics to set baselines and evaluate progress on environmental (and social) outcomes that farmers can readily apply to accurately track regenerative agricultural practices and their impacts. Individual indicators like NUE and soil organic carbon (SOC) are useful but do not tell the full story. Even the term regenerative agriculture is used in many different ways today.[43] Partnerships like Regen10, the SAI Platform, Field to Market and the Global Farm Metric are working to align on common definitions and metrics; the Sustainable Markets Initiative Agribusiness Task Force identifies this as the foundational question to unlock wider transformation in the system.[44] Furthermore, improving baseline data collection and quality should remain a top priority for all stakeholders.

### *Yields & costs*

The research here highlights many approaches to integrating regenerative practices into conventional row crop production systems but there are inconsistent findings on the effect of the transition on yields, costs and farmer incomes. Differentiating factors include crop types, practices used, geography and climate. Further research is needed to inform market shifts and policies to enable the transition, recognizing the importance of local context for planning and evaluating regen-ag implementation and considering short- and long-term outcomes.

Recent examples of conflicting findings include:

→ In a recent study considering wheat farmers in Kansas, BCG and OP2B found that farmers transitioning to regen-ag can see a 15% to 25% return on investment, after an initial multi-year transition period.[45]

→ Recent USDA research shows farmers growing corn following a cover crop had a 3.1% *increase in yield* compared to side-by-side fields with no cover crops.[46]

→ Satellites data show *yield reductions* in the range of 5% to 10% in areas with non-legume cover crops such as cereal rye and annual ryegrass.[47]

### *Markets for nature-based solutions*

There are nascent opportunities for value creation throughout the value chain from **nature-based solutions (NbS)**, including for soil-carbon. But farmer trust, MRV capabilities, market standardization and capital flows remain significant barriers to scaling NbS.

→ ***Note*** that the next phase of guidance under **WBCSD's Roadmaps to Nature Positive** will focus on corporate performance and accountability, including recommended indicators and metrics for priority action areas.

# Stage 3: *Disclose (initial disclosures)*

*03.*

# Stage 3:
## *Disclose (initial disclosures)*

**Initial disclosures can build on existing nature-related reporting practices and may 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 should increase.**

For companies linked to corn and soy production in the Upper Midwest, nature-related disclosures may be necessary to meet legal standards (i.e., according to the EPA and international trade requirements), through annual corporate sustainability reporting, and as part of pre-competitive collaborative groups such as the Midwest Rowcrop Collaborative. The **TNFD's sector- and biome-specific guidance** provides a framework, process and recommended metrics for corporate disclosure that are relevant for this landscape and aligned with other leading voluntary frameworks such as CDP, the European Corporate Sustainability Reporting Directive (CSRD), the Global Reporting Initiative (GRI) and the International Sustainability Standards Board (ISSB).

The **High Impact Commodity List From SBTN** is also instructive in this process.

In general, corporate reporting should include the value chain and landscape-specific assessments demonstrated in this deep dive, including acknowledgement of existing gaps and barriers as outlined in the previous section. The aim should not be perfection or full value chain data coverage but rather a materiality-led approach with transparency about the process, findings and progress. The key questions to consider may include:

- → What are stakeholders (financial and other) actually looking for?
- → What is in the company's control to manage and measure?
- → What falls in its broader spheres of influence?

Sticking closely to leading consensus-driven disclosure frameworks will help ensure a transparent and credible approach.

→ ***See*** the **Foundations guidance** and **row crops summary** for more detail on disclosure recommendations and linking to global frameworks, including GBF target 15.

# Annexes

## *Annex 1: Landscape profile*

Key considerations for the **Scoping** and **Locate** steps of corporate value chain nature assessment, as recommended in the LEAP approach from the Taskforce on Nature-related Financial Disclosures (TNFD) – including sector and subsector identification according to the Sustainability Accounting Standards Board (SASB) **Sustainable Industry Classification System (SICS)**, commodity presence on the Science Based Targets Network (SBTN) **High Impact Commodity List**, relevant biomes, the identification of biodiversity risks, water stress and other considerations. See the **Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) glossary** for definitions of key terms.

| *LOCATION* | | *SOURCE* |
|---|---|---|
| ***UPPER MIDWEST, USA*** | | |
| Geolocation | 35 million corn-growing acres spanning Illinois, Iowa, Minnesota & Wisconsin | |
| Biomes | Temperate subhumid grassland (T4.5)<br>Annual croplands (T7.1) | TNFD guidance |
| Biodiversity overall risk | Med-high | WWF Risk Filter |
| Biodiversity hotspot? | No | Critical Ecosystem Partnership Fund (CEPF) |
| Includes key biodiversity areas (KBAs)? | Yes | WWF Risk Filter |
| High water stress? | No | World Resources Institute (WRI) Aqueduct |

