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

Row crop commodities subsector

→ *Deep dive: Soy production in the Cerrado, Brazil*

World Business Council *for Sustainable Development*

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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.

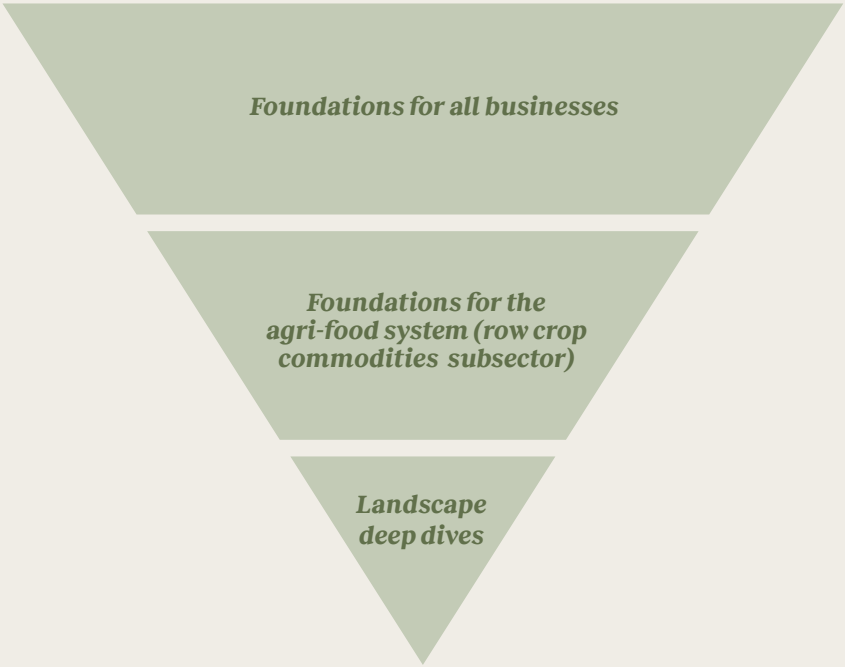
Nature-related dependencies, impacts, risks and opportunities (DIROs) are highly local and actions to address them are distinct from climate change mitigation, which generally includes more global considerations. Recognizing the inherent link between agriculture and the land, WBCSD has undertaken an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

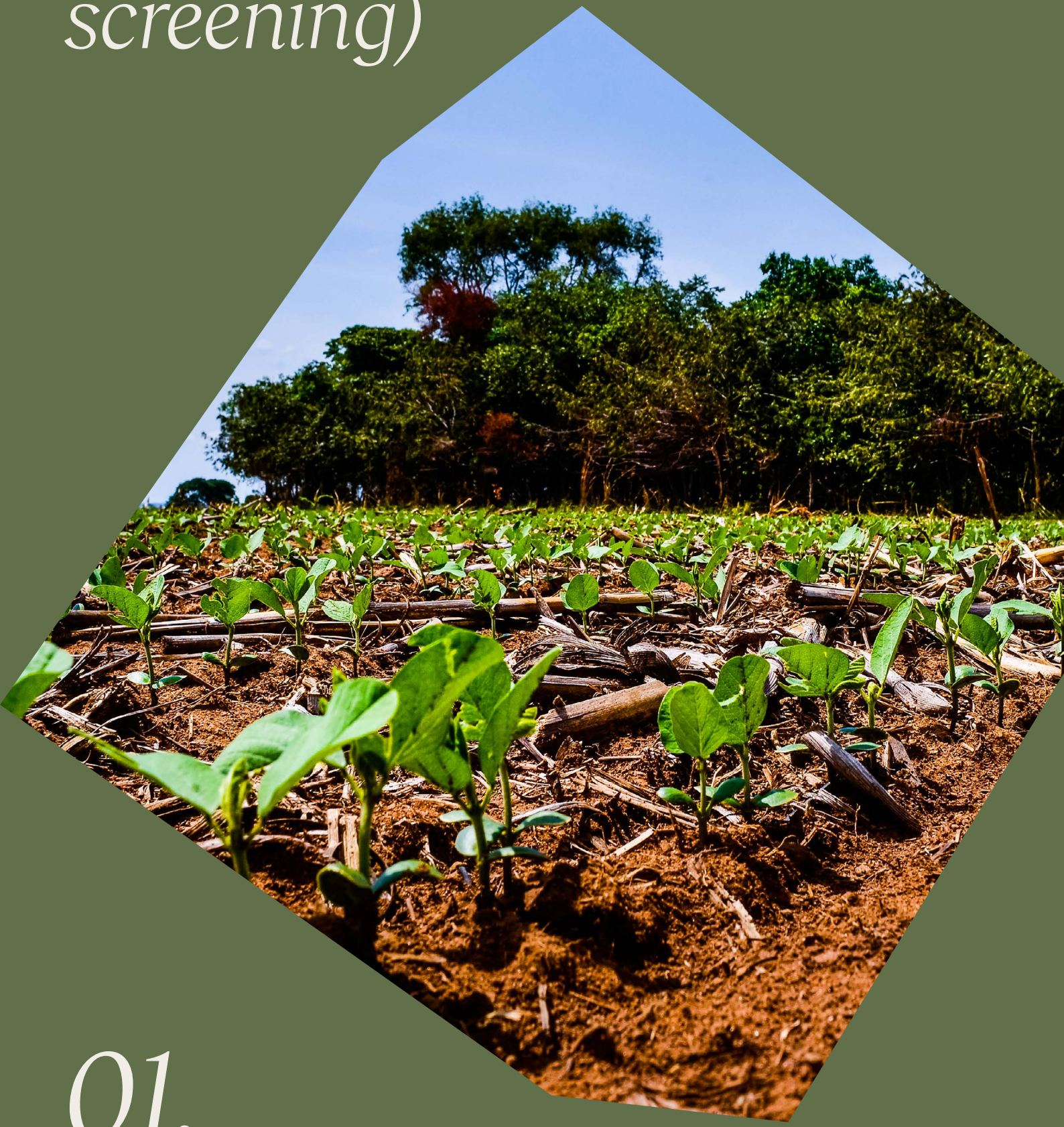


The deep dives explore nature-related DIROs, leading practices, context-specific resources, and unresolved challenges for three of the commodity crops that largely underpin the global food system: soy, corn and rice.[1] These crops are conventionally farmed under intensive methods in a small number of 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 soy, corn or cotton from the Cerrado 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 Cerrado