Note: The numbers linked to each biome refer to codes from the IUCN **Global Ecosystem Typology**

| *CROP CYCLE* | | | *SOURCE* |
|---|---|---|---|
| | *CORN* | *SOY* | |
| SICS sector | Food & Beverage | | SASB |
| SICS industries – upstream | Chemicals<br>*Industrial Machinery & Goods*<br>*Insurance, Commercial Banks*<br>*Electric Utilities* | | |
| SICS Industries – direct operations | Agricultural Products | | |
| SICS industries – downstream | Processed Foods<br>Transportation – Rail, Road, Marine<br>Food Retailers & Distributors<br>*Beverages – Alcoholic & Non-Alcoholic*<br>*Biotechnology & Pharmaceuticals*<br>*Biofuels* | | |
| High-impact commodity list? | Yes | Yes | SBTN |

Note: Sectors in italics could be relevant but were not assessed as unique to this deep dive

# Annex 2: Further reading

**Achieving nature-positive plant nutrition**: fertilizers and biodiversity: This report by the Scientific Panel on Responsible Plant Nutrition outlines the impact of mineral nutrition of agricultural crops and pastures on food and biodiversity and how to optimally manage nutrient inputs for biodiversity, food, nutrition and other outcomes.

**Ammonia Technology Roadmap**: An International Energy Agency report that uses scenario analysis to explore three possible futures for ammonia production and outlines scope 1 emissions reduction strategies for nitrogen fertilizers.

**Cultivating Farmer Prosperity: Investing in Regenerative Agriculture**: One Planet Business for Biodiversity (OP2B) and BCG provide research on return on investment when transitioning to regenerative farming practices. The report brings forward the farmer perspective on transitioning to regenerative agriculture. It explores the economics through the lens of an "average" Kansas wheat farmer but presents a methodology that is translatable and applicable to other geographies and commodities.

**Illinois Agronomy Handbook**: Developed by the University of Illinois College of Agricultural, Consumer & Environmental Sciences, this technical agronomic guidance is specifically relevant for Upper Midwest row crop production systems.

**Midwest Rowcrop Collaborative**: The collaborative explores new approaches to agricultural challenges to find solutions that increase productivity while ensuring soil health, protecting water, addressing the factors contributing to climate change and supporting farm families. The collaborative has three goals:

1. Ensure 30 million acres in the Midwest employ practices that support improved outcomes for soil health, greenhouse gases, water quality and use, biodiversity or farmer livelihoods;
2. Reduce net on-farm greenhouse gas (GHG) emissions in the Midwest row crop supply chain by 7 million metric tons;
3. Directly support at least 30,000 Midwestern farm operations in the transition to regenerative agriculture.

OP2B **Regenerative Agriculture & Restoration frameworks**: Frameworks developed in close partnership with farming groups, scientists and civil society that outlines a set of objectives and impact indicators and a process to measure impact. The frameworks aim to provide consistency across the industry, enable regenerative and restorative farming practices, inform corporate strategies and provide an essential process for measuring impact in a transparent way.

**Reducing Emissions from Fertilizer Use**: A report from the International Fertilizer Industry Association and SYSTEMIQ outlining scope 3 emissions reduction strategies for the use of mineral fertilizers.

**Regen10**: A multistakeholder, collaborative platform committed to answering the question: "What would it take this decade for 50% of the world's food to be produced in a way that supports healthy people, nature, and the climate?" Regen10 takes a farmer-centric, deeply inclusive and evidence-based approach with food producers, Indigenous Peoples and Local Communities front and center.

**Scaling regenerative farming: An action plan**: This report by the Sustainable Markets Initiative (SMI) lays out the findings of its Agribusiness Task Force, established to accelerate regenerative agriculture into becoming the predominant agricultural system worldwide. The findings detail five key areas that SMI believes require urgent action to make the economics of regenerative farming more appealing to farmers. The Action Plan also includes a guide outlining the actions each sector of the value chain can take now along with key insights for successful implementation.

# Acronyms and abbreviations

| | |
|---|---|
| CSRD | EU Corporate Sustainability Reporting Directive |
| DIRO | dependencies, impacts, risks and opportunities |
| EPA | United States Environmental Protection Agency |
| FSH | Farmers for Soil Health |
| GBF | Global Biodiversity Framework |
| GHG | greenhouse gas |
| GRI | Global Reporting Initiative |
| HAC | High Ambition Coalition for Nature and People |
| HCV | high conservation value |
| ICLFS | integrated crop-livestock-forestry systems |
| IPM | integrated pest management |
| ISSB | International Sustainability Standards Board |
| IUCN | International Union for Conservation of Nature |
| KBA | key biodiversity area |
| MRB | Mississippi River Basin |
| MRV | monitoring, reporting and verification |
| NbS | nature-based solutions |
| NFWF | National Fish and Wildlife Foundation |
| NPK | nitrogen, phosphorous and potassium |
| NUE | nitrogen use efficiency |
| OP2B | One Planet Business for Biodiversity |
| SASB | Sustainability Accounting Standards Board |
| SBTN | Science Based Targets Network |
| SDGs | Sustainable Development Goals |
| SICS | SASB Sustainable Industry Classification System |
| SOC | soil organic carbon |
| TNFD | Taskforce on Nature-related Financial Disclosures |
| USDA | United States Department of Agriculture |
| USGS | United States Geological Survey |
| WOTUS | Waters of the United States |

# Endnotes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## Disclaimer

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