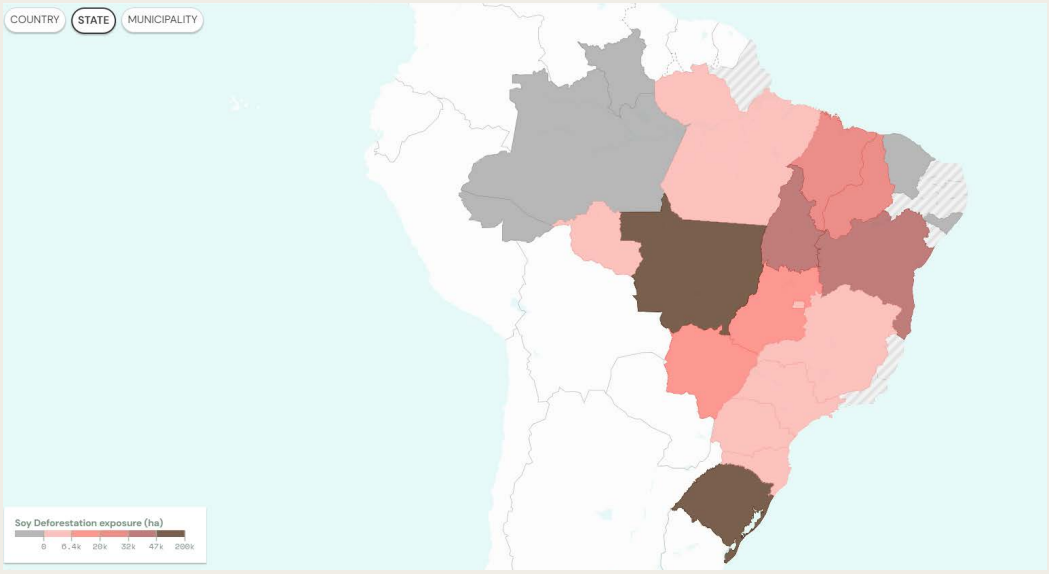
With an area of nearly 200 million hectares, the Cerrado covers almost 25% of Brazil, across 10 different states. It is the world's most biodiverse savannah and plays a key role in the global carbon cycle; its soil and root systems (also known as an "upside-down forest") store nearly 90 metric tons of carbon per hectare, providing a significant ecosystem service. The region is also critical for water and energy supply to the Brazilian population: 8 of the country's 12 major hydrological regions originate in the Cerrado, providing a water source for millions of citizens. And around 90% of Brazilians rely on hydroelectricity generated by water originating in the region.[4]

Brazil is a soy powerhouse, producing around one-third of the world's soybeans each year. And the Cerrado is the heart of the Brazilian soy sector, accounting for nearly half of nationwide soy production in 2020 (52 million tons),[5] covering an area of roughly 15 million hectares.

Over time the Cerrado has lost approximately half of its native vegetation, largely driven by agricultural and livestock expansion. But research shows Brazil can continue to meet global demand for soy (and beef) without any further expansion over native vegetation,[6] the most pressing environmental issue linked to agri-production in the region.[7] The MATOPIBA region – covering the states of Maranhão, Tocantins, Piauí and Bahia – has the highest deforestation exposure risk, according to the commodity mapping initiative Trase.[8] Just 3% of municipalities account for about half of all deforestation risk connected to soy in the region, underscoring the importance of location-based assessment and response.[9]

Figure 2: The Cerrado region of Brazil is a biodiversity hotspot and a major soy-producing region

Figure 3: 2020 soy deforestation exposure (ha) in the Cerrado



Source: **Trase**

The soy 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 soy but also includes corn and cotton as typical rotational crops in the region.

Figure 4: The generic soy 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 the Cerrado. See the materiality matrixes (tables 1, 2, 3 and 4) for the primary outputs of this materiality screening, aligned with the structure and methods of the leading nature-related assessment tools and frameworks.

Overview

Land-use change is the most significant driver of nature-related pressures from soy production in the Cerrado, particularly with regards to deforestation and conversion of native vegetation.[10] Around 70% of the Cerrado's soy-related carbon emissions come from agri-production;[11] the research for this deep dive shows it is possible to directionally extrapolate this finding to other nature-related impacts. In particular, there is growing concern about microclimate changes impacting crop productivity. Increasing evidence shows these effects causally link to the huge areas (expanses of upwards of 2,000 hectares) converted to soy plantation in the Cerrado, disrupting the natural hydrological and climate regulating systems.[12] There are also significant nature-related pressures from downstream trading and distribution due to transport infrastructure development and domestic road transportation across large areas.

Agri-production

Land-use change and GHG emissions

Today the Cerrado retains only around half of its original native vegetation, with agriculture as the biggest historical driver of land-use change; this trend has even accelerated in recent years. In 2021 there was an 8% increase in deforestation and conversion of native vegetation compared with the previous year and recent data shows continued increases despite a slowdown in land clearing in the neighboring Amazon biome, which has typically received more attention.[13]

Land clearing in this region is a complex environmental and socioeconomic topic linked to land speculation and land grabbing, a lack of governance and law enforcement, cattle ranching and insufficient programs focusing on payments for ecosystem services (PES).[14] Land-use change in the Cerrado has significant implications for the region's ecosystem services, biodiversity and carbon footprint.

Land-clearing practices are a significant driver of greenhouse gas (GHG) emissions, as trees, native vegetation and soil release stored carbon and also lose their ability to sequester and store carbon in the future. Soy production in the Cerrado produces over 50 million metric tons of CO_2 per year, with land-use change as the largest driver (42%). The MATOPIBA region has a carbon footprint two to six times larger than the Brazilian average due to land-use change (72% to 87% of the total) and the heavy use of lime for soil correction to maintain adequate conditions to grow soy.

There is a strong connection between the effects of land-use change and the land's state prior to the planting of soy crops but it is necessary to understand location-specific baseline conditions to determine this. When deforestation or conversion of native vegetation takes place, the (negative) impacts are generally significant for several nature-related indicators, including biodiversity and soil quality. However, if the land was previously degraded pasture (in alignment with an agreed-upon cutoff date such as 2020), then soy crops can have a small negative impact or even positive outcomes on nature.

Water use & microclimate effects

Most soy and corn in the Cerrado grows in rainfed systems. Even for irrigated crops, freshwater use is relatively low, mainly from surface rather than ground sources, and not broadly considered to be of high environmental impact. However there are localized issues, such as in the MATOPIBA region, where irrigation is growing as a practice, with installed pivot systems having increased nearly 200-fold from 1985 to 2017 and contributing to local water stress.[15]

There are rising concerns over microclimate changes in the Cerrado linked to deforestation and conversion of native vegetation,[16] with recent reports showing a local temperature increase of up to 3.5°C and a 44% reduction in evapotranspiration in converted areas, leading to up to 12% productivity loss on soy yields and an associated USD $99 loss per hectare per year.[17] These effects can also threaten the now-common second annual harvest practice. These dynamics create a concerning feedback loop, where farmers turn to further land clearing or often unsustainable intensification on existing cropland (i.e., increased agrichemical and water use) to maintain or expand production in the face of declining yields (see figures 6 and 7).

Agricultural practices

Compared to other growing regions, soy farms in the Cerrado show relatively high use of common regenerative agriculture practices such as no-till, crop rotation and integrated crop-livestock-forestry systems (ICLFS). Yet excessive use of mineral fertilizers and pesticides remains commonplace throughout the region, as a means to ensure consistent yields but often with negative effects on water and soil quality, biodiversity and GHG emissions. The adoption of genetically modified (GM) crops in Brazil – currently allowed only for cotton, sugarcane, eucalyptus, beans, corn and soy – has led to growth in pesticide use with possible increases in environmental and human exposure and associated negative impacts.[18] Brazil is one of the world's leading consumers of so-called "highly hazardous pesticides" (classified as seriously hazardous to health or the environment), of which around two-thirds of the country's use was for soy crops as of 2018.[19] In 2022, non-GM soybeans accounted for just 2% of the soy planted area in Brazil (although some experts expect volumes to nearly double in 2023 due to growing global demand and price premiums for non-GM beans).[20]

Biodiversity

The Cerrado is a globally recognized **biodiversity hotspot** and contains **key biodiversity** areas (KBAs). The region is home to some 5% of the planet's animals and plants; this includes over 200 species of mammals, 800 species of birds, 180 species of reptiles and 1,200 species of fish – including 60 at-risk species, of which 12 are critically endangered. The region holds more than 11,000 plant species, nearly half of which are found nowhere else on Earth.[21] In the Cerrado, the primary biodiversity impacts linked with agri-production are as a result of land clearing and overuse of pesticides.

Social issues

There is social concern over the concentration of land ownership and power dynamics, with some local communities becoming increasingly dependent on large producers and highly affected by the related landscape, infrastructure and accessibility to natural resources. The Cerrado biome – and the MATOPIBA region in particular – is home to many traditional cultures and historical communities (such as Indigenous peoples, foragers, *quilombolas*, *geraizeiros*, riverside peoples and family farmers) that are at great risk of displacement and the loss of their ways of life due to soy expansion.[22] In isolated cases, water use has become an issue of social concern, giving rise to disputes between large producers and local communities (such as in the state of Bahia). These social challenges can affect farmers' ability to improve their practices and agri-food companies' social license to operate locally.

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

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.

Upstream

The intensive and often inefficient use of fertilizers and pesticides in the Cerrado creates further demand for these inputs, which in general have a high carbon footprint and other environmental impacts through their extractive and manufacturing processes. Conventional soy production in the Cerrado involves the heavy use of lime for soil correction; the chemical process of calcination in lime production also has a high carbon footprint.[23]

Downstream

In the Cerrado, soy transportation takes place on roads over long distances and incentives to do so include tax-free ground transport between states. This entails very high GHG emissions compared to other crops and locations. Domestic transport in Brazil is the second-highest contributor to soy-related GHG emissions, responsible for some 26% of its total GHG footprint.[24] Brazil exports about 60% of all the soy it produces, mostly via ship, which has both climate and marine ecosystem impacts.[25] Processing and manufacturing and retail activities can also have high nature-related dependencies and impacts, especially on GHGs, water use and water pollution (these are generally higher for cotton).

Crop rotation considerations

Nature-related DIROs for corn production in the Cerrado track closely with the considerations for soy. In general, cotton has higher impacts, requiring different machinery, more complex industrial and storage systems and more fertilizers and pesticides (often with aerial applications). Cotton also requires increased irrigation and water consumption and retains less post-harvest biomass soil coverage. Its downstream impacts from processing, textile manufacturing (such as high water use) and retail operations are also typically greater than for soy and corn.

Looking ahead

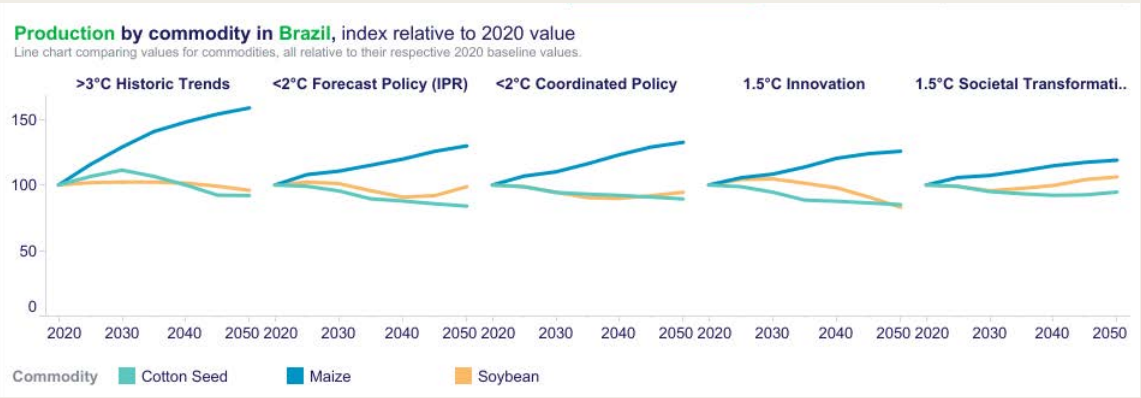
Climate change will exacerbate existing nature-related pressures in the Cerrado, as in other global productive landscapes. At the national level across Brazil, all climate transition scenarios show corn production increasing (possibly significantly) in the coming decades, while soy and cotton production may level off or even slow.[26] But as complementary rotational crops in the Cerrado, all three are likely to remain high priorities for business, policymakers, local communities and broader society in terms of their nature-related impacts, risks and opportunities.

Materiality matrixes

Tables 1, 2, 3 and 4 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 5: Production projections for Brazilian soy, corn and cotton under five different climate transition scenarios



Source: WBCSD, **Climate Scenario Tool**

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

Table 1: Soy & corn in the Cerrado – Key dependencies

Value chain stages	*Dependencies*																			
	Direct physical inputs					**Enable production processes**					**Mitigate direct impacts**				**Protect from disruption**					
	Animal-based energy	Fibers & other materials	Genetic materials	Groundwater	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 (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	↓	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	↓	Essential to maintain soil structure	Natural crop protection
Trading & distribution																Operations affected by temperatures		↓		
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 row crops summary, if any

Table 2: **Soy & corn in the Cerrado – 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			
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						↓						

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

Table 3: Cotton in the Cerrado – Key dependencies

Value chain stages	*Dependencies*																			
	Direct physical inputs					**Enable production processes**					**Mitigate direct impacts**				**Protect from disruption**					
	Animal-based energy	Fibers & other materials	Genetic materials	Groundwater	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	↓	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	↓	Essential to maintain soil structure	Natural crop protection
Trading & distribution																Operations affected by temperatures		↓		
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 row crops summary, if any

Table 4: **Cotton in the Cerrado – 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			
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 ↑		Industrial processes	Industrial processes					
Retail						Distribution & waste				Fashion industry 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 soy production the Cerrado.

Given the material issues linked to land-use change from soy production in the Cerrado, the main risks and opportunities for agri-food companies involved in this landscape and crop cycle also revolve around this primary driver of nature pressures.

Physical risks include the impacts of microclimate shifts and soil loss and degradation, namely reduced yields and increased operating costs. Climate change effects, including crop damage and loss from increased frequency or severity of storms and droughts, are also an emerging risk consideration.

There are also significant associated **transition risks** as domestic and trade-based anti-deforestation public policies come into force and if retailers, consumers and financial institutions choose not to purchase from or invest in companies and regions linked to deforestation and conversion of native vegetation issues. This can also increase cost of capital and put at risk a company's legal or community license to operate.

If deforestation and conversion-free (DCF) policies and practices show progress in curbing land-use change in the Cerrado, the attention of society and regulators could shift to restricting agrichemical use in the coming years. Emerging consumer trends – including a shift towards plant-based diets and meat alternatives in the Global North – may have the effect of reducing demand for animal feed and therefore soy.

Physical and transition risks can cascade from agri-producers to both downstream and upstream actors, including 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 (DCF and regenerative) farming practices and outcomes; and shifting business models to meet changing consumer and stakeholder demands (including innovation in bio-based agrichemicals; monitoring, reporting and verification (MRV) systems; and food product redesign).

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

Figure 6: **Interconnections between dependencies and impacts related to one key impact area – land-use change – in conventional soy production in the Cerrado and the resulting risks for agri-food companies**

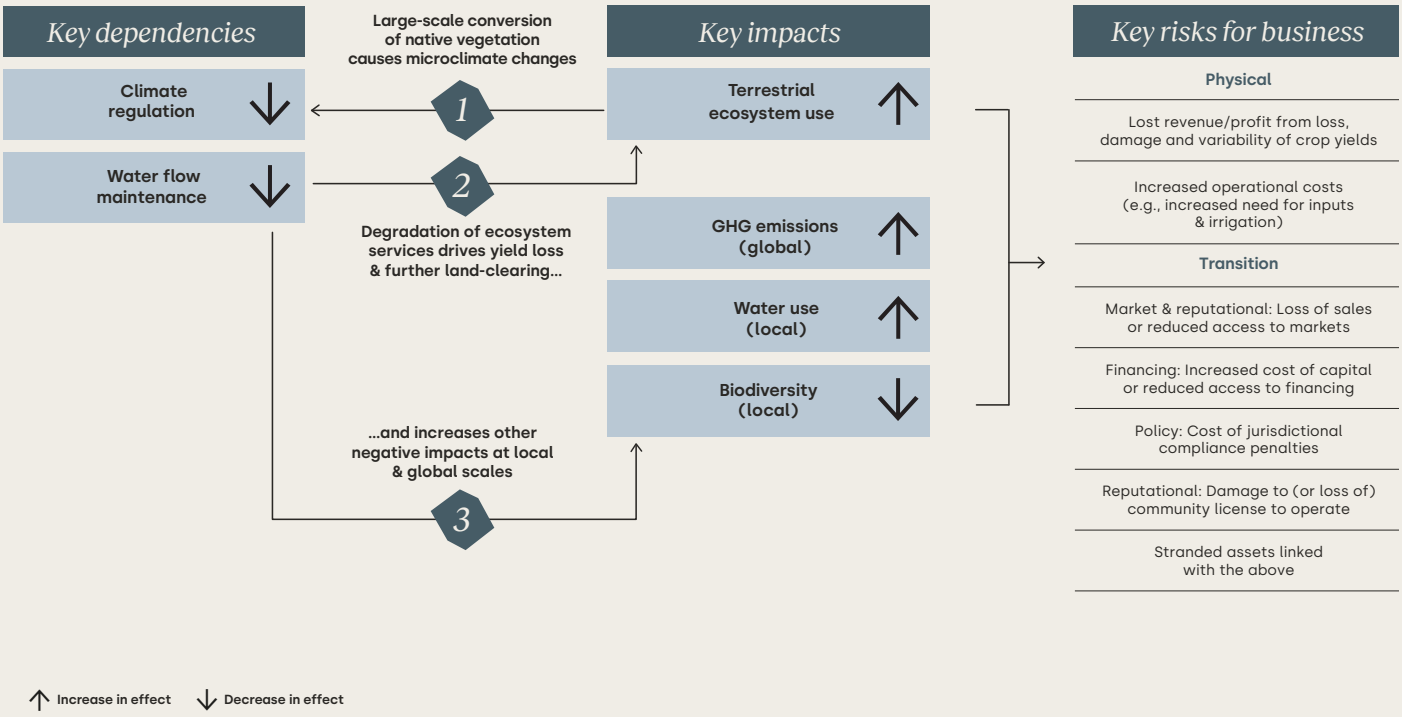
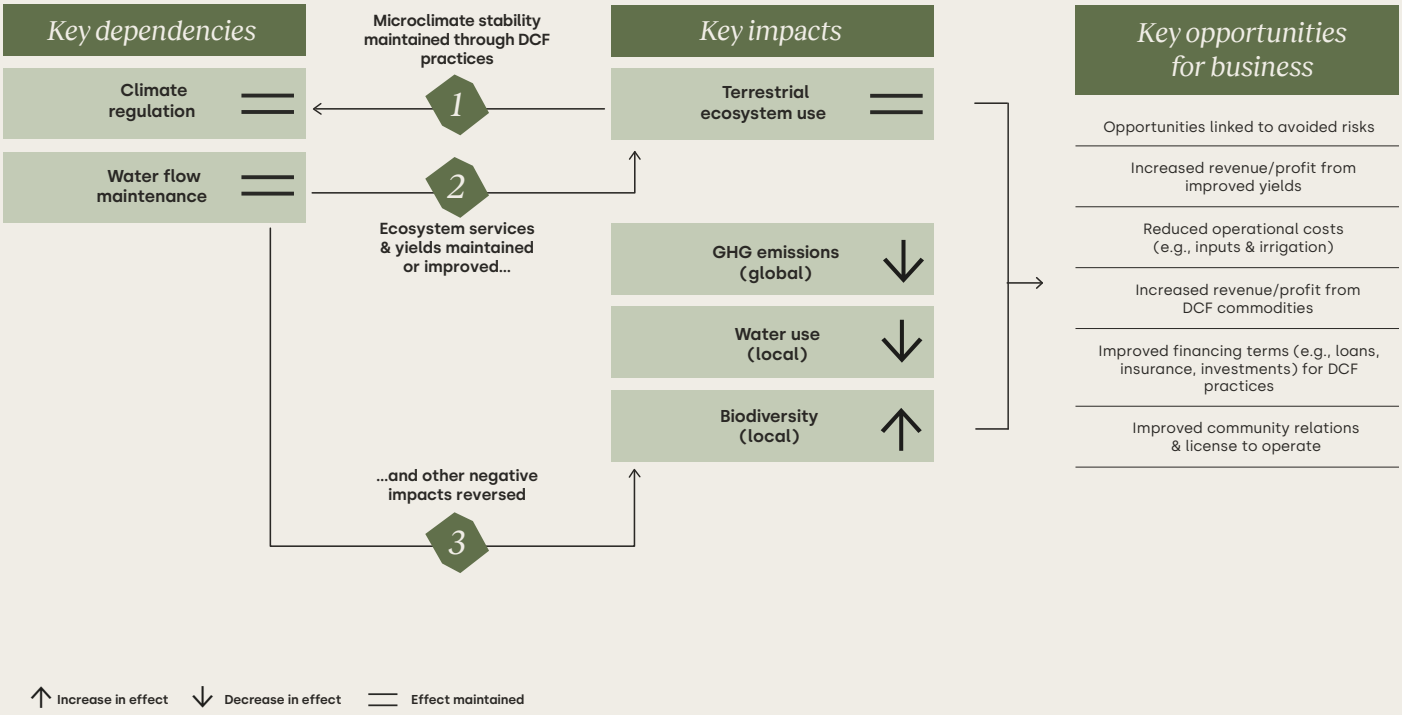


Figure 7: **Interconnections between dependencies and impacts in a more nature-positive soy production system founded on DCF practices and the resulting opportunities for agri-food companies**



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

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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.

DCF & improved agricultural practices

Halting and reversing deforestation and native vegetation conversion in the Cerrado – whether legal or illegal – will require meeting demand for soy without clearing additional land. This means existing and degraded agricultural land will need to produce more per hectare; thus DCF and sustainable production are tightly linked in this landscape. Recent research indicates it is feasible for the Cerrado to continue meeting global soy demand sustainably, without issues relating to crop technology or economic feasibility that may have been barriers in the past. Precision and regenerative agriculture (regen-ag) practices can bring higher productivity with lower costs and reduced environmental impacts. Many large producers in the Cerrado are already using common regen-ag practices such as no-till, crop rotation, cover crops and ICLFS; agri-food companies and stakeholders should support producers to scale these up across the region. Increasing on-farm biodiversity – such as through "bio-factories" cultivating bacteria and fungi to improve soil quality and integrating beekeeping activities around row crops – are smaller, cost-effective measures that can improve environmental results.

→ ***See the*** illustrative **maturity progression** on DCF production and sourcing for more detail. See the **row crops summary** for further guidance on priority actions relevant across row crop commodities.

As in all landscapes, producers large and small are the focal point for agri-food system transformation. All stakeholders have a role to play in supporting them through their respective spheres of influence.

*Spotlight on Bayer CropScience: As a leading global agriscience and input company engaged in Brazil, including the Cerrado landscape, Bayer has focused its sustainability ambitions where it can achieve the most impact: closing the yield gap via sustainable intensification, which includes reducing the environmental impact of crop production. Bayer has pledged a 30% reduction in on-field GHG emissions from the most emitting crop systems in the regions it serves and a 30% reduction of the environmental impact of chemical crop protection by 2030. Bayer has **increased its commitment** to strongly engaging and focusing on regenerative agriculture, aiming for nature-positive outcomes.*

*Bayer's **Pro Carbono program**, a multi-stakeholder, public-private consortium, supports 1,800 Brazilian farmers in using no-till, cover crop and crop rotation practices, productivity and carbon uptake boosters, "Nitrogen Smart" management practices, and precision agriculture to adjust plant density and fertilizers by yield zone. Recent farm trials showed increases of 5.6% in productivity and 7.6% in profitability in just the first year, while sequestering 200 kg of carbon per hectare. Linked with this program, in 2023 Bayer began delivering soybeans with a measured, tracked and deforestation-free carbon footprint, known as **PRO Carbono Commodities**, as part of a multi-stakeholder partnership with Brazilian environmental agency Embrapa, global commodities trader ADM and others. The potential is clear to Bom Futuro Agrícola, one of the first producers involved, whose CEO notes: "It will be a great opportunity to present our sustainable agricultural practices to the world, which protect natural vegetation, prevent deforestation and support global decarbonization efforts."*

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. Brazil's Forest Code – which requires conservation set-asides within working farms – sets the foundation for farm-level restoration within the Cerrado; and there are many local initiatives supporting farmers to go further (for example, see Farmer First Clusters in the Spotlight on the Soft Commodities Forum). Actions may include reforestation with native species on degraded agricultural or pasture land, watershed conservation programs and more. See The Nature Conservancy's **Regenerative Ranching & Agriculture (R2A)** program for collaborative landscape-level work ongoing in the Cerrado and other priority landscapes throughout Latin America.

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

For private sector stakeholders linked to this production system, there are ample opportunities to support the shift to a nature-positive system with a strong focus on eliminating deforestation and native vegetation conversion, in alignment with **SBTN Land target 1 (beta): "No Conversion of Natural Ecosystems**." In addition to the push of legislation, incentives have a key role to play (financial and otherwise) in encouraging the protection of forests and other critical landscapes. These can take the form of technical assistance, PES schemes, carbon and nature-based solutions (NbS) markets, paying premiums for sustainable products, special financial conditions for loans and investments, and support for local governance, partnerships and consortiums.

Individual companies, sector groups and the entire value chain must send stronger signals for adopting DCF-sourcing policies and improving monitoring of farm-level practices and outcomes.

Although it is legal to clear native forest in parts of the Cerrado, the case of the Amazon Soy Moratorium shows that market demand coupled with voluntary supply chain agreements can lead directly to a decrease in deforestation.[27]

Leading examples of industry collaboration on common DCF objectives include the Consumer Goods Forum (CGF) **Forest Positive Coalition – Soy Roadmap** and the **Agriculture Sector Roadmap to 1.5°C** developed by the world's largest agri-business companies with support from WBCSD and the Tropical Forest Alliance, with a specific focus on Cerrado soy supported by the global traders engaged in the **Soft Commodities Forum**.

*Spotlight on Nestlé: Global food leader Nestlé, in partnership with Proforest, has developed a **Theory of Change** applied to soy sourcing from the Cerrado (representing 7.2% of the company's soy purchases). The model sets approaches for both direct and indirect sourcing and embeds lessons learned with suppliers and key stakeholders. This sourcing approach helps to ensure a continuous supply of soy from responsible sources, while playing a part in developing thriving, resilient communities and stewarding natural resources for future generations. One of the central aims is to achieve the decoupling of soy expansion from the conversion or destruction of natural habitats. As of 2022, 99.3% of Nestlé's global volumes of purchased soy was deforestation-free, based on supply chain mapping and on-the-ground verification.*

*In addition, as part of its objective to scale-up regenerative agriculture, Nestlé supports The Nature Conservancy's **R2A** program across Latin America and in the Cerrado. It consists of implementing crop rotation, no-till and cover crops to ensure no bare soils and reducing agrichemicals through precision agriculture and the use of integrated pest management. These activities help lower carbon emissions while improving soil health and increasing resilience across landscapes by helping halt deforestation and land conversion.*

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

Public policy

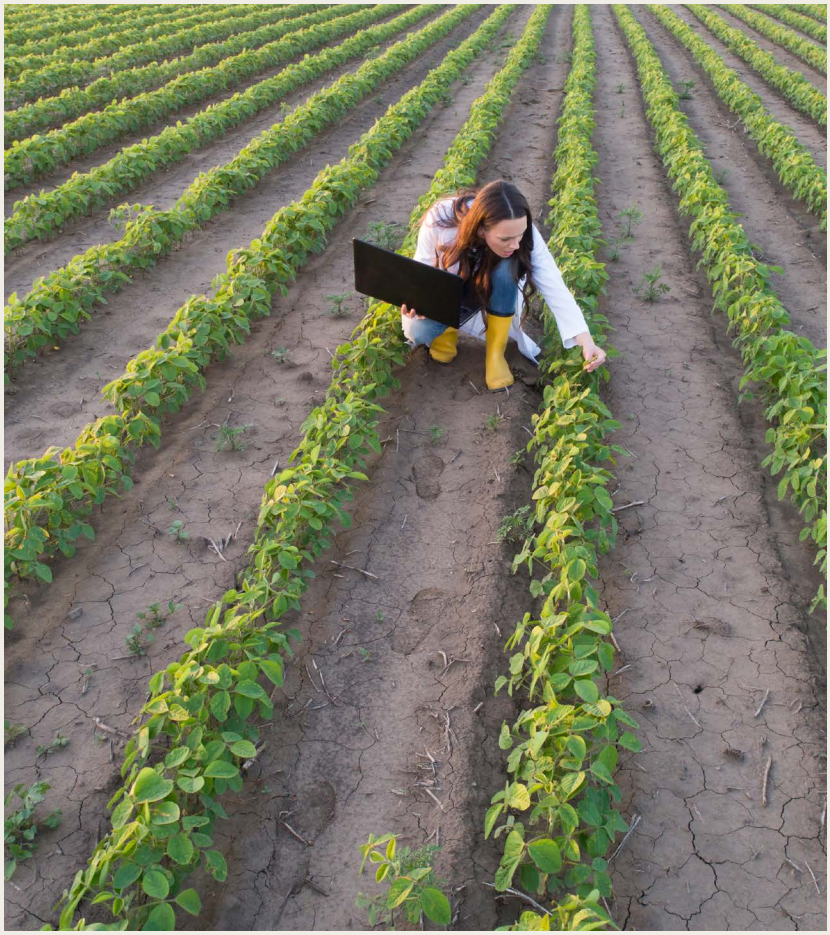
A fundamental issue underpinning the shift to DCF and nature-positive soy production in the Cerrado has to do with Brazilian Forest Code enforcement and the verifiability of the Rural Environmental Registry (CAR). The code – which requires 80% conservation for the Amazon but only between 20% and 35% conservation for the Cerrado – does allow for legal deforestation to take place. And while over 50% of lands in the Amazon are under protection, conservation units protect only 7.5% of the Cerrado. Furthermore, as noted by The Nature Conservancy, "historically, the Forest Code has been nearly impossible to implement and monitor."[28] The code is also key to monitoring and traceability for private sector DCF commitments. Businesses can send a strong signal by demanding and supporting better Forest Code enforcement.

Additionally, international trade policy can play a role in advancing domestic DCF policy and practices. The recently enacted EU and UK legislation[29] on advancing deforestation-free imports (the US and China are also considering such legislation) are the most salient examples; one expert describes them as the "most transformative polic(ies) on a global level with a direct impact on Brazil and on agricultural commodities." However, there is uncertainty as to the feasibility of implementing the required traceability and crop segregation by origin. If poorly implemented, these policies could have an overall *worsening* effect for on-the-ground practices (for example, if silos simply mix DCF beans with unverified beans, this could negate the incentive for improved practices in the first place).

At the local level, as negative impacts largely center on a relatively small number of municipalities, focused work in those regions can yield significant improvements. Jurisdictional approaches can support transforming production regions into sustainable production origins and channel market price premiums into improved producer incomes.

With regards to improving the socio-cultural impacts of soy production on local and traditional communities in the Cerrado, the following policy areas should be priorities: more secure land tenure, official recognition of the land and territorial claims of traditional peoples and rural communities, increased support for traditional agriculture and agroecological practices and markets, and overall better management of existing conservation units.[30] Agri-food companies can advance these measures by lending their full support to establishing, improving and enforcing relevant policies and by adhering to strict human rights protocols (aligned with International Labour Organization (ILO) conventions).

*Spotlight on the Soft Commodities Forum: The **Soft Commodities Forum** (SCF) enables collaboration between six leading agribusinesses and value chain partners to identify solutions to eliminate soy-driven deforestation and native vegetation conversion in the Cerrado. The SCF's action-driven landscape intervention strategy, the **Farmer First Clusters**, delivers financial incentives for producers to support native vegetation preservation and sustainable production practices. Incentives include payments for surplus legal reserves, restoration of degraded areas, technical assistance to increase sustainable production and Forest Code compliance, incentives for soy expansion over pasture, intensification of cattle production to free up existing pasture, and green financing. SCF members have collectively committed up to USD $7.2 million over 3 years, with a goal to raise USD $50 million to scale the model in the coming years.*



Maturity progression: DCF production & sourcing

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: **DCF production and sourcing.**

Table 5: Illustrative corporate maturity progression on DCF soy production & sourcing in the Cerrado

		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 t o support sector-level transformation	Lead pre-competitive coordination, civil society partnerships, trade associations & policy advocacy to catalyze food system transformation
	Business strategy	General commitment to DCF practices & sourcing in direct operations & supply chain; improve traceability of direct & indirect supply	Adopt time-bound, quantitative commitment to DCF practices & sourcing for all volumes, with regular progress reporting; invest in farmer incentives for DCF practices & outcomes	Adopt 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 practices	Eliminate deforestation from soy production in the Cerrado by 2025; support the protection of non-forest ecosystems in compliance with relevant local legislation; by the end of 2023, develop sector definition(s) to enable 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	Brazilian Forest Code regulation; EU Regulation on deforestation-free products; 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 (beta)

Note: This step-wise approach outlines priority actions, illustrative voluntary commitments and key references for actors up and down the soy value chain, in line with biome-specific guidelines and cutoff dates

Key trade-offs & remaining barriers

Nature-positive system transformation in the soy sector in the Cerrado involves several important and unresolved trade-offs and barriers. Agri-food companies up and down the value chain play a critical role in collaborating 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.

Definitions, baselines & cutoff dates

There is still a lack of consensus among the scientific, conservation and business communities on biome-specific definitions, baselines and cutoff dates, specifically on the issue of native vegetation conversion. The **Agriculture Sector Roadmap to 1.5°C**, **CGF Forest Positive Soy Roadmap** and **Accountability Framework initiative** outline some of these perspectives as they stand today. Ongoing efforts to harmonize and reach consensus will be critical to advancing progress on these issues.

Conservation & sustainable intensification

The tension between conservation imperatives – as embodied in the **Global Biodiversity Framework (GBF) "30x30" target**, **SBTN Land targets (beta)** and the Brazilian Forest Code – and the need to feed a growing global population is not unique to this region. But given its significant role in the global food supply chain and the region's ecosystem value and sensitivity, soy production in the Cerrado is a landscape on the front lines of this challenge. It is essential for all stakeholders to promote and scale sustainable intensification on existing productive lands to balance ecosystem protection with food security needs. There are successful models today (see box on Rizoma Agro and Scheffer)[31] but scaling these approaches across the Cerrado will require better coordination and funding from policymakers, agri-food companies up and down the value chain, banks and investors, and technical experts.

Data availability & comparability, traceability and measuring, reporting & verification (MRV)

Despite overall agreement on the major role of land-use change in GHG emissions and nature impacts related to soy production, quantitative values can vary greatly between studies and data sources and depend on practices in the field. A particular challenge is the relative lack of information about carbon soil storage in tropical systems like the Cerrado and on emerging practices in the region, such as ICLFS. It can be difficult to define baseline values for farm-level impacts, as each farm can look very different depending on the agricultural practices used, even in the same microregion. Biodiversity loss is an issue of growing concern in the region but the science to support metrics is less developed than for GHG emissions. Furthermore, commitment implementation and progress tracking, particularly as related to indirect suppliers and mixed silos, remain challenges for many agri-food companies.

Forward-thinking soy producers like Rizoma Agro and Scheffer are successfully advancing regenerative practices on their farms in Brazil. For example, Scheffer has cut synthetic inputs by some 40% for cotton and 50% for soy while maintaining yields in recent years, using crop rotation, cover cropping, no-till and bio-based inputs.

→ ***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 soy production in the Cerrado, nature-related disclosures may be necessary to meet legal standards (i.e., according to the Brazilian Forest Code and international trade requirements), through annual corporate sustainability reporting, and as part of pre-competitive collaborative groups such as the CGF and SCF. The **TNFD's sector- and biome-specific guidance** (particularly for the tropical forest biome) 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	*CERRADO, BRAZIL*	*SOURCES*
Geolocation	~200 million hectares spanning central Brazil between coastal Atlantic Forest & Amazon rainforest	
Biomes	Savannas and Grasslands (T4) Annual croplands (T7.1)	TNFD guidance
Biodiversity overall risk	Med-high	WWF Risk Filter
Biodiversity hotspot?	Yes	Critical Ecosystem Partnership Fund (CEPF)
Includes key biodiversity areas (KBAs)?	Yes	WWF Risk Filter
High water stress?	No	World Resources Institute (WRI) Aqueduct

COMMODITIES	*SOY*	*CORN*	*COTTON*	*SOURCES*
SICS sector	Food & Beverage			SASB
SICS industries – upstream	Chemicals *Industrial Machinery & Goods* *Insurance, Commercial Banks* *Electric Utilities*			
SICS Industries – direct operations	Agricultural Products			
SICS industries – downstream	Processed Foods Apparel, Accessories & Footwear Transportation – Rail, Road, Marine Food Retailers & Distributors *Beverages – Alcoholic & Non-Alcoholic* *Biotechnology & Pharmaceuticals* *Biofuels*			
High-impact commodity list?	Yes	Yes	Yes	SBTN

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

Annex 2: Further reading

Accountability Framework initiative (AFi): This collective effort of diverse organizations is dedicated to protecting forests, natural ecosystems and human rights by making ethical production and trade the new normal. The framework focuses on deforestation, ecosystem conversion and human rights, including the rights of Indigenous peoples, local communities and workers. Through these entry points, it also supports effective corporate action on climate, nature and sustainable development. In addition, the framework provides practical guidance on a range of operational topics, such as traceability, due diligence, supplier management and monitoring. AFi is adopted by several key nature frameworks, including CDP, GHG Protocol Land Sector and Removals Guidance, the Science Based Targets Network (SBTN) and the Science Based Targets initiative Forest Land and Agriculture Guidance (SBTi-FLAG).

Agriculture Sector Roadmap to 1.5°C: This roadmap, developed and owned by 14 of the world's largest agri-business companies, aims to accelerate action by the soy, palm oil and cattle sectors to address deforestation in their supply chains to align with global climate goals in a way that contributes to food security, economic development and farmer livelihoods. The roadmap was developed with the support of Tropical Forest Alliance and WBCSD. The three pillars of the roadmap identify:

- → Actions companies must take in their individual supply chains to reduce emissions from land use change (Pillar 1);
- → The role companies play in supporting the transition to forest-positive land-use management and commodity production in landscapes (Pillar 2);
- → How the companies will work with other stakeholders to support forest-positive sector transformation (Pillar 3).

Brazil Native Vegetation Protection Law (Forest Code): A law passed in 1965 requiring landowners to keep a certain percentage of their property under native vegetation. The Forest Code uses two types of protection instruments for conservation on private lands:

- → Permanent Preservation Areas: Areas identified as critical to the preservation of essential ecosystem functions where the clearing of vegetation is prohibited.
- → Legal Forest Reserve: A percentage of land that rural landowners must designate and maintain permanently as forest. This protected percentage varies from 20% to 80% depending on the type of vegetation present and the property's geographical location in the country.

The Forest Code introduced the Rural Environmental Registry (CAR), a database and environmental management tool that provides georeferenced data on private properties' Permanent Preservation Areas and Legal Forest Reserves. The CAR is also used to monitor and control deforestation in private landholdings.

European Commission Regulation for Deforestation-free Products: The legislation will require any company importing or exporting seven specific commodities (cocoa, coffee, soy, palm oil, wood, rubber and cattle) and their derivatives to and from the bloc to be able to prove that these products did not come from land deforested after 2020. The new rules aim to:

- → Avoid that the listed products Europeans buy, use and consume contribute to deforestation and forest degradation in the EU and globally;
- → Reduce carbon emissions caused by EU consumption and production of the relevant commodities by at least 32 million metric tons a year;
- → Address all deforestation driven by agricultural expansion to produce the commodities in the scope of the regulation, as well as forest degradation.

Consumer Goods Forum (CGF) **Forest Positive Coalition of Action**: The mission of this coalition 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. The coalition's commodity-specific approach includes a **roadmap and guidance on soy**.

Soft Commodities Forum (SCF): Hosted by WBCSD, the forum enables collaboration between six leading agribusinesses – ADM, Bunge, Cargill, COFCO International, Louis Dreyfus Company and Viterra – to identify solutions to eliminate soy-driven deforestation and native vegetation conversion in the Cerrado. By working in partnership with producers, consumer goods companies, civil society and governments to transform soy supply chains in member companies and beyond, the SCF contributes to the preservation of high-priority Cerrado ecosystems and transitions to more sustainable soy production.

TRASE: This supply chain tool maps the international trade and financing of commodities such as soy, beef and palm oil, enabling companies, investors and governments to address tropical deforestation.

Acronyms and abbreviations

AFi	Accountability Framework initiative
CAR	Cadastro Ambiental Rural, Brazil's Rural Environmental Registry
CSRD	EU Corporate Sustainability Reporting Directive
DCF	deforestation- and conversion-free
DIRO	dependencies, impacts, risks and opportunities
GBF	Global Biodiversity Framework
GHG	greenhouse gas
GM	genetically modified
GRI	Global Reporting Initiative
ICLFS	integrated crop-livestock-forestry systems
ILO	International Labour Organization
ISSB	International Sustainability Standards Board
IUCN	International Union for Conservation of Nature
KBA	key biodiversity area
LEAP	Locate, Evaluate, Assess, Prepare approach of the Taskforce on Nature-related Financial Disclosures (TNFD)
MATOPIBA	A Brazilian micro-region within the Cerrado, covering the states of Maranhão, Tocantins, Piauí and Bahia
MRV	monitoring, reporting & verification
NbS	nature-based solutions
PES	payment for ecosystem services
SASB	Sustainability Accounting Standards Board, now part of the International Financial Reporting Standards (IFRS) Foundation
SBTN	Science Based Targets Network
SCF	Soft Commodities Forum
SICS	SASB Sustainable Industry Classification System
TNFD	Taskforce on Nature-related Financial Disclosures

Endnotes

1 WBCSD (2021). Staple Crop Diversification Paper. Retrieved from: https://www.wbcsd.org/Programs/Food-and-Nature/Food-Land-Use/FReSH/Resources/Staple-Crop-Diversification-Paper.

2 Science Based Targets Network (SBTN) (2023). Technical Guidance – Step 1 – Assess. Retrieved from: https://sciencebasedtargetsnetwork.org/wp-content/uploads/2023/05/Technical-Guidance-2023-Step1-Assess-v1.pdf.

3 Hoang, N. T., Taherzadeh, O., Ohashi, H., Yonekura, Y., Nishijima, S., Yamabe, M., Matsui, T., Matsuda, H., Moran, D., & Kanemoto, K. (2023). Mapping potential conflicts between global agriculture and terrestrial conservation. Proceedings of the National Academy of Sciences of the United States of America, 120(23). Retrieved from: https://doi.org/10.1073/pnas.2208376120

4 WWF. Save the Cerrado: Our climate depends on it. Retrieved from: https://www.worldwildlife.org/pages/save-the-cerrado-our-climate-depends-on-it.

5 Trase. Trase Yearbook 2020. Retrieved from: https://insights.trase.earth/yearbook.

6 Strassburg, B. B. N., Latawiec, A. E., Barioni, L. G., Nobre, C. A., Porfírio-Da-Silva, V., Valentim, J. F., Vianna, M. D. S., & Assad, E. D. (2014). When enough should be enough: Improving the use of current agricultural lands could meet production demands and spare natural habitats in Brazil. Global Environmental Change-human and Policy Dimensions, 28, 84–97. Retrieved from: https://doi.org/10.1016/j.gloenvcha.2014.06.001

7 Ermgassen, E. K. H. J. Z., De Lima, M., Bellfield, H., Dontenville, A., Gardner, T. J., Godar, J., Heilmayr, R., Indenbaum, R. A., Reis, T. N. P. D., Ribeiro, V. a. R. M., & Meyfroidt, P. (2022). Addressing indirect sourcing in zero deforestation commodity supply chains. Science Advances, 8(17). Retrieved from: https://doi.org/10.1126/sciadv.abn3132.

8 Trase. Supply Chain Data Explorer. Retrieved from: https://explore.trase.earth/.

9 Ermgassen, E. K. H. J. Z., De Lima, M., Bellfield, H., Dontenville, A., Gardner, T. J., Godar, J., Heilmayr, R., Indenbaum, R. A., Reis, T. N. P. D., Ribeiro, V. a. R. M., & Meyfroidt, P. (2022). Addressing indirect sourcing in zero deforestation commodity supply chains. Science Advances, 8(17). Retrieved from: https://doi.org/10.1126/sciadv.abn3132.

10 Vieira, R. R. S., Ribeiro, B., Resende, F., Brum, F. T., Machado, N., Sales, L. P., Macedo, L. C., Soares-Filho, B., & Loyola, R. (2017). Compliance to Brazil's Forest Code will not protect biodiversity and ecosystem services. Diversity and Distributions, 24(4), 434–438. Retrieved from: https://doi.org/10.1111/ddi.12700.

11 Escobar, N., Tizado, E., Ermgassen, E. K. Z., Löfgren, P., Börner, J., & Godar, J. (2020). Spatially-explicit footprints of agricultural commodities: Mapping carbon emissions embodied in Brazil's soy exports. Global Environmental Change-human and Policy Dimensions, 62, 102067. Retrieved from: https://doi.org/10.1016/j.gloenvcha.2020.102067

12 Sources:

- Malhado, A. C. M., Pires, G. F., & Costa, M. H. (2010). Cerrado Conservation is Essential to Protect the Amazon Rainforest. AMBIO: A Journal of the Human Environment, 39(8), 580–584. Retrieved from: https://doi.org/10.1007/s13280-010-0084-6
- Gerow, A. & Seymour, F. (2023). Implications for the Private Sector of Non-Carbon Effects of Tropical Deforestation: Summary for Policymakers. World Resources Institute. Retrieved from: https://jaresourcehub.org/wp-content/uploads/2023/03/implications-private-sector-non-carbon-effects-tropical-deforestation.pdf.
- Dijkhorst, H., Kuepper, B., Piotrowski, M. (2018). Cerrado Deforestation Disrupts Water Systems and Poses Business Risks for Soy Producers. Chain Reaction Research. Retrieved from: https://chainreactionresearch.com/wp-content/uploads/2018/10/Cerrado-Deforestation-Disrupts-Water-Systems-and-Poses-Business-Risks-for-Soy-Producers-3.pdf.
- Flach, R., Abrahão, G. M., Bryant, B. P., Scarabello, M., Soterroni, A. C., Ramos, F. M., Valin, H., Obersteiner, M., & Cohn, A. (2021). Conserving the Cerrado and Amazon biomes of Brazil protects the soy economy from damaging warming. World Development, 146, 105582. Retrieved from: https://doi.org/10.1016/j.worlddev.2021.105582

13 Brazil Reports (2023). Deforestation falls in Amazon in 2023, but grows in the Cerrado, Brazil's second largest biome. Retrieved from: https://brazilreports.com/deforestation-falls-in-amazon-in-2023-but-grows-in-the-cerrado-brazils-second-largest-biome/4711/.

14 Pendrill, F., Persson, U. M., Kastner, T., & Wood, R. (2022). Deforestation risk embodied in production and consumption of agricultural and forestry commodities 2005-2018. Chalmers University of Technology, Senckenberg Society for Nature Research and Norwegian University of Science and Technology (NTNU). Retrieved from: https://doi.org/10.5281/zenodo.5886600.

15 Da Silva, A.L.G., De Souza, S. E. X. F., Filho, O. K., Eloy, L., Salmona, Y. B., & Passos, C. J. S. (2021). Water appropriation on the agricultural frontier in western Bahia and its contribution to streamflow reduction: Revisiting the debate in the Brazilian Cerrado. Water, 13(8), 1054. Retrieved from: https://doi.org/10.3390/w13081054.

16 Dijkhorst, H., Kuepper, B., Piotrowski, M. (2018). Cerrado Deforestation Disrupts Water Systems and Poses Business Risks for Soy Producers. Chain Reaction Research. Retrieved from: https://chainreactionresearch.com/wp-content/uploads/2018/10/Cerrado-Deforestation-Disrupts-Water-Systems-and-Poses-Business-Risks-for-Soy-Producers-3.pdf.

17 Rodrigues, A., Macedo, M. N., Silvério, D., Maracahipes, L., Coe, M. D., Brando, P. M., Shimbo, J. Z., Rajão, R., Soares-Filho, B., & Bustamante, M. M. C. (2022). Cerrado deforestation threatens regional climate and water availability for agriculture and ecosystems. Global Change Biology, 28(22), 6807–6822. Retrieved from: https://doi.org/10.1111/gcb.16386.

18 De Almeida, V. E. S., Friedrich, K., Tygel, A. F., Melgarejo, L. M., & Carneiro, F. F. (2017). Use of genetically modified crops and pesticides in Brazil: growing hazards. Ciencia & Saude Coletiva, 22(10), 3333–3339. Retrieved from: https://doi.org/10.1590/1413-812320172210.17112017

19 Greenpeace (2020). Soya, corn and cotton make Brazil world leader for hazardous pesticides. Retrieved from: https://unearthed.greenpeace.org/2020/02/20/brazil-pesticides-soya-corn-cotton-hazardous-croplife/.

20 ProTerra Foundation. Brazil: the non-GMO crop outlook for 2023. Retrieved from: https://www.proterrafoundation.org/news/brazil-the-non-gmo-crop-outlook-for-2023/.

21 WWF. Save the Cerrado: Our climate depends on it. Retrieved from: https://www.worldwildlife.org/pages/save-the-cerrado-our-climate-depends-on-it.

22 Dickie, A., Magno, I., Giampietro, J., Dolginow, A. (2016). Challenges and Opportunities for Conservation, Agricultural Production, and Social Inclusion in the Cerrado Biome. CEA Consulting for the Climate and Land Use Alliance. Retrieved from: http://www.climateandlandusealliance.org/wp-content/uploads/2016/09/Cerrado_Report_en.pdf.

23 Ministry of Science, Technology, Innovation and Communications of Brazil (2016). Estimativas Anuais: de Emissões de Gases de Efeito Estufa no Brasil. Retrieved from: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/publicacoes/estimativas-anuais-de-emissoes-gee/arquivos/estimativas_3ed.pdf.

24 Escobar, N., Tizado, E. J., Ermgassen, E. K. Z., Löfgren, P., Börner, J., & Godar, J. (2020). Spatially-explicit footprints of agricultural commodities: Mapping carbon emissions embodied in Brazil's soy exports. Global Environmental Change-human and Policy Dimensions, 62, 102067. Retrieved from: https://doi.org/10.1016/j.gloenvcha.2020.102067.

25 Pendrill, F., Persson, U. M., Kastner, T., & Wood, R. (2022). Deforestation risk embodied in production and consumption of agricultural and forestry commodities 2005-2018. Chalmers University of Technology, Senckenberg Society for Nature Research and Norwegian University of Science and Technology (NTNU). Retrieved from: https://doi.org/10.5281/zenodo.5886600.

26 WBCSD (2002). Climate Scenario Tool. Retrieved from: https://climatescenariocatalogue.org/explore-the-data/.

27 WWF (2021). Case Study: Brazil's Amazon soy moratorium. Retrieved from: https://forestsolutions.panda.org/case-studies/brazils-amazon-soy-moratorium.

28 The Nature Conservancy. Brazilian Amazon – The Forest Code: Using Law to Protect the Amazon. Retrieved from https://www.nature.org/en-us/about-us/where-we-work/latin-america/brazil/stories-in-brazil/brazils-forest-code/.

29 European Commission. Deforestation-free products. Retrieved from: https://environment.ec.europa.eu/topics/forests/deforestation/regulation-deforestation-free-products_en.

UK Department for Environment, Food and Rural Affairs. Implementing due diligence on forest risk commodities. Retrieved from: https://consult.defra.gov.uk/international-biodiversity-and-climate/implementing-due-diligence-forest-risk-commodities/.

30 Dickie, A., Magno, I., Giampietro, J., Dolginow, A. (2016). Challenges and Opportunities for Conservation, Agricultural Production, and Social Inclusion in the Cerrado Biome. CEA Consulting for the Climate and Land Use Alliance. Retrieved from: http://www.climateandlandusealliance.org/wp-content/uploads/2016/09/Cerrado_Report_en.pdf.

31 Innovation Forum (2023). Regenerative farming: building resilience in modern agriculture [podcast]. Retrieved from: https://www.innovationforum.co.uk/articles/regenerative-farming-building-resilience-in-modern-agriculture.

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